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ScienceDirect

ISSN 1755-3091

CYAN MAGENTA YELLOW BLACK

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

ISSN 1755-3091

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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

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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.

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CHINA JOURNAL OF ACCOUNTING RESEARCH

Volume 10/2 (2017)

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Banking deregulation and corporate tax avoidance

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ARTICLE INFO

Article history:
Received 1 March 2016
Accepted 27 September 2016
Available online 24 November 2016

Keywords:
Tax avoidance
Interstate banking deregulation
External financing

ABSTRACT

We investigate whether tax avoidance substitutes for external financing. We exploit interstate banking deregulation as a quasi-external shock to examine whether firms engage in less tax avoidance after banking deregulation, because of cheaper and easier access to credit from banks. We find no empirical evidence to support this substitutive relation, even for firms with higher financial constraints or firms with higher external financing dependence.
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1. Introduction

This study examines the substitutive relation between corporate tax avoidance and firms' use of debt. Corporate tax avoidance activities can increase a firm's tax savings, and consequently decrease its reliance on external funding such as debt. The substitution between debt tax shields and non-debt tax shields is modeled theoretically (DeAngelo and Masulis, 1980). However, empirical evidence on this issue is very mixed. Using a sample of 44 tax shelter firms, Graham and Tucker (2006) find empirical evidence that is consistent with the substitutive relation between these two. However, Edwards et al. (2013) find that only firms facing financial constraints exhibit a higher level of tax avoidance. Further, Bradley et al. (1984) find that non-debt tax shields and leverage are positively related, casting doubt on the existence of a significant avoidance-debt-substitution effect.

A major challenge in determining the empirical relation between tax avoidance and the use of debt is that both are endogenous in nature (Graham and Tucker, 2006). We alleviate this concern by exploiting the staggered interstate banking deregulation events in the United States. The Interstate Banking and Branching Efficiency Act (IBBEA) was passed in 1994 and became effective as of 1 June 1997. As described by Rice and Strahan (2010), during this period, states were allowed to erect up to four barriers to protect their local bank-

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http://dx.doi.org/10.1016/j.cjar.2016.09.004
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ing industry from out-of-state competition. Prior studies find that in states where the restrictions are relaxed, because of increased banking competition, firms have cheaper bank loans and easier access to credit (e.g., Rice and Strahan, 2010; Amore et al., 2013).[1] Therefore, interstate bank deregulation provides an ideal quasi-experiment to examine the substitutive relation between the use of credit and corporate tax avoidance.

Following Rice and Strahan (2010) and Cornaggia et al. (2015), we use *RSindex* to capture the degree of deregulation in different states and at different times. *RSindex* ranges from 0 to 4, indicating how many barriers the state erected after interstate banking deregulation. Firms in states that are open to competition (e.g., *RSindex* value is 0) have easier and cheaper access to bank loans than firms in less open states (e.g., *RSindex* value is 4).

We construct tests using staggered interstate banking deregulation events as exogenous shocks to the credit supply and the cost of bank loans. If the substitutive relation between cash savings from tax avoidance and external financing holds, we expect to observe a decrease in firms' tax avoidance practices after interstate deregulation when they have easier and cheaper access to external financing (i.e., bank loans). Therefore, we expect *RSindex* to be positively associated with tax avoidance.

Given that we are interested in broad tax avoidance strategies that could reduce the firm's explicit taxes, following Dyreng et al. (2010), Hope et al. (2013) and Hasan et al. (2014), among others, we use the effective tax rate (*GAAP ETR*), cash effective tax rate (*Cash ETR*), discretionary book-tax difference (*Discretionary BT*, as in Desai and Dharmapala (2006)) and discretionary permanent book-tax difference (*DTAX*, as in Frank et al. (2009)), as our measures of tax avoidance.

In our baseline model, we collect all available observations around interstate deregulation events (pooled sample) and control for standard determinants of tax avoidance. We find that the coefficients on *RSindex* are not statistically significant for all four measures of tax avoidance. Therefore, our results do not provide supportive evidence for the substitutive relation between tax avoidance practices and external financing. We further constrain our sample to different event windows and find similar results.

According to Edwards et al. (2013), firms with higher financial constraints are more likely to exploit cash savings from tax avoidance practices. To examine whether the substitutive relation holds for firms with higher financial constraints, we divide our sample into two subgroups based on firms' financial constraint levels and perform the baseline model using these subsamples.[2] We find that interstate banking deregulation has no significant effect on corporate tax avoidance even for firms that are facing higher financial constraints.

We further examine whether the extent to which companies depend on external finance affects the substitutive relation between tax avoidance and external financing. We assume that firms with higher dependence on external finance are more likely to be affected by interstate banking deregulation. The easier access to and lower cost of bank loans should make it easier for firms to access external funding, especially firms that are highly dependent on external financing. We perform subsample tests based on the measure of firms' external finance dependence developed by Duchin et al. (2010). We find that the coefficients on *RSindex* are not statistically significant, even for firms with higher dependence on external financing. In summary, we fail to find that interstate banking deregulation has a significant effect on firms' tax avoidance behavior, even when firms are facing financial constraints or highly dependent on external financing.

This study contributes to a growing stream of literature that examines the determinants of tax avoidance. Previous studies find very mixed results with regard to the relation between the use of debt and corporate tax avoidance. In our paper, we use banking deregulation as a natural experiment to better identify the effect of external financing shocks on tax avoidance behavior. Our empirical evidence fails to find a significant substitutive relation between tax avoidance and the use of debt, even for firms with financial constraints. Our paper sheds light on the debate in this research field. Our paper also contributes to the banking literature that examines the real effects of banking deregulation on corporate decision-making.

[1] Using DealScan dataset, we examine how interstate banking deregulation affects the costs and amounts of bank loans for US public firms. We find that bank loan spreads are significantly reduced and bank loan amounts are significantly increased after banking deregulation.

[2] We also perform an interaction model, interacting *RSindex* with the dummy variable *high_KZ* score. The results are consistent with the subsample regressions.

The rest of the paper proceeds as follows. Section 2 develops the hypothesis on the substitutive relation between cash savings from tax avoidance and external finance. Section 3 describes the sample. Section 4 presents the empirical results. Section 5 provides the subsample analyses and Section 6 explores the effect of intrastate deregulation. Section 7 concludes.

2. Hypothesis development

Numerous studies focus on the effects of firm-level characteristics on tax avoidance (e.g., Chen and Chu, 2005; Desai and Dharmapala, 2006; Wilson, 2009; Armstrong et al., 2012; Hoi et al., 2013). However, many research questions remain unanswered. Maydew (2001) and Hanlon and Heitzman (2010) suggest that the theoretical and empirical tax research from the accounting, finance and economics fields should be integrated to provide a more in-depth perspective on this issue. In this paper, we examine whether cash savings from tax avoidance can be substituted for the use of debt.

Prior tax avoidance studies suggest that tax planning is not free. In fact, it can be very costly to build up complex tax avoidance strategies (Desai and Dharmapala, 2006). Similar to raising funds from external sources, managers need to exploit unused tax strategies and consider the potential cost of cash savings from tax planning. According to Edwards et al. (2013), the implicit discount rate of funds is determined by (1) the amount of cash saved from tax planning, (2) the expected timing of eventual repayment (if at all), (3) potential penalties if caught by the tax authorities and (4) the cost of designing and implementing additional tax strategies. Not all of these costs apply to every tax strategy. For example, deferral strategies are similar to an interest-free loan obtained from the government, but firms eventually need to repay them. When firms use permanent tax avoidance strategies, they may avoid paying back the taxes if they are not sued by the tax authorities, but otherwise they will pay high penalties and interest on the tax owed to the tax authorities.[3]

DeAngelo and Masulis (1980) theoretically model the substitution between debt tax shields and non-debt tax shields. They argue that tax deductions from tax avoidance (e.g., tax sheltering) are non-debt tax shields, and non-debt tax shields can be substituted for tax deductions from debt interest. DeAngelo and Masulis (1980) show that a firm has an optimal amount of total tax deductions. If a firm uses more non-debt tax shields, it will use fewer debt tax deductions. Graham and Tucker (2006) empirically test DeAngelo and Masulis's (1980) theory. Using a sample of 44 tax shelter firms, Graham and Tucker (2006) find evidence to support the substitutive relation between tax avoidance and the use of debt. However, other studies using larger samples find very mixed results. For example, Edwards et al. (2013) find that the substitutive relation only exists for firms facing financial constraints. Bradley et al. (1984) find the totally opposite result that non-debt tax shields and leverage are positively related.

Extant studies have examined the real effects of banking deregulation. Jayaratne and Strahan (1996) suggest that bank deregulation significantly increases the rates of real per capita growth in income and output. Black and Strahan (2002) find that deregulation spurs entrepreneurship and helps small business and new business flourish. Morgan et al. (2004) find that the state-level business cycle is generally less volatile after the interstate banking regulation and the associated financial integration. A more related study by Rice and Strahan (2010) finds that after interstate banking deregulation, small firms have a lower cost of debt and easier access to bank loans in states that are more open to branching. Amore et al. (2013) find that interstate bank deregulation is associated with an 8% increase in the total net loan supply. Recent studies use bank deregulation as an exogenous shock to the credit supply and examine how it affects corporate decisions and outcomes (e.g., Rice and Strahan, 2010; Amore et al., 2013; Francis et al., 2014; Cornaggia et al., 2015). Based on these studies, we examine whether states' openness to branching directly affects firms' tax avoidance behavior. The openness to branching is positively correlated with lower loan costs and easier access to credit; hence, we are able to use these staggered deregulation events to test whether cash savings from tax avoidance substitute for external financing.

[3] Andreoni (1992) models this tax avoidance behavior. This discussion does not include the costs associated with implementing tax planning strategies. Mills et al. (1998) estimate that for every $1 invested in general tax planning, although these costs are not trivial, firms have an average return of approximately $4.

In sum, we predict that in states that are more open to branching after interstate deregulation, firms are more likely to reduce their tax avoidance practices because they have easier access to lower cost bank loans. We propose the following hypothesis:

H1: Tax avoidance is negatively correlated with states' openness to branching.

3. Sample and summary statistics

3.1. Sample

To investigate the effect of banking deregulation on corporate tax avoidance, we obtain data from two sources. We obtain data on interstate banking deregulation from Rice and Strahan (2010) and financial information from Standard & Poor's Compustat. Following the tax avoidance literature, we exclude firms in the utility (SIC codes 4900–4949) and finance (SIC codes 6000–6999) industries. We merge the firm data from Compustat with the deregulation data if a firm is headquartered in the same state as the deregulation state. After dropping missing information, we finally have 48,013 firm-year observations for 7,374 unique firms in 50 states. Table 1 reports the sample distribution by fiscal year. The firm-year observations are relatively evenly distributed from 1987 to 2010.

3.2. Variables

We construct a variable named *RSindex* following Rice and Strahan (2010). As described in Rice and Strahan (2010), the IBBEA allowed states to erect out-of-state entry barriers from the time of enactment in 1994 until 1 June 1997. States could use any combination of the following four provisions to set their barriers to interstate branching: (i) a minimum age for the target institution; (ii) de novo interstate branching; (iii) the

Table 1
Sample distribution.

Fiscal year	Frequency	Percent
1987	1983	4.13%
1988	2044	4.26%
1989	1912	3.98%
1990	1917	3.99%
1991	1864	3.88%
1992	1986	4.14%
1993	2132	4.44%
1994	2413	5.03%
1995	2450	5.10%
1996	2631	5.48%
1997	2666	5.55%
1998	2408	5.02%
1999	2326	4.84%
2000	2113	4.40%
2001	1681	3.50%
2002	1758	3.66%
2003	1845	3.84%
2004	1983	4.13%
2005	1940	4.04%
2006	1857	3.87%
2007	1744	3.63%
2008	1441	3.00%
2009	1362	2.84%
2010	1557	3.24%
Total	48,013	100%

This table presents the number and percentage of firm-year observations for the 1987 to 2010 period.

Table 2
Summary statistics.

Variable	N	Mean	Median	STD
Panel A				
Cash ETR	38,158	0.2911	0.2774	0.2358
GAAP ETR	41,482	0.3278	0.3639	0.1679
Discretionary BT	17,555	0.0379	0.0330	0.1152
DTAX	30,053	−0.0027	0.0020	0.3358
Panel B				
RSindex	48,013	2.7998	3.0000	1.4161
ROA	48,013	0.1175	0.0867	0.1961
Leverage	48,013	0.1903	0.1267	0.3822
Size	48,013	5.2786	5.2332	2.1512
LagMB	48,013	2.9374	2.0149	3.5309
NOL	48,013	0.2776	0.0000	0.4478
Delta_gdwill	48,013	0.0282	0.0000	0.1565
New investment	48,013	0.0738	0.0439	0.1164
Foreign asset	48,013	0.3875	0.0000	0.4872
Cash	48,013	0.1930	0.0887	0.3397

The full sample contains 48,013 firm-year observations for 7374 distinct firms from 1987 to 2010. Panel A presents the descriptive statistics for tax avoidance measures. Panel B presents the descriptive statistics for firm characteristics. Detailed definitions and measurements for all variables can be found in the Appendix.

acquisition of individual branches; and (iv) a statewide deposit cap. *RSindex* represents the number of provisions a state sets on interstate branching. Therefore, *RSindex* ranges from 0 to 4. States that have an *RSindex* of 0 are the most open toward branching and vice versa. [4]

Hanlon and Heitzman (2010) state that "if tax avoidance represents a continuum of tax planning strategies where something like municipal bond investments are at one end, then terms such as 'noncompliance,' 'evasion,' 'aggressiveness,' and 'sheltering' would be closer to the other end of the continuum." We are interested in all tax avoidance strategies that could reduce explicit taxes. Following studies such as Dyreng et al. (2010), Hope et al. (2013) and Hasan et al. (2014), we use four measures to capture this continuum. Two alternate tax rate measures, *GAAP ETR* and *Cash ETR*, are used to estimate broad tax avoidance practices (Dyreng et al., 2010; Hanlon and Heitzman, 2010). *GAAP ETR* is the ratio of total tax expenses to pretax income for a firm in a given year. *Cash ETR* is the ratio of cash tax paid to pretax income for a firm in a given year. By definition, a higher *GAAP ETR* or *Cash ETR* value means less corporate tax avoidance.

Two measures of book-tax difference are used to capture more aggressive tax planning strategies. Book-tax difference is a reasonable measure of more aggressive tax avoidance. For instance, Mills et al. (1998) find that firms with large book-tax differences are more likely to be audited by the IRS and have larger proposed audit adjustments. Wilson (2009) finds that book-tax differences are larger for firms accused of engaging in tax shelters than for a matched sample of non-accused firms. Our book-tax difference measures are (1) the Desai and Dharmapala (2006) discretionary book-tax difference (*Discretionary BT*) and (2) the Frank et al. (2009) permanent discretionary book-tax difference (*DTAX*). Higher *Discretionary BT* or *DTAX* means more aggressive tax avoidance.

Following the literature, we control for a vector of firm characteristics that may affect a firm's tax avoidance practice. Variable definitions are presented in the Appendix.

3.3. Summary statistics

In Table 2, Panel A reports the summary statistics of measures that capture tax avoidance practices. Due to the data requirement when constructing these measures, the sample sizes vary from 17,555 for *Discretionary*

[4] See Rice and Strahan (2010) for a detailed discussion and information about interstate deregulation.

BT to 41,482 for *GAAP ETR*. The sample statistics for these tax avoidance measures are similar to those in the extant tax literature (e.g., Dyreng et al., 2008; Hasan et al., 2014).

In Table 2, Panel B shows the summary statistics of *RSindex* and other control variables for the full sample. The mean of *RSindex* is about 2.80 with a standard deviation of 1.41, consistent with the study by Cornaggia et al. (2015). The statistics of the other control variables are in the range of those reported in previous studies (e.g., Armstrong et al., 2012).

4. Empirical results

4.1. Baseline regression results

Following Rice and Strahan (2010) and Cornaggia et al. (2015), we use interstate banking deregulations as external shocks to the supply and the price of bank loans. The staggered multiple deregulation events alleviate the problem associated with a single shock design, and exclude the possibility of some omitted factors coinciding with the shock that could affect the dependent variable. We estimate the following model:

$$Tax\ Avoidance\ Measure_{\{i,t\}} = \alpha + \beta_1 RSindex_{\{i,t\}} + \gamma Z_{\{i,t\}} + industry_{\{i,t\}} + year_t + State_i + \in_{\{i,t\}} \quad (1)$$

RSindex is the key independent variable, indicating the openness of the state toward out-of-state banking competition. Following the tax avoidance literature, we include relevant firm characteristics that may affect tax avoidance. We include the state fixed effect to control for omitted time-invariant state factors that might be correlated with tax avoidance practices such as the legal environment and the strictness of the tax authority.[5] We also control for year and industry fixed effects in the model.

Table 3 presents the results for the baseline OLS regression model in Eq. (1) and the adjusted standard errors for within-firm clustering and heteroscedasticity. The first column represents the regression result for *Cash ETR*. The estimated coefficient is 0.0017 and is not statistically significant, suggesting that interstate banking deregulation has no significant effect on firms' tax avoidance practices. The coefficients on the control variables are generally consistent with previous studies.

Column 2 shows the regression results for *GAAP ETR*. The results are similar to those in Column 1: the coefficient on *RSindex* is positive, but not significantly correlated with *GAAP ETR*. We present the regression results for *Discretionary BT* and *DTAX* in Columns 3 and 4. Consistent with effective tax rate-based tax avoidance measures, the coefficients on *RSindex* are not significant, further suggesting that interstate banking deregulation has no significant effect on firms' tax avoidance practices.

We further include observations for a (−3,+3)-year window around interstate deregulation events and perform the baseline regression model. Table 4 presents the results for the (−3,+3)-year window sample. We exclude observations in the year of the interstate deregulations. Because by eliminating some potential policy or business environment changes in the state over the long run, we can obtain a relatively clear view of how interstate deregulation could change tax avoidance behavior. The results for *Cash ETR, GAAP ETR, Discretionary BT* and *DTAX* are presented separately in Columns 1 to 4. The results in these regressions are consistent with those in Table 3, indicating that there is no significant effect of banking deregulation on corporate tax avoidance.

4.2. Robustness checks

In this section, we perform a series of robustness tests to ensure that our baseline regression results hold. We discuss the purposes and results of these additional analyses below.

We use four dummy variables to represent the different values of *RSindex*. For example, dummy variable *RSindex_0* equals 1 if the value of *RSindex* is 0; we also create *RSindex_1*, *RSindex_3* and *RSindex_4*. We add these dummy variables to the baseline model instead of using *RSindex*. Therefore, the group with an *RSindex*

[5] Different regions may have different levels of tax enforcement. Instead of controlling for state fixed effects, in a robustness check we control for region fixed effects and our main results hold.

Table 3
Baseline regression.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
RSindex	0.0017	0.0007	0.0003	−0.0008
	(0.9956)	(0.7131)	(0.0013)	(0.0028)
ROA	−0.2118***	0.0858***	0.0747**	0.0431
	(−7.4763)	(5.0456)	(0.0297)	(0.0483)
Leverage	−0.0621***	0.0364***	−0.0441**	−0.0111
	(−8.0785)	(6.7664)	(0.0159)	(0.0183)
Size	0.0124***	0.0133***	0.0022***	−0.0112***
	(12.2466)	(8.2805)	(0.0008)	(0.0035)
LagMB	−0.0032***	−0.0047***	−0.0004	0.0050***
	(−5.4214)	(−13.2120)	(0.0004)	(0.0007)
NOL	−0.0805***	−0.0378***	0.0115***	0.0105
	(−10.7323)	(−12.0038)	(0.0016)	(0.0125)
Delta_gdwill	0.0355**	0.0111*	−0.0060	−0.0309
	(2.6893)	(1.9487)	(0.0174)	(0.0493)
New investment	0.0622***	0.0029	−0.1405***	0.0138
	(3.2485)	(0.2394)	(0.0187)	(0.0415)
Foreign assets	0.0060*	0.0116***	−0.0030	−0.0041
	(1.8755)	(4.6355)	(0.0081)	(0.0040)
Cash	−0.0487***	−0.0631***	0.0048	0.0321**
	(−4.9564)	(−9.7433)	(0.0091)	(0.0140)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	35,540	38,761	17,555	30,053
adj. R^2	0.099	0.116	0.089	0.082

This table presents the regression results of the baseline model using the full sample. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variable is *RSindex*, ranging from 0 to 4. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

* Significance level at 10%.

** Significance level at 5%.

*** Significance level at 1%.

value of 2 is considered as the reference group. Table 5 shows the regression results using this model. Only 2 of the 16 coefficients are significant. Specifically, the coefficient on *RSindex_1* is 0.023 and significant at the 5% level when we use *Cash ETR* as the dependent variable, suggesting that firms in states where *RSindex* equals 1 pay more effective cash tax than firms in states where *RSindex* equals 2. The results also show that the *GAAP ETR* is significantly lower for firms in states where *RSindex* equals 3 than that for firms in states where *RSindex* equals 2. Overall, we find no other significant differences for the other tax measures and groups.

To estimate the possibility of a nonlinear relation, we perform two nonlinear regression models using *logRSindex* and *sqrRSindex,* separately. *logRSindex* equals the natural logarithm of 1 plus *RSindex*. Table 6 presents the regression results. Consistent with the main findings, interstate deregulation is not significantly correlated with tax avoidance measures. *sqrRSindex* equals the square of *RSindex*. To perform the nonlinear model, we include both *RSindex* and *sqrRSindex* in the regressions. The results presented in Table 7 show that the coefficients on these two independent variables are not statistically significant for the four tax avoidance measures, consistent with the main findings.

To compare the states at the two ends of the spectrum of openness toward branching deregulation, we perform a test using a subsample of firms at the two extremes. More specifically, the subsample includes only states with an *RSindex* value of 0 (totally open to branching) and 4 (most restrictive to branching) up to 1 June 1997. We also include firm-year observations in these states before the IBBEA effective date. *BranchRes-*

Table 4
Baseline Regression: (−3,+3) window.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
RSindex	0.0016	−0.0009	−0.000511	−0.00332
	(0.6686)	(−0.5925)	(0.0021)	(0.0040)
ROA	−0.2130***	0.0927***	0.0530	−0.00591
	(−5.6665)	(3.4587)	(0.0509)	(0.0444)
Leverage	−0.0580***	0.0536***	−0.0346**	0.00627
	(−5.8900)	(10.6479)	(0.0154)	(0.0201)
Size	0.0159***	0.0197***	0.00184*	−0.00843***
	(19.7406)	(20.1228)	(0.0010)	(0.0020)
LagMB	−0.0034***	−0.0059***	−0.000583	0.00366***
	(−4.2939)	(−9.8702)	(0.0005)	(0.0011)
NOL	−0.0883***	−0.0478***	0.0149***	0.0314***
	(−12.7228)	(−17.3449)	(0.0030)	(0.0038)
Delta_gdwill	0.0276**	0.0022	−0.0550	−0.0113
	(2.1552)	(0.1552)	(0.0385)	(0.0297)
New investment	0.1034***	0.0330***	−0.141***	0.0233
	(7.2861)	(3.9054)	(0.0270)	(0.0264)
Foreign assets	−0.0005	0.0102***	0.0204**	−0.00285
	(−0.1023)	(3.6559)	(0.0096)	(0.0058)
Cash	−0.0311**	−0.0506***	−0.00198	0.0292*
	(−2.6852)	(−10.3616)	(0.0117)	(0.0169)
N	15,541	16,202	6,434	11,590
adj. R^2	0.095	0.148	0.117	0.061

This table presents the regression results of the baseline model using the (−3,+3) window sample. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variable is RSindex, ranging from 0 to 4. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

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

trict is a dummy variable that equals 1 if the state implements four provisions by 1 June 1997, and 0 otherwise. *After* is a dummy variable that equals 1 when the fiscal year of the firm observation is after 1997. We drop the observations in the 1997 fiscal year to avoid contamination effects. We are interested in the variable *Restrict_After,* which is an interaction term between *BranchRestrict* and *After*. This research design is similar to a standard difference-in-differences method.

Table 8 presents the regression results for this difference-in-differences test. The results show that states that are restrictive to branching consistently pay lower *GAAP ETR*. *Discretional BT* is significantly higher after the interstate deregulation event. For the interaction term *Restrict_After*, it is significant at the 10% level when we use *DTAX* as the measure of tax avoidance, but it is not significant for the three other measures of tax avoidance. The results in general suggest that there is no significant relation between banking deregulation and tax avoidance practices.

It is possible that different regions may have different levels of tax enforcement. To mitigate this regional effect, we perform a robustness check to examine whether our main results are affected by region. Specifically, following the United States Census Bureau definition, we divide states into four regions: Northeast, Midwest, South and West. We then add region as a fixed effect to our baseline model. We find that our main results are unchanged after controlling for region. Finally, we test whether our results are driven by large states with more observations. Specifically, we drop observations from California, the state with the largest number of observations. We also drop observations from California, Texas and New York, the top three states in terms of the number of observations. Our main results hold for these robustness checks, suggesting that our results are not driven by certain large states. For brevity, the results of these robustness checks are not tabulated.

Table 5
Robustness test 1.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
RSindex_0	−0.0039	−0.0066	0.0081	−0.0017
	(0.0098)	(0.0046)	(0.0085)	(0.0205)
RSindex_1	0.0230**	−0.0049	0.0014	−0.0088
	(0.0082)	(0.0048)	(0.0114)	(0.0157)
RSindex_3	−0.0066	−0.0112**	0.0002	−0.0202
	(0.0079)	(0.0046)	(0.0058)	(0.0166)
RSindex_4	0.0135	−0.0071	0.0052	−0.0120
	(0.0090)	(0.0057)	(0.0076)	(0.0100)
ROA	−0.2132***	0.0926***	0.0534	−0.0062
	(0.0374)	(0.0268)	(0.0361)	(0.0357)
Leverage	−0.0580***	0.0536***	−0.0345***	0.0062
	(0.0099)	(0.0050)	(0.0071)	(0.0154)
Size	0.0161***	0.0197***	0.0018**	−0.0084***
	(0.0008)	(0.0010)	(0.0009)	(0.0019)
LagMB	−0.0034***	−0.0059***	−0.0006	0.0037***
	(0.0008)	(0.0006)	(0.0006)	(0.0009)
NOL	−0.0882***	−0.0477***	0.0150***	0.0315***
	(0.0069)	(0.0028)	(0.0019)	(0.0050)
Delta_gdwill	0.0274**	0.0021	−0.0550***	−0.0116
	(0.0128)	(0.0143)	(0.0147)	(0.0338)
New investment	0.1032***	0.0332***	−0.1407***	0.0231
	(0.0139)	(0.0084)	(0.0186)	(0.0297)
Foreign assets	−0.0005	0.0101***	0.0204**	−0.0030
	(0.0045)	(0.0028)	(0.0094)	(0.0052)
Cash	−0.0313**	−0.0507***	−0.0021	0.0291**
	(0.0117)	(0.0049)	(0.0104)	(0.0103)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	15,541	16,202	6,434	11,590
adj. R^2	0.096	0.148	0.117	0.061

This table presents the robustness check by using alternate measures of RSindex. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary Permanent Differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variables are RSindex_0 to RSindex_4. RSindex_0 is a dummy variable where RSindex equals 0; RSindex_1, RSindex_3 and RSindex_4 equal 1, 2 and 3, respectively. In the regression, the reference group is RSindex_2. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

** Significance level at 5%.

*** Significance level at 1%.

To sum up, our robustness checks support that there is no evidence of a significant relation between tax avoidance and bank deregulation.

5. Subsample tests

As discussed earlier, although the baseline tests show no significant results for *RSindex*, we assume that firms with high financial constraints are more likely to be affected by interstate banking deregulation, because easier access to bank loans after deregulation may relieve their financial constraints and subsequently change their tax avoidance practices. In this section, we examine whether companies' financial constraints moderate the effect of interstate deregulation on tax avoidance behavior.

Table 6
Robustness test 2.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
LogRSindex	0.0037	−0.0019	−0.0024	−0.0088
	(0.0059)	(0.0033)	(0.0044)	(0.0121)
ROA	−0.2130***	0.0927***	0.0531	−0.0059
	(0.0376)	(0.0268)	(0.0363)	(0.0357)
Leverage	−0.0580***	0.0536***	−0.0345***	0.0063
	(0.0098)	(0.0050)	(0.0071)	(0.0153)
Size	0.0159***	0.0197***	0.0018**	−0.0084***
	(0.0008)	(0.0010)	(0.0009)	(0.0019)
LagMB	−0.0034***	−0.0059***	−0.0006	0.0037***
	(0.0008)	(0.0006)	(0.0006)	(0.0009)
NOL	−0.0883***	−0.0478***	0.0149***	0.0315***
	(0.0069)	(0.0028)	(0.0018)	(0.0050)
Delta_gdwill	0.0275**	0.0022	−0.0551***	−0.0113
	(0.0128)	(0.0144)	(0.0150)	(0.0337)
New investment	0.1034***	0.0330***	−0.1406***	0.0232
	(0.0142)	(0.0085)	(0.0186)	(0.0297)
Foreign assets	−0.0005	0.0102***	0.0204**	−0.0029
	(0.0045)	(0.0028)	(0.0094)	(0.0051)
Cash	−0.0311**	−0.0506***	−0.0020	0.0292**
	(0.0116)	(0.0049)	(0.0103)	(0.0103)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	15,541	16,202	6434	11,590
adj. R^2	0.095	0.148	0.117	0.061

This table presents the robustness check by taking natural logarithm of RSindex. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variable is *logRSindex*, which equals the natural logarithm of (1 + RSindex).All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

** Significance level at 5%.

*** Significance level at 1%.

5.1. Financial constraints

If banking competition after interstate deregulation directly affects firms' access to bank loans, it may relax their financial constraints and decrease their tax avoidance practices for cash saving purposes. We use Kaplan and Zingales's (1997) financial constraint index, *KZscore*, and divide the (−3,+3)-year window sample into five subgroups according to the value of *KZscore.* We define firms in the top two quintile groups as highly financially constrained firms and those in the bottom two quintile groups as low financially constrained firms. The regression results for highly financially constrained firms are presented in Table 9, Panel A. The coefficient on *RSindex* is -0.000174 and is not statistically significant when we use *Cash ETR* as the dependent variable. Similar results are found for all other three tax avoidance measures. The results suggest that bank deregulation has no significant effect on tax avoidance practices even for financially constrained firms. In Panel B, we perform regressions for low financially constrained firms, and again the coefficients on *RSindex* are not significant for all tax avoidance measures. There are no significant differences between these two groups. Therefore, we do not find evidence to support the substitutive relation between tax avoidance and the use of debt, even for financially constrained firms.

Table 7
Robustness test 3.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
RSindex	−0.0070	−0.0003	−0.0081	−0.0082
	(0.0067)	(0.0042)	(0.0065)	(0.0180)
sqrRSindex	0.0021	−0.0001	0.0018	0.0012
	(0.0016)	(0.0011)	(0.0014)	(0.0036)
ROA	−0.2129***	0.0927***	0.0534	−0.0059
	(0.0376)	(0.0268)	(0.0362)	(0.0357)
Leverage	−0.0580***	0.0536***	−0.0345***	0.0063
	(0.0099)	(0.0050)	(0.0071)	(0.0153)
Size	0.0160***	0.0197***	0.0019**	−0.0084***
	(0.0008)	(0.0010)	(0.0009)	(0.0019)
LagMB	−0.0034***	−0.0059***	−0.0006	0.0037***
	(0.0008)	(0.0006)	(0.0006)	(0.0009)
NOL	−0.0883***	−0.0478***	0.0150***	0.0315***
	(0.0069)	(0.0028)	(0.0019)	(0.0050)
Delta_gdwill	0.0276**	0.0022	−0.0550***	−0.0114
	(0.0128)	(0.0143)	(0.0149)	(0.0338)
New investment	0.1030***	0.0331***	−0.1407***	0.0231
	(0.0141)	(0.0084)	(0.0186)	(0.0296)
Foreign assets	−0.0004	0.0102***	0.0204**	−0.0029
	(0.0045)	(0.0028)	(0.0094)	(0.0051)
Cash_w	−0.0312**	−0.0506***	−0.0021	0.0292**
	(0.0116)	(0.0049)	(0.0104)	(0.0103)
N	15,541	16,202	6434	11,590
adj. R^2	0.095	0.148	0.117	0.060

This table presents the robustness check by examining the nonlinear relation between RSindex and tax avoidance. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variable is *RSindex* and *sqrRSindex*. *sqrRSindex* is equal to the square of *RSindex*. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

** Significance level at 5%.

*** Significance level at 1%.

5.2. External finance dependence

Our earlier tests show no significant effect of banking deregulation on tax avoidance practices, and thus do not support the use of debt as substitutive of the cash savings from tax avoidance practices. In this subsection, we examine whether companies that are highly dependent on external financing sources substitute cash savings from tax avoidance with the use of debt. We expect that firms that are highly dependent on external finance decrease their tax avoidance, because they have easier access to credit after interstate deregulation. We use the measure of external finance dependence developed by Duchin et al. (2010) and construct a dummy variable, *High_dependence,* that equals 1 if the value of firm-year external finance dependence (EFD) is above the industry median (indicating higher EFD), and 0 otherwise.

In Table 10, Panel A shows the subsample regression analysis for high EFD firms. The coefficient on *RSindex* is 0.0080 and not statistically significant when we use *Cash ETR* as the dependent variable. Similar results are found for the other three tax avoidance measures. Panel B reports the regression results for low EFD firms. Again, the coefficients on *RSindex* are not statistically significant for all four tax avoidance measures. From these tests, we cannot conclude that these two subgroups are statistically and significantly different from each other. The results indicate that external financing dependence does not moderate the effect of interstate banking deregulation on tax avoidance practices.

Table 8
Robustness test 4.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
BranchRestrict	0.0064	−0.0538**	−0.0119	−0.0126
	(0.0519)	(0.0149)	(0.0193)	(0.0400)
After	−0.0092	−0.0020	0.0254***	−0.0035
	(0.0113)	(0.0027)	(0.0063)	(0.0054)
Restrict_After	0.0069	0.0053	0.0156	0.0181*
	(0.0227)	(0.0039)	(0.0084)	(0.0072)
ROA	−0.2670**	0.0440	0.1352*	0.0998
	(0.0705)	(0.0597)	(0.0605)	(0.0976)
Leverage	−0.0774***	0.0436***	0.0008	0.0239
	(0.0144)	(0.0098)	(0.0120)	(0.0138)
Size	0.0133***	0.0206***	−0.0017	−0.0061**
	(0.0023)	(0.0011)	(0.0022)	(0.0021)
LagMB	−0.0016	−0.0046***	−0.0012	0.0032
	(0.0020)	(0.0006)	(0.0015)	(0.0019)
NOL	−0.0705***	−0.0269***	0.0070	0.0327***
	(0.0119)	(0.0055)	(0.0063)	(0.0061)
Delta_gdwill	0.0582	0.0017	−0.1223*	0.0330
	(0.0394)	(0.0220)	(0.0527)	(0.0251)
New investment	0.0885*	0.0040	−0.1247**	−0.0557
	(0.0428)	(0.0169)	(0.0310)	(0.0350)
Foreign assets	0.0052	0.0155	0.0069	−0.0143
	(0.0073)	(0.0080)	(0.0142)	(0.0133)
Cash	−0.0170	−0.0494***	−0.0491**	−0.0348
	(0.0173)	(0.0114)	(0.0174)	(0.0379)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	3928	4118	1650	3037
adj. R^2	0.109	0.151	0.141	0.053

In this regression, we only include states with *RSindex*either equal to 0 (fully open to branching) or 4 (most restrictive to branching). *BranchRestrict* is a dummy variable that equals 1 if the state has four barriers after1 June1997, otherwise 0. *After* is a dummy variable that equals 1 if the fiscal year is after 1997. *Restrict_After* is the interaction term of *BranchRestrict* and *RSindex*. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

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

6. Intrastate deregulation

The literature documents different effects imposed by intrastate and interstate deregulations (e.g., Chava et al., 2013). In this section, we perform an additional test on the effect of intrastate deregulation on tax avoidance behavior. We assume that after intrastate deregulation, firms with severe financial constraints may increase their tax avoidance savings, because they may face more restrictive screening technology by banks (Dick and Lehnert, 2010).

We report the regression results in Table 11. Panel A presents the pooled sample regression results, which include all firm-year observations in the pre- and post-intrastate deregulation periods. The coefficients on *Post_intra* are not statistically significant for all four measures of tax avoidance, suggesting that intrastate deregulation has no significant effect on firms' tax avoidance behavior. Panel B shows the regression results for a (−3,+3)-year window around intrastate deregulation events. Consistent with the pooled sample regres-

sion results, the coefficients on *Post_intra* are not statistically significant for all tax avoidance measures. In sum, we do find no empirical evidence to support the effect of intrastate deregulation on corporate tax avoidance.

