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The effect of stock market pressure on the tradeoff between corporate and shareholders' tax benefits

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ABSTRACT

The Taiwanese government offers firms that invest in qualified projects in emerging high-tech industries two mutually exclusive tax incentives—a corporate 5-year tax exemption or shareholder investment tax credits. This study examines whether corporate managers take shareholder tax benefits into account in their corporate tax planning. The results show that privately held firms are more likely than listed firms to choose shareholder investment tax credits and forego corporate tax benefits. Listed firms with relatively high earnings response coefficients tend to choose a corporate 5-year tax exemption, as it can enhance reported after-tax earnings. Further, in the 5-year period following their choice of a particular tax incentive, firms choosing a corporate 5-year tax exemption exhibit significantly lower earnings persistence than those choosing shareholder investment tax credits. Taken together, these results suggest that stock market pressure has a significant effect on firms' choices between corporate and shareholder tax benefits, and that the choice of tax incentives has an effect on future earnings quality.

1. Introduction

To promote technological advancement, the Taiwanese government provides two mutually exclusive tax incentives to stimulate investment in qualified high-tech industries.[1] Companies that invest in the qualified industries can select either a 5-year exemption from corporate income tax on income derived from those investments or they can pass the tax incentive to their shareholders by granting shareholders investment tax credits of up to 20% (for corporate shareholders) or 10% (for individual shareholders) of the qualified

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[1] The qualified emerging hi-tech industries are regarded as strategically important to Taiwan's technological advancement and are specified in Articles 8 and 9 of the Statute for Upgrading Industries (Taiwan).

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investment amount.[2] As only one of the two alternatives can be selected, the choice of tax incentive is an important tax planning decision as to whether firms should keep the tax benefit at the corporate level or pass it to their shareholders. In Taiwan, the overall tax revenue losses resulting from these two tax incentives during the 1999–2005 period amounted to about US$3.6 billion.[3] The magnitude of the tax-savings from the two tax incentives is so significant that the choice between the two alternatives is generally regarded as one of the most important tax planning decisions made by managers in Taiwan.

The choice between shareholder tax benefits and corporate tax exemptions offered to managers of Taiwanese firms provides researchers with an opportunity to examine whether firms take shareholder taxes into account when making corporate tax planning decisions. Prior studies have addressed the role of capital market incentives in firms' tax planning concerns (Cloyd et al., 1996; Klassen, 1997; Armstrong et al., 2012; Graham et al., 2014). These studies, however, focus on the trade-off between corporate tax benefits and financial reporting costs. They have not addressed if and how capital market incentives affect a firm's choice between corporate and shareholder tax benefits. This study empirically investigates whether firms consider shareholder tax benefits when making corporate tax planning decisions in the presence of capital market pressure.

Scholes et al. (2015) emphasize in their classic textbook *Taxes and Business Strategy: A Planning Approach* that effective tax planning should take "all parties" into consideration. The Taiwanese context, in which firms choose either a corporate 5-year tax exemption or shareholder investment tax credits, constitutes a rare opportunity to empirically investigate how firms make the trade-off between corporate and shareholder tax benefits in tax planning.

Maximizing the overall tax benefits for a firm and its stockholders is contingent upon accurate forecasts of the firm's profitability in the 5-year period following the qualified investment. *Ex-ante*, if the projected tax-savings from a corporate 5-year tax exemption exceed those of shareholder investment tax credits, firms should choose a corporate 5-year tax exemption. Conversely, if the aggregate amount of shareholder investment tax credits exceeds the tax-savings of a corporate 5-year tax exemption, then the firm should choose shareholder investment tax credits and thereby shift the tax benefits directly to its stockholders.

Consider, as an example, an investment of $100 million in a qualified project. If the firm chooses shareholder investment tax credits, its shareholders may directly obtain tax credits of up to $20 million (for corporate shareholders) or $10 million (for individual shareholders). Conversely, if the firm chooses a corporate 5-year tax exemption, assuming that the rate of return on the project is a constant 20% per annum and the corresponding corporate tax rate is 25%,[4] the firm's overall tax savings during the 5-year period will be (undiscounted) $25 million in total. In the latter case, the shareholders pay the associated incremental individual income taxes, while the company distributes the tax-exempt earnings in the form of dividends. Thus, the optimal decision is based on the trade-off between corporate and shareholder tax savings.

In addition to creating tax savings for either firms or shareholders, the choice between the two tax incentives may also affect firms' reported earnings. Firms that choose a corporate 5-year tax exemption can directly reduce their corporate income tax expenses, whereas firms that pass investment tax credits to their shareholders still have to pay corporate income tax. Thus, *ceteris paribus,* firms choosing a corporate 5-year tax exemption will report greater after-tax earnings in their financial statements than firms choosing shareholder investment tax credits. Consequently, when choosing a tax incentive, firms are also making a trade-off between corporate financial reporting costs and shareholder tax benefits.

This study conducts empirical tests in the following two ways. First, I compare the tax planning decisions of privately held and listed firms.[5] Compared with listed firms, privately held firms, which do not have stock price pressure from the capital market, are more likely to choose shareholder investment tax credits, thereby giving

[2] The credit rate depends on the type of shareholder. The credit rate is 20% for corporate shareholders and 10% for individual shareholders. Firms that choose a corporate 5-year tax exemption must relinquish the application for shareholder investment tax credits, and *vice versa*, with no alteration being allowed after the choice is made.

[3] Financial Data Center, Ministry of Finance (Taiwan), Statistics on Tax Revenues of Profit-Seeking Enterprise Income Tax (1999–2005).

[4] Taiwan's corporate income tax rate is essentially a flat rate of 25% for taxable income above NT$100,000.

[5] Privately held firms' stocks are not listed on either of the two stock exchanges. Hence, privately held firms are not subject to stock price pressure from the capital market.

tax benefits directly to their shareholders. I examine whether the difference in stock price pressure between the two types of firms affects their choice between a corporate 5-year tax exemption and shareholder investment tax credits.

Second, I examine how tax planning decisions within listed firms vary with different levels of capital market pressure. As listed firms may differ in their level of stock price pressure, the incentive for them to increase reported earnings may also vary with the pressure from the capital market. For instance, listed firms with relatively high earnings response coefficients (ERCs), whose stock returns exhibit a high degree of covariation with reported earnings, are more likely than firms with low ERCs to have strong incentives to increase reported earnings to reduce their financial reporting costs. Accordingly, firms with high ERCs are more likely to choose a corporate 5-year tax exemption than firms with low ERCs. Hence, I use ERCs as a direct proxy for the degree of stock price pressure on listed firms and examine whether differences in listed firms' stock price pressure affect their choice of a corporate 5-year tax exemption or shareholder investment tax credits.[6]

To analyze the economic consequences of the choice of tax incentive, I further examine whether financial reporting incentives are different in firms that choose different types of tax incentives. For firms that choose shareholder investment credits, the total tax benefits of shareholders are determined by the qualified investment amount and are thus independent of firms' future earnings. In contrast, for firms choosing a corporate 5-year exemption, the total corporate tax benefits depend on the firms' future earnings during the 5-year exemption period. Thus, compared with firms that choose shareholders tax benefits, firms that choose a corporate 5-year exemption are likely to have a greater incentive to maximize their earnings during the exemption period, resulting in lower levels of earnings persistence.

The results of this study show that privately held firms are more likely than listed firms to choose shareholder investment tax credits. Additionally, listed firms with relatively high ERCs tend to choose a corporate 5-year tax exemption that increases their reported after-tax earnings. Further, in the 5-year period following their choice of a tax incentive, firms choosing a corporate 5-year tax exemption exhibit significantly lower earnings persistence than those choosing shareholder investment tax credits. Together, these results suggest that stock price pressure has a significant effect on firms' choices of corporate or shareholder tax benefits, and that the type of tax incentive affects future earnings quality, as proxied by earnings persistence. The results of this study extend the findings of previous studies (Cloyd et al., 1996; Klassen, 1997; Armstrong et al., 2012; Graham et al., 2014) by providing evidence that firms' tax planning decisions involve a trade-off between shareholder-level tax benefits and corporate reported earnings.

The remainder of this paper is organized as follows. Section 2 discusses previous empirical research on corporate tax planning. Section 3 develops the research hypotheses and describes the empirical procedures and sample used to test the hypotheses. Section 4 presents and discusses the empirical findings, and Section 5 concludes the paper with a discussion of the research results and their implications.

2. Related research

Tax planning plays an important role in business operations, yet few empirical studies have investigated the tax planning behavior of firms, as firms' tax planning data are confidential. Ke (2001) investigates the effect of the 1993 increase in the personal tax rate relative to the corporate tax rate on managerial compensation in privately held insurance companies. He finds that after 1993, in response to the changes in the relative rate schedules for individual and corporate income taxes, management-owned insurance companies pay their shareholders/managers less tax-deductible compensation than a control sample of non-management-owned counterparts. This result implies that when designing optimal shareholder/manager compensation, firms attempt to minimize the overall tax costs of both firms and shareholders.

The tax rate reduction of the 1986 Tax Reform Act (TRA 86) provides an experimental setting for examining firms' motivations to shift income from corporations to shareholders. As the TRA 86 reduces the top

[6] Unlike the US, Taiwan does not have sophisticated analyst-following data. Only a few well-known companies are followed by foreign analysts. Most Taiwanese companies do not have available data on analyst following or earnings forecasts. Therefore, I use ERCs as a proxy for stock price pressure.

personal tax rate to 28%, which is lower than the top corporate tax rate of 34%, C corporations, which unlike S corporations are subject to double taxation, have the incentive to shift income from corporations to shareholders, and, as a result, yield a lower pretax rate of returns. Using a sample of 6839 privately held C and S corporations from the motor carrier industry from the 1984–1992 period, Enis and Ke (2003) examine the effect of the TRA 86 on income shifting from corporations to shareholders. They estimate that during the sample period C corporations shifted an average of $130,587 of taxable income each year to shareholders after the TRA 86 was enacted.

Ke (2001) and Enis and Ke (2003) show that contingent upon the relative corporate and individual tax rates, managers do engage in strategic shifting of corporate taxable income to shareholders to minimize the overall tax burden for both firms and shareholders. This is consistent with the conclusion of Scholes et al. (2015) that an effective tax planning framework considers all stakeholders. By analyzing changes in reported earnings and other financial variables corresponding to changes in tax policies (e.g., TRA 86), these studies provide indirect evidence that firms seek to minimize the overall tax burden of their stakeholders in their strategic tax planning. In summary, previous studies support a broader hypothesis that rational firms will attempt to maximize the overall tax and nontax benefits of their stakeholders by making effective tax planning decisions. In contrast, this study directly observes firms' selection of specific alternative incentives that offer tax savings to either the firm or to its shareholders. Thus it provides a natural experiment to directly examine the factors associated with firms' specific tax planning decisions.

An alternative hypothesis to firms seeking to minimize the overall tax burden of stakeholders is that they balance this aim with the need to minimize financial reporting costs. Financial reporting costs (or capital market pressure, Klassen (1997)) are non-tax costs, such as debt covenant violation, reduced executive compensation and the perceived negative stock market consequences associated with reductions in reported earnings (Cloyd et al., 1996; Klassen, 1997; Armstrong et al., 2012; Graham et al., 2014). In a survey of financial executives of large and medium-sized public and private manufacturing firms, Cloyd et al. (1996) show that public firms with higher financial reporting costs are less inclined than private firms with lower financial reporting costs to choose financial accounting methods that conform to an aggressive tax position. Consequently, private firms are more likely to choose accounting methods that are less optimistic but are likely to increase the probability of successfully defending their tax positions if challenged by the IRS. These results suggest that in defending an aggressive tax position, managers face a trade-off between financial reporting costs and corporate tax benefits.

Using the concentration of inside ownership as a proxy for capital market pressure,[7] Klassen (1997) finds that in the trade-off between financial and tax reporting, firms with greater inside ownership concentration tend to favor corporate tax benefits, whereas those with lower inside ownership concentration tend to favor financial reporting costs.

Using proprietary data on the incentive compensation of tax directors of public companies, Armstrong et al. (2012) find a strong negative relationship between the incentive compensation of tax directors and the GAAP effective tax rate, but little relationship between the incentive compensation of tax directors and other tax attributes. These results indicate that tax directors of public companies are provided with incentives to reduce the level of tax expense reported in financial statements.

Analyzing survey responses from nearly 600 corporate tax executives, Graham et al. (2014) find that financial accounting incentives play an important role in tax planning—84% of surveyed publicly traded firms responded that the top management at their company cares at least as much about the GAAP ETR as they do about cash taxes paid. In addition, their regression results show that the primary driver for determining the relative importance of financial concerns is capital market incentives, as proxied by being publicly traded, having a high analyst following or having high institutional ownership.

Prior research indicates that public companies have strong incentives for considering financial reporting concerns in tax planning decisions (Klassen, 1997; Armstrong et al., 2012; Graham et al., 2014). These studies, however, do not examine the trade-off between corporate financial reporting costs and shareholder tax

[7] Klassen argues that firms with greater concentration of inside ownership experience less pressure from the capital market, whereas the opposite is true.

benefits: a potential trade-off may exist under the principle that effective tax planning should take into account all parties (Scholes et al., 2015). Thus, this study extends the literature by examining how firms make the choice between corporate and shareholder tax benefits. Further, instead of using survey data, this study uses firms' actual choices of tax incentives to analyze the determinants of the trade-off between corporate and shareholder tax benefits.

3. Research hypotheses and research methods

3.1. Research hypotheses

First, I consider the effect of stock market pressure on the choice between a corporate 5-year tax exemption and shareholder investment tax credits. For listed firms, the perceived stock market consequences of reported earnings are directly associated with the selected tax treatment. To increase reported after-tax earnings, listed firms are more likely to choose a corporate 5-year tax exemption. Conversely, privately held firms do not experience stock price pressure from the capital market and are accordingly more likely than their listed counterparts to choose shareholder investment tax credits and thereby directly pass tax benefits to their shareholders. Hence, the first hypothesis for this study is as follows.

H1. Privately held firms are more likely than listed firms to choose shareholder investment tax credits.

Second, I consider the effect of market pressure on the choice between a corporate 5-year tax exemption and shareholder investment tax credits. The measure of particular interest is the perceived capital market consequences of the reported net income associated with the selected tax treatment. I capture market pressure using firms' ERCs, which exhibit the levels of covariation between unexpected earnings and stock returns. Hence, changes in earnings will have a greater effect on listed firms with high ERCs than on those with low ERCs. Consequently, when trading off between financial reporting costs and shareholder tax benefits, listed firms with high ERCs are more likely to choose a corporate 5-year tax exemption, as it will increase the reported after-tax earnings in financial statements. Accordingly, the second hypothesis for this study is as follows.

H2. Listed firms with relatively high ERCs are more likely to choose a corporate 5-year tax exemption than listed firms with relatively low ERCs.

3.2. Regression model

3.2.1. Effect of stock price pressure on listed and privately held firms' choices of tax incentives

The sample for the examination of the effect of stock market pressure on the trade-off between corporate reported earnings and shareholder tax benefits includes both listed and privately held firms. As the dependent variable is the choice of one of the two tax incentives, I use a dummy variable (*TaxChoice*) to represent the choice decision and use a logistic regression estimation to analyze the tax planning decision. *TaxChoice* is set to one if the firm chooses shareholder investment tax credits and set to zero if it chooses a corporate 5-year tax exemption. The logistic regression model is as follows.

$$TaxChoice_{it} = \lambda_0 + \lambda_1 LISTED_i + \lambda_2 ROE_{it} + \lambda_3 DEBT_{it} + \lambda_4 SIZEit + \lambda_5 DYEAR_t + \varepsilon_{it} \quad (1)$$

where the subscript *i* represents the individual firm and *t* is the sample year. The definitions of the independent variables are as follows (expected signs on regression coefficients are in brackets).

LISTED (–)	A dummy variable for firms with stocks listed on the stock market. *LISTED* is set to 1 if the firm is a listed firm, and set to 0 if it is a privately held company
ROE (–)	Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity
DEBT (–)	Debt ratio, measured as long-term liabilities ÷ total assets

SIZE (?)	Firm size, measured by the natural log value of net sales
DYEAR (+)	A dummy variable for the sample period after the implementation of the Imputation System in Taiwan. Taiwan implemented the Imputation System in 1998; hence, *DYEAR* is set to 1 if the sample year is 1998 or later, and 0 otherwise

In Model (1), stock market pressure is represented by the coefficient on *LISTED*, an indicator variable for listed firms. According to the first hypothesis, in the presence of stock price pressure from the capital market, listed firms are more likely than privately held firms to choose a corporate 5-year tax exemption to increase reported after-tax earnings in financial statements. Hence, the coefficient on *LISTED* is expected to be negative.

ROE and *DEBT* are included in the regression model to control for the effect of firms' profitability and financial obligations on their choice of tax incentive. *ROE* is return on common stockholders' equity. Shareholders are more willing to preserve cash flows within firms if the firms have higher *ROEs*. Thus, firms with higher *ROEs* are more likely to choose a corporate 5-year tax exemption to reduce income tax payable at the corporate level and enable them to preserve more after-tax cash flows. *DEBT* is measured by long-term debt divided by total assets. To avoid violating debt covenants, firms with higher debt ratios have a greater need to preserve cash flows to pay off interest and debt that is due (Begley, 1990; DeFond and Jiambalvo, 1994). Accordingly, they may be more inclined to choose a corporate 5-year tax exemption to reduce the amount of cash needed to pay for corporate income tax.

SIZE is the natural log value of net sales and is used to control for the potential size effect on the propensity of firms to choose between the two tax incentives. *SIZE* is related to unobservable firm characteristics, such as diversification in ownership, growth opportunities, and economies of scales that may produce different propensities in tax planning (Mills et al., 1998). There is no predicted sign on the coefficient of *SIZE*.

DYEAR is a dummy variable for the period after the implementation of the Imputation System in Taiwan. Taiwan implemented the Imputation System in 1998. The Imputation System grants income tax that is paid at the corporate level as imputation tax credits (ITCs) to individual shareholders and allows individual shareholders to offset their income taxes with ITCs. If the individual income tax payable by a shareholder is less than the received ITCs, the shareholder can claim tax refunds for the excess of the received ITCs over his or her income tax payable. Hence, from a shareholder's perspective, income tax paid at the corporate level can offset income tax payable when filing individual tax returns and thus will not cause an increase in overall tax costs under the Imputation System. Accordingly, I expect that in the period after the implementation of the Imputation System, firms have fewer incentives to reduce income tax at the corporate level and more incentives to directly reduce taxes at the shareholder level.

3.2.2. Effect of stock price pressure on listed firms' choices of tax incentives

The second research hypothesis concerns the effect of differences in ERCs on listed firms' choices of tax incentives. To capture the market pressure caused by the relative values of firms' ERCs, *H_ERC* replaces *LISTED* in the regression model. *H_ERC* is an indicator variable for listed firms with relatively high ERCs. *H_ERC* is set to 1 if the firm's ERC is greater than the median ERC of all of the listed firms, and 0 otherwise. The regression model is as follows:

$$TaxChoice_{it} = \alpha_0 + \alpha_1 H\_ERC_{it} + \alpha_2 ROE_{it} + \alpha_3 DEBT_{it} + \alpha_4 SIZE_{it} + \alpha_5 DYEAR_{it} + \varepsilon_{it} \quad (2)$$

The definitions and measures of *DYEAR*, *ROE*, *SIZE* and *DEBT* in Model (2) are the same as in Model (1).

Following Collins and Kothari (1989) and Ali and Zarowin (1992), the estimation of ERCs proceeds as follows:

$$Ret_{i,QT} = a_i + b_i \Delta X_{i,QT}/P_{i,Q(T-1)} + c_i RetMkt_{Q,T} + d_i RetRF_{Q,T} + \varepsilon_{i,QT} \quad (3)$$

where the subscript i represents the individual firm and T is the estimation period that spans the 20 quarters preceding the year in which the sample firm chooses a tax incentive. Q represents the four quarters of a year by setting $Q = 1$ to 4. Model (3) is estimated separately for each sample firm. The individual firm's *ERC* is

Table 1
Sample selection procedures.

Panel A: Listed and privately held firms for regression Model (1)	
Total number of listed and privately held firms that were approved for tax incentives for newly emerging and important industries in the 1996–2001 period	747
Less: Number of cases in which the tax incentive qualification was repealed for not completing the investment project within four years	(127)
Number of cases in which projects were not funded by shareholder cash investments[a]	(41)
Listed firms that were missing financial statement data on selected variables	(76)
Number of listed and privately held firms for Model (1)	503
Panel B: Listed firms for regression Model (2)	
Total number of listed firms that were approved for tax incentives of newly emerging and important industries for the 1996–2001 period	466
Less: Number of cases in which the tax incentive qualification was repealed for not completing the investment project within four years	(54)
Number of cases in which projects were not funded by shareholder cash investments[a]	(37)
Listed firms that were missing financial statement data on selected variables	(36)
Number of cases in which the firms were newly listed and did not have sufficient stock return data for ERC estimation	(220)
Number of listed firms for Model (2)	119

[a] For investment projects that are not funded by shareholder cash investments, firms are not eligible to choose shareholder investment tax credits and can only apply for a corporate 5-year tax exemption. Thus, they do not have to make a trade-off between the two tax incentives.

obtained by the estimated regression coefficient $\hat{b}$ on $(\Delta X/P)$. In each firm's regression estimation, the sample period covers 20 quarters.[8] To obtain stable regression estimates, firms with data from less than 10 of the 20 quarters are excluded from the sample. The definitions and measures of the dependent and independent variables in Model (3) are as follows.

Ret	Individual firm *i*'s stock returns over the quarter Q_T
ΔX	Unexpected earnings, $\Delta X_{QT} = X_{QT} - X_{Q(T-1)}$. To account for seasonal fluctuations in quarterly data, unexpected quarterly earnings are calculated by subtracting the current quarter's earnings from the same quarter earnings in the previous year
P	Closing stock price at the end of the quarter Q_T
RetMkt	Rate of return of the market portfolio over the quarter Q_T
RetRF	Risk-free interest rate for quarter Q_T, measured by the deposit interest rate of the Bank of Taiwan (the government-owned bank)

3.3. Data and sample selection

Panels A and B of Table 1 outline the sample selection procedures for regression Models (1) and (2), respectively. The sample consists of firms that applied to the Ministry of Finance (Taiwan) for approval of qualified investments in emerging high-tech industries between 1996 and 2001. According to the Statue of Upgrading Industries (Taiwan), to claim the tax incentives, approved investment projects have to be completed within four years of the government's approval. The choice between the two tax incentives is made when the firms complete their planned investment projects. Hence, I collect data on each firm's choice of tax incentive when the firm finishes its investment plan. The annual financial statement data used in the regression models are from the year when the firm makes its tax incentive decision.

[8] Quarterly data are used to estimate *ERC*s because Taiwanese companies have a relatively short history compared with U.S. corporations. Using yearly data results in a significant reduction in sample size.

Panel A of Table 1 shows the initial sample of 747 cases of investment projects approved for tax incentives. The qualification for tax incentives was repealed in 127 cases due to failure to complete the investment projects within four years. The 41 firms with projects that were not funded by shareholder cash investments did not qualify for shareholder investment tax credits and could only apply for the corporate 5-year tax exemption; thus, they are excluded from the sample. Seventy-six firms are excluded for missing financial statement data on selected variables. Hence, the final sample for Model (1) consists of 503 firms. Similar selection procedures are applied to the sample for Model (2), as detailed in Panel B of Table 1. The final sample for Model (2) consists of 119 listed firms.

4. Results

4.1. Effect of capital market pressure on the choice of tax incentives—listed and privately held firms

4.1.1. Descriptive statistics and univariate analysis

Panels A, B, and C of Table 2 provide descriptive statistics of selected variables for the full sample, listed companies and privately held companies, respectively. The mean value of *TaxChoice* for privately held companies (0.555) is higher than that of listed companies (0.428), suggesting that privately held companies are more likely to choose shareholder investment tax credits. The mean values of *SIZE* and *ROE* in listed companies are greater than in the privately held companies, indicating that listed companies are usually larger in size and more profitable.

Table 3 shows the results of the correlation analysis of the dependent and independent variables. *LISTED* is significantly negatively related to *TaxChoice*, which is consistent with H1 in that listed firms are more likely to choose tax incentives that enhance reported corporate earnings. In addition, *ROE* is significantly negatively

Table 2
Descriptive statistics for selected variables—Model (1).

Variable	Mean	Median	Std. Dev.	Maximum	Minimum
Panel A: All listed and privately held firms (N = 503)					
TaxChoice	0.469	0.000	0.500	1.000	0.000
LISTED	0.674	1.000	0.469	1.000	0.000
ROE	0.043	0.074	0.206	0.677	−0.758[a]
DEBT	0.112	0.083	0.114	0.636	0.000
SIZE	14.179	14.281	2.617	19.608	3.689[a]
DYEAR	0.907	1.000	0.291	1.000	0.000
Panel B: Listed firms (N = 339)					
TaxChoice	0.428	0.000	0.495	1.000	0.000
ROE	0.093	0.101	0.194	0.677	−0.758[a]
DEBT	0.111	0.086	0.108	0.435	0.000
SIZE	14.929	14.894	1.906	19.608	3.689[a]
DYEAR	0.879	1.000	0.327	1.000	0.000
Panel C: Privately held firms (N = 164)					
TaxChoice	0.555	1.000	0.499	1.000	0.000
ROE	−0.060	−0.034	0.195	0.409	−0.758[a]
DEBT	0.114	0.070	0.126	0.636	0.000
SIZE	12.631	12.884	3.095	17.503	3.689[a]
DYEAR	0.963	1.000	0.188	1.000	0.000

TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
LISTED → 1 if the firm is a listed company, and 0 if it is a privately held company.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.
[a] Restrained to one-percentile value.

Table 3
Correlation analysis of selected variables—Model (1).

	TaxChoice	*LISTED*	*ROE*	*DEBT*	*SIZE*	*DYEAR*
TaxChoice	1					
LISTED	−0.1194	1				
	(0.0073)					
ROE	−0.1828	0.3627	1			
	(<.0001)	(<.0001)				
DEBT	−0.1103	−0.0110	−0.2232	1		
	(0.0133)	(0.8051)	(<.0001)			
SIZE	−0.0208	0.4564	0.3689	0.1171	1	
	(0.6423)	(<.0001)	(<.0001)	(0.0086)		
DYEAR	0.0828	−0.1359	−0.1647	0.0170	−0.0672	1
	(0.0634)	(0.0023)	(0.0002)	(0.7036)	(0.1322)	

(*p*-value in brackets).
TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
LISTED → 1 if the firm is a listed company, and 0 if it is a privately held company.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.

correlated with *TaxChoice*, suggesting that firms with greater *ROEs* are more likely to choose a corporate 5-year tax exemption.

