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Timely loss recognition and termination of unprofitable projects

Anup Srivastava [a,*], Shyam Sunder [b,1], Senyo Tse [c,2]

[a] Tuck School of Business, Dartmouth College, United States
[b] University of Arizona, Department of Accounting, United States
[c] Department of Accounting, Mays Business School, Texas A&M University, United States

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ABSTRACT

Ideally, firms should discontinue projects that become unprofitable. Managers, however, continue to operate such projects because of their limited employment horizons and empire-building motivations (Jensen, 1986; Ball, 2001). Prior studies suggest that timely loss recognition in accounting earnings enables lenders, shareholders, and boards of directors to identify unprofitable projects; thereby, enabling them to force managers to discontinue such projects before large value erosion occurs. However, this conjecture has not been tested empirically. Consistent with this notion, we find that timely loss recognition increases the likelihood of timely closures of unprofitable projects. Moreover, managers, by announcing late discontinuations of such projects, reveal their inability to select good projects and/or to contain losses, when projects turn unprofitable. Accordingly, thereafter, the fund providers and board of directors are likely to demand improved timeliness of loss recognition and stringent scrutiny of firms' capital expenditure plans. Consistently, we find that firms that announce large discontinuation losses reduce capital expenditures and improve timeliness of loss recognition in subsequent years. Our study provides evidence that timely loss reporting affects "real" economic decisions and creates economic benefits.

* Corresponding author at: Tuck School of Business, Dartmouth College, 100 Tuck Hall, Hanover, NH 03755-9000, United States. Tel.: +1 603 646 3162.
E-mail addresses: anup.srivastava@tuck.dartmouth.edu (A. Srivastava), shyamvsunder@email.arizona.edu (S. Sunder), stse@mays.tamu.edu (S. Tse).
[1] Address: University of Arizona, Department of Accounting, AZ 85721, United States. Tel.: +1 520 621 4830.
[2] Address: Department of Accounting, Mays Business School, Texas A&M University, 4353 TAMU, TX 77843-4353, United States. Tel.: +1 (979) 845 3784.

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1. Introduction

It is inevitable that some capital expenditure projects that firms undertake would later turn out to be unprofitable.[3] Investors would prefer that managers terminate such projects once their losses become apparent. However, managers may inefficiently continue to operate unprofitable projects, thereby magnifying firms' economic losses, rather than terminating them in a timely manner (e.g., Ball, 2001). This behavior stems from managers' limited employment horizons, empire building tendencies, overconfidence, aversion to reporting losses, and the fear of loss of reputation, remuneration, and employment. Prior studies suggest that timely loss recognition in accounting earnings should enable lenders, shareholders, and boards of directors (hereafter referred to as the "principals") to identify unprofitable projects in a timely manner, thus, enabling them to force managers to discontinue such projects before large value erosion (e.g., Ball, 2001; Ball and Shivakumar, 2005; Watts, 2003; LaFond and Roychowdhury, 2008). In this study, we examine whether timely reporting of losses results in timely termination of unprofitable projects, a question that remains unexamined.

In a related study, Ahmed and Duellman (2007, 2011) examine determinants of firms' project selection. They examine whether firms that recognize losses in a timely manner make good investment decisions. Similarly, Francis and Martin (2010) examine whether timely loss recognizers undertake profitable, and hence longer-lived, acquisitions. In addition, they examine whether timely loss recognizers divest acquired companies in a timely manner. Neither study examines companies' ex-post termination of unprofitable projects, however.[4] Firms are likely to initiate and terminate projects more frequently than they acquire and sell other companies. Thus we focus on the decision to discontinue operations since these are likely to represent a more complete picture of managers' investment decisions that turn unprofitable. Discontinued operations reported in the financial statements are important by definition since they are material. Decisions related to such projects create significant agency conflicts because their continuation, on the one hand, increases losses for lenders and shareholders, but on the other hand, may benefit managers. Accordingly, our study examines whether timely loss recognition reduces agency conflicts in the decision to discontinue operations.

We assume that managers are averse to discontinuing any projects, and therefore only terminate unprofitable projects.[5] We conjecture that firms with timely loss recognition are more likely to terminate unprofitable projects. Therefore, we first examine whether project discontinuations are positively associated with timely reporting of losses in the three-year period preceding the discontinuations. Consistent with prior studies (e.g. Francis and Martin, 2010), we use a matched-pair design. We identify a control group of firms that have similar investment opportunities and face similar economic shocks (that make projects unprofitable) as the sample discontinuation firms. The control group firms do not announce termination of unprofitable projects in the sample firm's discontinuation year or in the preceding three years. Accordingly, we examine whether sample firms that announce termination of projects have more effective timely loss recognition in the three preceding years than the control group.