Table 9
Subsample regressions 1.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
Panel A: Regression for high financially constrained group				
RSindex	−0.000174	0.000422	−0.000365	−0.00696
	(0.0019)	(0.0017)	(0.0015)	(0.0077)
KZindex	−0.00000669*	−0.0000103***	−0.000000550	0.00000473
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ROA	−0.236***	−0.00348	0.0359	−0.0399
	(0.0338)	(0.0292)	(0.0452)	(0.0469)
Leverage	−0.0292*	0.0574***	−0.0219	0.00439
	(0.0152)	(0.0085)	(0.0140)	(0.0354)
Size	0.0157***	0.0124***	0.00813***	−0.00872
	(0.0040)	(0.0032)	(0.0024)	(0.0104)
LagMB	−0.00185	−0.00210**	−0.000949	0.00107
	(0.0011)	(0.0008)	(0.0006)	(0.0014)
NOL	−0.0405***	−0.00169	0.00662**	0.00761
	(0.0094)	(0.0058)	(0.0026)	(0.0079)
Delta_gdwill	0.0491**	0.00732	−0.0964***	−0.0315
	(0.0182)	(0.0117)	(0.0307)	(0.0547)
New investment	0.0192	−0.00161	−0.129***	0.106
	(0.0210)	(0.0202)	(0.0204)	(0.0729)
Foreign assets	−0.00483	0.00735*	−0.0139	0.00288
	(0.0061)	(0.0038)	(0.0277)	(0.0137)
Cash	−0.0258	−0.0211*	−0.0154	0.0103
	(0.0241)	(0.0116)	(0.0175)	(0.0219)
N	5447	5527	3514	4511
adj. R^2	0.097	0.109	0.179	0.085
Panel B: Regression for low financially constrained group				
RSindex	0.00784*	−0.000302	0.00142	−0.000642
	(0.0043)	(0.0024)	(0.0047)	(0.0037)
KZindex	−0.000902***	−0.0000565	−0.00106*	0.000116
	(0.0003)	(0.0002)	(0.0006)	(0.0003)
ROA	−0.180***	0.146***	0.133**	0.0662
	(0.0482)	(0.0275)	(0.0570)	(0.0486)
Leverage	−0.0539**	0.0357***	−0.0237	0.0167
	(0.0208)	(0.0097)	(0.0304)	(0.0138)
Size	0.0525***	0.0367***	0.00491	−0.0194***
	(0.0047)	(0.0032)	(0.0078)	(0.0045)
LagMB	−0.00591***	−0.00888***	−0.000850	0.00680***
	(0.0015)	(0.0011)	(0.0019)	(0.0021)
NOL	−0.120***	−0.0788***	0.0217**	0.0487***
	(0.0074)	(0.0049)	(0.0083)	(0.0085)
Delta_gdwill	0.00628	−0.0115	−0.0790*	−0.0170
	(0.0140)	(0.0289)	(0.0414)	(0.0726)
New investment	0.0953***	0.0370**	−0.0684*	0.00817
	(0.0170)	(0.0162)	(0.0365)	(0.0519)
Foreign assets	0.00702	0.0176***	0.0407	−0.00999
	(0.0089)	(0.0035)	(0.0246)	(0.0099)
Cash	−0.0574***	−0.0833***	0.0230	0.0456**
	(0.0136)	(0.0114)	(0.0224)	(0.0182)

(*continued on next page*)

Table 9 (*continued*)

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
N	6201	6674	1290	4232
adj. R^2	0.121	0.184	0.111	0.059

This table presents the regression results of the baseline model using subsample tests. We follow Kaplan and Zingles's (1997) financial constraints index (*KZindex*). We divide the (−3,+3) window sample into high- and low- financially constrained groups, and perform the baseline model regression separately. The dependent variable is cash effective tax rates (*Cash ETR*), GAAP effective tax rates (*GAAP ETR*), discretionary book-tax difference (*Discretionary BT*) and discretionary permanent differences (*DTAX*) in columns 1, 2, 3 and 4, respectively. The key independent variable is *RSindex,* ranging from 0 to 4. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

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

Table 10
Subsample regressions 2.

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
Panel A: Regression for high EFD group				
RSindex	0.0080	0.0014	0.0002	−0.0000
	(0.0060)	(0.0034)	(0.0040)	(0.0028)
ROA	−0.5272***	0.0088	0.2207*	0.0040
	(0.0776)	(0.0497)	(0.1119)	(0.0468)
Leverage	−0.0930***	0.0423**	−0.0128	0.0220
	(0.0236)	(0.0190)	(0.0250)	(0.0130)
Size	0.0119***	0.0190***	−0.0007	−0.0070**
	(0.0033)	(0.0019)	(0.0047)	(0.0029)
LagMB	0.0032*	−0.0045***	−0.0029	0.0058
	(0.0017)	(0.0010)	(0.0038)	(0.0036)
NOL	−0.0858***	−0.0368***	0.0129	0.0290***
	(0.0133)	(0.0065)	(0.0114)	(0.0080)
Delta_gdwill	0.0716**	−0.0015	−0.2181**	0.0157
	(0.0273)	(0.0150)	(0.0843)	(0.0122)
New investment	0.0527	0.0337	−0.0976	−0.0197
	(0.0461)	(0.0269)	(0.0846)	(0.0609)
Foreign assets	0.0064	0.0201***	−0.0137	0.0054
	(0.0085)	(0.0066)	(0.0221)	(0.0073)
Cash	−0.0516**	−0.0525***	0.0722	−0.0028
	(0.0209)	(0.0131)	(0.0455)	(0.0248)
N	3087	3250	874	2155
adj. R^2	0.137	0.119	0.163	0.031
Panel B: Regression for low EFD group				
RSindex	0.0006	0.0003	−0.0029	−0.0051
	(0.0022)	(0.0014)	(0.0023)	(0.0055)
ROA	−0.1099***	0.1055***	0.0217	−0.0308
	(0.0373)	(0.0274)	(0.0498)	(0.0393)
Leverage	−0.0545***	0.0464***	−0.0488***	0.0011
	(0.0125)	(0.0076)	(0.0102)	(0.0251)
Size	0.0178***	0.0203***	0.0010	−0.0092***
	(0.0011)	(0.0011)	(0.0014)	(0.0023)
LagMB	−0.0050***	−0.0059***	0.0000	0.0038***
	(0.0008)	(0.0008)	(0.0006)	(0.0009)
NOL	−0.0885***	−0.0483***	0.0181***	0.0316***
	(0.0059)	(0.0039)	(0.0032)	(0.0059)

(*continued on next page*)

Table 10 (*continued*)

	(1) Cash ETR	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
Delta_gdwill	0.0082	0.0072	−0.0355**	−0.0331
	(0.0162)	(0.0134)	(0.0146)	(0.0493)
New investment	0.1333***	0.0327	−0.1846***	0.0547
	(0.0218)	(0.0203)	(0.0189)	(0.0415)
Foreign assets	−0.0016	0.0088**	0.0326***	−0.0043
	(0.0065)	(0.0031)	(0.0089)	(0.0081)
Cash	−0.0364**	−0.0440***	−0.0104	0.0409**
	(0.0144)	(0.0074)	(0.0076)	(0.0182)
N	10,009	11,770	3792	7296
adj. R^2	0.096	0.156	0.115	0.084

This table presents the regression results of the baseline model using subsample tests. We follow Duchin et al.'s (2010) external finance dependence (EFD) measure. If the firm-year EFD is 3-digits below the SIC median EFD, it is considered less dependent on external finance. We divide the (−3,+3) window sample into high- and low- EFD groups, and perform the baseline model regression separately. The dependent variable is cash effective tax rates (Cash ETR), GAAP effective tax rates (GAAP ETR), discretionary book-tax difference (Discretionary BT) and discretionary permanent differences (DTAX) in columns 1, 2, 3 and 4, respectively. The key independent variable is RSindex, ranging from 0 to 4. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroskedasticity and within-year clustering.

* Significance level at 10%.

** Significance level at 5%.

*** Significance level at 1%.

Table 11
Intrastate deregulation regressions.

	(1) Cash ETR_	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
Panel A: Full sample regression				
Post_intra	0.0159	−0.0133	0.0050	0.0105
	(0.0167)	(0.0101)	(0.0060)	(0.0240)
ROA	−0.4744***	0.0038	0.0691***	0.0248
	(0.0291)	(0.0201)	(0.0128)	(0.0558)
Leverage	−0.0699***	0.0596***	−0.0444***	−0.0396
	(0.0135)	(0.0093)	(0.0058)	(0.0256)
Size	0.0067***	0.0064***	0.0022***	−0.0042*
	(0.0012)	(0.0008)	(0.0005)	(0.0022)
LagMB	−0.0010	−0.0032***	0.0001	0.0054***
	(0.0007)	(0.0005)	(0.0003)	(0.0014)
NOL	−0.0508***	−0.0177***	0.0102***	0.0138
	(0.0046)	(0.0033)	(0.0020)	(0.0090)
Delta_gdwill	0.0734***	0.0432***	−0.0036	−0.0515
	(0.0215)	(0.0152)	(0.0093)	(0.0395)
New investment	0.0248	−0.0628***	−0.1493***	0.0620
	(0.0257)	(0.0178)	(0.0110)	(0.0491)
Foreign assets	−0.0146	−0.0034	−0.0013	−0.0341
	(0.0160)	(0.0108)	(0.0071)	(0.0282)
Cash	−0.0574***	−0.0707***	0.0260***	0.0357
	(0.0131)	(0.0090)	(0.0058)	(0.0263)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	10,909	11,462	13,540	8738
adj. R^2	0.085	0.082	0.103	0.109

(*continued on next page*)

Table 11 (*continued*)

	(1) Cash ETR_	(2) GAAP ETR	(3) Discretionary BT	(4) DTAX
Panel B: (−3,+3) window sample regression				
Post_intra	0.0191	0.0041	0.0124	0.0081
	(0.0215)	(0.0143)	(0.0160)	(0.0073)
ROA	−0.3571***	0.0850*	0.1629	0.0434
	(0.0593)	(0.0482)	(0.2724)	(0.0443)
Leverage	−0.0565	0.0534*	−0.0976***	−0.0001
	(0.0372)	(0.0304)	(0.0289)	(0.0094)
Size	0.0191***	0.0080***	0.0062**	−0.0032*
	(0.0016)	(0.0025)	(0.0023)	(0.0016)
LagMB	−0.0012	−0.0051***	−0.0057	0.0014
	(0.0016)	(0.0016)	(0.0049)	(0.0011)
NOL	−0.1385***	−0.0531***	0.0195**	0.0146***
	(0.0097)	(0.0153)	(0.0066)	(0.0041)
Delta_gdwill	0.1837***	0.0248	−0.0659	−0.0171
	(0.0333)	(0.0253)	(0.0671)	(0.0111)
New investment	0.0369	−0.0208	−0.2074***	0.0153
	(0.0340)	(0.0305)	(0.0694)	(0.0284)
Foreign assets	0.0090	0.0415***	−0.0210	−0.0070*
	(0.0141)	(0.0054)	(0.0477)	(0.0036)
Cash	0.0339	−0.0453***	0.0465	0.0112
	(0.0270)	(0.0126)	(0.0432)	(0.0189)
Control for				
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
N	2043	2457	1004	2143
adj. R^2	0.157	0.156	0.114	0.018

This table presents the regression results for intrastate deregulation. The key independent variable is *Post_intra*, a dummy variable that equals 1 when the fiscal year is after the state's intrastate deregulation event. All variables are defined in the Appendix. For brevity, we omit the subscripts in the table. Panel A shows the results for the intrastate deregulation tests including all firm-year observations. Panel B reports the results for intrastate deregulation tests including firm-year observation within a (−3,+3) year window around intrastate deregulation events. Standard errors are in parentheses. We use OLS regressions, and adjust standard errors for heteroscedasticity and within-year clustering.

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

7. Conclusion

This paper examines the substitutive relation between tax avoidance practices and the use of debt. We use interstate banking deregulations as external shocks to the supply and the price of credit. In states that are more open toward branching, firms are more likely to enjoy lower loan costs and easier access to credit. If the substitutive relation holds, those firms in open states should make more use of debt and consequently engage in less tax avoidance. However, we do not find empirical evidence to support this hypothesis. Further, we find that firms do not significantly change their tax avoidance behavior when they relax their financial constraints. This study contributes to the current debate on whether a substitutive relation exists between tax avoidance savings and the use of external financing. This paper also helps to understand the real effect of banking deregulation on the real economy.

Although we do not observe a significant effect of bank deregulation on corporate tax avoidance, we are cautious in drawing the conclusion that there is no substitutive relation between corporate tax avoidance and the use of debt. It is possible that such an effect may indeed exist, but we are simply unable to find it empirically due to some limitations and caveats in our study. First, our four measures of tax avoidance in gen-

eral capture the overall level of tax avoidance practices. It is possible that there is a substitutive relation between the use of debt and certain types of tax avoidance strategies, which are not directly measured in our study. Second, Graham and Tucker (2006) find a substitutive relation between the usage of debt and more aggressive tax avoidance such as tax sheltering, while our four measures capture more broad tax avoidance. Third, another potential explanation for our main results is that tax avoidance behavior is permanent or not reversible. When firms are facing financial constraints or are unable to meet their capital demand, they might exploit unused tax planning strategies and save cash for their capital demand. However, whether they reverse their tax avoidance strategies when their financial constraints relax is unknown. If tax avoidance strategies are permanent or irreversible, it is not surprising that we do not observe a significant change after banking deregulation. Fourth, although our research design is based on interstate banking deregulation as an external shock, our results could still be biased by some firm-level or region-level omitted variables.

Appendix A. Variable definitions

Variable	Definition
RSindex	Rice-Strahan index of inter-state banking deregulation based on Rice and Strahan (2010). It ranges from 0 (deregulated) to 4 (highly regulated) based on a state's regulation changes
CETR	The cash effective tax rate for the year, defined as total income taxes paid (TXPD) scaled by the total of pre-tax income (PI) minus minority interest (MII)
GAAP ETR	The GAAP effective tax rate for the year defined as total income-tax expenses (TXT) scaled by pre-tax income (PI)
Discretionary BT	Discretionary BT builds on the BT measure proposed by Manzon and Plesko (2002)
DTAX	Modified discretionary permanent differences and ETR differentials as defined in Frank et al. (2009)
Controls	
Lag M/B	Market capitalization (CSHO*PRCC_F) over the book value of total shareholders' equity (AT-LT) at the beginning of the year
Delta_gdwill	The annual change in good will if greater than 0; otherwise 0
ROA	Net income(or loss) (NI) scaled by beginning of the year total assets (AT)
Leverage	Long-term debt (LT) over total assets (AT)
Size	Natural logarithm of the market value of equity (PRCC_F 3 CSHO) for firms at the beginning of year
NOL	A dummy variable that equals 1 if the loss carried forward (TLCF) for the firm is positive at the beginning of the year
Cash	Cash holding for firm i, year t, defined as cash and marketable securities (CHE) divided by lagged assets (AT)
Foreign assets	Foreign income (PIFO) for firm i, year t, scaled by lagged assets (AT). Missing values in PIFO are set to 0

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China Journal of Accounting Research 10 (2017) 105–125

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China Journal of Accounting Research

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

Thorny roses: The motivations and economic consequences of holding equity stakes in financial institutions for China's listed nonfinancial firms

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ARTICLE INFO

Article history:
Received 13 November 2014
Accepted 6 April 2016
Available online 6 May 2016

Keywords:
Mixing of banking and commerce
Holding equity stakes in financial institutions
Motivations
Economic consequences

ABSTRACT

The reforms of China's financial system have significantly changed the country's financial sector. One noteworthy phenomenon is that many nonfinancial firms have obtained equity stakes in financial institutions. This study investigates the motivations behind and economic consequences of this recent proliferation of investments in financial institutions by nonfinancial listed firms. We find that the motivations for holding equity stakes in financial institutions include alleviating the pressure of industry competition, reducing transaction costs, and diversification to reduce risk. These investments, however, have double-edged effects on the performance of the investing firms. While their investment income increases, their operating income and overall return on assets decrease, as the investment income cannot compensate for the decrease in other operating income. The investing firms' cost of debt also increases, their cash-holding decreases, and stock price performance does not improve after investing in financial institutions. These effects contrast with the enthusiasm nonfinancial listed firms have for investing in financial institutions. The empirical findings in this study can inform financial industry regulators and decision-makers in listed firms. We advise nonfinancial firms to be cautious when considering investing in financial institutions.
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http://dx.doi.org/10.1016/j.cjar.2016.04.001
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1. Introduction

The debate over mixing/separating banking and commerce has carried on for centuries. The activities of banks have been restricted since they first emerged in the Mediterranean city states, and government limitations on the trade investment of banks first appeared in Venice in 1374 (Salley, 1976), before spreading throughout continental Europe. The powers of England's banks were restricted in the late 17th century, and the practice was then exported to colonial America. The market collapse of 1929 in the U.S. and the subsequent great depression reinforced restrictive powers of banks with the enactment of the Glass-Steagall Act in 1933 (Halpert, 1988). Today, financial systems worldwide are generally regulated (Barth et al., 2001). The fear of bank failure and monopoly were previously the main reasons to restrict bank powers, but today the most common concerns include conflicts of interest, excessive bank powers, and threats to the safety net (Krainer, 2000). There are, however, obvious benefits from the mixing of banking and commerce (Wall et al., 2008), such as economies of scale and scope, the fostering of internal capital markets, and diversification. The boundary between banking and commerce has never been clear-cut. Merchant banking was very common among banks in the Italian States of the Middle Ages (Craig, 2001), and universal banks in Germany and Japan have long been encouraged. In the U.S. today, there are various ways banking and commerce mix (Haubrich and Santos, 2003); commercial firms can own banks, for example. In fact, commercial firms throughout the world are commonly found to possess equity stakes in banks.

Traditionally, the activities of banks are restricted from two dimensions; first, from carrying out fee-based activities such as securities, insurance, and real estate, and second, from owning commercial firms, and/or from restricting commercial firms from owning banks. Globally, the divisions between bank and non-bank finance have been dismantled since the late 20th century, and increasingly more countries allow commercial firms to own banks. Bank ownership of commercial firms is permitted in Germany and other countries, but with certain limitations. The effect of bank ownership of firms, though restricted throughout the world, has been examined in the literature. But commercial firms' ownership in banks, though permitted in many countries, has been largely ignored. In this study, we attempt to fill this gap by investigating the motivations and economic consequences of commercial firms' equity stakes in banks. We also expand the concept of combining banking and commerce to include the equity stakes in various types of financial firms held by commercial businesses. We define this as the integration of finance and commerce, where finance represents the broad financial sector including banks, securities, insurance, various funds, trusts, etc., and commerce represents the nonfinancial sector as a whole.[1]

During China's financial system reforms, many commercial firms obtained equity stakes in financial institutions.[2] According to the Chinese Entrepreneurs Survey System (2011), 20.4% of firms surveyed had equity investments in financial institutions, and 27.8% had their own finance firms. The 2009 report of the International Finance Research Institute of the Bank of China (2010) revealed that nonfinancial business groups actually controlled 24 out of 52 trust firms, 19 out of the top 50 investment banks, 12 out of 25 property insurance firms, and 20 out of 39 life insurance firms. These represent 46%, 38%, 48%, and 51%, respectively. Even financial institutions controlled by the government or financial groups were found to be partially held by nonfinancial firms. An increasing number of commercial firms are interested in investing in the financial sector. For example, in 2010 China Mobile obtained 20% of the equity in Shanghai Pudong Development Bank for RMB39.8 billion. In 2013, Vanke invested RMB2.7 billion in Huishang Bank in exchange for 8.28% ownership, and the Evergrande Group obtained 5% of Huaxia Bank in 2014. Alibaba and Tencent, the two Chinese Internet giants, are currently expanding their financial empire though Alipay and WeChat Wallet.

[1] Political economists view the integration of finance and commerce as creating finance capital. The concept of finance capital was first proposed by Hilferding (1910), and then taken up by Lenin in his wartime analysis of the imperialist relations of the great world powers. Hilferding (1910) summarized the development of capitalism and concluded that "the most characteristic features of 'modern' capitalism are those processes of concentration which, on the one hand, 'eliminate free competition' through the formation of cartels and trusts, and on the other, bring bank and industrial capital into an ever more intimate relationship. Through this relationship capital assumes the form of finance capital, its supreme and most abstract expression."

[2] In this study, commercial firms refer to all nonfinancial firms. Financial institutions include banks, and firms dealing in securities, venture capital and private equity, insurance, finance, loans, trusts, guarantees, futures, asset management, investment funds, leasing, and pawnshops, etc.

Theoretically, by investing in the financial sector, commercial firms can obtain high returns, reduce transaction costs, and strategically diversify their operations. A large-scale capital flow from commercial to financial sectors can, however, give rise to economic instability and resource allocation problems.[3] There are also concerns of contagion effects. In this study, we attempt to discover the reasons behind these capital flows and explore their effects on the performance of commercial firms. Using hand-collected data on the equity stakes in financial institutions held by Chinese nonfinancial listed firms between 1999 and 2012, we find that the more intensive the industry competition, the more likely that a commercial firm will invest in financial institutions. This effect is more obvious in non-state controlled listed firms, when investee firms are non-bank financial institutions, and when investee firms are subject to less regulation. Reducing transaction costs is one motivation for commercial firms to hold equity stakes in banks. Consistent with the strategy of diversification, larger firms with higher profitability, more debt, and with sufficient cash are more likely to invest in financial institutions. Finally, the ownership type and structure can affect a commercial firms' decision on investing in financial institutions.

The economic consequences of investing in financial institutions by nonfinancial listed firms are not particularly good. We find that as nonfinancial listed firms invest more in financial institutions, their investment income increases, but other operating income decreases and the overall return on assets decreases. Increases in investment income cannot compensate for decreases in other operating income. Investing in financial institutions also increases the investing firms' costs of debt, decreases their cash-holdings, and their stock price performance does not improve. Investing in financial institutions does not therefore improve firm performance; in fact it deteriorates. Investing in financial institutions is like a thorny rose; it looks beautiful, but it can be dangerous.

The remainder of this paper is organized as follows: Section 2 introduces the evolution of the global trend of integrating of banking and commerce, particularly in China. Section 3 reviews the literature and presents the theoretical analysis. Section 4 describes the research design, Section 5 reports the empirical results, and Section 6 concludes the paper.

2. Institutional background

2.1. The evolution of mixing banking and commerce worldwide

Modern banking developed in the Mediterranean city states in the 13th and 14th centuries from the activities of "money changers" and merchants.[4] To prevent banks from undertaking risky activities and monopolizing particular commodities, their activities were at times restricted. For example, in 1374 the Venetian Senate prohibited bankers from dealing in copper, tin, iron, lead, saffron, and honey. Regulation alone was, however, not enough to prevent the economic and financial disruptions associated with banking failures, currency problems, and bubbles, so public banks were set up by governments. Established in 1694, the Bank of England was a chartered bank. The activities of the public banks of the European continent and the chartered banks in the U.K. were restricted and various regulations were imposed on them, to address monopoly and public interest concerns. Early banks in the United States were modeled on the Bank of England, and were prevented from engaging in mercantile enterprises. However, by the late 19th century, the bond departments of large national banks in New York and Chicago had begun to undertake investment banking activities, and eventually through securities affiliates they became involved in many types of financial activities.

In October 1929, the New York Stock Exchange crashed, triggering the 1929–1933 global economic crisis. The securities activities of commercial banks were blamed for fueling the crisis. In 1933, the Glass-Steagall Act revoked the powers of commercial banks, preventing them from engaging in securities activities. However, commercial banks could still expand into new activities through bank holding companies until 1956, when

[3] Wenzhou is a microcosm of economy instability arising from capital flow from commercial to financial sectors. As the birthplace of private economy in China, Wenzhou has millions of small- and medium-sized firms. Over the years, these firms have lost their competitive advantages. They invest their hot money in real estate, mining, the tertiary industry, and informal loans, resulting in a diminished manufacturing sector. This triggered the large-scale bankruptcies of 2011 in Wenzhou.

[4] The early upheavals of mixing/separation banking and commerce reviewed here are partly taken from Shull (1999).

the Bank Holding Act was passed. Even under this act, commercial banks were able to extend their activities by exploiting various loopholes. In the 1980s, legal and market changes substantially affected banks' expansion activities. Sears, a large conglomerate, was able own a retail enterprise, an insurance company, a securities firm, a real-estate development company, and a savings and loans company. Securities firms and insurance companies could also acquire banks that refrained either from commercial lending or taking demand deposits. The Glass-Steagall Act restrictions eased in the 1980s, and most of the barriers separating commercial banks from nonbank financial services were lifted by the Gramm-Leach-Bliley Act of 1999.

Elsewhere in the world, relationships between banks and commerce are often much closer. Interestingly, there are few explicit legal restrictions on the types of business a bank can undertake in the United Kingdom. For many years they have been able to hold equities of commercial firms and commercial firms can hold bank equities, but only since the "Big Bang" of 1987, commercial banks have aggressively moved into securities trading and insurance. In the late 19th century, universal banks emerged on the European continent as part of government efforts to rapidly industrialize. Universal banks provide short-term bank credit and intermediate and long-term capital, through underwriting and investing in equities. Under the universal banking system, banks and commercial companies maintain close and long-term relationships through ownership, credits, boards of directors, etc. In Japan, after World War II, the Glass-Steagall restrictions were imposed under the Securities Transaction Act of 1948, but banks and companies became associated in keiretsus (groups of enterprises) and since the 1970s banking activities have expanded. The Financial System Reform Law of 1992 permitted Japanese banks to conduct securities business through subsidiaries in which they had a 50% or greater share.

Industrial–financial groups persist and often prosper in many developing countries. During the Soviet regime, for example, the Russian banking system consisted of a single, monolithic bank owned by the state. The financial reforms of 1987 created three regional banks from the former state bank. The reforms of the early 1990s enabled a large number of private banks, over 2000 by 1993, to be established in Russia. The freedom to set up and own banks led to widespread enterprise shareholding. According to a survey in 1994 (Belyanova and Rozinsky, 1995), ownership of new banks was dominated by new private companies, while former state banks were in the main held by state institutions, state enterprises, private enterprises, and individuals, each with around 25% of the shares. Bank ownership of enterprises is, however, much less widespread. The banking industry of Taiwan was deregulated in the early 1990s, and before this liberalization most banks were state-owned and banking entry was highly regulated. The Ministry of Finance revised the Banking Law in 1991 to allow for the setting up of private commercial banks. Deregulation provided a means for the entry of private banks into the market, and the number of banks increased from 24 in 1990 to 51 in 2003 (Ma, 2007).

To summarize, worldwide deregulation has greatly broadened the activities of banks, but there are still substantial variation in the ability of banks to engage in securities, insurance, and real estate activities and in the combining of banking and commerce in different countries (Barth et al., 2001). More research into these variations is therefore required.

2.2. The integration of finance and commerce in China

2.2.1. Investing in commercial banks

The financial system of China was highly centralized under the Ministry of Finance after the establishment of the People's Republic of China in 1949. The People's Bank of China was the mono-bank and engaged in savings, credit, and money supply. Market entry and financial innovation was suppressed. Decentralization gradually followed with China's reform and open policy, and in 1979 the People's Bank of China separated from the Ministry of Finance and became the central bank. Subsequently, the Bank of China, the China Construction Bank, the Agricultural Bank of China, and the Industrial and Commercial Bank of China were established and began functioning as commercial banks. The joint stock commercial banks emerged in the 1980s. Of these, the Bank of Communications was the first national joint stock commercial bank, with 72% of its stocks held by the state and local government, and 28% by commercial firms. It was the first time commercial firms were allowed to enter the banking sector. Investment in the banking sector by commercial firms has since grown rapidly, and they have become important stakeholders in many commercial banks, such

as China Construction Bank, China Minsheng Bank, China Merchants Bank, Huaxia Bank, and Shanghai Pudong Development Bank.

2.2.2. Establishing finance firms

To facilitate the development of business groups, the State Council issued *Provisions on Further Promoting the Horizontal Economic Alliance* in 1986, and *Opinions on the Formation and Development of Business Groups* in 1987. These regulations allowed business groups to set up finance firms with the approval of the People's Bank of China. Finance firms can arrange borrowing and lending within the business group, and carry out transactions with banks or other financial institutions. Business groups can raise money from the public. The first finance company approved was the Dongfeng Motor Finance Company, established in May 1987, and many business groups have since established finance subsidiaries, including Petrol China, China Power, the CITIC Group, the China Everbright Group, China Wanxiang, the New Hope Group, the Haier Group, etc. By the end of 2015, 186 finance firms were organized by commercial firms in China.[5]

2.2.3. Cross-industry operations and the formation of financial holding groups

The four state-owned banks began multi-operations in 1984, in areas such as securities, leasing, real estate, and investment. The People's Bank of China was at the time both central bank and regulatory body, in charge of the regulation of banking, investment banking, insurance, and trust firms. However, due to the weak legal system, insufficient discipline, and a lack of risk control, the money from the banking sector flooded into the stock market and real estate. This dried up the credit funds available for enterprises, producing bubbles in the stock and real estate markets. By the beginning of the 1990s the financial system was seriously chaotic, the inflation rate was high, and the economy overheated. The central government then began to rectify and regulate the financial market, and in 1993 the State Council issued the *Decision on the Reform of the Financial System*, proposing the separation principle for the financial industry. The Law of the People's Bank of China, the Law of Commercial Banks, and the Law of Insurance were successively issued since 1995. These laws set up the rules of separating banking from commerce, and separating banking, investment banking, and insurance. Banks are prevented from owning equities in commercial firms, but commercial firms can still invest in banks. The China Securities Regulatory Commission was established in 1992 followed by the setting up of the China Banking Regulatory Commission and the China Insurance Regulatory Commission. These regulatory bodies aided the development of a sound financial market.

A global trend of broadening bank activities has emerged since the 1990s, and China's separate operation model was also relaxed. Commercial banks were able to set up fund management subsidiaries. And cross-industry operations could be realized through holding companies. For example, the Ping An China Group has insurance, securities, and commercial banking subsidiaries. The separation of Chinese banking and commerce is also a unilateral separation: commercial firms can invest in the financial sector.

An increasing number of business groups have entered the financial industry since 1997. The Haier Group invested RMB500 million in Qingdao Bank in 2001, and invested in Changjiang Securities and the Anshan Trust and Investment Co. It established its own finance subsidiary in 2002. The Luneng Group has strategically become the largest shareholder of Huaxia Bank, Xiangcai Securities, and Weishen Securities, the fourth largest shareholder of the Bank of Communications, and the controlling shareholder of Jinan Yingda International Trust and Shandong Jinshui Futures. Another example is the New Hope Group, the founding investor of China Minsheng Bank, which has now expanded its investment into insurance, securities, and investment firms. The main investing force in the financial industry is in fact the firms controlled by SASAC (State-owned Assets Supervision and Administration Commission of the State Council). Most SASAC-controlled firms have established finance subsidiaries, with some extending to banking, securities, insurance, and futures. In addition, many local governments restructured their banking, securities, insurance, trust, and leasing affiliates into controlling financial groups after 2009.

[5] The statistics are obtained from the website of the China Banking Regulatory Commission: http://www.cbrc.gov.cn/chinese/jrjg/index.html

In July 2013, the State Council issued its *Guidance on Financial Support to the Economic Structure Adjustment, Transition, and Upgrading*. The Guidance proposed 10 reform policies encouraging private capital to invest in financial institutions. By the end of 2013, 36 commercial banks were approved to be sponsored by private capital.

2.2.4. The rise of supply chain finance and Internet finance

In recent years, certain group companies have started to explore a new financing business model, providing financial services along the group supply chain. This innovation is known as supply chain finance, and it provides short-term credit and optimizes working capital for both the buyer and seller. Internet finance is another emerging innovation. E-commerce firms are able to start up various financial services by leveraging their customer and big data advantages. The businesses involve credit cards, mini-loans, insurance, and asset management. These new financing models have come into being through commercial firms rather than traditional financial institutions.

To summarize, China's financial market is emerging from its preliminary stage. In the process, we witness the unprecedented enthusiasm of commercial firms to invest in various sectors of the financial industry. This wave of enthusiasm for the financial sector promises technology and business innovations, but there are also possible hidden risks.

3. Literature review and theoretical underpinning

Theoretically, there are both costs and benefits of merging banking and commerce. The often-claimed benefits are a reduction of portfolio risk, economics of scale and/or scope, new sources of capital, a reduction of transaction costs, etc. The cost concerns include conflicts of interest, excessive market power, and risk contagion. The economic perspectives of bank ownership in commercial firms have been investigated, particularly in relation to German and Japanese banks. The findings of empirical studies generally support the theoretical arguments that banks' equity stakes in commercial firms reduce agency costs and the cost of capital, affect firm performance, and lower the cost of financial distress (see the review of Santos, 1997). The motivations and economic consequences of commercial firms' equity stakes in banks are, however, relatively unexamined. Ma (2007) argues that the investment by Taiwan firms during 1990s in the banking sector was used as a strategic commitment to an aggressive output stance, thus moving the industry to an equilibrium that is more favorable to the firms. Laeven (2001) and others find that the extensive enterprise ownership of banks in Russia fostered related lending. Lu et al. (2012) investigate the economic consequences of holding 5% or greater equity stakes in banks by nonfinancial listed firms from 2006 to 2008 in China. They find that for non-state-owned firms, holding significant bank ownership leads to lower interest expenses and less financial constraints. Combining these theoretical predictions and empirical findings with practices in China, we propose that obtaining high returns in the financial industry, reducing transaction costs, and diversifying risk are the three main economic reasons Chinese nonfinancial firms expand their operations into the financial sector.

3.1. Obtaining high returns of financial industry

Capital is profit driven. Tobin (1969) explains how money and capital can be inter-convertible using q theory. When q is greater than 1, the valuation of existing capital is higher than its replacement cost, causing investment in real capital. However, when q is smaller than 1, the valuation of existing capital is lower than its replacement cost. Selling assets at replacement cost and investment in the money market can reap higher returns on capital. In a similar vein, Porter (1985) points out that when an industry's rate of return stays at a low level and there is no sign of improvement in the future, firms in that industry will look elsewhere for better investment opportunities. The financial industry has traditionally featured high returns and high risk. Over the past ten years, the banking sector has been the most profitable industry in China, and higher profits have attracted more investment.[6] Therefore, we argue that the primary motivation for listed firms to invest in

[6] For example, in 2011, the average rate of return for the commercial sector was about 8%. For the same year, the return on equity for commercial banks was 20.4% (Yang and Dai, 2012).

the financial sector is to reap the high profitability of the financial industry. This argument is also consistent with life-cycle theory, which states that mature firms with abundant cash flow will start new businesses to sustain growth.

3.2. Reducing transaction costs

Firms and markets are two substitutable forms of resource allocation. The scope of a firm is determined by balancing the costs of organizing within the firm with the costs of organizing in another firm, or the costs involved in leaving the transaction to be organized by the price mechanism (Coase, 1937). Williamson (1979, 1985) pointed out that transaction costs include those of search and information, bargaining, and policing and enforcement. Firms weigh the costs of exchanging resources in the environment against the bureaucratic costs of performing activities in-house. Transaction costs related to the exchange of resources with the external environment may be reflected by environmental uncertainty, opportunism, risks, bounded rationality, core company assets, etc. For example, if firms view the environmental uncertainty as high, they may choose not to outsource or exchange resources with the environment.

Goto (1982) and Diamond (1984) use transaction cost theory to identify the fundamental reason for the existence of business groups and conglomerates. Goto (1982) states that if a firm forms or joins a group, it can economize on the transaction costs it would have incurred if the transaction had been carried out through the market, and can at the same time avoid the scale diseconomies or control losses that would have occurred if it had expanded internally and performed the transaction within the firm. If the net benefit of forming or joining a group exceeds that of implementing a transaction with the firm or through the market, the firm has the incentive to form or to join a group. This explains the existence of universal banks in Germany and of Keiretsus in Japan. Diamond (1984) develops a theory of financial intermediation based on minimizing the cost of monitoring information, which is useful in resolving incentive problems between borrowers and lenders. A financing intermediary has a net cost advantage relative to direct lending and borrowing, but intermediaries must bear certain risks for incentive purposes. To diversify the risks, financial intermediaries and firms can form conglomerates.

Hoshi et al. (1991) provide empirical evidence that within business groups where banks own large equity stakes in member firms and lend considerable capital, the information and incentive costs are low, free-rider problems can be reduced, and the costs of financial distress are also lower. In China, bank loans are the main source of financing (Allen et al., 2007). Due to transaction costs, credit quotas, and lending discriminants, many firms, particularly private ones, are constrained when obtaining bank loans. To finance their projects, firms need to maintain sound relationships with banks. They may even directly own equity stakes in banks.[7] Therefore, we predict that by investing in financial institutions, firms can internalize transaction costs when obtaining finance.

3.3. Diversification strategy

Commercial firms invest in the financial sector to diversify. There are costs and benefits to diversification. Diversified firms can utilize the internal capital markets to better allocate firm resources (Stein, 1997). Diversification also brings synergy effects and reduces risk (Hill and Hoskisson, 1987; Amit and Livnat, 1988). Diversification can, however, aggregate agency problems (Jensen, 1986). Managers use diversification to avoid risks and increase firm size uneconomically (Rajan et al., 2000). By investing in the financial sector, commercial firms can utilize investment opportunities that differ from their own line of business while stabilizing their overall income. For example, the Baosteel Group realized its income even in years when the steel industry as a whole was suffering losses, by reaping its profits from the financial sector.

[7] The Law of Commercial Banks released in 2003, article 40, states that commercial banks shall not issue credit loans to related parties; the provisions of collateral debt a commercial bank issued to related parties shall not be superior to those of similar debt issued to other parties. Where related parties include (1) the directors, supervisors, managers, and creditors and their close relatives of a commercial bank; and (2) the corporations, enterprises, and other economic organizations those listed above persons in or serve as top management. However, these regulations do not bar the issuance of credit debt to shareholders by commercial firms, as long as the shareholder has not appointed directors, supervisors, or managers to its invested banks. Even if the shareholder of a commercial bank has appointed directors, and/or supervisors, and/or managers to the invested bank, the bank can still issue collateral debt to its shareholder.