4.1.2. Logistic regression results

The left panel of Table 4 presents the logistic regression results for the full sample. The model's log likelihood χ^2 *is 24.34 and its p-value is 0.0002, suggesting that the regression model has overall good explanatory power.*

In the regression results for the full sample period, the coefficient on *LISTED* is significantly negative, with a *p*-value equal to 0.074. This result is consistent with H1 in that listed firms in the presence of stock price pressure tend to choose a corporate 5-year tax exemption to reduce financial reporting costs, whereas privately held firms that do not have stock price pressure from the capital market are more likely to choose shareholder investment tax credits and thereby directly pass tax benefits to their shareholders.

The coefficient on *ROE* is significantly negative with a *p*-value of 0.005. This is consistent with the prediction that firms with higher return on equity are able to make more efficient use of funds and thus tend to choose a corporate 5-year tax exemption to retain more after-tax cash flows within firms.

4.1.3. Additional analysis

Since Taiwan implemented the Imputation System in 1998, income tax paid at the corporate level is imputed as tax credits at the individual shareholder level. Transformations in the tax system may result in structural changes to firms' tax planning propensity, as the motivation to minimize corporate income tax may be less strong under new tax systems. Hence, I further modify the sample to examine whether differences in stock price pressure faced by listed companies continue to affect their choices of tax incentives under the Imputation System.

The right panel of Table 4 reports the regression results for the 1998–2001 sample period. The results show that the coefficient on *LISTED* remains significantly negative with a *p*-value of 0.081. The coefficients and significance levels of the other variables are not significantly different from those for the full sample period. This result suggests that under the Imputation System the effect of capital market pressure remains pronounced for listed firms when there is a trade-off between reported corporate earnings and shareholder tax benefits.

Table 4
Logistic regression results for Model (1).

Variable	Pred. sign	Full sample period (1996–2001)			Post-Imputation System sample period (1998–2001)		
		Coefficient	χ^2	*p*-value	Coefficient	χ^2	*p*-value
Intercept	?	−1.177	3.069	0.080	−1.094	2.983	0.084
LISTED	–	−0.390	2.993	0.083	−0.388	2.843	0.091
ROE	–	−1.670	8.760	0.003	−1.627	7.991	0.004
DEBT	–	1.192	1.967	0.161	1.028	1.363	0.242
SIZE	?	0.065	1.760	0.160	0.086	3.119	0.077
DYEAR	+	0.366	1.224	0.268			
		Log likelihood $\chi^2 = 23.13$ *p*-value = 0.0003 *N* = 503			Log likelihood $\chi^2 = 17.66$ *p*-value = 0.0014 *N* = 456		

TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
LISTED → 1 if the firm is a listed company, and 0 if it is a privately held company.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.

Table 5
Descriptive statistics for selected variables—Model (2).

Variable	Mean	Median	Std. Dev.	Maximum	Minimum
Panel A: All listed firms (N = 119)					
TaxChoice	0.454	0.000	0.500	1.000	0.000
H_ERC	0.504	1.000	0.502	1.000	0.000
ROE	0.061	0.083	0.194	0.338	−0.649[a]
DEBT	0.125	0.127	0.102	0.332	0.000
SIZE	15.923	15.911	1.506	19.608	13.318
DYEAR	0.908	1.000	0.291	1.000	0.000
Panel B: Listed firms that select shareholder investment tax credits (N = 54)					
H_ERC	0.463	0.000	0.503	1.000	0.000
ROE	0.014	0.063	0.259	0.330	−0.649[a]
DEBT	0.122	0.098	0.106	0.332	0.000
SIZE	15.690	15.502	1.612	19.608	13.318
DYEAR	0.981	1.000	0.136	1.000	0.000
Panel C: Listed firms that select a corporate 5-year exemption (N = 65)					
H_ERC	0.538	1.000	0.502	1.000	0.000
ROE	0.099	0.109	0.101	0.338	−0.255
DEBT	0.127	0.138	0.099	0.296	0.000
SIZE	16.116	16.293	1.394	19.493	13.391
DYEAR	0.846	1.000	0.364	1.000	0.000

TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
H_ERC → 1 if the firm's ERC is greater than the median ERC of all of the firms, and 0 otherwise.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.
[a] Restrained to one-percentile value.

Table 6
Correlation analysis of selected variables—Model (2) ($N = 119$).

	TaxChoice	*H_ERC*	*ROE*	*DEBT*	*SIZE*	*DYEAR*
TaxChoice	1					
H_ERC	−0.0752	1				
	(0.4165)					
ROE	−0.2450	−0.0831	1			
	(0.0073)	(0.3691)				
DEBT	−0.0265	−0.0504	−0.1901	1		
	(0.7749)	(0.5865)	(0.0380)			
SIZE	−0.1412	−0.1903	0.2405	0.0067	1	
	(0.1255)	(0.0381)	(0.0084)	(0.9427)		
DYEAR	0.2326	0.1478	−0.1432	0.0122	0.0630	1
	(0.0109)	(0.1088)	(0.1202)	(0.8951)	(0.4963)	

(*p*-value in brackets).
TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
H_ERC → 1 if the firm's ERC is greater than the median ERC of all of the firms, and 0 otherwise.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.

4.2. Effect of stock price pressure on listed firms' choices of tax incentives

4.2.1. Descriptive statistics and univariate analysis

To enhance the validity of the research findings, the sample is further modified to examine whether differences in ERCs produce differential effects on listed firms' choices of tax incentives. Panel A of Table 5 presents the descriptive statistics of selected variables for the sample of listed firms. Panels B and C of Table 5 list the descriptive statistics for listed firms that select shareholder investment tax credits and those that choose a corporate 5-year tax exemption, respectively. Consistent with expectations, the mean *H_ERC* of firms that choose a corporate 5-year exemption (0.538) is greater than that of firms that choose shareholder investment tax credits (0.463). The mean *ROE* of firms that choose a corporate 5-year exemption (0.099) is also higher than that of firms that choose shareholder investment tax credits (0.005). Table 6 presents the results of the correlation analysis for the dependent and independent variables. Similar to the results for the full sample, *ROE* is significantly negatively related to *TaxChoice*, suggesting that listed firms with greater *ROEs* are more likely to choose a corporate 5-year tax exemption.

4.2.2. Logistic regression results

Table 7 presents the logistic regression results for listed companies. The model's log likelihood χ^2 is 18.65 and its *p*-value is 0.0022. In addition, the correct ratio of predicted decisions based on a cutoff probability of 0.5 is about 70.7%.

The left and right panels of Table 7 present the results for the full sample period and the 1998-2001 sample period, respectively. The coefficients on *H_ERC* in both panels are negative and significant at 0.1, lending support to H2 in that listed companies with relatively higher ERCs, i.e. have a higher correlation between reported earnings and stock prices, tend to choose a corporate 5-year tax exemption to increase their after-tax earnings in financial statements. Both of the stock market pressure variables, *LISTED* and *H_ERC*, are significantly negative in Tables 4 and 7. However, the coefficients on *DEBT* are insignificant in Tables 4 and 7, suggesting that stock market pressure is a greater financial reporting incentive than debt covenant restrictions in firms choosing between the two types of tax benefits.

The coefficients on *ROE* in both of the regression results are negative and significant, consistent with the prediction that firms with higher return on equity tend to choose a corporate 5-year tax exemption to retain more after-tax cash flows within firms. Profitable firms are able to make more efficient use of funds and, as a

Table 7
Logistic regression results for Model (2).

Variable	Pred. sign	Full sample period (1996–2001)			Post-Imputation System sample period (1998–2001)		
		Coefficient	χ^2	*p*-value	Coefficient	χ^2	*p*-value
Intercept	?	1.508	0.397	0.529	4.228	3.272	0.071
H_ERC	–	−0.727	3.040	0.081	−0.720	2.874	0.090
ROE	–	−2.974	4.135	0.042	−3.241	4.528	0.033
DEBT	–	−1.884	0.835	0.361	−1.538	0.527	0.468
SIZE	?	−0.196	1.973	0.160	−0.219	2.364	0.124
DYEAR	+	2.381	4.722	0.030			
		Log likelihood $\chi^2 = 18.55$ *p*-value = 0.0023 *N* = 119			Log likelihood $\chi^2 = 12.05$ *p*-value = 0.0170 *N* = 108		

TaxChoice → The decision variable for the choice between a corporate 5-year tax exemption and shareholder investment tax credits. *TaxChoice* is 1 if the firm chooses shareholder investment tax credits, and 0 if it chooses a corporate 5-year tax exemption.
H_ERC → 1 if the firm's ERC is greater than the median ERC of all of the firms, and 0 otherwise.
ROE → Return on common stockholders' equity, measured by (net income – preferred stock dividends) ÷ common stockholders' equity.
DEBT → Debt ratio, measured as long-term liabilities ÷ total assets.
SIZE → Firm size, measured by the natural log value of net sales.
DYEAR → 1 if the year is in the post-Imputation System period, and 0 otherwise.

result, their shareholders are willing to retain cash flows within firms. Finally, consistent with expectations, the coefficient on *DYEAR* in the full sample regression results is positive and significant, suggesting that since the implementation of the Imputation System, firms prefer shareholder investment tax credits that directly reduce taxes payable at the shareholder level.

The financial statement data used in Models (1) and (2) are from the year in which the firm makes its decision. I also conduct robustness tests using financial statement data from the year before the firm makes its decision. The untabulated results are qualitatively similar to those shown in Tables 4 and 7.

4.2.3. Additional analysis

In choosing a tax incentive, a company is also deciding whether to transfer resources out of the firm to its shareholders. A controlling shareholder may influence a company's decision. Therefore, I further control for the effect of controlling shareholders' stake by adding the percentage of shares held by the top five shareholders (*TOP5*) to Model (2). The untabulated regression results show that the coefficient on *TOP5* is positive but insignificant, perhaps because tax benefits passing directly to shareholders are proportional to the percentage of shares they own if the company chooses shareholder investment credits, thereby reducing the potential conflict of interest between controlling and minority shareholders. Nevertheless, after controlling for the percentage of shares held by controlling shareholders, the coefficients on *H_ERC* remain negative and significant at 0.1, consistent with H2. In addition, the coefficients and significance levels of the other variables are not significantly different from those displayed in Table 7.

4.3. Effect of tax incentive choice on earnings persistence

In addition to the trade-off between tax benefits and financial reporting costs, the choice between a corporate five-year tax exemption and shareholder investment tax credits is likely to affect a firm's future earnings planning. For firms choosing shareholder investment tax credits, the total credit amount of their shareholder tax benefit is determined by the amount of the qualified investment approved by the government. Therefore, their shareholder tax benefits are independent of the firms' future earnings.

In contrast, for firms choosing a corporate five-year exemption, the total amount of their corporate tax benefit depends on the firms' earnings during the five-year tax-exemption period. To maximize corporate tax benefits it is necessary to increase the firms' earnings during the five-year tax-exemption period that follows the approval of the tax incentive. As a consequence, firms engaging in maximizing their earnings during the

five-year tax exemption period may have lower earnings persistence. To examine the possible economic consequences of different tax incentives, I further test whether firms choosing a corporate five-year exemption are likely to have lower earnings persistence than those choosing shareholder investment tax credits during the five-year exemption period.

Following Hanlon (2005) and Blaylock et al. (2012), I construct the following two earnings persistence equations as Models (4) and (5) to examine whether firms choosing a corporate five-year exemption tend to have lower earnings persistence.

$$PTBI_{i,t+1} = \gamma_0 + \gamma_1 PTBI_{i,t} + \varepsilon_{i,t+1} \tag{4}$$

$$PTBI_{i,t+1} = \alpha_0 + \alpha_1 PTBI_{i,t} + \alpha_2 EXEMPT_i + \alpha_3 EXEMPT_i \times PTBI_{i,t} + \varepsilon_{i,t+1} \tag{5}$$

where *PTBI* is pretax accounting income scaled by average total assets for cross-sectional comparability, and the coefficients γ_1 and α_1 are estimates of the mapping of current-period pretax earnings into future (one-period) earnings, referred to as the persistence parameter (Blaylock et al., 2012). *EXEMPT* is a dummy variable set to 1 if the firm chooses a corporate 5-year tax exemption, and 0 if it chooses shareholder investment tax credits. $EXEMPT \times PTI$ is the interaction term of *EXEMPT* and *PTI*. $EXEMPT \times PTI$ captures the effect of a 5-year exemption on earnings persistence.

Model (4) is the baseline model that forms the basis of earnings persistence tests in Hanlon (2005) and Blaylock et al. (2012). I add *EXEMPT* and $EXEMPT \times PTBI$ to Model (5) to test whether the choice of a corporate five-year exemption has a negative effect on firms' earnings persistence. I expect α_3, the coefficient on $EXEMPT \times PTBI$, to be negative if the choice of a corporate 5-year exemption results in a lower persistence of current-period pretax earnings into future earnings.

The left and right panels of Table 8 present the results of Models (4) and (5) respectively, using the five years following the year the firm makes the choice of tax incentive as the sample period.[9] The results show that both γ_1 and α_1 are positive and significant. However, as expected, α_3 is negative and significant, suggesting that firms choosing a corporate 5-year tax exemption have lower earnings persistence during the five years following the year they make their choice. Further, the coefficient γ_1 represents the average earnings persistence of the sample without controlling for the difference between the two types of tax incentives, and the coefficient α_1 is the average earnings persistence after controlling for this difference. The coefficient γ_1 (0.479) is noticeably lower than the coefficient α_1 (0.635), suggesting that the average earnings persistence of the sample is significantly reduced by firms choosing a corporate 5-year tax exemption. The results of Model (4) show that the average earnings persistence of firms choosing shareholder investment tax credits is about 0.635, whereas the average earnings persistence for firms choosing a corporate 5-year exemption is about 0.385,[10] nearly 40%[11] lower.

To exclude the possibility that the lower earnings persistence of firms choosing a corporate 5-year tax exemption is due to firm heterogeneity rather than firms strategically engaging in maximizing earnings behavior, I further conduct regression analysis for Models (4) and (5) using the five years following the fifth year after the firm makes its choice of tax incentive as the sample period. If the significant difference in earnings persistence between firms choosing the two types of tax incentives shown in Table 8 is due to firm heterogeneity, the difference should remain pronounced after the 5-year exemption period.

The left and right panels of Table 9 present the results of Models (4) and (5) respectively, for the sample period of the five years following the fifth year after the firm makes its choice of tax incentive.[12] The results show that both γ_1 and α_1 remain positive and significant in Table 9. However, α_3 becomes insignificant, as shown in Table 9, suggesting that the differences between firms that choose the two types of tax incentives disappear after the 5-year exemption period. In addition, the coefficient γ_1 is 0.514 and the coefficient α_1 is 0.538 in Table 9. The difference in the two earnings persistence coefficients does not appear to be noticeable whether or not the type of tax incentive is controlled for. The results provide evidence that the choice of tax

[9] Firms without five years of consecutive annual data are deleted, reducing the number of firms to 240 and the sample to 1200 firm-year observations (240 firms × 5 years).

[10] = the coefficient α_1 (0.635) – the coefficient α_3 (−0.250).

[11] = 1 – 0.385/0.645.

[12] The sample consists of 1135 firm-year observations.

Table 8
Regression results for Models (4) and (5). (Sample period: year $t+1$ to year $t+5$; choice of tax incentives at year t).

Variable	Pred. sign	$PTBI_{i,t+1} = \gamma_0 + \gamma_1 PTBI_{i,t} + \varepsilon_{i,t+1}$ (4)			$PTBI_{i,t+1} = \alpha_0 + \alpha_1 PTBI_{i,t} + \alpha_2 EXEMPT_i + \alpha_1 EXEMPT_i \times PTBI_{i,t} + \varepsilon_{i,t+1}$ (5)		
		Coefficient	*t*-stat.	*p*-value	Coefficient	*t*-stat.	*p*-value
Intercept	?	0.034	9.89	<0.0001	0.029	5.77	<0.0001
$PTI_{i,t}$	+	0.479	20.94	<0.0001	0.635	17.15	<0.0001
$EXEMPT_i$	?				0.010	1.41	0.1595
$EXEMPT_i \times PTI_{i,t}$	–				−0.250	−5.34	<0.0001
		Adjusted $R^2 = 0.2674$ *F*-stat. = 438.63 (*p*-value < 0.0001) $N = 1200$			Adjusted $R^2 = 0.2833$ *F*-stat. = 158.96 (*p*-value < 0.0001) $N = 1200$		

$PTI \rightarrow$ Pretax accounting income scaled by average total assets for cross-sectional comparability.
$EXEMPT \rightarrow 1$ if the firm chooses a corporate 5-year tax exemption, and 0 if it chooses shareholder investment tax credits.
$EXEMPT \times PTI \rightarrow$ The interaction term of *EXEMPT* and *PTI*.

Table 9
Regression results for Models (4) and (5). (Sample period: year $t+6$ to year $t+10$; the choice of tax incentives at year t).

Variable	Pred. sign	$PTBI_{i,t+1} = \gamma_0 + \gamma_1 PTBI_{i,t} + \varepsilon_{i,t+1}$ (4)			$PTBI_{i,t+1} = \alpha_0 + \alpha_1 PTBI_{i,t} + \alpha_2 EXEMPT_i + \alpha_1 EXEMPT_i \times PTBI_{i,t} + \varepsilon_{i,t+1}$ (5)		
		Coefficient	*t*-stat.	*p*-value	Coefficient	*t*-stat.	*p*-value
Intercept	?	0.022	6.95	<0.001	0.019	4.02	<0.001
$PTI_{i,t}$	+	0.514	24.64	<0.001	0.538	17.14	<0.001
$EXEMPT_i$	?				0.006	0.87	0.382
$EXEMPT_i \times PTI_{i,t}$	–				−0.044	−1.04	0.297
		Adjusted $R^2 = 0.3483$ *F*-stat. = 607.09 (*p*-value < 0.0001) $N = 1135$			Adjusted $R^2 = 0.3481$ *F*-stat. = 202.82 (*p*-value < 0.0001) $N = 1135$		

$PTI \rightarrow$ Pretax accounting income scaled by average total assets for cross-sectional comparability.
$EXEMPT \rightarrow 1$ if the firm chooses a corporate 5-year tax exemption, and 0 if it chooses shareholder investment tax credits.
$EXEMPT \times PTI \rightarrow$ The interaction term of *EXEMPT* and *PTI*.

incentive has an effect on firms' earnings persistence during the 5-year exemption period. Firms choosing a corporate 5-year tax exemption are more likely to have lower earnings persistence during the five-year exemption period than those choosing shareholder investment tax credits.

5. Conclusions and limitations

This study investigates the role of stock market pressure in the trade-off between corporate and shareholder tax benefits. The direct examination of firm managers' choice of two mutually exclusive alternative tax incentives indicates that privately held firms are more likely than listed firms to choose shareholder investment tax credits and forego corporate tax benefits. Listed firms with high ERCs are more likely than listed firms with low ERCs to choose a corporate 5-year tax exemption, as it can enhance reported after-tax earnings. This study further examines the consequences of different types of tax incentives on financial reporting quality. The results show that in the 5-year period following their choice of tax incentives, firms choosing a corporate 5-year tax exemption exhibit significantly lower earnings persistence than those choosing shareholder investment tax credits. The results suggest that stock market pressure has a significant effect on firms' choice of tax incentive and that the choice of tax incentive affects future earnings quality, as proxied by earnings persistence.

The results of this study extend previous research (Cloyd et al., 1996; Klassen, 1997; Armstrong et al., 2012; Graham et al., 2014) by providing direct evidence that firms making effective tax planning decisions consider

the trade-offs for all parties (corporations and shareholders) and all costs (tax costs and financial reporting costs). Further, this study provides evidence of the financial reporting consequences of two tax incentives. This demonstrates the complexity of the interaction between firms' tax and financial decisions (Scholes et al., 2015). The findings of this study also have important tax policy implications for countries that use imputation systems. Under imputation systems, firms are deemed to have fewer incentives to reduce corporate tax that is payable at the corporate level, because reducing taxes paid at the corporate level also reduces imputation credits attributable to shareholders. However, the results of this study suggest that non-tax costs such as financial reporting costs associated with corporate after-tax earnings remain a pronounced factor in firms' choices between corporate and shareholder tax benefits under imputation systems.

There are several limitations and caveats to this study. First, to focus on the effect of capital market incentives on corporate tax planning, the empirical models in this study may omit variables that are potentially correlated with firms' tax planning decisions, e.g., corporate governance, ownership structure, management compensation and the capital market efficiency hypothesis. To the extent that these omitted variables may be correlated with stock market pressure, they could confound the results. However, including more variables in the empirical models eliminates firms from the sample, which may cause other limitations. Second, the two types of tax incentives have been criticized for being over-abundant and may cause firms to over-invest in particular industries. This study does not address whether the tax incentives cause a loss of efficiency or distortions in resources allocation. The focus of this study is firms' tax planning behavior at the micro-level, which may inhibit the generalization of its findings for broader tax policy implications.

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Monetary policy and dynamic adjustment of corporate investment: A policy transmission channel perspective

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ABSTRACT

We investigate monetary policy effects on corporate investment adjustment, using a sample of China's A-share listed firms (2005–2012), under an asymmetic framework and from a monetary policy transmission channel perspective. We find that corporate investment adjustment is faster in expansionary than contractionary monetary policy periods. Monetary policy has a significant effect on adjustment speed through monetary and credit channels. An increase in the growth rate of money supply or credit accelerates adjustment. Both effects are significantly greater during tightening than expansionary periods. The monetary channel has significant asymmetry, whereas the credit channel has none. Leverage moderates the relationship between monetary policy and adjustment, with a greater effect in expansionary periods. This study enriches the corporate investment behavior literature and can help governments develop and optimize macro-control policies.

1. Introduction

Investment decisions are one of the three main financial decisions made by corporations. Modigliani and Miller (1958) propose that corporate investment decisions are independent of financing decisions under a series of strict assumptions. Subsequently, researchers have relaxed the strict hypothesis of the Modigliani–Miller theorem and developed the theory of investment cash flow sensitivities, based on the perspective of financing constraints caused by asymmetric information, and the theory of free cash flow over-investment, based on the perspective of agency conflicts. These theories argue that the appearance of imperfect markets and agency

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conflicts affects the scale and cost of enterprise financing, thereby affecting the decisions and efficiency of corporate investment.

The macroeconomic policy environment affects corporate investment decisions. Management science research has recently focused on overcoming the micro–macro divide in the field, expanding research methods and theoretical innovation and bridging the science-practice gap (Aguinis et al., 2011). Studies on the decision-making behavior of micro-enterprises that consider macro policies are increasingly common (Fan et al., 2014; Jiang and Rao, 2011; Rao et al., 2013). Studies based on the monetary policy perspective mainly focus on the influence of monetary policy on capital structure dynamic adjustment (Cook and Tang, 2010; Luo and Nie, 2012; Ma and Hu, 2012; Su and Zeng, 2009), the policy of cash holdings (Baum et al., 2006, 2008; Zhu and Lu, 2009) and credit financing (Li and Wang, 2011; Rao and Jiang, 2013a,b). Few studies focus on investment decisions.

Monetary policy is an important macro external variable that affects the investment decisions of enterprises. There is a body of literature focusing on the effect of monetary policy on corporate investment. Jing et al. (2012) find that loose monetary policy reduces the financing constraints of private enterprises. However, the financing redundancy resulting from loose monetary policy leads to inefficient investments by private enterprises with poor or general investment opportunities. In contrast, a good financing environment enables a company to take advantage of more investment opportunities, enhancing the efficiency of capital allocation when the company faces better investment opportunities. Xuan (2012) finds that a company can improve its ability to obtain loans and its investment level during tight monetary policies if it follows an ongoing conservative debt financial policy during expansionary monetary policies. Companies that follow a conservative debt financial policy are able to respond to monetary policy shocks and weaken their effects. Liu et al. (2013) find that internal capital markets in business groups buffer the effect of monetary policy on corporate investment.

The studies on monetary policy and corporate investment behavior mainly focus on under- and over-investment caused by credit financing constraints. Few studies explore the influence of monetary policies and transmission channels on the direction and speed of investment dynamic adjustment, especially from an asymmetric perspective. By clarifying these issues, we can reveal monetary policy transmission mechanisms at the micro level and examine their effects. Therefore, this paper uses Richardson's (2006) estimation model of expected investment and Flannery and Rangan's (2006) partial adjustment model to study the influence of monetary policy states and transmission channels on the direction and speed of investment dynamic adjustment.

Our results indicate that corporate investment adjustment is faster during expansionary monetary policy periods than contraction periods. The effect of the money supply on the corporate investment adjustment speed is significantly greater in tight monetary policy periods than in loose periods. This effect is significantly asymmetric. An increase in the growth rate of the credit scale accelerates corporate investment adjustment. This channel does not have a significant asymmetric effect. Leverage has a greater effect on corporate investment in expansionary monetary policy periods.

The contribution of this paper is as follows. First, the estimation model of the dynamic adjustment of corporate investment is designed by integrating the investment efficiency and partial adjustment models. This model provides the basis for studying the effect of monetary policy on the dynamic adjustment of corporate investment. Second, we study the effect of monetary policy transmission channels on corporate investment behavior through detailed microscopic transmission channels of monetary policy. Third, we examine whether monetary policy and its transmission channels have an asymmetric effect on the adjustment of corporate investment. Finally, the literature mainly focuses on the influence of financing constraints on investment, due to the credit channel of monetary policy. We simultaneously pay attention to the effect of the monetary channels of monetary policy on investment opportunities.

This study provides valuable policy implications for monetary authorities and managers. First, policy-makers should consider the effects of different policy instruments. Money supply and credit policy are effective tools for influencing corporate investment adjustment during contractionary monetary policy. Interest rates are an effective tool during expansionary monetary policy. Leverage has a greater effect on corporate financing ability during expansionary monetary policy than contractionary monetary policy. Monetary authorities

should pay more attention to firms with high leverage during loose monetary policies to detect financing difficulties.