We need a firm-year specific measure of timeliness of loss recognition to examine our research questions. We do not use measures that require multiple years' data for calculation (for example, Basu (1997) and Ball and Shivakumar (2005) measures) because we assume that firm characteristics can change over time. Accordingly, we use two state-of-the art measures of the timeliness of loss recognition at the firm-year level. Following Francis and Martin (2010), we use CSCORE (Khan and Watts, 2009).[6] We also report results for

[3] In this study, the notion of project "unprofitability" includes instances of (1) current losses; (2) negative present value of future cash flows; or (3) liquidation value exceeding present value of future cash flows. Such instances reduce firm value.

[4] Tan (2013) examines actions lenders initiate after debt covenant violation, resulting in more conservative investment decisions and financial reporting. Biddle et al. (2013) examine changes in financial reporting following increased bankruptcy risk.

[5] Bunsis (1997) and Jaggi et al. (2009) find evidence that shareholders react positively to asset write-downs that involve closing of an unprofitable plant or division.

[6] CSCORE is derived from Basu's (1997) notion of asymmetric timeliness of loss recognition and is a firm-year specific measure of conditional conservatism. Firm-year values of CSCORE can be calculated from cross-sectional returns and earnings data for one year. Similar to Basu's measure, CSCORE is calculated from earnings-return coefficients for firms with positive or negative returns. For our tests, we use the negative-return coefficient (rather than the difference between the coefficients for negative and positive returns) because we are interested in measuring cross-sectional variation in the timeliness of loss recognition. Khan and Watts (2009) label this measure "bad news timeliness" and obtain it by summing CSCORE (difference between timeliness of bad versus good news recognition) and GSCORE (timeliness of good news recognition).

the Conservatism Ratio, proposed by Callen et al. (2010).[7] In our first test, we find firms that the discontinuation firms have higher CSCORE in the three preceding years than the control group.

Our first test above provides preliminary evidence that timely-loss-recognition is positively associated with closures of projects. However, this test ignores the possibility that loss severity may be related to the timeliness of discontinuations. We expect late discontinuations of unprofitable projects to result in higher economic losses than timelier discontinuations. Accordingly, we measure timeliness of project closures by the magnitude of asset-deflated losses announced on discontinuation.[8] Moreover, we expect that firms with late discontinuations have less effective timely loss reporting than those with timely discontinuations. We test this hypothesis by performing three tests using three proxies of late discontinuations. In our first test, we find that the magnitude of discontinuation losses is negatively associated with the CSCORE. In our second test, we divide our sample firms into *small* discontinuation loss and *large* discontinuation loss categories using a loss cutoff of 1% of beginning-of-year assets. The separation helps us to test whether loss projects are discontinued in a timelier manner. We assume that the magnitude of the loss for most timely discontinuances is going to be smaller. We find that *large* discontinuation losses occur less frequently as CSCORE increases. We further partition the sample into four ordered categories comprised of firms with asset-deflated discontinuation losses smaller than 1%, and firms with losses of 1% to 3%, 3% to 5%, and greater than 5%. We find that the likelihood that a firm falls into a higher loss category is negatively associated with CSCORE. Jointly these results suggest that timely loss recognition not only increases the likelihood of termination of unprofitable projects, but it also increases the likelihood that such projects are discontinued in a timelier manner.

Managers of firms that announce large losses on discontinuations signal that they failed to discontinue unprofitable projects in a timely manner. In other words, they signal their inability to select profitable projects and/or to stop value erosion when projects turn unprofitable. After such announcements, we expect investors to demand timelier reporting of losses to prevent those managers from continuing to operate other unprofitable projects.[9] Accordingly, we expect late discontinuations to be followed subsequently by improvement in timeliness of loss recognition. We test this hypothesis by measuring CSCORE two years before and after firms report large discontinuations. We find that the changes in CSCORE are higher for late discontinuation firms than for control firms (i.e. those with no discontinuances) and timely discontinuations firms. Moreover, unless investors can force a change in management,[10] they are likely to more stringently scrutinize proposed projects or restrain those managers from further implementing large capital expenditure plans. Consistent with this conjecture, we find a significant decline in capital expenditures by late discontinuation firms relative to control firms and firms with timely discontinuations.