4. Research design

4.1. Models

Based on previous analysis, we construct regression models to investigate the motivations and economic consequences of commercial companies holding equity stakes in financial firms. We identify three motivations for commercial firms to invest in the financial sector: obtaining high returns, reducing transaction costs, and diversifying to reduce risks. We expect that when an industry's competition intensifies, returns decrease, and a firm will seek to invest in a more prosperous and profitable industry. We use the Herfindahl index (HHI, where a lower HHI indicates a higher level of competition) to measure the extent of industry competition, Q to measure investment opportunities, and ROA to measure profitability. We predict that the lower the HHI, the lower the Q, and the lower the ROA, the more likely a firm is to invest in the financial sector. A firm needs external finance to support its growth. In a perfect world, a firm can obtain finance without cost, so financing will be determined by the investment opportunity. However, in the real world, transaction costs make financing expensive. Firms are often financially constrained. We use the cost of debt financing to measure the transaction costs for obtaining loans. We expect that the higher the debt cost, the more likely firms will be to invest in the financial sector. Based on diversification theory, larger firms, older firms, and those with more cash flow are more likely to diversify operations and invest in the financial sector.

Investment in financial institutions constitutes one part of investment decisions. Therefore we control for other factors that influence investment, including internal cash flow (Cashflow), the level of debt (LEV), and uncertainty (Risk). In China, government control and institutional environments are important determinants of economic decisions, so we control for government control (GOV, a dummy variable for state-controlled firms), ownership concentration (Top1, the ownership of the largest shareholder), and the extent of marketization (Lnmindex).

We use a Logit model to investigate the motivations of holding equity stakes in financial institutions. The model is as follows:

$$\begin{aligned}\mathrm{Logit}(p) &= \mathrm{P}(y_{i,t}=1)\\ &= \beta_0+\beta_1\mathrm{HHI}_{i,t}+\beta_2 Q_{i,t-1}+\beta_3\mathrm{ROA}_{i,t}+\beta_4\mathrm{Debtcost}_{i,t}+\beta_5\mathrm{Size}_{i,t-1}+\beta_6\mathrm{Lnage}_{i,t}\\ &\quad+\beta_7\mathrm{Cashholding}_{i,t-1}+\beta_8\mathrm{Cashflow}_{i,t}+\beta_9\mathrm{LEV}_{i,t-1}+\beta_{10}\mathrm{Risk}_{i,t}+\beta_{11}\mathrm{GOV}_{i,t}+\beta_{12}\mathrm{Top1}_{i,t}\\ &\quad+\beta_{13}\mathrm{Lnmindex}_{i,t}+\mathrm{YearDummies}+\varepsilon_{it}\end{aligned}\tag{1}$$

P represents the probability of a nonfinancial listed firm investing in the financial sector. The dependent variables are Dfinfirm, Dfinfirmb, or Dfinfirmr. Table 1 gives the definitions of the variables.

To investigate the economic consequences of holding equity stakes in financial firms, we test the changes in firm performance before and after investing in the financial industry. In particular, we check the ROA and the components of ROA: CROA (operating return on total assets) and IROA (investment income on total assets). We also test for changes in the cost of debt (Debtcost), cash-holdings of investing firms (Cashholding), and stock price performance (Rw).

We use the following fixed-effect panel data regression to evaluate the influence of investing in the financial industry on firm performance:

$$\begin{aligned}\mathrm{Performance}_{i,t} &= \beta_0+\beta_1\mathrm{FIN}_{i,t}+\beta_2\mathrm{Size}_{i,t-1}+\beta_3\mathrm{LEV}_{i,t-1}+\beta_4 Q_{i,t-1}+\beta_5\mathrm{Risk}_{i,t}+\beta_6\mathrm{Lnage}_{i,t}\\ &\quad+\beta_7\mathrm{GOV}_{i,t}+\beta_8\mathrm{Top1}_{i,t}+\beta_9\mathrm{Lnmindex}_{i,t}+\mathrm{Yeardummy}+\varepsilon_{it}\end{aligned}\tag{2}$$

In model (2), the dependent variable, Performance, takes CROA, IROA, ROA, Debtcost, Rw, and Cashholding, where applicable. The main independent variable is the indicator of investing in the financial sector, and takes Dfin, Dfin and Dfinb, Dfin and Dfinr, Dfin and Ratio1, and Dfin and Ratio2, respectively. Size, LEV, Q, Risk, Lnage, GOV, Top1, and Lnindex are control variables. The model also controls for firm- and year-fixed effects. The variable definitions are given in Table 1.

Table 1
Variable definitions.

Variable	Definition
Dfinfirm	Dummy variable, coded 1 for firms with equity investment in the financial sector during 1999–2012, and 0 for firms without equity investment in the financial sector. This variable is coded at the firm-level. That is, if in any year during 1999–2012 a firm has equity investment in the financial sector, all the years of this firm are coded 1
Dfinfirmb	Dummy variable, coded 1 for firms with equity investment in the banking sector during 1999–2012 and 0 otherwise, also coded at the firm-level
Dfinfirmr	Dummy variable, coded 1 for firms with equity investment in banking, securities, and insurance sectors, where regulations are strict; coded 0 for firms with equity investment in the less-regulated financial sector, also coded at the firm-level
Dfin	Dummy variable, coded 1 for firm-years with equity investment in the financial sector, and 0 otherwise. This variable is coded at the firm-year-level
Dfinb	Dummy variable, coded 1 for firm-years with equity investment in the banking sector, and 0 otherwise. This variable is coded at the firm-year-level
Dfinr	Dummy variable, coded 1 for firm-years with equity investment in banking, securities and insurance sectors with strict regulation; and 0 for firm-years with equity investment in the less-regulated financial sector. This variable is coded at the firm-year-level
Invamt	The total balance of equity investment in financial institutions in RMB Yuan as at the end of a year
Ratio1	The first depth measure of equity investment in financial institutions, calculated as the total balance of equity investment in financial institutions divided by total assets
Ratio2	The second depth measure of equity investment in financial institutions, calculated as the total balance of equity investment in financial institutions divided by net assets
HHI	The Herfindahl index based on the ratio of industry turnover. The lower the index, the more intensive the competition
Q	The market-to-book ratio, calculated as the sum of market capitalization and the book value of debt divided by book value of total assets
CROA	Operating return on assets, calculated as operating earnings divided by average total assets
IROA	Investment return on total assets, calculated as investment income divided by average total assets
ROA	Return on assets, calculated as net income divided by average total assets
Debtcost	Cost of debt, calculated as financial expenses divided by average interest bearing debt
Size	Firm size, calculated as the log of total assets
Lnage	Log of listing age
Cashholding	Cash divided by total assets
Cashflow	Cash flows from operating activities divided by total assets at the beginning of the year
LEV	Leverage, calculated as total liabilities divided by total assets
Risk	Stock price volatility, calculated as the standard deviation of weekly stock returns during a year
Rw	Stock return, calculated as the mean of weekly market adjusted idiosyncratic stock returns during a year
GOV	Dummy variable for the type of shareholder, coded 1 for firms whose ultimate controlling shareholder is government or state asset management bureaus
Top1	The ownership ratio of the largest shareholder
Lnmindex	Log of the marketization index, which is the index of marketization of Fan et al. (2011). For firm-years in 2010, the index is estimated based on the change tendency during 2007–2009 (Mindex2010 = Mindex2009 + Mindex2008 − Mindex2007); for firm-years after 2010, the estimated 2010 index is used

4.2. Sample and data

The China Securities Regulatory Commission (CSRC) has required listed firms to publicly release detailed annual reports since 1999, which is therefore when our sample starts. Before 2007, equity investment was reported in the "long-term investment" account and since then, if the invested firm was listed, the investments were transferred to "available-for-sale" investments. For equity investment with over 50% ownership, the subsidiary is consolidated and not reported in the "long-term investment" account, but it can be traced in the footnotes of financial statements, where subsidiary information is disclosed. We therefore hand-collect investment totals, and the ratios invested in financial firms by nonfinancial listed companies, from the annual reports. The financial firms identified include firms providing services of banking, loans, securities, venture capital and private equity, insurance, finance, trusts, guarantees, futures, asset management, investment funds, leasing, and pawnshops. The sample period is 1999–2012. The financial and corporate governance data and stock returns are extracted from Wind and CSMAR.

Table 2
Research sample.

		Invest in financial sector during 1999–2012?	
Invest in financial sector in a certain year?		Yes	No
No		A	C
Yes		B	
Sample for motivation test	A & C, Dfinfirm coded 1 for firm-years in district A, and 0 for those in district C		
Sample 1 for consequence test	A, C & B, Dfin coded 1 for firm-years in district B, and 0 for those in district A and C		
Sample 2 for consequence test	A & B, Dfin coded 1 for firm-years in district B, and 0 for those in district A		

We start with all nonfinancial A-share listed firms from 1999 to 2012, and exclude extreme observations (for example, if the debt-to-asset ratio is greater than 1) and firm-years with missing values. The resulting sample is made up of 15,741 firm-year observations. Depending on the status of the equity stakes held in financial institutions, the 15,471 observations are divided into five groups. The first consists of 4778 observations for firms that never invest in financial institutions, and the second of 3719 for firms consistently reporting investments in financial institutions for all years of the sample period. The third group consists of 4070 observations for firms with no equity investment in financial institutions at the beginning of the sample period but that invest in financial institutions later. The fourth group comprises of 1247 observations for firms that initially have equity stakes in financial institutions but then sell them, and the last consists of 1927 observations for firms that occasionally invest in financial institutions.

To obtain a clean test sample we use the first and third groups totaling 8848 observations to investigate the motivations and the economic consequences of investing in financial institutions.[8,9] We use the first group and the early year observations of the third group before firms have invested in the financial sector to investigate motivations. The dummy variable Dfinfirm is coded 1 for firms that invest in the financial sector later in the 1999–2012 period and 0 otherwise. Dfinfirm is a firm-level indicator. We use two samples to investigate the performance of investing in the financial sector. The first consists of all observations in the first and third group, and the dummy variable Dfin is coded 1 for firm-years with investments in equity stakes of financial institutions and 0 otherwise. This construction results in a difference-in-difference test of the economic consequences when Chinese nonfinancial listed firms integrate finance and commerce. The second sample consists of observations from the third group, where the dummy variable Dfin is coded 1 for firm-years with equity investment in financial institutions and 0 otherwise.[10] Using the second sample, we can compare firm performance before and after equity stakes in financial institutions are held. Table 2 summarizes the construction process of the test samples.

5. Empirical results

5.1. Descriptive statistics

In empirical tests, all continuous variables are winsorized at 1% and 99%, except the marketization index (Lnmindex). Table 3 reports the descriptive statistics for the research sample. The firm-level statistics show that on average, 46% of firms have equity investment in the financial sector between 1999 and 2012, and 21.21% of firms hold equity stakes in banks, with 28.05% holding equity stakes in banking, securities, and

[8] Typically, the sample for the Logistic regression can be obtained by matching the research sample with a control sample. The matching standards can be industry, firm size, profitability, ... and so on, depending on the research scenario. However, in this study, industry, firm size, profitability, and other firm characteristics are independent variables of interest. If these differences are removed, the regression will become meaningless.

[9] As lag variables are used, the regression sample is slightly smaller.

[10] This sample is used in robustness checks.

Table 3
Descriptive statistics.

	Obs.	Mean	Median	S.D.	Minimum	Maximum
Dfinfirm	8848	0.4600	0	0.4984	0	1
Dfinfirmb	8848	0.2121	0	0.4088	0	1
Dfinfirmr	8848	0.2805	0	0.4493	0	1
Dfin	8848	0.2722	0	0.4451	0	1
Dfinb	8848	0.1118	0	0.3151	0	1
Dfinr	8848	0.1667	0	0.3727	0	1
Invamt	8848	$5.1306 * 10^7$	0	$3.4742 * 10^8$	0	$1.65 * 10^{10}$
Ratio1	8848	0.0081	0	0.0277	0	0.2216
Ratio2	8848	0.0171	0	0.0572	0	0.4579
HHI	8848	0.0751	0.0465	0.0966	0.0193	0.8236
Q	8848	1.6093	1.3172	0.8757	0.6723	6.1038
CROA	8848	0.0440	0.0408	0.0661	−0.1869	0.2435
IROA	8848	0.0064	0.0009	0.0179	−0.0267	0.1084
ROA	8848	0.0385	0.0370	0.0597	−0.2006	0.2111
Debtcost	8848	−0.0525	0.0364	0.5140	−4.4348	0.1594
Size	8848	21.4987	21.3298	1.1668	19.2094	26.0217
Age	8848	8.0118	7	4.6009	1	20
Lnage	8848	1.8752	1.9459	0.6992	0	2.9957
Cashholding	8848	0.1734	0.1414	0.1271	0.0059	0.6636
Cashflow	8848	0.0551	0.0526	0.0996	−0.2717	0.3738
LEV	8848	0.4709	0.4775	0.1933	0.0508	0.9369
Risk	8848	0.0454	0.0428	0.0175	0.0163	0.0985
GOV	8848	0.6443	1	0.4787	0	1
Top1	8848	0.3928	0.3794	0.1613	0.0909	0.7500
Mindex	8848	7.9440	7.97	2.3758	1.72	12.04
Lnmindex	8848	2.0218	2.0757	0.3305	0.5423	2.4882

insurance institutions over the same period. At the firm-year-level, on average 27.22% have equity investment in the financial sector, 11.18% in the banking sector, and 16.67% in banking, securities, and the insurance sector. The depth of investment in the financial sector on average is 0.81% of total assets and 1.71% of net assets, with maximums of 22.16% of total assets and 45.79% of net assets. The investment amount averages $5.1306 * 10^7$ and the maximum value is $1.65 * 10^{10}$. Investing in financial institutions is therefore very attractive for nonfinancial listed Chinese firms, though the level of investment varies greatly.[11] We conduct correlation checks for independent variables and find that the Pearson correlation coefficients are below 0.4, so multicollinearity is not serious in our research.[12]

5.2. Motivations for investing in financial institutions

Here we examine the results of logistic regressions of the determinants or motivations of investing in the financial sector. Government and regulation are important influencers of economic life in China, so we therefore investigate state-controlled firms and non-state controlled firms separately. The financial sector is highly regulated, and banking, securities, and insurance industries are subject to the strictest regulations. For nonfinancial firms, the goal of investing in the strictly regulated financial sector may be to obtain permits rather than profits. We therefore separately investigate the motivations of investing in the strictly regulated financial sector and in the relatively less strictly regulated sector. As the debate on separating banking and commerce

[11] Note that the statistics here are for Group 1 and 3 only. The remaining three groups of firms all occasionally had equity investment in the financial sector. Therefore, the popularity of holding equity stakes in financial institutions is much more common for non-financial listed firms as a whole.

[12] To save space, the correlation coefficients are not reported but are available upon request.

Table 4a
Determinants of equity investment in financial institutions.

	Whole sample		State-controlled firms		Non-state-controlled firms	
	Coef.	*Z* value	Coef.	*Z* value	Coef.	*Z* value
Constant	−8.0257	−8.85***	−7.5275	−7.12***	−9.2915	−4.71***
HHI	−0.7330	−2.26**	−0.2391	−0.66	−2.7700	−3.31***
Q	0.0075	0.12	−0.0456	−0.57	0.1151	1.16
ROA	3.7831	5.61***	3.2537	3.92***	4.2071	3.53***
Debtcost	−0.0069	−0.08	−0.1383	−1.38	0.6264	1.76*
Size	0.3942	9.33***	0.3894	8.00***	0.4201	4.60***
Lnage	−0.4471	−6.16***	−0.5115	−5.72***	−0.4198	−3.11***
Cashholding	1.6175	4.90***	1.5043	3.66***	2.1255	3.69***
Cashflow	0.3878	1.05	1.0027	2.17**	−0.7706	−1.22
LEV	1.3940	6.30***	1.2176	4.57***	1.9846	4.76***
Risk	−5.1940	−1.79*	−9.2367	−2.62***	4.4854	0.85
GOV	0.0299	0.37	–	–	–	–
Top1	−0.4714	−2.09**	−0.9957	−3.80***	1.0241	2.25**
Lnmindex	0.0028	0.02	0.1948	1.24	−0.5001	−1.95*
Year	Controlled		Controlled		Controlled	
LR chi2		648.29***		480.84***		192.06***
Pseudo R2		0.1066		0.1127		0.1075
OBS		5103		3464		1639

Note: the *Z* values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

has continued for many years, we also test the motivations of equity investments in banks and non-bank firms separately. Tables 4a and 4b report the results.

Tables 4a and 4b shows that the coefficient on the extent of industry competition (HHI) is negative in six out of seven regressions, indicating that the lower the HHI (i.e., the higher the extent of industry competition), the more likely nonfinancial firms are to invest in the financial sector. The negative coefficients are, however, significant only for the whole sample, the non-state controlled firm sample, the non-bank equity investment sample, and for the sample of investment in relatively less strictly regulated industries. The extent of industry competition is not a consideration for state-controlled firms, for those investing in the banking sector, and those investing in the strictly regulated sector. Government influence, rather than market forces, may drive the investment decisions of state-controlled firms. We also find that obtaining permits, rather than industry competition pressure, is the main concern when investing in the banking sector and the highly regulated financial sector.

The coefficients on the cost of interest-bearing debt (Debtcost) are significant only in the non-state controlled sample and in the investment in the banking sector regression, which indicates that non-state controlled firms are more financially constrained and aim to reduce transaction costs by investing in the financial sector. Firms with higher debt costs are more likely to invest in banks, in the hope of reducing their debt costs.

The coefficients on profitability (ROA), leverage (LEV), firm size (Size), and cash holding (Cashholding) are statistically positive across the seven regressions. More profitable and larger firms, and those with ample debt financing and abundant cash, are therefore more likely to investment in the financial sector, as they are less financially constrained. Their motivations for holding equity investment in financial institutions are more consistent with the diversification strategy. The coefficient on listing age (Lnage) is, however, negative and significant, which seems inconsistent with diversification theory, but the unique IPO market in China, with its high offering prices, high pricing in terms of P/E ratio, and high over-raised funds, causes newly listed firms to over-invest, including investing in the financial sector.

The explanatory power of the major determinants of investment, investment opportunity (*Q*), internal cash flow (Cashflow), and uncertainty (Risk) varies. The coefficients on investment opportunity are not significant

Table 4b
Determinants of equity investment in financial institutions (group regressions based on the type of invested firms).

	Investment in banks		Investment in non-bank financial institutions		Investment in the strictly regulated financial sector		Investment in the less-regulated financial sector	
	Coef.	*Z* value	Coef.	*Z* value	Coef.	*Z* value	Coef.	*Z* value
Constant	−4.3297	−3.01***	−11.4123	−10.88***	−5.2526	−4.04***	−11.9061	−10.78***
HHI	0.0589	0.15	−1.6686	−3.36***	−0.2520	−0.65	−1.4800	−2.87***
Q	−0.1540	−1.40	0.0789	1.15	−0.1224	−1.22	0.0799	1.12
ROA	3.4757	3.52***	4.0465	5.00***	3.2482	3.60***	4.3459	5.04***
Debtcost	2.2259	2.27**	−0.0618	−0.69	0.5247	1.50	−0.0544	−0.59
Size	0.2385	3.54***	0.4913	10.14***	0.2876	4.70***	0.4942	9.75***
Lnage	−0.4988	−4.61***	−0.4353	−5.15***	−0.6490	−6.57***	−0.3085	−3.44***
Cashholding	0.9761	1.90*	2.2760	5.98***	0.8268	1.81*	2.4036	5.99***
Cashflow	1.1684	2.04**	−0.0766	−0.18	0.7384	1.44	0.0459	0.10
LEV	0.8170	2.51**	1.6187	6.10***	1.0541	3.56***	1.6233	5.77***
Risk	−10.5947	−2.38**	−2.5561	−0.74	−11.0221	−2.70***	−0.5124	−0.14
GOV	0.1772	1.46	−0.0612	−0.64	0.2259	2.02**	−0.1395	−1.38
Top1	−0.9592	−2.94***	−0.1728	−0.65	−0.9003	−3.01***	−0.1155	−0.41
Lnmindex	−0.2413	−1.30	0.1821	1.14	−0.0608	−0.35	0.0814	0.48
Year	Controlled		Controlled		Controlled		Controlled	
LR chi2		433.94***		446.63***		537.22***		356.75***
Pseudo R2		0.1314		0.0996		0.1400		0.0890
OBS		4217		4543		4356		4404

Note: the *Z* values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

Table 5a
Effect of holding equity stakes in financial institutions on operating performance (dependent variable: CROA).

	(1)		(2)		(3)		(4)		(5)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.1813	5.33***	0.1813	5.33***	0.1815	5.34***	0.1859	5.46***	0.1887	5.55***
Dfin	−0.0040	−1.63	−0.0044	−1.59	−0.0009	−0.29	−0.0012	−0.46	0.0010	0.36
Dfinb			0.0011	0.32						
Dfinr					−0.0059	−1.71*				
Ratio1							−0.0995	−2.81***		
Ratio2									−0.0853	−5.14***
Size	−0.0065	−3.96***	−0.0065	−3.96***	−0.0065	−3.97***	−0.0066	−4.07***	−0.0068	−4.15***
LEV	−0.0337	−5.68***	−0.0338	−5.69***	−0.0333	−5.62***	−0.0340	−5.74***	−0.0323	−5.46***
Q	0.0139	12.69***	0.0139	12.70***	0.0138	12.65***	0.0139	12.71***	0.0138	12.65***
Risk	−0.1179	−2.21**	−0.1178	−2.21**	−0.1172	−2.20**	−0.1159	−2.18**	−0.1150	−2.16**
Lnage	−0.0241	−5.93***	−0.0241	−5.92***	−0.0240	−5.92***	−0.0243	−5.98***	−0.0248	−6.11***
GOV	−0.0135	−4.70***	−0.0135	−4.68***	−0.0136	−4.73***	−0.0135	−4.70***	−0.0136	−4.72***
Top1	0.0931	11.15***	0.0932	11.15***	0.0928	11.11***	0.0923	11.05***	0.0919	11.02***
Lnmindex	0.0002	0.13	0.0002	0.13	0.0002	0.14	0.0001	0.05	0.0000	0.01
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.1082		0.1082		0.1086		0.1092		0.1116
F		38.11***		36.46***		36.59***		36.83***		37.74***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

in any regressions. Therefore, listed firms do not wait until investment opportunities in their own industry are exhausted before entering the financial sector. For state-controlled firms, and for determinants of equity investment in banks, the coefficients on internal cash-flow are positive and significant, possibly indicating a free cash-flow problem. The coefficients on uncertainty are significant for the state-controlled firms sample and on the determinants of equity investment in banks and in the strictly regulated financial sector, which is consistent with the real stock option theory of investment.

Finally, the explanatory power of the corporate governance variables—the type of controlling shareholder (GOV), ownership concentration (Top1), and the marketization index (Lnmindex)—also varies. First, government control is only important in determining equity investment in the strictly regulated financial sector, which may indicate that connection with the state is useful in obtaining entry permits in the highly regulated sector. Second, for determinants of equity investment in banks, in the highly regulated financial sector, and for the state-controlled sample, the coefficients on the ownership of the largest shareholder are negative, but positive for the non-state controlled sample. Therefore, the higher the ownership concentration, the less willing state-controlled firms are to invest in the financial sector, but the more willing non-state-controlled firms are to invest. Finally, the overall explanatory power of the extent of marketization is low.

5.3. Economic consequences of holding equity stakes in financial institutions: Effect on operating returns (CROA)

Tables 5a and 5b report firm- and year-fixed effect estimates of the effect on operating returns of holding equity stakes in financial institutions. The coefficients on indicators of equity investment in financial institutions and in banks are insignificant, but this does not mean there is no effect on operating returns. The coefficients on the indicator of equity investment in strictly regulated financial institutions and on the depth of investment are negative and statistically significant. Investing in strictly regulated financial

Table 5b
Effect of holding equity stakes in financial institutions on operating performance: The effects of government control (dependent variable: CROA).

	(6)		(7)		(8)		(9)		(10)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.1812	5.32***	0.1808	5.31***	0.1825	5.36***	0.1858	5.45***	0.1886	5.55***
Dfin	−0.0037	−1.02	−0.0023	−0.52	0.0051	1.06	0.0000	−0.00	0.0010	0.26
Dfinb			−0.0033	−0.59						
Dfinr					−0.0161	−2.80***				
Ratio1							−0.1082	−2.54**		
Ratio2									−0.0697	−3.39***
Dfin * GOV	−0.0004	−0.09	−0.0030	−0.62	−0.0087	−1.57	−0.0017	−0.40	−0.0004	−0.08
Dfinb * GOV			0.0065	0.99						
Dfinr * GOV					0.0149	2.22**				
Ratio1 * GOV							0.0103	0.33		
Ratio2 * GOV									−0.0220	−1.35
Size	−0.0065	−3.96***	−0.0065	−3.95***	−0.0065	−4.00***	−0.0066	−4.07***	−0.0068	−4.16***
LEV	−0.0337	−5.68***	−0.0339	−5.71***	−0.0337	−5.67***	−0.0340	−5.72***	−0.0324	−5.46***
Q	0.0139	12.69***	0.0139	12.69***	0.0138	12.62***	0.0139	12.70***	0.0138	12.60***
Risk	−0.1179	−2.22**	−0.1180	−2.22**	−0.1169	−2.20**	−0.1163	−2.19**	−0.1139	−2.14**
Lnage	−0.0241	−5.93***	−0.0241	−5.94***	−0.0242	−5.95***	−0.0243	−5.99***	−0.0248	−6.10***
GOV	−0.0134	−4.29***	−0.0135	−4.32***	−0.0138	−4.40***	−0.0131	−4.19***	−0.0129	−4.13***
Top1	0.0931	11.14***	0.0934	11.16***	0.0926	11.08***	0.0922	11.03***	0.0918	11.00***
Lnmindex	0.0002	0.13	0.0002	0.15	0.0003	0.22	0.0001	0.04	0.0000	0.02
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.1082		0.1084		0.1092		0.1093		0.1119
F		36.45***		33.57***		33.88***		33.89***		34.80***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

institutions is therefore negatively related to a firm's ability to acquire operating earnings. As the amount of investment in financial institutions increases, operating return on assets decrease.

Table 5b demonstrates the effect of government control when including the interactions of GOV and the depth variables of holding equity stakes in financial institutions. The results in Column (8) show that government control influences the effect of operating earnings when investing in strictly regulated financial institutions. For non-state-controlled listed firms, investing in strictly regulated financial institutions is associated with a decrease in operating performance. The coefficient on Dfinr is −0.0161, which is significant at less than 1%. For state-controlled listed firms, this investment is not associated with decreased operating performance and the coefficient on Dfinr * GOV is 0.0149, significant at less than 5%. The aggregated effect of holding equity stakes in strictly regulated financial institutions is −0.0012 (−0.0161 + 0.0149). Non-state-controlled firms may place more importance on obtaining entry permits than on short-run economic returns.

5.4. Economic consequences of holding equity stakes in financial institutions: Effect on investment income (IROA)

Here, we investigate the effect of holding equity stakes in financial institutions on the performance of external expansion. As one component of external expansion, investment in financial institutions can contribute to investment income, which we therefore expect to increase. The firm- and year-fixed effect estimates are reported in Tables 6a and 6b. In regression (11) of Table 6a, the coefficient on Dfin is positive and significant, indicating that holding equity stakes is positively related with investment income. In regression (12), the coef-

Table 6a
Effect of holding equity stakes in financial institutions on investment performance (dependent variable: IROA).

	(11)		(12)		(13)		(14)		(15)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.0707	6.68***	0.0706	6.67	0.0706	6.67***	0.0688	6.50***	0.0694	6.56***
Dfin	0.0022	2.86***	0.0013	1.52	0.0015	1.59	0.0010	1.26	0.0014	1.67*
Dfinb			0.0023	2.14**						
Dfinr					0.0013	1.17				
Ratio1							0.0410	3.72***		
Ratio2									0.0140	2.71***
Size	−0.0034	−6.70***	−0.0034	−6.71***	−0.0034	−6.70***	−0.0033	−6.56***	−0.0034	−6.61***
LEV	0.0026	1.43	0.0025	1.36	0.0026	1.39	0.0028	1.51	0.0024	1.31
Q	0.0014	4.24***	0.0015	4.29***	0.0015	4.27***	0.0014	4.23***	0.0015	4.28***
Risk	−0.0054	−0.32	−0.0053	−0.32	−0.0055	−0.33	−0.0062	−0.37	−0.0058	−0.35
Lnage	0.0000	−0.03	0.0000	0.02	−0.0001	−0.04	0.0000	0.04	0.0001	0.06
GOV	−0.0003	−0.29	−0.0002	−0.21	−0.0002	−0.27	−0.0003	−0.30	−0.0003	−0.29
Top1	0.0033	1.25	0.0034	1.29	0.0033	1.28	0.0036	1.38	0.0035	1.33
Lnmindex	0.0001	0.18	0.0001	0.17	0.0001	0.18	0.0001	0.30	0.0001	0.25
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.0667		0.0673		0.0669		0.0686		0.0677
F		22.45***		21.69***		21.54***		22.12***		21.82***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

ficient on Dfin becomes insignificant, but the coefficient on Dfinb is significant. Therefore, only investment in banks can bring more investment income, which is also found in regression (13), where the coefficient on Dfinr is not significant. Nevertheless, as regressions (14) and (15) show, investment income increases with the amount of investment in financial institutions.

The effect of government control is also considered, and the results are reported in Table 6b. As regressions (16) and (17) show, though non-state-controlled firms earn higher investment income by investing in financial institutions, particularly banks, the investment returns of state-controlled firms do not increase. The coefficients on Dfin * GOV in regression (16) and on Dfinb * GOV in regression (17) are negative and significant. Combined with the negatively significant coefficients on Dfin and Dfinb, the overall results become insignificant. However, as the amount of investment grows, state-controlled firms also increase their investment income, as shown in regression (19).

5.5. Economic consequences of holding equity stakes in financial institutions: Effect on net income (ROA)

We then investigate the economic consequences of holding equity stakes in financial institutions in terms of net income, which is the bottom line of the operating results reported in Tables 7a and 7b. The coefficients on Dfin, Dfinb, and Dfinr in Table 7a are not significant, so investing in financial institutions does not increase or decrease return on assets. However, the coefficients on Ratio1 and Ratio2 are both negative and significant at less than 1%. Therefore, as the amount of the investments increases, return on assets significantly decrease. To summarize the results across Tables 5a, 6a, and 7a, we find that as the depth of investing in financial institutions increases, performance from external investment improves. The gains in investment income cannot, however, make up for the losses in other operating earnings. The aggregated result is a decrease in the overall return on assets.

We again consider the interaction effects of government control and of holding equity stakes in financial institutions. Table 7b shows that the only significant effect is found in regression (28), where for non-state controlled listed firms, investment in strictly regulated financial institutions result in lower return on assets,

Table 6b
Effect of holding equity stakes in financial institutions on investment performance: The effects of government control (dependent variable: IROA).

	(16)		(17)		(18)		(19)		(20)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.0694	6.56***	0.0697	6.59***	0.0691	6.53***	0.0685	6.48***	0.0684	6.46***
Dfin	0.0049	4.30***	0.0025	1.86*	0.0029	1.96*	0.0046	3.79***	0.0038	3.09***
Dfinb			0.0055	3.18***						
Dfinr					0.0035	1.96*				
Ratio1							0.0103	0.78		
Ratio2									0.0151	2.37**
Dfin * GOV	−0.0041	−3.21***	−0.0019	−1.22	−0.0022	−1.28	−0.0050	−3.83***	−0.0036	−2.70***
Dfinb * GOV			−0.0050	−2.46**						
Dfinr * GOV					−0.0033	−1.57				
Ratio1 * GOV							0.0372	3.87***		
Ratio2 * GOV									−0.0032	−0.62
Size	−0.0034	−6.65***	−0.0034	−6.68***	−0.0034	−6.62***	−0.0033	−6.61***	−0.0033	−6.57***
LEV	0.0027	1.46	0.0027	1.45	0.0027	1.45	0.0030	1.65*	0.0025	1.34
Q	0.0014	4.16***	0.0014	4.20***	0.0014	4.20***	0.0014	4.19***	0.0014	4.18***
Risk	−0.0059	−0.36	−0.0057	−0.35	−0.0061	−0.37	−0.0075	−0.45	−0.0061	−0.37
Lnage	−0.0002	−0.12	−0.0001	−0.04	−0.0001	−0.11	−0.0001	−0.11	0.0000	−0.03
GOV	0.0010	0.99	0.0011	1.14	0.0010	1.07	0.0008	0.86	0.0009	0.93
Top1	0.0030	1.17	0.0030	1.15	0.0032	1.21	0.0034	1.29	0.0032	1.25
Lnmindex	0.0000	0.11	0.0000	0.05	0.0000	0.05	0.0001	0.26	0.0001	0.17
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.0681		0.0695		0.0686		0.0717		0.0690
F		21.95***		20.63***		20.36***		21.35***		20.47***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

but this is not the case for state controlled listed firms, where the coefficient on Dfinr is insignificant at −0.0015 (−0.0133 + 0.0118).

In summary, holding equity stakes in financial institutions does not improve firm performance. As these firms are larger, more profitable, and have abundant cash before becoming involved in the financial sector, their actual performance deteriorates.

5.6. Additional tests

5.6.1. Other dimensions of firm performance

We further investigate the economic consequences of holding equity stakes in financial institutions by testing the effect on other dimensions of firm performance apart from profitability; transaction costs (Debtcost), market performance (stock returns), and cash-holdings.[13]

First, we test changes in transaction costs around investing in the financial sector and find the investment to be associated with a higher cost of debt, as the coefficient on Dfin is positive and significant. Investing in financial institutions raises leverage and overdrawing financial capacity, which may increase the cost of debt. The coefficient on Ratio1 * GOV is also positive and significant, so the effects on the cost of debt for state-controlled firms are therefore even higher.

Second, by using the mean of weekly market adjusted idiosyncratic stock returns during a year, Rw, to represent the stock price performance, we find that this is not influenced by holding equity stakes in financial

[13] To save space, the empirical results are not reported but are available upon request.

Table 7a
Effect of holding equity stakes in financial institutions on firm performance (dependent variable: ROA).

	(21)		(22)		(23)		(24)		(25)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.2208	6.84***	0.2209	6.84***	0.2210	6.85***	0.2250	6.97***	0.2276	7.06***
Dfin	−0.0021	−0.92	−0.0018	−0.69	0.0006	0.22	0.0004	0.15	0.0024	0.98
Dfinb			−0.0009	−0.28						
Dfinr					−0.0053	−1.61				
Ratio1							−0.0905	−2.69***		
Ratio2									−0.0787	−5.01***
Size	−0.0089	−5.73***	−0.0089	−5.73***	−0.0089	−5.73***	−0.0090	−5.83***	−0.0091	−5.91***
LEV	−0.0174	−3.09***	−0.0173	−3.08***	−0.0170	−3.03***	−0.0177	−3.14***	−0.0161	−2.87***
Q	0.0128	12.33***	0.0128	12.32***	0.0127	12.28***	0.0128	12.35***	0.0127	12.29***
Risk	−0.1176	−2.33**	−0.1176	−2.33**	−0.1170	−2.32**	−0.1158	−2.29**	−0.1149	−2.28**
Lnage	−0.0213	−5.53***	−0.0213	−5.54***	−0.0213	−5.52***	−0.0215	−5.58***	−0.0219	−5.71***
GOV	−0.0121	−4.44***	−0.0122	−4.45***	−0.0122	−4.47***	−0.0121	−4.44***	−0.0121	−4.45***
Top1	0.0792	9.99***	0.0792	9.98***	0.0789	9.96***	0.0785	9.90***	0.0781	9.86***
Lnmindex	0.0012	0.93	0.0012	0.93	0.0012	0.93	0.0011	0.85	0.0011	0.81
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.1043		0.1043		0.1047		0.1053		0.1076
F		36.58***		34.99***		35.11***		35.34***		36.20***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

institutions. In regressions of Model 2, the coefficients on indicators of holding equity stakes in financial institutions are all insignificant at a 5% level. Decreases in the accounting performance are therefore not reflected or identified by the market.

Third, we find that as its holding of equity stakes in the financial sector deepens, a firm's cash-holding decreases, so investing in financial institutions consumes cash reserves. The coefficient on Ration1 * GOV is also negative and significant, indicating that this effect is even greater for state-controlled firms. This of course can be a mixed blessing, as it also reduces free cash flow.

5.6.2. Robustness checks

To reinforce our empirical results we conduct four types of robustness checks.[14]

First, we check the robustness of the influence of government control through the interaction of GOV and the determining variables of exploring the motivations. In the main tests, we conduct regressions for state-controlled and non-state-controlled samples separately, and when using the interactions of GOV and the determinants (HHI, Q, ROA, Debtcost, Size, Lnage, and Cashholding), the results are consistent with those in Table 5a.

Second, we repeat the tests using only Group 3 firms to examine the influence on profitability of holding equity stakes in financial institutions. These firms did not invest in financial institutions at the beginning of the research period, but made later investments, which they held to the end of the research period. The results are essentially the same as those in the main tests.

Third, we redo the tests after excluding equity investments in finance firms, which are established to serve the financial matters within a group, and therefore internalize transaction costs. The results are consistent with those including finance firms.

[14] To save space, the empirical results are not reported but are available upon request.

Table 7b
Effect of holding equity stakes in financial institutions on firm performance: effects of government control (dependent variable: ROA).