Second, policy-makers should focus on optimizing the corporate investment scale and improving corporate investment efficiency to avoid over-investment and the resulting overcapacity. Company decision-makers need to pre-judge the influence of different policy instruments implemented by monetary authorities on corporate finance and investment opportunities. They should adopt an effective response in advance to ensure that the level of corporate investment can maximize returns.

The rest of the paper is organized as follows. In Section 2, we provide an overview of the macro policies in the institutional background of China and refine the research questions. Section 3 presents the model design, key concepts and definitions. Section 4 shows the sample selection and data sources. In Section 5, the empirical results are reported and robustness tests are conducted. Section 6 presents the discussion and Section 7 summarizes the main conclusions.

2. Institutional background analysis and research question refinement

Before 1978, a single planned economic system was implemented in China. The government relied on administration and planning to manage the economy, to poor effect and economic fluctuation. After the reform and opening up, especially in the mid-1980s, a market-oriented reform model was established. The Chinese economic environment and conditions were changing. In 1993, the Communist Party of China clearly proclaimed that establishing a socialist market economic system was the goal of its economic reform at its fourteenth conference. Since then, China has begun to gradually transform from a planned economy to a market economy. The government has gradually shifted its macroeconomic management from relying mainly on planning and executive orders to using market-based instruments, such as fiscal and monetary policies, in accordance with the market-oriented reform.

The main objective of macroeconomic regulation and control is the pursuit of stable economic growth with a reasonable level of the Consumer Price Index (CPI). The government's macroeconomic control focuses on adjusting the aggregate equilibrium with short-term, counter-cyclical, discretionary characteristics. Since 1997, economic growth has been steady and the CPI has fluctuated in a reasonable interval, as shown in Fig. 1. This shows enhanced macro-control ability and the effectiveness of market-based measures. As can be seen from the M_1 (a narrow measure of the money supply including currency and demand deposit) and credit scale growth rates, the discretionary monetary policy mainly uses counter-cyclical measures to achieve steady economic growth with a reasonable level of CPI.

China used to mainly use quantity-oriented monetary policy tools such as adjusting the statutory deposit reserve ratio, open market operations and credit scale control. Price-based monetary policy tools based on interest rates were used at a lower frequency. On 19 July 2013, approved by the State Council, the People's Bank of China decided to stop controlling the lending rates offered by financial institutions, which was an important step in market-based interest rate reform.[1] Under this reform, economic stimulus policies are no longer able to depend on liquidity injections. The price adjustment mechanism in the market of credit supply and demand is now active. This mechanism can optimize the allocation of credit resources and will have a profound effect on monetary policy transmission channels, mechanisms and effects.

How do macroeconomic policies affect a real economy? Do macro policies play their expected role? What are their transmission mechanisms? To answer these questions, we need to analyze and test the mechanisms and policy effects of macroeconomic policies at the micro level. Previous studies mainly focus on monetary policies' transmission channels, mechanisms and consequences from a macro perspective. We analyze the microscopic effect of monetary policy transmission channels on corporate investment behavior.

[1] Approved by the State Council, the People's Bank of China decided to remove controls on the lending interest rates offered by financial institutions to their clients from 20 July 2013. The loan interest rates of financial institutions are now determined autonomously by the financial institutions according to business principles. On 11 March 2014, Zhou Xiaochuan, the central bank governor, stated at a Chinese People's Political Consultative Conference that "deposit interest rate liberalization is certainly in the plan and probably can be realized within one or two years."

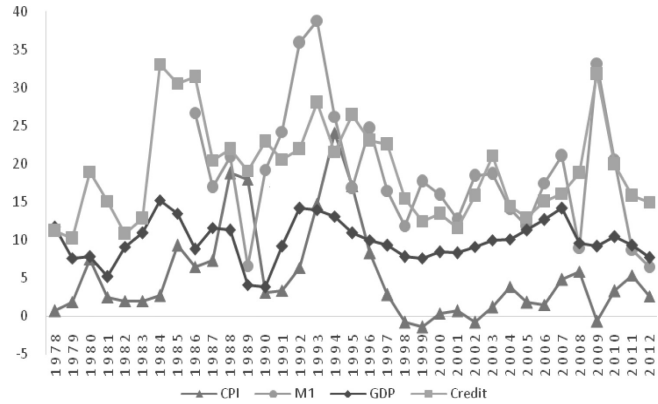

Figure 1. GDP growth, CPI growth and monetary policy from 1978 to 2012.

2.1. Asymmetric effects of monetary policy on corporate investment

For decades, macroeconomists have debated whether monetary policy has the same effect on real output during economic recessions and expansions. Before the 1920s, most economists believed that contractionary and expansionary monetary policies had symmetric effects, suggesting a linear relationship between money supply and output. After the 1920s, economists gradually realized that a "tightening monetary policy can effectively restrain [an] overheated economy, but the effect of [a] loose monetary policy in promoting economic growth is not obvious, which implies the effect of monetary policy is asymmetric." In the 1930s, Keynes argued with Pigou over whether monetary policies had less or no effect on output during a severe economic downturn. The limited effectiveness of an expansionary monetary policy was partially explained when the concept of a "liquidity trap" was introduced. In a liquidity trap, interest rates are so low that people believe that they cannot drop further. The monetary policy then fails (Keynes, 1936).

At the beginning of the 1990s, studies that empirically test the asymmetric effects of monetary policy gradually began appearing. Cover (1992) examines quarterly US post-war data from 1951 to 1987 and concludes that positive money supply shocks have no effect on output, whereas negative shocks reduce output. Karras (1996) examines 18 European countries from the 1953–1990 period and finds that negative money supply shocks have a statistically significant effect on output, whereas positive shocks have a statistically insignificant effect. Karras and Stokes (1999) find that the effects of money supply on prices and output of private consumption are symmetric, whereas the response of fixed investment is characterized by asymmetries, very similar to those that affect output.

The evidence from China for asymmetrical monetary shock effects is mixed. Huang and Deng (2000) use Chinese quarterly data from 1980 to 1997 and find the effects of monetary policies to be very different between China and Western countries. They find that the M_1 money supply shock has symmetric effects, whereas the M_2 (a broad measure of the money supply including currency, demand deposit and savings deposits) money supply shock has asymmetric effects. This asymmetry is opposite to that in Western countries: a positive money supply shock significantly affects output, whereas a negative money supply shock does not. However, Liu (2002) examines China's monthly data from 1990 to 2001 and suggests that the decelerating effect of a tight monetary policy is greater than the accelerating effect of an expansionary monetary policy. Chen et al. (2003) and Chen (2006) reach a similar conclusion to Liu after examining China's quarterly data from 1993–2002 and 1993–2005, respectively. Thus, due to differences in methods and sample windows, studies on the asymmetry of monetary policy effects at the macro-level do not reach consistent conclusions.

Does monetary policy have an asymmetrical effect on enterprise at the micro-level? Based on enterprise micro data, Gong and Meng (2012), Jing et al. (2012) and Qian (2013) find that expansionary and contractionary monetary policies have asymmetrical effects on corporate investment. However, the asymmetry is opposite to that found at the macro-level: expansionary monetary policy significantly alleviates financial constraints and promotes corporate investment, whereas contractionary monetary policy does not significantly

reduce corporate investment. The investment scale is sticky when adjusting downward due to investment inertia and sustainability. The transmission of monetary policy also has a lag effect, between a policy's implementation and managers in investment decision-making perceiving the implications of the policy.

Our first concern is therefore how different types of monetary policies affect the adjustment of corporate investment and whether expansionary and contractionary monetary policies have asymmetric effects on corporate investment.

2.2. Monetary policy transmission channels and the dynamic adjustment of investment in micro enterprises

Macroeconomic monetary policies have many relatively clear microscopic transmission channels, such as the money channel (which includes interest rates, exchange rates and the asset prices approach) and general credit channel of transmission (Bernanke and Blinder, 1992; Bernanke and Gertler, 1995). According to neoclassical economics, monetary policymakers use their leverage over short-term interest rates to influence the cost of capital and, consequently, spending on durable goods, such as fixed investment, housing, inventories and consumer durables. In turn, changes in aggregate demand affect the level of corporate investment. When the central bank raises interest rates, there is a corresponding increase in the cost of debt financing and the external financing constraints of companies (Luo and Nie, 2012). Companies become more dependent on internal financing or reduce current investment to dynamically adjust their scale of investment.

Since 1990, monetary economists, such as Benanke, Gertler, Kashyap and Stein, have proposed the theory of credit transmission of monetary policy when they study the role of micro-level enterprises in the monetary policy transmission process. Credit transmission theory suggests that monetary policy affects the availability of financing mainly through increasing or decreasing the supply of bank loans, thereby affecting the supply of corporate investment (Bernanke and Gertler, 1995; Oliner and Rudebusch, 1996). The credit rationing policy, which is used as an important monetary policy instrument in China[2], imposes a total credit limit. The total amount of new loans issued by all commercial banks every year cannot exceed the annual credit stipulated by the People's Bank of China in principle (Su and Zeng, 2009). Through the bank lending channel, a tight monetary policy reduces bank reserves and forces banks to shrink their loans, which reduces the commercial bank loans available to enterprises (Kashyap et al., 1993). In addition, due to economic structural adjustments, transformation and upgrading, banks are encouraged to issue loans to enterprises in the advanced manufacturing and strategic emerging industries. In contrast, loans to high energy consumption, high emission industries and overcapacity industries are strictly controlled, which strengthens bank credit financing constraints for some enterprises.

Researchers are interested in the effect of monetary policies on corporate investment behavior through the different transmission channels. Bernanke and Gertler (1995) note that monetary policy has a significant effect on long-term investment and find that monetary policy influences corporate investment through both the interest rate channel and the level of financing constraints. Chatelain and Tiomo (2003) suggest that monetary policy influences corporate investment through the interest rate channel, which can adjust the cost of capital, and through the credit channel, which can adjust external financing constraints. Zulkhibri (2013) finds that monetary policy significantly affects firms' access to external finance when interest rates are increasing. Bank-dependent firms are the most vulnerable to this effect. Internal finance is more important for high leverage firms during tight liquidity conditions.

Studies on Chinese companies draw similar conclusions. Zhang et al. (2012) study the dual effects of monetary policy on corporate investment supply and demand. They find that changes in monetary policy change investment opportunities, affect a company's willingness to invest through monetary channels, change the company's ability to raise funds and the supply of investment funds through the credit channel and ultimately affect the company's investment decisions. Monetary policies also affect corporate investment in companies with different financing constraints through different transmission channels. The monetary channel has a larger effect on low financing constraints companies, whereas the credit channel has a larger effect on high

[2] On 1 January 1998, the People's Bank of China abolished the control of the size of loans by state-owned commercial banks, which had been practiced for nearly five decades. At the end of 2007, to effectively control the high inflation rate, the central bank enabled credit size control again.

financing constraints companies. Huang et al. (2012) find that quantity-oriented and price-based monetary policies have heterogeneous effects on corporate investment behavior. The influence of monetary policies is constrained by the liquidity, inventory, size and asset–liability ratio of a firm. Firms with higher liquidity, lower inventory levels and lower asset–liability ratios are less sensitive to the effects of the two kinds of monetary policies. The larger a firm is, the less it is affected by quantity-oriented monetary policies, but the more sensitive it is to price-based monetary policies.

Fig. 2 presents the transmission channels and mechanisms by which monetary policy influences corporate investment behavior. When monetary policy changes (for example, from easing to tightening), it affects corporate investment opportunities and external financing constraints through the credit and monetary channels, respectively. Rational decision-makers in enterprises therefore actively consider adjusting their investment plans and scale to respond to these changes. From the perspective of credit financing constraints caused by the credit transmission channel, during a monetary policy contraction, corporate credit financing constraints and the opportunity cost of investment increase as the credit supply decreases. According to the net present value (NPV) rule and the theory of maximizing profit, the enterprise will reduce its investment projects to adjust its investment scale. During a loose monetary policy, external financing constraints and the cost of capital decline as the credit supply increases. According to the NPV rule, many projects with original negative NPV become profitable, so enterprises will expand their scale of investment to maximize profit.

From the perspective of the monetary transmission channel, during expansionary monetary policy, the total market demand increases as the base money supply increases. Enterprises expand production and increase their scale of investment due to the increase in investment opportunities. During tight monetary policy, the total market demand decreases and the cost of capital rises as the money supply decreases. Companies reduce their scale of investment as the reduction in investment opportunities causes investment demand to decrease.

Is there a linear relationship between the changes in monetary policy and corporate investment? Is there an asymmetric effect? Do different monetary policy transmission channels and tools have the same effect on the adjustment speed of corporate investment? All of these questions require in-depth empirical research.

Leverage plays an important moderating role in the effect of monetary policy on corporate investment. Lang et al. (1996) show that the effect of monetary policy changes on firms with high levels of leverage is larger than on those with low levels of leverage. There is a negative relationship between leverage and future growth at the firm level. Hu (1999) finds that monetary contractions reduce the growth of investment more in highly leveraged firms than in less leveraged firms. The results suggest that a broad credit channel for monetary policy exists and that it can operate through leverage, as adverse monetary shocks aggravate real debt burdens and raise the effective costs of investment.

Based on the above analysis, we empirically examine the effects of different monetary policy channels on the speed of corporate investment adjustment and whether there is an asymmetric effect. We test the role of leverage in the effect of monetary policy on corporate investment.

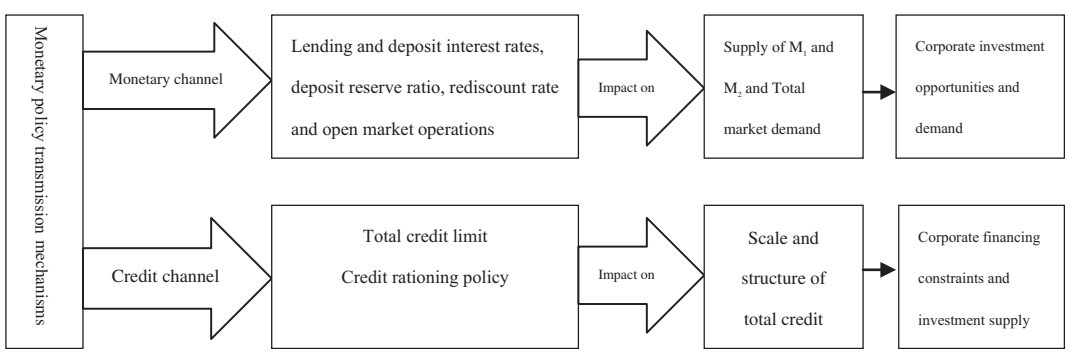

Figure 2. The transmission channels and mechanisms of monetary policy and its influence on investment behavior.

3. Model design and definition of key concepts

3.1. Dynamic adjustment model of corporate investment

We design the dynamic adjustment model of corporate investment with the effect of monetary policy by integrating Richardson's (2006) investment efficiency model and Flannery and Rangan's (2006) partial adjustment model. The model is derived as follows.

Step 1: Estimated model of expected investment.

According to Richardson (2006), there is an optimal scale of corporate investment. It depends on the last operating conditions of a company in a given external environment. We set the estimated model of expected corporate investment as follows:

$$I^*_{i,t} = \alpha X_{i,t-1}, \tag{1}$$

where $I^*_{i,t}$ represents the expected investment of company i in year t and $X_{i,t-1}$ is a vector of firm characteristic variables that affect the expected investment.

Step 2: Standard partial adjustment model.

In a frictionless world, firms quickly move back to their target level, which is the level they choose in the absence of any adjustment costs. However, in the presence of adjustment costs, firms may partially adjust back to their expected level of investment over multiple periods. We use Flannery and Rangan's (2006) standard partial adjustment model to estimate the speed of the adjustment of corporate investment to the next period target level.

The standard partial adjustment model of corporate investment is as follows:

$$I_{i,t} - I_{i,t-1} = \lambda(I^*_{i,t} - I_{i,t-1}) + \phi_{i,t}, \tag{2}$$

where $I_{i,t}$ and $I_{i,t-1}$ represent the actual investment level for firm i in periods t and $t-1$ and λ represents the adjustment speed of corporate investment to the target level from period $t-1$ to period t. The larger the value of λ, the faster the adjustment speed. $\lambda = 1$ indicates that firms fully adjust for any deviation away from their target investment level. We expect λ to be less than 1 in the presence of adjustment costs.

Step 3: Integrated partial adjustment model.

Following Flannery and Rangan, we substitute (1) into (2) and rearrange. The model of integrated corporate investment partial adjustment model is:

$$I_{i,t} = (1-\lambda)I_{i,t-1} + (\lambda\alpha)X_{i,t-1} + \omega_{i,t}. \tag{3}$$

Step 4: Dynamic adjustment model of investment with monetary policy effects.

Relaxing the assumption of a fixed external economic policy, we argue that a manager develops investment plans at the beginning of each year according to the operating conditions in the previous year and dynamically adjusts them according to this year's changes in macroeconomic policies. To investigate the effects of monetary policy and its transmission channels on the adjustment speed of corporate investment, we develop an extended integrated partial adjustment model. We add the interaction term between the variables for the current monetary policy period and the lagged variable of investment ($MC_t * I_{i,t-1}$) in the right of model (3), as follows:

$$I_{i,t} = (1-\lambda)I_{i,t-1} + \eta MC_t * I_{i,t-1} + (\lambda\alpha)X_{i,t-1} + \omega_{i,t}, \tag{4}$$

where MC_t represents monetary policy variables, proxied by the M_1 and M_2 growth rates and loan interest rates in the monetary channel and credit growth rates in the credit channel. The adjustment speed of corporate investment becomes $\lambda' = \lambda - \eta * MC_t$. As MC_t is generally positive, when the coefficient on the interaction item is significantly negative, the adjustment speed of corporate investment increases with an increase in the monetary policy variables, and *vice versa*. The calculations and definitions of the variables are shown in Table 1.

Table 1
Variable definitions.

Variable	Name	Definition and calculation
Dependent variables		
I_t	Investment	Cash for buying fixed assets, intangible assets and other long-term assets/total assets
Isd_t	Change rate of investment	$(I_t - I_{t-1})/I_{t-1}$
Variables of interest		
MP	Monetary policy states	MP equals 1 if in a tight monetary policy period, and 0 otherwise
M_1	Annual growth rate of M_1	(Money supply M_1 in this year – Money supply M_1 in the previous year)/Money supply M_1 in the previous year
M_2	Annual growth rate of M_2	(Money supply M_2 in this year – Money supply M_2 in the previous year)/Money supply M_2 in the previous year
Credit	Credit growth rate	Growth rate of annual cumulative new RMB loans issued by financial institutions
R	Loan interest rates	Weighted average interest rate of medium- and long-term loans with maturities in the 1–3 year range. If the benchmark interest rate is adjusted several times within a year, the annual weighted lending rate is calculated by the monthly weighted average of each benchmark interest rate in a year
Control variables		
Lnsize	Asset scale	Natural logarithm of total assets
Growth	Growth potential	Growth rate of operating income
Cash	Cash holdings	(Cash + short-term investments or tradable financial assets)/total assets
Lev	Leverage level	Total liabilities/total assets
Return	Market return	Cumulative return rate from May in year t to April in year $t+1$
Listage	Number of years listed	The number of years between the annual financial report and the firm's IPO
Industry	Industry	Industry dummies, which equal 1 if the observation belongs to each particular industry, and 0 otherwise
Year		Year dummies, which equal 1 if the observation belongs to a particular year, and 0 otherwise

3.2. Definition and determinants of corporate investment

According to Richardson's (2006) definition, total investment expenditure can then be split into (i) required investment expenditure to maintain assets in place and (ii) investment expenditure on new projects. We define corporate investment as new investment with a proxy using cash expenditure for buying fixed assets, intangible assets and other long-term assets and standardizing with total assets to eliminate the influence of size differences.

Following Richardson (2006), we estimate expected investment according to the following regression specification:

$$I_{i,t} = \beta_0 + \beta_1 Growth_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 Cash_{i,t-1} + \beta_4 Listage_{i,t-1} + \beta_5 Lnsize_{i,t-1} + \beta_6 Return_{i,t-1} + \beta_7 I_{i,t-1} + \sum Industry + \sum Year + \varepsilon_{i,t}. \quad (5)$$

The determinants of investment decisions include measures of growth opportunities, leverage, the level of cash, firm age, firm size, past stock returns, prior level of firm investment, industry fixed effects and annual fixed effects.

3.3. Definition of monetary policy states and transmission channels

3.3.1. Definition of monetary policy states

The government often describes three monetary policy states: active or expansionary monetary policy, prudent monetary policy and tight monetary policy. However, monetary policy is often divided into tightening and expansionary monetary policies, based on different indicators in the academic literature.

Indicators commonly used to determine the annual monetary policy direction in the literature are listed below:

(1) Monetary policy sentiment index of bankers

Zhu and Lu (2009) and Ye and Zhu (2009) measure the degree of tightening monetary policy using the monetary policy sentiment index from the bankers' survey carried out by the People's Bank of China and the National Bureau of Statistics of China. The survey records bankers' assessments of monetary policy as too loose, partially loose, moderate, tight, too tight and unknown. They use "too tight" to measure the degree of monetary policy tightening. The higher the ratio of bankers who believe that a monetary policy is too tight, the tighter monetary policy is. Qian (2013) use "moderate" as a measure of monetary policy. They judge the annual monetary policy direction as loose when the number of votes for "moderate" is higher than the average value of the investigation window, and otherwise judge the direction to be easing. As only votes for "moderate" are available for recent years, we use Qian's method to judge the monetary policy direction.

(2) The broad money supply (M_2) growth rate

Mayer et al. (1996) show a close relationship between money supply and nominal GDP in developed countries. In the major countries, the stock of money and GDP both grow in the same direction. Shirakawa (2001) suggests that nominal GDP makes a nearly consistent growth with money supply (M_2 + CDs (large time deposits, institutional money-market fund balances)) in Japan. Jing et al. (2012) use the annual broad money supply (M_2) growth rate as a measure of monetary policy.

Li and Wang (2011) use the difference between the nominal GDP growth rate and M_2 growth rate to measure the monetary policy state. The nominal GDP growth in the general sense represents the demand for currency for economic development, whereas the M_2 growth rate reflects the money supply level. If the difference between the two is positive, there is a money supply gap and the government implements contractionary monetary policy. If the difference is negative, then the money supply exceeds the demand of economic development and the government implements expansionary monetary policy.

(3) Benchmark interest rates and the legal deposit reserve rate

Li and Wang (2011) also use one-year lending interest rates as a measure of monetary policy. Rao and Jiang (2011) and Ma and Hu (2012) judge the monetary policy state according to the adjustment direction of the benchmark interest rate and the legal deposit reserve rate implemented by the central bank.

As shown in Table 2, 2006 and 2008–2010 are classified differently by the above three mainstream methods of determining the direction of the monetary policy. According to majority rule, we judge 2006 and 2008 to be tight monetary policy years and 2009 and 2010 to be loose monetary policy years. We divide the sample window into contraction years (2006, 2007, 2008 and 2011) and expansion years (2005, 2009, 2010 and 2012).

3.3.2. Definition of monetary policy transmission channels

Monetary policy transmission channels generally include the monetary channel (including interest rates, exchange rates and asset prices) and credit channel. The monetary channel influences M_1 and M_2 supply to achieve policy goals through monetary policy tools, such as interest rates, exchange rates, deposit reserves, open market operations and standing lending facilities.[3] As M_1 reflects the real purchasing power in an economy, which represents the market demand and reflects investment opportunities, we use the M_1 growth rate as the main proxy variable of the monetary channel. We use the M_2 growth rate and weighted average loan interest rate of loans with maturity in the one to three year range as robustness test variables.

[3] In January 2013, the People's Bank of China set up standing loan facilities which provide liquidity support for financial institutions.

Table 2
Definition of the annual monetary policy direction.

Indicators	Contraction years	Expansion years	Criteria for classification	References
The monetary policy sentiment index	2007, 2008, 2009, 2011	2005, 2006, 2010, 2012	Following the monetary policy sentiment index of bankers, we use the number of votes for "moderate" as a measure of monetary policy. The annual monetary policy direction is loose when the number is higher than the average value of the investigation window, otherwise it is tight	Qian (2013)
The broad money supply (M_2) growth rate	2006, 2007, 2008, 2011	2005, 2009, 2010, 2012	If the nominal GDP growth rate is more than the M_2 growth rate, the monetary policy that year is contractionary, otherwise it is expansionary	Li and Wang (2011)
Benchmark interest rates and the legal deposit reserve rate	2006, 2007, 2010, 2011	2005, 2008, 2009, 2012	We use the adjustment direction of the benchmark interest rate and the legal deposit reserve rate. The monetary policy is contractionary when the central bank raises the rates, otherwise it is expansionary	Rao and Jiang, (2011), Ma and Hu (2012)
Comprehensive judgment	2006, 2007, 2008, 2011	2005, 2009, 2010, 2012	We follow the majority rule. We judge the monetary policy state to be that of the majority of the above three methods	This paper

The credit channel generally refers to monetary policy tools that the central bank uses to adjust the credit financing supply to achieve a policy goal. The monetary policy tools of the credit channel are the total credit limit and credit rationing, which affect the scale and structure of total credit. New loans by financial institutions reflect the total credit supply, which affects the degree of external financing constraints that enterprises experience. We use the annual cumulative new RMB loans growth rate of financial institutions as the proxy variable for monetary policy through the credit channel.

4. Sample selection and data sources

The initial sample includes all A-share listed companies from 2005 to 2012. The final sample is obtained by filtering with the following conditions. (1) Observations with missing variables are dropped. (2) Financial and insurance companies are removed. (3) Observations with leverage levels that fall outside the outlier leverage levels of [0, 1] or investment rates equal to 0 are excluded. (4) Newly listed and specially treated companies are removed.

To meet the availability of the lag variable, we use a balanced panel data set of 1157 listed companies over the eight-year period. The final sample includes 9256 firm-year observations. Financial data of the listed companies are sourced from the China Stock Market and Accounting Research and Wind Information Co., Ltd. databases. Monetary policy variables are collected from the website of the People's Bank of China and the National Bureau of Standards of China. The money and credit supplies are taken from the Monetary Policy Implementation Report and the monetary policy sentiment index of bankers is taken from the Chinese Bankers Survey Report.

