Aims and Scope

The focus of the *China Journal of Accounting Research* is to publish theoretical and empirical research papers that use contemporary research methodologies to investigate issues about accounting, finance, auditing and corporate governance in China, the Greater China region and other emerging markets. The Journal also publishes insightful commentaries about China-related accounting research. The Journal encourages the application of economic and sociological theories to analyze and explain accounting issues under Chinese capital markets accurately and succinctly. The published research articles of the Journal will enable scholars to extract relevant issues about accounting, finance, auditing and corporate governance relate that to the capital markets and institutional environment of China.

China Journal of Accounting Research

Website: http://www.cnjar.com
http://www.cb.cityu.edu.hk/research/cjar

9 | 3 China Journal of Accounting Research Vol. 9/3 (2016) 175–250

ELSEVIER

Volume 9 • Issue 3 • September 2016

China Journal *of* Accounting Research

HOSTED BY
ELSEVIER

Available online at www.sciencedirect.com
ScienceDirect

ISSN 1755-3091

CYAN MAGENTA YELLOW BLACK

Production and hosting by Elsevier
Radarweg 29, 1043 NX Amsterdam, The Netherlands

ISSN 1755-3091

Founded by Sun Yat-sen University and City University of Hong Kong

Sponsored by: CPA Hong Kong Institute of Certified Public Accountants 香港會計師公會

Published quarterly in March, June, September, and December

China Journal of Accounting Research has been indexed by Emerging Sources Citation Index (ESCI), Cabell's Directory, Scopus, CNKI, Australian Business Deans Council (ABDC) Journal Quality List and Excellence in Research for Australia (ERA) Journal List.

Guidelines for Manuscripts Submitted to The China Journal of Accounting Research

The **China Journal of Accounting Research** "CJAR" (ISSN 1755-3091) publishes quarterly. It contains peer-reviewed articles and commentaries on accounting, auditing and corporate governance issues that relate to the greater China region.

We welcome the submission of both theoretical and empirical research papers pertinent to researchers, regulators and practitioners. Authors should note:

1 Submissions must be original contributions and not under consideration by any other journal. The author must state the work is not submitted or published elsewhere.

2 Authors submitting articles, notes and comments will be entitled to two free copies. Each author of a book review will receive a copy of the relevant issue.

3 Authors should submit their manuscripts (in Word format) via email to china.jar@gmail.com. All text, including endnotes, must be double-spaced. Authors will be notified when manuscripts are received by *CJAR*.

4 Authors should note:

- a cover page showing the title of the paper, the author's name, title and affiliation, e-mail address, and any acknowledgement should be included.
- to promote anonymous review, author(s) should confine his/her identify (such as name, affiliation, biographical information, and acknowledgment) to the cover page only.
- supply an abstract of about 120 words, stating the study's findings, sample and methodology in that order.
- key terms used in the text should be defined or explained as early as possible after they are first introduced.
- words in a foreign language are to be in italics.
- all citations in the text should refer to the author's (or authors') name and the year of publication.

  Examples: "the debt contracting explanation for conservatism (Watts and Zimmerman, 1986; Basu, 1997; Ahmed et al, 2002). Using the Basu (1997) asymmetric timeliness regression"
- include a list of reference for works cited as follows:
  - reference to a journal publication:

    Basu, S., Waymire, G.B., 2006. Record keeping and human evolution. Accounting Horizons 20 (3), 201–229.
  - reference to a book:

    Watts, R.L., Zimmerman, J.L., 1986. Positive accounting theory. Prentice Hall, Englewood Cliffs, NJ.
  - reference to a chapter in an edited book:

    Ball, R., 2001. Infrastructure requirements for an economically efficient system of public financial reporting and disclosure, 127–169. In: Litan, R., Herring, R. (Editors), Brookings-Wharton Papers on Financial Services. Brookings Institution Press, Washington, DC.
- omit all full stops in abbreviations. Example: 'eg', 'ie', 'Co', 'Ltd', 'etc'
- dates are in the order – date, month, year, eg '5 May 1975'
- quotation marks are single, but within a quotation are double.
- use endnotes rather than footnotes.
- put each table on a separate sheet; do not embed in the text but indicate where the table would best be inserted.

5 China Journal of Accounting Research copyright in works published by *CJAR*.

For additional information, please contact Irene Li, Department of Accountancy, City University of Hong Kong, Tat Chee Avenue, Kowloon Tong, Hong Kong. Telephone: +852 3442 7932. Fax: +852 3442 0349. E-mail: acwoo@cityu.edu.hk.

CHINA JOURNAL OF ACCOUNTING RESEARCH

Volume 9/3 (2016)

China Journal of Accounting Research 9 (2016) 175–190

HOSTED BY

Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Income smoothing and the cost of debt

Si Li [a,1], Nivine Richie [b,*]

[a] *Wilfrid Laurier University, Lazaridis School of Business and Economics, Canada*
[b] *University of North Carolina Wilmington, United States*

ARTICLE INFO

Article history:
Received 24 July 2015
Accepted 28 March 2016
Available online 4 May 2016

JEL classification:
G-12
G-32

Keywords:
Income smoothing
Earnings smoothing
Cost of debt
Credit spreads
Credit ratings
Garbling

ABSTRACT

The literature on income smoothing focuses on the effect of earnings smoothing on the equity market. This paper investigates the effect of income smoothing on the debt market. Using the Tucker–Zarowin (TZ) statistic of income smoothing, we find that firms with higher income smoothing rankings exhibit lower cost of debt, suggesting that the information signaling effect of income smoothing dominates the garbling effect. We also find that the effect of earnings smoothing on debt cost reduction is stronger in firms with more opaque information and greater distress risk.

1. Introduction

Although income smoothing has existed for decades, there is limited academic research on earnings smoothing. For example, Graham et al. (2005) report that "an overwhelming 96.9% of the survey respondents indicate that they prefer a smooth earnings path. Such a strong enthusiasm among managers for smooth earnings is perhaps not reflected in the academic literature." More recently, Dichev et al. (2013) state that "earnings management is driven by a host of intertwined factors but capital market motivations dominate, followed by debt contracting, and career and compensation issues."

* Corresponding author. Tel.: +1 910 962 3606.
E-mail addresses: sli@wlu.ca (S. Li), Richien@uncw.edu (N. Richie).
[1] Tel.: +1 519 884 0710x2395.

http://dx.doi.org/10.1016/j.cjar.2016.03.001
1755-3091/

There are generally two schools of thought as to what motivates managers to smooth. First, smoothing presents an arguably efficient vehicle for managers to reveal private information because it is easier for investors to predict future earnings from smoother earnings. Second, smoothing represents "garbling"; that is, smoothing is an exercise undertaken by managers in an attempt to fool analysts and others and to enhance managerial careers or compensation. The first school of thought (the information signaling view) is reflected in the works of Ronen and Sadan (1981), Demski (1998), Sankar and Subramanyam (2001), Srinidhi et al. (2001), Kirschenheiter and Melumad (2002) and Goel (2003), among others. Essentially, this school holds that income smoothing may reveal private information in much the same way that dividend smoothing can lead to information revelation (Miller and Rock, 1985). The second school of thought (the information garbling view) is reflected in the works of Beidleman (1973), Lambert (1984), Healy (1985), Fudenberg and Tirole (1995), Arya et al. (1998) and Demski and Frimor (1999), among others.

A handful of empirical studies have investigated the issue of income smoothing in the context of equity markets. Subramanyam (1996) finds that stock returns are positively associated with contemporaneous discretionary accruals, which are a measure of income smoothing. Hunt et al. (2000) find that income smoothing improves price-earnings multiples. Tucker and Zarowin (2006) report that the changes in the current stock prices of higher smoothing firms contain more information about these firms' future earnings than do the changes in the current stock prices of lower smoothing firms. Taken collectively, these studies support the notion that income smoothing represents an efficient vehicle for managers to reveal private information. Using survey data, Graham et al. (2005) find that the overwhelming majority of managers prefer a smooth earnings growth rate.[2]

Instead of examining the effect of income smoothing on the equity market, our paper examines the effect of income smoothing on the credit market. If income smoothing is informative and mitigates the asymmetric information problem between the firm and investors, then smoothing firms may exhibit a lower cost of debt capital due to lower information risk. This idea follows from the theory in Trueman and Titman (1988), who argue that a smooth earnings stream may potentially decrease assessments of default risk, and thus decrease the debt cost of capital. However, if income smoothing is garbling, and creditors can recognize smoothing as garbling, then smoothing firms could exhibit a higher cost of debt capital as creditors punish managers for gaming earnings.

Investigating the credit market is of great interest for the following reasons. First, investors in the bond market are predominantly institutional investors. For example, transactions with less than $1 million face value are considered "odd lots" (that is, less than the normal unit of trading). Because creditors are typically professional investors, they may be more able than equity stakeholders to differentiate the information effect from the garbling effect. Therefore, examining the signaling versus garbling debate through the lens of credit markets can help enhance our understanding of earnings smoothing. Second, Lang and Maffett (2011) argue that firm-level transparency could affect equity and debt differently. They mention that "Earnings smoothing is likely to be a particular issue...given the importance of stakeholders other than equity investors. In particular, stakeholders such as labor unions, governments and debt holders are exposed more directly to losses than to gains and so prefer lower risk. As a consequence, managers have incentives to report smooth earnings to create the impression of a less risky earnings stream." Managers have incentives to signal to the market to obtain debt financing at a lower cost because, all else being equal, lower debt costs imply more money left for shareholders and managers.

In addition to contributing to the literature on incoming smoothing, this study is related to extant studies that identify the determinants of the cost of debt. For example, Chen et al. (2007) report that bond liquidity is an important factor in explaining corporate yield spreads. Tang and Yan (2006) document liquidity effects with respect to credit default swap spreads. Our research suggests that income smoothing could serve as an additional factor that determines the cost of debt, as measured by credit spreads. Finally, this study is related to a growing body of research that addresses the issue of accounting transparency and asset pricing. In this context, the research presented here is perhaps most closely related to Yu (2005), who finds that firms with

[2] As far as we know, there is no direct empirical evidence for how earnings smoothing affects the cost of equity capital. The accounting literature does provide evidence that earnings management (as measured by accrual quality) "is frequently considered to increase opacity, decrease liquidity and increase equity cost of capital" (Lang and Maffett, 2011).

more information disclosure (measured as AIMR disclosure rankings) tend to exhibit lower credit spreads.[3] Yu's (2005) findings are consistent with the theory of discretionary disclosure that began with Verrecchia (1983), and with the incomplete accounting information model of Duffie and Lando (2001). By examining income smoothing, our paper provides evidence for whether income smoothing enhances (or reduces) the quality of information disclosure, which can be further translated into lower (or higher) cost of debt.

Using a large sample of publicly traded companies and the Tucker and Zarowin (2006) measure of income smoothing, we examine whether higher smoothing firms witness higher or lower cost of debt than their lower smoothing counterparts. The results indicate that higher smoothing firms exhibit lower cost of debt, both unconditionally and after controlling for factors previously known to explain credit spreads. Our results further suggest that the information signaling effect of income smoothing in reducing the cost of debt is stronger in firms with more opaque information, such as smaller firms. The effect is also stronger in firms with more distress risk, such as more volatile, less profitable and lower credit rating firms. Assuming that creditors are not fooled by income smoothing, the evidence presented here from the credit market affirms the conclusion drawn from most of the existing research using equity market data, namely that income smoothing may aid management to revel private information.

2. Research design

2.1. Measuring income smoothing

Income smoothing is commonly understood to mean management's use of discretionary accounting and management principles to reduce earnings variability. The main income smoothing measure used in this study is the standard metric used in the literature. Following Myers and Skinner (2002), Leuz et al. (2003), and Tucker and Zarowin (2006), we estimate income smoothing as the negative correlation between the change in a firm's discretionary-accruals proxy (ΔDAP) and the change in its pre-discretionary income (ΔPDI). This measure assumes that there is an innate, un-managed income series and that management uses discretionary accruals to smooth this raw series. When there is an increase (decrease) in the pre-discretionary income, a firm will use negative (positive) discretionary accruals to smooth its earnings. As a result, income smoothing is presented as the negative correlation between ΔDAP and ΔPDI, and more income smoothing is evidenced by a greater degree of negative correlation between ΔDAP and ΔPDI.

To estimate discretionary accruals, we follow Tucker and Zarowin (2006) by using the cross-sectional version of the Jones (1991) model as modified by Kothari et al. (2005), namely:

$$ACCRUALS_t = \beta_0(1/ASSETS_{t-1}) + \beta_1 \Delta SALES_t + \beta_2 PPE_t + \beta_3 ROA_t + \varepsilon_t, \quad (1)$$

where $ASSETS$ is total assets; $ACCRUALS$ stands for total accruals estimated as net income minus operating cash flows, deflated by lagged total assets; $\Delta SALES$ is change in sales scaled by lagged total assets; and PPE is gross property, plant and equipment scaled by lagged total assets.[4] ROA, return on assets, is measured as net income over lagged total assets. Following Tucker and Zarowin (2006), we include ROA in the regression because previous research finds that the Jones model is misspecified for well-performing or poorly performing firms (see Dechow et al., 1995 and Kothari et al., 2005). We also follow Tucker and Zarowin (2006) and omit a separate intercept term in regression (1). We perform a robustness analysis by estimating regression (1) with an intercept term, as in Eq. (7) of Kothari et al. (2005), and obtain similar results.

Non-discretionary accruals ($NDAP$) of firm j are then represented by the fitted values of regression (1):

$$NDAP_{j,t} = \hat{\beta}_0(1/ASSETS_{j,t-1}) + \hat{\beta}_1 \Delta SALES_{j,t} + \hat{\beta}_2 PPE_{j,t} + \hat{\beta}_3 ROA_{j,t}. \quad (2)$$

Discretionary accruals (DAP) are represented by the residuals, that is, the deviations of actual accruals from $NDAP$. The un-managed income series, i.e., pre-discretionary income (PDI), is calculated as net income (NI) minus discretionary accruals, or $PDI = NI - DAP$. Note that as DAP is assets-scaled, NI should also be assets-scaled here.

[3] "AIMR" stands for the Association for Investment Management and Research, the former name of the CFA Institute.

[4] Data definitions and measurement details for all of the variables are reported in the Appendix.

Table 1
Estimation of discretionary accruals and income smoothing.

Panel A: Summary statistics of the estimated coefficients from the modified Jones' model

Coefficient	Mean	Std Dev	Median	Minimum	Maximum
β_0	0.091	2.486	0.057	−66.264	13.903
β_1	0.009	0.287	0.005	−3.046	3.053
β_2	−0.063	0.270	−0.079	−3.117	3.512
β_3	0.501	0.344	0.494	−0.910	1.940
Adj. R^2	0.683	0.262	0.721	−0.170	1.000

Panel B: Summary statistics of the income smoothing variable

Variable	N	Mean	Median	Std Dev	Minimum	Maximum
DAP	60,448	−0.036	−0.023	1.527	−162.540	166.535
$TZStatistic = Corr(\Delta DAP, \Delta PDI)$	60,448	−0.731	−0.922	0.421	−1.000	1.000

Panel A presents the summary statistics from regression (1) of the estimated coefficients and adjusted R^2 of the Jones (1991) model, as modified by Kothari et al. (2005):

$$ACCRUALS_t = \beta_0(1/ASSETS_{t-1}) + \beta_1 \Delta SALES_t + \beta_2 PPE_t + \beta_3 ROA_t + \varepsilon_t$$

The regression is estimated using all of the firms in the same industry (two-digit SIC) for each year, using annual data for the 1988–2007 period. There are 951 industry-year regressions and the obtained estimates are summarized in the following table. $ACCRUALS$, $\Delta SALES$, PPE and ROA are scaled by lagged assets. Panel B reports the summary statistics of the income smoothing measures in which discretionary accruals is DAP and pre-discretionary income (PDI) = Net income (NI) − DAP. Detailed definitions of the variables are reported in the Appendix.

The smoothing measure is estimated as the correlation between the change in discretionary accruals and the change in un-managed income, $Corr(\Delta DAP, \Delta PDI)$, using the current year's and past four years' observations. Firms with more negative correlations are higher smoothing firms, whereas firms with less negative (or positive) correlations are lower smoothing firms. For ease of interpretation, we follow Tucker and Zarowin (2006) in creating our final income smoothing measure (IS), by converting the correlations into reverse fractional rankings by 2-digit industry SIC code. The IS measure ranges from 0 to 1 by industry-year with the highest income smoothers (most negative correlations) having high rankings and lowest income smoothers (less negative correlations) having low rankings.

We estimate regression (1) using all of the firms in the same industry (two-digit SIC) each year for the 1988 to 2007 period. We obtain the information on the variables from Compustat. Our sample starts in 1988 because one key variable that is used to estimate accruals, cash flow from operations, is only available from Compustat after 1988. Our sample stops just prior to the credit crisis that began in 2008. Because this study relies heavily on credit market data, we have chosen to avoid the issues associated with illiquidity and lack of reliable bond pricing that existed beginning in 2008. We exclude all of the firms in SIC codes 4000–4999 (regulated industries) and 6000–6999 (financial industries) because firms in these industries may have distinct types of accounting and debt costs. We then sort the sample firms by 2-digit SIC category per year. We discard any cross-section with less than 10 firms per industry-year category, resulting in 951 industry-year cross sections. Following the literature (Tucker and Zarowin, 2006), we Winsorize the variables used in Eq. (1) at ± three standard deviations per year.[5]

To show that our income smoothing estimates are in line with those presented in the literature, we first provide the regression (1) estimation results in Table 1 Panel A and show that the main statistics of the coefficient estimates in the accruals equation are comparable to those reported by Subramanyam (1996) and Tucker and Zarowin (2006). In addition, similar to Tucker and Zarowin (2006), we find that the mean coefficient on ROA is 0.501, indicating that accruals are positively related to profitability.

Table 1 Panel B presents the summary statistics of income smoothing variables in our sample. The earnings smoothing correlation $Corr(\Delta DAP, \Delta PDI)$ is −0.731, on average, with a median value of −0.922, which is

[5] We also Winsorize at ± three standard deviations per industry-year and find the results are qualitatively similar.

consistent with the mean and median reported by Tucker and Zarowin (2006) of −0.709 and −0.899, respectively.

2.2. Estimating the cost of debt

In an effort to improve bond market transparency, the National Association of Securities Dealers (NASD) began collecting and reporting bond transaction data in July 2002, using the Trade Reporting and Compliance Engine (TRACE). The TRACE system is designed to allow NASD members to "report over-the-counter (OTC) secondary market transactions in eligible fixed income securities to NASD and subject certain transaction reports to dissemination."[6] The Trade Reporting and Compliance Engine is the FINRA-developed vehicle that facilitates the mandatory reporting of over-the-counter secondary market transactions in eligible fixed income securities. All of the broker/dealers who are FINRA member firms have an obligation to report transactions in corporate bonds to TRACE under a SEC-approved set of rules. The system captures and disseminates consolidated information on secondary market transactions in publicly traded TRACE-eligible securities (investment grade, high yield and convertible corporate debt) representing all of the over-the-counter market activity in these bonds. The original TRACE-eligible securities included 500 corporate bonds of which 50 were high-yield securities. Currently, transaction data are reported for over 4000 different bond issues with approximately 20 percent of those issues being high-yield securities.

We use TRACE data to estimate the cost of debt for our sample of publicly traded firms from July 2002 through December 2007. The data are cleaned by eliminating all of the canceled or corrected trades, whether the cancellation is entered on the same transaction date or entered on a different transaction date.[7] We further clean the data by eliminating all of the "when-issue" trades and all of the trades that do not settle regular way. We select trades where the price excludes commission and, following Edwards et al. (2007), where the trade size is greater than or equal to $100,000. We further use the information from the Fixed Investment Security Database (FISD) to limit the sample to U.S. dollar-denominated, senior corporate debt issues. We also exclude privately placed, putable, exchangeable, perpetual and preferred securities. As a large number of firms in our sample issue callable bonds, we include callable issues and substitute the call date for the maturity date if the call is in-the-money. The most appropriate way to identify whether a bond is likely to be called is to select bonds where the yield-to-call is lower than the yield-to-maturity. However, in the absence of yield-to-call data, we compare the coupon rate to the yield-to-maturity. If the yield-to-maturity is lower than the coupon rate, then we substitute the call date for the maturity date of the bond issue. To estimate a daily yield from the transaction data we use the mid-point of all of the trades during the day to reflect the day's yield. Our final sample consists of 796 unique firms and 2097 bond issues.

Matching the high frequency transaction data of TRACE with annual data from Compustat presents a challenge for our sampling frequency. This is further complicated by the fact that many firms have more than one bond issue being reported. Of the firms in our sample, 359 have only one bond issue. The average number of bond issues per firm in our sample is 2.6 and the median is 2. The maximum number of issues per firm in our sample is 25. Bessembinder et al. (2008) describe three possible approaches to sampling bond data: (1) a representative bond approach, (2) a bond-level approach and (3) a firm-level approach. In the representative bond approach, researchers select one bond per firm, even though the firm may have several different bond issues outstanding. This approach faces serious limitations because different bond issues will have different durations; selecting one representative bond will necessarily ignore effects on other parts of the yield curve.

[6] In July 2007, the NASD and the member regulation, enforcement and arbitrage functions of the NYSE were consolidated to form the Financial Industry Regulatory Authority (FINRA). The history of the TRACE system is available online at www.finra.org/compliance/MarketTransparency/TRACE/FAQ/P085430.

[7] Based on TRACE documentation, trade errors that are caught the same trading day are corrected by entering a TRC_ST of C (cancellation) or W (correction or 'was'). These corrections are coded with the original message sequence number to identify a corrected trade. If a trade error is caught after the trade date, then it is corrected by entering an ASOF_CD of R (reversal) and an A (as of trade). These corrections are not linked to the original message sequence number so they must be matched based on trade date, time, price and volume. Occasionally, there is more than one original trade that matches a reversal, and occasionally there is more than one reversal trade for which no original trade can be found. We select the first matching original trade for each reversal and if no original trade can be found, then the reversal is assumed to be entered in error and is eliminated.

The bond-level approach captures more information than the representative approach as it treats each bond as a separate observation. Although this is preferred to the representative approach, it is not without problems of its own. Bessembinder et al. (2008) point out that this approach faces correlations across observations within the firm, and thus may weight higher quality firms more heavily as they are more likely to have multiple bond issues. The firm-level approach uses a market-value weighted average yield of all of the bonds per day per firm as the cost of debt capital. This composite measure of the cost of debt is free from the cross-correlation problem of the bond-level approach. In our study, we present results for both the bond-level and firm-level approaches.

3. Univariate analysis

Using the TZ earnings smoothing statistic, we perform a univariate analysis of the characteristics of high and low smoothing firms over the 2002–2007 sample period. Table 2 presents the results from comparing the top quartile with the bottom quartile (based on the TZ statistic) of the sample firms. By definition, the high smoothing firms have more negative TZ statistics with a mean of −0.99, whereas the low smoothing firms have less negative TZ statistics with a mean of −0.60.

Table 2 Panel A shows that the sample firms with smoother earnings are larger, more profitable, have more operating cash flows and have more growth options, than the firms with less smooth earnings. Higher smoothing firms have significantly lower debt-to-asset ratios—26 percent, on average, compared with lower smoothing firms with 37 percent, on average. The Z-score for the higher smoothing firms is significantly higher than for low smoothing firms, indicating that higher smoothing firms are financially healthier. Therefore, we control for all of these firm characteristics in our multivariate analysis. In addition, the statistics show that firms with smoother earnings also engage in more earnings management, as measured by the absolute value of discretionary accruals, *DAP*, estimated as the residual from regression (1). This suggests that income smoothing is related to earnings management. Indeed, we find that the reverse rank of TZ statistic and the absolute value of *DAP* are positively correlated at 0.15.

Table 2 Panel B shows that the high smoothing firms have lower average bond yields and higher average bond ratings than their low smoothing counterparts. The average bond yield for high smoothing firms is 5.35 percent, whereas the average bond yield for low smoothing firms is 6.78 percent, and this difference is statistically significant at conventional levels. Likewise, the average bond rating for high smoothing firms is 6.9 (approximately A-where the scale begins at 1 for AAA, 2 for AA+, …, and 22 for D). The average bond rating for low smoothing firms is 11.14, which corresponds to a BB+ rating. In addition, the bonds issued by top smoothing firms exhibit shorter terms to maturity and terms to call, lower coupon rates and higher amounts outstanding. In our subsequent multivariate regressions, we control for the above bond characteristics. Overall, these univariate results provide preliminary evidence that firms which smooth earnings have lower cost of debt, suggesting that they are signaling rather than garbling earnings information.

4. Multivariate analysis

4.1. Baseline regressions

We now turn to a multivariate analysis of the cost of debt capital by estimating a pooled cross-sectional time-series model using both a bond-level approach and a firm-level approach. The dependent variable is the daily yield per bond (bond-level approach) or the weighted average daily yield per firm (firm-level approach). The key explanatory variable is the income smoothing ranking (*IS*), which we expect to have a positive coefficient in the case of garbling and a negative coefficient in the case of signaling. The control variables are included based on prior research, which indicates the variables' explanatory power on cost of debt capital. Some of the control variables with predicted signs are described below.

4.1.1. Firm-specific factors

We first control for various firm characteristics, such as size, growth, profitability, Zscore and tangibility. These control variables deal with potential endogeneity; specifically, that firms with certain characteristics may

Table 2
Univariate analysis.

Variable		(1) Top quartile of TZ statistic (less smooth earnings)	(2) Bottom quartile of TZ statistic (smoother earnings)	(3) = (2)−(1) difference between bottom and top quartiles
Panel A: Sample firm characteristics				
TZ statistic	Mean	−0.60	−0.99	−0.39***
	Median	−0.77	−0.99	−0.22***
Total assets	Mean	12,608.24	26,299.32	13,691.08***
	Median	9668.31	16,361.00	6692.69***
Sales	Mean	14,340.68	18,462.36	4121.68***
	Median	9614.00	15,701.00	6087***
Net income	Mean	513.78	2172.89	1659.11***
	Median	286.14	1257.00	970.86***
Operating cash flow	Mean	1281.00	3216.24	1935.24***
	Median	674.06	1846.54	1172.48***
Market value	Mean	20,796.62	50,962.05	30,165.43***
	Median	14,275.19	31,785.13	17,509.94***
Market-to-book	Mean	1.66	2.08	0.42***
	Median	1.46	1.95	0.49***
Return on assets	Mean	0.028	0.075	0.047***
	Median	0.036	0.075	0.039***
Debt to assets	Mean	0.37	0.26	−0.11***
	Median	0.33	0.24	−0.09***
Zscore	Mean	1.69	2.00	0.31***
	Median	1.66	1.88	0.22***
Earnings management	Mean	0.07	0.38	0.31***
	Median	0.04	0.11	0.07***
Panel B: Sample bond characteristics				
TZ statistic	Mean	−0.60	−0.99	−0.39***
	Median	−0.77	−0.99	−0.22***
Weighted average yield	Mean	6.78	5.35	−1.43***
	Median	6.16	5.26	−0.90***
Term to maturity (years)	Mean	6.73	6.29	−0.44***
	Median	7.01	6.34	−0.67***
Term to call (years)	Mean	6.40	5.97	−0.43***
	Median	6.94	6.28	−0.66***
S&P rating	Mean	11.14	6.90	−4.24***
	Median	10	6	−4.00***
Coupon rate	Mean	6.95	6.10	−0.85***
	Median	6.90	5.79	−1.11***
Amount outstanding	Mean	565,356.46	741,749.17	176,392.71***
	Median	500,000	750,000	250,000***

This table presents the means and medians of sample firm (Panel A) and bond (Panel B) characteristics by the top and bottom quartile of income smoothing. Variable definitions are given in the Appendix.
*** Indicate statistical significance at the 1% level.

be associated with higher or lower cost of debt, and that these characteristics are correlated with income smoothing. For example, Ronen and Sadan (1981) use a signaling model and contend that only firms with good prospects elect to smooth. We discuss some of the following firm level control variables.

- Sales revenue to proxy for firm size, as larger firms can have economies of scale that would serve to reduce credit spreads (predicted negative sign).[8]
- Return on assets, which is a proxy for profitability as more profitable firms will have lower credit spreads (predicted negative sign).
- Firm volatility, with higher volatility implying higher default risk and thus higher credit spreads (predicted positive sign).
- Market-to-book ratio, where market value is the market value of equity plus the book value of debt and book value is the book value of assets. This is to control for differences in investment opportunities, with higher ratios implying either higher or lower credit spreads. High growth firms have more growth opportunities and this may be related to lower debt cost. In contrast, high growth option firms may have more intangibles and thus few tangibles in the company and this is related to higher debt costs (sign ambiguous).

4.1.2. Instrument-specific factors

- Bond coupon, which is a proxy for any tax effects (sign ambiguous).
- Illiquidity, following Chen et al. (2007), who find that less liquid issues are associated with higher bond yield spreads (predicted positive sign).

4.1.3. Market or macroeconomic factors

The literature suggests that credit spread and term spread are good proxies of macroeconomic conditions and help explain stock and bond returns (Chen et al., 1986; Fama and French, 1993). Specifically, credit spreads tend to widen in recessions and shrink in expansions (Collin-Dufresne et al., 2001), as investors require more compensation for increased default risk in bad economic times. High (low) term spreads are often used as an indicator of good (bad) economic prospects. As a result, we use the following two variables to proxy for macroeconomic conditions.

- Term spread is the slope of the prevailing treasury yield curve, often measured by the difference between 10- and 2-year treasury bond yields (predicted negative sign).
- Credit spread is the slope of the corporate debt yield curve, measured as the difference in yields between AAA corporate bond yields and BAA corporate bond yields (predicted positive sign).

Our complete model is estimated as

$$\begin{aligned} AVEYIELD_{j,t} = {} & \alpha_0 + \alpha_1 IS_j + \alpha_2 SIZE_j + \alpha_3 DEBT_j + \alpha_4 ROA_j + \alpha_5 VOLAT_j + \alpha_6 MKBK_j \\ & + \alpha_7 COVERAGE_j + \alpha_8 TANGIB_j + \alpha_9 ZSCORE_j + \alpha_{10} CALL_j + \alpha_{11} \ln MAT_j \\ & + \alpha_{12} COUPON + \alpha_{13} SP_j + \alpha_{14} ILLIQ_j + \alpha_{15} \ln OUTST_j + \alpha_{16} TSPREAD_j \\ & + \alpha_{17} CSPREAD_j + \varepsilon_j, \end{aligned} \tag{3}$$

where $AVEYIELD$ is the median daily yield per bond as reported by TRACE or the average of the median daily yield across all of the bond issues per firm; IS is the income smoothing ranking following Tucker and Zarowin (2006); $SIZE$ is the natural logarithm of beginning of period net sales; $DEBT$ is the beginning of period ratio of total debt to total assets; ROA is the beginning of period net income over total assets; $VOLAT$ is

[8] Sales revenue may also proxy for instrument liquidity (an instrument-specific factor), as it may reflect firm size and therefore issue size. Issue size is an often-used proxy for bond liquidity (Yu, 2005).

Table 3
Effect of income smoothing on the cost of debt.

Dep. Var. = cost of debt	(1) Bond level	(2) Bond level	(3) Firm level	(4) Firm level
IS	−2.07***	−0.36***	−2.19***	−0.42***
	(−7.79)	(−3.20)	(−5.75)	(−2.66)
SIZE		−0.10**		−0.10
		(−2.19)		(−1.50)
DEBT		0.42		0.39
		(1.23)		(0.80)
ROA		−4.00***		−4.26***
		(−5.33)		(−4.04)
VOLAT		1.63***		1.48*
		(2.91)		(1.93)
MKBK		0.13***		0.11*
		(2.92)		(1.84)
COVERAGE		0.07		0.03
		(0.79)		(0.23)
TANGIB		0.76**		0.78**
		(2.45)		(2.11)
ZSCORE		0.12*		0.12
		(1.68)		(1.33)
CALL		0.48**		–
		(1.98)		–
lnMAT		0.38***		0.37***
		(11.56)		(8.88)
COUPON		0.11***		0.12***
		(3.80)		(2.60)
SP		0.25***		0.25***
		(11.29)		(8.03)
ILLIQ		−0.003		0.01
		(−0.59)		(1.10)
lnOUTST		0.001		0.01
		(0.02)		(0.25)
TSPREAD		0.04		0.07
		(0.89)		(1.14)
CSPREAD		1.06***		1.07***
		(8.02)		(5.28)
Intercept	4.49	0.92	8.37	1.07
	(0.00)	(0.00)	(0.00)	(1.48)
Year, 2-digit SIC, and bond type effects	Yes	Yes	Yes	Yes
N	202,689	183,932	113,965	103,767
Adj. R^2	0.41	0.75	0.38	0.73

This table presents bond-level (Columns 1 and 2) and firm-level (Columns 3 and 4) OLS regression results. In Columns (1) and (2), the dependent variable is the daily yield for each bond. In Columns (3) and (4), the dependent variable is the average of the median daily yield across all of the bond issues per firm. Bond type effects refer to different bonds including senior note, unsecured note, senior debenture, discount note, index linked security, etc. Detailed definitions of the variables are reported in the Appendix. Heteroscedasticity robust *T*-statistics are given in parentheses and are adjusted for clustering within bond issues in Columns (1) and (2) and within firms in Columns (3) and (4).