Overall, our study provides evidence that the likelihood of firms' discontinuing unprofitable projects in a timely manner increases with timely loss recognition. Our study provides evidence on the extent to which timely loss reporting affects "real" economic decisions, and whether accounting conservatism provides economic benefits to investors (e.g. Watts and Zimmerman, 1986; Basu, 1997; Ball, 2001; Watts, 2003; Ball and Shivakumar, 2005). In particular, our study complements prior studies that claim that accounting conservatism can improve investment efficiency (e.g., Ball, 2001; Bushman and Piotroski, 2006; Biddle and Hillary, 2006). We also extend studies that examine accounting conservatism as a corporate governance mechanism (e.g., Watts, 2003; Beekes et al., 2004; Ahmed and Duellman, 2007, 2011). The rest of the paper proceeds as follows. Section 2 develops the hypotheses. Section 3 describes the sample, the research design, and the results. Section 4 describes supplementary tests to examine validity of our empirical measures, and Section 5 concludes.

[7] We use CSCORE as our primary measure because Francis and Martin (2010) use this measure to address questions that are closely related to ours. In addition, CSCORE requires less restrictive sampling procedure, preserving almost four times as many discontinuation observations for our tests as the Conservatism Ratio.

[8] Bunsis (1997), Heflin and Warfield (1997), and Elliott and Shaw (1988) find that the short-term return surrounding asset write-downs is negatively associated with the magnitude of write-downs. Heflin and Warfield (1997) conclude that firms with large write-downs delay their decisions by as much as three years.

[9] The late termination of unprofitable projects may indicate that the firm's accounting system does not provide timely information about losses. Auditors and boards of directors may respond by advocating and supporting for more timely loss recognition.

[10] Conyon and Florou (2002) find that corporate performance must fall drastically to force dismissal of senior executives.

2. Development of hypothesis

Some projects that managers initiate subsequently turn out to be unprofitable. Managers receive information on changes in expected cash flows from a project before external investors. Closing such unprofitable projects should cut firms' economic losses. However, managers continue to operate unprofitable projects because closing them may lead to reporting of one-time losses which might reduce their wealth via bonus, and lower their employment prospects through retention, promotion or alternative employment (Ball, 2001). Thus, managers delay closures, thus gradually incorporating reduced cash flows in earnings, even though doing so magnifies losses to lenders and shareholders. Similarly, Baumol (1967) and Jensen (1986) suggest that managers build empires rather than abandon unprofitable projects. Therefore, accounting regimes that force prompt loss recognition (that is, within managers' performance assessment periods) are likely to reduce managers' incentives to continue running unprofitable projects (e.g. Watts, 2003; Ball and Shivakumar, 2005). Other studies argue that timely recognition of losses improves corporate governance (e.g., Watts, 2003; Beekes et al., 2004; Ahmed and Duellman, 2007, 2011), reduces agency conflicts (e.g. LaFond and Roychowdhury, 2008), and improves investment efficiency (e.g., Bushman and Piotroski, 2006; Biddle and Hillary, 2006). We assume that managers prefer to continue operating all projects, only terminating unprofitable projects. Accordingly, we examine whether firms that promptly recognize economic losses in accounting earnings are more likely to terminate projects. This discussion leads us to our first hypothesis:

H1. Timely loss recognition increases the likelihood of project terminations.

Not all terminations of projects are likely to be timely. Some projects might only be terminated after producing losses that are too large to ignore or that become significant drains on firms' cash flows. Firms that do not recognize losses in a timely manner are more likely to have "late" terminations. Accordingly, we hypothesize the following:

H2. Timely loss recognition reduces the likelihood of late termination of unprofitable projects.

Managers of firms that announce late termination of unprofitable projects reveal their inability to select good projects and/or to contain economic losses when external events make projects unprofitable. The investors in firms with late terminations are likely to demand improvement in accounting information systems, specifically, to increase the timeliness of the reporting of economic losses, in order to prevent late discontinuations in future. Furthermore, unless investors can force for a change in the management team, they are likely to impose stringent project selection criteria or restrain managers from implementing large capital expenditure projects. Thus, we hypothesize the following:

H3a. Late termination of unprofitable projects is followed by improved timely loss recognition; and

H3b. Late termination of unprofitable projects is followed by reduced capital expenditure.

3. Sample selection, research design, and results

3.1. Sample selection

We describe sample selection procedure in Table 1. We classify all non-zero gains or losses from discontinued operations (Compustat item "DO") as discontinuation events. The "DO" data field contains the sum of (1) total income or loss from operations of a discontinued division and (2) the gain or loss on the disposal of that division. Compustat does not separately report data on those two categories of losses. We use this sum as an indicator of the unprofitability of the project because it provides an estimate of investors' total loss on the project discontinuation. In a later section, we examine the relation between DO and its components using hand collected data. Compustat has 25,668 firm-year observations (representing 8841 distinct firms) with non-zero entry in the "DO" field in the period 1968–2007.