Table 3 shows the sample by industry sector. The industry classification is based on the Industrial Distribution of Listed Companies index issued by the China Securities Regulatory Commission (CSRC). The manufacturing sector accounts for 55.2% of the sample. To make the sample distribution by industry sector more even, we use two-digit industry codes for the manufacturing sector to control for industry factors in the empirical estimation.

5. Model estimation and empirical analysis

5.1. Descriptive statistics

Table 4 provides descriptive statistics of the monetary policy variables. It demonstrates four proxy variables for the monetary policy transmission channels of the monetary policy states. There is a significant difference

Table 3
Sample distribution by industry sector.

Industry (CSRC code)	Frequency	Percent (%)
Agriculture (A)	177	1.91
Mining (B)	251	2.71
Manufacturing (C)	5109	55.2
Electricity, Gas, Water Supply (D)	496	5.36
Construction (E)	144	1.56
Transportation and Storage (F)	385	4.16
Information, Technology (G)	456	4.93
Wholesale and Retail Trade (H)	728	7.87
Real Estate (J)	777	8.39
Social Services (K)	297	3.21
Transmission, Culture (L)	105	1.13
Conglomerate (M)	344	3.72
Total	9256	100

Table 4
Descriptive statistics of the monetary policy variables.

MP	Statistical indicators	M_1	M_2	*R*	Credit
0	Mean	0.1795	0.1971	0.0574	0.3396
	Standard deviation (Sd)	0.0984	0.0506	0.0039	0.6776
1	Mean	0.1382	0.1596	0.0642	0.0870
	Sd	0.0500	0.0156	0.0061	0.2222
0–1	Difference	0.0414***	0.0375***	−0.0068***	0.2525***
	t-statistic	27.80	53.19	−66.15	26.61
Total	Mean	0.1565	0.1762	0.0612	0.1993
	Sd	0.0782	0.0403	0.0062	0.4972
	Coefficient of variation	49.97%	22.87%	10.13%	249.47%

Note: $^{*}p < 0.10$, $^{**}p < 0.05$.
*** $p < 0.01$.

between the monetary policy states in every proxy variable, which indicates that the definition of the monetary policy states is reasonable. From the coefficient of variation, monetary policy is mainly implemented through quantitative tools in the monetary channels to adjust the money supply. The price instrument with interest rates as the core has a small variation. The coefficient of variation of the credit growth rate is 249.47%, which suggests that monetary policy is mainly implemented through credit scale control.

Table 5 provides descriptive statistics for the main corporate variables. To avoid the influence of outliers, all of the continuous variables are winsorized at the 1% and 99% levels. As shown in Table 5, the average company in the sample has a listed age of 10.4, investment rate of 5.38%, leverage of 51.09%, cash holdings ratio of 15.59%, annual operating income growth of 14.92% and annual market return of 36.69%.

Table 5
Descriptive statistics of the main corporate variables.

Variable	Obs	Mean	Std.	Min.	P25	Median	P75	Max.
Age	9256	10.43	4.14	1	8	10	13	22
I	9256	0.0538	0.0499	0.0018	0.0147	0.0386	0.0771	0.1862
Lev	9256	0.5109	0.1794	0.1022	0.3849	0.5283	0.6502	0.7949
Cash	9256	0.1559	0.1080	0.0284	0.0777	0.1299	0.2054	0.5477
Growth	9256	0.1492	0.2635	−0.2936	−0.0168	0.1236	0.2812	0.7851
Return	9256	0.3669	0.8455	−0.6552	−0.2808	0.0733	0.9444	2.1408
Lnsize	9256	21.7705	1.2007	17.5367	20.9288	21.6631	22.4712	27.8520

Table 6
Estimating expected corporate investment.

Dependent variables		I_t	
Independent variable	Predicted sign	*B*	*t*-statistic
I_{t-1}	+	0.510^{***}	59.75
Lev_{t-1}	−	-0.0123^{***}	−4.39
$Lnsize_{t-1}$	+	0.00241^{***}	5.45
$Cash_{t-1}$	+	0.0356^{***}	8.15
$Growth_{t-1}$	+	0.00345^{***}	3.03
$Return_{t-1}$	+	0.00356^{***}	4.40
Age_{t-1}	−	-0.000565^{***}	−4.03
Constant	+/−	-0.0268^{***}	−2.84
Industry	/	Yes	–
Year	/	Yes	–
R-square		0.4037	
Wald chi^2		6242.99	
N		9256	

Note: $^{*}p < 0.1$, $^{**}p < 0.05$.
*** $p < 0.01$.

5.2. Empirical results

5.2.1. Estimating the expected level of capital investment

Adjustment model (4) internalizes the estimate of expected corporate investment. The premise of this internalization is that the target level of corporate investment can be appropriately fitted by the firm characteristic variables. We must therefore test and discuss the fitting effect of the expected corporate investment estimation model (5).

Table 6 reports the estimates of expected corporate investment. The sign of the coefficient is consistent with theoretical expectations and similar studies (e.g., Richardson, 2006). The estimates of all of the parameters are significant at the 1% level. The goodness of fit (0.4) is high. We therefore believe that model (5) is suitable for estimating the expected investment level with the selected firm characteristic variables.

5.2.2. Monetary policy states and dynamic adjustment of corporate investment

Table 7 reports the estimates of the effect of the monetary policy states on the adjustment speed of corporate investment. The regression results show that the coefficient of I_{t-1} is 0.499 and the coefficient of $MP * I_{t-1}$ is 0.0218. According to the economic significance of the model, the adjustment speed is $\lambda' = 0.501 - 0.0218 * MP$. The results show that corporate investment adjusts back to the target level faster during loose monetary policies than tight policies. Monetary policy has asymmetric effects on corporate investment in expansionary and tight periods. A typical firm closes about 50.1% of the gap between the actual and target investment levels in one year of loose monetary policy, with an adjustment HALF-LIFE[4] of 1.38 years. In contrast, it can only correct about 47.92% of the gap between the actual and target investment levels in a year of tight monetary policy, with an adjustment HALF-LIFE of 1.45 years.

5.2.3. Monetary transmission channels and the dynamic adjustment of corporate investment

To test whether monetary policy transmission channels have an asymmetric effect on the adjustment speed during different monetary policy states, we use simulation evidence to determine the significance of the observed differences in the coefficient estimates reported in the literature (Cleary, 1999; Islam and Mozumdar, 2007; Lian et al., 2010). A bootstrapping procedure is used to calculate empirical *p*-values that estimate the likelihood of obtaining the observed differences in coefficient estimates if the true coefficients are, in fact, equal.

[4] The adjustment HALF-LIFE is $(\ln 2)/\lambda$, where λ is the adjustment speed.

Table 7
Estimating the effect of monetary policy states on the adjustment speed of corporate investment.

Dependent variables	I_t	
Independent variable	*B*	*t*-statistic
I_{t-1}	0.499***	49.29
$MP * I_{t-1}$	0.0218*	1.94
Lev_{t-1}	−0.0123***	−4.40
$Lnsize_{t-1}$	0.00237***	5.46
$Cash_{t-1}$	0.0363***	8.39
$Growth_{t-1}$	0.00396***	3.56
$Return_{t-1}$	0.00286***	6.20
Age_{t-1}	−0.000604***	−5.13
Constant	−0.0273***	−2.98
Industry	Yes	/
Year	No	/
Wald chi^2	6222.93	/
R-square	0.4028	/
N	9256	/

Note: ** $p < 0.05$.
* $p < 0.10$.
*** $p < 0.01$.

Table 8
Estimating the effect of the monetary channel on the adjustment speed of corporate investment.

I_t	Full sample	Expansion ($MP = 0$)	Contraction ($MP = 1$)	Empirical *p*-value
I_{t-1}	0.558***	0.526***	0.630***	0.3010
	(40.52)	(29.98)	(24.53)	
$M_1 * I_{t-1}$	−0.300***	−0.117	−0.777***	0.0780*
	(−4.42)	(−1.54)	(−5.04)	
Lev_{t-1}	−0.0122***	−0.0125***	−0.0115***	
	(−4.36)	(−3.28)	(−2.81)	
$Lnsize_{t-1}$	0.00230***	0.00104*	0.00353***	
	(5.31)	(1.79)	(5.45)	
$Cash_{t-1}$	0.0355***	0.0274***	0.0436***	
	(8.22)	(4.65)	(6.85)	
$Growth_{t-1}$	0.00374***	0.00524***	0.00229	
	(3.35)	(3.30)	(1.45)	
$Return_{t-1}$	0.00286***	0.00334***	0.00207***	
	(6.35)	(4.75)	(3.19)	
Age_{t-1}	−0.000656***	−0.000754***	−0.000646***	
	(−5.58)	(−4.81)	(−3.48)	
Constant	−0.0250***	0.00105	−0.0494***	
	(−2.74)	(0.09)	(−3.57)	
Industry	Yes	Yes	Yes	
Year	No	No	No	
Wald chi^2	6249.38	3298.43	3035.18	
R-square	0.4038	0.4177	0.3976	
N	9256	4628	4628	

Note: (1) *t* statistics in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (2) Empirical *p*-values are generated using 1000 bootstrapping simulations to test the differences between the coefficient estimates of $MC * I_{t-1}$.

Table 8 reports the estimates of the effect of the monetary channel on the adjustment speed of corporate investment. The results show that the coefficient of I_{t-1} is 0.558 and the coefficient of $M_1 * I_{t-1}$ is −0.300 when we use the M_1 growth rate as the proxy variable of the monetary channel. According to the economic significance of the model, the adjustment speed is $\lambda' = 0.442 + 0.3 * M_1$. In our sample interval, a typical firm closes

about 46.147% of the gap between the actual and target investment levels in 2012, which has the lowest M_1 growth rate of 6.49%, corresponding to an adjustment HALF-LIFE of 1.50 years. In contrast, it closes about 53.905% of the gap between the actual and target levels in 2009, which has the highest M_1 growth rate of 32.35%, corresponding to an adjustment HALF-LIFE of 1.29 years. The results show that expanding the monetary policy by increasing the growth rate of M_1 can speed up the adjustment of corporate investment. The change in the M_1 supply has a greater effect on the adjustment speed of corporate investment in tight monetary policy periods than in loose monetary policy periods. The observed differences in the coefficient estimates indicate that monetary policy has an asymmetric effect on corporate investment in the monetary channel, at the 10% significance level. We can conclude that changing the money supply through monetary channels has a significant effect on corporate investment adjustment in tight monetary policy periods, but a non-significant effect in loose monetary policy periods.

5.2.4. Credit channel and dynamic adjustment of corporate investment

Table 9 reports the estimates of the effects of the credit channel on the speed of corporate investment adjustment. The results show that the coefficient of I_{t-1} is 0.522 and the coefficient of $Credit * I_{t-1}$ is −0.0449 when we use credit growth rate as the proxy variable of the credit channel. According to the economic significance of the model, the adjustment speed is $\lambda' = 0.478 + 0.0449 * Credit$. In our sample interval, a typical firm closes about 46.5% of the gap between the actual and target investment levels in 2010, which has the lowest credit growth rate of −28.90%, corresponding to an adjustment HALF-LIFE of 1.49 years. In contrast, it corrects about 54.45% of the gap between the actual and target levels in 2009, which has the highest credit growth rate of 148.13%, corresponding to an adjustment HALF-LIFE of 1.27 years. The results show that loose monetary policy can speed up corporate investment adjustment by increasing the credit supply. A change in credit supply has a greater effect on the speed of corporate investment adjustment in tight monetary policy periods than in loose monetary policy periods. The observed differences in the coefficient estimates indicate that the credit channel does not have an asymmetric effect, at the 10% significance level.

Table 9
Estimating the effect of the credit channel on the adjustment speed of corporate investment.

I_t	Full sample	Expansion ($MP = 0$)	Contraction ($MP = 1$)	Empirical p-value
I_{t-1}	0.522^{***}	0.514^{***}	0.558^{***}	0.2450
	(57.69)	(41.73)	(36.94)	
$Credit * I_{t-1}$	-0.0449^{***}	-0.0252^{**}	-0.216^{***}	0.2330
	(−3.95)	(−2.09)	(−4.79)	
Lev_{t-1}	-0.0123^{***}	-0.0124^{***}	-0.0116^{***}	
	(−4.39)	(−3.27)	(−2.82)	
$Lnsize_{t-1}$	0.00232^{***}	0.00105^{*}	0.00353^{***}	
	(5.37)	(1.81)	(5.43)	
$Cash_{t-1}$	0.0357^{***}	0.0276^{***}	0.0437^{***}	
	(8.25)	(4.70)	(6.86)	
$Growth_{t-1}$	0.00397^{***}	0.00534^{***}	0.00197	
	(3.57)	(3.38)	(1.24)	
$Return_{t-1}$	0.00252^{***}	0.00275^{***}	0.00198^{***}	
	(5.39)	(3.60)	(3.04)	
Age_{t-1}	-0.000634^{***}	-0.000733^{***}	-0.000694^{***}	
	(−5.40)	(−4.67)	(−3.66)	
Constant	-0.0258^{***}	0.000662	-0.0485^{***}	
	(−2.82)	(0.05)	(−3.50)	
Industry	Yes	Yes	Yes	
Year	No	No	No	
Wald chi^2	6242.71	3301.85	3031.04	
R-square	0.4035	0.4179	0.3973	
N	9256	4628	4628	

Note: (1) t statistics in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (2) Empirical p-values are generated using 1000 bootstrapping simulations to test the differences between the coefficient estimates of $MC * I_{t-1}$.

5.2.5. Robustness tests

We test the robustness of our results on the asymmetric effect in the monetary channel by repeating the test process using the M_2 growth rate and lending interest rates as proxies for the monetary channel of monetary policy. The results of the two tests, shown in Table 10, indicate that the differences in the coefficient estimates of the interaction term are significant at the 5% level. The results are therefore robust.

The results show that the coefficient of I_{t-1} is 0.598 and the coefficient of $M_2 * I_{t-1}$ is −0.490 when we use the M_2 growth rate as the proxy variable of the monetary channel. The adjustment speed is then $\lambda' = 0.402 + 0.49 * M_2$. In our sample interval, a typical firm closes about 46.87% of the gap between the actual and target investment levels in 2011, which has the lowest M_2 growth rate of 13.61%, corresponding to an adjustment HALF-LIFE of 1.48 years. In contrast, it corrects about 53.76% of the gap between the actual and target levels in 2009, which has the highest M_2 growth rate of 27.68%, corresponding to an adjustment HALF-LIFE of 1.29 years. The results show that expanding monetary policy to increase the growth rate of M_2 can speed up the adjustment of corporate investment. The effect of the change in M_2 supply on the adjustment speed of corporate investment is significantly greater in tight monetary policy periods than in loose monetary policy periods.

The results show that the coefficient of I_{t-1} is 0.375 and the coefficient of $R * I_{t-1}$ is 2.191 when we use lending rates as the proxy variable of the monetary channel. The adjustment speed is then $\lambda' = 0.625 - 2.191 * R$. In our sample interval, a typical firm closes about 50.67% of the gap between the actual and target investment levels in 2009, which has the lowest lending rates of 5.40%, corresponding to an adjustment HALF-LIFE of 1.37 years. In contrast, it corrects about 46.57% of the gap between the actual and target levels in 2008, which has the highest lending rates of 7.27%, corresponding to an adjustment HALF-LIFE of 1.49 years. The results show that contracting monetary policy by raising lending rates can slow down the adjustment of corporate investment. The effect of the change in lending rates on the adjustment speed of corporate investment is non-significantly greater in loose monetary policy periods than in tight monetary policy periods.

Table 10
Robustness test results.

I_t	Full sample	Expansion ($MP = 0$)	Contraction ($MP = 1$)	Empirical p-value
I_{t-1}	0.598***	0.561***	0.923***	0.2160
	(23.15)	(17.86)	(9.30)	
M_2 * I_{t-1}	−0.490***	−0.285*	−2.474***	0.0240**
	(−3.62)	(−1.91)	(−4.12)	
Constant	−0.0258***	0.00168	−0.0521***	
	(−2.82)	(0.14)	(−3.78)	
X and *Industry*	Yes	Yes	Yes	
Wald chi^2	6238.61	3300.60	3021.29	
R-square	0.4034	0.4178	0.3965	
N	9256	4628	4628	
I_{t-1}	0.375***	0.333***	0.371***	0.3730
	(6.31)	(2.78)	(2.83)	
R * I_{t-1}	2.191**	3.001	2.208	0.0030***
	(2.30)	(1.45)	(1.12)	
Constant	−0.0262***	0.00261	−0.0593***	
	(−2.86)	(0.21)	(−4.32)	
X and *Industry*	Yes	Yes	Yes	
Wald chi^2	6225.49	3297.94	2995.27	
R-square	0.4029	0.4176	0.3944	
N	9256	4628	4628	

Note: (1) t statistics in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (2) Empirical p-values are generated using 1000 bootstrapping simulations to test the differences between the coefficient estimates of $MC * I_{t-1}$. (3) We control for the related variables (X) and industry, but do not report them as there are too many variables.

6. Further discussion

6.1. Monetary policy and dynamic adjustment of corporate investment: role of leverage

The literature shows that the leverage level plays an important moderating role in the effect of monetary policy on the adjustment of corporate investment. We examine the effect of the leverage level on the relationship between the adjustment of corporate investment and monetary policy in different states. The results are shown in Table 11.

The results show that the coefficient of I_{t-1} is 0.323 and the coefficient of $Lev * I_{t-1}$ is 0.349. According to the economic significance of the model, the adjustment speed is $\lambda' = 0.677 - 0.349 * Lev$. A typical firm in our sample closes about 64.13% of the gap between the actual and target investment levels in one year when leverage is at its lowest level of 10.219%, corresponding to an adjustment HALF-LIFE of 1.08 years. In contrast, it corrects about 39.96% of the gap between the actual and target levels when leverage is at its highest level of 79.486%, corresponding to an adjustment HALF-LIFE of 1.73 years. The results show that the higher the leverage, the slower the adjustment speed of corporate investment. This result is due to the financing constraints that reduce the external financing supply for corporate investment. Leverage has a greater effect on the adjustment speed of corporate investment in loose monetary policy periods than in tight monetary policy periods. The observed differences in the coefficient estimates indicate that there is an asymmetric effect at the 10% significance level. The implication for policy-makers is that monetary authorities should pay more attention to firms with high leverage during loose monetary policy periods to solve their financing difficulties.

6.2. Differences between the relative and absolute speed of corporate investment adjustment

The empirical investigation above reports the effect of monetary policy on the relative speed of adjustment to the optimal level of investment. However, the effect of monetary policy on the absolute speed of adjustment of corporate investment is a more intuitive measure, which is the rate of change in the level of investment from one year to another. We repeat the empirical estimates using the absolute adjustment speed and compare the results. The empirical results of model (6) are shown in Table 12.

$$Isd_t = (I_{i,t} - I_{i,t-1})/I_{i,t-1} = \alpha MC_t + \beta X_{i,t-1} + \delta_{i,t}. \quad (6)$$

The results show that the effects of monetary policy variables on the absolute speed of adjustment of corporate investment are not significant, except for the effects of M_1 and lending rates R in tight monetary policy periods. However, lending rates have a greater effect on the absolute adjustment speed of corporate investment in tight monetary policy periods than in loose monetary policy periods, which is inconsistent with the results

Table 11
Estimating the effect of leverage on the adjustment speed of corporate investment.

I_t	Full sample	Expansion ($MP = 0$)	Contraction ($MP = 1$)	Empirical p-value
I_{t-1}	0.323***	0.315***	0.335***	0.3820
	(13.93)	(9.83)	(9.99)	
$Lev * I_{t-1}$	0.349***	0.349***	0.344***	0.0640*
	(8.66)	(6.36)	(5.82)	
Constant	−0.0142	0.0120	−0.0466***	
	(−1.54)	(0.97)	(−3.37)	
X and *Industry*	Yes	Yes	Yes	
Wald chi^2	6342.13	3363.81	3049.19	
R-square	0.4074	0.4224	0.3987	
N	9256	4628	4628	

Note: (1) t statistics in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (2) Empirical p-values are generated using 1000 bootstrapping simulations to test the differences between the coefficient estimates of $MC * I_{t-1}$. (3) We control for the related variables (X) and industry, but do not report them as there are too many variables.

Table 12
Estimating the effect of monetary policy on the absolute speed of adjustment of corporate investment.

Isd_t	Full sample	Expansion ($MP = 0$)	Contraction ($MP = 1$)	Empirical p-value
M_1	0.293	0.150	1.570*	0.4410
	(0.71)	(0.31)	(1.66)	
M_2	−0.304	0.446	0.583	0.4780
	(−0.37)	(0.47)	(0.15)	
R	−4.877	−2.012	−25.44*	0.4670
	(−0.82)	(−0.15)	(−1.65)	
$Credit$	−0.00198	0.0763	0.386	0.4470
	(−0.03)	(0.86)	(1.32)	
Lev_{t-1}	−0.103	−0.751**	0.541*	0.4830
	(−0.48)	(−2.46)	(1.80)	

Note: (1) t statistics in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (2) Empirical p-values are generated using 1000 bootstrapping simulations to test the differences between the coefficient estimates of $MC * I_{t-1}$. (3) We control for the related variables and industry, but do not report them because there are too many variables.

found using the relative speed of adjustment. All of the empirical p-values are larger than 10%, indicating no asymmetric effects on the absolute speed of adjustment of corporate investment under different monetary policy states.

The differences in the estimation results using relative and absolute adjustment speeds of corporate investment may be caused by the measure perspective of the two kinds of speed. The relative speed of adjustment adjusts to the optimal investment level, which takes into account the effects of over- or under-investment. The absolute speed of adjustment is based only on the rate of change in corporate investment. Therefore, we argue that the relative speed of adjustment is suitable for choosing monetary policy to optimize the investment scale. For example, in response to the international financial crisis of 2007, the Chinese government implemented an expansionary monetary policy and proactive fiscal policy with a 4 trillion investment plan from 2008. Although these measures played a short-term role in economic recovery, over-investment has resulted in overcapacity and redundant construction, which is harmful to the long-term development of the economy.

7. Conclusions and implications

Based on China's A-share listed firms from 2005 to 2012, we investigate the effects of monetary policy on the direction and speed of corporate investment adjustment. The results show that the adjustment speed of corporate investment is faster in expansionary monetary policy periods than in contractionary monetary policy periods. The monetary channel, proxied by M_1, M_2 and loan interest rates, has a significant effect on the adjustment of corporate investment. This effect is asymmetric across different monetary policy states. The credit channel, proxied by credit scale, has a significant, but not asymmetric effect on the adjustment of corporate investment. Leverage is an important factor for restricting the adjustment of corporate investment. The higher the leverage, the slower the adjustment speed of corporate investment.

Monetary authorities should pay attention to the effect of monetary policy on the adjustment of corporate investment. Expansionary monetary policy more effectively adjusts corporate investment than tightening policy. A change in the growth rate of M_1 or M_2 has a significantly greater effect on the adjustment of corporate investment during tight monetary policies. Leverage has a greater effect on financing capacity in loose monetary policy periods than in tight periods. Monetary authorities should pay more attention to firms with high leverage during loose monetary policy periods.

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Short sellers' accusations against Chinese reverse mergers: Information analytics or guilt by association?☆

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ABSTRACT

This paper studies short sellers' trading strategies and their effects on the financial market by examining their accusations of fraud against Chinese reverse merger firms (CRMs) in the US. We find that short sellers rely on firms' fundamental information, especially relative financial indicators, to locate their "prey." Specifically, they compare a target firm's financial indicators (e.g., growth and receivables) with both the industry average and the firm's history. We find no evidence that short sellers accuse CRMs simply because of their reverse merger label. Additionally, we test the accuracy of short sellers' accusations in the long run and find that accused firms are more likely to delist and less likely to recover from price plunges. Our results also indicate that CRMs' high exposure to short sellers' accusations stem from adverse selection problems: firms with high litigation risk are more likely to choose reverse mergers to access the US capital market. Overall, our results support the view that short sellers are sophisticated investors and shed some light on their decision processes.

1. Introduction

The effect that short sellers have on the financial market is a topic of great debate. On the one hand, advocates argue that short sellers are informed investors who are able to identify overpriced stocks and business

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misconduct, and thus their participation improves market efficiency (Miller, 1977; Jones and Lamont, 2002; Lamont and Stein, 2004). On the other hand, dissenters argue that short sellers use abusive trading strategies, dampen investor confidence in the financial market and decrease market liquidity (Cox, 2008). In this debate, although many papers have suggested that short-sellers are "smart guys" who can unearth overpriced companies and contribute to the efficiency of the stock market, their strategies for locating overvalued firms and their decision processes are still unknown.

We disentangle this debate by analyzing short sellers' motivations for accusing many US Chinese reverse merger firms (CRMs) of financial fraud. Between 2010 and 2011, short sellers accused 62 CRMs of fraud, leading to an almost 50% reduction in the CRMs' equity value. Short sellers clearly acted as crucial "fraud detectors" in the process, because most of these scandals started with short sellers' reports that questioned the credibility of the firms' financial reports. However, the real motivation behind short sellers' accusations against CRMs remains unknown. How do short sellers locate their prey? Do they base their accusations on information analytics or guilt by association? What kind of information do they use in their decision processes? This paper fills this gap in the literature.

We find no evidence that short sellers accuse CRMs simply because of their association with other ill-reputed CRMs (referred to as guilt by association). Specifically, we find that short sellers pay attention to unusually high growth in profitability and accounts receivables. In particular, they identify targets by comparing financial indicators with the industry average or with firms' histories. Firms with poor internal control, a small proportion of outside directors, a low level of managerial shareholdings and low-quality audit reports are more likely to be targets of short sellers. We further check the long-term performance of accused firms to test the accuracy of short sellers' accusations. Accused firms are more likely to delist from exchanges and less likely to recover from price plunges following short-sellers' accusations. Our results also suggest that CRMs' high exposure to short sellers' accusations stems from adverse selection problems: firms with high litigation risk are more likely to choose reverse mergers to access the US capital market.