	(26)		(27)		(28)		(29)		(30)	
	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value	Coef.	*T* value
Constant	0.2210	6.84***	0.2207	6.83***	0.2220	6.87***	0.2250	6.96***	0.2277	7.06***
Dfin	−0.0024	−0.70	−0.0005	−0.13	0.0049	1.07	0.0008	0.22	0.0019	0.50
Dfinb			−0.0043	−0.82						
Dfinr					−0.0133	−2.44**				
Ratio1							−0.0949	−2.35**		
Ratio2									−0.0630	−3.23***
Dfin * GOV	0.0004	0.11	−0.0018	−0.38	−0.0062	−1.18	−0.0006	−0.16	0.0006	0.14
Dfinb * GOV			0.0051	0.83						
Dfinr * GOV					0.0118	1.85*				
Ratio1 * GOV							0.0054	0.18		
Ratio2 * GOV									−0.0218	−1.41
Size	−0.0089	−5.73***	−0.0089	−5.72***	−0.0089	−5.76***	−0.0090	−5.83***	−0.0092	−5.92***
LEV	−0.0174	−3.09***	−0.0174	−3.10***	−0.0173	−3.07***	−0.0176	−3.13***	−0.0162	−2.87***
Q	0.0128	12.33***	0.0128	12.32***	0.0127	12.27***	0.0128	12.34***	0.0127	12.24***
Risk	−0.1175	−2.33**	−0.1177	−2.33**	−0.1166	−2.31**	−0.1160	−2.30**	−0.1138	−2.26**
Lnage	−0.0213	−5.53***	−0.0214	−5.54***	−0.0213	−5.54***	−0.0215	−5.58***	−0.0219	−5.69***
GOV	−0.0123	−4.12***	−0.0124	−4.16***	−0.0126	−4.22***	−0.0120	−4.03***	−0.0118	−3.97***
Top1	0.0792	9.99***	0.0793	10.00***	0.0788	9.94***	0.0784	9.89***	0.0780	9.85***
Lnmindex	0.0012	0.94	0.0012	0.95	0.0013	1.01	0.0011	0.85	0.0010	0.78
Year	Controlled		Controlled		Controlled		Controlled		Controlled	
R^2 within		0.1043		0.1044		0.1051		0.1053		0.1078
F		34.99***		32.21***		32.45***		32.50***		33.39***
OBS		8113		8113		8113		8113		8113
No. of firms		1182		1182		1182		1182		1182

Note: the *t*-values are calculated using robust standard errors.
*** Indicates the coefficient is statistically significant at 1%.
** Indicates the coefficient is statistically significant at 5%.
* Indicates the coefficient is statistically significant at 10%.

Finally, we explore any possible non-linear relationship between investing in the financial sector and firm performance by introducing the square terms of Ratio1 and Ratio2. No non-linear relationships are found in regressions on CROA, ROA, Debtcost, Rw, and Cashholding, but may exist for regressions of IROA. The square terms of Ratio1 and Ratio2 are positive and significant at a 1% level, so as the investment level in financial institutions increases, the investment income may first decrease and then increase. The relation is U-shaped. However, to conform to other regressions, we do not include the square item in the main tests.

6. Conclusions and future research

An increasing number of commercial firms have become involved in the financial sector during the process of establishing multi-layered capital markets in China. These firms are keen to obtain equity stakes in banks and firms dealing in securities, venture capital and private equity, insurance, finance, investment and trusts, guarantees, futures, asset management, investment funds, and pawnshops, etc. Integrating banking (finance) and commerce has been the subject of debate in both practice and in theory for many years, but empirical evidence on the commercial ownership of banks (and/or financial firms) is scarce. In this study, we provide evidence by comprehensively investigating the motivations and economic consequences of commercial firms entering the financial sector.

From a sample of Chinese nonfinancial listed A-share firms from 1999 to 2012, we find that there are numerous motivations for them to hold equity stakes in financial firms. They may be alleviating the competition pressure in the commercial sector, reducing transaction costs, diversifying operations, or obtaining precious permits.

We also find that investment income can increase after a firm holds equity stakes in financial institutions, but this is only the case for non-state-controlled firms, and overall operating income decreases, which cannot be offset by the increase in investment income. The return on assets declines as a result. Furthermore, after investing in financial institutions the cost of debt rises, cash-holding falls, and stock returns do not improve.

In summary, investing in financial institutions does not result in improvements in operating performance, nor does it reduce transaction costs. Given that these firms are larger, more profitable, and possess abundant cash reserves before becoming involved in the financial industry, their overall performance does in fact deteriorate. This contrasts with the view that the large-scale investment of capital from the commercial sector is chasing opportunities in the financial sector. Our empirical results caution regulators in the financial sector and decision-makers in the commercial sector when considering or allowing entry into the financial sector.

The empirical tests in this study are comprehensive but general. Research can further examine the integration of finance and commerce. Deeper insights can be gained on the effects on both the financial and the commercial sectors. The effects of holding equity stakes in financial institutions on investment and financing decision-making processes of firms in the commercial sector can, for example, be investigated further. In general, more studies on commercial firms' ownership in financial firms would be of benefit, as the current evidence is slim.

Acknowledgement

Liping Xu and Yu Xin are grateful for the valuable comments from the referee and for the financial support from the National Natural Science Foundation of China (Project Nos.: 71372151 and 71272201).

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China Journal of Accounting Research 10 (2017) 127–139

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China Journal of Accounting Research

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

Geographical relationships and CEO compensation contracts

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ARTICLE INFO

Article history:
Received 30 September 2015
Accepted 15 March 2017
Available online 25 April 2017

JEL classification:
G39
M49

Keywords:
Geographical relationships
Culture
CEO compensation
Pay–performance sensitivity

ABSTRACT

In this paper, we empirically analyze the effects that the geographical relationships between chairman and CEO have on the latter's compensation contracts, based on samples of listed A-share private firms from 2005 to 2014. We find that geographical relationships are related to lower pay–performance sensitivity, and that the correlation mainly exists in poor performance periods, suggesting that geographical relationships weaken the effectiveness of compensation contracts. We also find that geographical relationships can be substituted by external formal institutions.
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1. Introduction

CEO compensation contracts lie at the core of firm governance. Effective contracts relieve the agency problems that stem from a separation between ownership and management (Jensen and Meckling, 1976; Jensen and Murphy, 1990). However, the compensation contract is not a perfect tool for situations involving information asymmetry and limited rationality. CEOs tend to take opportunistic actions in their pursuit of private benefits, and shareholders rarely know that it is happening. From a Western perspective, agency problems are thought to be solved by external institutions. Yet while perfect property protection systems and legal mechanisms can improve contract enforcement (Williamson, 1985), emerging and transitioning environments such

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http://dx.doi.org/10.1016/j.cjar.2017.03.001
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as China cannot provide complete external institutional control, which can lead to inadequate property protection and legal penalty mechanisms (Chalos and O'Connor, 2004). As such, some studies treat social relationships as an alternative mechanism, as they provide motivation and reduce information asymmetry. The possible positive effects of social relationships are referred to as the substitution hypothesis (Wang, 2005; Zhao and Lv, 2015). Other research finds that social relationships reduce boards' supervision effectiveness. The possible negative effects of social relationships are referred to as the weakening hypothesis (Core et al., 1999; Hwang and Kim, 2009). In this paper, we test which of the aforementioned hypotheses is deterministic.

This paper focuses on representative social and geographical relationships to test their effects on compensation contracts. Geographical relationships are generated by one's proximity to another. From a sociological perspective, Chinese society is constructed through classifications and relationships. Classifications are the most fundamental informal social construct upon which relationships are built (Pan, 2000). "Countryman" is a common classification. As Fei (1948) says, Chinese social relationships form concentric circles, with home in the center. In addition to genetic relationships, geographical relationships and clanship are also important in China (Ma, 2008). In contrast to Zhao and Lv (2015), who focus on genetic relationships, we doubt the universality of altruism in genetic relationships (Wang et al., 2014; Wei and Chen, 2015). Compared with academic and colleague relationships, for which there is relatively little information, the effects of geographical relationships on contracts have been recorded (Cai et al., 2008) and are common in practice (Lu and Hu, 2014). Some studies find that geographical relationships influence economic behavior. For instance, informal financial organizations in Wenzhou built a credit network using geographical relationships to ultimately lower credit rates (Guo and Liu, 2002). However, geographical relationships can also increase firm risk (Lu and Hu, 2014) and reduce the effectiveness of internal control (Yu et al., 2017). Thus, the effects of social relationships on compensation contracts deserve to be explored.

We empirically analyze the effects of geographical relationships on the effectiveness of compensation contracts (compensation–performance sensitivity, also known as pay-performance sensitivity). We show that the sensitivity is lower in firms with geographical relationships. To distinguish between the substitution hypotheses and weakening hypotheses, we test the compensation stickiness and performance. According to the weakening hypothesis, geographical relationships can increase compensation stickiness. If geographical relationships act as umbrellas for CEOs' self-serving behavior, then compensation–performance sensitivity should only decrease in declining performance periods. According to the substitution hypothesis, CEO supervision does not rely on compensation contracts, and as such the reduction in compensation–performance sensitivity should be bi-directional. Our empirical result shows that the weakening effects of geographical relationships are only significant in declining periods, which supports the weakening hypothesis. We also test for the cross-sectional differences in institutions and find that the weakening effect is only significant in poor external institutions, indicating that governing by relationships may not be as powerful as doing so by institutional constraints. The abovementioned results remain robust after eliminating alternative mechanisms and endogeneity.

Our research makes several contributions to the literature. First, it supplements the relevant work being conducted in emerging and transitional markets. Studies on the effects of social relationships on compensation are largely based on developed markets (Core et al., 1999; Hwang and Kim, 2009; Fracassi and Tate, 2012). We also distinguish between two possible hypotheses and show how geographical relationships weaken CEO supervision. Second, unlike the research that focuses on clanship (Zhao and Lv, 2015), we explore geographical relationships to achieve a more universal conclusion. Finally, we emphasize the effectiveness of formal institutions to help guide regulators.

The remainder of this paper is organized as follows. The second section features a literature review, the third presents our theory and hypotheses, the fourth covers the research design, the fifth shares the empirical results and the final section concludes the paper.

2. Literature review

2.1. Board of directors and manager compensation

Early research is characterized by its focus on the effect of board structure on compensation contract effectiveness (Cyert et al., 1997), with board size as a deterministic factor of CEO variable compensation. When the

CEOs also serve as chairpersons, their compensation is typically 20–40% higher than average. Moreover, CEO compensation is negatively related to board shareholdings, and Brickley et al. (1997) confirm the positive relationship between duality and higher payment. Core et al. (1999) measure board effectiveness using an eight-structure index with items such as CEO–director separation and board size. They find that board effectiveness is negatively related to CEO payment. Cordeiro and Veliyath (2003) show that the ratio of independent directors is positively related to CEO cash payment. Chhaochharia and Grinstein (2009) reveal that following the Sarbanes–Oxley Act (2002), increases in independent director ratios lead to reduced CEO compensation.

Some Western studies explore the effect of boards on managerial compensation from a social network perspective. They suppose that every economic organization and person exists within a social network, such that all decisions are influenced by others and a firm's governance is influenced by its network. Core et al. (1999) show that in firms where the directors have more extensive external social relationships, CEO compensation is excessive, and ultimately damages managerial supervision. Larcker et al. (2005) confirm that in firms with social directors, CEO compensation is significantly higher, but future business performance is poorer. Some studies discuss how the private relationships between directors and CEOs affect managerial compensation. Hwang and Kim (2009) measure the private relationships between directors and CEOs based on army service experience, graduation from the same college, shared hometowns and shared major acquaintances. In firms where the directors have no private relationships with the CEOs, the latter's compensation is lower (reduced by $3.3 million on average). In firms where the directors and CEOs share private relationships, the latter's compensation– and layoff–performance sensitivity are lower. Engelberg et al. (2013) find that the presence of private relationships between CEOs and directors is related to higher CEO payment (increased by $17,000 on average), based on 2700 CEOs of large listed firms from 2000 to 2007. Faleye et al. (2011) confirm that private relationships between directors and managers increase managers' compensation. Armstrong et al. (2006) show that in firms where directors and managers share private relationships, compensation is higher, but future firm performance is poor.

2.2. Geographical relationships and firm behavior

In China, relationship culture is deeply rooted in the public psyche and thus tends to dominate behavior. Lin and Sun (2005) find that in situations lacking formal institution, geographical relationships can reduce search and trust costs between organizations and improve informal finance development. Guo and Liu (2002) find that geographical relationships provide informal financial institutions in Wenzhou with adequate information about the operating conditions, backgrounds and credit of mid- and small-sized firms, which reduces the credit risk. This also relieves the small-to-medium enterprise financing problem. Close relationships between shareholders and managers also largely reduce supervision costs and the likelihood of negative behavior. Liu and Chen (2012) also show that informal financial institutions in Wenzhou use social relationships to reduce credit risk. Industry clusters formed from geographical relationships benefit from the continuous interaction between firms and economy of scale (Li, 2008). However, there has been little research on internal geographical relationships' effects on internal behavior. Lu and Hu (2014) discuss the geographical relationships between directors and CEOs at the firm risk level and find that firms with them suffer higher financial risk and more takeovers.

Some researchers are aware of the effects that geographical relationships have on compensation contracts. Some studies show that such relationships have wide-reaching and profound effects when external institutions are inadequate. However, there is not enough research in the Chinese context, which makes our research both valuable and necessary.

3. Theory and hypotheses

3.1. Geographical relationships and the effectiveness of compensation incentives

Research on geographical relationships and how they influence the effectiveness of compensation incentives can be conducted from two sides: supervision and incentive.

From the supervision side, social relationships weaken contract enforcement. Social norms replace formal regulations in guiding behavior (Uzzi, 1996). Social relationships can reduce directors' independence and CEOs' sense of responsibility to maximize shareholders' benefits. For instance, Hwang and Kim (2009) find that in firms where the directors and CEOs have private relationships, the payment– and layoff–performance sensitivities are lower. Kramarz and Thesmar (2013) also find that CEOs with private relationships are less likely to be replaced for poor performance. Lu and Hu (2014) show that in firms with geographical relationships, director supervision is relaxed, increasing firm risk. These results suggest that social relationships can reduce directors' supervision incentives, which may reduce the effectiveness of compensation contracts.

From the incentive side, both compensation contracts and social relationships can provide incentives for CEOs to reduce agency costs. Becker (1974, 1976) proposes altruism incentives. When family members serve as CEOs, the clanship can provide incentives to reduce dependence on compensation contracts (Zhao and Lv, 2015). Social relationships can also protect reputations. Pan (2000) shows that the social relationship between two individuals is also an indication of individual existence in certain groups. For example, in a geographical relationship, both parties are from the same hometown group, and any opportunistic behavior may damage a member's reputation in the group (Standifird and Marshall, 2000). Finally, social relationships reduce information asymmetry (Adams and Ferreira, 2007), as directors' are less likely to demand accounting numbers by which to judge CEO performance (Yang et al., 2014). Thus, from the incentive side, social relationships reduce the demand for compensation contracts, along with their effectiveness.

Both the weakening hypothesis and the substitution hypothesis suggest that social relationships reduce the effectiveness of compensation contracts. Hence, we propose the first hypothesis:

H1. Ceteris paribus, compensation–performance sensitivity is lower in firms with geographical relationships.

3.2. Weakening or substitution?

Both the weakening hypothesis and the substitution hypothesis refer to lower compensation–performance sensitivity, but the effects of geographical relationships on compensation contract effectiveness differ between them. Compensation stickiness can be a good entry point to distinguish between the two hypotheses. Under the supervision hypothesis, geographical relationships reduce director supervision, resulting in lower compensation–performance sensitivity during poor performance periods because the ineffectiveness makes CEOs more likely to behave opportunistically. When firm performance is poor, CEOs tend to protect their own benefits first, keeping compensation high despite the drop in performance. When firm performance is good, CEOs may pursue higher compensation, creating a positive relationship. Under the substitution hypothesis, geographical relationships provide CEOs with incentives to reduce their self-serving behavior. Then, the payment–performance sensitivity is low, regardless of firm performance. Meanwhile, if geographical relationships become the protection system in a hometown group, the reputation-pursuing incentive drives CEOs to decrease their self-serving behavior. Finally, as Ouchi (1980) and Adams and Ferreira (2007) mention, geographical relationships can reduce information asymmetry and make performance judgments independent of financial numbers, reducing payment–performance sensitivity independent of firm performance.

Accordingly, we propose two alternative hypotheses:

H2a. Ceteris paribus, the negative connection between geographical relationship and compensation–performance sensitivity only exists in poor performance periods.

H2b. Ceteris paribus, the negative connection between geographical relationship and compensation–performance sensitivity exists both in good and poor performance periods.

4. Research design

4.1. Sample and data sources

In terms of CEO compensation, we focus on CEOs' salaries because stock-based incentives are not common at present, and salaries are still the primary composition of executive compensation (Xin et al., 2007; Fang, 2009).

We use the private listed companies that issued A-shares from 2005 to 2014 as the initial sample. We exclude (1) companies with incomplete board chairman and CEO information; (2) companies with a dual chairman/CEO; (3) financial and insurance firms; (4) special treatment (ST) or particular transfer (PT) firms; (5) companies where the chairman and the CEO are the same person; and (6) companies for which financial data are missing. Our final sample includes 4017 firm–year observations for the 2005–2014 period. To avoid the effects of extreme values, all of the continuous variables are winsorized at both the top and bottom percentiles.

Using executive information (name list, tenure, etc.) from the China Stock Market and Accounting Research (CSMAR) listed company database, we manually collect personal information from prospectuses, annual reports, company Websites, the SINA Finance website and other public channels. To characterize the strength of the geographical relationship, we quantify the distance (proximity) between the chairman and the CEO using the latitude and longitude of his or her birth locationusing Google Earth. We then obtain external governance circumstance data from the Fan et al. (2011) marketization index. Other financial data are from the CSMAR databases.

4.2. Empirical model and variable constructions

Following the compensation model developed by Xin and Tan (2009) and Fang (2009), we estimate the following regression model:

$$\begin{aligned}\mathrm{Comp}_{it} = {} & \beta_0 + \beta_1 \mathrm{Geodist}_{it}(\mathrm{Province}_{it}) + \beta_2 \mathrm{ROA}_{it} + \beta_3 \mathrm{Geodist}_{it}(\mathrm{Province}_{it}) * \mathrm{ROA}_{it} \\ & + \beta_{4-12} \mathrm{Control\ Variables}_{it-1} + \varepsilon_t\end{aligned}$$

The dependent variable, Comp, refers to the CEO's compensation. The independent variables refer to the geographical relationships, and we proxy for these connections using two variables: Province and Geodist. Province is an indicator variable that is equal to 1 if the birthplaces of the board chairman and the CEO are in the same province, and 0 otherwise. Geodist is the negative distance between the birthplaces of the board chairman and the CEO. All of the variables are as defined in Table 1.

5. Results

5.1. Descriptive statistics

Table 2 presents our descriptive data. The mean and standard deviation (SD) of CEO compensation (Comp) are 12.63 and 0.86, respectively. The mean and SD of geographical relationship (Province) are 0.46 and 0.50, respectively. Geodist, another indicator of geographical relationships, has a minimum value of 11.89, a maximum value of 0, a mean of 0.54 and an SD of 0.71, indicating a larger difference in the geographical relationship between board chairpersons and CEOs. In addition, the mean of return on assets (ROA) is 0.04, with a median ROA of 0.03, suggesting that the majority of the firms are profitable.

5.2. Empirical results

Based on Model 1, we use a regression and a two-way cluster (in the firm and two standard error dimensions) to test our hypotheses, and the results are as follows.

Table 1
Variable definitions.

Name	Definition
Comp	Natural log of CEO compensation
Province	Indicator variable that is equal to 1 if the birthplaces of the board chairman and the CEO are in the same province, and 0 otherwise
Geodist	Negative distance between the birthplaces of the board chairman and the CEO (mileage)
Law	Marketization index of 'market intermediary organizations and the legal system environment index' from the Fan et al. index (2011)
Size	Natural log of total assets
Lev	Total liabilities divided by total assets
ROA	Net income divided by total assets
RET	Stock market annual return rate
Listage	Number of years the firm has been listed
First	First major shareholders' holdings divided by the total number of shares
Growth	Average sales growth over the past two years
Age	CEO's age
Degree	Indicator variable that is equal to 1 if the CEO has had higher education experience, and 0 otherwise
Gender	Indicator variable that is equal to 1 if the CEO is male, and 0 otherwise
Director_totco	Number of positions in other company
Year	Year control variable
Industry	Industry control variable

Table 2
Descriptive statistics.

Variable	N	Mean	Std	Min	Lower quartile	Median	Upper quartile	Max
Comp	4017	12.63	0.86	4.94	12.11	12.69	13.20	16.12
Province	4017	0.46	0.50	0	0	0	1	1
Geodist	4017	−0.54	0.71	−11.89	−1.05	−0.30	0	0
Law	4017	8.71	1.93	4.81	7.27	8.77	10.42	11.80
Size	4017	21.71	1.14	19.27	20.88	21.60	22.39	25.14
Lev	4017	0.50	0.20	0.08	0.36	0.51	0.64	0.97
ROA	4017	0.04	0.06	−0.19	0.01	0.03	0.06	0.22
RET	4017	0.38	0.96	−0.75	−0.28	0.03	0.80	4.03
Listage	4017	12.47	4.44	0	9	12	16	30
First	4017	0.38	0.15	0.09	0.26	0.36	0.50	0.75
Growth	4017	0.21	0.49	−0.65	−0.01	0.14	0.30	3.20
Age	4017	46.87	5.92	33	43	47	51	61
Degree	4017	0.35	0.48	0	0	0	1	1
Gender	4017	0.95	0.22	0	1	1	1	1
Director_totco	4017	1.00	2.10	0	0	0	1	11

Table 3 presents the regression results of the effects of geographical relationships on compensation–performance sensitivity. The second and fourth columns report the results after controlling for correlated variables. As the results show, the coefficient on the interaction terms between Province and ROA is negative and significant at the 5% level, regardless of controls or other correlated variables. Similarly, we find that the coefficient on the interaction terms between Geodist and ROA is negative and significant at the 1% level. Taken together, these results provide some support for H1, that geographical relationships decrease compensation–performance sensitivity, consistent with the previous research.

We further find that the adverse effects of geographical relationships on compensation–performance sensitivity are caused by monitoring decreases in the effectiveness of the board, or the alternative role played by geographical relationships in relation to compensation contracts. Table 4 reports the results.

Columns 1 and 2 of Table 4 present the effects that geographical relationships have on compensation–performance sensitivity when performance is good (higher than last year). As the results show, the coefficients on

Table 3
Geographical relationships and CEO compensation.

	(1)	(2)	(3)	(4)
Province * ROA	−0.775**	−0.804**		
	(−2.08)	(−2.55)		
Geodist * ROA			−0.682***	−0.594***
			(−2.92)	(−2.82)
Province	−0.036	0.008		
	(−1.16)	(0.31)		
Geodist			−0.027	−0.039**
			(−1.30)	(−2.21)
ROA	4.426***	3.980***	4.349***	3.248***
	(12.08)	(10.82)	(8.44)	(10.15)
Law		0.088***		0.089***
		(7.25)		(7.36)
Size		0.212***		0.211***
		(13.03)		(13.12)
Lev		0.031		0.034
		(0.36)		(0.41)
RET		−0.008		−0.007
		(−0.49)		(−0.46)
Listage		−0.003		−0.0037
		(−0.80)		(−0.85)
First		−0.426***		−0.4150***
		(−3.61)		(−3.52)
Growth		−0.046*		−0.0463*
		(−1.68)		(−1.77)
Age		0.011***		0.0101***
		(4.00)		(3.86)
Degree		0.024		0.0225
		(0.68)		(0.64)
Gender		0.073		0.0759
		(1.10)		(1.17)
Director_totco		0.035***		0.0349***
		(4.20)		(4.19)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Constant	11.882***	6.351***	11.925***	6.356***
	(111.28)	(15.08)	(71.09)	(15.54)
N	4017	4017	4017	4017
Adj. R^2	0.239	0.355	0.137	0.357

Standard errors are in brackets.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

the interaction terms between geographical relationships and ROA are also negative, but not significant. In contrast, Columns 3 and 4 present the effects of geographical relationships on compensation–performance sensitivity when performance is poor (lower than last year). As the results show, the coefficient on the interaction terms between geographical relationships and ROA is negative and significant ($p < 0.01$ and $p < 0.05$, respectively).

Thus, the negative effects that geographical relationships have on compensation–performance sensitivity only appear in cases of poor performance, supporting H2a. We find that in companies with geographical relationships where the directors' monitoring effectiveness has been reduced, there is less performance–sensitive CEO compensation.

Table 4
Performance, geographical relationships and CEO compensation.

	Good performance		Poor performance	
	(1)	(2)	(3)	(4)
Province * ROA	−1.019		−0.924***	
	(−1.56)		(−3.12)	
Geodost * ROA		−0.625		−0.689**
		(−1.38)		(−2.20)
Province	0.046		−0.010	
	(1.21)		(−0.45)	
Geodist		−0.029		−0.045**
		(−0.75)		(−2.18)
ROA	4.600***	3.727***	3.839***	3.006***
	(10.62)	(7.15)	(8.01)	(8.23)
Law	0.086***	0.087***	0.090***	0.090***
	(6.61)	(8.64)	(6.41)	(9.99)
Size	0.203***	0.201***	0.218***	0.218***
	(11.66)	(9.07)	(10.79)	(11.25)
Lev	0.161	0.167	−0.053	−0.051
	(1.37)	(1.29)	(−0.60)	(−0.51)
RET	−0.022	−0.022	0.009	0.011
	(−0.83)	(−1.10)	(0.90)	(0.42)
Listage	−0.008	−0.008	−0.000	−0.000
	(−1.58)	(−1.58)	(−0.05)	(−0.07)
First	−0.382**	−0.371***	−0.449***	−0.437***
	(−2.13)	(−2.61)	(−3.94)	(−3.66)
Growth	−0.059	−0.060*	−0.028	−0.026
	(−1.16)	(−1.88)	(−1.28)	(−0.83)
Age	0.010**	0.006**	0.011***	0.010***
	(2.44)	(2.52)	(4.65)	(3.61)
Degree	0.036	0.035	0.012	0.011
	(0.76)	(0.83)	(0.34)	(0.30)
Gender	0.137*	0.146	0.024	0.023
	(1.69)	(1.48)	(0.30)	(0.36)
Director_totco	0.038***	0.038***	0.032***	0.031***
	(4.51)	(4.31)	(3.07)	(3.12)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Constant	7.142***	7.208***	6.232***	6.217***
	(16.07)	(13.69)	(13.27)	(13.94)
N	1495	1495	2522	2522
Adj. R^2	0.314	0.317	0.369	0.371

Standard errors are in brackets.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

5.3. Further analysis and robustness checks

5.3.1. The substitution effect between formal institutions and geographical relationships

Our main analysis shows that geographical relationships have complex effects on CEO compensation. Nevertheless, it is important to determine whether such an informal institution is necessary. Theoretically, if the external formal institutions are perfect, there is no need to resort to the informal institution. In this section, we further test the substitution effect between formal institutions and geographical relationships, as it influences the effects that geographical relationships have on CEO compensation under different institutional environments. As Table 5 shows, geographical relationships only significantly affect CEO compensation in cases of

Table 5
Geographical relationships and CEO compensation under different institutional environments.

	Good institution		Poor institution	
	(1)	(2)	(3)	(4)
Province * ROA	−0.521		−0.873**	
	(−0.92)		(−2.30)	
Geodost * ROA		−0.586		−0.563*
		(−1.37)		(−1.73)
Province	−0.073*		0.075*	
	(−1.85)		(1.93)	
Geodist		−0.065**		−0.008
		(−2.20)		(−0.29)
ROA	3.747***	3.152***	4.245***	3.493***
	(6.07)	(6.74)	(12.59)	(8.27)
Law	0.105***	0.100***	0.045**	0.047**
	(4.15)	(4.08)	(2.25)	(2.43)
Size	0.214***	0.216***	0.215***	0.213***
	(8.54)	(8.07)	(9.50)	(10.12)
Lev	−0.003	−0.005	0.101	0.107
	(−0.03)	(−0.04)	(1.03)	(0.81)
RET	0.007	0.009	−0.022	−0.021
	(0.33)	(0.47)	(−0.78)	(−0.94)
Listage	0.000	0.001	−0.008	−0.009
	(0.03)	(0.10)	(−1.15)	(−1.61)
First	−0.273*	−0.258	−0.584***	−0.576***
	(−1.81)	(−1.59)	(−4.15)	(−4.16)
Growth	−0.069**	−0.075**	−0.029	−0.025
	(−2.03)	(−2.15)	(−1.11)	(−0.88)
Age	0.007**	0.007*	0.012***	0.012***
	(2.35)	(1.89)	(3.22)	(3.17)
Degree	0.092*	0.089*	−0.032	−0.034
	(1.77)	(1.77)	(−0.92)	(−0.80)
Gender	0.007	0.015	0.138	0.137
	(0.09)	(0.19)	(1.27)	(1.33)
Director_totco	0.039***	0.038***	0.030**	0.029***
	(4.00)	(4.13)	(2.58)	(2.61)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Constant	6.665***	6.147***	7.753***	7.852***
	(9.99)	(9.50)	(13.94)	(15.78)
N	2068	2068	1949	1949
Adj. R^2	0.266	0.269	0.356	0.356

Standard errors are in brackets.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

poor institutional environments, suggesting that formal institutions have a substitution effect on geographical relationships.

5.3.2. The effects of other types of social connections

A number of recent papers emphasize how other types of social connections (relatives, colleagues, etc.) between executives or directors affect CEO compensation, and as such may affect our conclusion reliability. To account for such a possibility, in this section, we perform two tests. First, following Zhao and Lv (2015), we delete the samples with related connections between board Chairman and CEO. Second, we control for colleague connections by creating a new variable, *Inside*: an indicator variable that is equal to 1 if the CEO

Table 6
Control for other types of social connections.

	(1)	(2)
Province * ROA	−0.957***	
	(−2.59)	
Geodist * ROA		−0.737**
		(−2.37)
Province	0.040	
	(1.26)	
Geodist		−0.021
		(−0.88)
ROA	3.962***	3.082***
	(10.24)	(8.60)
Inside	0.074**	0.074**
	(2.39)	(2.03)
Law	0.089***	0.090***
	(6.12)	(9.69)
Size	0.207***	0.205***
	(11.96)	(10.81)
Lev	0.074	0.075
	(0.80)	(0.74)
RET	−0.012	−0.012
	(−1.07)	(−0.71)
Listage	−0.002	−0.002
	(−0.34)	(−0.40)
First	−0.419***	−0.409***
	(−3.47)	(−3.34)
Growth	−0.044	−0.045*
	(−1.49)	(−1.86)
Age	0.012***	0.011***
	(3.85)	(3.50)
Degree	0.031	0.031
	(0.82)	(0.83)
Gender	0.105	0.109
	(1.57)	(1.42)
Director_totco	0.041***	0.041***
	(5.05)	(5.22)
Year	Yes	Yes
Industry	Yes	Yes
Constant	7.215***	7.293***
	(16.77)	(15.56)
N	4017	4017
Adj. R^2	0.349	0.351

Standard errors are in brackets.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

comes from inside the company, and 0 otherwise. As Table 6 shows, after excluding other types of social connections, the results are similar to those in Table 3.

5.3.3. Endogeneity

A concern with these regressions is endogeneity. To grant our analysis more generality, we extend our analysis by testing whether our results may be driven by omitted variables. We also apply other sample specifications – board chairman or CEO turnover – that lead to changes in geographical relationships. Table 7 presents the results of these tests, which address the concern that our results may be driven by an unobserved characteristic.

Table 7
Changes in geographical relationships.

	(1)	(2)	(3)	(4)
Province * ROA	−0.708	−0.629*		
	(−1.40)	(−1.78)		
Geodost * ROA			−0.763***	−0.673**
			(−3.87)	(−2.37)
Province	−0.021	−0.002		
	(−0.89)	(−0.07)		
Geodist			−0.018	−0.055***
			(−0.90)	(−3.02)
ROA	4.012***	3.133***	4.176***	2.470***
	(7.88)	(7.04)	(8.04)	(6.03)
Law		0.094***		0.094***
		(5.81)		(6.01)
Size		0.238***		0.237***
		(10.41)		(10.19)
Lev		−0.066		−0.060
		(−0.78)		(−0.71)
RET		−0.011		−0.011
		(−0.41)		(−0.44)
Listage		−0.005		−0.005
		(−0.92)		(−0.88)
First		−0.508***		−0.498***
		(−3.37)		(−3.37)
Growth		−0.044		−0.042
		(−1.53)		(−1.49)
Age		0.010***		0.009***
		(4.45)		(4.04)
Degree		0.061		0.059
		(1.55)		(1.51)
Gender		0.019		0.020
		(0.18)		(0.19)
Director_totco		0.035***		0.035***
		(3.07)		(3.14)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Constant	13.014***	6.719***	12.412***	6.715***
	(99.08)	(10.71)	(59.58)	(10.66)
N	1616	1616	1616	1616
Adj. R^2	0.235	0.354	0.134	0.357

Standard errors are in brackets.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

6. Conclusion

There is growing interest in CEO compensation, both in practice and in the academic literature. Most studies focus on formal institutions, yet due to the traditional social structure and the imperfection of external institutional environments, informal institutions such as *GuanXi* have had widespread influence in corporate governance practices. In this study, we explore whether social connections among board chairpersons and CEOs affect CEO compensation. In particular, we inquire whether geographical relationships influence CEO compensation. Using data on private listed companies that issued A–shares from 2005 to 2014, we find that firms with geographical relationships typically exhibit lower levels of compensation–performance sensitivity. Further testing shows that the effects of geographical relationships only weaken compensation–perfor mance sensitivity significantly in cases of poor performance. These findings suggest that geographical relation-

ships reduce boards' monitoring effectiveness. We also find that geographical relationships only have significant effects on CEO compensation in cases of poor institutional environments and SOE, suggesting that formal institutions have a substitution effect on geographical relationships. Controlling for other types of social connection and endogeneity, our results are also statistically and economically significant.

We analyze the effects of geographical relationships on CEO compensation. In doing so, our work complements the literature by adding a new dimension to our understanding of the factors that affect CEO compensation. Our results highlight the influence that informal institutions can have on firm governance, and the importance of improving external formal institutions.

Acknowledgments

The authors are grateful to Prof. Donghua Chen, Qingquan Xin and the anonymous referees for their helpful comments and suggestions. The view is of the authors, as of course are any errors. The authors gratefully acknowledge financial support from China Postdoctoral Science Foundation (2016M601606) and Humanity and Social Science Youth foundation of Ministry of Education of China (15YJC790137).

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China Journal of Accounting Research 10 (2017) 141–166

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China Journal of Accounting Research

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

Female directors and real activities manipulation: Evidence from China

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ARTICLE INFO

Article history:
Received 23 December 2015
Accepted 14 December 2016
Available online 22 February 2017

JEL classification:
G32
G34
J70
M41

Keywords:
Female director
Gender diversity
Earnings management
Real activities manipulation
Corporate governance

ABSTRACT

Unlike previous studies that focus on accrual-based earnings management, this study analyzes real activities manipulation and investigates whether female directors on boards of directors (BoDs) affect managers' real activities manipulation. Using a large sample of 11,831 firm-year observations from Chinese listed companies from the 2000 to 2011 period, we find that higher female participation on BoDs is associated with lower levels of real activities manipulation, and that this negative relationship is stronger when female directors have higher ownership. These results hold for a battery of robustness checks. Overall, our findings indicate that board gender diversity may serve as a substitute mechanism for corporate governance to curb real activities manipulation and thus provide interested stakeholders with higher quality earnings reports.

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1. Introduction

In recent years, board gender diversity has drawn considerable attention worldwide, especially after the 2008 economic crisis (Sun et al., 2015; Terjesen et al., 2009). Despite the rapid increase in female participation in business in the last decade (Rose, 2007; Srinidhi et al., 2011), female directors are still underrepresented on corporate boards. Some European countries (e.g., Sweden, Norway and Spain) now impose legal requirements on corporations to allocate board seats to women. For example, Spain introduced legislation requiring a 40%

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http://dx.doi.org/10.1016/j.cjar.2016.12.004
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threshold for female board representation by the end of 2015. In this context, the economic benefits of female directors must be determined (Gul et al., 2011). If board gender diversity was known to increase firm value, firms would be willing to accept female directors on their boards even without legislation. The purpose of this study was to explore the role of female directors in curbing managers' real activities manipulation.

Managers have professional responsibilities and ethical obligations to report high quality earnings to outside stakeholders, such as investors and regulators (Krishnan and Parsons, 2008). However, self-serving managers all over the world are inclined to manipulate earnings to beat/meet benchmarks (Burgstahler and Dichev, 1997; DeGeorge et al., 1999; Liu and Lu, 2007). Generally, there are two earnings management strategies: accrual-based and real activities earnings manipulation (Cohen et al., 2008; Cohen and Zarowin, 2010; Zang, 2012). Prior studies of the effect of female directors focus on accrual-based earnings management and produce mixed results (Fields et al., 2001; Srinidhi et al., 2011; Sun et al., 2011). We argue that analyzing only one earnings management strategy fails to capture the overall effect of board gender diversity. In particular, as managers use the two earnings management strategies as substitutes for each other (Achleitner et al., 2014; Cohen et al., 2008; Cohen and Zarowin, 2010; Zang, 2012), a focus on accrual-based earnings management can be expected to lead to inconclusive results. Furthermore, in emerging economies such as China, where investors have a relatively low demand for high quality earnings and firms face low litigation risks (Allen et al., 2005; Chen et al., 2008; Liu and Tian, 2012), it is less costly for firms to manipulate accruals (Kuo et al., 2014). Thus, in emerging economies, female directors may play a more important role in curbing real activities manipulation. Finally, unlike accrual-based earnings management, which is achieved by exercising discretion over accruals in light of accounting principles, real activities manipulation is achieved by altering the timing and scale of operations, investments or financing transactions, which have real adverse economic consequences on a firm's long-term profitability and growth (Achleitner et al., 2014; Bereskin et al., 2014; Cohen and Zarowin, 2010; Gunny, 2010; Kim and Sohn, 2013; Zang, 2012). Given this fundamental difference, we predict that female directors, who are characterized by a lower tolerance of opportunism, less overconfidence and greater risk aversion, and as better monitors (Adams and Ferreira, 2009; Barber and Odean, 2001; Gul et al., 2011; Hillman et al., 2007; Krishnan and Parsons, 2008; Srinidhi et al., 2011; Sundén and Surette, 1998), may play a stronger role than male directors in curbing managers' real activities manipulation. However, few studies examine the potential effect of female directors on real activities manipulation.