Closing unprofitable projects in a timely manner can limit firms' economic losses and thus, timely discontinuations are likely to result in smaller losses than late discontinuations. We classify discontinuation losses of less than 1% of the firm's beginning-of-year assets as "timely" discontinuations and the others as "late". We deflate discontinuation losses by the firm's assets to measure the significance of discontinued operations to the firm. An alternative measure based on the ratio of the discontinuation losses to the assets of the discontinued operations may provide better assessment of the profitability of the discontinued operations; however, asset values of the discontinued operations are not available in the Compustat database. We test the consistency between measures derived using those two asset deflators (that is, the value of total assets and the value of discontinued assets) using hand-collected data in a later section.

We hypothesize that firms with effective timely-loss-recognition governance report *timely* discontinuations while those with less effective governance report *late* discontinuations. Therefore, we measure timeliness of loss reporting in the three years prior to the reported discontinuations and require that sample firms not report any discontinuation during those three years. We use CSCORE (Khan and Watts, 2009) as our primary firm-year measure of timely loss recognition. Thus, we require that sample firms have data in Compustat to calculate CSCORE (we describe estimation procedure in Appendix A) during those three prior years. These requirements leave us with 3618 firm-year observations (representing 2949 distinct firms) in our sample.

3.2. Research design: Control firms matched on industry, size, and time

Consistent with prior literature (e.g. Francis and Martin, 2010), we use a matched-pair design to test our hypotheses.[11] In order to examine the association of timely-loss-recognition-governance and project closures, we compare our sample firms to a group of "matched" firms that face similar investment opportunities and economic shocks as sample firms, but that do not report discontinuations.

As Fig. 1 illustrates, we match sample and control firms by industry and the book value of assets (Compustat item "AT") four years prior to the sample firm's report of discontinuations. Zucca and Campbell (1992) and Strong and Meyer (1987) also use a control group matched on industry and assets size to examine characteristics of firms that write down assets. We require that matched "control" firms do not report any discontinuations in the sample firms' discontinuation years or in the three prior years. Moreover, they should have data in Compustat to calculate CSCORE for those prior years. Of the 3618 discontinuation events above, we are able to find a match for 3523 (97.4%) firm years in the same three-digit SIC code industry and 78 (2.2%) in the same two-digit SIC code industry. This leaves us with 3601 sample firm-year observations for 2949 distinct firms.

In a later sub-section, we summarize the calculation of Conservatism Ratio (Callen et al., 2010), the related sample selection procedure, and our results for this measure. We use CSCORE as our primary measure because Francis and Martin (2010) use it in a similar study, and also because this measure imposes less restrictive sampling constraints, yielding almost four times as many observations as the Conservatism Ratio (3601 versus 997 observations).

3.3. Descriptive statistics and univariate tests

We present descriptive statistics for discontinuation firms in Table 1. Panel B shows that more than 80% of our sample firms report discontinuations only once. The remaining 20% firms report up to five discontinuations (reported by five firms) during the study period. Panel C shows that discontinuation firms are widely distributed across industry categories and no single industry category dominates. Nevertheless, the industry categories with the most frequent late discontinuations are Personal and Business Services, Business

[11] An alternative to this ex-post matched-pair design is to use a multivariate prediction model of discontinuations using all firms' data to examine whether lower CSCORE is associated with the likelihood of discontinuations. However, because discontinuations are relatively infrequent (occurring in fewer than 10% of all firm-years in the Compustat database) such a prediction model is likely to be noisy and to result in numerous false-positive errors.

Table 1
Sample derivation and distribution.

	Distinct firms	Firm-years
Panel A: Sample selection (H1a and H1b)		
Firm years in Compustat with non-zero assets (all years up to 2007)	28,330	364,792
Of the above, firms that report discontinuations	8841	25,668
Of the above, firms that report discontinuations, but do not report discontinuations in the previous three years, and have data to calculate CSCORE in the three years prior to discontinuations	2949	3618
Of the above, firms that have matched firms in control group (firms that do not report any discontinuations, are in similar industry as in sample firms, are closest in asset size four years prior to sample firm's reported discontinuation years, and have data to calculate CSCORE in the prior three years)	2938	3601

Frequency	Number of distinct firms
Panel B: Frequency of discontinuations by firms	
1	2409
2	422
3	85
4	17
5	5