Two competing hypotheses attempt to explain the strategies behind short sellers' fraud accusations. The *information analytics hypothesis* regards short sellers' research reports as reliable outputs produced by careful analysis. Therefore, their intensive attacks against CRMs are well-founded: firms targeted by short sellers are indeed inferior to their counterparts in terms of information disclosure. Many papers provide corroborating evidence of the informativeness of short sellers' actions. They argue that short sellers are able to identify stock overpricing and firm misconduct (e.g., Jones and Lamont, 2002; Christophe et al., 2004, 2009; Diether et al., 2009; Karpoff and Lou, 2010). At the same time, many argue that it is not necessarily true that short sellers are betting against information. Short sellers could take advantage of investors' negative perception of the CRM society and indiscriminately accuse any member of the society of "guilt by association." As an example, Dennis E. Nixon, the Chairman of Bancshares, claimed that his bank was attacked by short sellers who viewed it as guilty because of its association with banks in crisis and their troubles. Moreover, former SEC Chairman Christopher Cox (2008) noted that even "far-better" financial companies, such as JPMorgan Chase, could be vulnerable to guilt by association. We refer to this view as the "*guilt by association hypothesis.*"

To empirically test the two hypotheses, we collect data on all US-listed Chinese firms, including IPO firms (CIPO) and CRMs, and short sellers' reports accusing Chinese firms of fraud. We test the two hypotheses in two phases. In the first phase, we directly test whether a CRM is more likely to be attacked by short sellers after controlling for other factors and study the information they use in their decision process. In the second phase, we examine the post-accusation performance of accused firms to further test the validity of short sellers' accusations.

In the first phase, we use a dummy variable indicating the identity (CRM or CIPO) of a Chinese firm and conventional factors that are known to affect the occurrence of firm misconduct to explain a firm's probability of being accused. Because the factors affecting the probability of financial misstatement may also decide a firm's choice between reverse merger and IPO in the first place, we use two-stage IV approaches and propensity score matching to mitigate the endogeneity problem. We find no evidence that short sellers are more likely to accuse CRMs, after controlling for other factors. We document that short sellers target firms that have abnormally high growth in profitability and a higher proportion of accounts receivables relative to the industry average or firms' histories. Short sellers also pay attention to firms with weak fundamentals. These results indicate that CRMs' high exposure to short sellers' accusations stems from firms' adverse selection at the initial stage.

In the second phase, we study the post-accusation performance of accused firms. First, using a probit model, we show that accused firms are generally more likely to delist than other firms. To ensure that the delisting is not simply caused by the feedback effects of short sellers' accusations, we then conduct a longitudinal data analysis. Goldstein and Guembel (2008) argue that short selling may cause a price decline even when short sellers are not informed at all. A short seller can establish a short position on the stock and the selling pressure will drive the price down. The price decline will subsequently lead to cancelation of real investment projects and a reduction in the real value of the firm. If feedback effects were indeed at work, firms' survival times would be uncorrelated with short sellers' accusations. However, we find that non-accused firms generally stay in the market for longer than accused firms. This result suggests that such delisting is caused by ex-ante deterioration in firm fundamentals. Next, we examine the price performance of accused firms (both delisted firms and active firms) after the release of short sellers' research reports. If short sellers' accusations are groundless and misleading, investors will eventually realize this and the stock prices of implicated firms should rebound to their fair values. In contrast, if the price drops are caused by accusations that are informative about the poor quality of the firms, their stock prices are unlikely to recover. The summary statistics show that Chinese firms subsequently exhibit poor price performance and none of them are able to recover their stock prices to the pre-accusation level. Specifically, 63.7% of firms experienced a further price drop and only four firms recovered to more than 70% of their pre-accusation price. The results indicate that accused Chinese firms were generally overvalued before accusations and support the view that short sellers' are informed investors who are able to identify "bad apples."

This paper contributes to the literature in the following ways. First, we contribute to the literature on short sellers' decision processes. Although many papers have suggested that short sellers are "smart guys" who can unearth overvalued companies and contribute to efficient stock prices, only a handful of papers have examined their decision processes. Dechow et al. (2001), for example, show that short sellers particularly target firms that have a low fundamental (book value, earnings and cash flow) to price ratio. Desai et al. (2002) suggest that short selling is related to suspect financial reporting. However, no previous study, to the best of our knowledge, has examined the possibility that short sellers may also be taking advantage of the guilt by association fallacy. Indeed, industry has made a strong argument that short sellers sometimes simply indiscriminately attack firms associated with an ill-fated label, such as "banks" during the financial crisis period or CRMs at times when many such firms were exposed as fraudulent. This paper fills this gap. We find no evidence that short sellers are making use of the guilt by association fallacy. Second, we further analyze the information set short sellers use. We find that financial information and corporate governance are important considerations, especially relative financial indicators. Thus, our paper also contributes to the literature on firm fraud. Third, our paper also contributes to the literature debating the adverse selection and credibility of CRMs. We provide evidence that corroborates the findings of several working papers that have recently studied this issue by conducting fundamental analysis of CRMs (Lee et al., 2013). Finally, we contribute to the debate over the effects that short sellers have on the financial market.

The remainder of our paper is organized as follows. Section 2 provides the literature review and hypothesis development; Section 3 describes the data and sample selection; Section 4 discusses the research design and empirical results; Section 5 reports the robustness checks; and Section 6 concludes.

2. Literature review and hypothesis development

2.1. Short sellers' strategies

2.1.1. "Information analytics" hypothesis

Studies that examine the association between short selling and stock overpricing provide corroborating evidence about short sellers' information analytics. A large body of the literature finds that short sale activities preceding either unfavorable news or analyst downgrades are significantly and positively correlated with the extent of subsequent stock price declines (e.g., Christophe et al., 2004, 2009; Liu et al., 2008; Diether et al., 2009). For example, Christophe et al. (2009) find abnormal short-selling activity before analyst downgrades. Diether et al. (2009) find that short sellers increase their trading following positive returns and correctly predict future negative abnormal returns. Those results are consistent with the view that short sellers trade on the short-term overreaction of stock prices.

Moreover, some studies imply that short sellers are sophisticated investors who can identify overpriced stocks and business misconduct. Miller (1977) was the first to point out that the constraint on short selling leads to stock over-pricing. Subsequent studies support this prediction. Lamont and Stein (2004) and Jones and Lamont (2002) find that stocks that are costly to short have very low abnormal returns in the subsequent year. Karpoff and Lou (2010) study the short interest in stocks that are proven ex-post to be overvalued. They find that abnormal short interest increases steadily in the 19 months before the negative information is publicly revealed, particularly when the misconduct is severe. These results indicate that short sellers are proficient at analyzing information and are able to uncover financial misconduct. Relevant studies that directly examine the accounting quality of CRMs also provide evidence of short sellers' sophistication. Chen et al. (2012) argue that CRMs exhibit lower financial reporting quality than US RM firms.

Based on the reasoning above, we develop the *information analytics hypothesis*:

Hypothesis 1a. All else being equal, CRMs are no more likely to be accused by short sellers than their CIPO counterparties.

2.1.2. Guilt by association hypothesis

A contradictory view suggests that short sellers do not always bet against information. Rather, short sellers may simply be motivated by investors' negative perception of the CRM society and indiscriminately accuse its members of guilt by association. We refer to this view as the "guilt by association hypothesis."

The guilt by association fallacy is widely documented in the psychological literature. It refers to the unpleasant and often emotional assumption that an individual will have committed a crime if other individuals with the same social label have committed that crime. A typical example of such a fallacy is that "Simon, Karl, Jared and Brett are all petty criminals, and they are all friends of Josh. Therefore, Josh is a petty criminal." The stock market is conducive to such misperceptions because investors often value stocks based on the performance of the industry, region or any other peer group to which the firm belongs. Darrough et al. (2012) find that the high exposure of Chinese firms to fraud accusations affects not only the stock prices of accused firms, but also those of seemingly quite legitimate Chinese firms. Lee et al. (2013) examine the initial financial health and subsequent performance of reverse mergers and find that Chinese RMs are generally healthier and fare better than both their US RM counterparts and a group of industry-, size- and date-matched publicly traded firms from the same exchange. An implication is that given the huge negative perception about "made in China" and the prevalence of the guilt by association fallacy, it is possible that many accused Chinese firms are merely victims of their association with truly fraudulent firms.

Several studies have examined the strategies that influential players use to spread rumors to make a profit. The basic idea is that informed traders sometimes send false signals to their followers, then if the followers act on the false signal and move the price in the wrong direction, the informed trader can make a profit. Bommel (2003), for example, models that an informed investor with limited capital can spread imprecise rumors to followers, convince them to trade excessively and then make a profit from the subsequent price overshoots: she first trades when she receives private information and then when she knows the price to be overshooting. Fishman and Hagerty (1992) argue that corporate insiders who are required to disclose their trades can profit by signaling to their followers that they are trading on information, when in fact they are not. Of course, investors only believe in the rumors that they find plausible. The claim that a particular CRM firm is fraudulent is certainly a potentially plausible rumor because many other CRMs are fraudulent and investors are subject to the behavioral bias of committing the guilt by association fallacy. Aware of this phenomenon, short sellers can accuse CRMs and benefit from the resulting stock price drop and ruined reputation of the accused firm.

The guilt by association fallacy has been witnessed many times in the real world. The dot-com bubble is obviously a good illustration of such a fallacy, in a positive way. Another example is the International Bancshares Corporation. Dennis E. Nixon, the Chairman of Bancshares, claimed that his bank was attacked by short sellers who viewed it as guilty simply because of its association with the major banks and their troubles.

Based on the reasoning above, we develop the following hypothesis:

Hypothesis 1b. Short sellers' reports are based on the guilt by association fallacy. All else being equal, CRMs are more likely to be accused by short sellers than their non-CRM counterparts.

Table 1
Summary of factors influencing fraud-related litigation documented in prior studies.

Authors (Year)	Fraud against shareholders (firms' characteristics)					Fraud against auditors (auditors' characteristics)				
	Cadmus and Child (1953)	Beasley (1996)	Haslem (2005)	Persons (2005)	Efendi et al. (2007)	Stice (1991)	Carcello and Palmrose (1994)	Lys and Watts (1994)	Krishnan and Krishnan (1997)	Farber (2005)
Governance factors										
Internal control	*									
Board efficiency			*							
Board independence		*	*	*						*
Managerial ownership		*								
CEO power		*	*	*	*					*
Financial factors						*				
Account receivables						*		*		
Inventory						*		*		
Growth		*				*		*		
Profitability		*		*					*	
Size		*	*		*	*	*	*	*	
Financial distress		*			*		*	*	*	
Potential accruals-based Errors						*		*	*	
Auditor factors										
Auditor rank										*
Auditor independence						*				*
Industry factors					*	*				
Year factors					*	*				

This table summarizes the factors found to affect the probability of fraud in prior studies. The extant literature on financial misstatement generally falls into two categories. The first focuses on fraud litigation against shareholders and establishes a link between the likelihood of financial misstatement and firms' characteristics before the revealing of misstatements (Cadmus and Child, 1953; Beasley, 1996; Haslem, 2005; Persons, 2005; Efendi et al., 2007). The second stream focuses on auditors' risk management and analyzes the fraud litigation risk factors of both firms and auditors (Stice, 1991; Carcello and Palmrose, 1994; Lys and Watts, 1994; Krishnan and Krishnan, 1997; Farber, 2005).

2.2. Information used by short sellers

Karpoff and Lou (2010) suggest that short sellers are good at identifying fraudulent firms. If short sellers are indeed sophisticated investors, what kind of information do they rely on? A number of studies on fraud firms have shed light on this question (e.g., Cadmus and Child, 1953; Beasley, 1996; Haslem, 2005; Persons, 2005; Dechow et al., 2001) by identifying the factors that affect the probability of fraud. We summarize these factors in Table 1. Beasley (1996) argues that having a larger proportion of outside members on the board of directors significantly reduces the likelihood of financial statement fraud. Efendi et al. (2007) find that misstatements are more likely to occur in firms in which the CEO has sizable holdings of in-the-money stock options. Overall, these papers suggest that solid financial status and good corporate governance can efficiently reduce the occurrence of misconduct. More direct evidence, such as that provided by Dechow et al. (2001), shows that short sellers use financial information, such as the fundamental to valuation ratio, to assess whether a stock is overpriced.

We read the short sellers' reports and summarize the disclosed reasons for their accusations against CRMs. These statistics are reported in Table 2.[1] Of the 37 accusations, overstatement of profitability (operating revenue, net income and gross profit margin) and misleading operating information (forged contracts, false clients, false branches or false technologies) are the two leading reasons for accusations. More importantly, the reports indicate that short sellers value relative financial information. In the last two columns, we highlight the indicators that are usually compared with the industry average and firm history. For example, Muddy Water's

[1] The total number of firms under all categories exceeds the number of firms that were sued because firms were usually sued for multiple reasons.

Table 2
Reasons for accusations by short sellers.

Detailed reasons for accusations provided by short sellers	Total	CIPOs	CRMs	Compared with industry	Compared with past
Insufficient disclosure					
Hiding debt	2	0	2		
Hiding related transactions	10	0	10		
Hiding bad operating news	11	5	6		
Misleading disclosure					
Misstatement of financial information					
Revenues, net income, or gross profit	30	3	27	√	√
Asset/accounts receivable	2	0	2	√	√
Cash flow	6	0	6		
Turnover	1	0	1	√	√
Misstatement of operating information					
Contracts	3	1	2		
Future development	3	1	2		
Clients	5	0	5	√	
Productivity	4	0	4		
Retailer, sub firms	4	0	4	√	
Technology	4	0	4		
Others					
Resignation of independent auditors and directors	7	0	7		
Auditor change	8	0	8		
Poor staff management	2	1	1		
Management fraud	6	1	5		
Weak internal control	3	0	3		

This table summarizes the reasons for the accusations of financial fraud made against Chinese firms. We extract and classify all of the reasons for each accusation disclosed in short sellers' research and report the frequency of accusations in each category. We highlight the indicators that are usually compared with the industry average and firm history.

research report against China Media Express Holdings (CCME)[2] stresses the comparison between CCME's income and that of its peers: "We note that FMCN had a 2009 net income margin of 9%. AMCN and VISN both lost money that year."

Based on the above reasoning, we develop the second hypothesis:

Hypothesis 2. If the information analytics hypothesis is correct, financial information, especially relative financial indicators, plays a crucial role in short sellers' decisions.

2.3. Accuracy of short sellers' accusations

Revealing the strategies or information sources that short sellers use does not necessarily speak to the validity of their accusations against CRMs. Whether short sellers' accusations are accurate requires further investigation.

Firms' survival status provides a means to examine whether short sellers' accusations are accurate. The dynamics of the stock market (i.e., firms entering and exiting) lead to the efficient reallocation of productive resources from non-surviving to surviving firms (Baker and Kennedy, 2002). Consequently, a good firm attracts resource inflows and manages to stay in the market. In contrast, the market reveals the intrinsic value of bad firms and expels them. Therefore, we conjuncture that if short sellers can uncover the quality of firms, then the performance of these target firms will be weaker, indicated either by their subsequent delisting or price recovery.

[2] This report was published on February 3, 2011, on Muddy Water's website: http://www.muddywatersresearch.com/research/ccme/initiating-coverage-ccme/.

Based on this reasoning, we develop the following hypothesis:

Hypothesis 3. Firms that are targeted by short sellers are more likely to be delisted from the capital market or are unlikely to recover from the price drop caused by the accusation.

3. Data

3.1. Data source and sample construction

Our sample consists of 253 Chinese firms that went public on the US stock market between 2000 and 2011. We first extract company names from the CSMAR database and tickers from the Bloomberg website, then use information from the mass media in China and the COMPUSTAT database to supplement the sample and verify the data integrity.[3] We further require firms to have non-missing financial and proxy statements. Annual accounting and auditor data are from the COMPUSTAT database and the AUDIT ANALYTICS database. Annual corporate governance information is from financial statements (10-K or 20-F) in the SEC's EDGAR database. Finally, we refine our sample to 253 Chinese firms (1038 firm-year observations), with 108 CRMs and 145 CIPOs.

We apply the following procedure to identify the Chinese firms that were accused of fraud by short sellers. First, we identify Chinese firms that were once suspected of "fraud" if (1) they were sued by law firms[4] or (2) their financial reports were questioned in news reports in the major financial press. This procedure identifies 78 firms. Second, we trace these suspected firms to decide whether short sellers initiated those suspicions. A fraud is considered to have been "uncovered" by short sellers if (1) research reports are available on the websites of major short sellers or (2) a short seller's name is identified in investment reports on the websites of major American stock market analysts.[5] The sample selection procedure is summarized in Panel A of Table 3. Panel B of Table 3 presents a breakdown of the types of short sellers behind the accusations: 10 firms were accused by investment institutions, 35 by research groups and the remaining 10 by individual short sellers.

3.2. Status quo of lawsuits against Chinese firms

We summarize the status quo of lawsuits against Chinese firms as of December 30, 2011, in Table 4. As many as 26 accused firms had not obtained final verdicts by that date and only 8 had obtained final verdicts and closed their cases. Relying on settlement data may therefore not be a feasible method of evaluating the credibility of short sellers' accusations. Twenty of the 26 unsettled cases were against CRMs.

4. Empirical analysis

We present our empirical analysis in two subsections. In Section 4.1, we analyze short sellers' strategies and focus on the information they use in their decision-making process. In Section 4.2, we analyze the firms' post-accusation performance.

4.1. Tests of Hypotheses 1 and 2

4.1.1. Model specification and control variables

Previous studies have evaluated short sellers' role by focusing on their trading patterns rather than directly testing their strategies, largely because the latter is difficult to achieve in the absence of their private

[3] We check our list with Chinese-localized media such as finance.sina.com and imeigu.com to make sure all US listed Chinese firms are included.

[4] We also document these law firms' leading cases against Chinese firms: Neda Zaman Law Office, Milberg LLP, Rosen Law Firm, Shuman Law Office, Kessler Topaz Meltzer & Check, Glancy Binkow & Goldberg LLP, Izard Nobel LLP, Pomerantz Law, CMS, PLLC, Lieff Cabraser Heimann & Bernstein LLP, Federman & Sherwood, Law Offices of Howard G. Smith, and Bronstein, Gewirtz & Grossman LLC.

[5] For example, the website "Seeking Alpha" provides sophisticated individual short sellers such as Ian Bezek, Alfred and Little Axler and research groups such as Glaucus Research Group with a platform for publishing their investment research reports.

Table 3
Sample selection: US listed Chinese firms targeted by short sellers.

Panel A: Sample selection

Procedures	Number of firms
+Chinese firms suspected as fraudulent	78
−Fraud scandals revealed in investigations carried out by law firms or the SEC	16
−Fraud scandals not covered in short sellers' reports	7
=Total number of US listed Chinese financial firms targeted by short sellers	55

Panel B: Breakdown of types of short sellers

Type of short seller	Number of times acting as accuser
Investment Institutions	10
Absaroka investment institution	1
GeoInvesting	8
Kerrisdale capital	1
Research Group	35
Glaucus research group	5
International financial research & association	1
Muddy waters research	8
Variant view research	2
Citron research	18
Lucas McGee research	1
Individuals	10
Famous analysts	8
Anonymous analysts	2
Total	55

Panel A reports the procedure for identifying Chinese firms that were accused of fraud by short sellers. Panel B presents the breakdown of the types of short sellers.

information data. Fortunately, short sellers' frequent accusations against US Chinese firms allow us to directly test their strategies.

We use both probit regression and instrument variable regression (two-stage bootstrap and Wooldridge two-stage) to analyze short sellers' strategies. In the probit regression, we regress the accusation indicator dummy on the CRM indicator dummy and conventional factors that are documented to affect the occurrence of firm misconduct. For the two-stage bootstrap regression, we first predict the fitted values of the CRM indicator dummy. We then use the predicted value in the second stage regression and bootstrap the system 100 times to obtain a robust estimation. The Wooldridge two-stage approach first follows the same procedure as the two-stage bootstrap, then we use the predicted value as the instrument to conduct the standard two-stage least squares procedure. The models are as follows:

Model 1 (probit approach):

$$\begin{aligned}\text{Target}_{i,t} = {} & \beta_0 + \beta_1 \text{RM}_i + \gamma \text{Govfactors}_{i,t-1} + \xi \text{Finafactors}_{i,t-1} + \phi \text{Auditfactors}_{i,t-1} + \lambda \text{Industry}_{i,t-1} \\ & + \theta \text{Year}_{i,t-1} + \omega_{i,t} \end{aligned} \tag{1}$$

Model 2 (two-stage bootstrap and two-stage Wooldridge approach):

$$\begin{aligned}\text{RM}_{i,t} = {} & \delta_0 + \delta_1 \text{ROE}_{i,t-1} + \delta_2 \text{LEVERAGE}_{i,t-1} + \delta_3 \text{CEOCH}_{i,t-1} + \delta_4 \text{INSTHD}_{i,t-1} + \delta_5 \text{LODUE}_{i,t-1} \\ & + \delta_6 \text{HIGHTEC}_{i,t-1} + \delta_7 \text{CEOHD}_{i,t-1} + \delta_8 \text{HOTMKT}_{i,t-1} + v_{i,t}, \end{aligned} \tag{2}$$

$$\begin{aligned}\text{Target}_{i,t} = {} & \beta_0 + \beta_1 \text{RMfit}_i + \gamma' \text{Govfactors}_{i,t-1} + \xi' \text{Finafactors}_{i,t-1} + \phi' \text{Auditfactors}_{i,t-1} \\ & + \lambda' \text{Industry}_{i,t-1} + \theta' \text{Year}_{i,t-1} + \omega_{i,t}. \end{aligned} \tag{3}$$

Table 4
Status quo of lawsuits against accused Chinese firms.

Case classification	Total	CIPOs	CRMs
Total cases	55	18	37
Settled cases (with final verdicts)	8	1	7
Unsettled cases or cases settled out of court (without final verdicts)	26	6	20

This table summarizes the status quo of lawsuits against Chinese firms as of December 30, 2011.

$TARGET_{i,t}$ is an indicator variable that equals 1 if firm i in year t was accused by short sellers, and 0 otherwise. The *RM* (reverse merger) dummy equals 1 if a firm is a CRM and 0 otherwise. If the guilt by association hypothesis holds, we expect a significant positive relationship between the CRM dummy and a firm's probability of being accused. Otherwise, if the financial information analytics hypothesis holds, we expect an insignificant relationship.

$Govfactors_{i,t-1}$ is a set of governance factors in year $t-1$, comprising material weakness of internal control ($INTCONTRL_{t-1}$), proportion of outside directors ($OUTSIDE\%_{t-1}$), CEO duality ($CEOCH_{t-1}$), proportion of CEO holdings ($CEOHD_{t-1}$), managerial ownership ($MNGHD_{t-1}$) and number of directors ($BDSIZE_{t-1}$).

$Finafactors_{i,t-1}$ is a set of financial factors in year $t-1$ including firm size ($SIZE_{t-1}$), Zscore (ZSC_{t-1}), which measures firms' financial distress following Zmijewski (1984), sales growth ($GROWTH_{t-1}$), return on equity (ROE_{t-1}), accounts receivable (AR_{t-1}), leverage ratio ($LEVERAGE_{t-1}$) and the difference between the firms' financial characteristics (sales growth, ROE, inventory and accounts receivable) and the industry average or its own past average ($DIFFGR\_IND_{t-1}$, $DIFFROE\_IND_{t-1}$, $DIFFINV\_IND_{t-1}$, $DIFFAR\_IND_{t-1}$, $DIFFGR\_SELF_{t-1}$, $DIFFROE\_SELF_{t-1}$, $DIFFINV\_SELF_{t-1}$, $DIFFAR\_SELF_{t-1}$).

$Auditfactors_{i,t-1}$ is a set of audit factors in year $t-1$, comprising an indicator variable of whether the auditor is a member of the Big 4 ($ADTRANK_{t-1}$), the natural logarithm of audit fee ($AUDTFEE_{t-1}$) and the ratio of discretionary accruals to total assets (DA_{t-1}).

We choose the control variables that influence the likelihood of financial misstatement, as documented in the literature, and list them in Table 1. Weak corporate governance is believed to offer a powerful explanation for firms' misleading reports. Material weakness of internal control is expected to increase the likelihood of financial misstatement because the lack of an oversight mechanism may aggravate the agency problem (Cadmus and Child, 1953). Following Doyle et al. (2007), we use a dummy variable ($INTCONTRL_{t-1}$) that specifies whether a firm has material weakness of internal control to proxy for the quality of internal control systems. We also include board size and board independence. Studies show that including more outside directors on the board reduces financial misstatement because outsiders are more likely to question and challenge management's proposals (Beasley, 1996; Haslem, 2005[6]; Efendi et al., 2007; Farber, 2005). In addition, Haslem (2005) finds that firms with higher managerial options are more likely to settle their litigations, suggesting that a high level of managerial holdings decreases the misalignment between shareholders and managers' incentives, and thus reduces the incidence of misleading financial reports. We measure managerial ownership as the proportion of managerial shareholdings ($MNGHD_{t-1}$). Because manipulations are expected to be more likely when CEOs are able to dominate the board, we also include CEO duality ($CEOCH_{t-1}$) and the proportion of CEO holdings ($CEOHD_{t-1}$) as proxies for CEO power.

Several factors are included to capture firm financial characteristics, including sales growth, profitability, size, financial distress, potential accruals-based errors, accounts receivables and inventory. Stice (1991), Lys and Watts (1994), and Beasley (1996) find that firm growth is positively associated with litigation, which may be because fast-growing firms have a high turnover of inventory or receivables, and thus have a high risk of audit detection. We measure growth by the percentage change in sales between the current and previous year ($GROWTH_{t-1}$). Additionally, financial statements are more likely to be over-reported in firms with low profitability and a strong incentive to window dress. Similarly, four studies show that financial distress is significantly correlated with misstatement, but with mixed conclusions. Stice (1991) and Krishnan and Krishnan (1997) find a positive relationship between financial distress and misstatement, whereas Carcello

[6] Instead of the proportion of outsiders on a board, Haslem (2005) use an opposite proxy: the percentage of inside directors on the board.

and Palmrose (1994) and Lys and Watts (1994) find a negative relationship. In our test, financial distress is measured by Zscore and leverage. We include firm size (logarithm of total assets) to address the size effect, according to the literature (Carcello and Palmrose, 1994; Lys and Watts, 1994; Beasley, 1996; Krishnan and Krishnan, 1997; Haslem, 2005; Efendi et al., 2007). Moreover, according to Hypothesis 2, we include the difference between a firm's financial characteristics and the industry average level or the firm' own historical average to capture abnormal reported growth in financial characteristics (e.g., sales growth, ROE and inventory).