* Indicate statistical significance at the 10% level.
** Indicate statistical significance at the 5% level.
*** Indicate statistical significance at the 1% level.

the beginning of period standard deviation of CRSP daily equity returns using 252 days prior to bond spread measurements; *MKBK* is the beginning of period ratio of market value of the equity plus the book value of the debt to book value of the assets; *COVERAGE* is a dummy variable that takes a value of 1 if operating cash flows are greater than current liabilities; *TANGIB* is beginning of period property plant and equipment over total assets; *ZSCORE* is Altman's Z score; *CALL* is a dummy variable taking a value of 1 if the bond is

callable; *lnMAT* is the natural logarithm of the bond maturity measured in months (the natural log of the term to call is substituted if the bond call is in the money); *COUPON* is the annual coupon rate of the bond; *SP* is the *S&P* credit rating converted to a numeric scale, where 1 represents AAA and 22 represents a rating of *D*; *ILLIQ* is the standard deviation of the price during the week divided by the total volume traded during the week; *lnOUTST* is the natural logarithm of the amount of bonds outstanding; *TSPREAD* is the term spread estimated as the difference between the 10-year treasury yield and the 2-year treasury yield as reported by the Federal Reserve Board of Governors; and *CSPREAD* is the credit spread estimated as the difference between AAA corporate bond yields and BAA corporate bond yields as reported by the Federal Reserve Board of Governors.

Table 3 presents the results of the baseline regression results. Columns (1) and (2) include bond-level regressions and Columns 3 and 4 include firm-level regressions. Consistent with our univariate analysis, the coefficients on *IS* in all four columns are negative and significant, indicating that higher earnings smoothing firms are associated with lower cost of debt. To illustrate the economic significance, we take the bond level regression in Column (1) as an example. Given a one standard deviation (0.27) change in the income smoothing measure, the coefficient of −2.07 corresponds to $-2.07 \times 0.27 = -0.56(\%)$. That is, a one standard deviation increase in income smoothing corresponds to a reduction in the cost of debt by 56 basis points. This can be compared to the statistics of the sample firms, which have an average bond yield of 5.8%, with a standard deviation of 1.85% and a p5 yield of 2.6%. In Column (2), after we control for firm and bond characteristics in the regression, the economic magnitude of income smoothing becomes smaller. The coefficient, −0.36, is translated into a reduction in the cost of debt of $-0.36 \times 0.27 = -0.1(\%)$, which is 10 basis points.

The coefficients on the control variables are generally as expected. *SIZE* is negative and significant, indicating that larger firms experience lower bond yields. *ROA* is negative and significant, suggesting that more profitable firms experience lower borrowing costs. The variables *VOLAT*, *CALL*, *lnMAT*, *COUPON* and *SP* are all positive and significant, indicating that higher equity volatility, callable bonds, longer term bonds, bonds with higher coupons and more poorly rated bonds are associated with higher cost of debt. The market-to-book ratio is positively associated with the cost of debt. This is consistent with the notion that as firms with more growth options are riskier, debt holders demand higher returns from such companies. The results also show that credit spread is positively related to bond yields, suggesting that market-wide default risk is reflected in the individual bond yields.

4.2. Exploring potential channels

The results in the previous section show that firms with smoother earnings exhibit lower debt costs. We argue that this is consistent with the view that the information signaling effect of income smoothing (which reduces the cost of debt) dominates the garbling effect (which increases the cost of debt). To further disentangle the signaling effect from the garbling effect, this section explores the potential channels through which income smoothing may affect the cost of debt.

As we argue in the previous section, one mechanism of the signaling effect is that the firm uses smoother earnings to reduce the perceived probability of default and thus reduce the cost of borrowing funds. For example, Lang and Maffett (2011) mention that "a smooth earnings stream may potentially decrease assessments of default risk and, thus, decrease the debt cost of capital." We thus expect that the signaling effect of income smoothing should be stronger in firms with higher default risk, because income smoothing may have a greater benefit for firms with higher default risk than those with lower default risk.[9] In Table 4 Panel A, we conduct a subsample analysis by the degree of default risk, as proxied by firm equity volatility, bond credit ratings and firm profitability. We find that the reduction effect of income smoothing on the cost of debt is significant only in the subsamples of firms with higher default risk, that is, those with higher volatility, lower credit ratings and lower profitability.

[9] It may also be more costly for riskier firms to smooth earnings. Ronen and Sadan (1981) argue that only firms with good prospects smooth earnings, because borrowing from the future could be disastrous to a poorly performing firm if a problem explodes in the near term.

Table 4
Subsample analysis.

Panel A: Subsample analysis by information opaqueness

Dep. Var. = cost of debt	(1) Large firms (Q4)	(2) Middle-sized firms (Q2 and Q3)	(3) Small firms (Q1)	(4) Low volatility	(5) High volatility
Income smoothing	−0.034	−0.44***	−0.64***	−0.0018	−0.70***
	(−0.16)	(−2.91)	(−2.68)	(−0.02)	(−3.44)
Control variables and intercept	Yes	Yes	Yes	Yes	Yes
Year, 2-digit SIC, and bond type effects	Yes	Yes	Yes	Yes	Yes
N	46,172	91,819	45,941	92,042	91,890
Adj. R^2	0.66	0.75	0.76	0.70	0.78

Panel B: Subsample analysis by probability of default

Dep. Var. = cost of debt	(1) High ratings (A− or above)	(2) Low ratings (BBB+ or below)	(3) High profitability (*ROA*)	(4) Low profitability (*ROA*)
Income smoothing	0.0058	−0.42***	0.032	−0.64***
	(0.05)	(−2.61)	(0.30)	(−3.05)
Control variables and intercept	Yes	Yes	Yes	Yes
Year, 2-digit SIC, and bond type effects	Yes	Yes	Yes	Yes
N	87,027	96,905	91,689	92,243
Adj. R^2	0.64	0.73	0.74	0.76

Panel C: Subsample analysis by corporate governance

Dep. Var. = cost of debt	(1) CEO is board chair	(2) CEO is not board chair	(3) % inside directors above median	(4) % inside directors below median
Income smoothing	−0.30**	−0.45*	−0.31*	−0.38**
	(−2.24)	(−1.89)	(−1.91)	(−2.12)
Control variables and intercept	Yes	Yes	Yes	Yes
Year, 2-digit SIC, and bond type effects	Yes	Yes	Yes	Yes
N	128,067	45,580	89,546	94,386
Adj. R^2	0.79	0.74	0.77	0.73

Dep. Var. = cost of debt	(5) Blockholder indicator = 0	(6) Blockholder indicator = 1	(7) Institutional holdings below median	(8) Institutional holdings above median
Income smoothing	0.19	−0.46***	−0.34*	−0.40***
	(0.79)	(−3.89)	(−1.78)	(−3.06)
Control variables and intercept	Yes	Yes	Yes	Yes
Year, 2-digit SIC, and bond type effects	Yes	Yes	Yes	Yes
N	31,198	152,101	91,029	92,903
Adj. R^2	0.82	0.75	0.77	0.78

This table presents the results of the subsample analysis based on bond-level observations. The dependent variable is the cost of debt as measured by bond yield from trace. The results for the firm-level analysis are similar and thus omitted. Detailed definitions of the variables are reported in the Appendix. Heteroscedasticity robust *T*-statistics are given in parentheses and are adjusted for clustering within bond issues.

* Indicate statistical significance at the 10% level.

** Indicate statistical significance at the 5% level.

*** Indicate statistical significance at the 1% level.

Table 5
Robustness analysis.

Dep. Var. = cost of debt	(1) Bond fixed effects	(2) Firm fixed effects (firm-level analysis)	(3) Alternative *IS* measure (TZ statistic)	(4) Alternative *IS* measure (TZ rank with intercept)	(5) Alternative *IS* measure (LNW rank)	(6) Subsample of single-bond firms	(7) Subsample of multiple-bond firms
IS	−0.07***	−0.12***	0.45***	−0.28***	−0.23*	−0.50***	−0.21***
	(−5.09)	(−5.91)	(3.58)	(−2.74)	(−1.80)	(−12.30)	(−17.36)
SIZE	−0.11***	−0.15***	−0.11**	−0.10**	0.11	−0.11***	−0.04***
	(−5.64)	(−5.16)	(−2.44)	(−2.11)	(1.14)	(−5.66)	(−10.04)
DEBT	0.15**	0.06	0.32	0.38	0.71	1.30***	0.26***
	(2.49)	(0.69)	(0.96)	(1.13)	(1.45)	(12.69)	(6.51)
VOLAT	−0.26***	−0.98***	1.65***	1.63***	0.36	0.95***	1.63***
	(−3.62)	(−9.57)	(2.99)	(2.93)	(0.72)	(6.29)	(24.68)
CALL	–	–	0.44*	0.47*	0.70*	0.57***	0.67***
	–	–	(1.79)	(1.82)	(1.78)	(8.19)	(19.90)
lnMAT	−0.85***	0.36***	0.38***	0.38***	0.31***	−0.14***	0.42***
	(−113.78)	(73.01)	(11.55)	(11.36)	(6.80)	(−6.04)	(110.35)
COUPON	–	0.01	0.10***	0.11***	0.15***	0.28***	0.08***
	–	(1.56)	(3.63)	(3.74)	(4.17)	(21.66)	(34.27)
SP	–	0.08***	0.25***	0.26***	0.36***	0.19***	0.26***
	–	(4.48)	(11.42)	(11.53)	(7.68)	(22.03)	(118.41)
MKBK	−0.13***	−0.11***	0.15***	0.15***	0.34***	−0.09***	0.15***
	(−18.63)	(−10.12)	(3.14)	(3.05)	(4.80)	(−5.32)	(28.90)
ILLIQ	−0.002**	0.01***	−0.002	−0.003	0.01**	−0.01	−0.002*
	(−2.04)	(3.73)	(−0.54)	(−0.61)	(2.40)	(−1.26)	(−1.89)
COVERAGE	−0.07***	−0.001	0.06	0.04	−0.42***	0.34***	0.06***
	(−6.80)	(−0.10)	(0.69)	(0.50)	(−3.33)	(8.79)	(5.67)
lnOUTST	–	−0.02***	0.02	0.003	0.03	−0.23***	0.02***
	–	(−4.79)	(0.34)	(0.06)	(0.42)	(−7.55)	(5.11)
ROA	−1.62***	−2.65***	−3.96***	−4.02***	−8.18***	−6.18***	−3.25***
	(−13.72)	(−16.36)	(−5.18)	(−5.14)	(−6.28)	(−22.05)	(−42.10)
TANGIB	1.31***	1.53***	0.68**	0.73**	1.94***	−0.80***	0.95***
	(14.63)	(12.43)	(2.21)	(2.35)	(4.19)	(−11.11)	(28.58)
ZSCORE	−0.12***	−0.09***	0.11	0.12	0.38***	0.07***	0.07***
	(−6.90)	(−4.18)	(1.49)	(1.62)	(2.97)	(3.65)	(11.56)
TSPREAD	0.07***	0.05***	0.04	0.04	−0.08*	0.21***	0.01
	(10.37)	(4.92)	(0.80)	(0.84)	(−1.90)	(6.81)	(1.37)
CSPREAD	0.76***	1.06***	1.05***	1.06***	0.86***	0.98***	1.09***
	(32.86)	(30.22)	(7.91)	(8.00)	(6.86)	(9.46)	(35.16)
Intercept	7.94***	6.06***	1.10	0.86	−2.82	6.09***	1.13
	(37.93)	(17.68)	(0.00)	(0.00)	(−0.00)	(13.74)	(0.00)
	Year effects	Year effects	Year, 2-digit SIC, and bond type effects	Year, 2-digit SIC, and bond type effects	Year, 2-digit SIC, and bond type effects	Year, 2-digit SIC, and bond type effects	Year, 2-digit SIC, and bond type effects
N	183,932	103,767	183,932	183,932	240,355	21,074	162,858
Adj. R^2	0.88	0.86	0.75	0.75	0.67	0.81	0.75

This table presents the results of the robustness analysis. All of the regressions are based on bond-level observations, except those in Column (2) which are based on firm-level observations. The results based on firm-level observations in Columns (3)–(7) are similar and thus omitted. (1) is a bond fixed-effect regression and (2) is a firm fixed-effect regression. In Column (3), the original TZ statistic rather than the reverse fractional ranking is used as the main independent variable. In Column (4), we perform a robustness analysis using the income smoothing measure estimated from regression (1) with an intercept term, as in Eq. (7) of Kothari et al. (2005). In Column (5), we use the standard deviation-based income smoothing measure estimated as in Leuz et al. (2003). (6) is based on the subsample of firms that have only one bond issue and (7) is based on the subsample of firms that issue multiple bonds. The detailed definitions of the variables are reported in the Appendix. Heteroscedasticity robust *T*-statistics are in parentheses.

* Indicate statistical significance at the 10% level.
** Indicate statistical significance at the 5% level.
*** Indicate statistical significance at the 1% level.

In addition, if the signaling effect is the dominating effect of income smoothing on the cost of debt, then such an effect should be stronger in informationally opaque firms because information signaling is more valuable in such firms. Therefore, as shown in Table 4 Panel B, we perform an analysis by grouping firms by size. We find that the effect of income smoothing is only significant in middle-sized and small firms and is insignificant in large firms. Also, the magnitude of the coefficient is larger in smaller firms than in middle-sized firms. These results provide the evidence that the signaling effect is stronger in more opaque firms. Moreover, because volatile firms are less transparent, the results of the subsample analysis by firm volatility, given in Panel A of Table 4, provide additional evidence that the signaling effect is more significant in less transparent firms.

Furthermore, if the signaling role of income smoothing dominates the garbling role in determining bond yields, then we should expect to see that the effect of income smoothing in reducing debt costs is weaker in firms that have a higher possibility of managerial garbling, such as firms with weaker governance. We thus split the full sample into subsamples of firms with weaker and stronger corporate governance and then perform the regressions on these subsamples. The results, reported in Panel C of Table 4, show that the negative effect of income smoothing on bond yields is more negative in firms in which the CEO is not the board chair, the fraction of inside directors is below sample median, there is at least one blockholder with more than five percent of stock ownership and institutional stock holdings are above the sample median. These results suggest that stronger corporate governance weakens the garbling effect and makes the signaling effect more likely to dominate.

4.3. Robustness analysis

This section performs various robustness checks and reports the results in Table 5. The effect of income smoothing on the cost of debt may be contaminated by endogeneity. For example, it is possible that unobserved factors (such as an unobserved firm quality or culture) affect a firm's tendency to smooth its earnings and at the same time these factors may be related to bond yields. Or, unobserved macroeconomic shocks may affect bond yields and a firm's profitability and thus its tendency to smooth earnings. To deal with the issue, we use bond fixed effects and firm fixed effects regressions and report the results in Columns (1) and (2) of Table 5. The results show that the effect of income smoothing on bond yields remains negative and significant.

In Columns (3)–(5) of Table 5, we use alternative measures of income smoothing. First, in Column (3), instead of using the reverse ranking of the TZ statistic, we use the original TZ statistic as the main independent variable and find that more negative correlations between the change in discretionary accruals and the change in un-managed income (i.e., smoother earnings) correspond to lower cost of debt. Second, in the baseline regressions, we follow Tucker and Zarowin (2006) and omit a separate intercept term in regression (1). We thus perform a robustness analysis by estimating regression (1) with an intercept term, as in Eq. (7) of Kothari et al. (2005). We obtain similar results and report them in Column (4) of Table 5. Third, in Column (5), we use the standard deviation-based income smoothing measure estimated as in Leuz et al. (2003). The results remain similar.

Finally, as some sample firms carry multiple bond issues and others have only one bond issue, we perform regressions based on the subsample of firms with only one bond issue and the subsample of firms with multiple bond issues. The results, reported in Columns (6) and (7) of Table 5, show that the negative effects of income smoothing remain robust.

5. Conclusion

Using a large sample of publicly traded corporations and the Tucker and Zarowin (2006) measure of income smoothing, we find that income smoothing is a significant determinant of the cost of debt capital, with higher income smoothing firms exhibiting a lower contemporaneous cost of debt capital, as reflected by their lower bond yields. These results contribute to our understanding of income smoothing. Studies using equity market data suggest that smoothing improves the informational quality of past and current earnings. Our

results using credit market data complement past findings from the equity market. Our credit market results support the notion that income smoothing represents an information-signaling mechanism, rather than a garbling device. Finally, the results reported here add to a growing body of empirical literature that speaks to the issues of accounting transparency and asset pricing.

Despite this evidence, the findings reported here should be interpreted with the following two points in mind. First, as with other studies of income smoothing, which include Tucker and Zarowin (2006), measurement error in the discretionary accruals proxy used in this study may affect the results. Second, firms in the sample may be using private debt. It is possible that firms using more public debt tend to smooth earnings more because the benefit of information signaling could be larger in the public debt market than in the private debt market. As a result, the effect of income smoothing on the cost of public debt, as estimated in this paper, might be larger than the effect on the cost of private debt.[10]

Appendix A. Variable definitions

In Panel A, total assets, net sales, net income and operating cash flow are Compustat Data6, Data12, Data18 and Data308, respectively. The market value of the firm in $millions is the market value of the equity plus the book value of the debt, or the number of shares outstanding (Data25) times closing price per share (Data199) plus the book value of assets (Data6) less the book value of the equity (Data60). The market-to-book ratio is calculated as market value of the firm scaled by total assets. Return on assets is net income over total assets. Debt-to-assets is total debt (Data9 + Data34) divided by total assets. Zscore is Altman's Zscore. Accruals are net income less operating cash flow scaled by beginning of year market value. In Panel B, weighted average yield, term to maturity and term to call are the annualized averages associated with the publicly traded debt as reported by the TRACE system weighted by amount of debt outstanding.

Variable names	Variable definitions and corresponding Compustat data items
ASSETS	Total assets (data6)
Net income (*NI*)	Net income before extraordinary items (data18)
ACCRUALS	Total accruals estimated as net income before extraordinary items (data18) minus operating cash flows (data308), scaled by lagged total assets (data6)
ΔSALES	Change in sales (data12) from $t-1$ to t, scaled by lagged total assets (data6)
PPE	Gross property, plant and equipment (data7) scaled by lagged total assets (data6)
ROA	Return on assets, which is net income before extraordinary items (data18) over lagged total assets (data6)
NDAP	Non-discretionary accruals estimated as the fitted value from the regression in Table 1
DAP	Discretionary accruals estimated as the residual from the regression in Table 1
PDI	Pre-discretionary income, i.e., un-managed income, is calculated as net income before extraordinary items (data18) minus discretionary accruals (*DAP*)
Corr(*ΔDAP*, *ΔPDI*)	Correlation coefficient between the change in discretionary accruals and the change in un-managed income
IS	Income smoothing ranking following Tucker and Zarowin (2006). This *IS* measure is formed by converting the correlation, *Corr*(*ΔDAP*, *ΔPDI*), into reverse fractional rankings by two-digit industry SIC code for each year. The *IS* measure ranges from 0 to 1 by industry-year with the highest income smoothers (more negative correlations) having higher rankings, and lower income smoothers (less negative correlations) having lower rankings

[10] Aivazian et al. (2006) report that firms using public debt tend to smooth their dividends more than firms using the private debt market.

LNW rank	Income smoothing ranking following Leuz et al. (2003), with a higher rank indicating smoother earnings. We estimate the *LNW* income smoothing measure as the standard deviation of net income divided by the standard deviation of operating cash flows, with a larger value of the measure indicating less smooth earnings. The *LNW* rank is then defined as the reverse fractional rankings by two-digit industry SIC code within each year. In estimating the *LNW* variable, net income is income before extraordinary items (IB) scaled by lagged assets (AT). Operating cash flows are the difference between IB and total accruals, scaled by lagged AT. Total accruals here are defined as dACT–dLCT–dCHE + dDLC + dTXP–DP, where dACT is the year by year change in current assets (ACT), dLCT is the change in current liabilities (LCT), dCHE is the change in cash (CHE), dDLC is the change in debt in current liabilities (DLC), dTXP is the change in income taxes payable (TXP) (dTXP is treated as zero if missing), and DP is depreciation and amortization
EARNINGS MANAGEMENT	Absolute value of *DAP*, discretionary accruals estimated as the residual from the regression in Table 1
AVEYIELD	Median daily yield per bond as reported by TRACE or the average of the median daily yield across all of the bond issues per firm
SIZE	Natural logarithm of beginning of period net sales
DEBT	Beginning of period ratio of total debt to total assets
VOLAT	Beginning of period standard deviation of CRSP daily equity returns using 252 days prior to the bond spread measurements
CALL	A dummy variable taking a value of 1 if the bond is callable
lnMAT	Natural logarithm of the bond maturity measured in months or the natural log of the term to call if the call is in the money
lnOUTST	Natural logarithm of the amount of bonds outstanding
COUPON	Annual coupon rate of the bond
SP	*S&P* credit rating converted to a numeric scale where 1 represents AAA and 22 represents a rating of *D* (A greater numerical value indicates lower rating)
TSPREAD	Term spread estimated as the difference between the 10-year and the 2-year treasury yield as reported by the Federal Reserve Board of Governors
CSPREAD	Credit spread estimated as the difference between AAA and BAA corporate bond yields as reported by the Federal Reserve Board of Governors
MKBK	Beginning of the period ratio of market value of the equity plus the book value of the debt to book value of the assets
ILLIQ	Standard deviation of the price during the week divided by the total volume traded during the week
COVERAGE	A dummy variable that takes a value of 1 if operating cash flows are greater than current liabilities
ROA	Beginning of period net income over total assets
TANGIB	Beginning of period property plant and equipment over total assets
ZSCORE	Modified Altman's (1968) Z-score = (1.2 working capital + .4 retained earnings + 3.3 EBIT+0.999 Sales)/Total Assets = (1.2 data179 + 1.4 data36 + 3.3 data170 + 0.999 data12)/data6

References

Aivazian, F., Booth, L., Cleary, S., 2006. Dividend smoothing and debt ratings. J. Financ. Quant. Anal. 41 (2), 439–453.
Altman, E., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. J. Finance 23 (4), 589–609.
Arya, A., Glover, J., Sunder, S., 1998. Earnings management and the revelation principle. Rev. Acc. Stud. 3, 7–34.
Beidleman, C., 1973. Income smoothing: the role of management. Account. Rev. 48 (4), 653–667.

Bessembinder, H., Kahle, K., Maxwell, W., Xu, D., 2008. Measuring abnormal bond performance. University of Utah. (Unpublished working paper).
Chen, N., Roll, R., Ross, S., 1986. Economic forces and the stock market. J. Bus. 59 (3), 383–403.
Chen, L., Lesmond, D., Wei, J., 2007. Corporate yield spreads and bond liquidity. J. Finance 62 (1), 119–149.
Collin-Dufresne, P., Goldstein, R., Martin, J., 2001. The determinants of credit spread changes. J. Finance 56 (6), 2177–2207.
Dechow, P., Hutton, A., Sloan, R., 1995. Detecting earnings management. Account. Rev. 70 (2), 193–225.
Demski, J., 1998. Performance measure manipulation. Contemp. Account. Res. 15 (3), 261–285.
Demski, J., Frimor, H., 1999. Performance measure garbling under renegotiation in multi-period agencies. J. Account. Res. 37 (Supplement), 187–214.
Dichev, I., Graham, J., Harvey, C., Rajgopal, S., 2013. Earnings quality: evidence from the field. J. Account. Econ. 56, 1–33.
Duffie, D., Lando, D., 2001. Term structures of credit spreads with incomplete accounting information. Econometrica 69, 633–664.
Edwards, A., Harris, L., Piwowar, M., 2007. Corporate bond market transaction costs and transparency. J. Finance 2, 1421–1451.
Fama, E., French, K., 1993. Common risk factors in the returns of stocks and bonds. J. Financ. Econ. 33 (1), 3–56.
Fudenberg, D., Tirole, J., 1995. A theory of income and dividend smoothing based on incumbency rents. J. Political Economy 103 (1), 75–93.
Goel, A., 2003. Why do firms smooth earnings? J. Bus. 76, 151–192.
Graham, J., Harvey, C., Rajgopal, S., 2005. The economic implications of corporate financial reporting. J. Account. Econ. 40, 3–75.
Healy, P., 1985. The effect of bonus schemes on accounting decisions. J. Account. Econ. 20, 125–153.
Hunt, A., Moyer, S., Shevlin, T., 2000. Earnings volatility, earnings management, and equity value. University of Washington. (Unpublished working paper).
Jones, J., 1991. Earnings management during import relief investigations. J. Account. Res. 29 (2), 193–228.
Kirschenheiter, M., Melumad, N., 2002. Can big bath and earnings smoothing co-exist as equilibrium financial reporting strategies? J. Account. Res. 40 (3), 761–796.
Kothari, S., Leone, A., Wasley, C., 2005. Performance matched discretionary accruals. J. Account. Econ. 39 (1), 161–197.
Lambert, R., 1984. Income smoothing as rational equilibrium behavior. Account. Rev. 41 (4), 604–618.
Lang, M., Maffett, M., 2011. Economic effects of transparency in international equity markets: a review and suggestions for future research. Found. Trends Account. 5, 175–241.
Leuz, C., Nanda, D., Wysocki, P., 2003. Investor protection and earnings management. J. Financial Econ. 69, 505–527.
Miller, M., Rock, K., 1985. Dividend policy under asymmetric information. J. Finance 40, 1031–1051.
Myers, L., Skinner, D., 2002. Earnings momentum and earnings management. University of Michigan. (Unpublished working paper).
Ronen, J., Sadan, S., 1981. Smoothing Income Numbers: Means, Objectives, and Implications. Addison-Wesley Publishing Company, Boston, MA.
Sankar, M., Subramanyam, K., 2001. Reporting discretion and private information communication through earnings. J. Account. Res. 39 (2), 365–386.
Srinidhi, B., Ronen, J., Maindiratta, A., 2001. Market imperfections as the cause of accounting income smoothing – the case of differential capital access. Rev. Quant. Financ. Acc. 17, 283–300.
Subramanyam, K., 1996. The pricing of discretionary accruals. J. Account. Econ. 22, 249–281.
Tang, D., Yan, H., 2006. Liquidity and credit default swap spreads. Kennesaw State University. (Unpublished working paper).
Trueman, B., Titman, S., 1988. An explanation for accounting income smoothing. J. Account. Res. 26, 127–139.
Tucker, J., Zarowin, P., 2006. Does income smoothing improve earnings informativeness. Account. Rev. 81 (1), 251–270.
Verrecchia, R., 1983. Discretionary disclosure. J. Account. Econ. 5, 179–194.
Yu, F., 2005. Accounting transparency and the term structure of credit spreads. J. Financial Econ. 75 (1), 53–84.

China Journal of Accounting Research 9 (2016) 191–206

HOSTED BY

Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Disclosure of government financial information and the cost of local government's debt financing—Empirical evidence from provincial investment bonds for urban construction ☆

Zhibin Chen [a], Jun Pan [b,*], Liangliang Wang [a,*], Xiaofeng Shen [b]

[a] School of Economics & Management, Southeast University, China
[b] School of Finance & Economics, Jiangsu University, China

ARTICLE INFO

Article history:
Received 6 April 2015
Accepted 17 February 2016
Available online 5 April 2016

Keywords:
Local government debt
Cost of debt financing
Government financial information disclosure
Government intervention
Government audit

ABSTRACT

China's slowing economic growth and rapid urbanization have made local government debt financing a significant issue. This study uses a sample of China's provincial government data for the 2006–2012 period to examine the effect of the disclosure of financial information by local governments on their debt financing costs. The results show that financial information disclosure is conducive to public supervision and enhances government credibility, leading to a decrease in the cost of debt financing. Furthermore, increased government economic intervention increases the strength of the association between financial information disclosure and the cost of debt financing. Increased government audit prevention function weakens the strength of the association between financial information disclosure and the cost of debt financing.

1. Introduction

In recent years, local government debt has increased. Deputy finance minister Wang Baoan says: "The contradiction between tardiness of financial growth of revenue and strong rigidity of expenditure will further

* Corresponding authors.
E-mail addresses: panjun7219@163.com (J. Pan), acwangll@126.com (L. Wang).
☆ This study was supported by the National Natural Science Foundation of China (Project Nos. 71172064; 71502033; 71572071), National Statistics Research Plan Key Project (Project No. 2014LZ58), Universities' Philosophy and Social Science Research Project of Jiangsu Province General Project (Project No. 2015SJB836) and the Humanities and Social Sciences Research Youth Fund Project of Ministry of Education of China (Project No. 15YJC630096).

http://dx.doi.org/10.1016/j.cjar.2016.02.001
1755-3091/

intensify the pressure on local government debt." A 2013 report by the national government's Audit Department states that the government's direct liability for repayment of debt increased by 62.44% between 2010 and June 2013. As the expansion of debt is often accompanied by an increase in financial risk, the Third Plenary Session of the 18th session of the Central Committee of the Communist Party of China has announced that the relevant departments should establish a reasonable early warning mechanism to control government debt risk and to enhance management. For example, *The State Council on Strengthening the Opinions of the Local Government Debt Management* was issued by the State Council in 2014. However, a government without debt financing is not a government with no risk. Debt risk, to a large extent, is related to the ability to pay off debt (Liu, 2014), and blindness about debt financing combined with ignorance about the lending rate leads to huge risks for governments (Luo and She, 2014).

Previous studies of the cost of debt focus on corporate debt, financing scale and risk factors, such as accounting information and debt contracts (Sun et al., 2006; Lu et al., 2008; Deng, 2014), information disclosure and debt financing (Hu and Tang, 2007; Lu et al., 2013), control of local government debt scale (Azuma and Kurihara, 2011), municipal bonds and local government debt risk (Mikesell, 2002; Liu and Zhao, 2005; Han et al., 2005), government performance and cost of financing (Wilson and Howard, 1984). These previous studies, especially those examining financial disclosure, suggest that the cost of debt financing is less for local governments. Therefore, this study uses a sample of urban construction investment bonds[1] issued at the provincial level to explore how financial information transparency affects the cost of local government debt financing. The results show that a high degree of government financial information disclosure is associated with a low cost of local government debt financing. A higher government intervention index and more effective government auditing are also associated with a lower cost of local government debt financing, although these factors also weaken the negative relationship between local government financial information disclosure and government debt financing costs.

The rest of this paper is organized as follows. The second section discusses the institutional background. The third section presents the theoretical analysis and research hypotheses, and the fourth section presents the research design. The fifth section presents the empirical testing and results. The final section discusses the results and presents the conclusions.

2. Institutional background

Since its 1993 reforms of its fiscal and taxation system policy, the Chinese government has allocated more capital to regional infrastructure construction. However, these reforms have caused some problems at the local level, such as the mismatch of government fiscal power and responsibility, leading to a lack of financial resources. To meet the demands of economic development and political competition, local governments have financed their regional investment and financing platforms[2] (Mei, 2011) through bank loans and by issuing Quasi-municipal bonds (also called urban construction investment bonds, hereinafter referred to as "UCID").[3] Originally, the central government allowed the Shanghai government to issue bonds to raise money for urban construction in the new Pudong area. In 2005, with the support of state policy, the use of UCIDs spread rapidly. In 2008, in response to the global subprime mortgage crisis, the central government implemented the "four trillion plan" to stimulate economic growth, and this provided further opportunities for the development of UCIDs. The issuers of UCIDs are regional investment and financing platforms established by local governments and the aim is to raise money. The buyers are mainly institutional investors, and the money is used to make loan payments, pay for infrastructure construction and provide day-to-day

[1] These instruments originated in the Shanghai Pudong construction bonds at the beginning of 1992 and have developed relatively slowly. However, the 2008 financial crisis and the "four trillion plan" launched by the government stimulated their development. Due to concerns about the out of control local financing behavior, since 2013, the Chinese government has begun macro control of bonds. As document No. 43 [2014] indicates: "local government debt is facing full clear screening, issuing bonds is the only way to raise funds for provincial governments."

[2] According to the 1994 regulations, "The local government shall not issue bonds."

[3] The local government debt financing may also include forms of trust-financing, finance-leasing and BT-financing, but they are adopted at a very low rate, due to the relatively high cost of financing.

working capital. This debt financing source is local fiscal revenues, sales revenue from land leasing and other assets. From the perspective of credit risk and credit promotion measures, these platforms always use accounts receivable, the right of land use or third party professional guarantee agencies as pledges or insurance.

The amount of debt accumulated by local governments in China is constantly increasing, and this has attracted the attention of regulators. In 2010, a number of bad credit events, such as the Sichuan expressway event, Yunnan province energy investment group restructuring, and Shanghai Shenhong, led to a drop in the number of UCIDs issued. Subsequently, the government has begun to standardize the management of financing behavior (i.e., *Guidelines strengthening regulatory risk of local government financing platform loans in 2012* issued by the "China Banking Regulatory Commission" [CBRC]), which has caused a bank credit squeeze.[4] Therefore, local government debt capital is now largely financed without bank loans. Given the capital requirements of managing debt and funding projects under construction, UCIDs are important financing channels and the main source of borrowing to both repay existing debt and create new debt. The state council's 2014 *Opinion on strengthening the administration of local government deb*t states that the practice of local governments issuing government bonds and encouraging social capital to participate in public urban infrastructure projects has certain benefits for business investment and operations. It is likely that UCIDs will continue to be used, but the traditional UCIDs will be extended by changes such as a PPP subject for public offering items. According to Wind, the debt-cash of local governments in 2015 is mainly from sales revenue of land leases by local investment and financing platforms, local government fund and bonds replacement, bank loans, trust funds and other financing channels. Therefore, the timely and full disclose of information about funding sources and capital investment plans helps investors to evaluate UCIDs. As the rating of government bonds and interest rates is not only determined by accounting numbers, but also by factors such as the legal environment and information disclosure Wescott (1984), this study discusses the relationship between government financial information disclosure and debt financing costs.