Fama French industry number	Industry name	Frequency of discontinuations
Panel C: Distribution of discontinuations by industry		
1	Food Products	130
3	Tobacco Products	7
4	Recreation	101
5	Printing and Publishing	112
6	Consumer Goods	112
7	Apparel	63
8	Healthcare and Medical Equipment	264
9	Chemicals	99
10	Textiles	45
11	Construction and Construction	218
12	Steel Works Etc	86
13	Fabricated Products and Machinery	189
14	Electrical Equipment	140
15	Automobiles and Trucks	81
16	Aircraft, Ships, and railroad	46
17	Precious Metals, Non-Metallic	50
18	Coal	7
19	Petroleum and Natural Gas	159
20	Utilities	161

21	Communication	111
22	Personal and Business Services	360
23	Business Equipment	258
24	Business Supplies and Shipping	92
25	Transportation	97
26	Wholesale	203
27	Retail	213
28	Restaurants, Hotels, Motels	68
30	Other	129
	Total	3601

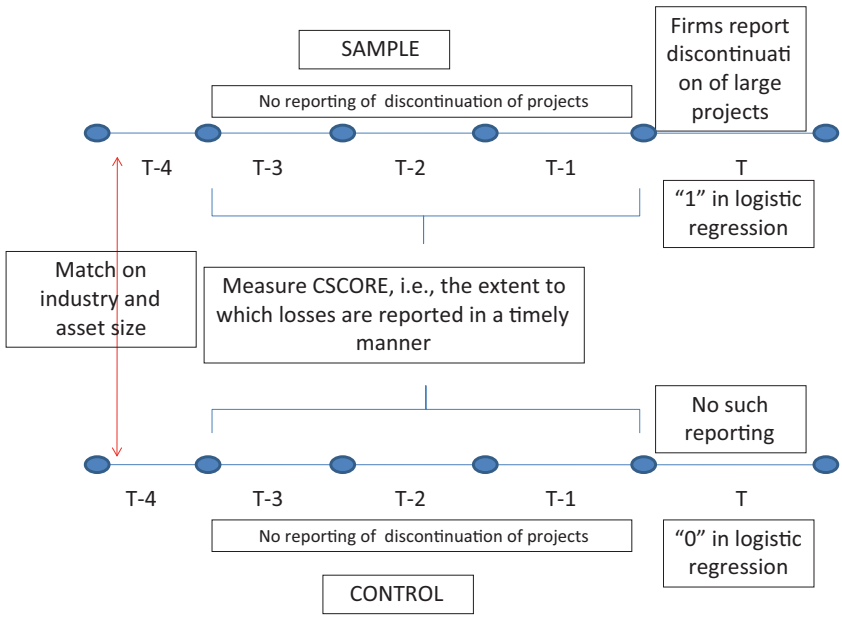

Figure 1a. Sample and control firms.

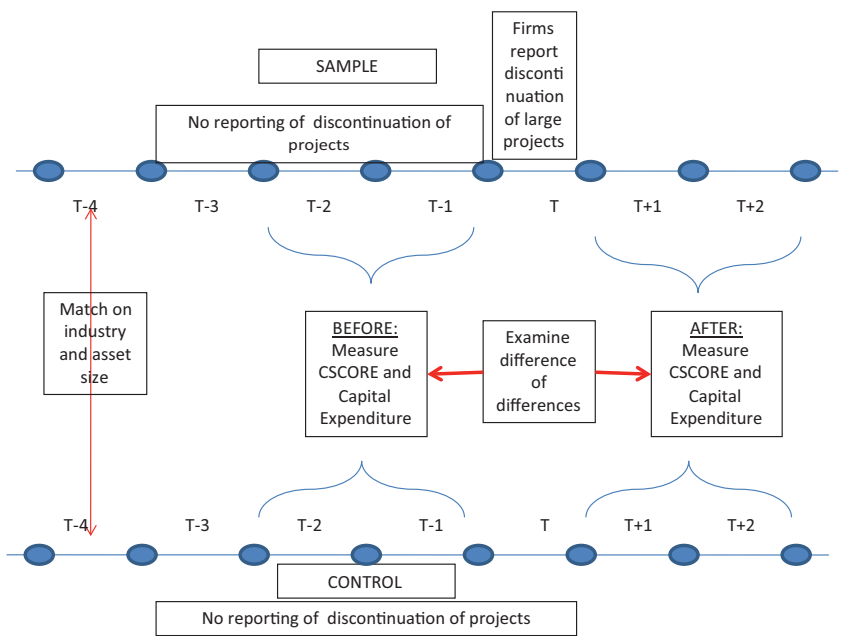

Figure 1b. Change in firm characteristics upon reporting of late discontinuations.