The effect of the auditor is controlled by two factors: auditor independence and auditor rank. Farber (2005) find that financial fraud is less likely in firms audited by Big 4 auditors. Auditors' proclivity to disclose discovered errors is also closely related to the incidence of misstatement: the more independent the auditor, the less likely they are to collude with their clients (Stice, 1991; Krishnan and Krishnan, 1997; Farber, 2005). We include the dummy ($ADTRANK_{t-1}$) to indicate whether the auditor is a member of the Big 4 and the logarithm of audit fees ($AUDTFEE_{t-1}$) as proxies for auditor independence. The potential accruals-based error, proxied by the ratio of discretionary accruals to total assets, is also included. It is expected to have a positive effect on the likelihood of fraud litigation because it is a proxy for accruals manipulation (Stice, 1991; Lys and Watts, 1994; Krishnan and Krishnan, 1997). We present more detailed definitions and the predicted signs of the effects of the control variables in Appendix A.

4.1.2. Empirical results

In this section, we present the estimation of our models. We use probit regressions to estimate model 1 and the two-stage bootstrap and Woodridge two-stage methods to estimate models 2 and 3.

The key independent variable in the probit model is the RM dummy. The key independent variable in the two-stage bootstrap and two-stage Woodridge methods is the fitted value of the RM dummy (RM*fit*) from the first stage. In each specification, we report both the coefficients and the marginal effects that are computed at the mean values of the other variables. We also report the *p* values of the *F* tests for each group of variables: governance, auditor and financial factors. The *F* test allows us to examine the overall effect of each group of factors on the likelihood of firms being targeted by short sellers. Year and industry fixed effects are included in all three models. We cluster standard errors by firm to control for cross-sectional heteroskedasticity and within-firm serial correlation.

We report the descriptive statistics in Table 5. The mean value of RM indicates that CRMs account for 31.9% of the entire sample. The average value of SIZE is 5.38, equivalent to $217.02 million ($=e^{5.38}$).

Table 6 reports the main results. In Panel A of Table 6, we present the first stage of both the two-stage bootstrap and two-stage Wooldridge procedures. In particular, we regress firms' choice between reverse merger and IPO on a series of exogenous factors to obtain the fitted value. Exogenous factors include market timing, high-tech industry and a range of financial characteristics. First, market factors play a crucial role when firms make their listing choice. Brau et al. (2003) find that IPOs and reverse mergers occur in waves that are negatively correlated, suggesting that market timing, also referred to as the "IPO period," is a key factor for firms to consider. Second, Ray (2008) documents that firms' listing choices are also influenced by high tech industries and high tech bubbles, as both are associated with higher IPO discount rates. Therefore, we include an indicator dummy to control for the high tech industry. We also include financial factors that correlate with the listing choice, including ROE, ROA, leverage and total assets (Gleason et al., 2005; Jindra et al., 2012). The results reported in Table 6 are consistent with previous findings. We find that firms with higher profitability, lower levels of institutional holdings and higher leverage ratios are more likely to go public through reverse mergers, especially during non-tech bubble periods. We then use the fitted value from the first stage to explain firms' probability of being targeted by short sellers.

We report the structural regression results in Panel B of Table 6. In the probit model, the coefficient on RM is 1.6 and significant at the 1% level. The marginal effect is 28.4%, showing that, *ceteris paribus*, an RM firm is 28.4% more likely to be accused by short sellers. In the two-stage bootstrap and Wooldridge two stage models, the coefficients on RMfit are both 0.067, but neither is significant. The results show that once the adverse selection problem is taken into consideration at the initial stage, the plausible relationship between RM firms and the probability of being accused by short sellers disappears. The reason we see a positive effect of RM on the probability of short seller accusation in the probit model is that firms that choose to go public via reverse mergers are more likely to be associated with misconduct in the first place.

Table 5
Descriptive statistics.

Variable	*N*	Mean	SD	P5	Median	P95
TARGET	1038	0.175	0.380	0.000	0.000	1.000
RM	1038	0.319	0.466	0.000	0.000	1.000
INTCONTRL	1038	0.257	0.437	0.000	0.000	1.000
OUTSIDE%	1038	0.629	0.134	0.429	0.600	0.857
CEOCH	1038	0.703	0.457	0.000	1.000	1.000
CEOHD	1038	0.269	0.184	0.000	0.235	0.583
MNGHD	1038	0.352	0.212	0.002	0.334	0.711
BSIZE	1038	1.846	0.244	1.386	1.946	2.197
DA	1038	−0.024	6.957	−0.347	0.278	0.675
ADTRANK	1038	0.566	0.496	0.000	1.000	1.000
AUDTFEE	1038	−1.000	1.308	−3.219	−0.737	0.550
SIZE	1038	5.386	1.756	2.498	5.462	7.922
LEVERAGE	1038	0.356	0.211	0.071	0.335	0.764
ZSCORE	1038	1.926	4.909	0.000	0.000	10.356
GROWTH	1038	0.670	0.804	−0.165	0.452	2.338
DIFFGR_IND	1038	−0.000	0.772	−0.836	−0.179	1.539
DIFFGR_SELF	1038	−0.048	0.913	−1.540	0.000	1.509
ROE	1038	0.140	0.273	−0.267	0.132	0.561
DIFFROE_IND	1038	−0.086	0.211	−0.318	−0.141	0.413
DIFFROE_SELF	1038	−0.019	0.288	−0.455	−0.003	0.432
INV	1038	0.079	0.106	0.000	0.035	0.285
DIFFIN_IND	1038	−0.000	0.084	−0.113	−0.015	0.160
DIFFIN_SELF	1038	−0.004	0.055	−0.084	0.000	0.063
AR	1038	0.165	0.153	0.007	0.120	0.471
DIFFAR_IND	1038	0.000	0.135	−0.154	−0.027	0.268
DIFFAR_SELF	1038	0.002	0.087	−0.118	−0.001	0.154
HOTMKT	1038	0.371	0.483	0.000	0.000	1.000
LODUE	1038	0.028	0.085	0.000	0.000	0.183
HIGHTEC	1038	0.256	0.437	0.000	0.000	1.000
INSTHD	1038	0.351	0.262	0.000	0.352	0.752

Because the simple probit model is subject to the endogeneity problem, our conclusions are based on the two-stage model and the two-stage bootstrap model, which generally produce the same results.

A few audit factors also play an important role in determining short sellers' targets. For example, audit fee ($AUDFEE_{t-1}$) plays an important role in short sellers' decision-making process. The negative coefficient on audit fee indicates that a higher audit fee can effectively increase the quality of financial reports and thus lower the probability of accusation. However, the joint significance test shows that auditor traits may not draw much attention from short sellers. The *p*-value of the *F*-test is 0.294 in the Wooldridge two-stage model.

For governance factors, the coefficient on internal control (proportion of outside directors) is significantly positive (negative), suggesting that the presence of material weakness (more outside directors) increases (decreases) a firm's probability of being accused. The results are consistent with the view that good corporate governance can effectively monitor managers and reduce the occurrence of firm misconduct. Firms with higher manager shareholdings ($MNGHD_{t-1}$) are less likely to be accused by short sellers, suggesting that greater alignment between managers' and shareholders' interests can effectively curb misconduct. The *F*-tests suggest that corporate governance factors are critical considerations for short sellers when choosing their targets.

Among the financial factors, the positive and significant coefficient on sales growth suggests that firms with high sales growth are more likely to be accused by short sellers. There are two possible explanations. First, fast-growing firms have a high turnover of inventory or receivables and thus have a high risk of audit detection. Second, financial fraud often involves inflation of earnings. Therefore, unusually high growth in sales might reflect manager manipulation. When a firm's growth rate is higher than the industry average, it is more likely to be accused by short sellers, suggesting that an abnormal increase in sales is likely to be associated with accounting manipulation. However, when the firm's growth rate is higher than its average growth rate, the probability is lowered. We also find that firms with high growth in accounts receivables are more likely to

Table 6
Multivariate analysis of short sellers' strategies.

Panel A: Exogenous determinants of the reverse merger indicator

Independent variable: RM	Coef.	Z-stat.
ROE_t	0.606***	3.27
$LEVERAGE_t$	0.499**	2.07
$CCEOCH_t$	−0.184	−1.61
$INSTHD_t$	−2.505***	−11.27
$LODUE_t$	0.297	0.52
$HIGHTEC_t$	−0.600***	−4.91
$CEOHD_t$	−0.22	−0.78
$HOTMKT_t$	0.242**	2.41
_CON	0.203	1.24
r2_p	0.18	
Correctly-classified	75.29%	

Panel B: Short sellers' strategy analysis

Specification		Probit model		Two-stage		Two-stage bootstrap	
		(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables		TARGET	*Marginal effect*	TARGET	*Marginal effect*	TARGET	*Marginal effect*
Independent variables		Coef.	*dy/dx*	Coef.	*dy/dx*	Coef.	*dy/dx*
RM or RMfit		1.600***	*28.40%*	0.067	*0.95%*	0.067	*0.95%*
		(2.865)		(0.198)		(0.395)	
Governance factors							
$INTCONTRL_{t-1}$	χ_1	1.081***	*19.80%*	1.229***	*27.20%*	1.229***	*27.20%*
		(3.128)		(3.757)		(4.474)	
$OUTSIDE\%_{t-1}$	χ_2	−7.038***	*−81.60%*	−5.775***	*−82.30%*	−5.775***	*−82.30%*
		(−4.469)		(−4.044)		(−5.956)	
$CEOCH_{t-1}$	χ_3	0.196	*2.14%*	0.092	*1.28%*	0.092	*1.28%*
		(0.613)		(0.315)		(0.474)	
$CEOHD_{t-1}$	χ_4	1.350	*15.70%*	2.135	*30.40%*	2.135	*30.40%*
		(0.728)		(1.197)		(1.643)	
$MNGHD_{t-1}$	χ_5	−2.524	*−29.30%*	−2.933*	*−41.80%*	−2.933**	*−41.80%*
		(−1.575)		(−1.894)		(−2.431)	
$BDSIZE_{t-1}$	χ_6	0.304	*3.52%*	0.610	*8.69%*	0.610*	*8.69%*
		(0.481)		(0.925)		(1.784)	
F-test: effect of governance factors on short sellers' decisions		$\chi_1+\chi_2+\chi_3+\chi_4+\chi_5+\chi_6$					
		p = 0.0038**		*p* = 0.0325**		*p* = 0.0007***	
Auditor factors	ρ_1						
$ADTRANK_{t-1}$		1.091***	*11.3%*	0.302	*4.12%*	0.302	*4.12%*
		(3.037)		(0.911)		(0.976)	
DA_{t-1}	ρ_2	0.294***	*3.41%*	0.299***	*4.27%*	0.299	*4.27%*
		(2.822)		(3.071)		(1.302)	
$AUDTFEE_{t-1}$	ρ_3	−0.250**	*−2.90%*	−0.292***	*−4.17%*	−0.292**	*−4.17%*
		(−2.458)		(−3.323)		(−2.282)	
F-test: effect of auditor factors on short sellers' decisions		$\rho_1+\rho_2+\rho_3$					
		p = 0.0039**		*p* = 0.3861		*p* = 0.2941	
Financial factors							
$SIZE_{t-1}$	π_1	0.207**	*2.40%*	0.143*	*2.04%*	0.143	*2.04%*
		(2.329)		(1.838)		(1.503)	
ZSC_{t-1}	π_2	0.022	*0.25%*	0.033	*0.47%*	0.033	*0.47%*
		(0.933)		(1.460)		(1.640)	
$GROWTH_{t-1}$	π_3	9.039**	*104.8%*	6.145*	*87.6%*	6.145***	*87.6%*
		(2.096)		(1.823)		(3.556)	

Table 6 (*continued*)

Specification		Probit model		Two-stage		Two-stage bootstrap	
		(1)	(2)	(3)	(4)	(5)	(6)
$DIFFGR\_IND_{t-1}$	π_4	-9.455^{**}	*−109.6%*	-6.531^{*}	*−93.1%*	-6.531^{***}	*−93.1%*
		(−2.192)		(−1.930)		(−3.823)	
$DIFFGR\_SELF_{t-1}$	π_5	9.273^{**}	*107.5%*	6.358^{*}	*0.907%*	6.358^{***}	*0.907%*
		(2.147)		(1.879)		(3.703)	
ROE_{t-1}	π_6	0.527	*6.11%*	0.440	*6.27%*	0.440	*6.27%*
		(0.760)		(0.608)		(0.710)	
$DIFFROE\_IND_{t-1}$	π_7	0.566	*6.56%*	0.358	*5.11%*	0.358	*5.11%*
		(0.842)		(0.492)		(0.506)	
$DIFFROE\_SELF_{t-1}$	π_8	0.026	*0.31%*	−0.073	*−1.04%*	−0.073	*−1.04%*
		(0.056)		(−0.153)		(−0.102)	
INV_{t-1}	π_9	0.492	*5.71%*	−2.163	*−30.8%*	−2.163	*−30.8%*
		(0.124)		(−0.613)		(−0.655)	
$DIFFINV\_IND_{t-1}$	π_{10}	−2.239	*−0.260*	0.843	*12.0%*	0.843	*12.0%*
		(−0.551)		(0.228)		(0.253)	
$DIFFINV\_SELF_{t-1}$	π_{11}	3.857^{***}	*44.7%*	3.290^{**}	*46.9%*	3.290	*46.9%*
		(2.609)		(2.299)		(0.968)	
AR_{t-1}	π_{12}	9.807^{***}	*113.7%*	7.620^{**}	*108.7%*	7.620^{***}	*108.7%*
		(2.875)		(2.480)		(3.076)	
$DIFFAR\_IND_{t-1}$	π_{13}	9.114^{***}	*105.6%*	7.266^{**}	*103.6%*	7.266^{***}	*103.6%*
		(2.739)		(2.365)		(2.896)	
$DIFFAR\_SELF_{t-1}$	π_{14}	−1.070	*−12.4%*	-1.224^{*}	*−1.74%*	−1.224	*−1.74%*
		(−1.500)		(−1.779)		(−1.038)	
$LEVERAGE_{t-1}$	π_{15}	0.331	*3.83%*	0.661	*9.43%*	0.661	*9.43%*
		(0.390)		(0.816)		(0.983)	
F-test: effect of financial factors on short sellers' decisions		$\pi_1+\pi_2+\pi_3+\pi_4+\pi_5+\pi_6+\pi_7+\pi_8+\pi_9+\pi_{10}+\pi_{11}+\pi_{12}+\pi_{13}+\pi_{14}+\pi_{15}$					
		$p=0.0046^{**}$		$p=0.0101^{**}$		$p=0.0001^{***}$	
Constant		−1.073		−0.889		−1.006	
		(−0.620)		(−0.577)		(−0.473)	
Year fixed effect		YES	YES	YES	YES	YES	YES
Industry fixed effect		YES	YES	YES	YES	YES	YES
Pseudo-R2		0.327		0.339		0.304	
Obs.		834		834		823	

This table reports the multivariate analysis of short sellers' strategies. In Panel A, we present the first stage of both the two-stage bootstrap and Wooldridge two-stage procedures. The two-stage bootstrap procedure requires two steps to estimate Model 2. First, we predict the fitted value of reverse mergers. Then we use the fitted value in the second stage regression and bootstrap the system 100 times. The first step in the Wooldridge two-stage approach is the same as in the two-stage bootstrap. In the second step, we use the predicted value as the instrument to conduct the standard two-stage least squares procedure. In Panel B, we present the results using three specifications. We estimate the following two models:

Model 1 (Probit):

$$\text{Probit}(\text{Target}_{i,t}) = \beta_0 + \beta_1 \text{RM}_i + \gamma \text{Govfactors}_{i,t-1} + \xi \text{Finafactors}_{i,t-1} + \phi \text{Auditfactors}_{i,t-1} + \lambda \text{Industry}_{i,t-1} + \theta \text{Year}_{i,t-1} + \omega_{i,t} \quad (1)$$

Model 2 (Two-stage Bootstrap and Wooldridge Two-stage):

$$\text{Probit}(\text{RM}_{i,t}) = \delta_0 + \delta_1 \text{ROE}_i + \delta_2 \text{LEVERAGE}_{i,t-1} + \delta_3 \text{CEOCH}_{i,t-1} + \delta_4 \text{INSTHD}_{i,t-1} + \delta_5 \text{LODUE}_{i,t-1} + \delta_6 \text{HIGHTEC}_{i,t-1} + \delta_7 \text{CEOHD}_{i,t-1} + \delta_8 \text{HOTMKT}_{i,t-1} + v_{i,t}, \quad (2)$$

$$\text{Probit}(\text{Target}_{i,t}) = \beta_0 + \beta_1 \text{RMfit}_i + \gamma' \text{Govfactors}_{i,t-1} + \xi' \text{Finafactors}_{i,t-1} + \phi' \text{Auditfactors}_{i,t-1} + \lambda' \text{Industry}_{i,t-1} + \theta' \text{Year}_{i,t-1} + \omega_{i,t}. \quad (3)$$

t-Statistics are provided in parentheses. We cluster standard errors by firm, allowing for cross-sectional heteroskedasticity and within-firm serial correlation. Marginal effects (dy/dx) are calculated at the mean values of the other variables and reported in Columns 2, 4, and 6. We emphasize the marginal effect in italics. Columns 1 and 2 report the result of the probit regression. Following the method used by Chang et al. (2009), columns 3 and 4 report the regression using a two-stage bootstrap procedure. The likelihood of choosing reverse mergers is obtained from the table. Columns 5 and 6 report the result of the Wooldridge two-stage procedure. We use the predicted probability of being a CRM and use it as the instrument in the standard two-stage least squares procedure.

* Denote significance levels of 10%.
** Denote significance levels of 5%.
*** Denote significance levels of 1%.

be accused. Accounts receivables are therefore also likely to be perceived as components that are susceptible to managerial manipulation. The joint significance of all of the financial factors also suggests that relative financial factors are critical considerations in short sellers' decision process, which supports Hypothesis 2.

4.2. Test of Hypothesis 3: post-accusation performance analysis

In this section, we further investigate the economic consequences of short sellers' accusations in two steps. First, we test the relationship between firms' survival rate (time) and the incidence of accusations by short sellers. Second, we summarize the price recovery process of accused firms.

4.2.1. Survival status analysis

The dynamics of the stock market (i.e., firms entering and exiting) lead to the reallocation of productive resources from non-surviving to surviving firms (Baker and Kennedy, 2002). Whether a given company delists or survives is greatly affected by substantial fundamental change. Thus, firms' survival status provides a means to examine whether short sellers' accusations are information-based. If the short sellers' reports carry credible information, then we would expect accused firms to have a higher delisting rate than other firms. Otherwise, the delisting rate should be the same.

To test the effect of short sellers' accusations on firm survival rates, we use the two-stage bootstrap and Woodridge two-stage methods to estimate model 5. The first stage regression is the same as model 1, and model 5 is

$$P(\text{Delist}_{i,t}) = F[\alpha_0 + \alpha_1 \text{Target}_i + \alpha_2 \text{RMfit}_i + \xi \text{Control Variables}_{i,t-1}] \quad (4)$$

where:

$\text{Delist}_{i,t}$ is a dummy variable that equals 1 if firm i was delisted in year t and 0 otherwise.

$\text{Target}_{i,t}$ is a dummy variable that equals 1 if firm i was targeted in year t by short sellers and 0 otherwise.

RM_i is a dummy variable that equals 1 if firm i was a reverse merger firm and 0 otherwise.

$\text{Control}_{i,t-1}$ is a series of lagged controls that other studies have included. Following Baker and Kennedy (2002), we include firms' profitability measured by the natural logarithm of sales and ROA; the proportion of collateral measured by the proportion of fixed assets; and other financial characteristics such as leverage and size. We also include an ADR dummy, US market returns and a NASDAQ dummy. Chaplinsky and Ramchand (2007) argue that ADRs are more likely to delist than their US counterparts due to the stricter regulations introduced by the SOX act. The NASDAQ market has witnessed a higher incidence of foreign firms delisting due to the simplified delisting process.[7] We also control for market condition measured by US stock market return and firms' financial characteristics, such as ROA and firm size.

Panel A of Table 7 presents an overview of Chinese firms' trading status as of December 31, 2012. Among 253 Chinese firms, only 134 (52.96%) firms remained active and 119 (47.04%) firms had delisted. Fifty (19.76%) firms were acquired by other firms and 62 (24.51%) firms had delisted due to distress. Those that had delisted due to distress can be further classified into nine categories. The leading cause (26 cases, 10.28%) is failure to meet the exchange's financial guidelines for continued listing, followed by delinquency in filing and non-payment of fees (8 cases). We report the empirical results of the delisting model 5 in columns 1–4 in Panel B of Table 7. The results are generally consistent with our predictions. We find that firms accused by short sellers (Target) bear a higher risk of delisting in the future, even after controlling for other factors. When we use the two-stage bootstrap specification, the coefficient of Target is significant at the 1–5% level in columns 1–3. In columns 4–6, we use the Wooldridge two-stage specification and the result remains the same. Those results support the view that firms that are targeted by short sellers are more likely to delist from the capital market. With the control variables, we find that companies are less likely to delist when they are profitable and when the market condition is optimistic, which is consistent with Baker and Kennedy (2002).

[7] As Chaplinsky and Ramchand (2007) document, "the NYSE requires that a firm gain the approval of its audit committee and Board of Directors before delisting, while NASDAQ simply requires a letter stating the reasons for delisting. In neither case is shareholder approval required."

Table 7
Post-accusation performance analysis.

Panel A: Overview of status of Chinese firms

Status	Numbers	Percentage (%)	Cumulative percentage (%)
Active	134	52.96	52.96
Takeover delisting	50	19.76	72.73
Distress delisting	62	24.51	97.23
Insufficient number of shareholders	*3*	*1.19*	
Price fell below acceptable level	*3*	*1.19*	
Insufficient capital, surplus, or equity	*5*	*1.98*	
Insufficient float or assets	*3*	*1.19*	
Bankruptcy, declared insolvent	*2*	*0.79*	
Delinquent in filing, non-payment of fees	*8*	*3.16*	
Failure to meet exception or equity requirements	*1*	*0.40*	
Failure to meet exchange's financial guidelines for continued listing	*26*	*10.28*	
Protection of investors and the public interest	*11*	*4.35*	
Delisted for other reasons	7	2.77	100.00

Panel B: Market effect

Dependent variables	Delist			
	Two-stage bootstrap		Wooldridge two-stage	
	(1)	(2)	(3)	(4)
Target	0.761**	1.342***	0.753**	0.723*
	(2.294)	(2.592)	(1.983)	(1.734)
RM or RM*fit*	0.311	−0.599	0.584	−0.098
	(1.252)	(−1.615)	(0.537)	(−0.051)
ADR		−3.202***		0.240
		(−2.913)		(0.222)
LNSALE		−0.581**		−0.089
		(−1.962)		(−0.361)
PPEAR		0.044		0.549
		(0.045)		(1.371)
SIZE		0.222		0.036
		(0.442)		(0.107)
ROA		−3.248*		−0.525
		(−1.828)		(−0.530)
LEVERAGE		−1.621		−0.276
		(−1.434)		(−0.420)
RETURN		−44.365***		0.293
		(−4.540)		(0.199)
NAS		−0.420		−0.490
		(−0.826)		(−1.564)
Constant	−6.103***	−13.677***	−7.106***	−1.603
	(−9.968)	(−4.002)	(−6.492)	(−0.684)
Year dummy	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES
Observations	586	408	623	405
r2_p	0.336	0.508	0.328	0.471

Panel A presents the overview of Chinese firms' status quo in the stock market as of December 31, 2012. Panel B reports the empirical results of the delisting models. In the two-stage bootstrap model, we first predict the fitted value of reverse merger (RM). Then we use the fitted value in the second-stage regression and bootstrap the system 100 times. In the Wooldridge two-stage approach, the first stage is the same as for the two-stage bootstrap. In the second step, we use the predicted value as the instrument to conduct the standard two-stage least squares procedure. The models are listed as follows:
Model (two-stage bootstrap and two-stage Wooldridge):

$$\text{Probit}(\text{RM}_{i,t}) = \delta_0 + \delta_1\text{ROE}_i + \delta_2\text{LEVERAGE}_{i,t-1} + \delta_3\text{CEOCH}_{i,t-1} + \delta_4\text{INSTHD}_{i,t-1} + \delta_5\text{LODUE}_{i,t-1} + \delta_6\text{HIGHTEC}_{i,t-1} + \delta_7\text{CEOHD}_{i,t-1} + \delta_8\text{HOTMKT}_{i,t-1} + v_{i,t}, \quad (2)$$

$$P(\text{Delist}_{i,t}) = F[\alpha_0 + \alpha_1\text{Target}_i + \alpha_2\text{RMfit}_i + \xi\text{Control Variables}_{i,t-1} \quad (3)$$

t-Statistics are provided in parentheses. We cluster standard errors by firm, allowing for cross-sectional heteroskedasticity and within-firm serial correlations.

* Denote significance levels of 10%.
** Denote significance levels of 5%.
*** Denote significance levels of 1%.

4.2.2. Price performance analysis

In an efficient market, stock prices incorporate a rich information set on a timely basis. Therefore, we further test the credibility of short sellers' accusations by investigating firms' stock price patterns in the subsequent period. If short sellers' accusations are groundless and misleading, investors will eventually realize this and the stock prices of implicated firms should rebound to their fair values. Otherwise, the stock prices are unlikely to recover after the accusations because the resulting price drops are informative about the poor quality of those firms.

We measure firms' price recovery rate as the percentage change in the stock price between the first release date of the short sellers' report and the delisting date if the firm is inactive, or December 31, 2012, if the firm is still active.

$$P_{\text{recovery}} = \frac{P_t - P_{\text{accuse}}}{P_{\text{accuse}}} \text{ if firms are still trading, and}$$

$$P_{\text{recovery}} = \frac{P_{\text{delist}} - P_{\text{accuse}}}{P_{\text{accuse}}} \text{ if firms were delisted,}$$

where P_{recovery} denotes the percentage of price recovery, P_t represents the closing price on December 31, 2012 if the firm is still trading, P_{delist} equals the delisting price if the firm is delisted and P_{delist} is the stock price at the first release date of the short sellers' report.

We summarize the price recovery pattern in Table 8. Consistent with the information analytics hypothesis, none of the accused firms are able to recover their price to the original level ($P_{\text{recovery}} \geqslant 1$). As many as 63.7% of firms ($P_{\text{recovery}} \leqslant 0$) never push their stock price back up and only 4 firms (7.28%) recover more than 70% of their price to the pre-accusation level. To better understand the distribution of the price recovery rate, we further classify accused firms into a delisted group and an active group.