3. Theoretical analysis and research hypotheses

3.1. Government financial information disclosure and the cost of debt financing

Information asymmetry theory (Akerlof, 1970) considers the problem of a "lemon market." Information asymmetry between the public and government creates a strong desire for access to information (Chang, 2008). Even internal stakeholders in the government have a strong need for information, which may be greater even than that of external stakeholders (Zhang et al., 2009; Lu, 2010). Disclosing government financial information may help the public to understand how public resources are used, reduce the asymmetrical distribution of information, increase social support (Zhang and Zhang, 2012) and promote the public fiduciary responsibilities of governments (Chen and Li, 2003; Huang et al., 2004). It is well-known that government financial transparency is the key to good financial management; it helps in the supervision and evaluation of government work, improves the operational efficiency of governments and reduces the corruption of government officials (Xiao and Yan, 2013; Zhou, 2010). Providing the public with accurate government financial information is an essential part of public supervision; it enhances a government's credibility, is a cornerstone of successful government transformation and is a necessary step in the creation of a responsible and service-oriented government.

Government financial information disclosure allows the general public and stakeholders to understand a government's macro policy and dynamic guidelines, to evaluate the government's resource allocation and to supervise government behavior. More specifically, government financial transparency helps public investors accurately assess government performance and enhances their investment confidence. As a result, investors make better investment decisions and this improves the efficiency of investment. Furthermore, by reducing information asymmetry between the public and the local government, transparency improves a government's image and credibility, which increases investors' trust and thus the government's ability to attract external

[4] According to statistics, the proportion of government debt balance accounted for by bank loans decreased from 79% at the end of 2010 to 56.5% in June, 2013.

debt and outside investment. When a government is facing debt financing, financial transparency sends positive signals to outside investors. This kind of reputation mechanism facilitates social relations and reduces the perceived risk of breach of contract, which influences financing pricing. As disclosure of government financial information increases the credibility of a government, it reduces the amount of financing revenues that investors require, i.e., the cost of government debt financing will be lower. Based on the above analysis, this study makes the following hypothesis.

H1. A higher level of government financial information disclosure is associated with a lower cost of local government debt financing.

3.2. Government financial information disclosure, government interference and the cost of debt financing

The structure and period of state debt financing are mainly affected by three factors: the legal system, marketization and government intervention (Demirguc-Kunt and Maksimovic, 1999; Giannetti, 2003). The government intervention index (a subindex of GDI) is a variable for measuring the degree of government intervention in the market. A high score represents a stronger marketization process and less government intervention (Fan and Wang, 2001; Xia and Chen, 2007). A low score on the index of government intervention indicates that a company's debt financing period will be longer, and that the debt financing cost will be higher (Sun et al., 2005). Although the fiscal decentralization that occurred between 1950 and 1960 mobilized local governments' participation in economic development, the imbalance between its financial rights and responsibilities aggravates local financial distress and forces local governments to interfere in the market, for example, by influencing financial institutions' credit decisions. This in turn affects local government debt financing. This has been called the "vassal economy" phenomenon (Shen and Dai, 1990), "tournament of promotion" behavior (Zhou, 2004) and "forced marriage" phenomenon (Xiang, 2012).

When a region has a low government intervention index score, the local government has strong control over the financial market and local enterprises and implicitly guarantees listed companies; this compels local state-owned banks to engage in differential loans (Jiang and Li, 2006). Due to risk control indicators, state-owned banks tend to have more restrictive conditions when considering giving loans to non-state enterprises; thus, the action is not conducive to the overall reduction of funding cost. However, when there is a high degree of government financial information disclosure, it is easier to break the local government administrative interference phenomenon. As a kind of reputation mechanism, it reduces the cost of local debt financing. When the government intervention index score is high, the level of marketization and rule of law are improved (Zhao, 2013), and this effectively reduces or even puts an end to government administrative personnel abusing their power over financial institutions, enterprises, institutions and investors. It also reduces the cost of communication between financial institutions and government officials and improves the efficiency of investment, thus reducing the cost of financing by local governments' investment and financing platforms. In this scenario, government intervention may cause a substitution effect on financial information disclosure, so that the incremental contribution of information disclosure to lower costs will decrease. Based on the above analysis, this study makes the following hypothesis:

H2. Government intervention lowers local governments' debt financing costs and weakens the cost-reduction effect of financial information disclosure on debt financing.

3.3. Government financial information disclosure, government audits and the cost of debt financing

Government audits are an important part of the national governance mechanism of supervision; they promote fiduciary responsibility, and play an "immune system" function (Liu, 2012; Liu et al., 2014). Fiscal transparency is part of a local government's economic responsibility, underpins the prevention, reveals and resists functions of government audits. The basic function of auditing is to discover and correct any potential hazards in an enterprise's economic activities. An audit is a kind of external supervision mechanism that can effectively reduce information asymmetry between principals and agents by monitoring the disclosure of information by all kinds of organizations. A strong government audit increases the possibility that a local

government has carried out adjustments identified in the audit, and this increases fiscal transparency Li and Liu (2014). Thus, effective audits increase the reliability of accounting information, improve the operational efficiency of a government, protect financial funds and reduce risk (Cai et al., 2009; Wei et al., 2010). The government of a region with greater marketization triggered by a government audit may have a lower debt financing cost (Tang et al., 2012), and a higher quality of audit is favorable for the formation of a good municipal bond market.

A government audit is a reputation mechanism that maintains the safety of financial capital and increases government accountability. Government audits examine financial revenues and expenditures and can improve the authenticity and reliability of government financial information. Therefore, a government audit can reduce the debt risk of local government and effectively reduce the cost of financing. When the government audit mechanism is not sound, the financial information disclosure system is more likely to find weaknesses in the debt financing of local government. The financial information disclosure system is an alternative to the government audit that can effectively prevent debt risk, and thus reduce the cost of debt financing. However, as government audits serve a prevention function, their presence can weaken the governance effect and reputation mechanism of local government financial information disclosure. The more effectively the government audit reduces the cost of debt financing, the higher its substitution effect on financial information disclosure; thus, effective audits weaken the effect of information disclosure on the cost of financing. Based on the above analysis, this study makes the following hypothesis.

H3. Effective government audits lower local governments' debt financing costs and weaken the ability of local government financial information disclosure to lower debt financing costs.

4. Research design

4.1. Sample selection and data sources

This study uses a sample of provincial governments (including provinces, autonomous regions and municipalities directly under the central government) during the 2006–2012 period. The Tibet autonomous region is excluded because of missing debt data. The UCID debt-related data are from the Wind database. The fiscal transparency data are from the *Fiscal transparency in China* report (2013) by the Finance and Public Policy Research Center of Shanghai University. According to the editor's introduction, the data for 2011 are related to the data from 2010, so this study uses the 2011 data for 2010 and 2012. The government intervention data are from a 2011 report *China's marketization index—regional relative progress of marketization* by Fan Gang, Wang Xiaolu and Zhu Hengpeng. The data from 2010 are approximated with data from 2009. The government audit data are from the *Chinese audit yearbook* (2014). The remaining data are from the CSMAR regional economic database.

4.2. Variable definitions and model specification

Building on previous research, this study uses the following regression model:

$$\mathrm{Loan_{mr}\ or\ Loan_{p50r}} = a_0 + a_1\mathrm{FTscore} + a_2\mathrm{Lngdpp} + a_3\mathrm{GAP2} + a_4\mathrm{INV2} + a_5\mathrm{IND1} + a_6\mathrm{IND2} + \varepsilon \quad (1)$$

If a_1 is significantly negative, H1 is supported, which suggests that government financial information disclosure has a negative effect on debt financing cost.

$$\mathrm{Loan_{mr}\ or\ Loan_{p50r}} = a_0 + a_1\mathrm{FTscore} + a_2\mathrm{gdi} + a_3\mathrm{FTscore} * \mathrm{gdi} + a_4\mathrm{Lngdpp} + a_5\mathrm{GAP2} + a_6\mathrm{INV2} + a_7\mathrm{IND1} + a_8\mathrm{IND2} + \varepsilon \quad (2)$$

$$\mathrm{Loan_{mr}\ or\ Loan_{p50r}} = a_0 + a_1\mathrm{FTscore} + a_2\mathrm{ATpre} + a_3\mathrm{FTscore} * \mathrm{ATpre} + a_4\mathrm{Lngdpp} + a_5\mathrm{GAP2} + a_6\mathrm{INV2} + a_7\mathrm{IND1} + a_8\mathrm{IND2} + \varepsilon \quad (3)$$

In models (2) and (3), the coefficients of interest are a_1 and a_3. If a_1 is significantly negative and a_3 is significantly positive, it suggests that a higher government intervention index score or a more effective government audit prevention function reduces the effect of government financial information disclosure on the cost of local government debt financing, i.e., H2 and H3 are supported.

In these models, the dependent variable is local government debt financing cost. Each year, many provincial cities issue UCIDs at different interest rates. Therefore, this study uses the mean interest rate (*Loan_mr*) of all of the UCIDs issued in a year by all provincial governments as a proxy for local government debt financing cost. Given the skewness and kurtosis of bond rates, the median value of all of the debt interest rate values (*Loan_p50r*) issued by each province is taken as a proxy variable for local government debt financing cost. The explanatory variables are government financial information disclosure (*FTscorew*), government intervention (*GDI*) and government audit (*ATPre*). The study uses the fiscal transparency scores for each province in China, calculated by the Shanghai University of Finance and Economics, as proxy variables for the degree of government financial information disclosure. The government and market index (*GDI*) is used as a proxy variable for the degree of government intervention in different regions. The government prevention index is represented by the ATPre index. The remaining variables are control variables. All of the variables are winsorized at the 5% and 95% levels.

The variable definitions are shown in Table 1.

5. Empirical results

5.1. Descriptive statistics

The standard deviation, minimum value and maximum value of the interest rates of each region, presented in Table 2, show there is a large range between regions in the UCID interest rates. The standard deviation for regional fiscal transparency is 9.261, and the minimum and maximum values are 16.920 and 50.410, respectively, illustrating the big difference among regional fiscal transparency. The average score for government financial information disclosure is 26.267 out of 100, illustrating that government finance information disclosure is generally low in China. There is very little difference between regions in terms of regional per capita GDP or fixed assets investment; however, the mean value of the fiscal gap is 1.095, with a maximum value of 2.958, which shows that some regions are experiencing widespread overspending and face capital pressure. There are also some differences in regional industry structures.

Fig. 1 illustrates the trend in the annual average value of fiscal transparency (*FTscore*). Clearly, the mechanism for local government financial information disclosure is improving. Between 2006 and 2012, 31 provinces (autonomous regions and municipalities directly under the central government) increased their fiscal information disclosure by nearly 36%, and the average score rose nearly eight points.

Fig. 2 shows the average scores for the fiscal transparency variable (*FTscore*) by province. The maximum value, 51.64, is nearly three times the minimum value of 15.9, indicating the large difference among provinces.

Table 1
Definitions of variables.

Variables	Symbol	Definitions
Dependent	Loan_mr	Mean rates of UCIDs issued in a given area
	Loan_p50r	Median rates of UCIDs issued in a given area
Explanatory	FTscore	Government financial information disclosure (score of fiscal transparency)
	FTrank	Government financial information disclosure (national ranking of fiscal transparency)
	GDI	Government intervention index
	ATPre	Government audit prevention function index
Control	Lngdpp	Natural logarithm (base e) of per capita GDP
	GAP2	(Final accounts of local fiscal expenditure − final accounts of local fiscal revenue)/final accounts of local fiscal revenue
	INV2	Natural logarithm of investment in fixed assets
	IND_1	First industry share of GDP (%)
	IND_2	Second industry share of GDP (%)

Table 2
Descriptive statistics.

	Obs.	Mean	Std.	Min.	Median	Max.
loan mr	172	5.492	1.108	3.479	5.659	7.284
loan p50r	172	5.507	1.116	3.564	5.675	7.200
FTscore	172	26.267	9.261	16.920	22.575	50.410
GDI	172	8.382	1.227	5.910	8.665	9.910
ATPre	164	10.310	1.479	7.542	10.272	12.973
lngdpp	172	10.285	0.518	9.438	10.268	11.238
GAP2	172	1.095	0.776	0.134	1.167	2.958
INV2	172	8.826	0.668	7.405	8.864	9.886
ind 1	172	0.105	0.049	0.009	0.110	0.177
ind 2	172	0.498	0.052	0.385	0.512	0.571

Note: All of the variables are winsorized at the 5% and 95% level.

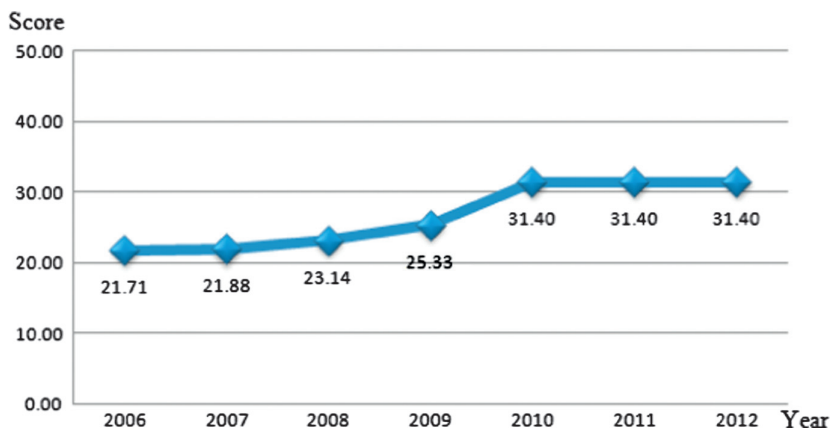

Figure 1. Fiscal transparency over time. Note: The fiscal transparency score has been indexed. Due to missing fiscal transparency data from 2010 and 2012, the study substituted 2011 data for those years.

The top five provinces for fiscal transparency are Fujian (51.64), Hainan (47.22), Xinjiang (39.82), Hei Longjiang (34.10) and Hebei (33.78). Of the four big economic zones, the fiscal transparency scores in the eastern provinces are all more than 20, and Fujian has the highest value (51.64), illustrating relatively high transparency.

5.2. Correlation analysis

The analysis of the correlation coefficients shows that the interest rates of regional urban construction investment bonds do not strongly correlate with government financial information disclosure, but are generally related to each of the control variables. The analysis of the Pearson correlation coefficients shows that the degree of correlation, from strongest to weakest, ranges from investment in fixed assets, secondary industry share of GDP, fiscal gap, the proportion of primary industry and per capita GDP. The Spearman correlation coefficients produce similar results; the strongest correlation is between fixed asset investment and local government debt interest rate. There are some differences between the two coefficients; compared to the Pearson coefficient, the Spearman coefficients show a stronger correlation between fiscal gap and interest rates than between the proportion of secondary industry and interest rates, and the correlation between the proportion of primary industry and interest rates is weaker. Overall, per capita GDP is correlated with government financial information disclosure, which illustrates that more open and transparent financial disclosure is associated with developments in the economy. At the same time, per capita GDP has a significantly negative correlation

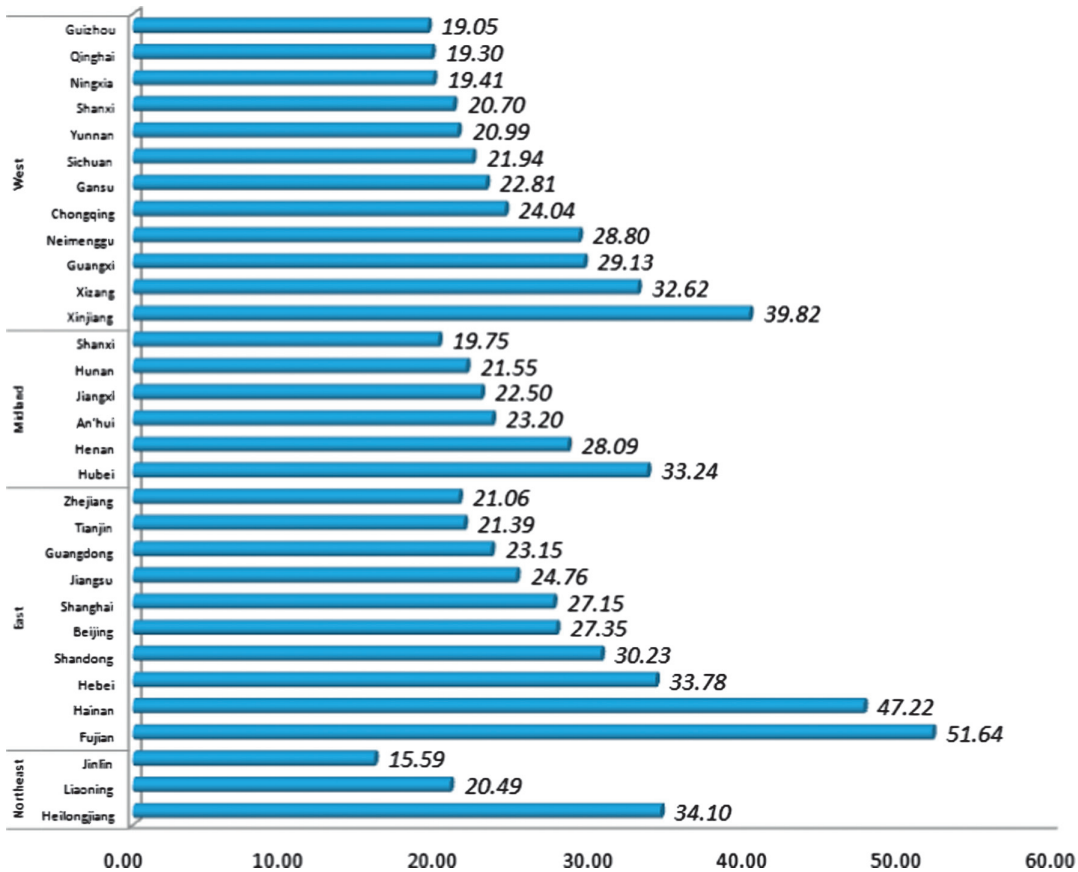

Figure 2. Fiscal transparency by province. Note: Fiscal transparency scores have been indexed. Due to the missing fiscal transparency data from 2010 and 2012, the study substituted 2011 data for those years.

with fiscal gap and the proportion of the primary industry, which implies that in addition to being associated with higher levels of economic development, a smaller fiscal gap is related to less pressure on financial capital, and less dependence on a primary industry (see Table 3).

Table 3
Correlation analysis.

	loan_mr	*loan_p50r*	*FTscore*	*GDI*	*ATPre*	*lngdpp*	*GAP2*	*INV2*	*ind_1*	*ind_2*
loan_mr	1.000	0.977***	0.033	−0.327***	0.061	0.170**	0.230***	0.343***	0.066	0.199***
loan_p50r	0.978***	1.000	0.030	−0.320***	0.071	0.156**	0.224***	0.351***	0.076	0.190**
FTscore	0.088	0.066	1.000	0.157**	0.189**	0.233***	−0.079	0.193**	0.016	−0.129*
GDI	−0.261***	−0.245***	0.023	1.000	0.248***	0.358***	−0.765***	0.297***	−0.416***	−0.061
ATPre	0.047	0.066	0.093	0.294***	1.000	0.257***	−0.248***	0.465***	−0.200***	0.216***
lngdpp	0.141*	0.139*	0.166**	0.307***	0.231***	1.000	−0.666***	0.422***	−0.816***	0.184**
GAP2	0.155**	0.138*	0.001	−0.759***	−0.307***	−0.621***	1.000	−0.299***	0.762***	−0.094
INV2	0.323***	0.337***	0.148*	0.406***	0.479***	0.396***	−0.436***	1.000	−0.175**	0.390***
ind_1	0.148*	0.143*	0.135*	−0.338***	−0.160**	−0.822***	0.677***	−0.101	1.000	−0.273***
ind_2	0.194**	0.189**	−0.087	−0.070	0.215***	0.114	−0.058	0.360***	−0.108	1.000

Note: The Pearson correlation coefficient is lower left; the Spearman correlation coefficient is upper right; The *ATPre* correlation coefficient and other variables' coefficients are the statistical results of 164 observations.

*** = 1% Significance level.

** = 5% Significance level.

* = 10% Significance level.

5.3. Basic regression results

The regression results with average interest rates, *loan_mr*, and median *loan_p50r*, as the dependent variables are as follows. The coefficient of government financial information disclosure (*FTscore*) is significantly negative at the 10% level. This supports H1: a higher degree of government financial information disclosure is associated with a lower issuing rate for UCIDs. In other words, government financial information disclosure reduces the cost of local government debt financing. For the control variables, the correlation coefficient of per capita GDP (*lngdpp*) is positively significant at the 1% level, i.e., regions with higher per capita GDP issue UCIDs at higher rates. Generally, a region with advanced economic development may be more able to develop a bond market and may get through the approval process more easily. This would suggest that such regions would issue UCIDs at a lower interest rate; the regression results may show the opposite trend because governments of richer regions may have larger capital demands, and therefore issue UCIDs at a higher interest rate. The coefficient of the proportion of the primary industry (*ind_1*) is also positively significant at the 5% level illustrating that the issuing rate of UCID increases with an increase in the contribution of a primary industry. These results confirm the study's hypotheses. Regions with relatively low levels of economic development with a larger proportion of GDP from a primary industry have low fiscal revenue, less experience in issuing bonds, and difficulty in examining and approving the issuing of bonds. The coefficient for fiscal gap (*GAP2*) is positively significant at the 10% level, indicating that higher interest rates for issuing bonds are associated with a large fiscal gap in some areas. It is not hard to understand that such areas often need more cash-capital. The proportion of the secondary industry (*ind_2*) and investment in fixed assets (*INV2*) are not significantly associated with local government debt financing costs (see Table 4).

Table 4
Relationship between government financial information disclosure and local government debt financing cost.

	(1) *loan_mr*	(2) *loan_p50r*
FTscore	−0.019*	−0.022*
	(−1.70)	(−1.94)
lngdpp	1.773***	1.720***
	(3.54)	(3.41)
GAP2	0.409*	0.394*
	(1.98)	(1.82)
INV2	0.285	0.334
	(1.34)	(1.46)
ind_1	15.401**	15.115**
	(2.65)	(2.57)
ind_2	2.421	2.090
	(0.98)	(0.82)
_cons	−18.022***	−17.619***
	(−3.84)	(−3.78)
N	172	172
r2_a	0.302	0.294
F	15.750	16.300

Note: r2_a is the adjusted R^2; F is from model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

5.4. The effect of government interference on the relationship between government financial information disclosure and the cost of local government debt financing

Additional analysis considers the relationship between the government intervention index (*GDI*) and the interaction of government financial information disclosure and the government intervention index (*FTscore**GDI). The coefficient of the government intervention index (*GDI*) is significantly negative at the 1% level, indicating that a higher value of *GDI* is associated with a lower UCID interest rate. A higher score on the government intervention index implies that the regional market is advanced, and this will provide a better environment for issuing bonds and reduce the issuing debt interest rates. The coefficient of government financial information disclosure (*FTscore*) is also significantly negative at the 1% level, but when considered along with the degree of government intervention (*GDI*), the effect of government financial information disclosure (*FTscore*) on the issuing rate of UCIDs decreases, i.e., government intervention reduces the effectiveness of government financial information disclosure on debt financing cost. The interaction term (*FTscore**GDI) is significantly positive at the 1% level. The test results for the control variables are nearly the same as in the previous test results. Both per capita GDP (*lngdpp*) and the proportion of primary industry (*ind_1*) are significantly positively related to UCID interest rates at the 1% level. Furthermore, investment in fixed assets (*INV2*) is significantly positively related to UCID interest rates at the 10% level (see Table 5).

5.5. The effect of government audit prevention function on the relationship between government financial information disclosure and the cost of local government debt financing

Further analysis examines the relationship between the government audit prevention function index (*ATPre*) and the interaction of the government financial information disclosure and government audit

Table 5
Government financial information disclosure and local government debt financing cost (I).

	(1) *loan_mr*	(2) *loan_p50r*
FTscore	−0.152***	−0.168***
	(−3.24)	(−3.17)
GDI	−0.755***	−0.803***
	(−3.01)	(−3.10)
*FTscore*GDI*	0.016***	0.018***
	(3.08)	(2.87)
lngdpp	1.781***	1.746***
	(3.90)	(4.02)
GAP2	−0.125	−0.156
	(−0.44)	(−0.54)
INV2	0.334*	0.378*
	(1.79)	(2.00)
ind_1	18.708***	18.722***
	(3.65)	(3.80)
ind_2	1.211	0.852
	(0.56)	(0.39)
_cons	−11.423**	−10.759**
	(−2.51)	(−2.36)
N	172	172
r2_a	0.367	0.364
F	9.477	11.003

Note: r2_a is the adjusted R^2. F is from model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

prevention function index (*FTscore*ATPre*). The coefficient of the government audit prevention function index is significantly negative at the 5% level, indicating that a higher value of ATPre is associated with a lower UCID interest rate. This supports the above argument that in a sound government audit system, an external audit plays a supervisory role. A sound external audit reduces the fiduciary duties of a local government and improves the government's reputation in the eyes of the public. It strengthens the government's credibility, and this improved reputation reduces the interest rates for issuing debt. The coefficient of government financial information disclosure (*FTscore*) is significantly negative at the 5% level for *loan_mr* and 1% level for *loan_p50r*, nearly the same as in the previous test results. However, when considered together with the degree of government audit prevention function index (*ATPre*), government financial information disclosure (*FTscore*) has a less negative effect on the UCID issuing rates, i.e., a strong government audit prevention function reduces the effect of government financial information disclosure on local government debt financing cost. The interaction term (*FTscore*ATPre*) is significantly positive at the 5% level. The results for the control variables are almost the same as above. Both per capita GDP (*lngdpp*) and the proportion of primary industry (*ind_1*) are significantly positively related to the UCID interest rates at the 1% and 5% level respectively. Furthermore, the fiscal gap (*GAP2*) is significantly positively related to the UCID interest rate (see Table 6).

5.6. Robustness tests

5.6.1. Alternative indicators of government financial information disclosure

In the first robustness test, the national rank of a region's government financial information disclosure (*FTrank*) is substituted for *FTscore*. The results show that the national ranking of government financial

Table 6
Government financial information disclosure and local government debt financing cost (II).

	(1) *loan_mr*	(2) *loan_p50r*
FTscore	−0.101**	−0.116***
	(−2.52)	(−2.79)
ATPre	−0.255**	−0.279**
	(−2.10)	(−2.15)
*FTscore*ATPre*	0.008**	0.009**
	(2.25)	(2.39)
lngdpp	1.905***	1.865***
	(3.57)	(3.48)
GAP2	0.431*	0.416*
	(1.96)	(1.78)
INV2	0.293	0.337
	(1.24)	(1.36)
ind_1	15.712**	15.690**
	(2.51)	(2.47)
ind_2	2.079	1.750
	(0.73)	(0.60)
_cons	−16.684***	−16.155***
	(−3.52)	(−3.36)
N	164	164
r2_a	0.313	0.307
F	12.273	12.390

Note: r2_a is the adjusted R^2, F is from model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

Table 7
Robustness test (I).

	(1)	(2)	(3)	(4)	(5)	(6)
	loan_mr			*loan_p50r*		
FTrank	0.033***	0.108	0.051	0.033***	0.133*	0.069
	(3.26)	(1.66)	(0.85)	(3.40)	(1.89)	(1.12)
GDI		−0.112			−0.069	
		(−0.82)			(−0.48)	
*FTrank*GDI*		−0.010			−0.013	
		(−1.30)			(−1.57)	
ATPre			0.018			0.049
			(0.17)			(0.51)
*FTrank*ATPre*			−0.002			−0.003
			(−0.32)			(−0.59)
lngdpp	1.692***	1.620***	1.741***	1.597***	1.560***	1.664***
	(4.40)	(4.58)	(4.17)	(4.01)	(4.58)	(3.87)
GAP2	0.260	−0.107	0.299	0.248	−0.133	0.285
	(1.45)	(−0.43)	(1.55)	(1.31)	(−0.53)	(1.40)
INV2	0.236	0.329*	0.235	0.291	0.383**	0.288
	(1.25)	(1.87)	(1.15)	(1.41)	(2.16)	(1.32)
ind_1	16.042***	17.367***	15.574***	15.300***	17.142***	15.220***
	(3.76)	(4.65)	(3.30)	(3.48)	(4.69)	(3.12)
ind_2	2.238	1.199	1.988	1.910	0.813	1.631
	(1.02)	(0.59)	(0.78)	(0.84)	(0.40)	(0.62)
_cons	−17.579***	−15.876***	−18.101***	−16.820***	−15.845***	−17.879***
	(−4.84)	(−4.15)	(−4.17)	(−4.58)	(−4.29)	(−4.10)
N	172	172	164	172	172	164
r2_a	0.339	0.368	0.337	0.326	0.362	0.325
F	27.482	17.187	20.696	29.546	15.834	21.390

Note: r2_a is the adjusted R^2, F is from model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

information disclosure (*FTrank*) is significantly positively related to UCID interest rates, illustrating that less government financial information disclosure is related to higher UCID interest rates. The coefficients of government intervention and government audit are no longer significant, but the positive effective of financial information disclosure (*FTrank*) on bond issuing rates is somewhat weakened (see Table 7).

5.6.2. Alternative indicators of investment in fixed assets

In a second robustness test, the natural logarithm of fixed assets investment per person (*INV*) is substituted for the natural logarithm of investment in fixed assets (*INV2*). The results are as follows. (i) In the first regression, there is no significant correlation between government financial information disclosure and local debt-financing cost. However, when the government intervention variable is added, the relationship between government financial information disclosure and government debt-financing cost is significantly negative at the 1% level, suggesting that government intervention changes the effect of financial information disclosure on the debt-financial cost of UCID. (ii) The results for the test of the effects of government audits are the same.

Investment in fixed assets is selected as a control variable because of its strong effect on interest rates. In particular, as one of the three main driving factors of GNP, investment in fixed assets not only affects the economic forecasts that shape expectations of the benchmark interest rate in the capital market, but also influences the demand for investment-related funds, which further affect interest rates (supply–demand relationship and price of cash in the capital market). However, due to the large difference between regions in the annual

Table 8
Robustness test (II).

	(1)	(2)	(3)	(4)	(5)	(6)
	loan_mr			*loan_p50r*		
FTscore	−0.015	−0.147***	−0.095***	−0.018	−0.163***	−0.109***
	(−1.36)	(−3.74)	(−2.93)	(−1.53)	(−3.54)	(−3.32)
GDI		−0.631***			−0.668***	
		(−2.91)			(−2.92)	
*FTscore*GDI*		0.016***			0.017***	
		(3.40)			(3.04)	
ATPre			−0.200**			−0.219**
			(−2.13)			(−2.10)
*FTscore*ATPre*			0.008**			0.009***
			(2.71)			(2.91)
lngdpp	0.030	0.422	0.107	−0.139	0.271	−0.060
	(0.05)	(0.82)	(0.17)	(−0.23)	(0.54)	(−0.10)
GAP2	−0.059	−0.391	−0.020	−0.126	−0.453*	−0.082
	(−0.40)	(−1.51)	(−0.13)	(−0.85)	(−1.78)	(−0.52)
INV	1.726***	1.478***	1.768***	1.872***	1.620***	1.915***
	(4.34)	(4.34)	(4.25)	(4.59)	(4.47)	(4.51)
ind_1	13.904***	18.061***	13.547***	13.863***	18.205***	13.623***
	(3.51)	(5.07)	(3.20)	(3.42)	(5.39)	(3.19)
ind_2	0.457	0.155	−0.265	0.064	−0.251	−0.712
	(0.21)	(0.08)	(−0.10)	(0.03)	(−0.13)	(−0.27)
_cons	−12.888***	−9.133**	−11.616***	−12.209***	−8.337**	−10.792***
	(−3.28)	(−2.33)	(−3.04)	(−3.09)	(−2.05)	(−2.77)
N	172	172	164	172	172	164
r2_a	0.377	0.412	0.397	0.378	0.417	0.402
F	46.953	27.189	40.759	42.557	23.484	33.218

Note: r2_a is the adjusted R^2, F is from the model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

investments in fixed assets, the results of the analysis, even if natural logarithm of the observations is used, may reflect the characteristics of data distribution and OLS regressions. It is also possible that the population affects the interest rate of funds. Therefore, fixed assets investment and the influence of demographics are considered together. In Table 8, the investment in fixed assets variable is modified with population average processing before being used in the regression. The scale data such as GDP per capita receive the same treatment.

5.6.3. Test results after controlling for the scale and time limit of UCID

To test whether the characteristics of the debt structure affect UCID interest rates, the characteristics of government debt structure are controlled for. A government debt scale variable (i.e., *LnLoan_ta*: natural logarithm of annual total issuance of local bonds) and a time limit of UCID variable (i.e., *Loan_mt*: annual mean value of local bonds' deadline) are included as structural variables. As shown in Table 9, when the control variables are introduced into the model, there are no substantive changes to the results.

5.6.4. Test results after controlling for the time effect

When *Year* dummy variables are added to the robustness test, the results are as follows. (1) When the government intervention variable is not added, there is no significant correlation between government

Table 9
Robustness test (III).