Equipment, and Healthcare and Medical Equipment industries. Fig. 2 shows that the reporting of discontinuations is distributed widely over the sample period from 1971 to 2007, but there is a distinct drop in the early

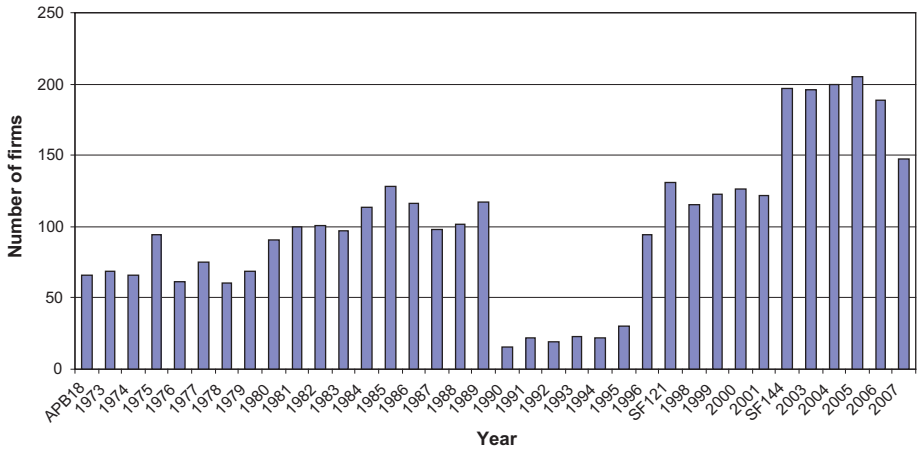

Figure 2. Number of firms reporting discontinued operations.

1990s, and large increases after 1995 and 2001, i.e., at about the time SFAS 121 (FASB, 1995) and SFAS 144 (FASB, 2001) respectively, became effective.[12]

Table 2 Panel A provides descriptive statistics of sample and control firms in the match year. The average size (total assets), market to book value ratio [measured as market value of equity {Price (PRCC_F) × Number of shares outstanding (CSHO)} divided by book value of equity (CEQ)], net profits (IB), capital expenditures (CAPX), and capital expenditure to total assets ratio are not statistically different for control and sample firms. This shows that the two groups of firms incurred similar capital expenditures in the matching year. While sample firms had statistically significant lower return on assets [ROA: Operating Income After Depreciation (OIADP)/Beginning-of-the-year Assets (AT)], the difference is not economically significant.[13] The mean difference in ROA is approximately 2%, and the median difference is 1%. Importantly, similarity in levels of capital expenditures and market to book ratio indicate that both groups of firms had similar investment opportunity sets.

Table 2 Panel B provides descriptive statistics on sample and control firms for the three years before the discontinuation year. The aggregate capital expenditure is not statistically different for the two groups, suggesting that sample and control firms had similar levels of investment firms leading up to the discontinuation. The return on assets for the sample firms continues to be lower than the control group. This table also shows that the average CSCORE in the three prior years is higher for sample firms than for the control firms, suggesting that the discontinuation firms on average had more effective prior timely-loss-reporting governance.

Table 2 Panel C provides descriptive statistics on the two groups of firms in the pre-discontinuation year. As in the preceding years, there continues to be no significant difference between the capital expenditures of sample and control firms, but the profitability gap widens significantly. The mean difference in ROA reaches approximately 6%. The mean ROA for sample firms becomes negative. Moreover, their cash balance (industry- and year-adjusted cash balance [CHE] inverse quartile rank) becomes significantly lower, which could drive managers' decisions to close unprofitable project in the following year. In other words, cash deficiency could act as an alternate governance mechanism (Jensen, 1986). Thus, based on evidence so far, it is unclear whether the project closures that sample firms would announce in the following year are timely or late.

[12] Accounting regulations APB 30, SFAS 121, and SFAS 144 governed reporting of gains/losses from discontinued operations during our study period. APB 30 required reporting of losses related to a "segment of a business", including a separate line of business or a separate class of customer. While APB 30 required reporting of estimates of expected disposal losses from discontinued divisions, it did not require firms to report impairment losses of assets they did not plan to dispose of. SFAS 121 established accounting standards for the impairment of long-lived assets and required firms to recognize an impairment loss if the carrying amount of the asset exceeds the undiscounted sum of the expected future cash flows. SFAS 144 consolidated provisions of APB 30 and SFAS 121 and expanded the definition of asset groups under APB 30 to include any segment, unit, subsidiary, or asset group whose cash flows can be identified separately.

[13] Strong and Meyer (1987), Elliott and Shaw (1988), Zucca and Campbell (1992), and Heflin and Warfield (1997) find that asset write-down firms underperform their industry peers.