5. Robustness tests

5.1. Robustness test for Hypothesis 1

In this section, we apply a propensity score matching approach as the robustness test, based on two considerations. First, in cases where the probit model contains a binary endogenous explanatory variable, it is difficult to obtain a consistent estimation through the regular IV procedure because in the second stage estimation we cannot pass the expected value through a nonlinear model. Even the modified procedure can only mitigate, rather than fully address, this problem. However, as Wooldridge (2002) suggests, the propensity score matching approach is attractive because there is no need to model the expected value of the independent variable. Second, propensity score matching, as a nonparametric method, can exclude the possibility of violations of other classic assumptions, which can be a potential problem with the two-stage bootstrap and Wooldridge two-stage procedures.

The results are reported in Table 9. The average treatment effect (ATT) is 0.091 and significant at the 1% level. This result shows that the ATT between the two groups is significant if we use nearest neighborhood matching, kernel density matching or local linear regression matching. The interpretation is that in terms of the probability of choosing a reverse merger when going public, there are two similar groups: the first group goes public through reverse mergers but the other group does not. However, there is almost no difference between the two groups in terms of the incidence of firms being accused of financial fraud by short sellers. Short sellers' judgments of financial fraud therefore do not rely on a firm's identity (CRM or CIPO).

5.2. Robustness test for Hypothesis 3

It can be argued that the positive relationship between the delisting likelihood and short seller accusations is driven by the feedback effects of short sellers' accusations, rather than firms' fundamentals. If this were true, we would expect firms' survival times to be uncorrelated with short sellers' accusations: firms will get delisted

Table 8
Price performance analysis.

Sample	Full sample			Delisted sample			Still trading sample		
P_recover	Freq.	Percent (%)	Cum. (%)	Freq.	Percent (%)	Cum. (%)	Freq.	Percent (%)	Cum. (%)
$-1 \geqslant P_{\text{recovery}}$	2	3.64	3.64	0	0.00	0.00	2	6.90	6.90
$-90\% \geqslant P_{\text{recovery}} \geqslant -99\%$	6	10.92	14.56	3	11.54	11.54	3	10.34	17.24
$-80\% \geqslant P_{\text{recovery}} \geqslant -89\%$	5	9.10	23.66	2	7.69	19.23	3	10.34	27.59
$-70\% \geqslant P_{\text{recovery}} \geqslant -79\%$	6	10.92	34.58	5	19.23	38.46	1	3.45	31.03
$-60\% \geqslant P_{\text{recovery}} \geqslant -69\%$	3	5.46	40.04	1	3.85	42.31	2	6.90	37.93
$-50\% \geqslant P_{\text{recovery}} \geqslant -59\%$	6	10.92	50.96	3	11.54	53.85	3	10.34	48.28
$-40\% \geqslant P_{\text{recovery}} \geqslant -49\%$	3	5.46	56.42	1	3.85	57.69	2	6.90	55.17
$-30\% \geqslant P_{\text{recovery}} \geqslant -39\%$	2	3.64	60.06	0	0.00	57.69	2	6.90	62.07
$-20\% \geqslant P_{\text{recovery}} \geqslant -1\%$	2	3.64	63.70	0	0.00	57.69	2	6.90	68.97
$0\% \geqslant P_{\text{recovery}} \geqslant 10\%$	14	25.48	89.18	10	38.46	96.15	4	13.79	82.76
$20\% \geqslant P_{\text{recovery}} \geqslant 50\%$	2	3.64	92.82	0	0.00	96.15	2	6.90	89.66
$70\% \geqslant P_{\text{recovery}} \geqslant 99\%$	4	7.28	100.10	1	3.85	100.00	3	10.34	100.00
Total	55			26			29		

Panel A in Table 8 reports the price recovery rate of accused firms. We calculate the price recovery percentage of accused firms as follows:

$$P_{\text{recovery}} = \frac{P_t - P_{\text{accuse}}}{P_{\text{accuse}}}$$

if firms are still trading, and

$$P_{\text{recovery}} = \frac{P_{\text{delist}} - P_{\text{accuse}}}{P_{\text{accuse}}}$$

if firms are delisted,

where P_{recovery} denotes the percentage of price recovery; P_{accuse} represents the stock price on the first release date of the short seller's report; P_t represents the closing price on December 31, 2012 if the firm is still trading; P_{delist} equals the delisting price if the firms is delisted; and P_{accuse} is the original price at the first release date of the short seller's report.

whenever they are attacked by short sellers. We test this alternative explanation by applying a longitudinal data analysis. We collect each firm's survival time and apply a Cox proportional hazard model. The Cox proportional hazard model allows us to use all available information, to deal with omitted between-firm variation and to loosen the assumptions on the data's distributional properties.

We present the results in columns 1–6 of Table 10. Because the Cox proportional hazard model transforms the dependent variable into a hazard rate, the hazard ratio coefficients are interpreted as a survival time scaling

Table 9
Robustness test of Hypothesis 1: propensity score approach.

Outcome variable: TARGET				
Matching method	Treated	Controls	ATT	*T*-statistics
Nearest neighborhood matching				
Caliper = 0.1	0.091	0	0.091	1.00
Caliper = 0.05	0.091	0	0.091	1.00
Caliper = 0.01	0.111	0	0.111	1.00
Kernel density matching	0.335	0.004	.331	1.13
Local linear regression matching	0.335	0.003	.332	1.05

This table reports the two-stage average treatment effect (ATT) using the propensity score matching method. The treatment variable is a dummy variable (RM) that takes the value of 1 if the firm chooses reverse merger to go public and 0 otherwise. The outcome variable is a dummy variable that takes the value of 1 if the firm is accused by short sellers and 0 otherwise. In the first stage, we calculate the propensity score of every firm. In the second stage, a common support sample is chosen using three matching methods: nearest neighborhood matching, kernel density matching and local linear regression matching. The ATT represents the average treatment effect of a firm's identity (CRM or CIPO) on the probability of the firm being accused of financial fraud by short sellers. ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

Table 10
Robustness test of Hypothesis 3: hazard model approach.

Hazard model						
	(1)	(2)	(3)	(4)	(5)	(6)
	Survival time	*Marginal effects*	Survival time	*Marginal effects*	Survival time	*Marginal effects*
	Coef.	*Haz. Ratio*	Coef.	*Haz. Ratio*	Coef.	*Haz. Ratio*
Target	0.271**	*1.31*	0.293*	*1.34*	0.298*	*1.35*
	(2.498)		*(1.927)*		*(1.918)*	
RM					−0.121	*0.89*
					(−0.584)	
ADR			0.571***	*1.70*	0.513***	*1.66*
			(3.019)		*(3.201)*	
LNSALE			−0.005	*1.00*	0.003	*1.01*
			(−0.044)		*(0.032)*	
PPEAT			−0.132	*0.87*	−0.097	*0.89*
			(−0.557)		*(−0.419)*	
SIZE			−0.163	*0.84*	−0.182	*0.83*
			(−1.288)		*(−1.492)*	
ROA			0.137	*1.14*	0.171	*1.18*
			(0.306)		*(0.379)*	
LEVERAGE			0.869**	*2.38*	0.876**	*2.40*
			(2.116)		*(2.169)*	
RETURN			−0.299***	*0.74*	−0.291***	*0.74*
			(−5.133)		*(−4.961)*	
NAS			0.837***	*2.30*	0.846***	*2.32*
			(3.643)		*(3.588)*	
Constant						
Year dummy	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Industry dummy	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
Observations	*491*		*491*		*491*	
r2_p	*0.001*		*0.017*		*0.017*	

This table presents the Cox proportional hazard model results. *t*-Statistics are provided in parentheses. We cluster standard errors by firm, allowing for cross-sectional heteroskedasticity and within-firm serial correlation. Marginal effects (d*y*/d*x*) are calculated at the mean value of the offset.

* Denote significance levels of 10%.
** Denote significance levels of 5%.
*** Denote significance levels of 1%.

factor: a hazard ratio greater than 1 accelerates failure (reduces survival time), whereas a hazard ratio less than 1 decelerates failure (increases survival time). Generally, the hazard rate for accused firms (Target) is 31–35% higher than for non-accused firms, from the models with or without control variables. This result indicates that short sellers are good at identifying fraudulent Chinese firms and forcing them out of the market. Consistent with Chaplinsky and Ramchand (2007), we find that the hazard rate is 113% higher for NASDAQ firms (NAS) and 70% higher for ADR firms (ADR). The coefficients on the other control variables are consistent with the findings obtained from the probit model.

6. Conclusion

The effect that short sellers have on the financial market has long been debated. Proponents argue that short sellers are sophisticated investors who can identify over-priced stocks and improve price efficiency. Dissenters, conversely, argue that short sellers use abusive trading strategies, dampen investor confidence in financial markets and decrease market liquidity.

In this paper, we contribute to the debate by directly testing short sellers' strategies in accusing Chinese reverse merger firms of financial fraud. Between 2010 and 2011, 62 CRMs were accused of fraud by short

sellers, leading to a reduction of almost 50% in the CRMs' equity value. We test two hypotheses regarding short sellers' strategies. One hypothesis is that short sellers' accusations against Chinese reverse merger firms are based on information analytics. The other hypothesis is that short sellers indiscriminately accuse Chinese reverse merger firms because of their association with other guilty Chinese reverse merger firms. We find little evidence that short sellers base their strategies on firms' reverse merger identity. In the long run, the accused firms are more likely to delist or fail to recover from the price drop following short sellers' accusations. The short sellers' decision process involves comparing the target firms' financial indicators (e.g., growth and receivables) with both the industry average and the firms' histories to locate "bad apples." Fundamentals such as the quality of corporate governance are also crucial determinants in short sellers' decision process. Firms that have poor internal control, a small proportion of outside directors, a low level of managerial shareholdings and low-quality audit reports are more likely to be targets of short sellers. Our results suggest that CRMs' high exposure to short sellers' accusations stems from firms' adverse selection: firms with a high litigation risk are more likely to choose a reverse merger to access the US capital market.

Appendix A. Variable definitions

Definition and brief descriptions of variables

Variable	Prediction	Definition
TARGET		A dummy variable that takes the value of 1 if a firm is involved in lawsuits launched by short sellers targeting it and 0 otherwise
RM	+	A dummy variable that takes the value of 1 if a firm is CRM and 0 otherwise
OUTSIDE%	−	The proportion of outside directors on the board
MNGHD	−	The percentage of shares held by management
INTCONTRL	+	A dummy variable that takes the value of 1 if there is material weakness presents and 0 otherwise
AUDTORANK	−	A dummy variable that takes the value of 1 if the auditor is one of the BIG FOUR and 0 otherwise
AUDTFEE	−	The logarithm of auditing fees
SIZE	?	The logarithm of market value
GROWTH	+	Percentage change in sales from year $t-1$ to year t
DIFFGR_IND	?	Difference between the firm's growth and industry average
DIFFGR_SELF	?	Difference between the firm's growth in year t and year $t-1$
ROE	−	Net income/equity.
DIFFROE_IND	?	Difference between the firm's ROE and industry average
DIFFROE_SELF	?	Difference between the firm's ROE in year t and year $t-1$
LEVERAGE	?	Calculated from total debt divided by total assets
HIGHTEC		A dummy variable that takes the value of 1 if a firm is in a high-tech industry and 0 otherwise
HOTMKT		A dummy variable that takes the value of 1 if this year is a "hot" year and 0 otherwise
INSTHD	?	The percentage of shares held by financial institutions
CEOCH	?	A dummy variable that takes the value of 1 if the CEO also serves as the board chairman and 0 otherwise
CEOHD	?	The percentage of shares held by the CEO
LODUE	?	Long term debt due in one year divided by liabilities
ZSC	−	Calculated from the Altman Z-Score model (Altman, 1968)
DA	+	Discretionary accruals estimated using the modified Jones model

(*continued on next page*)

Appendix A (*continued*)

Variable	Prediction	Definition
BSIZE	+	The logarithm of number of board directors
ADR	−	A dummy variable that takes the value of 1 if a foreign firm is an ADR and 0 otherwise
LNSALE	−	The logarithm of sales
PPEAT	−	The book value of property, plant and equipment divided by the book value of assets
ROA	−	Calculated from net income divided by total assets
NAS	−	A dummy variable that takes the value of 1 if the foreign firm is traded on NASDAQ and 0 otherwise
AR	+	Accounts receivables divided by total assets
DIFFAR_IND	?	Difference between the firm's accounts receivables and industry average
DIFFAR_SELF	?	Difference between the firm's accounts receivables in year t and year $t-1$
INV	+	Inventory divided by total assets
DIFFIN_IND	?	Difference between the firm's inventory and industry average
DIFFIN_SELF	?	Difference between the firm's inventory in year t and year $t-1$
INDUSTRY		Dummy variables that are set to 1 if the firm is in a certain industry and 0 otherwise
YEAR		Year dummy

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Management earnings forecasts and analyst forecasts: Evidence from mandatory disclosure system

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ABSTRACT

Distinct from the literature on the effects that management earnings forecasts (MEFs) properties, such as point, range and qualitative estimations, have on analyst forecasts, this study explores the effects of selective disclosure of MEFs. Under China's mandatory disclosure system, this study proposes that managers issue frequent forecasts to take advantage of opportune changes in predicted earnings. The argument herein is that this selective disclosure of MEFs increases information asymmetry and uncertainty, negatively influencing analyst earnings forecasts. Empirical evidence shows that firms that issue more frequent forecasts and make significant changes in MEFs are less likely to attract an analyst following, which can lead to less accurate analyst forecasts. The results imply that the selective disclosure of MEFs damages information transmission and market efficiency, which can enlighten regulators seeking to further enhance disclosure policies.

1. Introduction

Management earnings forecasts (MEFs) of listed companies can reduce information asymmetry and the cost of capital, improving the efficiency of resource allocation in the capital market. Since 2001, regulators have constantly changed policies to promote and perfect the management forecast system in the Chinese capital market. A firm's management must release earnings forecasts when they anticipate that the firm's

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performance may fluctuate or deviate significantly from preliminary expectations. This provides investors with more timely information and reduces information asymmetry in the capital market. The literature tends to focus either on the institutional background of voluntary management forecasts or on the alternative MEF types (e.g., Libby et al., 2006; Wang and Wang, 2012). However, few studies explore the effects of MEFs on analyst earnings forecasts (AEFs) under a mandatory system. This issue is especially important in China, as executives may make selective disclosures opportunistically under the mandatory system. The selective disclosure of MEFs may not be consistent with the regulation's original intention, thus whether and how MEFs are selectively disclosed influence the behavior of market participants, making them important but rarely addressed questions. This study fills this gap by investigating MEFs' effects on analyst forecasts.

Under the existing mandatory management forecast system, as long as predicted performance reaches the required threshold, managers must disclose their earnings forecasts. Although the system is mandatory, managers have some selectivity in their choices that allow them to strategically maximize their own benefits before the actual earnings are disclosed in an annual report, such as selecting a certain management forecast form (qualitative or quantitative, point or range estimation). Some studies investigate how the types of MEFs affect the behavior of securities analysts, such as Libby et al. (2006) and Wang and Wang (2012). In contrast, this study focuses on the important issues of forecast frequency and significant changes. A significant change in a forecast is defined as managers making opposite forecasts in multiple MEFs, such as from loss to profit or from profit to loss. The selective disclosure of MEFs, such as multiple forecasts and significant forecast changes, is common in China's capital market. For example, the listed firm "Green Earth" (stock code: 002200) forecast an increase in third-quarter earnings from 20% to 50% in 2009, then further revised the net profit range for 2009 downward to less than 30% in earnings forecasts made on January 30, 2010. A net profit for 2009 of 62.12 million yuan was forecast in a preliminary earnings estimate on February 27, 2010, only to be corrected to a loss of 127.96 million yuan on April 28, 2010. However, the earnings in 2009 were reported as a loss of 151.23 million yuan when the annual report was released on April 30, 2010. The company not only disclosed its earnings forecasts many times, but also changed their nature, prompting a significant change in earnings forecasts.

Management earnings forecasts aim to increase decision-related information for investors and reduce information asymmetry to reduce the cost of capital. As sophisticated investors, analysts rely on both public and private information to make earnings forecasts, and thus they are more sensitive to the quality and quantity of information. If a firm's management selectively discloses MEFs, then analysts face greater information risk and uncertainty, which can result in them issuing less-accurate forecasts. Anecdotal evidence shows that MEFs are always a strong focus of financial analysts as a "prelude" to the annual financial statements of listed companies.[1] As a channel of information transmission, MEFs provide more information and hence improve the quality of prediction for analysts (Libby et al., 2006). However, the error and uncertainty in MEFs may also affect analysts' forecast accuracy and dispersion (Barron et al., 1998; Zhang, 2006). If a firm's management makes a selective disclosure, such as multiple forecasts or significant forecast changes, the quantity and quality of analysts' access to public information changes, ultimately affecting their forecast quality. This study predicts that the selective disclosure of MEFs increases information uncertainty, causing analysts to change their subsequent decisions and thus reducing their forecast accuracy. The empirical results support this hypothesis and show that firms with greater forecast frequency and significant forecast changes are less likely to attract an analyst following and reduce analysts' forecast accuracy.

This study contributes to the literature in the following ways. First, it provides direct evidence of how selectively disclosing MEFs affects financial analysts' behavior. Previous studies mainly focus on the ways in which alternative MEF types influence analysts' forecasts. This study extends the research to include the economic consequences that selectively disclosing MEFs has on analysts' forecasts. Second, this study provides empirical evidence of the relationship between information disclosure and analyst behavior under an institutional background of mandatory MEFs. Unlike some mature capital markets, such as those in the United States,

[1] Analysts often use the earnings forecasts of listed companies to make forecast revisions and engage in further tracking. An example is DaYe Special Steel (000708), which published a positive profit alert for 2010 on January 24, 2011, leading Guosen Securities to issue an analysis report based on the earnings forecast. They stated that the performance of beneficial equipment manufacturing was better than expected "the next day." For details: http://stock.hexun.com/2011-01-25/127008640.html.

MEFs are mandatory in China. This study explores selective disclosure in a mandatory disclosure system to provide new empirical evidence of the relationship between MEFs and AEFs. Third, this study has important policy implications. It shows that the selective disclosure of MEFs, such as multiple forecasts and significant forecast changes, has a negative effect on AEFs. This indirectly affects investors' behavior and hence the effectiveness of the capital market, further destabilizing the Chinese capital market. If regulators focus only on system design and ignore execution efficiency, any regulatory effects will be superficial, implying that regulators should pay more attention to the effective implementation of MEF system, rather than perfecting the policy.

The rest of this study is organized as follows. Section 2 discusses the background and develops the hypotheses. Section 3 discusses the research design. Section 4 reports the empirical results and Section 5 concludes with a summary and a discussion of policy implications.

2. Institutional background and hypothesis development

2.1. Institutional background

The Chinese Securities Regulatory Commission (CSRC) oversees the Chinese capital market and delegates the authority to issue disclosure regulations to the stock exchanges. All Chinese companies end their fiscal years on December 31 and file quarterly, semiannual and annual financial reports with the stock exchanges. Before 1998, the CSRC did not stipulate a mandatory MEF system. Thus, investors in the capital market could not obtain comprehensive, timely information. This information asymmetry problem became an increasing concern for regulators and investors. In 1998, the CSRC enacted the requirement that listed firms suffering a loss in the previous three years or a large loss must disclose an earnings warning. This was the first time that the CSRC enacted a mandatory management forecast requirement, which was pivotal for China's capital market. At the end of 2001, another requirement entitled, "Notice of Effectively Conducting Annual Report Disclosure Work of the Listed Firm" was implemented by both the Shenzhen and Shanghai Stock Exchanges. This notice required not only firms with anticipated fiscal-year losses, but also those with anticipated earnings increases or decreases, to issue mandatory management forecasts. This rule, however, only required listed firms to disclose forecasts within 30 calendar days of the end of the fiscal year, to increase information timeliness, because it is difficult to disentangle such forecasts from earnings preannouncements.[2]

In 2002, significant changes were made in the requirements for MEFs. The CSRC confirmed the basic principle of "forecasting the next quarterly earnings in this quarterly report," which meant that listed companies must make the forecast if a loss or a dramatic earnings increase or decrease was expected. Moreover, the "Notice of Effectively Conducting Annual Report Disclosure Work of the Listed Firm in 2002" required listed companies to make an immediate supplementary notice when necessary if they did not disclose a fiscal-year loss or a large change in earnings in the third-quarter or temporary reports, or if they did not report when their actual earnings differed from the forecasted earnings. Fundamentally, these requirements promote the timeliness of MEFs. More management forecasts are now made by listed firms in the fiscal year, narrowing the time gap between forecasts. More importantly, pre-forecast rather than post disclosure not only helps investors to understand earnings changes and make informed decisions, but also helps regulators to focus on firms with persistent abnormal accounting earnings changes.

In 2006, the CSRC began to require that listed companies with a loss the previous year and a profit the present year forecast their earnings. This requirement completed the MEF system. Until 2006, the mandatory MEF system required all listed firms to make an earnings forecast in the third-quarter report or a temporary announcement in the event of a loss, when a loss became a profit or when earnings increased or decreased more than 50% in one fiscal year.

Similar to the literature, this study only focuses on the MEFs of annual earnings, not including semi-annual earnings. Table 1 lists the changes in the MEF system made by the Shenzhen and Shanghai Stock Exchanges during 2001–2007.[3]

[2] An earnings preannouncement is another way of disclosing earnings before the announcement of an annual report.

[3] We do not analyze the management forecast system after 2007 because it changed from mandatory to voluntary disclosure. The sample thus covers the 2001–2007 period.

Table 1
Regulation of management earnings forecasts in China: 2001–2007.

Year	Index	Requirement	Disclosure date	Need to disclose in the last-quarter report
2001	Total profits or earnings before extraordinary items	Loss or earnings increase or decrease of at least 50%	Before January 31, 2002	No
2002	Net income or earnings before extraordinary items[a]	Loss or earnings increase or decrease of at least 50%	Immediately	Yes. In the third-quarter report
2003	Net income	Loss or earnings increase or decrease of at least 50%	Immediately	Yes. In the third-quarter report
2004	Net income	Loss or earnings increase or decrease of at least 50%	Immediately	Yes. In the third-quarter report
2005	Net income	Loss or earnings increase or decrease of at least 50%	During one month after fiscal year end	Yes. In the third-quarter report
2006	Net income	Loss, change from loss to profit, earnings increase or decrease of at least 50%	Within one month of the fiscal year end	Yes. In the third-quarter report
2007	Net income	Loss, change form loss to profit, earnings increase or decrease of at least 50%	Within one month of the fiscal year end	Yes. In the third-quarter report

[a] In this year, net income or earnings before extraordinary items is used for the Shanghai Stock Exchange, whereas only net income is used for the Shenzhen Stock Exchange.

Table 1 shows that the MEF system began changing gradually in 2001, but was not complete until 2007. First, the system only required firms to disclose a loss in 2000. Beginning in 2001, firms with a loss or earnings increases or decreases of at least 50% were all required to make a disclosure. Beginning in 2006, firms sustaining a change from a loss to a profit or vice-versa joined the list of those required to disclose. Hence, the Chinese MEF system was improved gradually. Second, the indices used in this system have become increasingly stable and reasonable. Between 2001 and 2002, firms could choose between net income (and total profit) and earnings before extraordinary items as the benchmark. After 2002, however, net income was used exclusively. Such regulation changes can improve the relevance and usefulness of earnings forecast information, which is the main concern for investors. Third, listed firms are now required to make more timely MEF disclosures. Unlike in previous years, the recent regulation requires a firm's management to disclose their earnings forecasts not only within one month of the fiscal year end, but also in the third quarter report. The present-day MEF system provides more timely and unambiguous accounting information to market participants, thus mitigating the information asymmetry between firms and investors.

2.2. Hypothesis development

Managers can usually decide whether, when and what to disclose to outside investors when maximizing stockholders' wealth or their private benefits (Hirst et al., 2008). The literature on voluntary MEF environments investigates the influence of management earnings disclosures from an information transmission perspective. For example, Skinner (1994) finds that firms disclose bad news through earnings forecasts to avoid litigation risk. Kothari et al. (2009) note that managers prefer to disclose good news earlier than bad news for career consideration reasons. Matsumoto (2002) finds that managers make earnings forecasts to decrease analysts' forecasts and mitigate the market reaction to bad news. Frankel and McNichols (1995) and Lang and Lundholm (2000) argue that firms disclose information more frequently and disclose more good news when they seek re-financing from outsiders. These studies show that in a voluntary disclosure environment, managers have an incentive to influence investor behavior to achieve specific goals. Given management's rational economic perspective, they often disclose financial or non-financial information selectively or opportunistically to maximize their own benefits rather than those of outside investors.

It can be inferred that China's mandatory MEF system forces managers to disclose MEFs once the subsequent predicted annual earnings reach a specific threshold, but managers can still use their disclosure behavior, such as alternative forms, forecast frequency or significant forecast changes to maximize their benefits. Because managers have information advantages over outside investors, it is very difficult for the latter

to judge the reliability of MEFs, and they can be easily misled by managers with opportunistic incentives. This study investigates two typical MEF disclosure practices in China's mandatory MEFs system: multiple forecasts and significant forecast changes. Multiple forecasts are defined by the disclosure numbers of MEFs for annual earnings and significant forecast changes are when managers release opposite earnings forecasts over at least two forecasts. For example, a manager might predict that the subsequent annual earnings will increase at least 50% from the previous year in one forecast, and in the next forecast the predicted earnings are revised to reflect at least a 50% decrease. This study investigates these selective MEF practices and their influence over analysts' forecasts.