Studies of corporate governance must focus on not only how an individual mechanism works, but also how the interaction of different mechanisms mitigates agency problems (Kim and Lu, 2011). That is, understanding how board gender diversity interacts with other mechanisms to curb real activities manipulation is also an important issue. On the one hand, the role of female directors largely depends on their personal characteristics, which may change under certain conditions, as all human beings, regardless of gender, are inevitably emotional and more or less opportunistic. In other words, the effectiveness of female directors in curbing managers' real activities manipulation may be unstable. Therefore, it is important for firms to design firm-level mechanisms that formalize and even enhance the role of female directors. On the other hand, stakeholders have long been interested in mechanisms that can mitigate earnings manipulation and improve earnings quality (Krishnan and Parsons, 2008). Thus, it is meaningful to know whether the role of board gender diversity is unique and irreplaceable. If the role of female directors is unique, stakeholders should voluntarily push firms to increase female board representation, as firms would otherwise depend on traditional mechanisms rather than a gender-diverse board. However, to date, little is known about the interactions between board gender diversity and other governance mechanisms.

To fill these knowledge gaps, we develop a conceptual model of the links between female participation on boards of directors (BoDs) and real activities manipulation. As ownership structure is one of the most cited influences on agency problems (Shleifer and Vishny, 1997), we further examine the moderating effect of stock ownership on the association between female participation on BoDs and real activities manipulation. We test this model in the context of China because it is the largest emerging economy in the world, and despite its severe earnings management (Kuo et al., 2014; Liu and Lu, 2007; Qi et al., 2014), little is known about real activities manipulation there. In general, there is limited evidence from emerging economies on whether BoDs are able to discipline managers' earnings management. Hence, a focus on Chinese firms allows us to extend the boundaries of existing knowledge on the antecedents of real activities manipulation. Moreover, the social status of women in China is assumed to be relatively high due to the policy of gender equality that has been

implemented by the Communist Party of China since its founding in 1949 (Leung, 2003; Peng et al., 2009). Therefore, China provides a good setting for examining the potential effects of gender diversity on corporate behavior and decision making.

Using a large sample of 11,831 firm-year observations from Chinese A-share listed firms for the 2000–2011 period, we find that when a firm has a critical mass of women serving on its BoD, i.e., at least 3 women or a high ratio of women on BoD, its managers engage in less real activities manipulation. In addition, we find that the negative relation is more pronounced when female directors hold higher ownership, indicating that stock ownership may enhance the role of female directors in curbing real activities manipulation. To further verify our findings, we undertake a battery of robustness checks. First, we split the role of female directors from that of female CEOs/chairmen by introducing female CEOs/chairmen as a control variable in the regressions, and find that female CEOs/chairmen have no significant relation with real activities manipulation; more importantly, our results are robust to this test. Second, we differentiate the governance effects of inside and outside female directors and find that although our results are valid for both, the effects are stronger for inside directors. Third, as firms with less real activities manipulation may be more likely to appoint women to serve on BoDs, we use the Heckman two-stage selection model and the propensity score matching (PSM) approach to address the issue of endogenous selection, and our findings still hold. Fourth, given the unique context of Chinese listed firms' two-tier boards, i.e., a BoD and a supervisory board, we examine the association between female participation on two-tier boards and real activities manipulation and arrive at similar findings. Fifth, as China's split share structure reform occurred during our sample period, we explore the effect of the reform on the role of female directors and get consistent and significant findings only in the subsample after the reform. Sixth, we examine the association of female participation on BoDs for each category of real activities manipulation, i.e., sales manipulation, overproduction and discretionary fees manipulation. The results indicate that female participation on BoDs curbs managers' real earnings management mainly through reducing sales manipulation and overproduction. Finally, as several studies have documented a trade-off between accrual-based and real activities earnings management (Achleitner et al., 2014; Cohen et al., 2008; Cohen and Zarowin, 2010; Zang, 2012), we also examine the role of female directors in curbing accrual-based earnings management and rerun the regressions by adding the level of accrual-based earnings management as a control variable. The results suggest that female directors have no relation with accrual-based earnings management, while our findings still hold after controlling for the potential trade-off between two kinds of earnings management.

This study makes several contributions to the literature. First, we extend the literature on female directors by showing that female participation on BoDs can help to curb managers' real activities manipulation. Female directors have received increasing research attention all over the world (Adams and Ferreira, 2009; Bear et al., 2010; Chen et al., 2016; Fields et al., 2001; Gul et al., 2011; Jia and Zhang, 2012, 2013; Jin et al., 2014; Srinidhi et al., 2011; Sun et al., 2015; Terjesen et al., 2009). To our knowledge, we are among the first to examine whether female directors may discipline managers who are engaging in real activities manipulation. Specifically, this study finds evidence that female directors can effectively curb real activities manipulation but not accrual-based earnings management.

Second, we contribute to the growing literature on real activities manipulation in the area of earnings management. Real activities manipulation is detrimental to a firm's long-term growth and competitive advantages (Achleitner et al., 2014; Bereskin et al., 2014; Cohen and Zarowin, 2010; Gunny, 2010; Kim and Sohn, 2013; Zang, 2012). In particular, scholars argue that real activities manipulation is largely opaque to outside stakeholders and less easy to be detected than accrual-based strategies of earnings management (Ge and Kim, 2014; Graham et al., 2005; Zang, 2012). However, we have limited knowledge of the mechanisms for solving this agency problem. In this study, we find evidence showing that board gender diversity is an effective mechanism for alleviating real activities manipulation.

Finally, we not only examine how female directorships work, but also explore how female directors may interact with other governance mechanisms to curb managers' real activities manipulation. More precisely, this study finds that female directors' ownership enhances their role in curbing real activities manipulation. In this way, our study helps to deepen our understanding of the role of female directors. In addition, these results have important practical implications for firms and regulators. In particular, they suggest that firms can make full use of the role of female directors by implementing stock-based compensation schemes.

2. Literature review and hypotheses development

2.1. Literature review

To examine the role of female directors in curbing real activities manipulation, we bring together two different strands of research.

First, this study builds on studies of board gender diversity. Although gender differences have been widely discussed in the psychology, sociology and economics fields, scholars have only begun to link gender diversity to corporate behavior and outcomes in the past two decades (Terjesen et al., 2009). Scholars initially explored the association between board gender diversity and firm performance, but the results of these early studies are inconclusive. For example, some studies find that board gender diversity is beneficial to firm performance (e.g., Campbell and Mínguez-Vera, 2008; Erhardt et al., 2003), some fail to get a significant finding (e.g., Carter et al., 2010; Rose, 2007) and others conclude that board gender diversity is detrimental to firm outcomes (e.g., Adams and Ferreira, 2009; Haslam et al., 2010). Particularly, Joecks et al. (2013) document a U-shaped relationship between board gender diversity and firm performance, indicating that a critical mass of female directors achieves the best performance. Thus, the economic effect of board gender diversity is an ongoing debate.

As firm performance is a complex function of many factors, more recent research has largely examined the role of board gender diversity in specific types of corporate behavior. For instance, studies document that female directors can improve corporate social performance and particularly increase corporate philanthropy (e.g., Bear et al., 2010; Jia and Zhang, 2011, 2012, 2013; Post et al., 2011; Williams, 2003), which is consistent with the common view that women care more about others and think more highly of social responsibility than men. Apart from this, as women have long been viewed as more risk averse than men (Barber and Odean, 2001; Byrnes et al., 1999; Sundén and Surette, 1998), scholars have examined the role of female directors in shaping corporate risk-taking behavior. They find that firms with higher female director participation have lower leverage, invest less in R&D, achieve lower investment efficiency and make fewer takeover defenses (Adams and Ferreira, 2009; Chen et al., 2016; Jin et al., 2014). In addition, more gender-diverse boards are found to play a better monitoring role by promoting higher board attendance, joining more monitoring committees and demanding greater accountability for managers' poor performance (Adams and Ferreira, 2009; Hillman et al., 2007), indicating that female directors are better and more active monitors.

However, evidence on the effect of board gender diversity on corporate accounting decision making is limited and the results are mixed.[1] For example, Gul et al. (2011) find that female directors are associated with higher earnings quality. Similarly, Srinidhi et al. (2011) document that female directors can improve the informativeness of stock prices by disclosing more firm-specific information and stimulating the collection of private information. However, Sun et al. (2011) fail to identify an association between female directors on audit committees and the extent of accrual-based earnings management. Given these limited and inconclusive results, the role of female directors in corporate accounting decision making is still an open question and requires more research.

Second, our study builds on research on real earnings management. Generally, managers have two different strategies for managing firms' earnings: accrual-based and real activities earnings management (Cohen et al., 2008; Cohen and Zarowin, 2010; Ge and Kim, 2014; Zang, 2012). Unlike the accrual-based strategy, which does not harm corporate daily operations or have real outcomes, real activities strategies are detrimental to a firm's growth and competitive advantages due to their long-term effects on sales manipulation, overproduction and abnormal reduction of discretionary expenses (Cohen et al., 2008; Graham et al., 2005; Roychowdhury, 2006; Zang, 2012). For example, Zhang et al. (2008) document that meager-profit enterprises in China engage in real activities manipulation to avoid losses. Gunny (2010) finds that real activities manipulation is positively associated with firms merely meeting earnings benchmarks, and that such manipulation

[1] Likewise, evidence for the effect of gender diversity among top executives on corporate accounting decision making is also mixed. For instance, whereas Krishnan and Parsons (2008) show that earnings quality is positively associated with gender diversity in senior management, Ye et al. (2010) find insignificant differences in the discretionary accruals of firms with female and male top executives in China.

adversely affects subsequent performance. Similarly, Francis et al. (2011) show that insiders use real activities to hide bad information, which results in a higher risk of future stock price crash. Taking a step further, Bereskin et al. (2014) and Lian et al. (2014) document that managing real earnings by cutting R&D expenses significantly reduces the number of subsequent innovations and their technological importance and novelty. In addition, Kim and Sohn (2013) and Ge and Kim (2014) find that outside investors and bondholders require a higher risk premium for real activities manipulation. That is, focal firms suffer a higher cost of capital caused by real activities manipulation.

As real activities manipulation results in adverse economic consequences, it is a critical and striking issue to understand how to alleviate this opportunistic behavior, particularly after the survey by Graham et al. (2005) demonstrated that real activities management is a common practice. Roychowdhury (2006) finds that sophisticated institutional investors are able to curtail real activities manipulation. Similarly, Wongsunwai (2013) finds that IPO firms backed by higher quality venture capitalists experience lower real activities manipulation. Moreover, recent studies have found evidence indicating that media coverage and Big 4 auditors are effective external governance mechanisms for alleviating real earnings management (e.g., Qi et al., 2014; Zhu et al., 2015). Despite this progress, few studies examine the effectiveness of internal governance mechanisms. One exception is a study by Ge and Kim (2014), who find that real earnings management increases with better board governance and decreases with higher takeover protection, indicating that tough board monitoring may enhance managerial incentives for real earnings management while takeover protection may reduce it. In essence, scholars have reached a consensus that as real activities manipulation is opaque to outside stakeholders and thus largely not subject to external monitoring scrutiny (Ge and Kim, 2014; Graham et al., 2005; Zang, 2012), internal governance mechanisms should play a stronger role. However, there is limited evidence to support this consensus.

Therefore, in this study, we investigate the influence of board gender diversity on real activities manipulation.

2.2. Hypothesis development

Previous studies have identified three reasons why board gender diversity engenders less real activities manipulation. Although these reasons may also be applicable to accrual-based earnings management/quality (Gul et al., 2011; Srinidhi et al., 2011), we argue that they are more powerful and persuasive in explaining the mechanisms through which female directors affect real activities earnings management. We outline the three mechanisms as follows.

First, female participation on BoDs optimizes the board structure and improves boards' abilities and effectiveness in monitoring managers' real activities manipulation. Generally speaking, a board with diverse expertise will have a broader scope of action and exhibit more perspectives in making board decisions (Srinidhi et al., 2011). Accordingly, female participation on BoDs brings different experiences that enrich board discussions and thus improves the quality of board decisions (Hillman et al., 2007). Specifically, studies of organization theory suggest that female participation facilitates the discussion of tough issues and promotes board communications (Clarke, 2005; Huse and Solberg, 2006; Joy, 2008). In addition, Adams and Ferreira (2009) find that a more gender-diverse board is associated with higher board attendance by both male and female directors and more demands for accountability for managers' poor performance. Therefore, female participation improves a board's monitoring abilities and effectiveness. As real earnings management is largely nested in normal operation activities and thus difficult to detect (Ge and Kim, 2014; Graham et al., 2005; Zang, 2012), detecting it requires great diligence and energy from boards. In this sense, female participation helps boards to achieve this difficult task.

Second, as they are better at monitoring, female directors are better at curbing managers' real activities manipulation. As Adams and Ferreira (2009) find, relative to male directors, female directors have better board attendance records and are more likely to join monitoring committees such as the audit, nominating and corporate governance committees. In other words, female directors provide better oversight of managers' opportunistic behavior (Adams and Ferreira, 2009; Hillman et al., 2007). Furthermore, studies suggest that female directors tend to behave and think more independently than their male counterparts (Adams et al.,

2010; Carter et al., 2003), which is crucial for effective monitoring (Srinidhi et al., 2011). Therefore, female directors as monitors can help boards to better detect real earnings management.

Finally, female directors may exhibit less tolerance for managers' real activities manipulation and require a higher earnings quality from managers. Many studies provide evidence that women are usually more risk averse, less overconfident and less tolerant of opportunistic behavior than men. For example, Bernardi and Arnold (1997) find that women, on average, score higher than men on a moral development measure in public accounting firms, suggesting that women are more sensitive to unethical opportunistic issues. Likewise, Sundén and Surette (1998) examine gender differences in the allocation of assets in retirement savings plans and find that women are less likely than men to invest in stocks and other risky assets. Furthermore, Barber and Odean (2001) find that women, on average, hold securities for a longer period than men, indicating that women are less overconfident in their abilities and thus trade less frequently. Therefore, as real activities manipulation is unethical and risky and has profound adverse economic consequences (Achleitner et al., 2014; Bereskin et al., 2014; Cohen and Zarowin, 2010; Gunny, 2010; Zang, 2012), female directors, because of their general ethical differences from men, are more likely to reject real activities manipulation.

In summary, as female directors are more risk averse, less tolerant of opportunistic behavior and more active and better monitors than male directors, they can improve boards' total monitoring abilities and effectiveness. Thus, we predict that firms with gender-diverse boards experience less real activities manipulation. Therefore, we put forward the first testable hypothesis.

Hypothesis 1. Firms with gender-diverse boards engage in less real activities manipulation.

To ensure that female directors create economic benefits, it is important to understand how to make full use of their gender-specific differences. In this study, we argue that stock ownership is one of the best mechanisms for enhancing and formalizing the role of female directors in curbing real activities manipulation. As classic economics and agency theory suggest, all human beings are rational and self-interested economic beings with their own utility functions (Berle and Means, 1932; Jensen and Meckling, 1976). In particular, as organizational roles may override traditional gender roles, female directors may have values and needs more similar to the males in their organizations than to females who are not part of their organizations (Shawver and Clements, 2015). That is, female directors are also rational and self-interested actors. As stock ownership aligns the interests of female directors with other stakeholders, female directors with high ownership are more likely to have a stronger monitoring role in curbing managers' real activities manipulation. Furthermore, stock ownership, specifically getting returns based on future long-term performance, induces female directors to pursue a firm's long-term growth and value (Kim and Lu, 2011). In this regard, as real activities manipulation involves operating actions that deviate from normal business practices (e.g., sales manipulation, overproduction, cutting discretionary expenses) and harm firms' competitive advantages and long-term value (Achleitner et al., 2014; Bereskin et al., 2014; Cohen and Zarowin, 2010; Ge and Kim, 2014; Gunny, 2010; Zang, 2012), female directors with high ownership have stronger incentives to monitor managers' opportunistic activities. In short, stock ownership reinforces the role of female directors in detecting real activities manipulation. Therefore, we put forward the second testable hypothesis.

Hypothesis 2. Stock ownership enhances the negative association between board gender diversity and real activities manipulation.

3. Research design

3.1. Sample and data

The initial sample includes all of the firms listed on both the Shanghai and Shenzhen Stock Exchanges in the 2000–2011 period. Panel A of Table 1 details the sample selection process. After collecting the full sample of 18,531 firm-year observations, we screen the target sample using the following step-by-step criteria: (1)

Table 1
Sample selection and distribution.

Panel A: Sample selection process

Initial firm-year observations	18,531
Step 1: Eliminate firm-year observations for firms with a status of ST, *ST or PT	(1180)
Step 2: Eliminate firm-year observations for firms that issue debt exceeding the asset value	(279)
Step 3: Eliminate firm-year observations for firms that belong to financial industries	(264)
Step 4: Eliminate firm-year observations for firms that issue B- and/or H-shares to foreign investors	(1359)
Step 5: Eliminate firm-year observations where data required to measure variables used in this study are not available	(3618)
Final firm-year observations	11,831

Panel B: Sample distribution by year and industry

Industry	Code	Year												Total by industry	%
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
Agribusiness	A	9	13	16	18	19	21	24	25	26	26	32	34	263	2.22
Mining	B	10	11	14	17	16	21	18	21	26	31	34	39	258	2.18
Manufacturing	C	291	352	416	457	486	515	576	565	619	703	760	915	6655	56.25
Public utilities	D	26	30	31	30	35	42	46	44	45	56	53	56	494	4.18
Construction	E	5	5	8	8	11	15	18	18	20	26	29	35	198	1.67
Transportation	F	10	11	15	18	19	23	26	26	28	44	45	48	313	2.65
Information technology	G	35	42	47	51	50	58	59	56	65	70	81	118	732	6.19
Wholesale, retail and trade	H	61	60	72	73	78	78	78	77	82	85	93	98	935	7.9
Real estate	J	61	65	68	73	73	69	66	60	66	76	80	90	847	7.16
Social service	K	20	20	23	26	26	29	30	30	34	38	37	45	358	3.03
Communication and culture	L	9	10	10	11	13	12	11	10	11	12	11	15	135	1.14
Conglomerate	M	46	54	55	54	55	53	51	53	54	54	56	58	643	5.43
Total by year		583	673	775	836	881	936	1003	985	1076	1221	1311	1551	11,831	
%		4.93	5.69	6.55	7.07	7.45	7.91	8.48	8.33	9.09	10.32	11.08	13.11		100

remove 1180 firm-years for firms that have a transaction status of special treatment (ST), suspension from trading (*ST) or particular transfer (PT); (2) remove 279 firm-years for firms that issue debt exceeding the asset value; (3) remove 264 firm-years for firms belonging to financial industries; (4) remove 1359 firm-years for firms that issue B- and/or H-shares to foreign investors; and (5) remove 3618 firm-years with missing data for measured variables. Our final sample includes 1680 unique firms and 11,831 firm-year observations. Panel B of Table 1 reports our sample distribution by year and industry. We obtain the data from the China Stock Market & Accounting Research (CSMAR) database, which is designed and developed by Shenzhen GTA Information Technology Company, a major provider of Chinese data.

3.2. Measures

3.2.1. Dependent variables

To capture *real activities manipulation*, we follow Roychowdhury (2006) and Cohen and Zarowin (2010) to estimate an aggregate measure based on abnormal levels of cash flows from operations (*RM_CFO*), discretionary expenditures (*RM_DISEXP*) and production costs (*RM_PROD*). For every firm-year, we measure *RM_CFO*, *RM_DISEXP* and *RM_PROD* as the differences between actual values and the normal levels calculated using the estimated coefficient from cross-sectional regressions for each industry and year, as given in Eqs. (1)–(3), respectively.

$$CFO_{i,t}/A_{i,t-1} = \beta_0 + \beta_1(1/A_{i,t-1}) + \beta_2(S_{i,t}/A_{i,t-1}) + \beta_3(\Delta S_{i,t}/A_{i,t-1}) + \varepsilon_t, \quad (1)$$

$$DISEXP_{i,t}/A_{i,t-1} = \beta_0 + \beta_1(1/A_{i,t-1}) + \beta_2(S_{i,t-1}/A_{i,t-1}) + \varepsilon_t \text{ and} \quad (2)$$

$$PROD_{i,t}/A_{i,t-1} = \beta_0 + \beta_1(1/A_{i,t-1}) + \beta_2(S_{i,t}/A_{i,t-1}) + \beta_3(\Delta S_{i,t}/A_{i,t-1}) + \beta_4(\Delta S_{i,t-1}/A_{i,t-1}) + \varepsilon_t, \quad (3)$$

where $CFO_{i,t}$ is the net cash flow from the operations of firm i for year t; $DISEXP_{i,t}$ is the sum of sales expenses and administrative expenses of firm i for year t[2]; $PROD_{i,t}$ is the sum of the cost of goods sold and the change in inventories of firm i for year t; $A_{i,t-1}$ is the total assets of firm i at the end of year $t-1$; $S_{i,t}$ is the sales of firm i for year t; $\Delta S_{i,t}$ is the change in the sales of firm i between year t and year $t-1$; and $\Delta S_{i,t-1}$ is the change in the sales of firm i between year $t-1$ and year $t-2$.

Then, we use *RM_CFO*, *RM_DISEXP* and *RM_PROD* variables as proxies for real activities manipulation. At given sales levels, firms that manage earnings upward are likely to have one or all of the following: unusually low cash flow from operations, low discretionary expenses and/or high production costs. Therefore, we use Eq. (4) to aggregately measure the extent of *real activities manipulation* (*RM*).

$$RM = RM\_PROD - RM\_CFO - RM\_DISEXP \tag{4}$$

In additional tests, we also use *RM_CFO*, *RM_DISEXP* and *RM_PROD* as direct measures of real activities manipulation.

3.2.2. Independent variables

Following previous studies (e.g., Adams and Ferreira, 2009; Jia and Zhang, 2013; Torchia et al., 2011; Williams, 2003), we introduce two independent variables, *critical mass of women on BoDs* and *ratio of women on BoDs*, to measure female participation on a BoD. Specifically, the *critical mass of women on BoDs* variable is a dummy variable, which equals 1 if a firm has at least three women serving on BoDs, and 0 otherwise. The *ratio of women on BoDs* variable is the proportion of female directors on a BoD. According to critical mass theory, a majority may often dismiss or devalue the opinions of a minority in the boardroom (Westphal and Milton, 2000). A relatively low level of female participation on BoDs is unlikely to have a significant effect on corporate decision making (Joecks et al., 2013; Post et al., 2011; Rose, 2007; Torchia et al., 2011). Therefore, both of our two independent variables may be needed to fully capture the potential effect of female directors on real activities manipulation.

3.2.3. Moderating variable

To test H2, we construct a moderating variable, i.e., *ownership of women on BoDs*, which is measured as the ratio of the average shares held by women on BoDs to total shares.

3.2.4. Control variables

Following Sun et al. (2011) and Qi et al. (2014), we include a number of control variables that are widely known to affect real activities manipulation. *Firm size* is measured as the natural logarithm of the number of employees. *Firm age* equals the number of years since IPO. *Firm profitability* is proxied by return on assets (ROA), which equals the ratio of profit before interest and tax over total assets. *Firm growth* is measured as the sales growth rate from year $t-1$ to year t. *Market to book value* is measured as the ratio of stock price to book value per share at the end of the year. *Firm loss* is a dummy coded 1 if a firm has a negative net income, and 0 otherwise. *External auditor* is a dummy coded 1 if a firm is audited by Big 4 auditors, and 0 otherwise. *External audit opinion* is a dummy coded 1 if a firm gets a qualified audit opinion, and 0 otherwise. *Adopting IFRS* is a dummy coded 1 after 2006 (not included), when China started to require listed firms to adopt IFRS, and 0 otherwise. *Ownership concentration* is measured as the ratio of top five shareholders' shares to a firm's total shares. *State ownership* is measured as the ratio of state shares to a firm's total shares. In addition, we generate industry and year indicators to control for industry and time effects. The definitions of all of the variables are listed in Table 2.

[2] In China, listed companies are not required to disclose their advertising expenditures and R&D expenditures separately; these expenditures are included in sales expenditures and administrative expenditures, respectively, in the fiscal reports. Therefore, the data for corporate advertising expenditures and R&D expenditures have many missing values. As an alternative, we measure discretionary expenditures as the sum of sales expenditures and administrative expenditures.

Table 2
Variable definitions.

Dependent variable	
Real activities manipulation	The sum of *RM_CFO*, *RM_PROD* and *RM_DISEXP*, in which *RM_CFO* is the abnormal cash flow from operations, measured as the product of −1 and the residuals from model (1); *RM_PROD* is the abnormal production cost, measured as the residuals from model (2); *RM_DISEXP* is the abnormal discretionary expenses, measured as the product of −1 and the residuals from model (3)
Independent variables	
Critical mass of women on BoDs	An indicator variable that equals 1 if a firm has at least three women serving on the BoD, and 0 otherwise
Ratio of women on BoDs	The ratio of the number of women serving on the BoD to the total number of directors on the BoD
Moderating variable	
Ownership of women on BoDs	The ratio of the average shares held by all of the women on the BoD to the total shares
Control variables	
Firm size	The natural logarithm of the number of employees
Firm age	The number of years since IPO
Firm profitability	Return on assets (ROA), which equals the ratio of profit before interest and tax over total assets
Firm growth	The sales growth rate for year $t-1$ to t
Market to book value	The ratio of stock price to book value per share at the end of the year
Firm loss	An indicator variable, which equals 1 when a firm has a negative net income, and 0 otherwise
External auditor	An indicator variable, which equals 1 if a firm's external auditor belongs to Big 4 auditors, i.e., Deloitte & Touche (DT), Price Waterhouse Coopers (PWC), Ernst & Young (EY) and KPMG, and 0 otherwise
External audit opinion	An indicator variable that equals 1 if a firm gets a qualified audit opinion, and 0 otherwise
Adopting IFRS	An indicator variable that equals 1 for any year after 2006 (not included), when Chinese listed firms were required to adopt IFRS
Ownership concentration	The ratio of top 5 shareholders' shares to a firm's total shares
State ownership	The ratio of state shares to a firm's total shares
Industry indicators	Each indicator variable corresponds to an industry, and equals 1 if a firm belongs to this industry, and 0 otherwise
Year indicators	Each indicator variable corresponds to a sample year, and equals 1 if an observation comes from this year, and 0 otherwise

3.3. The model

We conduct OLS regressions to test our hypotheses, where standard errors are corrected using the Huber–White procedure. To control for potential endogeneity between female directors and real activities manipulation, we use lagged values of the independent and control variables. Multicollinearity appears insignificant because the average variance inflation factor (VIF) for each regression model is much less than the cutoff point of 10 (Neter et al., 1990). We also center the interaction variables to further avoid the problem of multicollinearity. Finally, we winsorize the top and bottom 1% of each continuous variable to control the influence of some outliers.

4. Results

Table 3 reports the descriptive statistics for the main variables used in this study. In the whole sample, 8.1% of the firms have at least three female directors and the average ratio of female directors to total directors on BoDs is 10.2%, which is close to the 10.1% reported in a study by Sun et al. (2015) for a Chinese sample and higher than the 8.9% reported in Hong Kong and the 8.5% reported in the U.S., but lower than the 11.7% in the U.K. (Adams and Ferreira, 2009; Sun et al., 2015). This result suggests that although female directors are still underrepresented throughout the world, China has made great strides in increasing female participation on BoDs. However, on average, female directors own a mere 0.1% of firms' stocks, reflecting China's severe restrictions on stock-based compensation systems. In addition, 3.2% of firms use Big 4 auditors (i.e., DT, PWC, EY and KPMG), suggesting a low market share.

Table 4 displays the Pearson's correlation coefficients of the variables included in the regression models. Our two measures of female participation on BoDs, *critical mass of women on BoDs* and *ratio of women on BoDs*, are highly correlated ($r = 0.631$, $p < 0.01$). As expected, both measures are significantly and negatively related to *real activities manipulation* ($r = -0.044$, $p < 0.01$; $r = -0.058$, $p < 0.01$), preliminarily supporting Hypothesis 1 that female directors are able to curb managers' real activities manipulation. We also find a significant and negative correlation between female director ownership and real activities manipulation ($r = -0.096$, $p < 0.01$), which corroborates our argument that stock ownership may inherently motivate female directors to play a stronger role in supervising managers' earnings manipulation through real activities. In addition, almost all of the correlation coefficients for the remaining variables are less than 0.5, implying that including these variables in the regression models would create only a weak problem of multicollinearity.

Table 5 shows the results of the OLS regression analyses. Hypothesis 1 predicts that female participation on BoDs, measured by *critical mass of women on BoDs* and *ratio of women on BoDs*, has a negative relationship

Table 3
Descriptive statistics.

Variables	*N*	Mean	SD	Min	Q1	Median	Q3	Max
Real activities manipulation	11,831	−0.164	0.441	−2.544	−0.181	−0.079	0.006	0.621
Critical mass of women on BoDs	11,831	0.081	0.273	0.000	0.000	0.000	0.000	1.000
Ratio of women on BoDs	11,831	0.102	0.104	0.000	0.000	0.100	0.154	0.444
Ownership of women on BoDs	11,831	0.001	0.013	0.000	0.000	0.000	0.000	0.470
Firm size	11,831	7.389	1.278	3.584	6.690	7.480	8.210	10.305
Firm age	11,831	8.779	4.161	2.000	5.000	8.000	12.000	19.000
Firm profitability	11,831	0.057	0.065	−0.184	0.030	0.055	0.086	0.258
Firm growth	11,831	0.226	0.489	−0.678	0.002	0.153	0.338	3.146
Market to book value	11,831	1.677	0.936	0.822	1.086	1.353	1.900	6.111
Firm loss	11,831	0.106	0.308	0.000	0.000	0.000	0.000	1.000
External auditor	11,831	0.032	0.175	0.000	0.000	0.000	0.000	1.000
External audit opinion	11,831	0.945	0.229	0.000	1.000	1.000	1.000	1.000
Adopting IFRS	11,831	0.519	0.500	0.000	0.000	1.000	1.000	1.000
Ownership concentration	11,831	0.531	0.144	0.192	0.431	0.542	0.639	0.830
State ownership	11,831	0.235	0.250	0.000	0.000	0.150	0.460	0.750

All of the variables are defined in Table 2.

Table 4
Pearson's correlation matrix ($N = 11{,}831$).

Variables	1	2	3	4	5	6	7
1. Real activities manipulation	1.000						
2. Critical mass of women on BoDs	−0.044***	1.000					
3. Ratio of women on BoDs	−0.058***	0.631***	1.000				
4. Ownership of women on BoDs	−0.096***	0.039***	0.083***	1.000			
5. Firm size	−0.027***	−0.039***	−0.094***	−0.024***	1.000		
6. Firm age	0.010	0.032***	0.050***	−0.114***	−0.033***	1.000	
7. Firm profitability	−0.150***	0.008	0.001	0.044***	0.111***	−0.053***	1.000
8. Firm growth	−0.086***	−0.009	−0.008	0.006	0.009	−0.024***	0.244***
9. Market to book value	−0.113***	0.015	0.032***	0.009	−0.160***	0.112***	0.224***
10. Firm loss	0.049***	−0.006	−0.007	−0.025***	−0.061***	0.039***	−0.637***
11. External auditor	0.008	0.003	−0.030***	−0.006	0.054***	0.008	0.061***
12. External audit opinion	−0.023**	−0.014	−0.008	0.008	0.094***	−0.002	0.295***
13. Adopting IFRS	−0.216***	0.027***	0.066***	0.076***	0.054***	0.380***	0.157***
14. Ownership concentration	0.000	−0.062***	−0.082***	0.057***	0.082***	−0.408***	0.136***
15. State ownership	0.166***	−0.080***	−0.114***	−0.081***	0.119***	−0.221***	−0.035***

	8	9	10	11	12	13	14
8. Firm growth	1.000						
9. Market to book value	−0.002	1.000					
10. Firm loss	−0.179***	−0.018*	1.000				
11. External auditor	0.008	−0.055***	−0.037***	1.000			
12. External audit opinion	0.081***	−0.037***	−0.310***	0.021**	1.000		
13. Adopting IFRS	0.012	0.347***	−0.058***	−0.002	0.111***	1.000	
14. Ownership concentration	0.094***	−0.173***	−0.081***	0.088***	0.029***	−0.232***	1.000
15. State ownership	0.017*	−0.270***	0.000	0.033***	0.002	−0.412***	0.414***

All of the variables are defined in Table 2.
*** Significance at the 1% level (two sided).
** Significance at the 5% level (two sided).
* Significance at the 10% level (two sided).

with real earnings manipulation. As Table 5 shows, the variable *critical mass of women on BoDs* has a significant and negative regression coefficient (**Model 1**: $\beta = -0.021$, $p < 0.10$). Similarly, *ratio of women on BoDs* has a significant and negative regression coefficient (**Model 3**: $\beta = -0.069$, $p < 0.05$). Thus, Hypothesis 1 is supported.

Hypothesis 2 concerns the moderating effect of ownership of women on BoDs. As shown in Table 5, the coefficients on both interactions, i.e., critical mass of women on BoDs × ownership of women on BoDs and ratio of women on BoDs × ownership of women on BoDs, are significantly negative (**Model 2**: $\beta = -1.573$, $p < 0.05$; **Model 4**: $\beta = -9.487$, $p < 0.01$). These results suggest that female directors' ownership intensifies the negative association between female participation on BoDs and real activities manipulation, supporting Hypothesis 2.

5. Robustness checks

5.1. Tests for splitting the role of female directors from female CEOs/chairmen

As CEOs have overall responsibility for most corporate business decisions (Francis et al., 2013) and previous research suggests that the individual features of CEOs may shape corporate decision making and outcomes (Bertrand and Schoar, 2003; Cai et al., 2012), one may argue that if a firm has a female CEO or chairman, the role of female directors on BoDs is limited. Furthermore, a female CEO/chairman may be naturally prone to appoint female directors to the BoDs. To mitigate this concern, we re-examine the association between female directors and real activities manipulation by controlling for the presence of female CEOs/chairmen. Specifically, female CEOs are captured by a dummy variable, denoted by *female CEO*,

Table 5
Relationship between women on BoDs and real activities manipulation and the moderating effect of ownership of women on BoDs.

	Dependent variable: Real activities manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on BoDs	**−0.021***	**−0.017**		
	(−1.812)	**(−1.485)**		
Ratio of women on BoDs			**−0.069****	**−0.060***
			(−2.217)	**(−1.921)**
Critical mass of women on BoDs × Ownership of women on BoDs		**−1.573****		
		(−2.212)		
Ratio of women on BoDs × Ownership of women on BoDs				**−9.487*****
				(−3.764)
Ownership of women on BoDs		**−0.705*****		**−0.098**
		(−2.913)		**(−0.330)**
Firm size	0.004	0.003	0.003	0.003
	(1.241)	(1.157)	(1.139)	(1.073)
Firm age	0.010***	0.009***	0.010***	0.009***
	(10.570)	(9.965)	(10.521)	(9.843)
Firm profitability	−0.621***	−0.616***	−0.622***	−0.616***
	(−8.871)	(−8.801)	(−8.877)	(−8.807)
Firm growth	−0.070***	−0.071***	−0.070***	−0.071***
	(−10.485)	(−10.518)	(−10.484)	(−10.518)
Market to book value	−0.053***	−0.053***	−0.053***	−0.053***
	(−12.165)	(−12.270)	(−12.176)	(−12.326)
Firm loss	−0.052***	−0.052***	−0.052***	−0.052***
	(−3.776)	(−3.757)	(−3.780)	(−3.765)
External auditor	0.012	0.011	0.011	0.011
	(0.677)	(0.632)	(0.612)	(0.591)
External audit opinion	0.052***	0.051***	0.052***	0.050***
	(3.482)	(3.426)	(3.482)	(3.379)
Adopting IFRS	−0.005	−0.002	−0.004	−0.001
	(−0.272)	(−0.122)	(−0.205)	(−0.057)
Ownership concentration	0.058**	0.063**	0.058**	0.064**
	(2.162)	(2.341)	(2.157)	(2.394)
State ownership	−0.004	−0.007	−0.005	−0.008
	(−0.285)	(−0.447)	(−0.303)	(−0.478)
Constant	0.071	0.074	0.078*	0.080*
	(1.560)	(1.621)	(1.690)	(1.751)
Number of observations	11,831	11,831	11,831	11,831
VIF value	3.41	3.28	3.42	3.31
F value	242.52***	229.35***	242.61***	229.85
Adj. R^2	40.25%	40.32%	40.26%	40.37%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before they are included in the regression models. *T*-statistics are in parentheses. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).
** Significance at the 5% level (two sided).
* Significance at the 10% level (two sided).

which equals 1 if a firm has a female CEO/chairman, and 0 otherwise.[3] Table 6 presents the empirical results.