Table 2
Descriptive statistics.

Firm demographics in $ M	Mean			Q1		Median		Q3	
	Control	Sample	Difference	Control	Sample	Control	Sample	Control	Sample
Panel A: Descriptive statistics for sample and control firms in the match year (four years before sample firms report discontinuations)									
Total Assets	2062	2512	450	46	53	171	199	782	1021
Revenue	1664	2061	397**	54	63	209	238	869	1075
Market Value of Equity	2350	2156	−194	31	34	137	153	741	829
Net Income	80	74	−6	1	1	8	7	40	42
Capital Expenditure	139	161	22	2	2	10	11	48	63
Capital expenditure to lagged assets ratio	0.09	0.09	0.00	0.03	0.03	0.06	0.06	0.11	0.11
Asset turnover ratio	1.36	1.32	−0.04	0.77	0.76	1.20	1.19	1.69	1.65
ROE	0.09	0.07	−0.02***	0.06	0.05	0.12	0.11	0.17	0.16
ROA	0.06	0.04	−0.02***	0.03	0.02	0.06	0.05	0.11	0.09
Market to Book	2.39	2.38	−0.01	0.97	0.93	1.63	1.53	2.72	2.53
Panel B: Descriptive statistics for sample and control firms in the three years before sample firms report discontinuations									
Aggregate capital expenditure to lagged assets	0.082	0.076	0.006	0.036	0.035	0.062	0.060	0.104	0.096
Average ROA	0.059	0.037	−0.022***	0.028	0.013	0.058	0.043	0.096	0.076
Aggregate CSCORE (Loss coefficient)	0.139	0.151	0.012***	0.087	0.095	0.133	0.143	0.184	0.200
Panel C: Descriptive statistics for sample and control firms in the year before sample firms report discontinuations									
Total Assets	2624	3328	704*	65	76	246	280	1109	1423
Revenue	2260	2767	507*	77	90	297	328	1165	1478
Market Value of Equity	2926	2690	−236	42	38	190	173	1014	933
Net Income	145	127	−18	2	0	10	7	55	52
Aggregate capital expenditure to lagged assets ratio	0.08	0.08	0.00	0.03	0.03	0.06	0.05	0.10	0.09
Asset Turnover	1.56	1.50	−0.06	0.76	0.78	1.17	1.19	1.66	1.65
ROE	0.08	−0.20	−0.28	0.05	0.01	0.11	0.09	0.16	0.14
ROA	0.05	−0.01	−0.06*	0.03	0.00	0.06	0.04	0.10	0.07
Market to Book	2.18	3.55	1.37	0.96	0.86	1.55	1.37	2.57	2.24
Industry and year adjusted cash-deficiency quartile rank	2.47	2.60	0.13***	2	2	2	3	3	3

	Mean	Q1	Median	Q3
Panel D: Descriptive statistics for sample firms in discontinuation years				
Gains/Losses from discontinued operations in $ M	0.23	−6.84	−0.81	2.15
Absolute value of Gains/Losses from discontinued operations as % of lagged assets	4.42%	0.52%	1.56%	4.57%
Gains/Losses from discontinued operations as % of lagged assets	−0.78%	−2.68%	−0.52%	0.54%
Percent of firms that announce *late* discontinuations	40.9%			

* Significant at p-level of 0.10.
** Significant at p-level of 0.05.
*** Significant at p-level of 0.01.

Table 2 Panel D provides descriptive statistics of gains/losses on discontinued operations for sample firms. The mean unsigned effect of discontinuation event on income amounts to 4.4% of beginning-of-the-year assets and the median is 1.5%, indicating a significant impact on firm's reported assets and income. The mean signed effect is −0.78% and the median is −0.52%. About 40% of the sample firms announce late discontinuations (that is, report discontinuation losses greater than 1%).

3.4. Testing Hypothesis H1

To investigate determinants of project discontinuations, we use a multivariate logistic regression model to explain the firm's membership in the treatment versus control groups. We use the following equation:

$$LogLikelihood(DiscontinuedOp)_t = \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i} + \beta_3 \times MarketToBook_{t-1} + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i} + \beta_7 \times Dummy\_APB30\_year_t + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t, \quad (1)$$

We code *DiscontinuedOp* as 1 if the firm reports a discontinued operation in year t and zero otherwise. The coefficient of interest is β_2, the coefficient on aggregate CSCORE in the three years prior to discontinuation year. We expect firms that report discontinuations to have higher CSCORE than other firms, so we expect β_2 to be positive. We control for factors that might affect the likelihood of project discontinuation, in particular, the firm's investment opportunities set (proxied by market to book ratio) and firm size (natural log of firm's assets). We also control for cash deficiency because it could affect discontinuation decisions for two reasons. First, a cash surplus firm can forego external funding for its projects and thereby avoid the increased monitoring from external fund providers. Second, a cash-deficient firm is more likely to shelve unprofitable projects to conserve resources. We also control for firm performance in the three prior years because high overall profitability could reduce pressure on firms to terminate unprofitable operations. Finally, we control for the fixed effects of applicable accounting regulation (APB 30 (1973), SAFS 121, and SFAS 144) that could affect the reporting of discontinued operations (as shown in Fig. 2).