	(1)	(2)	(3)	(4)	(5)	(6)
	loan_mr			*loan_p50r*		
FTscore	−0.017	−0.137***	−0.078*	−0.019*	−0.151***	−0.091**
	(−1.55)	(−2.78)	(−1.88)	(−1.80)	(−2.80)	(−2.14)
GDI		−0.689**			−0.731***	
		(−2.75)			(−2.84)	
*FTscore*GDI*		0.014**			0.016**	
		(2.73)			(2.59)	
ATPre			−0.202*			−0.224*
			(−1.78)			(−1.86)
*FTscore*ATPre*			0.006			0.007*
			(1.68)			(1.85)
lnloan_ta	0.095	0.127	0.093	0.094	0.127	0.097
	(0.92)	(1.18)	(0.82)	(0.94)	(1.19)	(0.88)
loan_mt	0.072**	0.053**	0.070**	0.076***	0.056**	0.075**
	(2.69)	(2.10)	(2.42)	(2.79)	(2.21)	(2.54)
lngdpp	1.775***	1.725***	1.864***	1.728***	1.694***	1.823***
	(3.74)	(3.83)	(3.68)	(3.59)	(3.87)	(3.56)
GAP2	0.494**	−0.048	0.513**	0.487**	−0.068	0.504**
	(2.29)	(−0.15)	(2.25)	(2.21)	(−0.22)	(2.14)
INV2	0.240	0.236	0.270	0.293	0.284	0.316
	(0.98)	(1.02)	(0.93)	(1.18)	(1.27)	(1.11)
ind_1	14.476**	18.112***	14.429**	14.086**	18.018***	14.305**
	(2.62)	(3.51)	(2.37)	(2.55)	(3.71)	(2.35)
ind_2	2.128	1.481	1.667	1.734	1.083	1.295
	(0.86)	(0.68)	(0.59)	(0.69)	(0.50)	(0.44)
_cons	−18.804***	−12.148**	−17.649***	−18.490***	−11.612**	−17.196***
	(−4.27)	(−2.59)	(−4.01)	(−4.24)	(−2.42)	(−3.85)
N	172	172	164	172	172	164
r2_a	0.334	0.384	0.343	0.330	0.384	0.341
F	20.563	13.424	19.533	24.663	16.806	24.473

Note: r2_a is the adjusted R^2, F is from model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

financial information disclosure and local debt-financing cost. However, when government intervention is considered, the relationship between government financial information disclosure and government debt-financing cost is significantly negative at the 5% level, suggesting that government intervention changes the effect of financial information disclosure on the debt-financial cost of UCID. (2) The results for the test of the effects of government audits are the same (see Table 10).

6. Conclusions and discussion

In China's current social and economic system, the level of financial information disclosure by provincial governments is low. Although overall the degree of information disclosure has been increasing, there is still a large variation between regions in both information disclosure and the cost of government debt financing. The above analyses show that there is a significant and negative relationship between government financial information disclosure and the cost of local government debt financing, i.e., more government financial information disclosure is associated with lower UCID interest rates. When the government intervention index is used as a regulating variable, the analyses show that with a high score on the government intervention index (*GDI*), the substitution effect of financial information disclosure is increased, and so the effect of fiscal transparency

Table 10
Robustness test (IV).

	(1)	(2)	(3)	(4)	(5)	(6)
	loan_mr			*loan_p50r*		
FTscore	−0.015	−0.096**	−0.086**	−0.018	−0.115**	−0.103***
	(−1.10)	(−2.41)	(−2.50)	(−1.36)	(−2.56)	(−3.01)
GDI		−0.458**			−0.516**	
		(−2.55)			(−2.69)	
*FTscore*GDI*		0.010**			0.012**	
		(2.36)			(2.31)	
ATPre			−0.157			−0.183
			(−1.53)			(−1.69)
*FTscore*ATPre*			0.007**			0.008***
			(2.48)			(2.77)
lngdpp	0.360	0.525	0.564	0.321	0.521	0.538
	(0.80)	(1.28)	(1.20)	(0.68)	(1.33)	(1.12)
GAP2	−0.140	−0.363	−0.156	−0.202	−0.439	−0.230
	(−0.55)	(−1.16)	(−0.60)	(−0.78)	(−1.38)	(−0.87)
INV2	−0.083	0.018	−0.174	−0.078	0.024	−0.190
	(−0.38)	(0.08)	(−0.79)	(−0.34)	(0.12)	(−0.83)
ind_1	9.611*	11.891**	10.820**	9.966*	12.643***	11.539**
	(1.99)	(2.60)	(2.09)	(2.04)	(2.93)	(2.25)
ind_2	3.468*	2.489	2.860	3.310*	2.271	2.787
	(1.99)	(1.48)	(1.40)	(1.85)	(1.38)	(1.31)
_cons	−1.260	0.619	1.855	−0.717	1.285	2.710
	(−0.25)	(0.14)	(0.35)	(−0.14)	(0.29)	(0.49)
Year Dummies	Y	Y	Y	Y	Y	Y
N	172	172	164	172	172	164
r2_a	0.553	0.572	0.554	0.526	0.549	0.532
F	96.019	108.581	122.927	72.501	90.825	85.105

Note: r2_a is the adjusted R^2, F is from the model F.
*** = 1% Significance levels.
** = 5% Significance levels.
* = 10% Significance levels.

on debt financing cost is decreased. When the government audit prevention function index is used as a regulating variable, the analyses show that as the government audits' prevention function strengthens, the effect of fiscal transparency on debt financing cost weakens and vice versa. The results of the robustness tests, which replace *FTscore* with *FTrank* and then *INV2* with *INV*, are consistent with the initial conclusions. Of course, this study only examines a few of the many factors that influence local government debt financing. Other factors need to be examined in subsequent studies. In addition, urban construction investment bonds are used to examine the cost of government debt; however, they may not reflect the whole picture of local government debt. As the new "budget law" has implemented strict information disclosure mechanisms and credit evaluation systems for local governments issuing bonds, future research can adopt a more comprehensive perspective.

References

Akerlof, G.A., 1970. The market for lemons: quality uncertainty and the market mechanism. Q. J. Econ. 84, 488–500.
Azuma, Y., Kurihara, J., 2011. Examining China's local government fiscal dynamics: with a special emphasis on local investment companies (LICs). Politico-Econ. Commentaries 5, 1–19.
Cai, C., Li, J.T., Liu, G.X., 2009. The basic foundation mechanism and path selection of government audit to maintain national economic security. Auditing Res. 4, 7–11.
Chang, L., 2008. The new public management, government performance evaluation and improvement of government financial reports. Account. Res. 4, 19–24.

Chen, L.Q., Li, J.F., 2003. Review of international government accounting standards and its development. Account. Res. 9, 49–52.
Demirguc-Kunt, A., Maksimovic, V., 1999. Institutional, financial markets, and firm debt maturity. J. Financial Econ. 54, 295–336.
Deng, J.P., 2014. Banking association, accounting information and debt financing – empirical study based on the private enterprises of country. J. Account. Econ. 1, 3–14.
Fan, G., Wang, X.L., 2001. The 2000 annual report of various regions' marketization process. J. China Natl. School Administration 3, 17–27.
Giannetti, M., 2003. Do better institutional mitigate agency problems? Evidence from corporate finance choices. J. Financial Quant. Anal. 38, 185–212.
Han, L.Y., Mou, H., Wang, Z.B., 2005. Risk identification and control strategy of municipal bond. Manage. World 3, 58–66.
Hu, Y.M., Tang, S.L., 2007. Audit, information transparency and bank lending rates. Auditing Res. 6, 74–84.
Huang, S.Z., Liu, Y.S., Wang, P., 2004. Difficult issues, hot points and inspiration of American federal government accounting—based on analysis of federal government auditing report. Account. Res. 11, 13–18.
Jiang, W., Li, B., 2006. Large shareholders control, asset substitution and capital structure. Working Paper. Accounting Society of China, vol. 9, pp. 1417–1425.
Li, J.T., Liu, L., 2014. Discussion on the function of government audit to improve fiscal transparency and guard against financial risks. Finan. Account. Monthly 7, 70–73.
Liu, J.Y., 2012. Discussion of national governance and national audit. Soc. Sci. China 6, 60–72.
Liu, L., Cui, Y., Zhang, X., 2014. Empirical research of national audit maintains the financial security—based on the empirical evidence of provincial panel data. Auditing Res. 1, 35–42.
Liu, S.X., 2014. Local government debt risk does not come from debt itself. Chin. Cadres Tribune 2, 68.
Liu, S.X., Zhao, X.J., 2005. Risk and prevention of municipal income bonds. Manage. World 3, 50–57.
Lu, J.W., 2010. Goals and reform of governmental accounting under perspective of public finance. Contemporary Econ. Manage. 1, 93–96.
Lu, Z.F., Zhu, J.G., Sun, B.X., 2008. Earnings management, accounting information and bank debt contract. Manage. World 3, 152–158.
Lu, X.W., Wang, J.Q., Dong, D.Y., 2013. Directors' network, information transfer and debt financing cost. Manage. World 3, 55–64.
Luo, D.L., She, G.M., 2014. Official's turnover and local government debt issue. Econ. Res. J. 06, 131–146.
Mei, J.M., 2011. Problems about the operation of local government's financing platform. Publ. Finan. Res. 5, 64–66.
Mikesell, J.L., 2002. The threat to state sales taxes from E-commerce: a review of the principal issues. Municipal Finan. J. 23, 48–61.
Shen, L.R., Dai, Y.C., 1990. Formation of ''vassal economy'' in our country, its disadvantages and roots. Econ. Res. J. 3, 12–19.
Sun, Z., Liu, F.W., Li, Z.Q., 2005. Marketization process, government intervention and corporate debt maturity structure. Econ. Res. J. 5, 52–63.
Sun, Z., Li, Z.Q., Wang, J.B., 2006. Property of ownership, accounting information and debt contract—based on experimental evidence from listed company in our country. Manage. World 10, 100–107.
Tang, X.S., Luo, S., Wang, H.Y., 2012. Marketization and the role of government audit. Auditing Res. 3, 25–31.
Wei, D.H., Tan, Z.Y., Tang, S.Q., 2010. Relationship research of government audits efficiency and financial capital operation security—based on statistics and empirical research of audit's yearbook data. Auditing Res. 3, 9–14.
Wescott, S.H., 1984. Accounting numbers and socioeconomic variables as predictors of municipal general obligation bond ratings. J. Account. Res. 22, 412–423.
Wilson, E.R., Howard, T.P., 1984. The association between municipal market measures and selected financial reporting practices: additional evidence. J. Accounting Res. 20, 7–29.
Xia, L.J., Chen, X.Y., 2007. The process of marketization, SOE's reform strategy and endogenous decision of corporate governance structure. Econ. Res. J. 7, 82–95.
Xiang, Y., 2012. The Formative Mechanism Study of Enterprises Excessive Investment Under Government Intervention. School of Management of Southwestern University of Finance and Economics, Chengdu.
Xiao, P., Yan, C., 2013. Study of driving factors and choice of path of China's fiscal transparency—based on empirical analysis of the 28 provinces' panel data. Comp. Econ. Soc. Syst. 4, 199–206.
Zhang, Q., Zhang, X.Z., Cheng, X.J., 2009. Choice of government accounting foundation, stakeholders' motives and the influence of institutional environment—based on the inspection from questionnaire data in China. Account. Res. 7, 35–42.
Zhang, Q., Zhang, J., 2012. Conflict between supply and demand of information, decision making based on information and government accounting reform – a discussion about paradox of information disclosure in public field of China. Account. Res. 7, 24–31.
Zhao, Q., 2013. Government invention, rule of law, financial development and excessive investment of listed SOEs. Econ. Survey 30, 149–153.
Zhou, L.A., 2004. Motivation and cooperation of government officials come from the promotion game—reason for the long term existence of local protectionism and redundant construction problems in china. Econ. Res. J. 6, 33–40.
Zhou, H.B., 2010. Fiscal transparency and fiscal supervision. Res. Finan. Account. 16, 66–67.

China Journal of Accounting Research 9 (2016) 207–233

HOSTED BY

Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Bank equity connections, intellectual property protection and enterprise innovation – A bank ownership perspective

Xing Liu [1], Shuiquan Jiang *

School of Economics and Business Administration, Chongqing University, China

ARTICLE INFO

Article history:
Received 21 February 2015
Accepted 21 April 2016
Available online 20 May 2016

Keywords:
Bank equity connections
Intellectual property protection
Corporate innovation
Innovation performance

ABSTRACT

This study investigates the effects of bank equity connections and intellectual property protection on enterprises' innovation behavior, and the regulating effect of intellectual property protection on the relationship between bank equity connections and innovation. In general, bank equity connections and intellectual property protection not only significantly increase innovation input, but also improve innovation performance. However, the efficiency of bank equity connections is influenced by the heterogeneity of enterprises and the value orientation of the subjects. Bank equity connections have a more significantly positive effect on innovation in private and central enterprises, whereas the principal-agent problem and government intervention may weaken the marginal contribution of bank equity connections to the innovation of local state-owned enterprises. Bank equity connections and intellectual property protection are complementary in promoting enterprise innovation. Not only are the combined effects of bank equity connections and intellectual property protection greater than the individual effects, but when the latter is relatively weak, the former's positive effect on innovation is obviously weakened and may even crowd out innovation.

* Corresponding author. Tel.: +86 13996059207.
E-mail addresses: liuxing@cqu.edu.cn (X. Liu), jiang_shui_quan@126.com (S. Jiang).
[1] Tel.: +86 13908309776.

http://dx.doi.org/10.1016/j.cjar.2016.04.002
1755-3091/

1. Introduction

Since the beginning of its economic reforms in 1978, China's market-orientation and property rights have created a "growth miracle." However, this growth has excessively relied on high input, high consumption and high emissions. The lack of independent innovation and technological progress has limited the intensive and efficient use of resources and sustainable economic growth (Wu and Mi, 2011; Chen and Hu, 2011). The rapid increase in labor costs, the increase in resource environment pressure and shrinking external demand have resulted in increasingly negative externalities in this low-end economic growth pattern. Therefore, strengthening technological progress, changing the mode of economic growth, and improving the ability to innovate and gradually shift from factor-driven economic growth to innovation-driven economic growth are urgent tasks. In fact, increasing innovation and building an innovative country were emphasized in China's 12th 5-year plan. But the current outlook for innovation development is not optimistic. Although the ratio of R&D expenses to sales revenue in large- and medium-sized industrial enterprises increased from 0.48% in 1996 to about 0.93% in 2010, the level of innovation input still fell behind that of developed countries. According to Hall and Oriani (2006), the ratio of R&D expenses to sales revenue in the United States, Britain, Germany and France is 4.9%, 2.9%, 4.5% and 4.2%, respectively. In 1992, R&D expenses reached 1.97% of GDP, a record; however, the ratio has reached 2.66%, 1.86%, 2.40% and 2.16%, respectively, in the United States, Britain, Germany and France, since the end of the 20th century.[2] Furthermore, the conversion rate for scientific and technological achievements in developed countries is more than 80%, whereas in China, the conversion rate is very low, only 20%, and the authentic industrialization rate is less than 5% (Xiao and Wang, 2014).

Accordingly, understanding why investment in innovation and the effects of such investment are so low in Chinese enterprises, and how to promote innovation are important issues both theoretically and practically. Enterprise innovation can be easily restricted by financing limitations due to its high risk, long incubation period and information asymmetry. Access to a steady stream of financial support may be a key factor in innovation decisions. Enterprises' financing channels include internal financing and external financing. Although internal financing provides higher autonomy and less risk, using internal financing to fund an innovation project may be difficult, not only due to the constraints imposed by corporate earnings and business fluctuations, but also because of ownership structure, management incentives, investor risk appetite, institutional investors governance, product market competition and so on (Lin et al., 2011a, 2011b, 2011c; Aghion et al., 2005, 2013; Li and Song, 2010; Becker-Blease, 2011; O'Connor and Rafferty, 2012; Lu and Dang, 2014; Sapra et al., 2014; Tian and Wang, 2014). Therefore, access to external capital is of paramount importance to ease the risk of investing in innovation. In fact, there are several studies of the relationship between external financing and innovation in China. Using an innovation resource acquisition research perspective, Brown et al. (2013), Chemmanur et al. (2014) and Cornaggia et al. (2015) investigate the relationships of enterprise innovation with stock financing, corporate venture capital and credit financing, respectively. Hsu et al. (2014) use the data of 32 developed countries and emerging markets and examine the effect of the securities and credit markets on enterprise innovation at the national level. Domestic scholars Xie and Fang (2011) find that banking reform and regional financial development promote investment in innovation in Chinese enterprises by expanding financing channels. Using the World Bank's survey data of more than 12,000 Chinese enterprises, Ma et al. (2014) find that the acquisition of bank credit can increase the probability of R&D and the intensity of innovation by 8.6% and 0.24%, respectively.

Although these scholars reveal the transmission mechanisms that transform external financing into enterprise innovation, these studies are mainly based on institutional environments in developed countries, such as the USA and Britain, and their basic assumptions and logical deductions may not be effectively migrated to emerging markets such as China. Therefore, their findings may not reasonably explain, forecast or guide innovation behavior in China. For instance, although with the rapid development of China's capital market, securities financing and credit financing have become the two most important external financing channels for

[2] *Source:* China Statistical Yearbook (1996–2013). Before 2011, this yearbook separately disclosed the R&D expenses and sales income of China's large- and medium-sized industrial enterprises. In 2011, the large and medium-sized industrial enterprises were grouped into the category of above-scale enterprises; this yearbook did not separate large- and middle-scale enterprises, nor did the financial reports reveal information about scientific or technological innovations. Therefore, the data are only for the fiscal year that ended in 2010.

listed corporations, due to China's bank-dominated financial system, external financing of enterprises, even listed enterprises, is still dominated by credit financing. This greatly weakens the ability of securities financing to promote enterprise innovation.[3]

Furthermore, in existing studies, enterprises are viewed as passive recipients in an external financing environment; thus, these studies ignore the innovative behavior of enterprises facing external difficulties, the transmission channels of innovation and the effect of the external environment on micro transmission mechanisms. During economic transfers, the imperfections in China's capital market and institutional arrangement distort the factor market and resource mismatch problems (Xu, 2011; Zhu and Lu, 2011, 2012). The low efficiency of both the market and government also encourages enterprises to invest in social capital, such as building political connections, hiring executives with financial backgrounds and so on, to obtain resource allocation advantages (Liu et al., 2013; Cull et al., 2015). However, compared to these indirect associations, the equity connections established by holding bank ownership are a much more direct association; this strategy has been widely used in emerging markets, but has not received attention from scholars (Khanna and Yafeh, 2007; Chen and Chen, 2012). According to statistics collected by the author, approximately 14.79% of Chinese manufacturing listed companies hold more than 2% of the total ownership of a bank. In recent years, to strengthen our economy and compete with foreign rivals, our government, learning from the development experiences of neighboring countries, has issued a series of realization measures and preferential policies,[4] that encourage and guide non-financial capital into the financial sector. These measures will undoubtedly further highlight the effect of bank equity connections on the economy. Unfortunately, this phenomenon has not been examined in academic circles; few studies have analyzed the mechanisms and economic consequences of bank equity connections from an innovation perspective. This is also important because the mechanisms through which bank equity connections affect enterprises' financial decisions are also affected by corporate governance mechanisms and the external institutional environment.

After a series of substantial structural reforms, such as the "State retreats and private advances" reform, and the reform of the share system, China's original state-owned enterprises gradually converted into modern joint-stock enterprises through various means, such as spin-off listings, binding listings, holistic listings. But in the current transition period, the influence of ultimate property rights on enterprise innovation still exists and must not be overlooked. Although the government considers innovation as the primary driver of economic transformation, they also have to consider employment, economic growth and multiple other targets when promoting innovation, and they must incorporate these targets into their state-owned enterprises. The government's strategic plans continuously change along with the actual economic situation; funding innovative projects would not only bring numerous risks but would also influence technological innovations in private enterprises. Even more seriously, the current government performance assessment system, which takes GDP as the key measure, makes government officials and state-owned enterprise executives prefer short-term goals and short-term investment, as they carry less risk over brief and uncertain tenures. This leads to a reduction in innovation investment, which has high risks and a long periodicity. Thus, the resource allocation function of bank equity connections can be easily diverted to the rent-seeking channels of government officials or state-owned enterprise executives.

[3] Unlike some regions such as Europe and the Americas, the centerpiece of China's financial system is credit financing, and securities financing is underdeveloped. According to the executive report of China's central bank on monetary policy disclosure, from 2006 to 2012 foreign currency loans, entrustment loans, trust loans, no discount bank draft, corporate bonds and stock financing were, respectively, 65.82%, 7.01%, 6.44%, 7.86%, 9.46% and 3.42% of the capital that the real economy obtained from the financial system. Because political interference in private enterprises often results in low levels of corporate transparency and greater business risk, etc., private enterprises have remained marginalized in the stock and bond markets (Zhu and Lu, 2011). Therefore, their dependence on bank credit may be larger. The data from the China Stock Market, Accounting Research and Wind Information Co., Ltd. databases show that from 2006 to 2013, many more Chinese listed companies were financed with bank credit than with equity financing. Specifically, despite IPO financing, the external financing of China's listed companies is still primarily bank loans. Thus compared to other nations and areas, equity financing in China plays a limited role in promoting innovation.

[4] For example, in 1999 The People's Bank of China issued interim provisions on financial institutions. In 2004, the China Banking Regulatory Commission formally published the "Management approach of the related transactions between commercial banks and insiders or shareholders." In 2011, China issued "Several opinions of the State Council on encouraging and guiding the healthy development of private investment."

In addition, due to the characteristics of externality and quasi-public goods, innovation needs a good legal protection environment or a mechanism that reduces the risk of information disclosure of R&D and protects the rights of creative subjects (Lerner, 2009). However, due to the absence of intellectual property protection, independent innovation in China is severely suppressed and there is abnormal dependence on social networks; in particular, government connections that can be used to obtain "relationship rents" are preferred over innovation investment (Xiao and Wang, 2014). Since the enactment of its patent law in 1992, China has promulgated a series of judicial interpretations, implementation details and administration regulations meant to protect creative subjects, but the difficulties in reporting, investigating and collecting proof, offering testimony, and dealing with the law enforcement process still negatively affect the protection of creative subjects' rights. Under the circumstances, it is doubtful whether the resource allocation advantages of bank equity connections can promote innovation. Today, China is at a critical juncture and the government is promoting structural adjustment of the economy and seeks to enhance the quality of economic development by strengthening autonomous innovation.

This study analyzes the transmission mechanisms of bank equity connections in innovation investment and innovation performance and investigates the different effects of bank equity connections in different enterprises and how the interaction between bank equity connections and intellectual property protection stimulates domestic innovation. This research not only enriches our understanding of relevant topics, it also offers suggestions for increasing innovation.

The rest of this paper is organized as follows. First, this paper discusses the mechanisms and effect of bank equity connections on enterprises' innovative behavior, observes the different effects of bank ownership on different enterprises, and reveals the "black box" between bank equity connections and corporate innovation. It not only explains the reasons why more and more enterprises are inclined to invest in banks, it also contributes to the empirical study of this topic. Second, although previous studies have used the intellectual property protection index to investigate the influences of the institutional evolvement of intellectual property protection on enterprise innovation, we use the distribution density of patent agencies and the scale of technology transfer to describe the knowledge protection environment, which helps to improve the depth and objectivity of our argument. Finally, this paper embeds bank equity connections into the transmission mechanism of intellectual property protection and the value orientation of governing bodies, reveals the connection between enterprises' initiatives and institutional evolution, and establishes a bridge between macroeconomic reforms and the micro behavior of enterprises. Today, China is trying to develop a financial system that is suitable for its special national conditions, and the main questions for this system are how to guide and standardize non-financial capital into the financial sector and how to introduce competitive drivers and property right constraints that will optimize incentives and constraint mechanisms of commercial banks. The conclusions provide a theoretical basis and some empirical support for answers to these questions.

This article is organized as follows. Section 1 is the introduction section, Section 2 presents the theoretical analysis and research hypotheses, Section 3 describes the research sample and model, Section 4 presents the results and analysis, Section 5 is an extended test of the data and the final section contains a discussion of the results and some recommendations.

2. Theoretical analysis and research hypotheses

2.1. Bank equity connections, enterprise heterogeneity and enterprise innovation

In the perfect capital market described in MM theory, enterprises always have access to financing at the same cost as internal funds; the only factor determining whether enterprises innovate is the marginal value of their innovative projects (McLean et al., 2012). In reality, however, the imperfection of the capital market and the lack of institutional arrangements distort the configuration of China's capital market. Information asymmetry, caused by adverse selection and moral hazards, means that innovation investment is a capital investment requiring high investment, high risks and long-periodicity. It is difficult for investors or creditors to appraise the real risk and value of innovation investment, and the external capital market, which uses competition and price mechanisms to allocate resources, is not always effective (Rajan and Zingales, 2001; Beck and Levine, 2002); this results in the "lemon market" problem (Leland and Pyle, 1977). In this environment,

innovation investment can reduce an enterprise's ability to mortgage and will have a direct effect on their ability to acquire external resources (Brown et al., 2009). Therefore, to avoid the defects of the market and system, companies have intense motivation to seek alternative financing mechanisms; developing a bank equity connection is a common mechanism in many emerging market countries. We argue that this connection between financial markets and enterprises provides resource support and other synergistic effects through multiple paths.

According to resource-based theory and social capital theory, the network of social relationships formed by a bank equity connection can help to mobilize or secure necessary resources for enterprises' innovations. This can be of critical importance in China's economic transitional context (Allen et al., 2005). First, information asymmetry, and the moral hazard and adverse selection problems caused by information asymmetry, are the key factors in financing. However, partial ownership of a bank can bring financial advantages by improving the exchange of information between lenders and borrowers. A bank equity connection can promote information sharing and business coordination between banks and enterprises through compact and organizational arrangements, and can internalize external financing. This not only reduces the risk of information disclosure of R&D, it also helps to solve the problem of funding innovation through asset replacement, reducing loan restrictions, increasing credit and so on.

The cooperative atmosphere created by bank ownership also helps to improve information collection and the supervision of an enterprise's actions. Haubrich (1989) points out that long and stable business relations encourage information production and the supervision of lenders, and so strengthen governance. Zhai et al. (2014) also find that a bank–enterprise relationship introduces market supervision into enterprises and that "interior market management" promotes the supervision and regulation of the behavior of both large shareholders and management. For this reason, a bank equity connection may cultivate innovation because the "EBC" itself may alleviate the agency problem. A bank equity connection can also function as a reputation authentication or guarantee mechanism that signals corporate financing capacity. Other external borrowers may think that a bank equity connection guarantees the quality of relationship loans, because they believe that the information advantages and the nepotism formed by bank ownership mean that the loans from the relationship banks are implicitly guaranteed, thus reducing information asymmetry and easing financing constraints (Chen and Chen, 2012; Lu et al., 2012; Liu and Jiang, 2015).

In China, political interference and the low efficiency of commercial banks exacerbate the mismatch between basic resources and the funding risks of innovative projects; as a result, there is a phenomenon of scale and ownership discrimination in the resource allocation process (Song et al., 2011; Zhu and Lu, 2011, 2012). This means that some quality innovation projects are delayed or shelved and reduce innovation investment. A bank equity connection can partially alleviate such discrimination in the allocation of resources, and thus alleviate the financing constraints of innovative projects. Knowledge and ability also play important roles in financing management; many companies encounter trouble in financing due to a lack of high-quality financial talent, but holding bank ownership can optimize an enterprise's knowledge structure and intellectual capital. The knowledge integration between banks and enterprises can lead to tailor-made innovative financing schemes such as structured financing.

Last but not the least, social networks built through bank equity connections can boost the formation of social capital, such as political connections and relationships. This not only helps with project financing, it also helps to capture other scarce resources such as tax breaks, government subsidies and so on. According to capability-based theory, a bank equity connection not only means that enterprises can obtain abundant resources, they can also enhance the dynamic capability of resource allocation, including absorptive capacity, integration capability and innovation ability (Wang and Ahmed, 2007). Absorptive capacity refers to the capacity to identify values and to identify and master external knowledge and embed it in management decisions. It is a capacity based on the awareness, precognition, and assessment and application of an external knowledge source. Enterprises with strong absorptive capacity can sense, acquire and integrate external information and knowledge, and obtain sustainable competitive advantages. Such enterprises emphasize the importance of knowledge and experience. In fact, it is the information sharing and knowledge integration advantage of holding bank ownership that allows a bank equity connection to improve an enterprise's absorptive capacity and promote the value identification, scientific assessment and decision-making optimization of innovation investment.

Integration ability is the ability to identify and seize market opportunities through flexible resource allocation and dynamic management. The flexible allocation of resources and the adjustment of business strategies help to cope with volatility in the external economic environment; that is, integration capacity reflects the inner organizational efficiency of enterprises and the integration between enterprises and the external environment. Bank equity connections improve integration ability in two ways. First, it can set up an internal capital market that includes banks, and thus gets around the financing restrictions of the external market by centralizing management and internal capital market operations. This eases the pressure on capital allocation due to the cash flow characteristics of cross-complementary behavior, cross-subsidization, etc. Second, there is a tremendous amount of prophase investment and infrastructure investment that must occur to turn an idea into a product. In that respect, the effect of bank equity connections on resource conformity and managerial collaboration can provide a solution to the resource dependence of innovation projects. In addition to promoting the application and popularization of new technology, a bank equity connection can also help to establish scale advantage and remove entry barriers, both of which promote the successful hatching of innovation projects and claim the monopoly profits of innovations. Overall, the effect of bank equity connections on innovation capability is a remarkable reflection of its effect on improving the absorption and integrative capacities of enterprises. Based on above analysis, we propose the first hypothesis.

H1. Bank equity connections are positively related to the intensity of innovation investment.

Bank equity connections can independently affect the innovation behavior of enterprises through two paths: cultivating resource supplies and enhancing dynamic configurations. However, the complicated governance mechanisms of listed companies mean these paths are restricted by property right arrangements and the value orientation of the governing body. Given this heterogeneity, the above-mentioned effects may not occur in all enterprises.

Cultivating resource supplies can be challenging, as China is still in an economic transition period, and the distortion of the factors market and the lack of institutional arrangements squeeze out the effect of national commercial banks, state-owned enterprises' soft budget constraints and the shortage of the capital for private companies, which generally face serious credit ration problems (Lin et al., 2010; Song et al., 2011; Li et al., 2012). This situation reduces dependence on the resource advantage of a bank equity connection in national enterprises, local state-owned enterprises and private enterprises. Furthermore, the value orientations of the governing bodies of national enterprises, which are the main levers for adjusting the economy, are important factors in economic and social development; they propel innovative national construction and promote economic structural adjustments and upgrades. Thus, the legal regulation of central government-control enterprises is relatively complete.

However, in the process of transforming "made in China" into "created in China," these central enterprises are confronting waves of economic globalization, more complicated multilateral cooperation in international relations and more intense competition in international education; these circumstances demand greater innovation intensity and innovation performance. Thus, bank equity connections can obviously have a positive influence on the innovative behavior of central enterprises. For local state-owned enterprises, although they have greater talent development, technical exchanges, implicit state guarantees, technology innovation incentives, etc., officials prefer fixed asset investment projects that have less risk, more efficiency and high labor absorption capacity, because they also promote employment, social stability, environmental governance, GDP growth or other political achievements, and because currently government officials' performance is assessed by changes in GDP. Furthermore, the executives of local state-owned enterprises are not truly professional managers, but rather administrative officials appointed by the government in some form; thus the agency problem, which is caused by the separation of control rights and ownership, makes the executives of local state-owned enterprises prefer short-term goals and short-term gains with less risk during their relatively short and uncertainty terms. This is a better strategy for meeting the needs of political advancement and other interest demands such as non-pecuniary compensation.

These factors distort the investment behavior of local state-owned enterprises (Chen and Chen, 2014). Moreover, Tian (2005), Xin and Lin (2006), and Qian and Yeung (2015) find that in China the governance role of debt is inefficient. First, the government's implicit guarantee of state-owned enterprises encourages financial institutions to provide capital to state-owned enterprises and weakens their motivation to supervise

and restrict corporate borrowers. Second, manager's expectations of soft budget constraints and governmental interference in SOE investment lead to rapid expansion based on excessive debt and this distorts the debt governance mechanism in local state-owned enterprises. Therefore, without effective supervision, the strategy of holding bank ownership may be alienated to the channels of managerial interests. Furthermore, bank equity connections may also distort the debt governance in local state-owned enterprises by loosening budget restrictions. In other words, the resource advantage of bank equity connections strengthens the right seeking and tunneling behavior of managers (Zhao et al., 2010; Peng et al., 2011; Li and Ma, 2014).

Therefore, the positive effects of bank equity connections on local state-owned enterprises' innovative behavior may not be significant, and may even be negative. But in private enterprises with clear property rights, company executives are often the largest shareholders or agents appointed by the largest shareholders. Accordingly, the principal-agent conflicts of private enterprises are relatively moderate. Moreover, fierce competition in the manager market can standardize and restrict executive behavior. Such managers dedicate greater attention to the long-term interests of enterprises and actively innovate due to the incentives of innovation profits. In such cases, the resource advantage of bank equity connections may be enough to break through their source constraints bottleneck. Accordingly, the potential innovation advantages of bank equity connections are maximized in private enterprises. Based on the above analysis, we propose a second hypothesis.

H2. The intensity of the positive effects of bank equity connections on enterprises' innovative behavior is strongest in private enterprises, moderate in central enterprises and weakest in local state-owned enterprises.

2.2. Bank equity connections, intellectual property protection and enterprise innovation

Scientific and technological innovation have several characteristics; they are non-competitive and non-exclusive and have positive externality. In business, all of the above characteristics create the free-rider problem and enhance market failure (Romer, 1986). Survey data suggest that among China's domestic companies, rivals usually begin launching a similar product or substitutes within four to five months of a new product entering the market (Xiao and Wang, 2014). As the motivation for innovation investment is profit, the high investment and high risk characteristics of innovation investments mean that enterprises will only invest in innovations when there is the potential for high profits. As intellectual property protection is the most important institutional arrangement for supporting enterprise innovation, its role must not be neglected. First, the protection of intellectual property rights, as a system guarantee, protects the private interest of the right's holder by granting them a legal monopoly. (Of course, such legal rights do not counter-act any other laws, including antimonopoly laws.) This not only helps to compensate innovators for the prophase investment of innovation by guaranteeing monopolistic profit within the statutory time, it also reduces the problem of the pricing of technology transformation caused by the emergence of substitutes. This ensures the economic compensation of innovative investment and establishes a long-term stimulation mechanism (Yi et al., 2013).