As shown in Table 6, after controlling for female CEOs, the regression results are qualitatively similar to those in Table 5. Specifically, female participation on BoDs, as measured by both *critical mass of women on BoDs* and *ratio of women on BoDs*, still has a negative relationship with real activities manipulation. In addition, female directors' ownership still significantly moderates the association between female participation on BoDs and real activities manipulation. Female CEOs are found to have no significant relationship with real

[3] In China, board chairmen are usually legal representatives of listed companies and take overall responsibility for corporate decision making. In other words, chairmen in China act more like CEOs in Western economies such as U.S and U.K.

Table 6
Additional test for separating the role of female directors from the effect of female CEOs/chairmen.

	Dependent variable: Real activities manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on BoDs	**−0.021***	**−0.017**		
	(−1.746)	**(−1.476)**		
Ratio of women on BoDs			**−0.069****	**−0.063***
			(−2.149)	**(−1.942)**
Critical mass of women on BoDs × Ownership of women on BoDs		**−1.573****		
		(−2.210)		
Ratio of women on BoDs × Ownership of women on BoDs				**−9.485*****
				(−3.762)
Ownership of women on BoDs		**−0.706*****		**−0.106**
		(−2.902)		**(−0.357)**
Female CEO	**−0.003**	**0.001**	**0.000**	**0.004**
	(−0.255)	**(0.063)**	**(0.031)**	**(0.334)**
Firm size	0.004	0.003	0.003	0.003
	(1.231)	(1.158)	(1.139)	(1.080)
Firm age	0.010***	0.009***	0.010***	0.009***
	(10.566)	(9.965)	(10.521)	(9.840)
Firm profitability	−0.621***	−0.616***	−0.622***	−0.616***
	(−8.868)	(−8.801)	(−8.877)	(−8.809)
Firm growth	−0.070***	−0.071***	−0.070***	−0.071***
	(−10.482)	(−10.517)	(−10.484)	(−10.520)
Market to book value	−0.053***	−0.053***	−0.053***	−0.053***
	(−12.167)	(−12.269)	(−12.174)	(−12.324)
Firm loss	−0.052***	−0.052***	−0.052***	−0.052***
	(−3.778)	(−3.757)	(−3.780)	(−3.762)
External auditor	0.012	0.011	0.011	0.011
	(0.680)	(0.631)	(0.611)	(0.584)
External audit opinion	0.052***	0.051***	0.052***	0.050***
	(3.480)	(3.426)	(3.482)	(3.380)
Adopting IFRS	−0.037**	−0.034*	−0.036*	−0.033*
	(−1.984)	(−1.836)	(−1.937)	(−1.785)
Ownership concentration	0.059**	0.063**	0.058**	0.064**
	(2.170)	(2.337)	(2.154)	(2.379)
State ownership	−0.005	−0.007	−0.005	−0.007
	(−0.294)	(−0.445)	(−0.302)	(−0.469)
Constant	0.072	0.074	0.078*	0.080*
	(1.564)	(1.620)	(1.690)	(1.751)
Number of observations	11,831	11,831	11,831	11,831
F value	235.38***	222.96***	235.45***	223.45***
Adj. R^2	40.25%	40.31%	40.26%	40.37%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).
** Significance at the 5% level (two sided).
* Significance at the 10% level (two sided).

activities manipulation, perhaps because the role of femaleness in curbing earnings management is not strong enough to dominate the pressure to beat/meet performance benchmarks that CEOs/chairmen face. In summary, the presence of female CEOs/chairmen does not change our main results in Table 5 and our two hypotheses are still supported.

5.2. Tests for differentiating the effects between inside and outside female directors

This study considers both inside and outside female directors. It is commonly accepted that outside directors (e.g., independent directors in China), who are independent of firm management and have incentives to

develop and maintain their reputations as experts, may play a stronger monitoring role than inside directors (Fama and Jensen, 1983; Jiang et al., 2016). However, inside directors are usually dual-posted by firm managers and thus are more likely to side with firm management on major decisions. Therefore, it is unclear whether inside female directors have different effects on real activities management from outside female directors. To deal with this concern, we try to differentiate the governance effects of inside and outside female directors by separating the two kinds of directors and rerunning the regressions. The results are shown in Table 7.

As Table 7 shows, both inside and outside female directors are able to help firms curb real earnings management (**Model 1**: $\beta = -0.129$, $p < 0.01$; **Model 3**: $\beta = -0.341$, $p < 0.01$). To some extent, as there are more inside female directors on the board, inside female directors are found to play a stronger role than outside female directors (**Model 4**: $\beta = -0.027$, $p < 0.10$; **Model 6**: $\beta = 0.086$, $p > 0.10$). Moreover, stock ownership is found to enhance the role of inside female directors in curbing real activities manipulation (**Model 2**: $\beta = -8.338$, $p < 0.01$; **Model 5**: $\beta = -10.251$, $p < 0.01$).[4] In sum, our findings are robust for both inside and outside female directors, but stronger for inside female directors.

5.3. Tests for endogeneity concerns using the Heckman selection model and PSM approach

A major concern is that this study's findings may be subject to a potential self-selection bias problem. That is, firms with less real activities manipulation may be more likely to appoint females to serve on their BoDs. To address this potential endogenous selection, we conduct a Heckman two-stage selection model. In the first stage, we run the Probit regression model to predict female participation on BoDs, using *female CEO* as the instrumental variable and other control variables in Table 5. Then, we generate the *inverse Mills ratio* after the Probit choice regression.[5] In the second stage, we add the *inverse Mills ratio* to the OLS regression models in Table 5 to control for any endogeneity in the choice of female directors.

The results of the Heckman two-stage selection model, given in Table 8, show that the variable *inverse Mills ratio* has insignificant coefficients in all of the OLS regression models (i.e., **Models 2**–**3** and **Models 5**–**6**) that take real activities manipulation as the dependent variable, indicating that the self-selection problem is weak. More importantly, the results are consistent with the main findings given in Table 5. This suggests that female participation on BoDs curbs real activities manipulation, which disproves the hypothesis that firms with less real activities manipulation are more prone to appoint female directors. In addition, the coefficient of the instrumental variable in the first-stage model, *female CEO*, is positive and significant (**Model 1**: $\beta = 0.772$, $p < 0.01$; **Model 4**: $\beta = 1.272$, $p < 0.01$), indicating that firms with a female chairman/CEO are more likely to appoint females to their BoDs.

In our sample, only 8.1% of the firms have a critical mass of female directors on their BoDs, indicating that female directors may not be randomly distributed in firms. Therefore, to make causal interpretations of the results, we apply the PSM approach to structure the non-experimental data to look like experimental data. Specifically, we take firms with a critical mass of female directors as our experimental sample and apply the PSM approach to construct a control sample consisting of firms with highly similar characteristics but without a critical mass of female directors. Then, we estimate the causal effects of female directors on real activities manipulation by comparing the two groups in the sample. For our matching process, we follow Francis et al. (2013) and run a logistic regression of *critical mass of women on BoDs* on firm size, firm leverage and the industry and year indicators. Then, we use the propensity scores obtained from the logistic regression and perform an one-to-one nearest neighbor match without replacement. After that, we rerun our regressions in the new sample. As Table 9 shows, the results are highly consistent with those in Table 5, indicating the insignificance of the endogeneity problem and providing additional support for our hypotheses.

[4] As outside independent directors in China are not allowed to hold stock ownership in the firms they serve, we are unable to investigate the moderating effect of stock ownership on the role of outside female directors.

[5] In particular, when using the continuous variable, i.e., *ratio of women on BoDs*, to measure female participation on BoDs, we construct a dummy variable, denoted by *high ratio of women on BoDs*, that equals 1 if a firm-year's ratio of women on BoDs is no less than the median ratio of women on BoDs in the full sample and 0 otherwise, for the sake of running a Probit choice regression in the first stage.

Table 7
Additional test for differentiating the effects between inside and outside female directors.

	Dependent variable: Real activities manipulation					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Critical mass of inside women on BoDs	**−0.129*** **	**−0.125*** **				
	(−7.811)	**(−7.533)**				
Critical mass of outside women on BoDs			**−0.341*** **			
			(−11.007)			
Critical mass of inside women on BoDs × Ownership of inside women on BoDs		**−8.338*** **				
		(−2.696)				
Ratio of inside women on BoDs				**−0.072***	**−0.058**	
				(−1.916)	**(−1.545)**	
Ratio of outside women on BoDs						**0.086**
						(1.600)
Ratio of inside women on BoDs × Ownership of inside women on BoDs					**−10.251*** **	
					(−2.625)	
Ownership of inside women on BoDs		−0.476**			1.085*	
		(−2.074)			(1.736)	
Firm size	0.003	0.003	0.002	0.003	0.003	0.004
	(1.007)	(1.003)	(0.729)	(1.169)	(1.156)	(1.312)
Firm age	0.010***	0.009***	0.008***	0.010***	0.010***	0.010***
	(10.109)	(9.711)	(8.696)	(10.582)	(10.251)	(10.583)
Firm profitability	−0.612***	−0.612***	−0.565***	−0.626***	−0.625***	−0.624***
	(−8.762)	(−8.767)	(−8.090)	(−8.936)	(−8.926)	(−8.914)
Firm growth	−0.071***	−0.071***	−0.073***	−0.070***	−0.070***	−0.070***
	(−10.548)	(−10.553)	(−10.866)	(−10.486)	(−10.475)	(−10.481)
Market to book value	−0.054***	−0.055***	−0.057***	−0.053***	−0.053***	−0.053***
	(−12.538)	(−12.589)	(−13.177)	(−12.146)	(−12.187)	(−12.138)
Firm loss	−0.050***	−0.051***	−0.047***	−0.052***	−0.053***	−0.052***
	(−3.657)	(−3.682)	(−3.420)	(−3.803)	(−3.820)	(−3.784)
External auditor	0.010	0.010	0.008	0.012	0.012	0.013
	(0.566)	(0.569)	(0.436)	(0.652)	(0.656)	(0.698)
External audit opinion	0.051***	0.051***	0.048***	0.052***	0.051***	0.052***
	(3.441)	(3.421)	(3.277)	(3.507)	(3.432)	(3.509)
Adopting IFRS	−0.025	−0.023	−0.008	−0.021	−0.019	−0.021
	(−1.368)	(−1.266)	(−0.440)	(−1.112)	(−1.011)	(−1.135)
Ownership concentration	0.061**	0.062**	0.065**	0.059**	0.062**	0.062**
	(2.283)	(2.325)	(2.412)	(2.206)	(2.320)	(2.301)
State ownership	−0.008	−0.009	−0.008	−0.004	−0.005	−0.003
	(−0.479)	(−0.583)	(−0.530)	(−0.259)	(−0.337)	(−0.163)
Constant	0.101**	0.102**	0.098**	0.076*	0.076*	0.064
	(2.209)	(2.240)	(2.157)	(1.651)	(1.651)	(1.401)
Number of observations	11,831	11,831	11,831	11,831	11,831	11,831
F value	245.460	231.992	248.5180	242.544	229.151	242.488
Adj. R^2	40.54%	40.60%	40.84%	40.26%	40.30%	40.25%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).
** Significance at the 5% level (two sided).
* Significance at the 10% level (two sided).

5.4. Tests for the effects of women on two-tier boards

China does not use the Anglo–Saxon unitary board model; publically listed firms are required by the Company Law to operate a two-tier board system (e.g., a BoD and a supervisory board) (Firth et al., 2007; Xiao et al., 2004). According to China's Company Law, a BoD is a firm's decision-making unit and the supervisory board serves largely as a monitoring mechanism (Jia and Zhang, 2011). Accordingly, one concern may emerge

Table 8
Additional test for the self-selection problem using the Heckman two-stage selection model.

	First stage	Second stage	Second stage	First stage	Second stage	Second stage
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Critical mass of women on BoDs		**−0.021***	**−0.017**			
		(−1.742)	**(−1.471)**			
Ratio of women on BoDs					**−0.071****	**−0.064****
					(−2.193)	**(−1.974)**
Critical mass of women on BoDs × Ownership of women on BoDs			**−1.573****			
			(−2.211)			
Ratio of women on BoDs × Ownership of women on BoDs						**−9.481*****
						(−3.761)
Ownership of women on BoDs			**−0.706*****			**−0.108**
			(−2.898)			**(−0.363)**
Inverse Mills ratio		**0.006**	**−0.001**		**−0.004**	**−0.010**
		(0.283)	**(−0.032)**		**(−0.201)**	**(−0.457)**
Female CEO	**0.772*****			**1.272*****		
	(14.908)			**(20.681)**		
Firm size	−0.051***	0.003	0.003	−0.065***	0.003	0.003
	(−3.296)	(1.083)	(1.106)	(−5.971)	(1.146)	(1.162)
Firm age	−0.000	0.010***	0.009***	−0.009**	0.010***	0.009***
	(−0.064)	(10.562)	(9.965)	(−2.447)	(10.457)	(9.827)
Firm profitability	0.565	−0.618***	−0.616***	−0.125	−0.621***	−0.616***
	(1.463)	(−8.737)	(−8.715)	(−0.473)	(−8.873)	(−8.798)
Firm growth	−0.024	−0.071***	−0.071***	0.020	−0.070***	−0.071***
	(−0.635)	(−10.485)	(−10.501)	(0.780)	(−10.481)	(−10.527)
Market to book value	−0.038	−0.053***	−0.053***	−0.028*	−0.053***	−0.053***
	(−1.607)	(−12.062)	(−12.122)	(−1.704)	(−12.106)	(−12.236)
Firm loss	0.031	−0.052***	−0.052***	−0.007	−0.052***	−0.052***
	(0.412)	(−3.765)	(−3.756)	(−0.131)	(−3.777)	(−3.758)
External auditor	0.113	0.013	0.011	−0.406***	0.012	0.013
	(1.158)	(0.706)	(0.623)	(−5.766)	(0.643)	(0.696)
External audit opinion	−0.126	0.051***	0.051***	−0.055	0.052***	0.050***
	(−1.591)	(3.402)	(3.393)	(−0.989)	(3.488)	(3.399)
Adopting IFRS	−0.161	−0.038**	−0.034*	0.183***	−0.037*	−0.035*
	(−1.532)	(−2.008)	(−1.815)	(2.585)	(−1.946)	(−1.829)
Ownership concentration	−0.605***	0.056*	0.063**	−0.320***	0.059**	0.066**
	(−4.128)	(1.955)	(2.222)	(−3.126)	(2.166)	(2.431)
State ownership	−0.506***	−0.007	−0.007	−0.251***	−0.004	−0.006
	(−5.494)	(−0.389)	(−0.370)	(−4.212)	(−0.243)	(−0.352)
Constant	−0.284	0.066	0.075	0.495***	0.080*	0.085*
	(−1.170)	(1.357)	(1.524)	(2.866)	(1.690)	(1.809)
Number of observations	11,831	11,831	11,831	11,831	11,831	11,831
F/Chi^2 value	505.22***	235.38***	222.96***	1079.78***	235.45***	223.45***
Adj. R^2/Log likelihood	−3085.7013	40.25%	40.31%	−7655.7020	40.26%	40.37%

The dependent variables of **Model 1**, **Model 4** and other models are *critical mass of women on BoDs*, *high ratio of women on BoDs* and *real activities manipulation* respectively, where *high ratio of women on BoDs* is a dummy variable that equals 1 if a firm-year ratio of women on BoDs is no less than the median ratio of women on BoDs in the full sample, and 0 otherwise. The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. T/Z-statistics are in parentheses. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

about our findings: does female participation in the supervisory board matter to real activities manipulation? To address this concern, we generate two new variables to capture female participation on two-tier boards, i.e., *critical mass of women on two-tier boards* and *ratio of women on two-tier boards*. More precisely, the variable *critical mass of women on two-tier boards* is a dummy variable that equals 1 if a firm has at least three

Table 9
Additional test for the endogeneity concern using the PSM approach.

	Dependent variable: Real activities manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on BoDs	**−0.047****	**−0.044****		
	(−2.544)	**(−2.394)**		
Ratio of women on BoDs			**−0.145****	**−0.134****
			(−2.200)	**(−2.012)**
Critical mass of women on BoDs × Ownership of women on BoDs		**−7.007*****		
		(−2.645)		
Ratio of women on BoDs × Ownership of women on BoDs				**−20.684****
				(−2.506)
Ownership of women on BoDs		3.872		3.467
		(1.637)		(1.489)
Firm size	0.007	0.007	0.006	0.006
	(0.818)	(0.817)	(0.718)	(0.699)
Firm age	0.009***	0.008***	0.009***	0.008***
	(3.585)	(3.171)	(3.569)	(3.195)
Firm profitability	−0.542***	−0.519***	−0.534***	−0.514**
	(−2.707)	(−2.595)	(−2.663)	(−2.570)
Firm growth	−0.049**	−0.050**	−0.050**	−0.051**
	(−2.459)	(−2.511)	(−2.507)	(−2.546)
Market to book value	−0.068***	−0.069***	−0.068***	−0.069***
	(−5.759)	(−5.821)	(−5.750)	(−5.864)
Firm loss	−0.070*	−0.068*	−0.069*	−0.069*
	(−1.713)	(−1.673)	(−1.689)	(−1.701)
External auditor	−0.055	−0.060	−0.058	−0.061
	(−0.996)	(−1.092)	(−1.052)	(−1.105)
External audit opinion	0.034	0.031	0.036	0.030
	(0.804)	(0.730)	(0.841)	(0.707)
Adopting IFRS	−0.010	−0.003	−0.009	−0.003
	(−0.181)	(−0.055)	(−0.157)	(−0.047)
Ownership concentration	0.111	0.127	0.117	0.140*
	(1.437)	(1.638)	(1.515)	(1.809)
State ownership	−0.015	−0.020	−0.016	−0.020
	(−0.314)	(−0.417)	(−0.321)	(−0.422)
Constant	0.099	0.089	0.101	0.093
	(0.730)	(0.659)	(0.743)	(0.683)
Number of observations	1841	1841	1841	1841
F value	37.357***	35.870***	37.274***	35.750***
Adj. R^2	39.47%	39.88%	39.42%	39.80%

For the matching process, we follow Francis et al. (2013) to run a logistic regression of *critical mass of women on BoDs* on firm size, firm leverage and industry and year indicators and then use the propensity scores obtained from the logistic regression and perform an one-to-one nearest neighbor match without replacement. The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

women serving on two-tier boards, and 0 otherwise; the variable *ratio of women on two-tier boards* is calculated as the ratio of women serving on two-tier boards. We then rerun the regression analyses using these two new variables as independent variables.

Table 10 presents the results for the effects of women on two-tier boards. The variable *critical mass of women on two-tier boards* in **Models 1–2** consistently has negative coefficients at the 5% significance level; *ratio of women on two-tier boards* in **Models 3–4** consistently has negative coefficients at the 5% significance level at least. For the moderating effect of ownership of women on two-tier boards, the interaction term has significant and negative coefficients (**Model 2**: $\beta = -1.437$, $p < 0.05$; **Model 4**: $\beta = -11.438$, $p < 0.01$). These results sug-

Table 10
Additional test for the effects of women on two-tier boards on real activities manipulation and other determinations.

	Dependent variable: Real activities manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on two-tier boards	**−0.016****	**−0.015****		
	(−2.284)	**(−2.132)**		
Ratio of women on two-tier boards			**−0.084*****	**−0.076****
			(−2.727)	**(−2.491)**
Critical mass of women on two-tier boards × Ownership of women on two-tier boards		**−1.437****		
		(−2.142)		
Ratio of women on two-tier boards × Ownership of women on two-tier boards				**−11.438*****
				(−3.722)
Ownership of women on two-tier boards		**−1.168*****		**−1.019*****
		(−3.830)		**(−3.360)**
Firm size	0.004	0.003	0.003	0.003
	(1.251)	(1.134)	(1.066)	(0.970)
Firm age	0.010***	0.009***	0.010***	0.009***
	(10.554)	(9.841)	(10.549)	(9.694)
Firm profitability	−0.623***	−0.616***	−0.620***	−0.613***
	(−8.900)	(−8.801)	(−8.862)	(−8.759)
Firm growth	−0.070***	−0.070***	−0.070***	−0.071***
	(−10.461)	(−10.503)	(−10.479)	(−10.531)
Market to book value	−0.053***	−0.053***	−0.053***	−0.053***
	(−12.142)	(−12.284)	(−12.132)	(−12.310)
Firm loss	−0.052***	−0.052***	−0.052***	−0.052***
	(−3.788)	(−3.759)	(−3.801)	(−3.775)
External auditor	0.012	0.011	0.011	0.010
	(0.635)	(0.607)	(0.605)	(0.569)
External audit opinion	0.052***	0.051***	0.052***	0.050***
	(3.513)	(3.426)	(3.491)	(3.357)
Adopting IFRS	−0.004	−0.001	−0.003	0.000
	(−0.231)	(−0.071)	(−0.193)	(0.004)
Ownership concentration	0.058**	0.062**	0.057**	0.064**
	(2.138)	(2.314)	(2.120)	(2.364)
State ownership	−0.005	−0.008	−0.006	−0.009
	(−0.287)	(−0.485)	(−0.375)	(−0.594)
Constant	0.042	0.047	0.052	0.057
	(0.925)	(1.038)	(1.146)	(1.251)
Number of observations	11,831	11,831	11,831	11,831
F value	242.62***	229.56***	242.74***	230.10***
Adj. R^2	40.26%	40.34***	40.27%	40.40%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. The *critical mass of women on two-tier boards* variable equals 1 if at least three women serve on two-tier boards, and 0 otherwise; the *ownership of women on two-tier boards* variable equals the average ratio of ownership held by women on two-tier boards; the other variables are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

gest that both Hypotheses 1 and 2 are still supported when we focus on female participation on two-tier boards. In summary, our main findings are robust when extended from women on BoDs to women on two-tier boards.

5.5. Tests for the effects of the split share structure reform

The split share structure reform has fundamentally changed large shareholders' incentives and improved corporate governance in China (Kuo et al., 2014; Liu and Tian, 2012). We take advantage of the reform's

Table 11
Additional test for the effect of the split share structure reform.

	Dependent variable: Real activities manipulation			
	Model 1 $SSSR = 0$	Model 2 $SSSR = 1$	Model 3 $SSSR = 0$	Model 4 $SSSR = 1$
Critical mass of women on BoDs	**0.002**	**−0.008**		
	(0.220)	**(−0.408)**		
Ratio of women on BoDs			**0.070**	**−0.042**
			(1.596)	**(−0.808)**
Critical mass of women on BoDs × Ownership of women on BoDs	**−0.031**	**−1.485***		
	(−0.005)	**(−1.667)**		
Ratio of women on BoDs × Ownership of women on BoDs			**63.911***	**−9.345*****
			(1.957)	**(−2.974)**
Ownership of women on BoDs	1.431	−0.551*	−1.790	0.043
	(0.826)	(−1.827)	(−0.747)	(0.118)
Firm size	−0.016***	0.019***	−0.016***	0.019***
	(−7.638)	(4.036)	(−7.644)	(3.979)
Firm age	−0.003***	0.011***	−0.003***	0.011***
	(−3.171)	(7.858)	(−3.137)	(7.759)
Firm profitability	−0.449***	−0.761***	−0.449***	−0.759***
	(−8.604)	(−6.790)	(−8.596)	(−6.781)
Firm growth	−0.013***	−0.123***	−0.013***	−0.123***
	(−2.833)	(−10.901)	(−2.846)	(−10.906)
Market to book value	−0.029***	−0.051***	−0.029***	−0.051***
	(−5.355)	(−8.442)	(−5.381)	(−8.500)
Firm loss	−0.067***	−0.016	−0.067***	−0.016
	(−7.046)	(−0.665)	(−7.026)	(−0.669)
External auditor	−0.005	0.015	−0.005	0.015
	(−0.422)	(0.483)	(−0.388)	(0.473)
External audit opinion	0.018**	0.078**	0.018**	0.075**
	(2.069)	(2.535)	(2.067)	(2.465)
Adopting IFRS	–	−0.069	–	−0.068
	–	(−0.928)	–	(−0.908)
Ownership concentration	−0.004	0.080*	−0.004	0.082*
	(−0.178)	(1.872)	(−0.183)	(1.925)
State ownership	0.002	−0.017	0.002	−0.019
	(0.233)	(−0.572)	(0.193)	(−0.621)
Constant	−0.385***	0.136	−0.392***	0.142
	(−3.861)	(1.428)	(−3.925)	(1.481)
Number of observations	5309	6522	5309	6522
F value	19.209***	146.109***	19.338***	146.452***
Adj. R^2	10.17%	43.78%	10.23%	43.84%

The indicator variable *SSRN* equals 1 for the period commencing a year after a focal firm has completed the split share structure reform, and 0 otherwise. The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. *SSSR* is an indicator variable that equals 1 for the period commencing a year after a firm has completed the split share structure reform, and 0 otherwise. All of the variables are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

occurrence during our sample period and explore whether it affected the role of female directors in curbing real activities manipulation. The results are shown in Table 11.

As Table 11 displays, in the subsample before the reform, our main variables of interest do not have significant coefficients or coefficients with the expected signs. However, in the subsample after the reform, consistent with our expectations, both *critical mass of women on BoDs* and *ratio of women on BoDs* have negative coefficients. More importantly, their interactions with *ownership of women on BoDs* have significant and negative coefficients (**Model 2**: $\beta = -1.485$, $p < 0.10$; **Model 4**: $\beta = -9.345$, $p < 0.01$), thereby providing support for our hypotheses. Thus, our main insights are limited to firm-year observations after the split share structure

reform, perhaps because the reform creates an incentive alignment effect that induces large shareholders and BoDs to actively monitor managers' real activities manipulation. Another reason may be that firms shifted their use of earnings management methods from accruals to real activities after the reform (Kuo et al., 2014), and the increase in real activities manipulation made the role of female directors more obvious.

5.6. Separate tests using the three subindices of real activities manipulation

In this study, following Roychowdhury's (2006) model, we use the three kinds of real activities earnings management, i.e., sales manipulation (*RM_CFO*), overproduction (*RM_PROD*) and discretionary fees manipulation (*RM_DISEXP*), to construct a comprehensive index of real activities manipulation. To further test the effect of female participation on BoDs on real earnings management and to shed light on the specific mechanisms of this process, we examine the association of female participation on BoDs for each category of real activities manipulation. In particular, as *RM_CFO* and *RM_DISEXP* are a pair of inverse indexes that reflect the extent of real activities manipulation, we change the value of *RM_CFO* and *RM_DISEXP* by multiplying it by −1 for the sake of explanatory convenience. Table 12 presents the regression results.

As Table 12 shows, although the significance level is low, both *critical mass of women on BoDs* and *ratio of women on BoDs* have a negative relation with each category of real activities manipulation, i.e., *RM_CFO*, *RM_PROD* and *RM_DISEXP*, consistent with our prediction in Hypothesis 1. More importantly, when taking *RM_CFO* as the dependent variable, the interactions, i.e., *critical mass of women on BoDs* × *ownership of women on BoDs* and *ratio of women on BoDs* × *ownership of women on BoDs*, have significant negative coefficients (**Model 1**: $\beta = -0.467$, $p < 0.05$; **Model 2**: $\beta = -1.880$, $p < 0.05$). Similarly, when taking *RM_PROD* as the dependent variable, the interactions, i.e., *critical mass of women on BoDs* × *ownership of women on BoDs* and *ratio of women on BoDs* × *ownership of women on BoDs*, also have negative coefficients (**Model 3**: $\beta = -0.696$, $p > 0.10$; **Model 4**: $\beta = -7.140$, $p < 0.01$). However, when taking *RM_DISEXP* as the dependent variable, the interactions, i.e., *critical mass of women on BoDs* × *ownership of women on BoDs* and *ratio of women on BoDs* × *ownership of women on BoDs*, do not have significant and consistent coefficients (**Model 5**: $\beta = -0.140$, $p > 0.10$; **Model 6**: $\beta = 0.001$, $p > 0.10$).

In summary, these results indicate that the role of female participation on BoDs in curbing real earnings management is mainly exercised by reducing sales manipulation and overproduction rather than through by reducing discretionary expenditures,[6] perhaps because firms with gender-diverse boards tend to invest less in R&D projects (Adams and Ferreira, 2009; Chen et al., 2016; Jin et al., 2014). As a result, in firms with female directors, there is relatively limited space for managers to manipulate earnings by reducing discretionary expenditures such as R&D investment, so the role of female directors may over time become weak in curbing this kind of real activities manipulation.

5.7. Tests for the effects of women on BoDs on accrual-based earnings manipulation

Several previous studies focus on the role of female directors/executives in curbing accrual-based earnings management and improving earnings quality (e.g., Krishnan and Parsons, 2008; Srinidhi et al., 2011; Sun et al., 2011; Ye et al., 2010). Most are conducted in the U.S. context, and it is unclear whether female board participation would affect accrual-based earnings manipulation in China. To address this concern, we first estimate the extent of accrual-based earnings manipulation based on a cross-sectional version of the modified Jones (1991) model by DeFond and Jiambalvo (1994), and then regress *accrual-based earnings manipulation* on female participation on BoDs. The regression results, given in Table 13, show that neither of the proxy variables for female participation on BoDs, i.e., *critical mass of women on BoDs* or *ratio of women on BoDs*,

[6] Our additional tests show that the degree of overproduction and sales manipulation significantly increases from year t to year $t+1$ and then significantly decreases from year $t+1$ to year $t+2$ in firms with a critical mass of female directors. That is, overproduction and sales manipulation do not persist over time, and there is a within-firm reversal of real activities manipulation. However, our further tests find that the cross-sectional variation of real activities manipulation persists in years $t+1$ and $t+2$. Therefore, the within-firm reversal does not affect our main findings.

Table 12
Additional tests for three subindices of real activities manipulation.

	Dependent variable: RM_CFO		Dependent variable: RM_PROD		Dependent variable: RM_DISEXP	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Critical mass of women on BoDs	**−0.002**		**−0.011**		**−0.003**	
	(−0.536)		**(−1.063)**		**(−1.370)**	
Ratio of women on BoDs		**−0.007**		**−0.041**		**−0.008**
		(−0.722)		**(−1.559)**		**(−1.374)**
Critical mass of women on BoDs × Ownership of women on BoDs	**−0.467****		**−0.696**		**−0.140**	
	(−2.197)		**(−1.150)**		**(−1.039)**	
Ratio of women on BoDs × Ownership of women on BoDs		**−1.880****		**−7.140*****		**0.001**
		(−2.498)		**(−3.330)**		**(0.003)**
Ownership of women on BoDs	**−0.022**	**0.090**	**−0.531*****	**−0.055**	**−0.155*****	**−0.158*****
	(−0.304)	**(1.022)**	**(−2.582)**	**(−0.218)**	**(−3.365)**	**(−2.810)**
Firm size	−0.003***	−0.003***	0.020***	0.020***	−0.013***	−0.013***
	(−3.635)	(−3.666)	(8.461)	(8.387)	(−23.627)	(−23.643)
Firm age	0.000	0.000	0.009***	0.009***	−0.000	−0.000
	(1.618)	(1.566)	(11.320)	(11.191)	(−0.834)	(−0.826)
Firm profitability	−0.480***	−0.480***	−0.012	−0.012	−0.104***	−0.104***
	(−22.955)	(−22.963)	(−0.205)	(−0.197)	(−7.799)	(−7.816)
Firm growth	0.006***	0.006***	−0.056***	−0.056***	−0.023***	−0.023***
	(2.826)	(2.831)	(−9.878)	(−9.883)	(−17.883)	(−17.876)
Market to book value	−0.015***	−0.015***	−0.023***	−0.023***	−0.015***	−0.015***
	(−11.669)	(−11.701)	(−6.205)	(−6.253)	(−17.758)	(−17.757)
Firm loss	−0.022***	−0.022***	0.002	0.002	−0.031***	−0.031***
	(−5.353)	(−5.359)	(0.209)	(0.208)	(−11.705)	(−11.711)
External auditor	−0.003	−0.003	0.030**	0.030*	−0.009***	−0.009***
	(−0.591)	(−0.597)	(1.966)	(1.930)	(−2.596)	(−2.631)
External audit opinion	0.003	0.003	0.041***	0.041***	0.005*	0.005*
	(0.619)	(0.592)	(3.273)	(3.224)	(1.663)	(1.675)
Adopting IFRS	0.003	0.003	−0.013	−0.012	0.006*	0.006*
	(0.601)	(0.623)	(−0.868)	(−0.810)	(1.746)	(1.781)
Ownership concentration	0.013*	0.014*	0.068***	0.070***	−0.021***	−0.021***
	(1.664)	(1.689)	(2.985)	(3.041)	(−4.178)	(−4.191)
State ownership	−0.010**	−0.011**	−0.020	−0.02	0.022***	0.022***
	(−2.222)	(−2.233)	(−1.474)	(−1.515)	(7.225)	(7.239)
Constant	0.045***	0.046***	−0.175***	−0.171***	0.117***	0.118***
	(3.353)	(3.400)	(−4.562)	(−4.430)	(13.616)	(13.629)
Number of observations	11,831	11,831	11,831	11,831	11,831	11,831
F value	77.59***	77.64***	261.56***	262.11***	91.92***	91.87***
Adj. R^2	18.47%	18.48%	43.53%	43.58%	21.20%	21.19%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. Please see the definitions and measurements of the three subindices of real activities manipulation, i.e., *RM_CFO*, *RM_PROD* and *RM_DISEXP*, in Section 3.2. The other variables are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

has a significant coefficient (**Model 1**: $\beta = 0.003$, $p > 0.10$; **Model 3**: $\beta = 0.003$, $p > 0.10$). Moreover, the interactions between female directors' ownership and female participation on BoDs also have insignificant coefficients. These results suggest that female directors do not help to curb accrual-based earning management in China, perhaps because it is less costly for firms to manipulate accruals in China due to relatively low demand for high quality earnings and low litigation risks (Allen et al., 2005; Liu and Tian, 2012; Kuo et al., 2014).

Zang (2012) documents that managers use real activities manipulation and accrual-based earnings management as substitutes for each other in managing earnings. This suggests another potential explanation for the results: the reduction in real activities manipulation may be the result of an increase in accrual-based earnings management rather than an increase in female board participation. We investigate this possibility by including

Table 13
Additional tests for the effects of women on BoDs on accrual-based earnings manipulation and other determinations.

	Dependent variable: Accrual-based earnings manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on BoDs	**0.003**	**0.004**		
	(0.704)	**(0.891)**		
Ratio of women on BoDs			**0.003**	**0.005**
			(0.270)	**(0.436)**
Critical mass of women on BoDs × Ownership of women on BoDs		**−0.298**		
		(−1.118)		
Ratio of women on BoDs × Ownership of women on BoDs				**0.329**
				(0.348)
Ownership of women on BoDs		**−0.217****		**−0.252****
		(−2.391)		**(−2.266)**
Firm size	−0.005***	−0.005***	−0.005***	−0.005***
	(−4.903)	(−4.977)	(−4.897)	(−4.979)
Firm age	−0.001***	−0.001***	−0.001**	−0.001***
	(−2.581)	(−2.938)	(−2.574)	(−2.879)
Firm profitability	0.132***	0.134***	0.133***	0.134***
	(5.048)	(5.102)	(5.057)	(5.102)
Firm growth	0.020***	0.020***	0.020***	0.020***
	(7.896)	(7.878)	(7.893)	(7.879)
Market to book value	−0.006***	−0.006***	−0.006***	−0.006***
	(−3.515)	(−3.598)	(−3.521)	(−3.601)
Firm loss	0.034***	0.034***	0.034***	0.034***
	(6.551)	(6.567)	(6.553)	(6.563)
External auditor	−0.000	−0.000	−0.000	−0.000
	(−0.039)	(−0.071)	(−0.027)	(−0.044)
External audit opinion	−0.014**	−0.014**	−0.014**	−0.014**
	(−2.481)	(−2.524)	(−2.490)	(−2.519)
Adopting IFRS	0.015**	0.015**	0.014**	0.015**
	(2.209)	(2.321)	(2.193)	(2.288)
Ownership concentration	0.034***	0.035***	0.034***	0.035***
	(3.338)	(3.466)	(3.323)	(3.423)
State ownership	−0.015**	−0.015***	−0.015**	−0.016***
	(−2.488)	(−2.612)	(−2.511)	(−2.623)
Constant	0.098***	0.099***	0.098***	0.099***
	(5.794)	(5.853)	(5.784)	(5.843)
Number of observations	11,831	11,831	11,831	11,831
F value	172.99***	163.41***	172.97***	163.34***
Adj. R^2	32.42%	32.45%	32.42%	32.45%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. *Accrual-based earnings manipulation* is measured based on a cross-sectional version of the modified Jones (1991) model by DeFond and Jiambalvo (1994). All of the variables except *accrual-based earnings manipulation* are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

accrual-based earnings manipulation as a control variable when regressing *real activities manipulation* on female participation on BoDs. The regression results, given in Table 14, show that after controlling for the potential trade-off between real activities and accrual-based earnings management, the results are highly consistent with our main finding given in Table 5, suggesting that the negative association between real activities manipulation and female participation on BoDs does not depend on the extent of accrual-based earnings management. In addition, Table 14 shows that the variable *accrual-based earnings manipulation* has a significant and negative relationship with real activities manipulation in all of the regression models, indicating a trade-off between two kinds of earnings management in the context of China and thus extending the boundary of Zang's (2012) findings.

Table 14
Additional tests for the trade-off between real activities manipulation and accrual-based earnings manipulation.