As sophisticated investors, analysts rely on both public and private information to form their own forecasts. Previous studies investigate whether and how public information, such as annual reports, segment reports and management earnings forecasts, affect analysts' forecast properties (e.g., Baldwin, 1984; Hodder et al., 2008; Langberg and Sivaramakrishnan, 2008; Libby et al., 2006). In the research on MEFs, early studies consistently find that MEFs are associated with statistically significant stock price reactions (e.g., Ajinkya and Gift, 1984; Penman, 1980; Waymire, 1984), which strongly suggests that MEFs provide new information not previously reflected in investors' beliefs about firms' earnings prospects. Based on these findings, Waymire (1986) further examine the relative accuracy of analyst earnings forecasts prepared both before and after (prior and posterior forecasts) voluntary MEFs, with the following primary results: (1) management forecasts are, on average, more accurate than analysts' forecasts prepared before management forecasts and (2) analysts' forecasts prepared after management forecasts are no more accurate than MEFs. These observed accuracy differences imply that managers hold inside information upon forecast release. These studies and findings on stock price reactions and analyst forecast behavior strongly suggest that MEFs provide new information related to firms' earnings prospects that financial analysts then absorb into their decision processes. Subsequent studies focus on the alternative MEF types, bias in MEFs and how managerial behavior influences analysts' forecasts. For example, Skinner (1994) and Libby et al. (2006) investigate the effects of point and range earnings forecasts and find that while forecast types do not have an immediate effect after performance disclosure, once the actual results have been released, the performance forecast form does affect analysts' forecasts. Tan et al. (2010) investigate whether and how biased MEFs influence analysts' forecasts. Specifically, they examine how analysts' incentives interact with the consistency and magnitude of bias in management's guidance when determining the extent to which analysts' adjust their earnings estimates for the known bias. Experiments show that analysts do not adjust their forecasts to account for managers' tendency to provide downwardly-biased guidance, even though they are aware of this tendency (Hun-Tong et al., 2002), and the findings are ascribed to analysts' belief that maintaining a good relationship with management matters in the post-regulation fair disclosure environment.

Given the aforementioned studies, financial analysts rely on MEFs to make their forecasts. Although MEFs are mandatory in China's market, management can make other selective choices, such as making multiple forecasts or significant forecast changes. This selective disclosure of MEFs exaggerates information uncertainty, making it more difficult for analysts to make informed decisions about processing this public information. Hence, MEFs significantly influence analysts' forecasts. Zhang (2006) investigates the relationship between information uncertainty and AEFs and finds that greater information uncertainty leads to larger forecast errors. Thus, it is reasonable to believe that the selective disclosure of MEFs increases information uncertainty, negatively affecting AEFs.

In summary, a negative association between the selective disclosure of MEFs and analysts' forecasts is expected, and the hypotheses are as follows.

H1. Selective MEFs (forecast frequency and significant forecast changes) have a negative effect on AEFs.

This study focuses on the two properties of analysts' forecasts: analyst following and forecast accuracy; hence, H1 is divided into the following sub-hypotheses.

H1a. Firms with more frequent forecasts or significant forecast changes are less likely to have an analyst following.

H1b. Firms with more frequent forecasts or significant forecast changes exhibit inferior AEF accuracy.

3. Research design

3.1. Empirical model and variable definitions

To investigate the effect of MEFs on analysts' forecasts, analyst following and forecast accuracy are used as the dependent variables and the following regression models are used to test the hypotheses.

$$NUM_{i,t} = a_0 + a_1 DL_{i,t} + a_2 LOGTA_{i,t} + a_3 INS_{i,t} + a_4 EV_{i,t} + a_5 BIG10_{i,t} + a_6 MB_{i,t} + a_7 ROE_{i,t} + CONTROL_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$FERROR_{i,t} = a_0 + a_1 DL_{i,t} + a_2 LOGTA_{i,t} + a_3 CR1_{i,t} + a_4 EV_{i,t} + a_5 CORR_{i,t} + a_6 UPDATE_{i,t} + CONTROL_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $FERROR_{i,t} = ABS[Mean(Fnetpro_{i,t}) - Netpro_{i,t}]/Tval_{i,t}$ refers to analyst forecast accuracy. This measure captures the magnitude of the difference between analyst forecast earnings (*Fnetpro*) and actual earnings (*Netpro*). *NUM* is defined as the number of analysts following firm *i* in year *t*. The main variable of interest is $DL_{i,t}$, which reflects the selective disclosure of MEFs and is divided into two variables: *TIMEs* and *BL*. Multiple forecasts (or forecast frequency) of MEFs is *TIMEs*, measured as MEF frequency. A significant forecast change is *BL*, an indicator that equals 1 if the current MEF is revised to oppose the previous one, and 0 otherwise. Citing previous studies (e.g., Bai, 2009; Wang and Wang, 2012), other factors affecting analysts' forecasts are controlled for. *LOGTA* is firm size, such that a larger firm size results in a greater analyst following, more available information and lower analyst forecast error. *INS* is the holding ratio of institutional investors, such that a higher holding ratio results in better institutional investor supervision of selective disclosure, a higher likelihood of analyst following and lower analyst forecast error. *EV* refers to earnings volatility and is calculated as the standard deviation of earnings during the previous three years, divided by the absolute value of the mean of the 3-year earnings. It is predicted that higher earnings volatility will result in a smaller likelihood of analyst following and lower forecast accuracy. *BIG*10 refers to auditing quality and is equal to 1 if the auditor is among the 10 largest auditor firms according to client assets. *MB* is firm growth, calculated as the ratio of market value to book value. *ROE* is earnings divided by net equity. *CORR* refer to the credibility of earnings information, calculated as the correlation coefficient between accounting earnings and annual stock returns. *UPDATE* refers to the frequency with which forecasts are updated by brokers, measured as the total number of all analyst reports for firm *i* in year *t*, divided by the number of brokers following the firm. All of the variable definitions are summarized in Table 2.

Table 2
Variable definitions.

Variables	Definitions
Dependent variables	
NUM	The number of analysts following the firm
FERROR	Forecast error, which is calculated as the absolute value of the difference between the means of the predicted and actual earnings, divided by market value at the previous year's end
Independent variables	
BL	An indicator variable for a significant change, coded as 1 if the manager makes different earnings forecasts in two adjacent predictions, and 0 otherwise
TIMES	The natural logarithm of the number of MEFs
Control variables	
LOGTA	The natural logarithm of total assets
INS	The ratio of institutional shareholdings to total outstanding shares
EV	Earnings volatility, calculated as the standard deviation of net income over the previous three years
*BIG*10	The indicator variable for auditor size, coded as 1 if the auditor is one of the largest 10 firms in the industry according to client assets, and 0 otherwise
MB	The ratio of the market value of equity to book value
ROE	Earnings divided by net equity
CORR	The correlation coefficient of stock returns and net income over the previous three years
UPDATE	Total number of all analyst reports for firm *i* in year *t* divided by the number of brokers following the firm

Table 3
Sample selection.

Sample selection process	Observations
Management earnings forecasts during 2001–2007	4514
Delete: Forecasts issued after April 30 the following year	3
Earnings forecasts with a non-specific form	72
B-share listing firms	377
Firms in the financial industry	87
Remaining management earnings forecasts	3975
Merge with sample of analyst forecasts	3975
Final sample after deleting observations with missing values	2613

3.2. Sample selection

The initial sample includes all of the MEFs for annual earnings released by A-share listed companies from 2001 to 2007. First, MEFs issued after April 30 the following year are dropped. Second, ambiguous MEFs are deleted. Third, firms issuing only B-stocks are dropped. Finally, firms in the financial industries are excluded. The remaining sample includes 3975 firm-year observations. For the analyst forecasts sample, because every analyst is capable of making multiple forecasts for a firm in a specific year, the most recent forecast for each analyst is kept. Second, the number of analysts following and analyst forecast errors based on firm year are calculated. Finally, after merging the MEF and AEF samples and excluding the observations with missing values for the control variables in the regressions, 2613 firm-year observations are retained. Table 3 reports the sample selection procedure. The data on MEFs are from the WIND dataset and AEFs and other financial data are from the CSMAR dataset.

Table 4 lists the yearly distributions of significant forecast changes and forecast frequency in Panels A and B, respectively.[4] Panel A shows that the ratio of significant forecast changes decreased from 10.12% in 2003 to 5% in 2007. Panel B shows that firms with one MEF increased from 71.97% in 2003 to 81.75% in 2007. In contrast, firms with two MEFs decreased over the period. These results imply that the improvement and strengthening of the MEF system weakened selective MEF disclosure.

4. Empirical analysis

4.1. Descriptive analysis

Table 5 shows the summary statistics for the main variables used in the analysis. The mean value of *FERROR* is 0.0280, which means that the difference between the average forecast earnings and actual earnings accounts for 2.8% of the year-end market value. *NUM* is the number of analysts following a firm in a year, which indicates that on average, every firm has at least one analyst following it with a maximum of 19 followers. The mean value of *BL* is 0.078, which means that between 2002 and 2007, about 7% of firms changed their earnings forecast dramatically. The mean value of *TIMES* is 1.27, which means that on average, each firm makes at least one earnings forecast.

4.2. Univariate tests

Table 6 reports the univariate test results for significant forecast changes. Based on the two groups, with and without significant forecast changes, Table 6 shows that firms with significant changes have lower analysts following (0.4054 vs 1.0733 for mean and 0.000 vs 0.000 for median) and higher forecast errors (0.063 vs

[4] Table 4 only lists the yearly distributions from 2002 and deletes observations in 2001, which is due to missing analyst following data.

Table 4
Yearly distributions of managers' selective earnings forecast disclosures.[1]

Panel A: Yearly distribution of significant forecast changes

Year	Significant forecast changes		
	No change	Change	Total
2002	18	1	19
	94.74%	5.26%	
2003	311	35	346
	89.88%	10.12%	
2004	425	49	474
	89.66%	10.34%	
2005	502	33	535
	93.83%	6.17%	
2006	511	32	543
	94.11%	5.89%	
2007	661	35	696
	94.97%	5.03%	
Total	2428	185	2613
	92.92%	7.08%	

Panel B: Yearly distribution of forecast frequency

Year	MEF frequency				
	1	2	3	4 or more	Total
2002	15	4	0	0	19
	78.95%	21.05%	0%	0%	
2003	249	76	10	11	346
	71.97%	21.97%	2.89%	3.17%	
2004	344	112	16	2	474
	72.57%	23.63%	3.38%	0.42%	
2005	423	100	12	0	535
	79.07%	18.69%	2.24%	0%	
2006	430	107	5	1	543
	79.19%	19.71%	0.92%	0.18%	
2007	569	117	10	0	696
	81.75%	16.81%	1.44%	0%	
Total	2030	516	53	4	2613
	77.69%	19.75%	2.03%	0.15%	

Table 5
Descriptive statistics.

Variables	Obs.	Mean	Median	Std.	Min	Max
NUM	2613	1.0260	0.0000	2.1431	0.0000	19.0000
FERROR	894	0.0280	0.0132	0.0491	0.0001	0.4377
BL	2613	0.0708	0.0000	0.2565	0.0000	1.0000
TIMES	2613	1.2759	1.0000	0.7441	1.0000	16.0000
LOGTA	2613	21.2792	21.1776	1.0556	14.9374	26.8547
INS	2613	13.2102	4.7034	17.8576	0.0001	77.0529
EV	2613	1.8720	0.5375	5.3388	0.0237	62.1303
*BIG*10	2613	0.2254	0.0000	0.4179	0.0000	1.0000
MB	2613	4.6192	2.7047	8.6874	0.5651	138.0744
ROE	2613	−0.0477	0.0492	0.5761	−6.2290	2.5275
CORR	2613	1.2822	0.5012	6.2208	−40.5558	43.5299
UPDATE	894	1.2057	1.0000	0.4640	0.5000	4.0000

Table 6
Univariate tests of significant forecast changes.

Variables	*BL*	Obs.	Mean	Median	*T* value	*Z* value
NUM	Non-significant change	2428	1.0733	0.0000	6.15***	5.5***
	Significant change	185	0.4054	0.0000		
FERROR	Non-significant change	865	0.0268	0.0130	−2.19**	−2.14**
	Significant change	29	0.0630	0.0202		

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

0.0268 for mean and 0.0202 vs 0.0130 for median). The *t*-tests and Wilcoxon tests reveal a significant difference between these two groups, thus the univariate tests support our hypotheses.

Table 7 reports the correlation coefficient matrix and shows that *TIMES* has a significant negative (positive) correlation with *NUM* (*FERROR*) at the 1% level. This indicates that a higher MEF frequency is associated with a smaller analyst following and a higher forecast error. This finding is consistent with our hypotheses. Table 7 also shows no notable associations among the other variables.

4.3. Multivariate tests

Based on Models (1) and (2), Table 8 reports the multivariate regression results. Consistent with the univariate analysis, firms with multiple forecasts and significant forecast changes experience a lower analyst

Table 7
Coefficient correlation matrix.

Variables	*FERROR*	*NUM*	*BL*	*TIMES*	*LOGTA*	*INS*	*EV*	*BIG*10	*MB*	*ROE*	*CORR*	*UPDATE*
FERROR		−0.148***	0.131***	0.138***	0.153***	−0.184***	0.064*	0.041	−0.145***	−0.424***	−0.07**	−0.059*
NUM	−0.153***		−0.08***	−0.075***	0.389***	0.666***	−0.1***	0.133***	0.058***	0.156***	0.015	−0.031
BL	0.072**	−0.108***		0.309***	−0.074***	−0.091***	−0.001	−0.031	−0.026	−0.017	0.01	−0.031
TIMES	0.145***	−0.115***	0.511***		−0.073***	−0.082***	0.022	−0.035*	−0.009	−0.131***	−0.002	0.023
LOGTA	0.215***	0.372***	−0.073***	−0.055***		0.376***	−0.088***	0.209***	−0.18***	0.128***	−0.011	0.018
INS	−0.15***	0.608***	−0.116***	−0.098***	0.353***		−0.124***	0.15***	0.081***	0.196***	−0.053***	0.083**
EV	0.048	−0.268***	0.03	0.093***	−0.172***	−0.269***		−0.043**	−0.009	−0.065***	−0.017	−0.006
*BIG*10	0.08**	0.142***	−0.031	−0.048**	0.176***	0.134***	−0.082***		−0.036*	0.021	−0.034*	−0.033
MB	−0.396***	0.208***	−0.04**	−0.007	−0.183***	0.359***	0.069***	−0.014		0.004	−0.027	0.112***
ROE	0.014	0.501***	−0.148***	−0.16***	0.257***	0.534***	−0.298***	0.094***	0.297***		−0.024	0.037
CORR	−0.047	−0.073***	0.016	0.007	−0.022	−0.146***	0.053***	−0.062***	−0.09***	−0.135***		0.002
UPDATE	−0.115***	0.157***	−0.055	−0.017	0.032	0.168***	−0.031	−0.019	0.175***	0.108***	−0.01	

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

Table 8
Relationship between managers' earnings forecasts and analyst forecasts.

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
BL	−0.0640*		0.0285***	
	(−1.84)		(3.50)	
TIMES		−0.0772*		0.0307***
		(−1.79)		(3.56)
LOGTA	0.113***	0.113***	0.0102***	0.0101***
	(11.69)	(11.73)	(7.00)	(6.95)

(*continued on next page*)

Table 8 (*continued*)

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
INS	0.0228***	0.0228***	−0.0003***	−0.00036***
	(40.65)	(40.70)	(−3.74)	(−3.51)
EV	−0.0034**	−0.0034**	0.0003	0.0003
	(−2.03)	(−2.00)	(0.55)	(0.42)
*BIG*10	0.0181	0.0177	−0.0009	−0.0010
	(0.83)	(0.81)	(−0.28)	(−0.31)
MB	0.0018*	0.0018*	−0.0006	−0.0006
	(1.71)	(1.75)	(−1.61)	(−1.56)
ROE	0.0459***	0.0425***	−0.0779***	−0.0783***
	(2.91)	(2.68)	(−13.15)	(−13.26)
CORR	0.0024*	0.0024*	−0.0005**	−0.0005**
	(1.69)	(1.67)	(−2.12)	(−2.19)
UPDATE			−0.0028	−0.0035
			(−0.91)	(−1.13)
Ind Contr	Yes	Yes	Yes	Yes
Constant	−2.236***	−2.183***	−0.169***	−0.189***
	(−10.58)	(−10.13)	(−5.21)	(−5.70)
Observations	2613	2613	894	894
Adj. R^2	0.53	0.53	0.25	0.25

Notes: t-values are reported in brackets.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

following and higher forecast errors. Specifically, the coefficient on *BL* is significantly negatively related to *NUM* at the 10% level (coefficient = −0.064 with $t = -1.84$) and significantly positively related to *FERROR* at the 1% level (coefficient = 0.029 with $t = 3.50$). Meanwhile, the coefficient on *TIMES* is significantly negatively related to *NUM* at the 10% level (coefficient = −0.077 with $t = -1.79$) and significantly positively related to *FERROR* at the 1% level (coefficient = 0.031 with $t = 3.56$). Therefore, these results are consistent with our hypothesis that the selective disclosure of MEFs negatively influences analysts' forecasts.

4.4. Additional analysis

The results show that the selective disclosure of MEFs increases the uncertainty of information for analysts, negatively influencing their forecasts. However, firms with a higher analyst following or forecast accuracy are less likely to experience selective MEF disclosure due to the outside governance from analysts. Hence, there is an endogeneity problem in the analysis. To mitigate this endogeneity issue and enhance the reliability of the results, a two-step regression based on the determination model is conducted. In the first step, the following model is constructed:

$$DL_{i,t} = a_0 + a_1 Growth_{i,t} + a_2 SOE_{i,t} + a_3 ROA_{i,t} + a_4 CEOshare_{i,t} + a_5 HHI_{i,t} + a_6 Size_{i,t} + a_7 DEBT_{i,t} + IND_{i,t} + \varepsilon_{i,t} \quad (3)$$

where *DL* refers to selective MEF disclosure, as measured by *BL* and *TIMES*. *Growth* indicates the difference in total assets between the present and previous year. *SOE* is the firm's ownership, and equals 1 if the ultimate controller is the state, and 0 otherwise. *ROA* is return on total assets, which indicates the firm's profitability. *CEOshare* is the proportion of shares held by the CEO, which represents insiders' incentives. *HHI* is the Herfindahl–Hirschman index, calculated as $HHI = \sum (X_i/X)^2$, where $X = \sum X_i$ and X_i is the sales of firm *i*. *SIZE* is measured as the natural logarithm of total assets. *DEBT* is the leverage of the firm and *IND*

Table 9
Determinants of management earnings forecasts.

Variables	Column (1) *BL*	Column (2) *TIMES*
Growth	−0.0875	−0.0164**
	(−0.46)	(−2.05)
SOE	0.0992	0.0028
	(0.51)	(0.26)
ROA	−1.4610*	−0.4200***
	(−1.83)	(−8.17)
CEOshare	−360.0	1.2500
	(−0.52)	(0.86)
HHI	1.5000	−0.1400
	(0.94)	(−1.17)
Size	−0.3570***	−0.0108**
	(−3.45)	(−2.05)
DEBT	0.6660	0.0630**
	(1.34)	(2.28)
Ind Contr	Yes	Yes
Constant	4.6070**	1.0690***
	(2.11)	(9.49)
Observations	2026	2026
Adj. R^2	0.04	0.06

Notes: *t*-values are reported in brackets.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

are industry dummy variables. The results based on Model (3) are listed in Table 9 and show that *Growth*, *ROA* and *SIZE* (*DEBT*) are (is) negatively (positively) related to *BL* and *TIMES*. Likewise, all four coefficients are significant in Columns (1) and (2) of Table 9, except for *Growth* and *DEBT* in Column (1).

Table 10
2SLS regression results.

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
BL	−3.3490***		0.0229	
	(−3.65)		(0.22)	
TIMES		−1.6970***		0.1400**
		(−5.35)		(2.03)
LOGTA	0.0876***	0.136***	0.0099***	0.0103***
	(2.99)	(9.22)	(4.65)	(5.62)
INS	0.0236***	0.0249***	−0.0003***	−0.0002**
	(15.17)	(28.37)	(−3.18)	(−1.97)
EV	−0.0075**	−0.0056**	0.0005	0.0004
	(−2.06)	(−2.52)	(0.81)	(0.59)
*BIG*10	0.0235	0.0246	0.0007	−0.0009
	(0.44)	(0.75)	(0.19)	(−0.22)
MB	−0.0019	0.0007	−0.0004	−0.0004
	(−0.78)	(0.48)	(−1.00)	(−0.95)
ROE	0.0673*	−0.0114	−0.0734***	−0.0703***
	(1.95)	(−0.46)	(−9.99)	(−10.67)
CORR	0.0034	0.0023	−0.0005*	−0.0005
	(0.81)	(0.88)	(−1.74)	(−1.45)

(*continued on next page*)

Table 10 (*continued*)

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
UPDATE			−0.0025	−0.0038
			(−0.71)	(−0.99)
Ind Contr	Yes	Yes	Yes	Yes
Constant	−1.3920**	−1.2540***	−0.1660***	−0.2860***
	(−2.01)	(−2.68)	(−3.18)	(−3.81)
Observations	2026	2026	676	676
Adj. R^2	0.15	0.39	0.30	0.13

Notes: t-values are reported in brackets.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

In the second stage, the predicted values of *DL* in Table 9 are incorporated into Models (1) and (2). The results are shown in Table 10, which shows that all of the results are consistent with our hypothesis, except that the coefficient of *BL* is no longer significant in the *FERROR* model.

4.5. Robustness tests

In addition to the main tests above, several robustness tests were conducted. First, the omitted variable problem is eliminated by controlling for firm fixed effects in the regression model. The results are shown in

Table 11
Robustness test (1): Fixed effects model.

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
BL	−0.0343		0.0312**	
	(−0.88)		(2.23)	
TIMES		−0.0570		0.0336**
		(−1.17)		(2.24)
LOGTA	0.3210***	0.3180***	−0.0059	−0.0051
	(9.26)	(9.17)	(−0.80)	(−0.70)
INS	0.0158***	0.0158***	−0.0001	−0.0001
	(16.45)	(16.49)	(−0.66)	(−0.73)
EV	−0.0022	−0.0021	0.0004	0.0003
	(−1.16)	(−1.11)	(0.52)	(0.32)
*BIG*10	0.0346	0.0353	0.0014	−0.0000
	(0.89)	(0.91)	(0.18)	(−0.002)
MB	0.0038***	0.0038***	−0.0005	−0.0005
	(3.08)	(3.08)	(−0.64)	(−0.67)
ROE	−0.0020	−0.0044	−0.0699***	−0.0692***
	(−0.11)	(−0.25)	(−5.20)	(−5.14)
CORR	0.0037*	0.0037*	−0.0002	−0.0002
	(1.80)	(1.82)	(−0.45)	(−0.43)
UPDATE			−0.0077	−0.0072
			(−1.40)	(−1.29)
Constant	−6.6390***	−6.5450***	0.1760	0.1350
	(−9.08)	(−8.89)	(1.13)	(0.85)
Observations	2613	2613	894	894
Adj. R^2	0.23	0.23	1.61	1.61

Notes: t-valued are reported in brackets.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 12
Robustness tests (2): Analyst forecast behavior after management earnings forecasts.

Variables	Number of analysts (*NUM*)		Forecast error (*FERROR*)	
	BL	*TIMES*	*BL*	*TIMES*
BL	−0.1120***		−0.4210	
	(−3.34)		(−1.31)	
TIMES		−0.2070***		0.6930**
		(−5.00)		(2.46)
LOGTA	0.0917***	0.0916***	0.0466	0.0404
	(9.91)	(9.93)	(1.26)	(1.09)
INS	0.0153***	0.0153***	−0.0014	−0.0011
	(28.42)	(28.48)	(−0.70)	(−0.52)
EV	−0.0010	−0.0009	−0.0127	−0.0130
	(−0.61)	(−0.54)	(−0.96)	(−0.98)
*BIG*10	−0.0158	−0.0172	−0.0369	−0.0157
	(−0.75)	(−0.82)	(−0.43)	(−0.19)
MB	0.0020**	0.0021**	0.0005	−0.0005
	(1.99)	(2.04)	(0.05)	(−0.05)
ROE	0.0401***	0.0312**	−0.7150***	−0.6560**
	(2.65)	(2.05)	(−2.60)	(−2.39)
CORR	0.0033**	0.0032**	0.0020	0.0024
	(2.38)	(2.33)	(0.37)	(0.43)
UPDATE			0.0052	0.0375
			(0.05)	(0.37)
Ind Contr	Yes	Yes	Yes	Yes
Constant	−1.8170***	−1.6500***	−0.7420	−1.2810
	(−8.94)	(−7.99)	(−0.88)	(−1.48)
Observations	2613	2613	512	512
Adj. R^2	0.37	0.37	0.11	0.12

Notes: *t*-values are reported in brackets.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 11 and the findings are generally consistent with our hypothesis, except that *BL* and *TIMES* are no longer significant in the analyst following model.

Second, the results may also be caused by simultaneity. Two methods are used to solve this problem. First, only analyst forecasts that were issued after MEFs disclosure are kept. This requirement reduces the final sample from 894 to 512. The results based on this sample (observations = 512) are shown in Table 12 and are similar to those in Table 8. Second, *BL* and *TIMES* last year are used as the main explanatory variables and the untabulated results are also similar to those in Table 8.

Finally, the results may be driven by firm complexity.[5] To control for this effect, several variables are selected to proxy for firm complexity, including intangible assets, accounts receivable, inventory and the sum of accounts receivable and inventory. The full sample is then divided into sub-samples to examine whether the results are consistent. The untabulated results show that there are no significant differences between the two sub-samples, indicating that the findings are not driven by firm complexity.

5. Conclusion

This study examines the association between selective MEF disclosure and analysts' forecasts under China's mandatory MEF system. Two types of selective MEF disclosure and their effects on analysts' following and forecast accuracy are examined: forecast frequency and significant forecast changes. The empirical

[5] We thank the referee for this suggestion.

results show that such selective disclosure negatively influences analysts' forecasts and reduces analyst following and forecast accuracy. These results imply that in addition to MEF type, how and how frequently managers disclose MEFs also influence analysts' forecasts in mandatory MEF system, such as the one in China.

This study makes several important potential contributions to the literature and practice. First, MEFs are one of most important information sources for analysts' forecasts. This study examines the effect of managerial disclosure behavior on AEFs from an information uncertainty perspective. It also contributes to the literature on information disclosure quality (Lang and Lundholm, 1996; Bai, 2009; Langberg and Sivaramakrishnan, 2008). Second, this study provides more empirical evidence illustrating the relationship between information uncertainty and analysts' behavior (Zhang, 2006). Third, this study's results have important policy implications. The empirical evidence shows that selective MEF disclosure negatively influences analysts' forecasts. Meanwhile, financial analysts are an important intermediary and they play a main role in mitigating the information asymmetry in the capital market. Thus, more resources should be devoted by regulators to supervise MEF disclosure in an effort to improve market efficiency.

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