Intellectual property protection also plays an essential role in the dissemination and promotion of technological information and the use of technology. For example, a strong patent protection regime can speed up the dissemination of technological information, can greatly cut down on repeated investment, and allow other innovators to stand on the shoulders of giants to develop new technologies and devices. This accelerates technical innovations and strengthens competition in the technology market (Moser, 2005, 2012). Finally, intellectual property protection can ease the financing constraints on innovative projects. Intellectual property rights protection can reduce the uncertainty of innovation transformation by supporting the profits of an innovation, thus reducing the value evaluation risk and easing the information asymmetry in its financing.

However, the highest degree of intellectual property protection is not always the best. The dual effect of intellectual property means that a lack of adequate intellectual property protection means that innovations are liable to be infringed on and duplicated. This not only reduces interest in innovation, it also has a negative effect on accumulated resources and technology maturity. But a monopoly caused by strong intellectual property protection might hinder market competition and reduce the driving force of innovation. Horii and Iwaisako (2007) find that innovation incentive requires a reasonable degree of intellectual property protection, but blindly strengthening IPR protection may hinder economic growth. Thus, the protection of intellectual

property rights has to balance between static losses resulting in over-monopolization and dynamic gains over the long term.

China's market, established under a period of economic transformation, is a nascent market that possesses many immature characteristics. Although China has carried out a series of changes and additions so that legislation related to intellectual property protection approaches and reaches the protection level seen in Western countries, problems are still not solved effectively and promptly, especially issues of group infringement, repeat infringement, etc. There are widespread difficulties in reporting, investigating and collecting proof, offering testimony, treating and changing in the process of safeguarding rights. Even worse, in some provinces, the intellectual property protection is weak, owing to uneven regional development in China. Accordingly, in the current situation, strengthening IPR protection levels may have positive effects on enterprises' innovative behavior (Lin et al., 2010). As mentioned above, the distortion of the factor market and the lack of institutional arrangements seriously distort the innovative behavior of Chinese enterprises. This is reflected not only in the restraints on external resources for, from the least to the greatest, private enterprises, local state-owned enterprises and central enterprises, but also in alternative mechanisms of intellectual property protection, such as administrative interference, restrictions on industry entrance or other preferential policies with which the state-owned enterprises and especially the central-owned enterprises could conserve their power and earn profits from innovations. Therefore, the dependence on intellectual property protection is different for enterprises with different property rights. Based on above analysis, we propose a third hypothesis.

H3. Intellectual property protection is positively related to the intensity of innovation investment, and the accelerating effect of intellectual property protection is strongest in private enterprise innovation, moderate in local state-owned enterprise innovation, and weakest in central enterprise innovation.

Both bank equity connections and intellectual property protection can promote business enterprise innovation. A further question is whether there is any relationship between bank equity connections and intellectual property protection in promoting innovation. From the theoretical standpoint, intellectual property protection may affect the relationship between bank equity connections and innovation through two contrary mechanisms. First, both bank equity connections and intellectual property protection can ease resource allocation constraints. Bank equity connections can also help to maintain the legitimate rights of creative subjects by promoting the industrialization of innovation achievements, establishing market power and removing entry barriers, etc. In other words, bank equity connections and intellectual property protection are substitutable to a certain extent. Therefore, bank equity connections may reduce the dependence of innovative companies on intellectual property protection. That is to say, the existence of one mechanism may reduce the dependence on the other mechanism. However, there may also be a complementary relationship between them. The potential interactions are as follows: (1) moderate intellectual property protection is a prerequisite for bank equity connections to effectively promote innovation. When the intellectual property protection is weak, the law is less binding on infringers, and thus piracy, counterfeiting and other violations weaken innovation and reduce the investment returns and enthusiasm of investors. In this case, even with the resource disposal advantage of bank equity connections, enterprises may prefer less risky investments to innovation investment (Zhang et al., 2011; Cull et al., 2015). (2) With the strengthening of intellectual property protection, the excess profits of innovation will also increase; thus, the innovation investment prompted by the bank equity connection can create more value, i.e., it has a multiplier effect on innovation. Moreover, the distortion of the factor market and the absence of institutional arrangements in China mean that the transmission effect of intellectual property protection needs some complementary mechanisms, such as bank equity connections. Based on above analysis, we propose a competitive hypothesis as follows.

H4a. There is a substitutional relationship between bank equity connections and intellectual property protection in promoting innovation.

H4b. There is a complementary relationship between bank equity connections and intellectual property protection in promoting innovation.

3. Research design

3.1. Data and sample

This study examines the effect of bank equity connections and intellectual property protection on firm innovation, and the interaction between them in this process. The initial sample comprises all of the A-share manufacturing and information technology listed companies for the 2006–2013 period. The final sample is obtained by filtering this sample with the following conditions: (1) newly listed and specially treated companies are removed; (2) observations with missing variables or with abnormal data are dropped; (3) ST companies, and financial and insurance companies are removed; (4) observations with leverage levels that fall outside the outlier leverage levels of $[0, 1]$ are excluded; (5) to avoid the consequences of differences in accounting standards, financing environment, supervision mechanisms and so on, companies with stock in the A-share market, B-share market and H-share market at the same time are removed; (6) taking into account the effect of acquisition, mergers and other non-recurrent activities on innovation investment, companies undergoing major asset reorganizations in the 2006–2013 period are removed; and (7) companies with changes in actual controllers are removed. In addition, to avoid the influence of outliers, all of the continuous variables are winsorized at the 1% and 99% levels. After the above procedure, the final sample includes 4475 firm-year observations.

3.2. Definition of main variables

The innovation data, EBC data and intellectual property protection data (IPR data) are manually reconciled. Based on the related regulations in China's accounting standards and other relevant systems, we collect and screen the innovation data from the information disclosure in "management expenses" and "cash payments relating to other financing activities," which are disclosed in the board reports, annual reports and the notes to financial statements.

The EBC data used in this study are collected from the WIND database, which is a leading integrated financial data service provider in China. We also apply the following treatments when sorting the EBC data: (1) when companies hold many commercial bank shares, only the event with the maximum stake is considered; (2) as a small investment in a bank may not have any material effect on corporate capital allocation, according to the principle of "essence is more important than form," firms that hold less than 2% of a bank's total ownership or that are not in the list of the 10 largest shareholders for banks are dropped[5]; (3) to avoid the "noise" effect of holding other financial institution shares, we eliminate companies that have other financial institutions ownership but do not hold bank ownership.

For the other main explanatory variable, we select the following methods to measure the intensity of China's intellectual property protection (IPP). (1) The technology market trade of different provinces, autonomous regions and municipalities (IPP1). That is, IPP1 is equal to the contract annual turnover of the technology market in different regions divided by the annual gross domestic product in the region. The essence

[5] According to the "Management approach of the related transactions between commercial banks and insiders or shareholders" regulations, the China Banking Regulatory Commission formally published in 2004, associated subjects comprise connected natural persons, legal persons or other organizations, which directly, indirectly and jointly hold 5%+ bank ownership shares or voting rights. But according to the "Information Disclosure by Commercial Banks" regulations, in force since 2007, banks are required to disclose which shareholders are in the list of the 10 largest shareholders for banks as these are regarded as large shareholders that can influence bank policies and operation decisions. In fact, according to statistics collected by the author, due to the size and ownership structure of commercial banks, holding 2%+ bank ownership shares or voting rights often requires a magnitude of funds and can enter the top ten largest shareholders, and has an important impact on bank policies and operation decisions. Therefore, we choose holding more than 2% of a bank's total ownership and appearing on the list of the 10 largest shareholders for a bank as the definition criterion of "whether the firms have a bank equity connection". We focus only on non-financial firms when we identify firms holding significant bank ownership. In addition, to ensure the reliability of our empirical results, we also choose 2%, 3% and 5% as the definition criterion, respectively. That is, select the subsample of non-financial firms which hold 2%+, 3%+, and 5% bank ownership shares and use the propensity score matching of Rosenbaum and Rubin (1985) to find and screen the paired samples to re-examine the hypotheses of this paper. The conclusions are the same as those reported. Due to the limited length of this paper, the manuscript is somewhat abbreviated.

of technology trade is the transfer of intellectual property, which depends to a large degree on the effective implementation of an intellectual property rights protection mechanism. Moreover, the laws protecting intellectual property in China are mainly enforced locally (Long and Wang, 2014). Specifically, as technical contracts can only be reached when people have confidence that the law protects intellectual property, the trade in the technology market can be used to measure the status of intellectual property protection in the region. (2) The distribution density of patent agencies (IPP2).[6] IPP2 is equal to the number of patent agencies in different regions divided by the total population in the area. The greater IPP2, the stronger the competition. Such healthy competition keeps the cost of intellectual property protection low and the service much more comprehensive. Furthermore, the pressure of competition makes the patent agency step up publicity efforts and strengthen public awareness of intellectual property protection. Thus, using the distribution density of patent agencies to measure the status of intellectual property protection is reasonable. These two measurement methods are not only objective, they characterize the propagation mechanism of the protection system for intellectual property rights more carefully and thoroughly than the intellectual property protection index at the national level.

3.3. Model design and definition of other concepts

In view of the possible endogenous relationship between bank equity connections and corporate characteristics, we control for selection bias and endogeneity with Heckman's (Winner of Nobel Prize in Economics in 2000) two-stage method and 2SLS. The first phase is a probability type Probit regression, which is used to estimate the probability of a bank equity connection; then, the forecast results are used to estimate the Inverse Mills Ratio (IMR). Subsequently, the IMR is put into the second stage model to control and overcome the effect of self-selection and endogeneity on the empirical analysis.[7]

$$BEC_{i,t} = \alpha_0 + \alpha_1 Political_{i,t} + \alpha_2 FD_{r,t} + \alpha_3 Growth_{i,t} + \alpha_4 Roa_{i,t} + \alpha_5 Debt_{i,t} + \alpha_6 Size_{i,t} + \alpha_7 State_{i,t} + \sum Ind + \sum Year + \varepsilon \quad (1)$$

As stated, we run a Probit regression on the above model to estimate the probability of a bank equity connection. To identify the firms with bank equity connections, we use an indicator variable, BEC, which equals one if a firm holds more than 2% of a bank's total ownership and is in the list of 10 largest shareholders, and zero otherwise. Similarly, we identify whether a firm has political connections using an indicator variable, Political, which is equal to one if a firm has a political connection, and zero otherwise. Additionally, based on prior studies (Wu et al., 2012), we include control variables for the financial deepening measure (FD), firm size (Size), financial leverage (Debt), a nature of property right dummy (State), growth opportunities (growth), profitability (ROA) and industry and year dummy variables. Debt is equal to total debt divided by total assets. Size is defined as the natural logarithm of total assets. ROA is return on assets and is equal to net income divided by total assets. Growth is sales growth and is equal to the difference between the sales in this year and the sales in previous years, divided by the sales in the previous year. FD is defined as the ratio of bank loans to GDP in the province in which the firm is located. Industry and year dummy variables are included in the model to account for time-invariant industry heterogeneity and time trends. Industry classification is based on that of the China Securities Regulatory Commission (CSRC), which recognizes 21 industries, with a one-digit code for non-manufacturing industries and a two-digit code for manufacturing industries.

[6] The data of the technology market trade are collected from the "Yearbook of Science and Technology of China", published by the State Statistical bureau and the Ministry of Science and Technology. The data of the number of the patent agencies in different regions are collected from the "Annual Survey of patent agencies", published by the State Intellectual Property Office ("SIPO"). The study did not take into account the impact of the patent department of national defense because of the specialties of their operation. Furthermore, we also dropped the samples in Tibetan regions because of missing data of IPP1 and IPP2.

[7] To control and overcome the effect of self-selection and endogeneity, we also use the propensity score matching of Rosenbaum and Rubin (1985) to find and screen the paired samples. On this foundation, we set a control group that also takes part in the experiment. We use contrastive analysis to assess whether there are differences in the innovation behavior between enterprises with bank equity connections and enterprises without it; the conclusions are consistent with those reported in this paper. Due to limited space, we do not give the details of these tests.

Further, to test H1, we build model (2), based on the estimate of the IMR, to investigate the effect of bank equity connections on investment intensity.

$$R\&D_{i,t} = \beta_0 + \beta_1 BEC_{i,t} + \beta_2 CF_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4 Age_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 Growth_{i,t-1} + \beta_7 Roa_{i,t-1} + \beta_8 IMR_{i,t} + \sum Ind + \sum Year + \sum Region + \sigma \quad (2)$$

The dependent variable, R&D, captures the intensity of firm innovation, and is equal to R&D expenditure divided by total operating income. The explanatory variable is BEC. According to the theoretical analysis aforesaid, a bank equity connection improves innovation by alleviating the resources stipulation of innovation investment and enhancing dynamic configuration capability. Therefore, we expect that R&D is positively related to BEC. Moreover, in the selection of control variables, based on prior studies (Wu et al., 2012; Fang et al., 2014; Acharya et al., 2014; He and Tian, 2013), we include the financial deepening measure (FD), firm size (Size), financial leverage (Debt), cash flow (CF), growth opportunities (growth), the profitability (ROA), a region dummy (Region) and industry and year dummy variables. The cash flow ratio (CF) is defined as net cash flow from operations divided by total assets. The region dummy is added to capture differences in economic development, legal institutions (enforcement and judicial efficiency) and corruption across regions. To test H3, H4a and H4b, using model (2), we introduce variables of the intellectual property protection index (IPP) and the interaction terms between BEC and IPP to test the influence of intellectual property rights protection on technological innovation and the relationship between bank equity connections and innovation. According to the preceding theoretical analysis, whether or not companies have established a bank equity connection, intellectual property protection will help to alleviate the resources stipulation of innovation investment and to promote the value transformation of innovation achievements, and thus will encourage innovation. As such, we anticipate that the regression coefficients of IPP1 and IPP2 to R&D are both significantly positive.[8]

$$R\&D_{i,t} = \kappa_0 + \kappa_1 BEC_{i,t} + \kappa_2 IPP_{r,t} + \kappa_3 IPP_{r,t} * BEC_{i,t} + \kappa_4 CF_{i,t-1} + \kappa_5 Size_{i,t-1} + \kappa_6 Growth_{i,t-1} + \kappa_7 Roa_{i,t-1} + \kappa_8 Debt_{i,t-1} + \kappa_9 Age_{i,t-1} + \kappa_{10} IMR_{i,t} + \sum Ind + \sum Year + \sum Region + v \quad (3)$$

For context, to observe the different effects of different properties (central enterprises, local state-owned enterprises, private enterprise) on enterprises' innovative behavior, we apply group testing according to property rights. We compare the differences in the regression coefficients between the groups using the Chow test, and judge whether the difference in the groups' regression coefficients is statistically significant (Prob > chi2).

The calculations and definitions of the variables (including the variables that are used in the extended test) are shown in Table 1.

4. Empirical results and analysis

4.1. Descriptive statistics

Tables 2 and 3 show the industry distribution of the final sample and the distribution of the bank equity connection sample by industry and year. The sample period is 2006–2013. The sample is composed of 4475 firm-year observations, including 662 firm-years (approximately 14.79% of the firm-years in the full sample) in which firms hold more than 2% of a bank's total ownership and appear on the list of the bank's 10 largest shareholders. Every industry except the wood and furniture industries contain firms with bank equity connections. In addition, 296 firm-years hold more than 5% bank ownership stakes.

The distribution by year of the BEC shows that there was a brief fall in the number of enterprises with bank equity connections in 2007 and 2008; this is related to the exposure of related-party guarantees in the Delong Department and the Green Cool scandal. Overall, the increase in the number of enterprises establishing bank equity connections is an obvious trend. Hence, our sample suggests that holding significant ownership in

[8] The use of interactive items results in the multi-collinearity problem. To this end, we did the VIF test, to weaken the influence of the multi-collinearity problem. Following Kemp (2003), the data central processing method is used to process the interactive item data.

Table 1
Variable definitions.

Variable	Name	Definition and calculation
R&D	Innovation investment	R&D is equal to R&D expenditure divided by total operating income
OI	Financial performance of innovation	(Main business income − main business cost)/main business income; it can be used to characterize the financial performance of enterprises' innovation
Tobin's q	Value performance of innovation	The ratio of the book value of total assets minus the book value of equity plus the market value of equity to the book value of assets; it can be used to characterize the value performance of enterprises' innovation
BEC	Bank equity connection	Equals one, if a firm holds more than 2% of a bank's total ownership and appears on the list of the 10 largest shareholders for a bank, and zero otherwise
IPP1	Technology market trade	IPP1 is equal to the contract annual turnover of the technology market in different regions divided by annual gross domestic product in the region
IPP2	The distribution density of the patent agency	IPP2 is equal to the number of patent agencies in a region divided by the total population in the area
Political	Political connection	Political is equal to one if a firm has a political connection in which the chairman, general manager or actual controller are or were NPC Deputies, CPPCC Members or government officials at the county level or above, and zero otherwise
Size	Firm size	The natural logarithm of total assets
CF	Cash flow	CF equals the net cash flow from operations divided by total assets
Debt	Financial leverage	Debt equal to total debt divided by total assets
Growth	Growth opportunities	Growth is sales growth, calculated as the difference between this year's sales and the previous year's sales divided by the previous year's sales
Intangible	Capital formation	Intangible is equal to net intangible assets divided by net fixed assets
ROA	Profitability	ROA is return on assets, and is equal to net income divided by total assets
State	Nature of property right dummy	State State is a dummy that equals two if the firm is ultimately controlled by the state-owned Assets Supervision and Administration Committee (SASAC), and one if the firm is ultimately controlled by the local government, and zero otherwise
Age	Number of years listed	The number of years between the annual financial report and a firm's IPO
Inv	New investment	Cash for buying fixed assets, intangible assets and other long-term assets/total assets
Cash	Cash holdings	Calculated as the sum of cash and cash equivalents divided by non-cash assets. Of those, non-cash assets are equal to total assets-money funds-tradable financial assets-short-term investments
ΔCash	Net increase in cash and cash equivalents	Calculated as the net increase in cash and cash equivalents divided by non-cash assets
Nwc	Net working capital	(Cash + short-term investments or tradable financial assets)/total assets (Current assets − current liabilities − cash and cash equivalents)/total assets
IMR	Inverse Mills Ratio	The Inverse Mills Ratio is estimated with Heckman's two-stage approach, and is used to control for selection bias and endogeneity problems
Region	Region dummy	Region dummies, which equal one if the observation belongs to a particular region, and zero otherwise, controls for the effect of other factors in the region[a]
Year	Time variable	Year dummies equal one if the observation belongs to a particular year, and zero otherwise
Ind	Industry	Industry dummies equal 1 if the observation belongs to a particular industry, and zero otherwise. To make the sample distribution by industry sector more even, we use two-digit industry codes for the manufacturing sector to control for industry factors in the empirical estimation

[a] Using the methods to divide economic regions proposed by the State Council Development Research Center, we identified three economic areas, east-region, middle-region and west-region, and set the region dummies. Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan are included in the eastern region of China. Shanxi, Jilin, Heilongjiang, Jiangxi, Anhui, Henan, Hunan and Hubei are included in the central region of China. Sichuan, Shaanxi, Yunnan, Guizhou, Guangxi, Inner Mongolia, Gansu, Ningxia, Qinghai and Xinjiang are included in the western region of China.

banks is a very popular strategy in China; this result highlights the academic value and practical significance of this study.

Table 4 shows the number of intellectual property agencies (except for the patent department of national defense), the transaction scale of the regional technology markets and the average value of the intellectual property protection index (IPP) in various provinces, autonomous regions and municipalities between 2006

Table 2
Industry distribution of sample firm-years and the distribution of BEC by industry.

Industry (industry code)	Sample firms	BEC = 1	
	Number of firm-years	Number of firm-years	Percent
Food and beverage (C0)	49	9	18.37
Textile, clothes and fur (C1)	198	32	16.16
Timber and furniture (C2)	10	0	0.00
Paper making and printing (C3)	92	8	8.70
Petroleum, chemistry, rubber and plastic (C4)	672	66	9.82
Electronic (C5)	350	55	15.71
Metal and non-metal (C6)	482	96	19.92
Machinery, equipment and instrument (C7)	1458	190	13.03
Medicine and biological products (C8)	650	116	17.85
Other manufacturing (C9)	45	18	40.00
Information technology (G)	469	72	15.35
Total (firm-year observations)	4475	662	14.79

Table 3
Distribution of BEC by year.

Fiscal year	2006	2007	2008	2009	2010	2011	2012	2013	Total
Total sample	518	522	536	559	564	571	597	608	4475
Sample with EBC	86	71	70	79	83	86	91	96	662
Percent	16.60	13.60	13.06	14.13	14.72	15.06	15.24	15.79	14.79

Table 4
Intellectual property protection in China between 2006 and 2013.

Variable	2006	2007	2008	2009	2010	2011	2012	2013
The number of intellectual property agencies	582	593	642	676	717	775	823	896
The transaction scale of the technology market (Billion)	1818	2227	2665	3039	3907	4764	6437	7469
The average value of IPP1 in various regions	0.0073	0.0074	0.0076	0.0078	0.0084	0.0089	0.0105	0.0123
The average value of IPP2 in various regions	0.0066	0.0066	0.0071	0.0073	0.0074	0.0080	0.0083	0.0089

and 2013. As shown in Table 4, in aggregate, the protection of intellectual property in China has continuously increased since 2008. This is primarily due to improvements in IPR protection awareness and the gradual improvement in institutional arrangements. The second session of the Tenth National People's Congress passed a constitution revision bill in March 2004 that modified Article 13 and clearly stipulates that the lawful private property of citizens is inviolable. The lawful private property of citizens includes patents, trademarks, franchises, copyright, goodwill. It provides a legal basis for intellectual property protection at a constitutional level. The State Council issued the "Outline of National Intellectual Property Strategy" in 2008, which further highlights the important position of intellectual property in the national strategy. Of course, it is worth pointing out that although that has been significant progress in the efforts to protect intellectual property rights, the development of intellectual property protection is not quite balanced across all regions of China. The problems, lack of awareness of independent intellectual property rights protection and the lack of relevant resources and talent, are quite severe in many areas. In a word, intellectual property protection in China still has a long way to go.

Table 5 provides descriptive statistics of the main variables and the results of the single variable analysis. To avoid the influence of outliers, all of the continuous variables are winsorized at the 1% and 99% levels. As shown in Panel A of Table 5, the mean and median of IPP1 are 0.014 and 0.004, respectively. The mean and median of IPP2 are 0.013 and 0.005. These indicate that there is a significant deviation between the mean and median of IPP1 and IPP2; that is, the development of intellectual property protection is not balanced across different regions and in different years. Actually, taking Beijing's active technology market as an

Table 5
Descriptive statistics of the main variables and the results of single variable analysis.

	Total sample		BEC = 0		BEC = 1		*t*-Tests mean
	Mean	Median	Mean	Median	Mean	Median	
Panel A: Descriptive statistics of the main variables							
R&D	0.0256	0.0258	0.0254	0.0252	0.0266	0.0271	(2.09**)
IPP1	0.014	0.004	0.014	0.004	0.014	0.004	(0.96)
IPP2	0.013	0.005	0.013	0.004	0.013	0.005	(1.02)
FD	1.209	1.066	1.205	1.066	1.231	1.066	(0.86)
Size	21.86	21.75	21.77	21.58	22.36	22.10	(13.60***)
CF	0.046	0.043	0.046	0.042	0.048	0.044	(2.29**)
Lev	0.497	0.504	0.492	0.505	0.526	0.512	(3.15***)
Growth	0.119	0.112	0.120	0.113	0.114	0.108	(1.26)
ROA	0.060	0.052	0.059	0.051	0.065	0.057	(3.08***)
Tobin' q	1.936	1.680	1.938	1.651	1.925	1.706	(−1.04)
OI	0.223	0.188	0.222	0.186	0.231	0.179	(1.71*)
Cash	0.249	0.235	0.253	0.230	0.226	0.196	(−3.93***)
ΔCash	0.013	0.011	0.014	0.012	0.005	0.002	(−5.62***)
Inv	0.057	0.042	0.056	0.040	0.062	0.053	(2.86***)
Age	10.35	10	9.607	10	14.63	11	(10.22***)

	Mean	Median		Mean	Median
Panel B: Single variable analysis of R&D					
IPP1 ⩽ Median	0.0249	0.0248	IPP2 ⩽ Median	0.0252	0.0250
IPP1 > Median	0.0263	0.0259	IPP2 > Median	0.0260	0.0257
t-Tests mean	6.03***		*t*-Tests mean	5.97***	

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

example, in 2006, there were only 120 intellectual property agencies in Beijing, but this number more than doubled to 254 between 2006 and 2013; however, there were only three intellectual property agencies in Gansu, Ningxia, Qinghai, in 2013. This also reflects the unbalanced nature of regional IPR protection. In addition, based on a univariate comparison, firms with bank equity connections tend to be larger, more profitable, and have more debt, net cash flow and new investment.

To visually display the effect of bank equity connections and intellectual property protection on enterprise innovation, we divide the sample into two groups according to bank equity connections and the median of the IPP index, and conduct a single variable analysis of R&D. As shown in Panel A of Table 5, the innovation investment intensity is higher in firms with a bank equity connection at a level of 5%, which is consistent with our prediction in H1. Similarly, as shown in Panel B of Table 5, whether it is grouped by the median IPP1, or by the median IPP2, innovation investment intensity is higher in the group where the lack of intellectual property protection is lower with significance at the 1% level, which is consistent with H3. All of the above results preliminarily confirm that both bank equity connections and intellectual property protection have a positive effect on innovation.

4.2. Bank equity connections, enterprise heterogeneity and enterprise innovation

Table 6 shows the parameter estimation results of models (1) and (2) after controlling for selection bias and endogeneity using Heckman's correction and 2SLS. The estimation for model (1), shown in column 1 in Table 6, suggests that political connections, financial depth in the region, growth opportunities, profitability, firm size and the nature of ownership affect whether firms establish bank equity connections. The results of estimating model (2) for the full sample are shown in the second column in Table 6. The coefficient of BEC is 0.012 (*t*-value = 1.74), suggesting that compared to firms without bank equity connections, those with bank equity connections invest more in innovation. These results are consistent with H1. Furthermore, to test

Table 6
Bank equity connections, enterprise heterogeneity and enterprise innovation.

First stage		Second stage	Full sample	Central enterprises	Local state-owned enterprises	Private enterprises
Dependent variable: *BEC*	Column 1	Dependent variable: *R&D*	Column 2	Column 3	Column 4	Column 5
Intercept	−0.515***	*Intercept*	−0.221**	−0.056***	−0.389**	−0.387**
	(−3.67)		(−2.45)	(−2.90)	(−2.17)	(−2.00)
PC	0.006**	*BEC*	0.012*	0.009*	0.001	0.015**
	(1.96)		(1.74)	(1.69)	(1.12)	(2.49)
FD	−0.051*	*CF*	0.076***	0.068*	0.071***	0.082***
	(−1.68)		(2.77)	(1.82)	(2.63)	(4.99)
Lev	0.241***	*Size*	0.042*	0.039**	0.040**	0.045***
	(5.88)		(1.89)	(2.06)	(2.28)	(2.94)
Growth	−0.269**	*Growth*	0.012**	0.008***	0.018**	0.012***
	(−2.39)		(2.42)	(2.59)	(2.03)	(2.68)
Size	0.295***	*Debt*	−0.039***	−0.016	−0.048***	−0.064***
	(12.78)		(−2.74)	(−1.53)	(−2.86)	(−2.90)
ROA	−0.467***	*ROA*	0.043***	0.029*	0.055**	0.058*
	(−3.02)		(2.78)	(1.70)	(2.22)	(1.81)
State	−0.027*	*Age*	−0.009***	−0.006***	−0.005***	−0.010***
	(−1.88)		(−5.28)	(−3.59)	(−5.91)	(−3.76)
		IMR	0.028*	0.016	0.071**	0.067**
			(1.80)	(0.40)	(2.36)	(1.98)
Year & Ind	*Control*	*Year & Ind & Region*	*Control*	*Control*	*Control*	*Control*
Obs	4475	Obs	4475	929	2060	1486
Pseudo R^2	0.1086	*Adj-*R^2	0.2597	0.2948	0.2631	0.2879

Note: In the first stage regression with the Probit regression model, the numbers in brackets are the *z*-values; in the second stage regression model, the numbers in brackets are the *t*-values.

* Significance at the 10% level.

** Significance at the 5% level.

*** Significance at the 1% level.

whether the effect of BEC differs across firms with different properties, we divide the sample into three groups by ownership type and compare the differences in the BEC coefficient across the three groups. Columns 3–5 in Table 6 report the results. In the subsample of central enterprises, the coefficient of BEC is 0.009 (t-value = 1.69). Similarly, in the private enterprises group, the coefficient of BEC is 0.015 (t-value = 2.49). The results presented in column 4 suggest that bank equity connections do not affect the innovation investment of local state-owned enterprises. We also compare the influence of BEC on firms with different properties using the Chow test. As shown in columns 3 and 5 in Table 6, the coefficients of BEC vary from 0.001 to 0.015, and there is a significant difference between the two groups ($P < 0.001$). These results show that bank equity connections have various effects on innovation in the three types of enterprises. Due to their monopoly advantages and their special role in the national economy, central enterprises easily obtain policy support and exogenous financing. Hence, the innovation advantages of BEC are relatively weak in central enterprises. However, the situation for private enterprises is different; the long-term ownership and scale discrimination in private enterprise financing, financing constraints and policy bias hinder the innovation investment of private enterprises. Therefore, the effect of BEC on resource acquisition and on dynamic configuration capability is strongest in these firms. Local state-owned enterprises probably use the resources advantage of BEC to invest excessively, due to the government's widespread intervention and insufficient oversight of executive power; hence, the effect of bank equity connections on investment is insignificant in local state-owned enterprises. And yet, the regression coefficient of IMR shows that the selection of this instrumental variable is reasonable.

4.3. Bank equity connections, intellectual property protection and enterprise innovation

Table 7 shows the effect of intellectual property protection on enterprise innovation, and the interactive relationship between bank equity connections and intellectual property protection in the process of improving innovation. In columns 1–8, IPP1and IPP2 are used to measure the status of intellectual property protection in various regions. We find that the coefficients of IPP1 and IPP2 are all significantly positive across all columns; that is, in the whole sample and in the subsamples, the level of intellectual property protection (IPP) is positive related to the intensity of innovation investment. This is consistent with H3. Moreover, to investigate the interactive relationship between bank equity connections and intellectual property protection in the process of improving innovation, we include the interaction terms of bank equity connections and the intellectual property protection index in the model. The results are reported in columns 1–8 in Table 7. The interaction term between BEC and IPP1, shown in column 1, is significantly positive at a level of 5%, and the interaction term between BEC and IPP2, shown in column 2, is significantly positive at the level of 5%. This supports our hypothesis H4b; intellectual property rights protection can strengthen the enhancement effects of bank equity connections on corporate innovation. The testing of different property rights groups shows that the coefficients of IPP1 and IPP2 are lowest for central enterprises, moderate for local state-owned enterprises and highest for private enterprises and the Chow's test of each pair shows that there are significant differences between column 3 and column 5 (P-Value = 0.056), between column 5 and column 7 (P-Value = 0.031), between column 3 and column 7 (P-Value = 0.006), between column 4 and column 6 (P-Value = 0.092), between column 6 and column 8 (P-Value = 0.049) and between column 4 and column 8 (P-Value = 0.011). All of the tests pass the significant test with at least a 0.01 level.

Therefore, intellectual property protection has a different facilitation effect on different types of enterprises, which is consistent with H3. Intellectual property protection has less effect in enterprises that can safeguard the rights and benefits of innovation with alternative mechanisms, such as administrative intervention. The capacity to pursue their rights through alternative means increases gradually from private enterprises to local state-owned enterprises to central enterprises; as the level of government control increases, the dependence on intellectual property protection becomes weaker. Columns 3 and 4 in Table 7 show that the coefficients of IPP1*BEC and IPP2*BEC are positive, and the coefficient of IPP1*BEC is significant at a level of 10%, indicating that in central enterprises, the interaction between intellectual property rights protection and bank equity connections has a significant effect on innovation. However, in columns 5 and 6, the coefficients of IPP1*BEC and IPP2*BEC are both insignificant, indicating that the interactions do not affect the innovative behavior of local state-owned enterprises, perhaps due to the distortion of the bank equity connection, which severely weakens the moderating effect of intellectual property protection. For private enterprises, columns 7

Table 7
Bank equity connections, intellectual property protection and enterprise innovation.