	Dependent variable: Real activities manipulation			
	Model 1	Model 2	Model 3	Model 4
Critical mass of women on BoDs	**−0.020***	**−0.016**		
	(−1.752)	**(−1.405)**		
Ratio of women on BoDs			**−0.068****	**−0.058***
			(−2.201)	**(−1.887)**
Critical mass of women on BoDs × Ownership of women on BoDs		**−1.651****		
		(−2.331)		
Ratio of women on BoDs × Ownership of women on BoDs				**−9.402*****
				(−3.747)
Ownership of women on BoDs		**−0.761*****		**−0.163**
		(−3.160)		**(−0.552)**
Accrual-based earnings manipulation	**−0.257*****	**−0.260*****	**−0.257*****	**−0.259*****
	(−10.506)	**(−10.615)**	**(−10.513)**	**(−10.587)**
Firm size	0.002	0.002	0.002	0.002
	(0.772)	(0.675)	(0.669)	(0.593)
Firm age	0.010***	0.009***	0.010***	0.009***
	(10.366)	(9.722)	(10.318)	(9.605)
Firm profitability	−0.587***	−0.581***	−0.587***	−0.582***
	(−8.414)	(−8.335)	(−8.420)	(−8.342)
Firm growth	−0.065***	−0.065***	−0.065***	−0.065***
	(−9.744)	(−9.772)	(−9.743)	(−9.774)
Market to book value	−0.054***	−0.055***	−0.054***	−0.055***
	(−12.555)	(−12.673)	(−12.566)	(−12.728)
Firm loss	−0.043***	−0.043***	−0.043***	−0.043***
	(−3.154)	(−3.127)	(−3.158)	(−3.137)
External auditor	0.012	0.011	0.011	0.011
	(0.677)	(0.628)	(0.612)	(0.589)
External audit opinion	0.048***	0.047***	0.048***	0.046***
	(3.257)	(3.195)	(3.256)	(3.149)
Adopting IFRS	−0.035*	−0.032*	−0.035*	−0.031*
	(−1.899)	(−1.733)	(−1.848)	(−1.683)
Ownership concentration	0.067**	0.072***	0.067**	0.073***
	(2.494)	(2.689)	(2.488)	(2.737)
State ownership	−0.008	−0.011	−0.009	−0.012
	(−0.527)	(−0.704)	(−0.547)	(−0.736)
Constant	0.098**	0.102**	0.105**	0.108**
	(2.159)	(2.233)	(2.289)	(2.360)
Number of observations	11,831	11,831	11,831	11,831
F value	240.82***	228.22***	240.91***	228.68***
Adj. R^2	40.80%	40.88%	40.81%	40.93%

The industry and year indicators are included in all of the regression models but omitted from the table to save space. The interaction terms are mean-centered before being included in the regression models. *T*-statistics are in parentheses. *Accrual-based earnings manipulation* is measured based on a cross-sectional version of the modified Jones (1991) model by DeFond and Jiambalvo (1994). All of the variables except *accrual-based earnings manipulation* are defined in Table 2.

*** Significance at the 1% level (two sided).

** Significance at the 5% level (two sided).

* Significance at the 10% level (two sided).

6. Summary and conclusions

This study investigates the role of female directors in curbing managers' real activities manipulation. Using a large sample of Chinese listed firms from the 2000 to 2011 period, we find that female participation on BoDs, as measured by the critical mass of female directors and the ratio of female directors, is associated with less real activities manipulation. Furthermore, this negative association is more pronounced when female directors have a higher ownership stake. These results hold for a battery of robustness checks. Overall, our findings

demonstrate that female directors help boards to curb real activities manipulation effectively, and stock ownership can enhance this effect.

Our study contributes to several strands of research. First, it contributes to the board gender diversity literature by showing that firms with a gender-diverse board exhibit less real activities manipulation. Previous studies of the consequences of female directors focus on accrual-based earnings management/quality and draw inconclusive results (Gul et al., 2011; Srinidhi et al., 2011; Sun et al., 2011). To our knowledge, our study is one of the few, if not the first, to examine the role of female directors in curbing real activities manipulation. Second, our study contributes to the literature on real activities manipulation by showing that a gender-diverse board can effectively alleviate real activities manipulation. As current research largely examines the effectiveness of external mechanisms (Qi et al., 2014; Roychowdhury, 2006; Zhu et al., 2015), we expand the scarce literature testing the role of internal governance mechanisms in curbing real activities manipulation, which is to a large extent opaque to outside stakeholders and thus more subject to internal monitoring scrutiny (Ge and Kim, 2014; Graham et al., 2005; Zang, 2012). Furthermore, responding to Kim and Lu's (2011) call for more in-depth work on the interactive effects of different governance mechanisms on mitigating agency problems, our study contributes to the corporate governance literature by showing the interactive effect between board gender diversity and stock ownership schemes.

As real activities manipulation, although detrimental to a firm's long-term growth, is a common practice among managers trying to meet short-term earnings targets, our findings are of great interest to shareholders and regulators. Our results indicate that shareholders can curb costly real earnings manipulation by increasing female participation on BoDs and implementing stock-based compensation systems. Our study is limited to Chinese firms, which have relatively weak corporate governance and underdeveloped institutions. Therefore, there may be limits to the generalizability of our findings. Future research should test our arguments and conclusions in diverse contexts. The measurement of real activities manipulation is concrete but incomplete due to potential measurement errors. Scholars should develop a better measure to fully capture the exact extent of real activities manipulation. Finally, our knowledge of the interactive effects between different governance mechanisms is still limited. More in-depth research is needed to gain a better understanding of corporate governance.

Acknowledgments

We acknowledge financial support from the National Natural Science Foundation of China (Grant Nos. 71202061, 71572160 and 71672197), Program for New Century Excellent Talents in University of Fujian Province (2015), and Program for Cultivating Outstanding Young Research Talents in University of Fujian Province (2015), and would also like to thank Xingqiang Du for his constructive suggestions and help. All remaining errors are our own.

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China Journal of Accounting Research 10 (2017) 167–188

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China Journal of Accounting Research

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Peer effects in decision-making: Evidence from corporate investment

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ARTICLE INFO

Article history:
Received 19 September 2014
Accepted 25 November 2016
Available online 16 January 2017

Keywords:
Peer effects
Corporate investment
Managerial learning

ABSTRACT

We show that peer effects influence corporate investment decisions. Using a sample of China's listed firms from 1999 to 2012, we show that a one standard deviation increase in peer firms' investments is associated with a 4% increase in firm *i*'s investments. We further identify the mechanisms, conditions and economic consequences of peer effects in firms' investment decisions. We find that peer effects are more pronounced when firms have information advantages and the information disclosure quality of peer firms is higher, or if they face more fierce competition. When firms are industry followers, are young or have financial constraints, they are highly sensitive to their peers firms. We also quantify the economic consequences generated by peer effects, which can increase firm performance in future periods.
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1. Introduction

It is common for corporations to interact with peer firms in decision-making, such as signing strategic cooperating agreements and developing marketing strategies. Previous studies show that peer firms play an important role in shaping a variety of corporate policies, such as product pricing (Bertrand, 1883) and advertising (Stigler, 1968), but the effect of peer-firm behavior on corporate financial policy is often ignored in empirical research, or at most assumed to operate through an unmeasured effect on firm-specific determinants. Recent studies examine whether the characteristics or behavior of peer firms affect corporate capital structure (Leary and Roberts, 2014), mergers and acquisitions (Bizjak et al., 2009) and tax avoidance (Li et al., 2014).

☆ We acknowledge funding for project 71263034 and 71572087 from the National Natural Science Foundation of China.
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http://dx.doi.org/10.1016/j.cjar.2016.11.002
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Investment decisions are important and determine corporate development. Most studies that examine peer effects in corporate investment suggest that managers can gain useful information from the stock price of peer firms. Edmans et al. (2012a, 2012b) and Bond et al. (2012) point out that stock prices include information that is helpful in guiding a firm's investment policy, such as industry growth opportunities, external environment, competitor strategy and consumer demands. Valuing the stock price of peer firms can therefore capture useful information to help reduce investment uncertainty. Ozoguz and Rebello (2013) find that firms' investment policy reacts appropriately to volatility in a peer firms' stock price. Using U.S. listed firms from 1996 to 2008, Foucault and Fresard (2014) find that the valuation of peers matters for a firm's investment: a one standard deviation increase in a peers' valuation is associated with a 5.9% increase in corporate investment. Fracassi (2012) and Dougal et al. (2012) provide similar empirical results. However, few studies investigate whether managers directly mimic the investment behavior of peer firms. In this study, we predict that firms' investment behavior is influenced by peer firms' investment decisions, and provide empirical evidence to support the prediction.

In the stock markets of developed counties, stock prices aggregate diverse corporate decisions and ultimately reflect an accurate assessment of firm value. However, China has only slowly developed a legal framework for its stock market, and has a weak law enforcement record. Consequently, the idiosyncratic information of firms is deficient, and stock prices are highly synchronous (Morck et al., 2000; Zhu et al., 2007). In this undeveloped stock market, stock prices are not the most useful source of information when real decisions are taken. Firms are more likely to directly mimic the strategies and decisions of their peers. Liu and Chen (2012) find that it is common for firms to imitate their peers' behavior in the industry cluster, and this imitation can increase the performance of both a firm and its peers. Focusing on corporate mergers and acquisitions, Chen and Lu (2013) argue that the acquisition premium is significantly affected by peer firms. This evidence shows that managers have strong incentives to learn from peer firms, enabling them to maximize firm value or avoid the potential risk of failure (Ren, 2002; Zhuang, 2003; Li et al., 2011).

We examine the effect of the investment policy of peer firms on a firm's investment. Information imperfection and investment uncertainty are the main reasons behind the learning behavior of a peer group (Lieberman and Asaba, 2006). Any investment decision involves risk and uncertainty. Managers may be unsure of the likelihood of possible outcomes, and may have fundamental difficulties recognizing cause and effect relationships and the full range of potential consequences (Milliken, 1987). In environments of uncertainty and ambiguity, managers are particularly likely to imitate the investment activities of peers. This imitation, though still highly imperfect, can significantly reduce the investment risk and the possibility of falling behind rivals. Peer firms therefore have a strong influence on managerial perceptions and beliefs. For example, Mongolia Yili Industrial Group Co., Ltd., a large dairy enterprise, produces "breakfast milk" and attaches importance to a nutritional breakfast. Mengniu Dairy, the biggest competitor of Yili, then actively rolls out "Mengniu breakfast milk." "JinDian (金典) milk" produced by Yili and "TeLunsu (特仑苏) milk" produced by Mengniu are also good examples of the learning effect in product development. While specific cases of firms learning from their peers can be identified, it is unclear whether the learning effect is widespread in investment policies.

The challenge in examining learning from a peer group is to identify the set of firms that can use the investment policies of peers to guide their own investment decisions. Generally, this group will include firms that have several similar characteristics (e.g., industry, size, diversification, business complexity and financing constraints), so the behavior of these firms is similar within the same market. The more similarities a firm has with its peers, the more likely it is to mimic their investment decisions to reduce the potential failure risk. Considering all these characteristics simultaneously is not practical, however, as peer groups may be made up of too few firms, which would be noisy when filtering external shocks. Following Albuquerque (2009) and Leary and Roberts (2014), we specify peer firms as those in the same industry and in upper and lower size quartiles (0.75 times to 1.25 times a firm's total assets) in relation to the firm. After specifying the peers of each firm, we examine whether peer firms influence the investment behavior of the firms, and find that they play an important role in shaping corporate investment decisions. Specifically, we find that a one standard deviation increase in peer firms' investment is associated with a 4% increase in firm *i*'s investment. Investment can generally be divided into two categories: (1) investment in property, plant and equipment (PPE) and (2) investment in intangible assets such as R&D, and we test the peer effect in these two types of investment. The results show that both types are sensitive to the investment policies of peer firms, while the peer effect is more pronounced in PPE

investment. Specifically, a one standard deviation increase in PPE investment by peer firms leads to a 14.4% increase in the PPE investment of firm *i*.

To ensure the robustness of the empirical results, we specify peer firms according to different criteria and reexamine the peer effect in corporate investment policy. In robustness tests, we specify the firms in the same registering city and industry, and in the upper and lower size quartiles (0.75 times to 1.25 times a firm's total assets) to the firm as provincial-level peer firms. We define firms as national-level peer firms if their assets are in the range of 0.9–1.1 times the assets of the firm and in the same industry. The inferences are robust to these different measures. We replace the lagged control variables with contemporaneous controls to address the concern that investment policy affects firm-specific and peer firm characteristics with a lag. Again, we see little change in the results, suggesting that model misspecification in the control variables is unlikely to be behind our results.

Evidence is, however, insufficient to conclude that peer firms influence the firm's investments as the relation can covary, due to reflection problems (Manski, 1993; Shue, 2013). Reflection problems arise when a researcher observing the distribution of behavior in a population tries to infer whether the average behavior in a group influences the behavior of the individuals that comprise the group. In the current context, this problem is recreated by identifying peer firms in same industry. Firms from the same industry face similar institutional environments, investment opportunities and consumption demands, and are more likely to make similar investment decisions. The inability to accurately model the relevant factors influencing the firms' investment and its peers generates endogeneity bias. Identifying peer effects is therefore an empirical challenge. We use the following tests to further establish the causality of our findings.

First, specifying firms in the same industry but not in upper and lower size quartiles of that firm as non-peer firms, we examine the effect of the investment of a non-peer firm on the firm's investment. If our findings are driven by the macroeconomic environment, industry factors or market-level factors rather than by learning behavior, then we can predict there is a significant positive relationship between the investment of peer firms and that of the firm, as non-peer firms are still in the same industry. However, if we cannot observe a positive relationship, we can infer that the findings are not driven by the reflection problem. Second, we conduct an instrumental variable method to address the possible endogeneity bias, using our measures of peer firm equity shocks as instruments for peer firm investment policy. The peer firms return shocks are serially uncorrelated and serially cross-uncorrelated, and are less likely to be manipulated by managers when compared to other investment determinants, such as profitability and cash ratios. The instrument variable selected therefore meets the requirements for instrument relevance and exogeneity. Third, with the inclusion of firm fixed effects in the regression model, we reexamine whether peer firms influence the investment behavior of the firm. This specification addresses the concern that commonality in a firm's investment policy is due to time-invariant investment determinants over the business cycle.

The alternative explanation of the results is that a firm's investment policies are driven by a response to their peers' characteristics rather than investment behavior. Here, the peer effect in corporate investment arises when firms respond to changes in the characteristics of their peers' profitability, risk, etc. However, the response to their peers' characteristics is different from learning behavior. Thus, we provide additional analysis to investigate this distinction. To distinguish between these alternatives, we exploit heterogeneity in firms' investment responses to their peers' equity shocks after controlling for their peers' investment. The evidence shows that holding fixed the peer firm equity shock, the investments are strongly positively correlated with investments in the peer firms, but investments are unrelated to the peer firm equity shock, holding fixed the peer firm investments. Thus, firms only change their investment in response to a peer firm equity shock if it is accompanied by a change in peer firm investment, which provides additional support to our conclusion.

Next, we identify the possible channels through which peer firms influence a firm's investment. Lieberman and Asaba (2006) find that firms imitate to avoid falling behind their rivals, or because they believe that their rivals' actions convey information. According to information based theory, firms disclose large amounts of information, such as their business strategy, financial performance, expected future outlook, current and future investment outlays, material contracts and business risks, and this information has a strong spillover effect on the decision-making of others (Gigler, 1994; Kumar and Langberg, 2010). Managers then have an incentive to value information disclosed by peers, which will guide their real decisions. Empirical evidence demonstrates that a firm's disclosures can have positive externalities. For example, using a private firm

context, Badertscher et al. (2013) examine the externalities of public firm presence on the investment decisions of private firms, and find that public firm presence reduces uncertainty in a specific industry and increases the investment efficiency of private firms in that industry. Beatty et al. (2013) find that peers react to high-profile fraudulent reports by increasing their investment expenditure during the fraud period, due to the spillover effect of fraudulent information. We therefore predict that information is an important channel through which peers matter to firms in their investment decisions. We test this prediction in two ways. First, following Houston et al. (2014), we use the distance between the registering city of the firm and the capital city Beijing to measure the informativeness of the firm, and then examine whether the peer effect in corporate investment policy varies with a firm's informativeness. Given that most policies in China are made at conferences in Beijing, it is possible for firms close to Beijing to identify potential industry policies and investment opportunities in advance, thus reducing the investment uncertainty and incentive to learn from peers. The results show that closer to Beijing a firm is the less sensitive and its investment policy is to peers. Second, we investigate whether the information quality of peers influences the learning effect. Institutional background and regulatory environment differences between mainland China and Hong Kong also lead to a difference in the quality of information disclosure of listed firms (Pistor and Xu, 2005; Ke et al., 2015). The information disclosed by AH share firms is therefore more reliable and valuable. We test this prediction by using AH share firms to measure information quality. We find that the learning effect is more pronounced when at least one AH share firm is in a peer group.

According to rival-based theory, firms' imitation is also a response designed to mitigate competitive rivalry or risk. Firms imitate others in an effort to maintain their relative position or to neutralize the aggressive actions of rivals. Imitation to mitigate rivalry is most common when firms with comparable resource endowments and market positions face one another. In a highly competitive environment, suffering from a high risk of bankruptcy, firms have strong incentives to learn from the strategies of their peer firms (Peress, 2010; Ozoguz and Rebello, 2013). Klemperer (1992) argues that learning from others can to some extent alleviate competitive pressure. Chen and Chang (2012) also provide evidence that firm's cash holdings respond more positively to peers when the product market is highly competitive. Thus, firms learn from each other in the introduction of new products and processes, in the adoption of managerial methods and organizational forms and in the entry of certain investments and the timing of the investment. Learning behavior therefore helps firms preserve the status quo among their close competitors, even in industries where strong rivalry is maintained. Similar to previous studies (Curry and George, 1983; Giroud and Mueller, 2011), we use the Herfindahl index and the number of firms in each two-digit industry to proxy for market competition, and then examine whether the peer effect in investment policy varies with product market competition. The results show that the learning effect in investment policy is more pronounced in a highly competitive market.

To better understand why peer firms affect investment policy, we further examine the heterogeneity in peer effects. First, industry leaders are more likely to have the ability to capture the investment opportunities and develop innovative products and techniques than non-industry leaders. Consequently, we predict that the peer effect is less pronounced in the investment policies of industry leader firms. Second, lacking sufficient market experience and available resources, young firms are more likely to mimic the investment behavior of peer firms, to reduce uncertainty and the risk of failure (Petersen and Rajan, 1994; Hadlock and Pierce, 2010). We predict that the investment of young firms is more sensitive to the investment of their peer firms. Third, financially constrained firms are less sensitive to the behavior of peer firms than unconstrained firms, as mimicking behavior is assumed to be more costly for financial constrained firms, given their high cost of financing. These inferences are supported by empirical results.

Finally, using ROA and Tobin-Q in the next one to three years to measure future corporate performance, we examine the economic consequences generated from this learning behavior in corporate investment policies. Learning behavior in investment is found to benefit corporate performance. Specifically, learning behavior increases corporate performance and firm value. The results reveal the importance of the learning effect in investment under an uncertain environment.

Our study contributes to the literature in two ways. First, previous studies suggest that a firm's investment policy is typically assumed to be determined as a function of its growth opportunities, financing constraints, marginal tax rate and external regulations. The role of peer firm behavior in affecting investment policy is often ignored. Following the research perspective of Ozoguz and Rebello (2013) and Foucault and Fresard

(2014), this study's focus is on the role of a peer firm in shaping a firm's investment policy. Using a sample of Chinese listed firms from 1999 to 2013, we extend the literature by analyzing the direct relation between a firm's and its peers' investments, which differs from the studies by Ozoguz and Rebello (2013) and Foucault and Fresard (2014). We further address the reflection problem and endogeneity bias, identifying the potential channels and mechanisms behind the peer effect in investment, and finally confirm the economic consequences of these effects. The findings extend our understanding of investment determinants.

Second, peer effects have been mainly applied in psychology and sociology research (Valliant, 1995; Dishion et al., 1999; Katz et al., 2001). Many studies have examined the peer effect on corporate real decisions, such as corporate capital structure, merges and acquisitions and corporate governance (John and Kadyrzhanova, 2008; Chen and Chang, 2012; Leary and Roberts, 2014; Foucault and Fresard, 2014). We first examine the role of a peer firm in shaping a firm's investment decisions, which extends the literature on peer effects. Lieberman and Asaba (2006) argue that information needs and competition pressure are two channels through which peers influence the behavior of the firm. In this study, we empirically test these two predictions and provide evidence to support the theoretical prediction of Lieberman and Asaba (2006), which reveals the mechanism of the learning effect.

The remainder of this paper is as follows. Section 2 reviews the literature. Section 3 develops the hypothesis based on theoretical analysis. Section 4 introduces the sample selection and the variables, and develops the empirical model. Section 5 presents the summary statistics and main empirical results. Section 6 identifies the potential channels through which peer firms affect firms' investment policies. Section 7 examines the cross-sectional heterogeneity in the effects to better understand the economic mechanisms behind the peer effect. Section 8 presents the economic consequences of the peer effect in investment decisions. Section 9 concludes.

2. Literature review

In economic theory, it is argued that peer firms play an important role in shaping corporate decisions, such as through product pricing (Bertrand, 1883) and product advertising (Stigler, 1968). An increasing number of empirical studies examine the characteristics or behavior of peer firms and whether they affect a firm's behavior. Using a sample of U.S. listed firms, John and Kadyrzhanova (2008) investigate the peer effect in corporate governance. Studies also examine the effect of peer firms on corporate capital structure (Leary and Roberts, 2014), merges and acquisitions (Bizjak et al., 2009) and tax avoidance (Li et al., 2014). For example, Leary and Roberts (2014) present evidence that a one standard deviation increase in peer firms' leverage ratios is associated with a 10% increase in firm *i*'s leverage ratio, an effect greater than that of any other determinants. In corporate investment policies, the behavior of peer firms has a strong spillover effect on a firm's investment decisions (Foucault and Fresard, 2014), so the possibility of a significant effect cannot be ignored.

Information-based and rivals-based theories are typically used to explain learning behavior among peer firms (Benoit, 1984; Lieberman and Asaba, 2006). In information-based theories, information imperfection is viewed as the main cause of learning behavior. Managers can learn new information from peer firms' stock prices, which can then guide their real decisions. Managers do not have perfect information on every decision-relevant factor, so learning from peers can help them capture more useful information and reduce investment uncertainty. Conlisk (1980) finds that experience or experiment is more costly and time-consuming than imitation, so firms whose information is imperfect rationally imitate the strategies of others to reduce the possibility of failure. Under environmental uncertainty, it is difficult for managers to predict the consequences of a particular investment, as it raises the likelihood of undesirable outcomes and the risk of failure (Milliken, 1987). Firms with imperfect information when making investment decisions are therefore more likely to learn investment behavior from peer firms, to reduce investment risk (Foucault and Fresard, 2014), as they believe that peers' actions convey information about growth opportunities, investment opportunities and industry fluctuations.

Investment decisions also reflect managers' rationally formed expectations, and provide a signal of managers' abilities (Scharfstein and Jeremy, 1990). Although decision-makers can make optimal investment decisions by capturing and analyzing as many investment-relevant factors as possible, the risk of

investment failure is still significant. Under an uncertain environment, managers are more likely to imitate the investment behavior of other managers, as from the perspective of managers concerned about their reputation in the labor market, this mimicking behavior is rational and costless (Palley, 1995; Scharfstein and Jeremy, 1990). It is better for the reputations of managers to fail conventionally than to succeed unconventionally.

According to the rivals-based theory, learning behavior commonly acts to defuse rivals and stabilize relative positions in the market. Firms imitate each other in the introduction of new products and processes, the adoption of managerial methods and organizational forms, and the timing and types of investments, as learning behavior is helpful in gaining competitive advantage (Klemperer, 1992) and reducing investment uncertainty (Knickerbocker, 1973). Firms imitate others in an effort to maintain their relative positions or to neutralize the aggressive actions of rivals. Chen and Chang (2012) find that firms also tend to have sizeable cash reserves when their rivals hold high cash holdings. From the perspective of market competition, imitation to mitigate rivalry in important corporate decisions is most rational when firms with comparable resource endowments and market positions face each another.

3. Hypothesis development

Imitation processes are most interesting in environments characterized by uncertainty or ambiguity. Few decisions have outcomes that are fully predictable. Managers take actions, the consequences of which depend on the future state of the environment. Managers therefore actively and regularly imitate peers' behavior or actions to overcome information imperfection and protect and enhance managerial reputation. They may also believe that imitation is important in defusing rivalry and reducing risk for their firms. Chen and Chang (2012), for example, present evidence that the ratio of cash to total assets is significantly influenced by peer firms' average cash holdings. They argue that firms imitate others to reserve cash in an effort to maintain their relative position or to neutralize the aggressive actions of rivals. Chen and Lu (2013) find that peers' merger and acquisition programs are considered and referred to by a firm when preparing their own programs to maximize their merger and acquisition performance. Investment policy is important and determines corporate development. Promising investment not only establishes the direction for future development, but also allocates available resources more efficiently, enhancing corporate performance and market value. Firms may suffer enormous financial loss and even the risk of bankruptcy due to errors in vital investments. Consequently, firms within the same strategic group may adopt similar behavior to constrain competition and maintain competitive advantages.

In a developed stock market, a firm's stock price provides useful information such as growth opportunities, the state of the economy, the position of competitors and consumer demand. Decision-makers can learn from peer firms' stock price and use the information to guide their investment policy, thus reducing uncertainty and failure risk. Foucault and Fresard (2014) present evidence that the investment behavior of a firm is affected significantly by its peer firms' stock prices, as this informs managers about growth opportunities, thereby overcoming information imperfection and enabling them to make optimal investment decisions. However, the Chinese stock market's legal framework has developed slowly, and law enforcement is weak. Consequently, specific firm information is lacking, and stock prices are highly synchronous (Morck et al., 2000; Zhu et al., 2007). In emerging economies such as China, stock prices provide less useful information to managers making decisions than in developed countries. Learning directly from the real decisions of peer firms rather than from their stock prices is more efficient and prevalent, and the mechanism is different from that of developed countries. Liu and Chen (2012) find that the learning behavior of Chinese firms is common in an industry cluster, and significantly enhances productivity for both a firm and its peers. We can therefore infer that a firm has strong incentives to mimic the investment behavior of peer firms in China, thus reducing the failure risk of investment and mitigating competitive pressure as much as possible. We therefore conduct a statistics test of the following hypothesis:

H1. A firm's investment is significantly influenced by its peer firms.

4. Research design, sample selection and summary statistics

4.1. Corporate investment model

Following Richardson (2006), we control for firm-level factors relevant to investment decisions and the corporate investment model is set as follows:

$$Inv_t = \beta_0 + \beta_1 Growth_{t-1} + \beta_2 Lev_{t-1} + \beta_3 Cash_{t-1} + \beta_4 Age_{t-1} + \beta_5 Size_{t-1} + \beta_6 Ret_{t-1} + \beta_7 Inv_{t-1} + Year\ fixed\ effect + Industry\ fixed\ effect + \varepsilon \quad (1)$$

where *Inv* is the measure of corporate investment policy, defined as the ratio of capital expenditure to the beginning-of-year book assets; *Growth* is the measure of growth opportunities, which is calculated as sales growth; *Lev* is the ratio of total debt over total assets; *Cash* is the balance of cash and short-term investments deflated by total assets measured at the beginning of the year; *Age* is the log of the number of years the firm has been listed on stock markets as of the start of the year; *Size* is the log of total assets measured at the start of the year; and *Ret* is the stock returns for the year prior to the investment year. *Year fixed effect* is a vector of indicator variables to capture year fixed effects. *Industry fixed effect* is a vector of indicator variables to capture industry fixed effects.

4.2. Baseline empirical model

To examine whether the investment policy of peer firms matters in a firm's investment decision, the average investment of peer firms is incorporated in the model (1). We also control for peer firms' characteristics in the model to mitigate omitted variable bias.

$$Inv_{ijt} = \alpha + \beta\ PInv_{-ijt} + \delta\ Firm\ Specific\ Factors_{ijt-1} + \gamma\ Peer\ Firms\ Factors_{-ijt-1} + Year\ fixed\ effect_t + Industry\ fixed\ effect_j + \varepsilon \quad (2)$$

where the indices ***i***, ***j*** and ***t*** correspond to firm, industry and year, respectively. The outcome variable Inv_{ijt} is the measure of investment. $PInv_{-ijt}$ denotes peer firms' average investment (excluding firm *i*). *Firm Specific* $Factor_{ijt-1}$ contains firm's sales growth, leverage, cash ratio, firm age, firm size, stock return and investment at year $t-1$. *Peer Firms* $Factors_{-ijt-1}$ contains peer firms' sales growth, leverage, cash ratio, firm age, firm size, stock return and investment at year $t-1$.

The challenge in examining how firms learn from their peer group is to identify the set of firms that can use the investment policy of peers to guide their own investment decisions. The group will typically include firms that have several characteristics in common (e.g., industry, size, diversification, business complexity and financing constraints), so the behavior of these firms is similar in the same market. Firms are more likely to mimic the investment decisions of their peers if they are similar, reducing potential failure risk. Yet considering all the characteristics simultaneously is not practical as it may result in a peer group consisting of too few firms, which would be noisy when filtering external shocks. Following Albuquerque (2009) and Leary and Roberts (2014), we specify firms in the same industry and with upper and lower size quartiles (0.75 times to 1.25 times a firm's total assets) as similar peer firms. Table 1 provides definitions of the specific variables.

4.3. Sample selection

We obtain financial data from the China Stock Market and Accounting Research Database (CSMAR) from 1999 to 2013. We drop (1) financial, insurance and utility firms, (2) firm-years that do not match other firms in the same industry and size quartiles, and (3) observations with missing data on any variables. The final sample contains 17,463 observations from 1999 to 2013. To avoid the effect of outliers, we winsorize the top and bottom 1% of the continuous variables. To correct this statistical problem, we use a "clustering" method to adjust the standard error of the estimated coefficient for each company (Petersen, 2009).

Table 1
Variable definitions.

Variable	Definition
Inv	Firm's investment, measured as the ratio of capital expenditure over the total assets
PInv	Peer firms' average investment
Growth	Firm's (peer firms') sales growth
Lev	Firm's (peer firms') book leverage, measured as the ratio of total debt over total assets
Cash	Firm's (peer firms') cash ratio, measured as the ratio of cash balance over total assets
Age	Firm's (peer firms') age, log of the number of years the firm has been listed on stock markets
Size	Firm's (peer firms') size, log of total assets
Ret	Firm's (peer firms') annual stock return
Inv	Firm's (peer firms') investment in year $t-1$
Shock	Peer firm's average specific stock return calculated using a market model
Dis	Log of distance between the registering cities of firms to the capital city Beijing
AH	AH dummy variable. If there is at least one AH share firm among the peer group, it equals 1
HHI	Herfindahl index, $HHI = 1 - \Sigma Pi^2$, where Pi is sales share of the firm
Num	Log of the number of firms in an industry
Leader	Industry leader. If the sales share of the firm is in the upper third at each industry-year, it equals 1
Young	Young firm. If the age of the firm is in the upper third at each industry-year, it equals 1
WW	Financing constraints, measured as ww index, which states that the larger the number, the more severe the financing constraints faced

4.4. Descriptive statistics and correlation analysis

Table 2 presents the descriptive statistics. Variables are grouped into two distinct categories: peer firm averages and firm-specific factors. The mean (median) of the corporate investment is 0.062 (0.039), and means (medians) of PPE and R&D investment are 0.031 (0.012) and 0.005 (0.001), respectively. The mean (median) of sales growth is 0.184 (0.146). The average cash holding and leverage are 0.485 and 0.190, respectively. The means of firm size, age, stock return and lagged investment are 21.332, 8.148, 0.172 and 0.066. For peer firm averages, the mean (median) of the investment is 0.063 (0.040), and means (medians) of PPE and R&D investment are 0.043 (0.035) and 0.001 (0.005), respectively. The latter group includes variables constructed as firm *i*'s value in year *t*. At this point, we simply note the similarities of many statistics to the former group.

In addition, we also report summary statistics for other variables. The peer firm average equity shock is 0.218, and the average log of distance from the registering city of the firms to Beijing is roughly 6.505. About 29.1% of firms have at least one AH-share peer firm in their peer group. The mean of MP is −0.160. The average HHI is 0.935 and 98 firms are in the two-digit industry code. Of the sample, about 35.8% of firms are industry leaders, and over 75% firms are young firms in the market. The average for WW index, which measures corporate financing constraints is −0.962.

In Table 3, we present the results of the correlation analysis of the variables. The correlation coefficient of PInv with *Inv* is 0.262 and is significant at a 5% level, showing that corporate investment is strongly positively correlated with the average investment of peer firms. Firm *i*'s sales growth, leverage ratio, firm size, stock return and lagged investment are positively significant at a 5% level. However, its cash ratio and age are negatively correlated with investment. A peer firm's specific characteristics also affect a firm's investment decision. For example, peer firms' growth, size and lagged investment are significant at 5% level. The correlation coefficients of leverage ratio and firm age with firm *i*'s investment are −0.046 and −0.031 respectively, and are significant at a 5% level.

5. The role and implications of the peer effect

5.1. Empirical results for baseline model

Table 4 shows the empirical results for the effects of peer firms on corporate investment. When controlling for only the year and the industry fixed effects in the model, the result is reported in column (1). The coefficient

Table 2
Summary statistics.

Variable	*N*	Mean	SD	Min	Q1	Median	Q3	Max
Inv	17,463	0.062	0.064	0.000	0.011	0.039	0.090	0.227
PInv	17,463	0.063	0.040	0.000	0.035	0.058	0.086	0.153
Firm-specific characteristics								
PPE	17,463	0.031	0.071	−0.079	−0.011	0.012	0.062	0.210
RD	17,463	0.005	0.016	−0.015	−0.001	0.001	0.006	0.055
Growth	17,463	0.184	0.324	−0.366	−0.015	0.146	0.338	0.986
Cash	17,463	0.485	0.189	0.143	0.342	0.491	0.629	0.824
Lev	17,463	0.190	0.143	0.019	0.082	0.150	0.263	0.546
Size	17,463	21.332	1.001	19.720	20.584	21.203	21.975	23.445
Age	17,463	8.148	4.274	2.000	4.000	8.000	11.000	16.000
Ret	17,463	0.172	0.638	−0.456	−0.252	−0.036	0.339	2.059
Inv	17,463	0.066	0.069	0.000	0.012	0.042	0.097	0.245
Peer firm-specific characteristics								
PPE	17,463	0.040	0.043	−0.031	0.008	0.035	0.067	0.133
RD	17,463	0.007	0.010	−0.007	0.000	0.005	0.013	0.031
Growth	17,463	0.246	0.251	−0.079	0.087	0.195	0.324	0.987
Cash	17,463	0.198	0.090	0.043	0.138	0.185	0.242	0.411
Lev	17,463	0.480	0.113	0.243	0.409	0.487	0.558	0.686
Size	17,463	21.263	0.972	19.461	20.586	21.178	21.898	23.232
Age	17,463	7.892	2.880	3.000	5.632	7.773	9.958	13.421
Ret	17,463	0.202	0.656	−0.366	−0.192	0.000	0.307	2.362
Inv	17,463	0.067	0.042	0.000	0.038	0.062	0.094	0.159
Other variables								
Shock	13,667	0.218	0.728	−0.462	−0.233	0.001	0.213	2.144
Dis	17,463	6.505	1.628	0.693	6.448	6.950	7.318	7.635
AH	17,463	0.291	0.454	0.000	0.000	0.000	1.000	1.000
HHI	17,458	0.935	0.056	0.647	0.921	0.956	0.967	0.982
Num	17,458	4.584	0.706	2.833	4.127	4.522	5.100	6.188
Leader	17,463	0.358	0.479	0.000	0.000	0.000	1.000	1.000
Young	17,463	0.754	0.431	0.000	1.000	1.000	1.000	1.000
WW	17,307	−0.962	0.075	−1.146	−1.013	−0.963	−0.907	−0.786

Table 3
Correlation matrix.

		(1) Firm-specific characteristics						(2) Peer firm-specific characteristics						
	Inv	Growth	Cash	Lev	Size	Age	Ret	Inv	Growth	Cash	Lev	Size	Age	Ret	Inv
PInv	0.262*														
(1) Growth	0.154*	0.091*													
Cash	−0.171*	−0.051*	0.027*												
Lev	0.140*	0.028*	0.200*	−0.319*											
Size	0.123*	0.289*	0.133*	0.228*	0.040*										
Age	−0.189*	−0.041*	−0.057*	0.286*	−0.167*	0.237*									
Ret	0.053*	0.004	0.043*	0.042*	−0.029*	−0.033*	0.034*								
Inv	0.585*	0.249*	0.207*	−0.127*	0.134*	0.177*	−0.229*	−0.028*							
(2) Growth	0.036*	0.121*	0.112*	0.037*	0.043*	0.149*	0.061*	−0.045*	0.036*						
Cash	0.010	0.184*	0.064*	−0.115*	0.279*	0.060*	0.047*	−0.114*	0.012	0.262*					
Lev	−0.046*	0.002	0.025*	0.259*	−0.063*	0.268*	0.203*	0.070*	−0.045*	0.171*	−0.096*				
Size	0.181*	0.401*	0.142*	0.172*	0.069*	0.831*	0.213*	−0.010	0.187*	0.225*	0.199*	0.431*			
Age	−0.031*	0.026*	0.031*	0.176*	0.059*	0.333*	0.479*	0.046*	−0.043*	0.173*	0.159*	0.500*	0.470*		
Ret	0.004	0.029*	−0.027*	0.044*	−0.065*	−0.011*	0.039*	0.807*	−0.049*	−0.011	−0.105*	0.117*	0.002	0.083*	
Inv	0.246*	0.709*	0.089*	−0.053*	0.017*	0.291*	−0.068*	−0.083*	0.267*	0.164*	0.177*	0.010	0.418*	−0.020*	−0.076*

* Significant at a 5% level (two-tailed test).

Table 4
Effect of peer firms on corporate investment.