Dependent variable: *R&D*	Full sample		Central enterprises		Local state-owned enterprises		Private enterprises	
	IPP = IPP1 Column 1	IPP = IPP2 Column 2	IPP = IPP1 Column 3	IPP = IPP2 Column 4	IPP = IPP1 Column 5	IPP = IPP2 Column 6	IPP = IPP1 Column 7	IPP = IPP2 Column 8
Intercept	−0.329***	−0.354***	−0.791***	−0.828***	−0.357**	−0.416**	−0.076**	−0.014***
	(−3.62)	(−3.81)	(−3.38)	(−3.55)	(−2.00)	(−2.32)	(−2.46)	(−3.08)
BEC	0.008*	0.011*	0.001	0.002	−0.002	−0.006	0.001*	0.002**
	(1.68)	(1.71)	(0.87)	(0.96)	(−0.71)	(−0.98)	(1.94)	(2.16)
IPP1	0.191***	–	0.152***	–	0.208***	–	0.328***	–
	(5.33)	–	(3.75)	–	(2.68)	–	(3.40)	–
*IPP1*BEC*	0.112**		0.070*	–	0.051	–	0.365***	–
	(2.18)		(1.71)	–	(0.60)	–	(3.24)	–
IPP2	–	0.206***	–	0.182***	–	0.297***	–	0.403***
	–	(5.39)	–	(3.82)	–	(3.13)	–	(3.35)
*IPP2*BEC*	–	0.125**	–	0.073	–	0.056	–	0.415***
	–	(2.05)	–	(1.17)	–	(0.72)	–	(2.99)
CF	0.081**	0.076***	0.063***	0.058***	0.085**	0.080***	0.092***	0.082***
	(2.26)	(2.64)	(2.71)	(2.69)	(2.52)	(2.64)	(4.13)	(6.10)
Size	0.046***	0.038***	0.029***	0.030***	0.048*	0.039**	0.051***	0.049**
	(3.22)	(3.12)	(3.19)	(3.36)	(1.95)	(2.29)	(3.09)	(2.00)
Growth	0.011***	0.012***	0.009***	0.011***	0.010*	0.016**	0.085**	0.072***
	(2.97)	(3.16)	(3.28)	(3.45)	(1.85)	(2.09)	(2.32)	(3.67)
Debt	−0.021**	−0.024***	−0.015**	−0.016***	−0.025**	−0.031*	−0.029***	−0.031***
	(−2.28)	(−2.61)	(−1.99)	(−3.17)	(−2.24)	(−1.67)	(−4.81)	(−5.11)
ROA	0.055***	0.058***	0.126***	0.132***	0.063**	0.075**	0.051**	0.063**
	(3.66)	(3.80)	(3.36)	(3.52)	(1.98)	(2.23)	(2.32)	(2.09)
Age	−0.010***	−0.009***	−0.006***	−0.008***	−0.016***	−0.017***	−0.001***	−0.009***
	(−10.22)	(−10.23)	(−3.02)	(−3.13)	(−6.06)	(−6.09)	(−3.96)	(−6.71)
IMR	0.053***	0.057***	0.135***	0.142***	0.054*	0.070**	0.011	0.028**
	(3.28)	(3.48)	(3.25)	(3.43)	(1.72)	(2.12)	(0.37)	(2.02)
Year & Ind & Region	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*
Obs	4475	4475	929	929	2060	2060	1486	1486
Adj-R^2	0.2765	0.2760	0.3138	0.3125	0.2940	0.2941	0.3106	0.3105

Note: *t* statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

and 8 in Table 7 show that the coefficients of the interaction terms between IPP1 and BEC and between IPP2 and BEC are both significantly positive at the 1% level, and Chow's test shows that there are significant differences between column 5 and column 7 (*P*-Value = 0.056), indicating that in private enterprises, the complementary effect of bank equity connections and intellectual property protection is most prominent. Private enterprises probably still struggle to protect their rights with alternative mechanisms, leading to greater dependence on intellectual property protection. These results are consistent with H4b.

In Table 7, we investigate whether the interaction between intellectual property protection and bank equity connections promotes innovation. In Table 8, we divide the sample into two groups according to the median IPP1 and compare the regression coefficients of bank equity connections. In the higher IPP1 group, intellectual property protection is relatively weak, whereas in the lower IPP1 group, the influence of intellectual property protection is comparatively strong. As shown in columns 1–3 in Table 8, the coefficients of BEC are significantly positive at the 10% level in columns 1 and 3, but the coefficient of BEC is insignificant in the statistical sense, indicating that when IPP1 is below the median, bank equity connections can promote innovation in private enterprises and central enterprises, but might have little effect on innovation in local state-owned enterprises. Similarly, the results shown in columns 4 and 6 show that the coefficients of BEC are as follows:

Table 8
Bank equity connections, intellectual property protection and enterprise innovation (grouped according to the median of IPP1).

Dependent variable: *R&D*	IPP1 ⩽ median			IPP1 > median		
	Central enterprises Column 1	Local state-owned enterprises Column 2	Private enterprises Column 3	Central enterprises Column 4	Local state-owned enterprises Column 5	Private enterprises Column 6
Intercept	−0.146***	−0.180***	−0.041**	−0.036**	−0.345	−0.594**
	(−7.68)	(−4.28)	(−2.16)	(−2.12)	(−1.47)	(−1.98)
BEC	0.007*	−0.002	0.008*	0.010**	0.005	0.019***
	(1.70)	(−1.17)	(1.86)	(2.16)	(1.57)	(3.50)
CF	0.070**	0.089**	0.091***	0.065*	0.073**	0.081***
	(2.07)	(2.25)	(3.88)	(1.69)	(2.08)	(2.95)
Size	0.38*	0.042**	0.048***	0.025	0.006*	0.019**
	(1.70)	(2.28)	(2.91)	(0.03)	(1.67)	(2.19)
Growth	0.009**	0.015**	0.026**	0.010*	0.022**	0.021**
	(2.52)	(2.04)	(2.17)	(1.76)	(2.26)	(2.32)
Debt	−0.019*	−0.031**	−0.039***	−0.016*	−0.025**	−0.028***
	(−1.85)	(−2.39)	(−4.96)	(−1.76)	(−2.26)	(−2.58)
ROA	0.101**	0.092**	0.116**	0.095**	0.055*	0.063**
	(2.06)	(2.11)	(2.30)	(2.25)	(1.89)	(2.41)
Age	−0.009***	−0.012***	−0.007***	−0.021***	−0.012***	−0.014***
	(−2.72)	(−2.86)	(−4.19)	(−5.60)	(−3.18)	(−4.82)
IMR	0.015**	0.030*	0.012**	0.011*	0.079*	0.101**
	(2.17)	(1.85)	(2.26)	(1.68)	(1.82)	(1.96)
Year & Ind & Region	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*
Obs	929	2060	1486	929	2060	1486
Adj-R²	0.3934	0.2951	0.3130	0.3187	0.2930	0.3412

Note: *t* statistics in parentheses. We also divide the sample into two groups according to the median of IPP2 and test the effect of bank equity connection on enterprise innovation behavior. The conclusions are the same as those reported in Table 8.

* Significance at the 10% level.

** Significance at the 5% level.

*** Significance at the 1% level.

0.010 and 0.019, which are significant at the 1% and 5% levels, respectively. However, in column 5, the coefficient of BEC does not reach the level of statistical significance. Furthermore, the Chow's test shows that there are significant differences between column 1 and column 4 (P-Value = 0.091) and between column 3 and column 6 (P-Value = 0.025), indicating that when intellectual property protection is relatively poor, bank equity connections can stimulate innovation in central enterprises and private enterprises, but this effect is relatively weak, especially as bank equity connections do not promote innovation in local state-owned enterprises and may even crowd out innovation investment. These results show the dependence of the transmission mechanism of bank equity connections on intellectual property protection and strongly supports H4b.

5. Additional analysis: bank equity connections, intellectual property protection and innovation performance

Innovation is the engine of economic reorientation and structural adjustment in an industry and it enhances the quality of economic development. In the long term, investing in innovation is important in sustainable corporation development, but the huge investment and large venture can cause serious uncertainty about short-term performance. Moreover, the public goods characteristic of innovation means that the return from investment in innovation projects is very uncertain. The above research shows that bank equity connections and intellectual property protection can encourage enterprises to increase innovation, but it is unclear whether they improve innovation performance. In the following sections, we examine the influence of bank equity connections and intellectual property protection on innovation performance. To this end, we construct the following models.

$$\begin{aligned} Tobin'\ q_{i,t}(OI_{i,t}) = {} & \rho_0 + \rho_1 R\&D_{i,t-1} + \rho_2 BEC_{i,t} + \rho_3 BEC_{i,t} * R\&D_{i,t-1} + \rho_4 Size_{i,t} + \rho_5 Debt_{i,t} + \rho_6 Age_{i,t} \\ & + \rho_7 Intangible_{i,t} + \rho_8 IMR_{i,t} + \sum Ind + \sum Year + \sum Region + \varepsilon \end{aligned} \tag{4}$$

$$\begin{aligned} Tobin'\ q_{i,t}(OI_{i,t}) = {} & \lambda_0 + \lambda_1 R\&D_{i,t-1} + \lambda_2 BEC_{i,t} + \lambda_3 BEC_{i,t} * R\&D_{i,t-1} + \lambda_4 IPP_{r,t} * BEC_{i,t} + \lambda_5 IPP_{r,t} \\ & + \lambda_6 IPP_{r,t} * R\&D_{i,t-1} + \lambda_7 IPP_{r,t} * BEC_{i,t} * R\&D_{i,t-1} + \lambda_8 Size_{i,t} + \lambda_9 Debt_{i,t} \\ & + \lambda_{10} Age_{i,t} + \lambda_{11} Intangible_{i,t} + \lambda_{12} IMR_{i,t} + \sum Ind + \sum Year + \sum Region + \varepsilon, \end{aligned} \tag{5}$$

where *OI* and *Tobin's q* represent the financial performance and value performance of enterprises' innovations, respectively. We choose gross margins as an alternative variable for innovation performance, as not only can innovation improve enterprise performance by either increasing output or reducing costs or a mixture of the two, but there may also be the problem of earnings management. Thus *OI* is a comparatively ideal variable to measure innovation performance. To investigate the influence of bank equity connections and intellectual property protection on innovation performance and the relationship between them in this process, we include BEC, IPP, and the interactive terms between BEC and R&D, between IPP and R&D, between IPP and BEC, and the three-way interaction term between IPP, BEC and R&D. In addition to these variables, we also include *Size*, *Debt*, *Intangible*, *Age*, *IMR* and other factors to control for their effect on innovation.

5.1. Bank equity connections and innovation performance

Table 9 presents the test results of model (5). As shown in columns 1 and 2 of Table 9, the coefficient of the interaction terms between BEC and R&D is 0.056 and 0.048, respectively, which are both significant at the 1% level; that is, on average, for all types of firms, holding significant bank ownership is helpful for transforming innovation achievements into value. Columns 3–8 of Table 9 show the results of the estimation of model (5) using the subsamples. In the group testing of property rights, the coefficients of BEC*R&D are significantly positive for central enterprises and private enterprises, and the coefficients are bigger in the subsample that only includes private enterprises. However, in columns 5 and 6, the coefficients of BEC*R&D are both insignificant, indicating that bank equity connections have no significant effect on innovation performance in local state-owned enterprises. Furthermore, Chow's test of the subsample of private enterprises and central enterprises shows that there are significant differences between column 3 and column 7 (P-Value = 0.032) and

Table 9
Bank equity connections, enterprise heterogeneity and innovation performance.

Dependent variable	Full sample		Central enterprises		Local state-owned enterprises		Private enterprises	
	Tobin's q Column 1	*OI* Column 2	*Tobin's q* Column 3	*OI* Column 4	*Tobin's q* Column 5	*OI* Column 6	*Tobin's q* Column 7	*OI* Column 8
Intercept	−0.606***	−0.896***	−0.698*	−0.629**	−0.780***	−0.541***	−0.565***	−0.678**
	(−3.49)	(−5.52)	(−1.66)	(−2.29)	(−5.27)	(−6.06)	(−3.20)	(−2.46)
BEC	0.012	0.018	0.008*	0.016**	0.007	0.005	0.009***	0.010**
	(1.04)	(1.55)	(1.70)	(2.08)	(0.85)	(0.76)	(2.98)	(2.22)
R&D	1.112***	0.932***	1.072***	0.823***	0.976*	0.680*	1.190***	1.002***
	(4.03)	(9.51)	(6.25)	(5.25)	(1.71)	(1.66)	(4.01)	(8.71)
BEC∗R&D	0.056*	0.048*	0.051*	0.021*	−0.012	−0.010	0.084***	0.065***
	(1.67)	(1.83)	(1.75)	(1.87)	(−1.56)	(−1.38)	(2.93)	(3.24)
Size	−0.267***	−0.056*	−0.261***	−0.042*	−0.248***	−0.063***	−0.459	−0.003
	(−2.74)	(−1.76)	(−3.82)	(−1.92)	(−9.89)	(−2.80)	(−1.22)	(−1.52)
Debt	−0.758***	−0.276***	−0.450**	−0.118***	−0.713***	−0.397***	−0.873***	−0.217***
	(−8.59)	(−6.85)	(−2.45)	(−3.42)	(−6.70)	(−5.89)	(−4.76)	(−9.75)
Intangible	0.225***	0.081***	0.215*	0.076**	0.220*	0.067***	0.310**	0.097***
	(2.68)	(7.37)	(1.90)	(2.49)	(1.71)	(4.26)	(1.99)	(4.80)
Age	−0.013**	−0.029***	−0.066	−0.058***	−0.017**	−0.016**	0.130*	0.011*
	(−2.36)	(−6.19)	(−0.84)	(−3.68)	(−2.12)	(−2.17)	(1.66)	(1.72)
IMR	0.537***	0.229***	0.202***	0.186***	0.306**	0.389*	0.156*	0.170***
	(2.64)	(3.12)	(2.97)	(4.13)	(2.10)	(1.89)	(1.92)	(3.64)
Year & Ind & Region	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*
Obs	4475	4475	929	929	2060	2060	1486	1486
Adj-R2	0.4370	0.4272	0.4686	0.4068	0.4685	0.4598	0.4484	0.5062

Note: *t* statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

between column 4 and column 8 (*P*-Value = 0.086); the differences are significant at the 10% level. In other words, in different enterprises, bank equity connections have different facilitation effects on innovation performance, and the intensity of the effect is greatest in private enterprises, moderate in central enterprises and weakest in local state-owned enterprises, perhaps because the internal control systems and many other institutional arrangements are better in central enterprises than in local state-owned enterprises. Therefore, bank equity connections are positively related to innovation performance. However, due to soft budget constraints, a monopolistic market structure and the imperfect financial supervision system, this effect is stronger in private enterprises. For local state-owned enterprises, the short-term interest appeals of local government officials and the self-interested behavior of corporate executives are likely to distort the capital investment of local state-owned enterprises and make the resource disposal advantage of bank equity connections a less efficient tool for increasing profits. This results in less investment in innovation overall, and bank equity connections may even have a slightly negative effect on innovation performance in local state-owned enterprises.

5.2. Bank equity connections, intellectual property protection and innovation performance

Taking IPP1 as the proxy variable for intellectual property protection, we investigate the individual influence of intellectual property protection on innovation performance, and the interaction between intellectual property protection and bank equity connections. As shown in columns 1 and 2 of Table 10, the coefficients of IPP1∗R&D are significantly positive at 10% and 5% levels, respectively. Moreover, the coefficients of IPP1∗BEC∗R&D are 0.154 and 0.140, respectively, and are both significant. These results indicate that for all firms, intellectual property protection not only improves innovation performance, it can positively moderate the relation between bank equity connections and innovation performance. In addition, as shown in columns 3–8 of Table 10, we find that for central enterprises, local state-owned enterprises and private enterprises,

Table 10
Bank equity connections, intellectual property protection and innovation performance (IPP = IPP1).

Dependent variable	Full sample		Central enterprises		Local state-owned enterprises		Private enterprises	
	Tobin's q Column 1	*OI* Column 2	*Tobin's q* Column 3	*OI* Column 4	*Tobin's q* Column 5	*OI* Column 6	*Tobin's q* Column 7	*OI* Column 8
Intercept	−0.568***	−0.855***	−0.556***	−0.672***	−0.283***	−0.324***	−0.263***	−0.856**
	(−3.20)	(−5.53)	(−4.71)	(−2.72)	(−3.29)	(−5.84)	(−3.35)	(−2.51)
BEC	0.003	0.007	0.075	0.023*	−0.006	0.010	0.007**	0.008*
	(1.19)	(1.62)	(1.49)	(1.68)	(−1.52)	(1.22)	(1.98)	(1.70)
R&D	0.997***	0.908***	0.942**	0.920***	0.816***	0.848**	0.998***	0.915***
	(2.68)	(7.83)	(1.98)	(4.25)	(2.91)	(2.59)	(4.62)	(10.02)
BEC∗*R&D*	0.050*	0.026	0.044*	0.028*	−0.308	−0.730	0.066***	0.052**
	(1.66)	(1.05)	(1.76)	(1.80)	(−1.16)	(−1.47)	(2.59)	(2.11)
IPP1	0.227*	0.136*	0.450*	0.131*	0.138*	0.219	0.508***	0.232**
	(1.69)	(1.70)	(1.88)	(1.85)	(1.84)	(1.18)	(2.63)	(2.06)
IPP1∗*BEC*	0.031**	0.026*	0.020*	0.015*	0.011	0.008	0.039***	0.035**
	(2.09)	(1.78)	(1.73)	(1.84)	(1.16)	(1.22)	(4.61)	(3.37)
IPP1∗*R&D*	0.583*	0.321**	0.502**	0.276**	0.465*	0.218*	0.910***	0.772***
	(1.77)	(2.42)	(2.09)	(2.11)	(1.92)	(1.90)	(5.59)	(2.92)
IPP1∗*BEC*∗*R&D*	0.154*	0.140**	0.170*	0.085**	0.205	0.138	0.288***	0.202***
	(1.93)	(2.10)	(1.76)	(2.09)	(1.53)	(1.07)	(3.12)	(2.83)
Size	−0.350***	−0.076***	−0.352***	−0.339***	−0.252***	−0.228*	−0.063***	−0.060**
	(−6.93)	(−7.03)	(−5.50)	(−3.16)	(−9.20)	(−1.92)	(−3.06)	(−2.35)
Debt	−0.762***	−0.224***	−0.441***	−0.120***	−0.813***	−0.202*	−0.908***	−0.165***
	(−8.59)	(−13.65)	(−2.66)	(−3.52)	(−5.66)	(−1.69)	(−14.70)	(−10.72)
Intangible	0.162**	0.080***	0.060**	0.076***	0.192*	0.077***	0.188***	0.083***
	(2.29)	(7.34)	(2.25)	(2.76)	(2.06)	(3.16)	(2.89)	(7.22)
Age	−0.017**	−0.023***	−0.042	−0.031***	−0.040*	−0.023***	0.033	−0.024***
	(−1.98)	(−3.32)	(−0.81)	(−3.15)	(−1.67)	(−2.80)	(1.20)	(−6.10)
IMR	−0.131***	−0.173***	−0.150***	−0.190***	−0.136*	−0.125***	−0.154***	−0.121***
	(−3.49)	(−7.81)	(−5.36)	(−4.26)	(−1.79)	(−2.75)	(−2.80)	(−3.29)
Year & Ind & Region	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*
Obs	4475	4475	929	929	2060	2060	1486	1486
Adj-R^2	0.4382	0.4276	0.4709	0.4089	0.4879	0.4640	0.4493	0.4257

Note: *t* statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

the coefficients of IPP1*R&D are significantly positive and that the coefficient is lowest for central enterprises and highest in private enterprises. Moreover, Chow's test shows that there are significant differences between each pair. These results suggest that the positive effect of intellectual property protection on innovation performance is strongest in private enterprises and weakest in central enterprises, which is consistent with H3. One explanation might simply be, similar to Table 7, that the capacity to pursue rights through alternative means increases gradually with increases in government control level, so the dependence on intellectual property protection becomes weaker. To analyze the relationship between intellectual property protection and bank equity connections, we include the three-way interaction term among IPP1, R&D and the BEC dummy. We focus on the coefficient of IPP1*BEC*R&D. As shown in columns 3–8 of Table 10, the coefficients of I PP1*BEC*R&D are all significantly positive, except in the subsample of local state-owned enterprises; the coefficient of IPP1*BEC*R&D is greater in the subsample of private enterprises than in the subsample of central enterprises. Furthermore, Chow's test shows that there are significant differences between columns 3 and 7 (P-Value = 0.056) and between columns 4 and 8 (P-Value = 0.071). This indicates that the interactive effect between bank equity connections and intellectual property protection makes the strongest improvements in innovation performance in private enterprises, and the least improvement in local state-owned enterprises, perhaps because the short-term interests of local government officials and the self-interested behavior of

Table 11
Bank equity connections, intellectual property protection and innovation performance (IPP = IPP2).

Dependent variable	Full sample		Central enterprises		Local state-owned enterprises		Private enterprises	
	Tobin's q	*OI*	*Tobin's q*	*OI*	*Tobin's q*	*OI*	*Tobin's q*	*OI*
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Intercept	−0.455***	−0.362***	−0.671**	−0.580**	−0.475***	−0.331***	−0.428***	−0.373**
	(−3.15)	(−3.43)	(−2.03)	(−2.51)	(−4.66)	(−5.75)	(−5.61)	(−2.86)
BEC	0.073	0.010*	0.064	0.008*	−0.021	−0.008	0.013**	0.010**
	(1.53)	(1.66)	(1.16)	(1.77)	(−0.64)	(−1.09)	(2.03)	(2.12)
R&D	0.966***	0.868***	1.032**	0.827***	0.936*	0.716**	0.950***	0.922***
	(2.72)	(3.96)	(2.09)	(3.10)	(1.86)	(2.48)	(3.02)	(3.17)
*BEC*R&D*	0.039*	0.038*	0.027*	0.017	−0.024	−0.064	0.065**	0.042*
	(1.91)	(1.67)	(1.70)	(1.13)	(−0.79)	(−1.37)	(2.28)	(1.77)
IPP2	0.342***	0.115**	0.270*	0.094*	0.240**	0.164*	0.359***	0.638**
	(2.86)	(2.02)	(1.85)	(1.88)	(2.23)	(1.75)	(2.82)	(2.45)
*IPP2*BEC*	0.042*	0.036*	0.021	0.027*	0.017	0.30	0.064***	0.051**
	(1.72)	(1.91)	(1.36)	(1.66)	(1.03)	(0.99)	(2.25)	(2.84)
*IPP2*R&D*	0.348**	0.253***	0.226**	0.197*	0.335*	0.250***	0.466**	0.321***
	(2.30)	(2.82)	(1.98)	(1.78)	(1.82)	(2.69)	(2.27)	(3.11)
*IPP2*BEC*R&D*	0.261*	0.058**	0.437	0.037*	0.160	0.251	0.651***	0.128***
	(1.85)	(2.08)	(1.48)	(1.86)	(1.12)	(1.06)	(3.12)	(2.73)
Size	−0.266***	−0.077*	−0.465***	−0.060*	−0.252***	−0.095**	−0.053	−0.039
	(−11.05)	(−1.81)	(−14.36)	(−1.90)	(−9.19)	(−2.08)	(−1.38)	(−1.58)
Debt	−0.826***	−0.168***	−0.438**	−0.056	−0.861***	−0.196***	−0.142***	−0.310***
	(−9.32)	(−13.16)	(−2.29)	(−1.03)	(−6.12)	(−10.19)	(−9.49)	(−9.28)
Intangible	0.225***	0.082***	0.131**	0.053***	0.228*	0.088***	0.304**	0.097***
	(3.32)	(7.54)	(2.20)	(2.69)	(1.79)	(4.40)	(2.46)	(7.11)
Age	−0.059**	−0.027***	−0.032**	−0.036***	−0.057***	−0.023***	−0.163**	−0.028
	(−2.50)	(−3.29)	(−2.29)	(−3.82)	(−3.53)	(−3.12)	(−2.02)	(−1.49)
IMR	−0.512***	−0.260***	−0.112***	−0.192***	−0.060**	−0.165***	−0.043*	−0.066***
	(−3.90)	(−7.79)	(−5.53)	(−4.49)	(−2.44)	(−3.48)	(−1.92)	(−2.56)
Year & Ind & Region	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*	*Control*
Obs	4475	4475	929	929	2060	2060	1486	1486
Adj-R^2	0.4385	0.4156	0.4704	0.4008	0.4849	0.4642	0.4547	0.4969

Note: t statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

corporate executives are likely to distort the capital investment of local state-owned enterprises and make the resources disposal advantage of a bank equity connection an inefficient tool for extracting profits. This would result in less investment in innovation, so in this case, bank equity connections do not improve innovative performance even if reinforced with the protection of intellectual property rights.

In Table 11 we use IPP2 as the proxy variable for intellectual property protection. The results in columns 1–8 show that the coefficients of IPP2 and IPP2*R&D are all significantly positive. This suggests that intellectual property protection reduces the cost of innovation, enhances corporate value and improves innovation performance, whether in the whole sample regression or in the subsamples grouped by type of property rights. As shown in columns 2–8 of Table 10, the coefficient of IPP2*R&D is largest in the private enterprises subsample, and smallest in the central enterprises subsample. Furthermore, Chow's test shows that there are significant differences between each pair, indicating that the positive effect of intellectual property protection gradually increases from the central enterprises, through state-owned enterprises to private enterprises. Here, we focus on the coefficient of IPP2*BEC*R&D. As shown in columns 1–2 of Table 10, the coefficients of I PP2*BEC*R&D are all significantly positive. This suggests that intellectual property protection and bank equity connections complement each other. Furthermore, we find that when the dependent variable is measured by *Tobin's q*, the coefficients of IPP2*BEC*R&D are insignificant in columns 3 and 5, but significantly positive in column 7, indicating that the complementary effect of intellectual property protection and bank equity connections has the most influence on private enterprises, and has little influence on the other two types of enterprises. In the same way, when the dependent variable is *OI*, the coefficient of IPP2*BEC*R&D is positive but not significant in the subsample of private enterprises, whereas in column 4, the subsample of central enterprises, and in column 8, the subsample of private enterprises, the coefficients are both significantly positive, but greater for private enterprises. Chow's test shows that there are significant differences between column 4 and column 8 ($P = 0.061$). These results suggest that the positive moderating effect of intellectual property protection on the relationship between bank equity connections and innovation performance is the strongest in private enterprises and weakest in local state-owned enterprises.

Table 12
Bank equity connections, enterprise heterogeneity and financing constraints.

Dependent variable: *ΔCash*	Full sample Column 1	Central enterprises Column 2	Local state-owned enterprises Column 3	Private enterprises Column 4
Intercept	−0.130**	−0.224***	−0.385***	−0.426***
	(−2.10)	(−3.82)	(−5.61)	(−4.53)
CF	0.191***	0.183***	0.195***	0.260***
	(6.09)	(5.73)	(6.46)	(12.87)
BEC	−0.006**	−0.003	−0.005**	−0.010***
	(−2.50)	(−0.76)	(−2.22)	(−3.92)
*BEC*CF*	−0.015*	−0.002*	−0.019**	−0.022***
	(−1.92)	(−1.70)	(−1.98)	(−2.88)
Size	0.050***	0.039***	0.055***	0.062***
	(2.66)	(5.12)	(6.59)	(6.80)
Growth	0.015***	0.013***	0.016***	0.022***
	(4.30)	(8.16)	(5.60)	(6.79)
Inv	−0.182***	−0.189***	−0.178***	−0.170***
	(−5.82)	(−5.20)	(−3.85)	(−2.90)
Nwc	−0.029**	−0.027*	−0.030***	−0.036***
	(−2.40)	(−1.81)	(−3.56)	(−5.18)
IMR	0.028***	0.020**	0.029***	0.031***
	(3.96)	(2.10)	(7.18)	(4.62)
Year & Ind	*Control*	*Control*	*Control*	*Control*
N	4475	929	2060	1486
Adj-R^2	0.1155	0.1338	0.1311	0.1204

Note: *t* statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

5.3. Robustness tests for whether bank equity connections can ease financing constraints

In light of the above findings, it appears that relaxing financing constraints is one of the most important mechanisms through which bank equity connections promote innovation. Therefore, it is interesting to examine whether listed companies face serious financing constraints and whether holding bank ownership can ease these financing constraints. Following Almeida et al. (2004), we use the cash–cash flow sensitivity model to investigate the effect of bank equity connections on financing constraints. The model is as follows.

$$\Delta Cash_{i,t} = \kappa_0 + \kappa_1 CF_{i,t} + \kappa_2 BEC_{i,t} + \kappa_3 BEC_{i,t} * CF_{i,t} + \kappa_4 Size_{i,t} + \kappa_5 Growth_{i,t} + \kappa_6 Nwc_{i,t} + \kappa_7 Inv_{i,t} + \kappa_8 IMR_{i,t} + \sum Ind + \sum Year + \sum Region + \sigma, \quad (6)$$

where $\Delta Cash$ represents the net increase in cash and cash equivalents. To investigate the influence of bank equity connections on financing constraints, we include BEC∗CF. In addition to these variables, we also include firm size (*Size*), cash flow (*CF*), net working capital (*NWC*), new investment (*Inv*), growth opportunities (*Growth*), Inverse Mills Ratio (*IMR*) and other variables.

The results, shown in Table 12, show that the coefficients of CF are all significantly positive, suggesting that all kinds of companies need to conserve a certain level of cash. According to the economic significance given in model (6), all of the companies are facing some degree of financing constraints. Further, the coefficient of BEC∗CF is −0.015 (t-value = −1.92) in the full sample, suggesting that holding significant bank ownership can significantly reduce the sensitivity of cash holdings to cash flow. Furthermore, the absolute values of the coefficients of BEC∗CF are the lowest in the subsample of central enterprises and the highest in the subsample of private enterprises and Chow's test shows that there are significant differences between each pair. These results suggest that the effect of bank equity connections on enterprises financing constraints is strongest in private enterprises and weakest in central enterprises, perhaps because soft budget constraints reduce the dependence of state-owned enterprises, especially central enterprises, on bank equity connections. In addition, to ensure the reliability of our empirical results, we make the following six tests. (1) We use the investment-cash flow sensitivity model to investigate the effects of bank equity connections and intellectual property protection on corporate financing constraints. The results show that both holding significant bank ownership and reinforcing the legal protection of intellectual property rights can significantly reduce the sensitivity of investment to cash flow. (2) To further control for the effect of an endogenous relationship between bank equity connections and enterprise characteristics, we use standard propensity score matching to create a highly comparable control group, and conduct a contrast analysis of the influence of bank ownership on innovation input and innovative performance. (3) We select a subsample of companies with significant bank ownership, set the BECD dummy to one if a firm holds more than 5% of a bank's total ownership, and zero otherwise, and use BECD instead of BEC in models (2)–(6). After the above treatment, we find that the greater the amount of shares in a bank, the stronger the positive effect of bank equity connections on innovation is (4). By taking the ratio of the innovation inputs to total assets as a substitute variable for innovation intensity, and introducing it into models (2)–(5), we investigate the influence of bank equity connections on enterprise innovation behavior. The index of relative amounts of government intervention in firms and the index of intellectual property rights protection are used to reflect the degree of government intervention within the region that enterprises are incorporated (or registered) in (Fan et al., 2011). This allows us to investigate the effect of institutional environment on enterprise innovation behavior and its moderating effect on the relationship between bank equity connections and enterprise innovation. The results show that government intervention has a negative moderating effect, whereas the moderating effect of intellectual property protection is significantly positive. This is consistent with the above research conclusions. (5) As the socioeconomic outputs of innovation investment appear after a time lag, in a robustness test, we introduce a two-period lag R&D ($R\&D_{i,t}$) and construct the interactive items to analyze the effect of bank equity connections and intellectual property protection on innovation performance. (6) We use the chairman and general manager, to study the separation of ownership and control, as indicators to reflect the first-class principal-agent issues and the second-class principal-agent issues of the company, respectively, and find that in the subsample of private enterprises, the resource allocation function of bank equity connections may be alienated due to second-class principal-agent issues, whereas both the first-class principal-agent issues and the second-class

principal-agent issues of the company may distort the resource allocation function of bank equity connections in state-owned enterprises, especially in local state-owned enterprises. Based on the above tests, we hold that our conclusions are relatively robust.

6. Conclusions and implications

Innovation has the power to promote national economic growth. However, China's imperfect capital market and institutional arrangements severely inhibit the innovation behavior of Chinese enterprises. This study uses a sample of China's A-share manufacturing and information technology listed firms from the 2006 to 2013 period and an analytical framework that integrates new institutions' economics theory, bank equity connection theory and innovation investment theory to investigate the effect of bank equity connections and intellectual property protection on enterprises' innovative behavior and the interactive relationship between them in this process. The results indicate the following. (1) Bank equity connections can promote innovation by easing the resource constraints on innovation investment, enhancing dynamic configurations and in other ways. Therefore, compared to enterprises without significant bank ownership, enterprises with significant bank ownership invest more in innovation and achieve better innovation performance. (2) The innovation advantages of a bank equity connection have different effects on innovation in enterprises with different properties. Specifically, the facilitation effect of bank equity connections on innovation is strongest in private enterprises, moderate in central enterprises and weakest in local state-owned enterprises. This is mainly due to the diversity in the essential factors, resource endowments and corporate governance mechanisms. (3) As the most important institutional arrangement for enterprise innovation, the role of intellectual property protection in promoting innovation must not be neglected. Strengthening intellectual property rights not only helps to increase innovation and innovation input, it also significantly improves innovation performance. Of course, this result is affected by the nature of property rights; specifically, the intensity of this effect is strongest in private enterprises, moderate in local state-owned enterprises and weakest in central enterprises, mainly due to the various abilities of enterprises with different properties to safeguard their legitimate rights and interests through alternative mechanisms. (4) There is a complementary relationship between bank equity connections and intellectual property protection in stimulating innovation. Not only does the combination of factors increase the strength of the influence, when intellectual property protection is weak, the positive effect of bank equity connections on innovation obviously weakens, and innovation investment may even be squeezed out due to dissimilar functions. The above research findings not only help us to understand how bank equity connections and intellectual property protection affect enterprise innovation behavior, they also have implications for China's economic policy.

Based on these results, the Chinese government may consider the following recommendations.

(1) The government should encourage the transformation of non-financial capital into financial capital and promote and encourage qualified enterprises to purchase stakes in banks or to integrate the industry with financial institutions, to promote resource integration and to remedy market failure and the weaknesses of the system. (2) The above tests show that intellectual property protection not only has a significant incentive effect on enterprise innovation, it also offers an important system guarantee for bank equity connections. Therefore, we should pay more attention to the protection of intellectual property rights, gradually improve China's intellectual property rights legal system, especially the execution system, and establish an all-direction defense and punishment for violations. (3) The transmission mechanisms of bank equity connections and intellectual property protection are to a large extent affected by property right characteristics. The diversity in essential factors and resource endowment affects the efficiencies of bank equity connections and intellectual property protection. Furthermore, political intervention and the opportunistic behavior of senior executives in local state-owned enterprises can turn a bank equity connection into a tunneling channel. Hence, reducing government intervention, establishing a modern enterprise system, and realizing efficiency and fairness dynamic equilibrium are several important aspects in the process of economic reform. More attention should be paid to them.

Acknowledgments

We thank Professor Qi Wang from the National University of Singapore, the anonymous reviewers and the participants at the Special Issue Symposium for China Journal of Accounting Research in April 2015 for their helpful comments and suggestions. We are completely responsible for the contents of this paper.

We also appreciate the support of the National Natural Science Foundation of China (Approval Nos. 71232004, 71172082, 71302117 and 71402109) and the Humanities and Social Science Research Foundation of the Ministry of Education of China (Approval Nos. 14XJC790009).

References

Aghion, P., Bloom, N., Blundell, R., Griffith, R., Howitt, P., 2005. Competition and innovation, an inverted-U relationship. Quart. J. Econ. 120 (2), 701–728.

Aghion, P., Reenen, J.V., Zingales, L., 2013. Innovation and institutional ownership. Am. Econ. Rev. 103 (1), 277–304.

Allen, F., Qian, J., Qian, M.J., 2005. Law, finance, and economic growth in China. J. Finan. Econ. 77 (1), 57–116.

Almeida, H., Campello, M., Weisbach, M.S., 2004. The cash flow sensitivity of cash. J. Finan. 59 (4), 1777–1804.

Beck, T., Levine, R., 2002. Industry growth and capital allocation, does having a market or bank-based system matter? J. Finan. Econ. 64, 147–180.

Becker-Blease, J.R., 2011. Governance and innovation. J. Corp. Finan. 17 (4), 947–958.

Brown, J.R., Fazzari, S.M., Petersen, B., 2009. Financing innovation and growth, cash flow, external equity, and the 1990s R&D boom. J. Finan. 64 (1), 151–185.

Brown, J., Martinsson, G., Petersen, B., 2013. Laws, stock markets, and innovation. J. Finan. 68 (4), 1517–1549.

Chemmanur, T., Loutskina, E., Tian, X., 2014. Corporate venture capital, value creation, and innovation. Rev. Finan. Stud. 27 (8), 2434–2473.

Chen, D., Chen, Y.S., 2012. Bank equity connections, monetary policy changes, cash management. J. Finan. Res. 12, 122–136 (in Chinese).

Chen, Z.Y., Chen, S.X., 2014. Institutional environment, local government investment impulse and local soft budget. Econ. Res. J. 3, 76–87 (in Chinese).

Chen, Y.W., Hu, W.M., 2011. Distortions, misallocation and losses: theory and application. China Econ. Quart. 4, 1401–1422 (in Chinese).

Cornaggia, J., Mao, Y.F., Tian, X., Wolfe, B., 2015. Does banking competition affect Innovation? J. Finan. Econ. 115 (1), 189–209.

Cull, R., Li, W., Sun, B., Xu, L.C., 2015. Government connections and financial constraints, evidence from a large representative sample of Chinese firms. J. Corp. Finan. 32, 271–294.

Fan, G., Wang, X.L., Zhu, H.P., 2011. NERI INDEX of Marketization of China's Provinces 2011 Report. Economic Science Press (in Chinese).

Fang, V., Tian, X., Tice, S., 2014. Does stock liquidity enhance or impede firm innovation? J. Finan. 69 (5), 2085–2125.

Hall, B.H., Oriani, R., 2006. Does the market value R&D investment by European firms? Evidence from a panel of manufacturing firms in France, Germany, and Italy. Int. J. Ind. Organ. 24 (5), 971–993.

Haubrich, J.G., 1989. Financial intermediation: delegated monitoring and long-term relationships. J. Bank. Finan. 13 (1), 9–20.

He, J., Tian, X., 2013. The dark side of analyst coverage: the case of innovation. J. Finan. Econ. 109 (3), 856–878.

Horii, R., Iwaisako, T., 2007. Economic growth with imperfect protection of intellectual property rights. J. Econ. 90 (1), 45–85.

Hsu, P.H., Tian, X., Xu, Y., 2014. Financial development and innovation: cross-country evidence. J. Finan. Econ. 112 (1), 116–135.

Kemp, F., 2003. Applied multiple regression/correlation analysis for the behavioral sciences. J. Roy. Stat. Soc.: Ser. D (The Statistician) 52 (4), 689–705.

Khanna, T., Yafeh, Y., 2007. Business groups in emerging markets paragons or parasites. J. Econ. Lit. 45 (2), 331–372.

Leland, H.E., Pyle, D.H., 1977. Informational asymmetries financial structure and financial intermediation. J. Finan. 32 (2), 371–387.

Lerner, J., 2009. The empirical impact of intellectual property rights on innovation: puzzles and clue. Am. Econ. Rev. 99 (2), 343–348.

Li, W.A., Ma, C., 2014. The combination model of "industrial and financial" and companies investment efficiency: a research based on holding financial institutions of listing corporations in China. J. Finan. Res. 11, 109–126 (in Chinese).

Li, C.T., Song, M., 2010. Innovation activities in Chinese manufacturing firms: the roles of firm ownership and CEO incentives. Econ. Res. J. 5, 55–67 (in Chinese).

Li, Z.O., Su, X.J., Yang, Z.F., 2012. State control, access to capital and firm performance. China J. Account. Res. 5 (2), 101–125.

Lin, C., Lin, P., Song, F., 2010. Property rights protection and corporate R&D: evidence from China. J. Dev. Econ. 93 (1), 49–62.

Lin, C., Lin, P., Song, F.M., Li, C.T., 2011a. Managerial incentives, CEO characteristics and corporate innovation in China's private sect. J. Compar. Econ. 39 (2), 176–190.

Lin, C., Ma, Y., Xuan, Y.H., 2011b. Ownership structure and financial constraints: evidence from a structural estimation. J. Finan. Econ. 102 (2), 416–431.

Lin, C., Ma, Y., Malatesta, P., Xuan, Y.H., 2011c. Ownership structure and the cost of corporate borrowing. J. Finan. Econ. 100 (1), 1–23.

Liu, X., Jiang, S.Q., 2015. Bank equity connection, banking competition and financing constraints of private enterprises. Chin. J. Manage. Sci. 12, 1–10 (in Chinese).
Liu, Q.G., Tang, J.H., Tian, G.G., 2013. Does political capital create value in the IPO market? Evidence from China. J. Corp. Finan. 23, 395–413.
Long, X.N., Wang, J., 2014. Local judicial protectionism in China: an empirical study of people's supreme court IP cases. Econ. Issues China 3, 3–18 (in Chinese).
Lu, T., Dang, Y., 2014. Corporate governance and innovation: differences among industry categories. Econ. Res. J. 6, 115–128 (in Chinese).
Lu, Z.F., Zhu, J.G., Zhang, W.N., 2012. Bank discrimination, holding bank ownership, and economic consequences: evidence from China. J. Bank. Finan. 36 (2), 341–354.
Ma, G.R., Liu, M., Yang, E.Y., 2014. Bank lines of credit, credit squeeze and firm R&D. J. Finan. Res. 7, 76–93 (in Chinese).
McLean, R.D., Zhang, T.Y., Zhao, M.X., 2012. Why does the law matter? Investor protection and its effects on investment, finance, and growth. J. Finan. 67 (1), 313–350.
Moser, P., 2005. How do patent laws influence innovation? Evidence from nineteenth-century world's fairs. Am. Econ. Rev. 95 (4), 1214–1236.
Moser, P., 2012. Innovation without patents: evidence from world fairs. J. Law Econ. 55 (1), 43–74.
O'Connor, M., Rafferty, M., 2012. Corporate governance and innovation. J. Finan. Quant. Anal. 47 (2), 397–413.
Acharya, V.V., Baghai, R.P., Subramanian, K.V., 2014. Wrongful discharge laws and innovation. Rev. Finan. Stud. 27 (1), 301–346.
Peng, W.Q., Wei, K.C.J., Yang, Z.S., 2011. Tunneling or propping: evidence from connected transactions in China. J. Corp. Finan. 11 (7), 306–325.
Qian, M.J., Yeung, B.Y., 2015. Bank financing and corporate governance. J. Corp. Finan. 32, 258–270.
Rajan, R.G., Zingales, L., 2001. Financial systems, industrial structure, and growth. Oxford Rev. Econ. Policy 17 (4), 467–482.
Romer, P.M., 1986. Increasing returns and long-run growth. J. Polit. Econ. 94 (5), 1002–1037.
Rosenbaum, P.R., Rubin, D.B., 1985. Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. Am. Stat. 39 (1), 3–38.
Sapra, H., Subramanian, A., Subramanian, K.V., 2014. Corporate governance and innovation: theory and evidence. J. Finan. Quant. Anal. 49 (4), 957–1003.
Song, Z., Storesletten, K., Zilibotti, F., 2011. Growing like China. Am. Econ. Rev. 101 (1), 196–233.
Tian, L.H., 2005. State-owned property right, soft budget constraints, and debt governance of China's public listed firms. Manage. World 7, 123–128 (in Chinese).
Tian, X., Wang, T., 2014. Tolerance for failure and corporate innovation. Rev. Finan. Stud. 27 (1), 211–255.
Wang, C.L., Ahmed, P.K., 2007. Dynamic capabilities: a review and research agenda. Int. J. Manage. Rev. 9 (1), 31–51.
Wu, Y.B., Mi, Z.Y., 2011. Innovation, imitation and enterprise efficiency. Soc. Sci. China 4, 77–94 (in Chinese).
Wu, W.F., Rui, O.M., Wu, C.F., 2012. Trade credit, cash holdings and financial deepening: evidence from a transitional economy. J. Bank. Finan. 36 (11), 2868–2883.
Xiao, X.Z., Wang, Y.P., 2014. Government subsidies and enterprise decision of social capital investment – evidence from strategic emerging industries. China Ind. Econ. 9, 148–160 (in Chinese).
Xie, W.M., Fang, H.X., 2011. Financial development, financing constraints and firm R&D investment. J. Finan. Res. 5, 171–183 (in Chinese).
Xin, Q.Q., Lin, B., 2006. Debt leverage and corporate investment: a duplicate soft budget constraint perspective. J. Finan. Econ. 32 (7), 73–83 (in Chinese).
Xu, C.G., 2011. The fundamental institutions of China's reforms and development. J. Econ. Lit. 49 (4), 1076–1151.
Yi, Z.F., Ye, J.Y., Huang, Y.H., 2013. The protection of intellectual property rights and enterprise innovation: transmission mechanism and its inspection. J. World Econ. 12, 111–129 (in Chinese).
Zhai, S.B., Yi, H.Q., Zheng, J., Tang, W., Cao, X.Q., 2014. Study on the relationship between the banking connection and the investment efficiency: evidence from Chinese private listed firms. Account. Res. 4, 74–80 (in Chinese).
Zhang, J., Zhou, X.Y., Li, Y., 2011. Does factor market distortion barrage Chinese firms' R&D? Econ. Res. J. 8, 78–91.
Zhao, J., Guan, X., Gao, C., 2010. Can the social capital control chain replace the equity control chain?—The construction and use of the double control chain of the ultimate shareholders of listed companies in China. Manage. World 3, 127–139 (in Chinese).
Zhu, J.G., Lu, Z.F., 2011. Ownership type equity financing and the efficiency of resource allocation. J. Finan. Res. 1, 131–148.
Zhu, J.G., Lu, Z.F., 2012. Financing demand, ownership type, and equity financing discrimination: a research based on the issue of going public. Nankai Bus. Rev. 15 (4), 141–150 (in Chinese).

China Journal of Accounting Research 9 (2016) 235–250

HOSTED BY

ELSEVIER

Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Religion and stock price crash risk: Evidence from China

Wenfei Li, Guilong Cai *

Sun Yat-sen Business School, Sun Yat-sen University, China

ARTICLE INFO

Article history:
Received 11 September 2014
Accepted 21 April 2016
Available online 20 May 2016

Keywords:
Religious environment
Stock price crash risk
Informal institution
Corporate governance

ABSTRACT

This paper investigates whether religious traditions influence firm-specific crash risk in China. Using a sample of A-share listed firms from 2003 to 2013, we provide evidence that the more intense the religious environment, the lower the stock price crash risk, implying that religion plays an important role in Chinese corporate governance. Further, we find that (1) religion affects stock price crash risk by reducing earnings management and the management perk problem; (2) different religions have different effects, and Taoism, in particular, is unrelated to crash risk; and (3) the effects of religion are more pronounced with higher quality corporate governance and a stronger legal environment. Religion constrains the management agency problem, thus reducing stock price crash risk in China. Our paper enriches the literature on stock price crash risk and religion, and on new economic geography.

1. Introduction

The global financial crisis of 2008 stimulated scholars' interest in stock price crash risk. However, the current literature mainly focuses on the relationship between formal institutions, such as corporate governance, and stock price crash risk. Relatively few studies explore the effect of informal institutions such as religion. In China, an emerging and transitioning country, formal institutions such as investor protection systems, corporate governance and accounting standards are less developed (Allen et al., 2005), listed firms' opaqueness is high and agency problems are severe. The Chinese stock market has therefore been experiencing big bubbles and crashes (Piotroski and Wong, 2012). Unfortunately, many formal mechanisms that can effectively reduce stock price crash risk in mature capital markets fail to work in the Chinese capital market. When formal

* Corresponding author. Tel.: +86 15017566664; fax: +86 (20) 84036924.
E-mail addresses: liwenfei21@126.com (W. Li), caiglong@mail2.sysu.edu.cn (G. Cai).

http://dx.doi.org/10.1016/j.cjar.2016.04.003
1755-3091/

institutions cannot effectively reduce stock price crash risk, it is worth examining whether informal institutions can play an alternative governance role. As Wei (2002) states, it is of great practical significance to explore the moral and ethical basis of the market economy from the perspective of informal institutions.

The role of informal institutions in corporate governance in China cannot be ignored and may even play a more important role than previously thought (Chen et al., 2013). Religion, an important part of the informal institutional environment, has a long history in China and greatly influences people's behavior. When it comes to the dramatically fluctuating Chinese stock market, whether religion can reduce stock price crash risk is an open question. Callen and Fang (2015) were the first to study the effect of religion on stock price crash risk in the United States. However, the Chinese religious environment is very different from that of America. First, the religious faith of Chinese people does not necessarily identify belief, rather "belonging" (*gui shu*) and "participation" (*can yu*), unlike Western Christianity, which requires "conversion" (*gui yi*) and "commitment" (*wei sheng*) (Zhang, 2015). Second, although Western religions are strongly doctrinaire, Chinese religions are more secular. Chinese believers pay more attention to the function of the religion they participate in and the choice of religion has a certain randomness; there is not such a great distinction between different sects, such as the difference between Catholicism and other types of Christianity. Third, Christianity, including Catholicism, is a foreign religion, and Chinese believers' religious attitudes may differ from those of believers in the United States. As the differences in the religious environments of China and Western countries are great, it is meaningful to examine the influence of religion on stock price crash risk in China.

Therefore, we hand-collect details of 552 religious sites in 23 provinces and use China's A-share listed companies during 2003–2013 as our research sample. We investigate the relationship between religion and stock price crash risk, and find that religion can effectively reduce stock price crash risk even after controlling for other factors that influence the risk. In addition, we explore the following three questions: What is the channel through which religion acts on crash risk? Do different types of religions have different effects on crash risk? Is there any variation in religion's effect on crash risk at different levels of corporate governance?

The results show that (1) The mechanisms of religion's influence on stock price crash risk are through reducing earnings management and managers' perk consumption. (2) Different types of religions have different effects on stock price crash risk. Specifically, Taoism has no influence on stock price crash risk whereas Buddhism, Christianity, Catholicism and Islam have significant effects. These differences can be attributed to the unique religious environment in China and Chinese people's attitude toward religion. (3) The effect of religion on stock price crash risk depends on the institutional environment. Specifically, only when the quality of corporate governance and the legal environment is high does religion significantly influence stock price crash risk. These results show that the governance role of religion is conditional on higher quality corporate governance and a strong external legal environment.

Our study contributes to the literature in several ways. First, there has been little research examining stock price crash risk from the perspective of informal institutions; we examine the influence of religion on stock price crash risk in the Chinese capital market, thus filling that void. The current literature studies the factors affecting stock price crash risk mainly from the perspective of formal institutions (e.g., Xu et al., 2013a,b; Chen et al., forthcoming). As formal institutions are weak in China, it is not reasonable to ignore the role of informal institutions in corporate governance. Therefore, we explore whether religion can reduce stock price crash risk in China. Our results show that religion plays an important role in constraining management opportunism in China, which reduces stock price crash risk. We provide some evidence in support of Weber's (1905) contention that religion plays an important role in the development of modern secular culture in the context of stock price crash risk.

Second, we further examine the mechanisms of religion's effect on stock price crash risk, to deepen our understanding of how religion affects stock price crash risk. The closest study to ours is that of Callen and Fang (2015), who find that religion can reduce stock price crash risk; however, they do not show how religion exerts its effect. To fill this gap, we explore the mechanism of religion's influence on stock price crash risk, and find that religion reduces stock price crash risk by mitigating management agency problems.

Third, our study also contributes to the literature on religion. Most studies of religion take Christianity as their main research focus (e.g., Callen and Fang, 2015), and only a few papers examine the role of Buddhism and/or Taoism in the context of China (Chen et al., 2013; Du, 2013, 2015; Du et al., 2014). These studies do not analyze the different effects of different kinds of religion comprehensively. China's culture of

non-excludability and inclusive religious beliefs lead to the existence of multiple religions. This gives us an opportunity to study the effects of different religions. Jiang et al. (2015) compare the influence of Western and Eastern religions on risk-taking. In this paper, we first comprehensively study the effect of different types of religion on stock price crash risk. In particular, we provide evidence that foreign religions (e.g., Christianity and Catholicism) can constrain opportunistic management behavior and reduce stock price crash risk in China.

Fourth, the new economic geography literature emphasizes the importance of geography on managers' and investors' decision-making. Examples include how corporate location can affect firms' financial decision-making (Almazan et al., 2010; Arena and Michael, 2012), mergers and acquisitions (Kang and Kim, 2008; Kedia et al., 2008) and dividend policies (John et al., 2011). We find that management decision-making is more likely to be influenced in firms located in areas with higher levels of religiosity, and the crash risk of such firms is lower. Therefore, our research also enriches the literature on new economic geography with the finding that geographical location affects stock price crash risk.

The remainder of our paper is organized as follows. Section 2 introduces the institutional background of religion in China, and reviews the literature and theoretical analysis. Section 3 describes the sample, variable measurement and research design. Section 4 presents the empirical results and robustness checks. Section 5 further explores the relationship between religion and stock price crash risk and Section 6 concludes the paper.

2. Institutional background, literature and theoretical analysis

2.1. Religion in China

The proportion of the population identifying as religious adherents has reached as high as 84% worldwide by 2010, and is expected to increase in the next four decades (Pew Research Center, 2015). The role that religion plays in the social, political and economic fields is gradually being confirmed, and research on Chinese religion is just getting started (Jin and Qiu, 2008). In particular, the economic consequences of religion remain largely unexplored in the financial accounting research. In fact, religions including Buddhism, Taoism, Christianity and Islam, as well as folk religions, have a long history in China. Buddhism was introduced in the Han Dynasty over 2000 years ago, Taoism originated in China more than 1700 years ago, Islam has a history of more than 1300 years in China, and Christianity, including Catholicism, came to China in the early nineteenth century.

A paradoxical view, the so-called "Chinese religion of no importance theory" believes that China as a nation lacks religious belief, as religion does not play an important role or have an essential position in Chinese society. However, Yang (1961) notes that:

> The under-evaluation of the place of religion in Chinese society did not find much support from reality. There was not one corner in the vast land of China where one did not find temples, shrines, altars and other places of worship. The temples and shrines dotting the entire landscape were a visible indication of the strong and pervasive influence of religion in Chinese society, for they stood as symbols of a social reality.

Unlike Western institutional religion, which has a system of theology, rituals and organization of its own, independent of other secular social institutions, Chinese religions are diffused (Yang, 1961), that is, their faith, rituals and religious activities are merged with daily life and have become a part of everyday life. As a result of the combining of religious doctrine and daily life, China's diffused religion does not have a systematic scripture or well organized church institution; at its core is worship of heaven, respect of forefathers and polytheism. The weakness of formally organized religion in China does not imply the absence of an important function played by religious structural systems in Chinese society and culture (He, 2007). A Chinese person with faith in religion does not necessarily identify as being a religious adherent, but rather as a believer in Buddhism or Taoism, going into a temple "to pilgrimage," where what is required is not formal religious ceremony, but "a sincere heart that can work wonders" and "doing good deeds unto others."

Even during the ten years of the Cultural Revolution in China, when the government adopted a policy of eradicating religions, the embers of Chinese religion were never extinguished. After the Cultural Revolution,

especially since the reform and opening up in 1978, thanks to the policy of freedom of religious belief, religious activities have been restored and people's right to freedom of religious belief is respected and protected by law (Du, 2010). As a result, religion has been re-flourishing and affecting people's behavior in the following ways.

First, more and more people believe in religion. Religion is gradually being recognized as a cultural phenomenon reflecting a kind of culture or core value of civilization, rather than a symbol of ignorance or backwardness as in the past (Du, 2010). By 2012, there were over 10 million Chinese religious adherents, more than 139,000 religious activity sites, more than 360,000 religious workers, and at least 5500 religious groups in China (Li, 2013). Second, the influence of religion on entrepreneurs or managers is increasingly important. Religious belief provides people with emotional support (Idler, 1987). With globalization of economies and consequent increasing competition, entrepreneurs and managers facing a growing level of anxiety turn to religion for spiritual relaxation, comfort and peace of mind. For example, a large number of elite businesspeople have joined the Beijing International Christian Fellowship, and in Wenzhou, Zhejiang province, entrepreneurs are called "religious boss" for their faith in Christianity (Chen, 2005). Thirdly, religious activity sites have been rehabilitated. Religious temples, as scenic tourism spots in China, are often refurbished by local governments on the grounds of "protecting cultural relics and maintaining tourist attractions" (Du, 2013). In addition, adherents and entrepreneurs donate to construct or repair temples, as in the case of Wang Jianlin, the chairman of the board of Dalian Wanda Group Co., Ltd., who donated 1 billion yuan indirectly to Da Bao′en Temple through the Nanjing municipal government. The improvement of religious activity sites and their surrounding infrastructure has greatly contributed to the dissemination and development of a religious spirit in China.

2.2. Literature review and hypothesis development

Stock price crash risk arises when managers withhold bad news. When the accumulated negative information reaches a tipping point, as the Chinese proverb says, "truth will come to light sooner or later." The information will be suddenly released to the stock market and the stock price will fall sharply, i.e., a stock price crash. The lower a company's transparency, the higher the information asymmetry between managers and outside investors, so managers will be likely to hide negative information, resulting in an abrupt decline in stock price. The current literature has supported this view on the basis of agency theory. Kim et al. (2011a) provide evidence that when managers are using corporate tax avoidance as a resource transfer vehicle ("tunneling"), concealing unfavorable information and masking the firm performance excessively, the accumulated negative information will lead to a stock price crash. Also based on agency theory, Kim et al. (2011b) find that granting managers, especially the CFO, options will lead to stock price crash risk. Scholars also find that firms' real earnings management (Francis et al., 2014), manager overconfidence (Kim et al., forthcoming), perk consumption (Xu et al., 2014), political promotions (Piotroski et al., 2015) and mandatory IFRS adoption (DeFond et al., 2011) will increase stock price crash risk. However, female managers (Li and Liu, 2012), tax enforcement (Jiang, 2013), accounting conservatism (Kim and Zhang, 2016), higher corporate transparency (Hutton et al., 2009), higher quality internal controls (Ye et al., 2015; Chen et al., forthcoming), auditor industry specialization (Jiang and Yi, 2013), corporate social responsibility (Kim et al., 2014), good corporate governance (Andreou et al., forthcoming) and the proportion held by block shareholders (Wang et al., 2015) will reduce stock price crash risk. In short, managerial opportunism will enable managers to hide bad news, and when the accumulated negative information reaches a critical threshold, it will suddenly be released to the stock market all at once, leading to a crash. However, the effect of governance on stock price crash risk varies across institutional environments.

Institutional constructions are still weak in China, which is a transitional economy. External corporate governance mechanisms that can effectively reduce stock price crash risk in developed countries, such as the presence of financial analysts and institutional investors, exacerbate rather than reduce stock price crash risk in China's capital market (Xu et al., 2013a,b). When institutional mechanisms fail to reduce stock price crash risk, can religion, as one of the informal institutions, play a role in constraining management opportunism? Iannaccone (1998) points out that religion shapes personal values and beliefs, and has an important effect on people's economic behavior and decision-making. Recent studies also confirm that religion has an effect on information disclosure (Riahi-Belkaoui, 2004; Dyreng et al., 2012), a firm's risk-taking or risk

exposure (Jiang et al., 2015; Hilary and Hui, 2009), owner–manager agency costs (Du, 2013), equity pricing (EI Ghoul et al., 2012), financial reporting irregularities or earnings management (McGuire et al., 2012; Chen et al., 2013), corporate philanthropic giving (Du et al., 2014), entrepreneurship (Nunziata and Rocco, 2011; Ruan et al., 2014) and tunneling (Du, 2015). The paper most relevant to our research is Callen and Fang (2015), which reports that firms headquartered in countries with higher levels of religiosity exhibit lower levels of future stock price crash risk.

From the literature review, we can see that on the one hand, the main reason for stock price crash risk is the agency problem; the literature provides evidence mainly from the perspective of formal rather than informal institutions. On the other hand, the literature provides preliminary evidence that religion can influence the behavior of managers and investors. This paper argues that religion can alleviate principal–agent problems, thus reducing stock price crash risk.

First, religion can reduce stock price crash risk by alleviating earnings management behavior. Although different religions have different doctrines, they all emphasize moral and ethical standards, requesting honest and trustworthy behavior, upholding human needs and breaking the pursuit of secular, material and sensual pleasures. For example, as a basic moral principle, Buddhism demands "do not be evil, pursue the public good and self purification" and takes the "Five Precepts" as its basic ethical standard (Zhang, 2007). Christianity requires that Christians must "not give false testimony" (they should be honest), and must not be greedy (they should not do anything unethically for personal gain). Burckhardt (1979) points out that "religion is the most important link to maintain the human society, because only it can be qualified to act as a guardian of a particular moral state." By reducing a firm's information opacity, self-interested managers often try to manipulate the firm's stock price. People who have religious beliefs tend to hold traditional views on moral issues and have conservative moral standards (Barnett et al., 1996), and constrain their own manipulative behavior. People who have religious beliefs are often risk-averse (Miller, 2000; Diaz, 2000). Once the manipulation of bad news is discovered, managers will be exposed to the risk of litigation (McGuire et al., 2012). Therefore, to reduce the risk of being sued, religious managers will engage in less earnings manipulation, which will lead to lower stock price crash risk.

Second, religion can reduce stock price crash risk by inhibiting managers' self-interested behavior. Religious managers will reduce their desires and greed through inner practice and abstinence, thus alleviating the agency problem. Companies in China, especially state-owned enterprises, have compensation regulations. Therefore, managers generally have a strong incentive to pursue excessive perks to make up their loss in compensation. As a result, pursuing perks is a serious agency problem in Chinese companies. Xu et al. (2014) find that to get more perks, managers may conceal bad news by portraying inappropriate resource consumption as effective resource utilization, and to achieve the purpose of empire building, managers will make short-sighted over-investment disguised as valuable investment. These actions will lead to the continuous accumulation of bad news and thus ultimately to a stock price crash. Du (2013) notes that religion can reduce managers' pursuit of perks. Therefore, religion can reduce stock price crash risk by alleviating the agency problem of managers' perk consumption.

In summary, religion plays an important role in mitigating agency problems, especially in the case of weak external supervision mechanisms (McGuire et al., 2012). We therefore believe that the stronger the religious atmosphere where listed companies are located, the lower the future stock price crash risk, because agency problems are likely to be suppressed.

3. Research design

3.1. Sample selection and data sources

Our initial sample consists of all Chinese A-share listed companies from 2003 to 2013. Following previous studies, we screen the sample and exclude (1) financial firms, (2) firms with fewer than 30 trading weeks of stock return data in a fiscal year (Jin and Myers, 2006), (3) firms whose transaction status is special treatment (ST) or particular transfer (PT), and (4) observations with incomplete financial data. To mitigate the effects of outliers, we winsorize continuous variables at the 1% level in both tails. Our financial data is obtained from the

China Stock Market and Accounting Research (CSMAR) database. The study's final sample consists of 11,171 firm-year observations.

Following Chen et al. (2013), we collect data on 552 religious sites in 23 provinces in China as follows: (1) 148 provincial key temples mentioned in the *Report by the Religious Affairs Bureau under the State Council about Determining Buddhism and Taoism National Key Temples in the Han Nationality Area*; and (2) venues for religious activities that were awarded "The First National Advanced Collectives and Individuals in Establishing Harmonious Temples" by the China State Administration of Religious Affairs in 2010.[1]

3.2. Variable measurement

3.2.1. Measuring firm-specific crash risk

Following Kim et al. (2011a,b), we use two measures of stock price crash risk. We first estimate firm-specific weekly returns, denoted $W_{i,t}$, as the natural log of one plus the residual return from the expanded market model regression for each firm and year:

$$R_{i,t} = \alpha_i + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{i,t} \tag{1}$$

where $R_{i,t}$ is the return that considers the yields on cash dividend reinvestment on stock i in week t and $R_{m,t}$ is the value-weighted market return in week t. The firm-specific weekly returns for firm i in week t are measured by $W_{i,t} = Ln(1 + \varepsilon_{i,t})$, where $\varepsilon_{i,t}$ is the residual in Eq. (1).

Second, we construct the following two variables based on $W_{i,t}$:

(1) The negative coefficient of skewness, *NCSKEW*

$$NCSKEW_{i,t} = -\left[n(n-1)^{3/2}\sum W_{i,t}^3\right] \Big/ \left[(n-1)(n-2)\left(\sum W_{i,t}^2\right)^{3/2}\right] \tag{2}$$

where n is the number of trading weeks of stock i in year t. A higher value of *NCSKEW* means a higher skewness coefficient, corresponding to a greater stock crash risk.

(2) The down-to-up volatility, *DUVOL*

$$DUVOL_{i,t} = \log\left\{(n_u - 1)\sum_{down} W_{i,t}^2 \Big/ (n_d - 1)\sum_{up} W_{i,t}^2\right\} \tag{3}$$

where n_u and n_d are the number of up and down weeks in year t, respectively. A higher value of *DUVOL* indicates a more left-skewed distribution, which means a stock has a greater crash risk.

3.2.2. Measuring religion

The managers of firms registered in areas with higher levels of religiosity (i.e., a more pronounced religious atmosphere) will be more likely to participate in religious activities than managers in areas with lower levels of religiosity, and thus these managers will be more easily influenced by religion.

Following Du (2013) and Du et al. (2014), we calculate the distance between the registered address of the listed company and the site of religious activity to measure the degree to which managers are affected by religion. The detailed procedure is as follows.[2]

[1] We combine the two reports to reflect the overall effect of temples in China and to analyze whether different kinds of religion have different effects on Chinese enterprises. In addition, we follow Chen et al. (2013) and only use the 148 provincial key temples; the results are the same (untabulated).

[2] A more direct measure of the effect of religion on corporate executives is the distance between the birthplace of top executives and religious temples. However, due to issues of personal privacy, it is very difficult to acquire data about the birthplaces of the executives. Therefore, following Du (2013) and Du et al. (2014), we calculate the distance between the registered address of the listed company and the religious activities site to measure the degree to which managers are affected by religion.

First, using Google Earth, we obtain the longitude and latitude of every firm-year observation in our sample according to its registered address. Similarly, we check the geographic location of every religious activities site in our sample and obtain its longitude and latitude.

Second, we calculate the distance between each firm and the religious activities sites according to their respective longitudes and latitudes, equaling the length of the minor arc across the surface of the earth. *RELIGION* is the number of famous temples within a 200 km radius of the firm's registered address. The higher the value, the stronger the effect of managers influenced by religion. We also use the number of temples within a 100 km and a 300 km radius around the firm to proxy for religion for robust results. The formulae are as follows:

$$\cos\theta = \sin lat_r \times \sin lat_f + \cos lat_r \times \cos lat_f \times \cos(lon_r - lon_f) \tag{4}$$

$$\text{rad} = (40075.04/360) \times (180/\pi) \tag{5}$$

$$d = \text{rad} \times (\pi/2 - \arctan(\cos\theta/\sqrt{1-\cos^2\theta})) \tag{6}$$

where d is the distance between the registered address of each firm and a temple. We define the longitude and latitude of a temple (a firm) as lon_r and lat_r (lon_f and lat_f), respectively.

3.2.3. Control variables

We control for several factors shown to influence crash likelihood (Chen et al., 2001; Kim et al., 2011a,b). First, we control for the lag value of crash risk to account for the potential serial correlation of *NCSKEW* and *DUVOL*. Stocks with higher volatility are more likely to experience a crash in the future, so we control for weekly return volatility (*SIGMA*). Hutton et al. (2009) show that firms with earnings management are more prone to suffer from a future crash, so we include the absolute value of abnormal accruals (*ABACC*), measured as the previous three year's moving sum of the absolute value of discretionary accruals, where discretionary accruals are estimated by the modified Jones model. We control for the de-trended share turnover (*TURNOVER*), calculated as the average monthly share turnover in year t minus the average monthly share turnover in year $t-1$. As past returns can help to forecast crash risk, we control for past returns (*RET*) measured as the mean of firm-specific weekly returns over the fiscal year. Similarly, we control for the market-to-book ratio (*MB*) because those firms with higher *MB* are also predicted to have a higher crash risk. To control for the size effect, we include firm size (*SIZE*), calculated as the natural log of the book value of total assets. We also control for leverage (*LEV*), calculated as debt divided by total assets, and profitability measured by return on assets (*ROA*). As the quality of auditors and property rights will affect a firm's transparency, we also control for audit quality (*BIG4*) which is equal to one if the firm engages a Big4 audit firm and zero otherwise, and the ownership of the firm (*SOE*) which is equal to one if the firm is a state-owned enterprise and zero otherwise.