	Dep: Inv					
	(1)		(2)		(3)	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
PInv	**0.2205*****	**11.26**	**0.0906*****	**6.73**	**0.0618*****	**3.97**
Firm-specific characteristics						
$Growth_{t-1}$			0.0032**	2.40	0.0026**	2.00
$Cash_{t-1}$			−0.0270***	−10.57	−0.0262***	−10.02
Lev_{t-1}			0.0162***	4.49	0.0160***	4.32
$Size_{t-1}$			0.0013**	2.46	−0.0088***	−5.53
Age_{t-1}			−0.0008***	−6.67	−0.0009***	−6.70
Ret_{t-1}			0.0150***	11.85	0.0136***	10.62
Inv_{t-1}			0.4659***	51.88	0.4603***	50.59
Peer firm-specific characteristics						
$Growth_{t-1}$					0.0041**	2.47
$Cash_{t-1}$					−0.0369***	−5.93
Lev_{t-1}					−0.0242***	−4.81
$Size_{t-1}$					0.0156***	9.32
Age_{t-1}					−0.0009***	−3.37
Ret_{t-1}					0.0019	0.92
Inv_{t-1}					−0.0520***	−3.42
Constant	0.0249***	6.78	−0.0033	−0.31	−0.0903***	−8.10
Year		Controlled		Controlled		Controlled
Industry		Controlled		Controlled		Controlled
N		17,463		17,463		17,463
Adj. *R*-sq.		0.113		0.388		0.398
F		31.5252		201.4452		181.6136

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.
*Significance at a 10% level (two-tailed test).
** Significance at a 5% level (two-tailed test).
*** Significance at a 1% level (two-tailed test).

of Pinv is 0.2205, significant at a 1% ($t = 11.26$) level, which indicates that firm *i*'s investment is significantly influenced by peer firms. Specifically, a one standard deviation increase in the average peer firm investment leads to a 14.2 percentage point increase in firm *i*'s investment. Following Richardson (2006), we add firm-specific characteristics such as sales growth $Growth_{t-1}$, cash ratio $Cash_{t-1}$, leverage ratio Lev_{t-1}, firm size $Size_{t-1}$, firm age Age_{t-1}, annual stock return Ret_{t-1} and lagged investment Inv_{t-1} as control variables to mitigate the effect of other factors. From the estimates in column (2) of Table 4, we see that the coefficient on the PInv in the regression is 0.0906 and significant at a 1% ($t = 6.73$) level, which is consistent with column (1). We also control for the peer firms' specific characteristics in the model to mitigate omitted variable bias (Leary and Roberts, 2014). Regarding omitted factors, we note the following in column (3) of Table 4. The adjusted R^2 is 0.398, and the control variables are statistically significant in the expected directions. The coefficient on the PInv is positive and significant at a 1% level, which indicates that a one standard deviation increase in the average peer firm investment leads to a 4% (calculation: $(0.0618 \times 0.040)/0.062$) increase in firm *i*'s investment after controlling for firm-specific and peer firm-specific characteristics. This suggests that peer firms play an important role in shaping corporate investment policy, which may be a strategy used to reduce investment uncertainty and stabilize the competition position in the market. The above regression results provide evidence supporting our Hypothesis.

We then classify investment into tangible and intangible asset investment, and examine the peer effects in both investment types. The results are presented in Table 5. In column (1), the coefficient on PPE is 0.1401, and significant at a 1% level ($t = 7.09$), which indicates that firm *i*'s PPE investment increases 14.4% points

Table 5
Peer effects on different investment types.

	(1) Dep: PPE investment		(2) Dep: R&D investment	
	Coefficient	*t*-Value	Coefficient	*t*-Value
PPE	**0.1041*****	**(7.09)**		
RD			**0.0277****	**(1.97)**
Firm-specific characteristics				
$Growth_{t-1}$	0.0043***	(2.68)	−0.0002	(−0.41)
$Cash_{t-1}$	−0.0167***	(−5.10)	−0.0008	(−1.00)
Lev_{t-1}	0.0401***	(9.72)	0.0037***	(3.83)
$Size_{t-1}$	−0.0145***	(−7.16)	−0.0025***	(−6.99)
Age_{t-1}	−0.0008***	(−5.28)	−0.0002***	(−6.59)
Ret_{t-1}	0.0117***	(7.88)	0.0019***	(4.88)
Inv_{t-1}	0.3730***	(36.87)	0.0236***	(10.10)
Peer firm-specific characteristics				
$Growth_{t-1}$	0.0049**	(2.39)	0.0003	(0.48)
$Cash_{t-1}$	−0.0567***	(−7.52)	−0.0033*	(−1.71)
Lev_{t-1}	−0.0210***	(−3.18)	−0.0015	(−0.99)
$Size_{t-1}$	0.0236***	(10.90)	0.0029***	(7.27)
Age_{t-1}	−0.0015***	(−4.57)	−0.0001*	(−1.81)
Ret_{t-1}	0.0001	(0.02)	0.0005	(0.92)
Inv_{t-1}	−0.0399**	(−2.23)	0.0013	(0.34)
Constant	−0.1535***	(−10.62)	−0.0020	(−0.60)
Year		Controlled		Controlled
Industry		Controlled		Controlled
N		17,463		17,463
Adj. *R*-sq.		0.263		0.056
F		98.5492		18.9477

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.
* Significance at a 10% level (two-tailed test).
** Significance at a 5% level (two-tailed test).
*** Significance at a 1% level (two-tailed test).

with a one standard deviation increase in peer firms' PPE investment. Regarding R&D investment in column (2), we find that the coefficient is significantly positive, and that a one standard deviation increase in average peer firms R&D investment leads to a 5.54% increase in firm *i*'s R&D investment. In summary, firms have a strong incentive to mimic their peer firms' PPE and R&D investment, but the peer effect is more pronounced in tangible asset investment. Mimicking intangible asset investment policies requires more support, such as corresponding research teams and techniques, making this learning behavior more difficult in the short term.

5.2. Robustness tests

The above evidence shows that peer firms are important determinants for corporate investment. To avoid peer identification bias due to the current criteria, we specify peer firms using new criteria and then test our hypothesis. We not only consider industry and size in identifying peer firms, but also consider their registered province, based on spatial competition theory. We specify firms in the same registering city and industry, and in the upper and lower size quartiles (0.75 times to 1.25 times of a firm's total assets) to the firm as provincial-level peer firms. The results are reported in Panel A of Table 6. The coefficients on PInv are 0.0638 and 0.0918 in columns (1) and (2), respectively. The significantly positive coefficients are consistent with the above findings and provide further support for our hypothesis. Second, we replace provincial-level peer firms with national-level peers and re-examine the peer effect in corporate investment. We define firms whose assets are in the range of 0.9–1.1 times the assets of the firm and when the industry is the same as national-level peer firms. From the estimates in columns (3) and (4), we can see that the coefficients on Pinv measured by national

Table 6
Robustness tests.

	Dep: Inv							
	Peer (Prov, 25%)				Peer (Nat, 10%)			
	(1)		(2)		(3)		(4)	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
Panel A Specifying peers using different criteria								
PInv	**0.0638*****	**4.30**	**0.0918*****	**5.09**	**0.0939*****	**7.68**	**0.1400*****	**10.03**
Firm-specific characteristics								
$Growth_{t-1}$	0.0062***	3.00	0.0054***	2.65	0.0038***	2.62	0.0016	1.17
$Cash_{t-1}$	−0.0282***	−7.62	−0.0270***	−7.28	−0.0266***	−9.53	−0.0234***	−8.48
Lev_{t-1}	0.0162***	3.25	0.0178***	3.61	0.0168***	4.48	0.0156***	4.19
$Size_{t-1}$	−0.0012	−1.45	−0.0119***	−4.00	−0.0003	−0.50	−0.0320***	−10.96
Age_{t-1}	−0.0007***	−3.99	−0.0007***	−3.86	−0.0007***	−5.09	−0.0007***	−4.91
Ret_{t-1}	0.0160***	8.81	0.0148***	7.86	0.0151***	11.11	0.0110***	8.10
Inv_{t-1}	0.4632***	36.28	0.4584***	35.79	0.4694***	50.51	0.4496***	48.63
Peer firm-specific characteristics								
$Growth_{t-1}$			0.0060**	2.04			0.0060***	3.40
$Cash_{t-1}$			−0.0153***	−2.58			−0.0075	−1.34
Lev_{t-1}			0.0051	1.18			0.0064	1.51
$Size_{t-1}$			0.0128***	3.54			0.0346***	11.02
Age_{t-1}			0.0001	0.55			0.0002	1.10
Ret_{t-1}			0.0032	1.18			0.0034	1.62
Inv_{t-1}			0.0035	0.22			−0.0180	−1.40
Constant	0.0494***	2.91	0.0028	0.12	0.0264**	2.19	−0.0372***	−2.73
Year		Controlled		Controlled		Controlled		Controlled
Industry		Controlled		Controlled		Controlled		Controlled
N		7634		7634		15,284		15,284
Adj. *R*-sq.		0.397		0.410		0.385		0.420
F		119.3529		105.5605		177.6010		153.9109

	Dep: Inv					
	(1) Peer (Prov, 25%)		(2) Peer (Nat, 25%)		(3) Peer (Nat, 10%)	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
Panel B Replacing lagged with contemporaneous control variables						
PInv	**0.1015*****	**5.44**	**0.0870*****	**4.23**	**0.0744*****	**4.92**
Firm-specific characteristics						
Growth	0.0295***	18.46	0.0294***	12.53	0.0306***	17.37
Cash	−0.0238***	−6.14	−0.0261***	−4.87	−0.0224***	−5.39
Lev	0.0220***	3.98	0.0169**	2.29	0.0237***	4.07
Size	0.0139***	8.84	0.0110***	7.91	0.0103***	5.12
Age	−0.0031***	−15.51	−0.0033***	−12.72	−0.0031***	−14.92
Ret	0.0025*	1.92	0.0019	1.04	0.0027*	1.92
Peer firm-specific characteristics						
Growth	0.0022	1.17	−0.0036	−1.08	0.0012	0.57
Cash	0.0041	0.47	0.0015	0.17	−0.0079	−1.08
Lev	−0.0054	−0.84	0.0042	0.71	−0.0063	−1.22
Size	−0.0022	−1.41	0.0003	0.31	0.0027	1.49
Age	0.0001	0.32	−0.0001	−0.29	−0.0002	−0.88
Ret	−0.0056***	−2.94	−0.0019	−0.66	−0.0029	−1.36
Constant	−0.1858***	−10.96	−0.1822***	−7.31	−0.2112***	−11.36
Year		Controlled		Controlled		Controlled
Industry		Controlled		Controlled		Controlled

(*continued on next page*)

Table 6 (*continued*)

	(1) Peer (Prov, 25%)		(2) Peer (Nat, 25%)		(3) Peer (Nat, 10%)	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
N		17,463		7634		15,284
Adj. *R*-sq.		0.212		0.216		0.204
F		51.0907		30.9489		46.7047

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.

* Significance at a 10% level (two-tailed test).

** Significance at a 5% level (two-tailed test).

*** Significance at a 1% level (two-tailed test).

peer firms' average investment are positive (0.0939 and 0.1400) and significant ($t = 7.86$; $t = 10.03$). The evidence shows that peer firms do influence a firm's investment decision-making. In summary, the inferences are robust to these different measures.

Furthermore, we replace the lagged control variables with contemporaneous controls to address the concern that investment policy affects firm-specific and peer firm characteristics with a lag. The results are tabulated and reported in Panel B of Table 6. As expected, the coefficients on explanatory variables are strongly positive. Again, we see little change in the results, suggesting that model misspecification in the control variables is unlikely to be behind our results. All the robustness tests are consistent with our main results, further strengthening the reasoning on peer effects in corporate investment decisions.

5.3. Reflection problem and endogeneity bias

The above evidence is, however, insufficient to establish a causal relationship between the investment of peer firms and a firm's investment, as the correlation may be driven by a reflection problem. This problem is due to how peer firms are identified, in this case as peers in the same industry. Firms from the same industry face similar institutional environments, investment opportunities and consumption demands, so are more likely to make similar investment decisions. Our next challenge is therefore to identify the causality and mitigate the disturbance of the reflection problem (Manski, 1993; Shue, 2013). Specifying firms in the same industry but not in the upper and lower size quartiles as the firm as non-peers, we then examine whether these non-peer firms can influence corporate investment policies. The test is reasonable and valuable as these non-peer firms are still in the same industry and the same regulatory environment, so they can filter the effects of their macro-economy, industry policy and market development on investment synchronicity. If our findings are driven by these common factors rather than by a learning incentive, then we can predict that there will still be a significantly positive relation between non-peers' investment and a firm's own investment. However, the results from column (1) of Table 7 show that the coefficient on NPInv is negative (−0.0048) and insignificant ($t = -0.19$), which violates the expectation based on the reflection problem. The evidence that non-peers in the same industry do not affect corporate investment suppresses reflection problem concerns but supports the causality of the peer effect in investment decisions.

To alleviate endogeneity bias, we follow the method of Leary and Roberts (2014) and use peer firm equity shocks to instrument for peer firm investment policy. Foucault and Fresard (2014) find that stock prices react to corporate investment policy, which shows that equity shock, correlated with investment decisions, meets the requirement of instrumental relevance. The peer firms return shocks are serially uncorrelated and cross-uncorrelated, and are less likely to be manipulated by managers compared to other investment determinants, such as profitability and cash ratios. This measure is available for a broad panel of firms and thus mitigates the statistical power and external validity concerns, when comparing CEO sudden death. While these features do not guarantee exogeneity, they are reassuring as they suggest that peer firm return shocks contain little common variation. Regression results using instrumental variables are reported in column (2) of Table 7. When using average peer firm investment as the dependent variable in the first stage, instrumental variable is positive

Table 7
Reflection problem and endogeneity bias.

	Dep: Inv					
	(1) OLS		(2) 2SLS		(3) FE	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
NPInv	**−0.0048**	**−0.19**				
PInv			**0.6666***	**1.86**	**0.0847*****	**5.24**
Firm-specific characteristics						
$Growth_{t-1}$	−0.0002	−0.14	0.0008	0.62	0.0035***	2.64
$Cash_{t-1}$	0.0110***	2.59	−0.0352***	−7.90	−0.0290***	−11.38
Lev_{t-1}	−0.0181***	−6.09	0.0601***	12.93	0.0155***	4.29
$Size_{t-1}$	−0.0582***	−13.40	−0.0269***	−13.44	0.0023***	4.76
Age_{t-1}	−0.0005***	−3.41	−0.0008	−0.83	−0.0009***	−7.19
Ret_{t-1}	0.0066***	4.61	0.0099***	8.05	0.0153***	11.94
Inv_{t-1}	0.4488***	29.80	0.2699***	26.47	0.4720***	53.01
Peer firm-specific characteristics						
$Growth_{t-1}$	0.0045*	1.79	0.0029*	1.67	0.0005	0.82
$Cash_{t-1}$	−0.0205**	−2.47	−0.0261***	−3.54	−0.0168	−1.59
Lev_{t-1}	0.0149	0.98	−0.0207***	−3.53	−0.0279***	−3.22
$Size_{t-1}$	0.0596***	21.13	0.0197***	9.88	−0.0004**	−2.05
Age_{t-1}	0.0006*	1.82	−0.0005	−1.46	−0.0007	−1.41
Ret_{t-1}	−0.0015	−0.22	0.0015	0.76	0.0044	1.13
Inv_{t-1}	−0.2360	−1.27	−0.0312**	−2.00	0.0847***	3.30
Constant	−0.0252	−0.68	0.2080***	7.93	0.0061	0.49
First stage in 2SLS regression						
Shock			0.0052***	4.66		
Year		Controlled		Controlled		Controlled
Industry		Controlled		Controlled		—
Firm		—		—		Controlled
N		17,463		13,667		17,463
Adj. *R*-sq.		0.385		0.397		0.185
F		182.0175		184.9233		41.1082

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.
* Significance at a 10% level (two-tailed test).
** Significance at a 5% level (two-tailed test).
*** Significance at a 1% level (two-tailed test).

and significant at a 1% level. In the second stage, the coefficient on PInv is still significantly positive, which is consistent with the main results.

Finally, with the inclusion of firm fixed effects in the regression model, we reexamine whether peer firms influence the investment behavior of a firm. As shown in column (3), the coefficient on Pinv is 0.0824 and significant at a 1% level ($t = 5.24$). The evidence indicates that commonalities among firm's investment policy are time-invariant investment determinants over the business cycle, but this does not influence the conclusion. All tests confirm the findings are robust after removing the reflection problem and mitigating endogeneity bias.

While our results establish the presence of significant peer effects, they are subject to limitations. We cannot distinguish between the characteristics and behavior of peer firms that affect a firm's investment policy. To exclude the alternative explanation, we exploit heterogeneity in a firm's investment change responses to their peers' equity shock, by performing a double sort of the data, based on quintiles of our peer firm average equity shocks and peer firm investment changes. Within each quintile combination, we calculate the average changes in investment for firm *i* and *t*-statistics of whether this change is significantly different from zero.

The results are presented in Table 8, where quintile 1 represents the lowest 20% of the distribution and quintile 5 the highest. For example, the average change in investment among firms in the lowest peer firm

Table 8
Removal of alternative explanation.

Peer Return Shock	PInv					
	1 (low)	2	3	4	5 (high)	5-1
1 (low)	0.0407*** (22.26)	0.0474*** (18.96)	0.0495*** (17.81)	0.0652*** (22.98)	0.0859*** (30.78)	0.0452*** (14.15)
2	0.0285*** (12.65)	0.0489*** (20.43)	0.0530*** (24.32)	0.0618*** (23.52)	0.0839*** (26.74)	0.0554*** (13.23)
3	0.0337*** (13.99)	0.0455*** (22.32)	0.0495*** (27.17)	0.0653*** (27.57)	0.0798*** (27.48)	0.0462*** (11.88)
4	0.0323*** (12.23)	0.0446*** (20.53)	0.0519*** (21.74)	0.0613*** (24.59)	0.0838*** (27.25)	0.0515*** (11.67)
5 (high)	0.0420*** (19.64)	0.0489*** (19.96)	0.0511*** (20.17)	0.0603*** (21.08)	0.0842*** (27.38)	0.0422*** (11.61)
5-1	0.0013 (0.46)	0.0014 (0.39)	0.0016 (0.41)	−0.0048 (−1.19)	−0.0018** (−0.42)	

* Significance at a 10% level (two-tailed test).
** Significance at a 5% level (two-tailed test).
*** Significance at a 1% level (two-tailed test).

equity shock quintile and the highest peer firm leverage change quintile is 0.0859 with a *t*-statistic of 30.78. We note a monotonic increase in the average investment change across each row. Holding fixed the peer firm equity shock, investment changes are strongly positively correlated with changes in peer firm investment. The converse is not true. Average investment changes are largely uncorrelated with the peer firm equity shock, holding fixed peer firms' average investment change. In fact, in the last row (5-1), where the difference of average peer firm investment changes between rows 1 and 5 is indistinguishable from zero, the cell averages are all economically small and two are statistically insignificant. Thus, firms only change their investment in response to a peer firm equity shock if it is accompanied by a change in peer firm investment. These findings reinforce the implication of the regression results and suggest that a firm's investment is more likely a response to peer firm financial policies, as opposed to characteristics.

6. Channels of identification

Lieberman and Asaba (2006) found that information imperfection and market competition are the two main causes of imitation among the peer group. Thus, we empirically examine the channels through which peer effects operate. Based on information theory, firms actively learn from peers' decisions as they have imperfect information on decision-making and they believe that peers' actions convey some useful information to guide their real decisions. If firms are able to capture information about macroeconomic or industry policy in advance, or if they can identify the profitable investment opportunities, then we can predict that the firms have the advantage in collecting and analyzing information, and thus have less incentive to mimic the investment decisions of peer firms. Investment is critical to further development, and firms usually take some time to select projects, survey consumer demand, analyze viability and finalize projects. The peer group faces similar institutional environments, investment opportunities and consumption demands, and is likely to make similar investment decisions. As such, a firm is eager to notice and value the information of peer firms so they can overcome information imperfection and reduce uncertainty. Thus, we predict that the information quality of peer firms also influences the peer effect in investment. We test these two predictions in two ways.

First, following Houston et al. (2014), we use the distance between the registering city of the firm and the capital city Beijing to measure the informational advantage of the firm. Most relevant investment policies are made at conferences in Beijing, and firms near the city are more likely to identify profitable investment opportunities in advance, so we predict that the investment of firms far from Beijing is more sensitive to that of their peers. As shown in column (1) of Table 9, the coefficient on the interaction term PInv × Dis is 0.0135, and significant at a 10% level ($t = 1.93$), demonstrating that investment is more sensitive to peer firms far from Beijing. The evidence for our prediction is strong.

AH companies are Chinese firms that have A-shares listed in mainland China and H-shares listed in Hong Kong. They are under the supervision of the Chinese Securities Regulatory Commission (CSRC), and also four Hong Kong regulatory agencies: (1) the Hong Kong Securities and Futures Commission (HKSFC), (2) the Hong Kong Stock Exchange (HKSE), (3) the Hong Kong Institute of Certified Public Accountants (HKICPA) and (4) the Independent Commission against Corruption. The Hong Kong media, analysts and

Table 9
Information-based theory.

	Dep: Inv			
	(1)		(2)	
	Coefficient	*t*-Value	Coefficient	*t*-Value
PInv	−0.0240	−0.51	0.0442***	2.66
Dis	−0.0003	−0.58		
PInv × Dis	**0.0135***	**1.93**		
AH			−0.0070***	−3.36
PInv × AH			**0.1103***	**3.53**
Firm-specific characteristics				
$Growth_{t-1}$	0.0026**	2.00	0.0026**	2.02
$Cash_{t-1}$	0.0161***	4.37	0.0160***	4.30
Lev_{t-1}	−0.0264***	−10.06	−0.0264***	−10.06
$Size_{t-1}$	−0.0088***	−5.50	−0.0090***	−5.65
Age_{t-1}	−0.0009***	−6.79	−0.0009***	−6.72
Ret_{t-1}	0.0136***	10.61	0.0136***	10.57
Inv_{t-1}	0.4595***	50.54	0.4597***	50.49
Peer firm-specific characteristics				
$Growth_{t-1}$	0.0042**	2.49	0.0043**	2.56
$Cash_{t-1}$	−0.0375***	−6.02	−0.0360***	−5.76
Lev_{t-1}	−0.0239***	−4.73	−0.0241***	−4.76
$Size_{t-1}$	0.0156***	9.37	0.0158***	9.45
Age_{t-1}	−0.0009***	−3.46	−0.0009***	−3.24
Ret_{t-1}	0.0019	0.92	0.0018	0.90
Inv_{t-1}	−0.0523***	−3.44	−0.0545***	−3.58
Constant	−0.0905***	−7.48	−0.0903***	−7.93
Year		Controlled		Controlled
Industry		Controlled		Controlled
N		17,463		17,463
Adj. *R*-sq.		0.398		0.398
F		175.1240		175.4697

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.
* Significance at a 10% level (two-tailed test).
** Significance at a 5% level (two-tailed test).
*** Significance at a 1% level (two-tailed test).

institutional investors also play an important role in enforcement. However, China has only recently developed a legal framework for the stock market, and has a weak law enforcement record (Pistor and Xu, 2005). The legal environment has improved in recent years, but it still lags behind Hong Kong in terms of the protection afforded to minority investors. The market for financial analysts is not well developed and institutional ownership is low (Chen et al., 2013). Institutional investors and brokerage firms are often affiliated with the government, so may lack incentives to protect private shareholders. Finally, the media in China are less active than their counterparts in Hong Kong in terms of investigating and publicizing accounting scandals. Government control of the media can prevent full disclosure, as stories are affected by political interests. Consequently, the information disclosed by an AH share firm is more reliable and valuable (Ke et al., 2015). We define a dummy variable AH to measure the information quality of peer firms. Specifically, if at least one AH share firm is in the peer group, then AH equals one, otherwise zero. The results are presented in column (2) of Table 9. The coefficient on the interaction term PInv × AH is 0.1103, and significant at a 1% ($t = 3.53$) level, which indicates that the peer effect on corporate investment is more pronounced when the peer group includes at least one AH share firm. The above evidence provides solid support that sensitivity to peer firms' investment varies with the informativeness of both a firm and its peers.

Avoiding falling behind rivals is an important incentive for firms to imitate each other. Imitation to moderate rivalry is most common when firms with comparable resource endowments and market positions face one another. Under a highly competitive market, firms are exposed to a higher risk of bankruptcy and continuous operating is uncertain, which leads to severe financing constraints (Povel and Raith, 2004). They also pay more attention to resource allocation behavior as they compete for limited resources such as consumers in the highly competitive market (Valta, 2012). Chen and Chang (2012) find that the ratio of cash to total assets is significantly influenced by peer firms' average cash holdings. They argue that firms imitate others to reserve cash in an effort to maintain their relative position or to neutralize the aggressive actions of rivals. We next examine whether market competition influences the peer effect in corporate investment policy. Similar to previous studies (Curry and George, 1983; Giroud and Mueller, 2011), we use the Herfindahl index and the number of firms in each two-digit industry to proxy for market competition. From the estimates in Table 10, we find that the coefficients on the interaction terms are both positive and significant, which supports our prediction. In summary, the evidence demonstrates that when competitors take similar action, there is less chance that any firm will succeed or fail relative to others. Imitation therefore helps preserve the status quo among competitors that follow each other. In a competitive market, these firms have strong incentives to learn from the behavior of peer firms.

Table 10
Rival-based theory.

	Dep: Inv			
	(1) HHI		(2) Num	
	Coefficient	*t*-Value	Coefficient	*t*-Value
PInv	−0.0901*	−1.86	−0.1272***	−2.85
HHI	0.0092	0.48		
PInv × HHI	**0.1402*** **	**3.25**		
Num			−0.0028	−1.09
PInv × Num			**0.0362*** **	**4.53**
Firm-specific characteristics				
$Growth_{t-1}$	0.0026**	1.96	0.0026**	1.98
$Cash_{t-1}$	−0.0263***	−10.05	−0.0263***	−10.00
Lev_{t-1}	0.0161***	4.32	0.0159***	4.28
$Size_{t-1}$	−0.0093***	−5.78	−0.0094***	−5.81
Age_{t-1}	−0.0009***	−6.73	−0.0009***	−6.76
Ret_{t-1}	0.0136***	10.66	0.0136***	10.61
Inv_{t-1}	0.4602***	50.63	0.4596***	50.61
Peer firm-specific characteristics				
$Growth_{t-1}$	0.0038**	2.24	0.0039**	2.32
$Cash_{t-1}$	−0.0355***	−5.67	−0.0357***	−5.69
Lev_{t-1}	−0.0259***	−5.11	−0.0255***	−5.02
$Size_{t-1}$	0.0162***	9.60	0.0162***	9.57
Age_{t-1}	−0.0009***	−3.57	−0.0009***	−3.42
Ret_{t-1}	0.0016	0.78	0.0015	0.75
Inv_{t-1}	−0.0474***	−3.09	−0.0453***	−2.95
Constant	−0.1003***	−4.69	−0.0780***	−5.01
Year		Controlled		Controlled
Industry		Controlled		Controlled
N		17,458		17,458
Adj. *R*-sq.		0.399		0.399
F		174.8980		176.4205

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.

* Significance at a 10% level (two-tailed test).

** Significance at a 5% level (two-tailed test).

*** Significance at a 1% level (two-tailed test).

7. Heterogeneity in peer effect

Given the importance of peer firm behavior for firms' investment policy, we now turn to why firms mimic one another. In this section, we focus on firm specific characteristics such as industry leader position, firm age and corporate financing constraints, and then examine whether some firms within the industry are more or less sensitive to their peers' investment policy.

First, we examine whether an industry leader is less sensitive to peer firms' investment behavior. In general, industry leaders are more likely to have the ability to identify potentially profitable investment opportunities and innovate on new products, thus making the imitation to peer firms less valuable for industry leader. Leary and Roberts (2014) present evidence showing that industry leaders' financial policy is less sensitive to its peers' financial policy, though peer firms play an important role in shaping corporate capital structure. They argue that small firms have stronger incentive to mimic their peers' investment behavior, to reduce investment uncertainty. We categorize firms within each industry-year into two groups, industry leaders and followers. We define these by sorting firms within each industry-year into three groups according to their sales share.

Table 11
Heterogeneity in peer effect.

	Dep: Inv					
	(1) Industry Leader		(2) Firm Age		(3) Financing Constraints	
	Coefficient	*t*-Value	Coefficient	*t*-Value	Coefficient	*t*-Value
PInv	0.1241***	7.69	0.0285	1.24	−0.0687*	−1.73
Leader	0.0097***	5.60				
PInv × Leader	**−0.0450****	**−2.31**				
Young			−0.0025	−1.60		
PInv × Young			**0.0375***	**1.80**		
WW					−0.2297***	−20.65
PInv × WW					**−0.1082*****	**−3.39**
Firm-specific characteristics						
$Growth_{t-1}$	0.0021	1.56	0.0026**	2.01	0.0014	1.08
$Cash_{t-1}$	−0.0290***	−11.18	−0.0264***	−10.09	−0.0156***	−6.04
Lev_{t-1}	0.0121***	3.26	0.0160***	4.32	0.0070*	1.93
$Size_{t-1}$	−0.0103***	−6.33	−0.0088***	−5.48	−0.0194***	−14.55
Age_{t-1}	−0.0009***	−6.72	−0.0009***	−6.09	−0.0006***	−4.33
Ret_{t-1}	0.0132***	10.21	0.0136***	10.61	0.0097***	7.81
Inv_{t-1}	0.4722***	52.95	0.4599***	50.31	0.4400***	49.48
Peer firm-specific characteristics						
$Growth_{t-1}$	0.0032*	1.88	0.0041**	2.45	0.0042**	2.51
$Cash_{t-1}$	−0.0552***	−9.12	−0.0360***	−5.73	−0.0297***	−5.00
Lev_{t-1}	−0.0318***	−6.55	−0.0244***	−4.85	−0.0228***	−4.65
$Size_{t-1}$	0.0147***	8.77	0.0156***	9.30	0.0112***	8.10
Age_{t-1}	−0.0010***	−4.45	−0.0009***	−3.34	−0.0004	−1.58
Ret_{t-1}	0.0019	0.97	0.0018	0.90	0.0032	1.62
Inv_{t-1}	0.0005	0.88	−0.0518***	−3.41	−0.0329**	−2.20
Constant	−0.0433***	−3.43	−0.0899***	−8.05	0.0005	0.04
Year		Controlled		Controlled		Controlled
Industry		Controlled		Controlled		Controlled
N		17,463		17,463		17,307
Adj. *R*-sq.		0.394		0.398		0.424
F		223.1080		174.9855		197.7103

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.

* Significance at a 10% level (two-tailed test).

** Significance at a 5% level (two-tailed test).

*** Significance at a 1% level (two-tailed test).

Industry leaders are those firms in the top third of the distribution. From the results in column (1) of Table 11, we find that the coefficient on the interaction term is negative and significant at a 5% level, which indicates that industry leaders' investment policy is less influenced by their peers compared to followers' investment behavior. The inference is consistent with Leary and Roberts (2014).

Second, previous evidence shows that young firms are different from mature firms in many aspects, such as unfamiliarity with the regulatory environment, a poor ability to capture valuable information, and higher capital costs of financing, and that young firms lack sufficient operating experience and sufficient available resource to compete with rivals (Petersen and Rajan, 1994; Hadlock and Pierce, 2010). Relative to mature firms, young firms are therefore exposed to higher risk of bankruptcy (Dune et al., 1989), and "follow-the-leader" behavior is the result of risk minimization. If rivals match each other, none become relatively better or worse off. This strategy guarantees that their competitive capabilities remain roughly in balance. We therefore predict that the investment of young firms is more sensitive to that of peer firms. We also categorize firms within each industry-year into two groups, young firms and mature firms. We define these by sorting firms within each industry-year into three groups according to their age in the listed year. Young firms are those in the bottom third of the distribution. The results show that the interaction term is significantly positive, which is consistent with our prediction.

Firms are defined as more financially constrained by Whited-Wu's (2006) index. The empirical results are reported in column (3) of Table 11. The coefficient on PInv × WW is −0.1082, and is significant at a 1% level. The finding suggests that financing constraints moderate the learning effect in corporate investment decisions, as mimicking behavior is expected to be more costly for financially constrained firms, given their high cost of financing. This evidence indicates that industry leaders, mature firms and financially constrained firms are less sensitive to their peers' investment policy.

Table 12
Economic consequences of peer effect.

	(1) $T+1$		(2) $T+2$		(3) $T+3$	
	Dep: ROA	Dep: Tobin-Q	Dep: ROA	Dep: Tobin-Q	Dep: ROA	Dep: Tobin-Q
Inv	0.1030***	−1.4310***	0.0628***	−0.5086**	0.0514***	−0.5299**
	4.87	−4.21	3.86	−2.42	2.98	−2.45
Pinv	−0.0503	−3.0759***	−0.0634***	−1.1022***	−0.0808***	−1.1882***
	−1.61	−6.17	−2.78	−3.87	−3.19	−3.97
Inv × Pinv	**0.3825**	**22.1938*** **	**0.4517***	**9.1425*** **	**0.4958***	**9.2450*** **
	1.22	**4.71**	**1.85**	**3.00**	**1.86**	**2.96**
Growth	0.0432***	0.0338	0.0265***	0.0332*	0.0226***	0.0273
	18.48	1.32	17.84	1.96	15.10	1.54
Lev	−0.1223***	−0.2243**	−0.0809***	−0.3277***	−0.0704***	−0.3221***
	−22.96	−2.23	−19.69	−5.37	−15.48	−4.99
Size	0.0114***	−0.4312***	0.0075***	−0.3395***	0.0075***	−0.3408***
	12.40	−21.72	9.50	−29.92	8.29	−27.79
Age	−0.0003	0.0200***	−0.0003	0.0144***	−0.0003	0.0126***
	−1.12	4.50	−1.31	4.97	−1.14	3.39
Constant	−0.1562***	11.1052***	−0.0955***	9.0714***	−0.1027***	8.8939***
	−8.43	28.46	−5.95	39.07	−5.61	35.53
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
N	15,366	14,820	13,610	12,641	12,035	10,712
Adj. *R*-sq.	0.175	0.387	0.182	0.448	0.158	0.447
F	53.4831	82.8870	57.8204	174.4153	41.3233	128.7491

Note: All coefficient estimates are adjusted using heteroskedasticity and company clustering to obtain robust standard errors. Adjusted *t*-statistics are provided in brackets.

* Significance at a 10% level (two-tailed test).

** Significance at a 5% level (two-tailed test).

*** Significance at a 1% level (two-tailed test).

8. Economic consequences of peer effect

Finally, using ROA and Tobin-Q to measure corporate performance in the next one to three years, we examine the economic consequences generated from learning behavior. From the estimates in Table 12, we find that the coefficients on the interaction term Inv × Pinv are significantly positive, which indicates learning behavior in investment benefit corporate performance. Specifically, learning behavior can increase corporate performance and firm value. The results reveal the importance of the learning effect under an uncertain environment .

9. Conclusion

It is common for corporations to interact with peer firms in decision-making, through actions such as signing strategic cooperating agreements and developing marketing strategies. Recent studies examine whether the characteristics or behavior of peer firms affects corporate capital structure (Leary and Roberts, 2014), mergers and acquisitions (Bizjak et al., 2009) and tax avoidance (Li et al., 2014). Investment decisions are important and determine corporate development. Most studies examining the peer effect in corporate investment hold that managers can gain useful information from the stock price of peer firms. Edmans et al. (2012a, 2012b) and Bond et al. (2012) point out that stock prices contain useful information that is helpful in guiding a firm's investment policy, such as industry growth opportunities, external environment, strategy of competitors and consumer demands. Valuing the stock price of peer firms can capture useful information, which can reduce investment uncertainty. However, few studies examine the direct effect of peer firms' investment behavior on the firm's investment policy. The aim of this study was therefore to identify whether, how, and why peer firm behavior matters for corporate investment policies.

Using a sample of China's listed firms from 1999 to 2012 and following Albuquerque (2009) to define peer firms, we indicate that a one standard deviation increase in peer firms' investment is associated with a 4% increase in firm *i*'s investment. Classifying investment into tangible asset investment and intangible asset investment, we then examine the peer effect in these different types. We find that both are significantly influenced by the investment behavior of peer firms, while the peer effect is more pronounced in tangible asset investment. To establish the causal relationship between a firm's investment and peer firms' investment policy, we address the reflection problem and endogeneity bias as much as possible. We use the following tests to address these concerns. First, specifying firms that are in the same industry but are not in the upper and lower size quartiles as the firm as a non-peer group, we examine the effect of the behavior of non-peer firms have on the firm's investment policy. Second, we use the instrumental variable method to address the possible endogeneity bias, and predict that the learning effect is still significant by using two stage least squared regression. Third, we incorporate the year fixed effect and firm fixed effect into the model, and reexamine the peer effect on investment. The results change little and are consistent with the main findings of the study.

Next, we identify the possible channels through which peer firms influence corporate investment policy. We find that peer effects are more pronounced when firms have information advantages and when the information disclosure quality of peer firms is higher or if they face more fierce competition. To reveal the potential mechanisms behind peer effects in investment policy, we further explore heterogeneity in the peer effect. When firms are industry followers, are young or have financial constraints, they are highly sensitive to their peers firms. We also quantify the economic consequences generated by peer effects, which can increase firm performance in future periods.

Acknowledgments

This study is the result of research supported by the National Natural Science Foundation of China (71263034, 71572087). We acknowledge the executive editor and the anonymous reviewer for their useful comments and suggestions.

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