3.3. The empirical model

To test whether religion will reduce stock price crash risk, we design the empirical model as follows:

$$CrashRisk_{i,t} = \alpha_0 + \alpha_1 \times RELIGION_{i,t-1} + \alpha_2 \times Controls_{i,t-1} + \varepsilon_{i,t-1} \tag{7}$$

We include industry and year dummies to control for industry and year fixed effects in all regressions. We report t-values based on robust standard errors clustered by firm. A significant negative coefficient of α_1 indicates that religion can reduce stock price crash risk.

4. Empirical results

4.1. Descriptive statistics

Table 1 presents the descriptive statistics for the main variables. The mean values of $NCSKEW_t$ and $DUVOL_t$ are −0.19 and −0.18, respectively. The mean value of $NCSKEW_t$ is similar to the estimates in Chen et al. (forthcoming). The respective standard deviations of $NCSKEW_t$ and $DUVOL_t$ are 0.61 and

Table 1
Descriptive statistics.

Variable	Obs.	Mean	Std. dev.	Min.	Median	Max.
$NCSKEW_t$	11,171	−0.19	0.61	−1.84	−0.19	1.43
$DUVOL_t$	11,171	−0.18	0.45	−1.29	−0.18	0.93
$RELIGION_{t-1}100$	11,171	10.29	8.15	0.00	9.00	36.00
$RELIGION_{t-1}200$	11,171	28.04	21.58	0.00	23.00	93.00
$RELIGION_{t-1}300$	11,171	48.81	35.55	0.00	43.00	127.00
$DTURNOVER_{t-1}$	11,171	−0.01	0.33	−0.88	0.00	0.84
RET_{t-1}	11,171	−0.10	0.06	−0.30	−0.09	−0.01
$SIGMA_{t-1}$	11,171	4.27	1.38	1.63	4.17	7.85
$SIZE_{t-1}$	11,171	21.77	1.15	19.38	21.64	25.33
LEV_{t-1}	11,171	0.50	0.18	0.08	0.51	0.89
ROA_{t-1}	11,171	0.04	0.05	−0.15	0.03	0.20
MB_{t-1}	11,171	1.65	1.00	0.75	1.28	6.54
$ABACC_{t-1}$	11,171	0.05	0.04	0.01	0.04	0.28
SOE_{t-1}	11,171	0.67	0.47	0.00	1.00	1.00
$BIG4_{t-1}$	11,171	0.07	0.26	0.00	0.00	1.00

0.45, which means that the two crash risk variables have large differences in our sample. The mean value for $RELIGION_{t-1}200$ is 28.04, meaning that there are on average 28 temples within a 200 km radius of the firm's registered address.

Panel A of Table 2 shows the location distribution of religious temples and the listed companies. There are no religious temples within 100 km of 10.69% of the listed companies, and the percentage of firms with no religious sites within the radius declines gradually with distance. Panel B reports the results of the univariate tests. We distinguish between firms affected by high and low degrees of religion; a value higher than the median indicates a high degree of religious influence, and a value lower than the median indicates a low degree of religious influence. We can see that whether $NCSKEW_t$ or $DUVOL_t$ is used to measure stock price crash risk, there is a significant difference between a high and low degree of religion, implying that firms registered in areas with higher levels of religiosity are less prone to crashes, providing preliminary support for our conjecture.

4.2. The effect of religion on crash risk

Table 3 presents the results of our regression analysis of the relation between religion and future firm-specific stock price crash risk after controlling for other potential factors that influence crash risk. We can see that whether the future firm-specific crash risk is measured as $NCSKEW_t$ or $DUVOL_t$, the estimated coefficients of $RELIGION_{t-1}200$ are both significantly negative at the 1% level (t-values = −2.89 and −3.30). This finding supports our hypothesis; that is, the more religious the environment where a listed firm is located, the lower the future firm-specific crash risk, which is consistent with the view that religion can play a positive role

Table 2
Location distribution of temples and listed firms and univariate tests.

Temples within x km of the firm	100 km	%	200 km	%	300 km	%
Panel A: Location distribution of temples and listed firms						
Yes	9977	89.31	10,216	91.45	10,527	94.24
No	1194	10.69	955	8.55	644	5.76
Total	11,171	100	11,171	100	11,171	100

	Higher religious influence	Lower religious influence	Diff.	t-Value	p-Value
Panel B: Univariate tests					
$NCSKEW_t$	−0.204	−0.180	−0.025	−2.132	0.016
$DUVOL_t$	−0.188	−0.166	−0.021	−2.562	0.005

Table 3
Regression analysis on the effect of religion on crash risk.

Dependent variable	(1)	(2)
	$NCSKEW_t$	$DUVOL_t$
$RELIGION_{t-1}200$	−0.810***	−0.693***
	(−2.89)	(−3.30)
$NCSKEW_{t-1}$	0.005	
	(0.50)	
$DUVOL_{t-1}$		−0.004
		(−0.42)
$DTURNOVER_{t-1}$	0.037	0.018
	(1.54)	(1.00)
RET_{t-1}	2.445***	1.830***
	(4.66)	(4.63)
$SIGMA_{t-1}$	0.120***	0.085***
	(4.83)	(4.68)
$SIZE_{t-1}$	−0.022***	−0.016***
	(−2.92)	(−2.95)
LEV_{t-1}	0.107***	0.064**
	(2.76)	(2.23)
ROA_{t-1}	0.714***	0.485***
	(5.46)	(5.06)
MB_{t-1}	0.048***	0.030***
	(6.24)	(5.04)
$ABACC_{t-1}$	0.064	−0.008
	(0.50)	(−0.08)
$BIG4_{t-1}$	0.001	−0.002
	(0.03)	(−0.14)
SOE_{t-1}	−0.029**	−0.030***
	(−2.28)	(−3.13)
Constant	0.184	0.158
	(1.00)	(1.22)
Year	Yes	Yes
Industry	Yes	Yes
N	11,171	11,171
Adjusted R^2	0.071	0.063
F	21.17	19.71

Notes: t-values are reported in parentheses.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

in corporate governance. As China's religious policy opens up, religious activities are booming, more and more people are becoming religious adherents and the influence of religion will gradually become more important. Overall, our results offer some evidence that religion can constrain managerial opportunism, mitigate the adverse effect of a sudden release of bad news and thus reduce firm-specific crash risk.

The coefficients of the control variables are generally consistent with prior research. First, the coefficients of RET_{t-1}, $SIGMA_{t-1}$ and MB_{t-1} are significantly positive at the 1% level, which is consistent with Chen et al. (2001) and Jiang and Yi (2013). Second, the coefficients of $ABACC_{t-1}$ and $DTURNOVER_{t-1}$ are both insignificant, which is also consistent with studies of stock price crash risk based on Chinese data (e.g., Xu et al., 2012).

4.3. Robustness checks

Our result is robust to a battery of sensitivity tests as follows (untabulated).

4.3.1. Alternative proxy for religion

We calculate the number of religious activity sites within a 100 km and 300 km radius around the firm's registered address as two alternative proxies for the religious variable and then re-estimate Eq. (7). Our results still hold using these two alternative measurements. Whether the religious variable is measured as the number of temples within 100 km, 200 km or 300 km, the coefficients of $RELIGION_{t-1}$ are all significantly negative. In addition, the absolute value of the religious coefficient decreases with distance, suggesting that firms closer to religious activity sites are less prone to crashes. The results for other control variables are consistent with the previous findings.

4.3.2. The influence of analysts and institutional investors

Xu et al. (2013a,b) find that financial analysts and institutional investors can also affect firm-specific crash risk. To alleviate the effect of omitted variables, we include $ANALYST_{t-1}$ and $INSTI_{t-1}$ in the model. The results show that the coefficient of $RELIGION_{t-1}200$ is still significantly negative at the 1% level after controlling for financial analysts and institutional investors. Consistent with Xu et al. (2013a,b), $ANALYST_{t-1}$ and $INSTI_{t-1}$ are associated with positive stock price crash risk. These findings indicate that in terms of stock price crash risk, external governance mechanisms in the Chinese capital market fail to work effectively; instead, they increase the volatility of the stock market.

5. Further research

5.1. The mechanisms of religion's effect on firm-specific crash risk

According to the above theoretical analyses, religion will weaken principal–agent problems and thus reduce stock price crash risk. Specifically, religion can reduce stock price crash risk by mitigating earnings management and perk consumption. To test the pathways via which religion acts on stock price crash risk, we use the Sobel intermediary factor test method (Baron and Kenny, 1986) to analyze the intermediary effect. Taking the earnings management intermediary effect as an example, we design the following models:

$$CrashRisk_{i,t} = \alpha_0 + \alpha_1 \times RELIGION_{i,t-1} + \alpha_2 \times Controls_{i,t-1} + \varepsilon_{i,t-1} \tag{8}$$

$$EM_{i,t} = \beta_0 + \beta_1 \times RELIGION_{i,t-1} + \beta_2 \times Controls_{i,t-1} + \mu_{i,t-1} \tag{9}$$

$$CrashRisk_{i,t} = \gamma_0 + \gamma_1 \times RELIGION_{i,t-1} + \gamma_2 \times EM_{i,t} + \gamma_3 \times Controls_{i,t-1} + \delta_{i,t-1} \tag{10}$$

where α_1 in Eq. (8) is the total effect of religion on stock price crash risk, β_1 in Eq. (9) is the effect of religion on earnings management, and γ_2 in Eq. (10) is the effect of the intermediate variables of earnings management on stock price crash risk. The mediation effect of earnings management is an indirect effect, that is, the product of β_1 and γ_2. The relationship between them is the total effect = direct effect + mediator effect, that is, $\alpha_1 = \gamma_1 + \beta_1\gamma_2$. One of the key steps in testing the mediating effect is to test the null hypothesis $\beta_1 \times \gamma_2 = 0$. The Sobel test is the most well-known method (Sobel, 1982). The test statistic $Z = \beta_1\gamma_2/s_{\beta_1\gamma_2}$, where $s_{\beta_1\gamma_2} = \sqrt{\beta_1^2 s_{\gamma_2}^2 + \gamma_2^2 s_{\beta_1}^2}$ is the standard error of $\beta_1\gamma_2$, and s_{β_1} and s_{γ_2} are the standard errors of β_1 and γ_2, respectively. If the null hypothesis is rejected, then there is an intermediary effect.

Table 4 presents the intermediary effects of regression testing. Panel A shows the results for whether religion reduces firm-specific crash risk by reducing earnings management. We use discretionary accruals to measure earnings management. In Column (1), the coefficient of $RELIGION_{t-1}$ is −0.755, and significant at 1% level, which is consistent with previous findings suggesting that religion reduces stock price crash risk. In Column (2), the coefficient of $RELIGION_{t-1}$ is also significantly negative, indicating that religion can reduce the earnings management problem, consistent with Chen et al. (2013). When we add the intermediary factor EM_t into model (1), the absolute value of the coefficient decreases from 0.755 to 0.733, and is still significantly negative at the 1% level. The Sobel Z value is −1.89, which is significant at the 10% level, suggesting that there is a

Table 4
Mechanisms of religion's influence on crash risk.

	(1) $NCSKEW_t$	(2) $EM_t/PERK_t$	(3) $NCSKEW_t$		(4) $DUVOL_t$	(5) $EM_t/PERK_t$	(6) $DUVOL_t$
Panel A: Earnings management channel							
$RELIGION_{t-1}200$	−0.755***	−0.076**	−0.733***	$RELIGION_{t-1}200$	−0.663***	−0.076**	−0.651***
	(−2.70)	(−2.24)	(−2.63)		(−3.16)	(−2.24)	(−3.12)
EM_t			0.317***	EM_t			0.164**
			(3.50)				(2.41)
Controls	Yes	Yes	Yes	Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes	Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Industry	Yes	Yes	Yes
N	11,032	11,032	11,032	N	11,032	11,032	11,032
Adj-R^2	0.074	0.074	0.075	Adj-R^2	0.067	0.074	0.067
F	21.94	15.51	22.01	F	20.55	15.51	20.4
Sobel Z (p-value)			−1.89 (0.0588)	Sobel Z (p-value)			−1.64 (0.1009)
Panel B: Perk consumption channel							
$RELIGION_{t-1}200$	−0.749***	−0.298***	−0.650**	$RELIGION_{t-1}200$	−0.662***	−0.298***	−0.595***
	(−2.68)	(−4.13)	(−2.34)		(−3.17)	(−4.13)	(−2.86)
$PERK_t$			0.354***	$PERK_t$			0.250***
			(5.48)				(5.57)
Controls	Yes	Yes	Yes	Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes	Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Industry	Yes	Yes	Yes
N	11,032	11,027	11,027	N	11,032	11,027	11,027
Adj-R^2	0.074	0.201	0.076	Adj-R^2	0.067	0.201	0.069
F	21.46	19.78	22.07	F	20.08	19.78	20.93
Sobel Z (p-value)			−3.30 (0.0009)	Sobel Z (p-value)			−3.32 (0.0009)

Notes: t-values are reported in parentheses.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

partial mediation effect of earnings management. The ratio of the indirect effect to the direct effect is 3.28%.[3] Overall, Columns (1)–(3) show that religion does reduce firm-specific crash risk by reducing earnings management.

Panel B of Table 4 shows whether religion reduces stock price crash risk by means of moderating the problem of perk consumption. We use management fees to measure managers' perk consumption (Ang et al., 2000).[4] In Column (2), the coefficient of $RELIGION_{t-1}$ is significantly negative at the 1% level, indicating that religion can reduce managers' perk consumption significantly, which is consistent with Du (2013). In Column (1), the coefficient of $RELIGION_{t-1}$ is significantly negative at the 1% level. However, when we add the intermediary factor of $PERK_t$ into model (1), the absolute value of the coefficient of $RELIGION_{t-1}$ decreases from 0.749 to 0.650, and both are significantly negative at the 5% level. The Sobel Z value is −3.30 and significant at the 1% level, showing that there is a partial mediation effect of perk consumption. The ratio of the indirect effect to the direct effect is 15.01%.

The results in Table 4 show that religion reduces firm-specific crash risk by reducing agency problems such as earnings management and perk consumption.

[3] The indirect effect of earnings management is −0.024 (−0.076 × 0.317), whereas the direct effect is −0.733, so the value of the indirect effect accounted for by the direct effect is 3.28%.
[4] We also use sales management expense ratio to measure perk consumption; the result is consistent.

5.2. The effect of different types of religion on crash risk

Previous studies on the economic consequences of religion have only rarely examined the effect of different types of religion, thus failing to fully reflect the effect of different religions. Fortunately, the uniqueness of China's religious policy and environment give us the opportunity to study the role different religions played in corporate governance.

In America, Christianity is dominant, whereas China is a country of religious diversity, with the five major religions being Buddhism, Taoism, Catholicism, Christianity and Islam. To further study the different effects of different kinds of religions on corporate governance in China we divide the sample into five subsamples—Buddhism, Taoism, Catholicism, Christianity and Islam—and then regress them respectively. Table 5 reports the effects of these different religions on crash risk. We can see that the coefficients of the religion variable are all significantly negative except for that of Taoism, which implies that Buddhism, Catholicism, Christianity and Islam reduce firm-specific crash risk whereas Taoism does not. Our findings are consistent with Du (2013), who compares the influence of Buddhism and Taoism on agency costs and finds that only Buddhism can significantly reduce a company's agency costs. We can also see that foreign religions such as Christianity can significantly reduce stock price crash risk. Callen and Fang (2015) find that Christianity can significantly reduce stock price crash risk in the United States. Columns (3) and (8) of Table 5 are consistent with the result of Callen and Fang (2015). The results show that the dissemination of Christianity into China can effectively restrain managers' hiding of negative news, as well as reducing firm-specific crash risk. Prior to research studying Western religions finds that the governance role that religion plays comes predominantly from Protestantism rather than from Catholicism (EI Ghoul et al., 2012). Our results show that both Catholicism and Christianity can play a significant role in corporate governance to reduce stock price crash risk. This is mainly due to the unique Chinese religious environment and the differences between American and Chinese attitudes to religion. In China, religious adherents do not strictly distinguish between religious sects, instead, they pay more attention to the function of religion, and are even blind to worship and faith in god (Liang, 2002). Therefore, foreign religions, whether Protestant Christianity or Catholicism, can both have a governing effect on the managers of listed companies in China.

Table 5
Influence of different types of religion on crash risk.

Dependent variable	(1) $NCSKEW_t$	(2)	(3)	(4)	(5)	(6) $DUVOL_t$	(7)	(8)	(9)	(10)
	Buddhism	Taoism	Christianity	Catholicism	Islam	Buddhism	Taoism	Christianity	Catholicism	Islam
$RELIGION_{t-1}200$	−1.136**					−1.109***				
	(−2.50)					(−3.26)				
$RELIGION_{t-1}200$		−3.668					−3.125			
		(−1.25)					(−1.42)			
$RELIGION_{t-1}200$			−3.326**					−2.448**		
			(−2.53)					(−2.47)		
$RELIGION_{t-1}200$				−7.836**					−7.602***	
				(−2.53)					(−3.34)	
$RELIGION_{t-1}200$					−4.654**					−2.843*
					(−2.39)					(−1.90)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	11,032	11,032	11,032	11,032	11,032	11,032	11,032	11,032	11,032	11,032
Adjusted R^2	0.074	0.074	0.074	0.074	0.074	0.067	0.066	0.066	0.067	0.066
F	21.46	21.06	21.35	21.37	21.20	20.09	19.73	19.99	20.11	19.76

Notes: t-values are reported in parentheses.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

5.3. The effect of religion on crash risk in different governance environments: supplementary or substitution?

There is a debate over whether the effect of formal and informal institutions on managers' behavior is supplementary or one of substitution. On the one hand, from the perspective of corporate governance, if the quality of corporate governance is low, managerial opportunism may be extreme. It is doubtful that religion can constrain managers to hide bad news in companies with lower-quality governance. However, Callen and Fang (2015) find that the negative relationship between religion and future crash risk is stronger for firms with weaker corporate governance in the United States, which implies that there is a substitutable relationship between religion and corporate governance working on firm-specific crash risk. On the other hand, from the perspective of external governance mechanisms, because religion is part of the social rather than the legal culture, whether people abide by religious doctrines depends on their moral self-discipline rather than the law. There is theoretically a supplementary or substitutional relationship between religion and institutional governance mechanisms. Based on China's institutional background, Chen et al. (2013) point out that religion influences actors' utility functions and risk attitudes, and people are willing to pay a higher cost to achieve a higher standard. Therefore, they argue that the relationship between religion and corporate governance is more complementary than substitutional, and their empirical results support this idea.

To comprehensively reflect the relationship between religion and governance mechanisms in terms of crash risk, we analyze the two aspects of internal governance and external governance. However, there may be an endogeneity problem because religion can also affect corporate governance (Chen et al., 2013). To avoid this problem, we do not use conventional variables to measure corporate governance.[5]

The Chinese government mandated IFRS adoption in 2007; the non-tradable shares reform ended in the same year and the "New Company Law" had been in force for one year. As a result, the quality of Chinese listed firms' corporate governance has greatly increased since 2007. Therefore, we use the external shock in 2007 to separate the subsample of high-quality corporate governance (after 2007) from the subsample of low quality governance (before 2007). The advantage of using this measure is that the change of corporate governance is an exogenous shock, and therefore not influenced by religion. Following Chen et al. (2013), we use the legal environment where the firm is located to measure the quality of external governance.[6]

Table 6 presents the results of the cross-sectional analyses. Column (2) in Panel A and Column (8) in Panel B show that in the high-quality corporate governance group, the coefficients of religion are significantly negative at the 1% level, but in the low-quality corporate governance group (Column (1) in Panel A and Column (7) in Panel B), the coefficients of religion are insignificant. These results suggest that in China, there is a complementary relationship between religion and internal governance, which is inconsistent with the finding reported in Callen and Fang (2015). The reason may be that the overall corporate governance level is higher in America and the quality of internal corporate governance is relatively low in China. In this case, it is difficult for religion to play a governance role. In terms of external governance, Column (4) in Panel A and Column (10) in Panel B show that in the strong legal environment group, the coefficients of religion are significantly negative at the 5% level ($NCSKEW_t$) or 1% level ($DUVOL_t$), but in the weak legal environment group, the coefficients of religion are insignificant (Column (3) in Panel A and Column (9) in Panel B). The results suggest that the relationship between religion and external governance is supplementary, which is also consistent with Chen et al. (2013).

Whether religion can effectively reduce firm-specific crash risk depends on the quality of the governance environment. Specifically, religion can effectively play a governance role only in firms with high-quality internal governance in a strong legal environment. These results imply that religion cannot completely replace internal governance and a strong legal system; when internal corporate governance and the legal environment are of high enough quality, they create a situation in which religion can exert an effect.

[5] We also use traditional corporate governance variables such as the duality of the CEO and chairman of the board (Kim et al., 2014) and separation of ownership and control to measure corporate governance; the results are consistent.

[6] Variables are defined as follows: we use the mean of Fang Gang index in provinces to measure the development of the legal environment from 2001 to 2009. When the provincial legal development level is higher than the median, then $LAW = 1$, otherwise $LAW = 0$. LAW equal to 1 indicates that the company's external governance is better.

Table 6
Cross-sectional analyses of governance environments.

	(1) Year ⩽ 2007	(2) Year > 2007	(3) $LAW = 0$	(4) $LAW = 1$
Panel A: Dependent variable = $NCSKEW_t$				
$RELIGION_{t-1}200$	−0.609	−0.883***	−0.009	−0.749**
	(−1.16)	(−2.71)	(−0.01)	(−2.34)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	3642	7390	2522	8510
Adjusted R^2	0.015	0.075	0.064	0.075
Panel B: Dependent variable = $DUVOL_t$				
	(7) Year ⩽ 2007	(8) Year > 2007	(9) $LAW = 0$	(10) $LAW = 1$
$RELIGION_{t-1}200$	−0.627	−0.752***	0.311	−0.655***
	(−1.64)	(−3.12)	(0.48)	(−2.74)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	3642	7390	2522	8510
Adjusted R^2	0.013	0.064	0.053	0.069

Notes: t-values are reported in parentheses.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

6. Conclusion

The past decade has seen increasing attention given to stock price crash risk around the world, because such crashes can be highly detrimental to a country's economy and the capital market. However, the current literature on crash risk mainly considers formal institutions such as corporate governance, and few studies have examined whether informal institutions can influence firm-specific crash risk. In this paper, we investigate the relationship between religion and stock price crash risk in terms of an informal institution, which enriches the literature on stock price crash risk and religion, and also contributes to the field of new economic geography.

Our results show that firms in a more religious environment have lower firm-specific crash risk in China. We also find the following:

(1) Earnings management and perk consumption have partial intermediary effects on religion and stock price crash risk. Religion's effects on crash risk are enacted through the channel of reducing the agency problems of earnings management and managers' perk consumption.
(2) Different types of religions have different effects on crash risk in China. In particular, Taoism has no association with crash risk whereas the foreign religions of Catholicism and Christianity both significantly reduce stock price crash risk.
(3) The effect of religion on stock crash risk depends on the quality of the governance environment. Specifically, the negative relationship between religion and crash risk is more pronounced when the quality of corporate governance and the legal environment is higher, suggesting that there is a complementary relationship between religion and formal governance mechanisms.

In summary, to the best of our knowledge, this study is the first to demonstrate that religion plays a governance role in relieving management opportunism problems and thus reducing firm-specific crash risk

in the transformation of socialist China. Our findings have implications for how to recognize and effectively improve the positive role of religion in corporate governance in weak governance environments. It is of vital importance to note that religion can work well only when the quality of corporate governance and the legal environment are improved.

Acknowledgments

The authors thank the executive editor and anonymous referees for their helpful suggestions. This study was supported by the National Natural Science Foundation of China (Project Nos. 71372151; 71502040; 7157020419; 71332004).

References

Andreou, P.C., Antoniou, C., Horton, J., Louca, C., 2016. Corporate governance and firm-specific stock price crashes. Eur. Financ. Manage. (forthcoming).
Ang, J.S., Cole, R.A., Lin, J.W., 2000. Agency cost and ownership structure. J. Finance 55 (1), 81–106.
Allen, F., Qian, J., Qian, M., 2005. Law, finance and economic growth in China. J. Financ. Econ. 77 (1), 57–116.
Almazan, A., Motta, A.D., Titman, S., Uysal, V., 2010. Financial structure, acquisition opportunities and firm locations. J. Finance 65 (2), 529–563.
Arena, M.P., Michael, D., 2012. Firm location and corporate debt. J. Bank. Finance 36 (4), 1079–1092.
Barnett, T., Bass, K., Brown, G., 1996. Religiosity, ethical ideology and intentions to report a peer's wrong doing. J. Bus. Ethics 15 (11), 1161–1175.
Baron, R.M., Kenny, D.A., 1986. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J. Pers. Soc. Psychol. 51, 1173–1182.
Burckhardt, J., 1979. Reflections on History. Liberty Classics, Indianapolis.
Callen, J.L., Fang, X., 2015. Religion and stock price crash risk. J. Financ. Quant. Anal. 50 (1/2), 169–195.
Chen, C., 2005. Christianity in China during the Transition Period: A Case Study of Christianity in Zhejiang. Oriental Press, Beijing (in Chinese).
Chen, D., Hu, X., Liang, S., Xin, F., 2013. Religious tradition and corporate governance. Econ. Res. J. 9, 71–84 (in Chinese).
Chen, J., Chan, K.C., Dong, W., Zhang, F., 2016. Internal control and stock price crash risk: evidence from China. Eur. Acc. Rev. (forthcoming).
Chen, J., Hong, H., Stein, J.C., 2001. Forecasting crashes: trading volume, past returns, and conditional skewness in stock prices. J. Financ. Econ. 61 (3), 345–381.
DeFond, M., Hu, X., Hung, M., Li, S., 2011. The impact of mandatory IFRS adoption on foreign mutual fund ownership: the role of comparability. J. Acc. Econ. 51 (3), 240–258.
Diaz, J., 2000. Religion and gambling in sin-city: a statistical analysis of the relationship between religion and gambling patterns in Las Vegas residents. Soc. Sci. J. 37, 453–458.
Du, X., 2013. Does religion matter to owner–manager agency costs? Evidence from China. J. Bus. Ethics 118 (2), 319–347.
Du, X., 2015. Does Confucianism reduce minority shareholder expropriation? Evidence from China. J. Bus. Ethics 132 (4), 661–716.
Du, X., Jian, W., Du, Y.J., Feng, W., Zeng, Q., 2014. Religion, the nature of ultimate owner, and corporate philanthropic giving: evidence from China. J. Bus. Ethics 123 (2), 235–256.
Du, Y., 2010. Current situation and development trend of religions in contemporary China. J. Central Inst. Social. 5, 77–88 (in Chinese).
Dyreng, S., Mayew, W., Williams, C., 2012. Religious social norms and corporate financial reporting. J. Bus. Financ. Acc. 39, 845–875.
El Ghoul, S., Guedhami, O., Ni, Y., Pittman, J., Saadi, S., 2012. Does religion matter to equity pricing? J. Bus. Ethics 111 (4), 491–518.
Francis, B., Hasan, I., Li, L.X., 2014. Abnormal real operations, real earnings management, and subsequent crashes in stock prices. Rev. Quant. Financ. Acc. 46 (2), 217–260.
He, Y., 2007. Cultural Studies on Contemporary Chinese Religion. Northeast Normal University. Doctoral thesis (in Chinese).
Hilary, G., Hui, K.W., 2009. Does religion matter in corporate decision making in America? J. Financ. Econ. 93 (3), 455–473.
Hutton, A.P., Marcus, A.J., Tehranian, H., 2009. Opaque financial reports, R2, and crash risk. J. Financ. Econ. 94 (1), 67–86.
Iannaccone, L.R., 1998. Introduction to the economics of religion. J. Econ. Lit. 36 (3), 1465–1495.
Idler, E., 1987. Religious involvement and the health of the elderly: some hypotheses and an initial test. Soc. Forces 66 (1), 226–238.
Jiang, F., Jiang, Z., Kim, K.A., Zhang, M., 2015. Family-firm risk-taking: does religion matter? J. Corp. Financ. 33, 260–278.
Jiang, X., 2013. Tax enforcement, tax aggressiveness and stock price crash risk. Nankai Bus. Rev. 5, 152–160 (in Chinese).
Jiang, X., Yi, Z., 2013. Auditor industry specialization and stock price crash risk. China Acc. Rev. 11 (2), 133–150 (in Chinese).
Jin, L., Myers, S., 2006. R2 around the world: new theory and new tests. J. Financ. Econ. 79 (2), 257–292.
Jin, Z., Qiu, Y., 2008. Chinese Religious Report. Social Science Literature Press, Beijing (in Chinese).
John, K., Knyazeva, A., Knyazeva, D., 2011. Does geography matter? Firm location and corporate payout policy. J. Financ. Econ. 101 (3), 533–551.
Kang, J.K., Kim, J.M., 2008. The geography of block acquisitions. J. Finance 63 (6), 2817–2858.

Kedia, S., Panchapagesan, V., Uysal, V., 2008. Geography and acquirer returns. J. Financ. Intermed. 17 (2), 256–275.
Kim, J.B., Li, Y., Zhang, L., 2011a. Corporate tax avoidance and stock price crash risk: firm-level analysis. J. Financ. Econ. 100 (3), 639–662.
Kim, J.B., Li, Y., Zhang, L., 2011b. CEO versus CFO: equity incentives and crashes. J. Financ. Econ. 101 (3), 713–730.
Kim, J.B., Wang, Z., Zhang, L., 2016. CEO overconfidence and stock price crash risk. Contemp. Acc. Res. (forthcoming).
Kim, J.B., Zhang, L., 2016. Accounting conservatism and stock price crash risk: firm-level evidence. Contemp. Acc. Res. 33 (1), 412–441.
Kim, Y., Li, H., Li, S., 2014. Corporate social responsibility and stock price crash risk. J. Bank. Finance 43, 1–13.
Li, F., 2013. A preliminary study on the trust of religious organizations based on data from Shanghai. Chin. J. Sociol. 33 (2), 85–110 (in Chinese).
Li, X., Liu, H., 2012. CEO vs CFO: gender and stock price crash risk. J. World Econ. 12, 102–129 (in Chinese).
Liang, L., 2002. The religious view of Chinese traditional society and religious faith. Acad. J. Zhongzhou 6, 104–108 (in Chinese).
McGuire, S.T., Omer, T.C., Sharp, N.Y., 2012. The impact of religion on financial reporting irregularities. Acc. Rev. 87 (2), 645–673.
Miller, A.S., 2000. Going to hell in Asia: the relationship between risk and religion in a cross culture setting. Rev. Relig. Res. 42 (1), 5–18.
Nunziata, L., Rocco, L., 2011. The Implications of Cultural Background on Labor Market Choices: The Case of Religion and Entrepreneurship. IZA Working Paper.
Pew Research Center, 2015. The Future of World Religions: Population Growth Projections, 2010–2050, 2th April. <http://www.pewforum.org/2015/04/02/religious-projections-2010-2050/>.
Piotroski, J.D., Wong, T.J., 2012. Institutions and information environment of Chinese listed firms. In: Capitalizing China. University of Chicago Press, Chicago, pp. 242–246.
Piotroski, J.D., Wong, T.J., Zhang, T., 2015. Political incentives to suppress negative information: evidence from Chinese listed firms. J. Acc. Res. 53 (2), 405–409.
Riahi-Belkaoui, A., 2004. Law, religiosity and earnings opacity internationally. J. Acc. Audit. Perform. Eval. 1 (4), 493–502.
Ruan, R., Zheng, F., Liu, L., 2014. The power of religious believing: does religion influence entrepreneurship? Econ. Res. J. 3, 171–184 (in Chinese).
Sobel, M.E., 1982. Asymptotic confidence intervals for indirect effects in structural equation models. Sociol. Methodol. 13, 290–312.
Wang, H., Cao, F., Ye, K.T., 2015. Monitoring or tunneling? The proportion of the proportion held by the big shareholders and the risk of the crash of the stock price. Manage. World 2, 45–57 (in Chinese).
Weber, M., 1905. The Protestant Ethic and the Spirit of Capitalism. Allen and Unwin, London.
Wei, S., 2002. Economics and Ethics: Exploring the Ethical Dimensions of Market Economy and the Moral Foundation. Shanghai People's Press, Shanghai (in Chinese).
Xu, N., Jiang, X., Chan, K.C., Yi, Z., 2013a. Analyst coverage, optimism, and stock price crash risk: evidence from China. Pac.-Basin Finance J. 25 (11), 217–239.
Xu, N., Jiang, X., Yi, Z., Xu, X., 2012. Conflicts of interest, analyst optimism and stock price crash risk. Econ. Res. J. 7, 127–140 (in Chinese).
Xu, N., Li, X., Yuan, Q., Chan, K.C., 2014. Excess perks and stock price crash risk: evidence from China. J. Corp. Finance 25 (4), 419–434.
Xu, N., Yu, S., Yi, Z., 2013b. Herding behavior of institutional investors and stock price crash risk. Manage. World 7, 31–43 (in Chinese).
Yang, C.K., 1961. Religion in Chinese Society: A Study of Contemporary Social Functions of Religion and Some of their Historical Factors. University of California Press, Berkeley and Los Angeles.
Ye, K., Cao, F., Wang, H., 2015. Can internal control information disclosure reduce stock price crash risk. J. Financ. Res. 2, 192–206 (in Chinese).
Zhang, L., 2015. Three characteristics of Chinese religious tradition. China Relig. 4, 60–61.
Zhang, Z., 2007. The positive role of religious ethics for building a harmonious society. Theor. Explor. 4, 32–34 (in Chinese).