3.5. Results for Hypothesis H1

We present results in Table 3. We find that the coefficient on prior aggregate CSCORE is positive. Consistent with Hypothesis H1, this shows that on average, effective timely-loss-recognition governance

Table 3
Project discontinuations and prior timeliness of loss recognition. **Panel A:** Test to examine whether discontinuations are associated with higher CSCORE (dichotomous logistic regression model).*

$$LogLikelihood_t = \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i}/3 + \beta_3 \times MarketToBook_{t-1} + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i}/3 + \beta_7 \times Dummy\_APB30\_year_t + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t.$$

Variable	Predicted sign	Model 1	
		Estimate	p-value**
Intercept 1		−0.440	0.006
CSCORE		1.969	<0.001
MarketToBook	?	−0.059	<0.001
LogSize	?	0.110	<0.001
CashDeficiencyQuartileRank	+	0.077	0.009
Profitability	−	−4.259	<0.001
Controls for fixed-effects for APB 30, SFAS 121, and SFAS 144			Yes
N			7202
Model chi-square			244.1
Probability			<0.001
Percent Concordant			60.8%
Pseudo *R*-squared			0.044

* Dichotomous dependent variable that equals one for firms that report discontinuations and zero for matched control firms.
** One-tailed test for directional hypotheses.

increases the likelihood of shelving projects. The coefficient on the market to book ratio is negative, which suggests that firms with smaller investment opportunities are more likely to discontinue projects. The coefficient on the cash deficiency variable is positive, which suggests that cash-deficient firms are more likely to close projects.

3.6. Testing Hypothesis H2

The dichotomous logistic model described above treats all late discontinuations as having equal severity. As we note above, some of the reported discontinuations could potentially represent *timely* closures, while the others represent *late* closures. We expect *timely* closures to be associated with more effective timely-loss-recognition governance than *late* closures. The more timely a firm's loss recognition, the smaller the loss on discontinued operations should be. We first examine this conjecture by estimating the relation between the loss on discontinued operations and CSCORE while controlling for other determinants of discontinued operations and the related losses. The model is

$$\begin{aligned} LossOnDiscontinuation_t = {} & \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i} + \beta_3 \times MarketToBook_{t-1} \\ & + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} \\ & + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i} + \beta_7 \times Dummy\_APB30\_year_t \\ & + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t, \end{aligned} \tag{2}$$

where *LossOnDiscontinuation* is the loss on discontinued operations deflated by beginning of year assets.

We eliminate observations with gains on discontinued operations and only estimate model (2) on firms with losses on discontinued operation – a sample comprised of 2278 observations. We expect the coefficient of CSCORE, β_2, to be negative, reflecting a negative relation between conservatism and losses on discontinued operations.

Next, we estimate two logistic model specifications on the entire sample of discontinued-operations firms. The logistic regression model is

$$\begin{aligned} LogLikelihood(LateDiscontinuation)_t = {} & \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i} + \beta_3 \times MarketToBook_{t-1} \\ & + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} \\ & + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i} + \beta_7 \times Dummy\_APB30\_year_t \\ & + \beta_8 \times Dummy\_SFAS121\_year_t \\ & + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t. \end{aligned} \tag{3}$$

In the first specification, we use a dichotomous dependent variable that takes the value of one for *late* closures and zero for *timely* closures. We classify firms with losses on discontinuation smaller than 1% of beginning-of-the-year assets and firms with gains on discontinuation as *timely* discontinuations and other firms as *late* discontinuations. In the second specification, we use an ordered dependent variable that incorporates discontinuation severity and takes a value of three for firms that report *extremely late discontinuations* (losses on discontinuation exceed 5% of beginning-of-the-year assets), two for *very late discontinuation* (losses on discontinuation exceed 3% but are below 5% of beginning-of-the-year assets), one for firms that report *late discontinuations* (losses are 1–3% of beginning-of-year assets) and zero for firms that report *timely discontinuations* (the remaining firms). In both specifications, β_2 measures the effect of CSCORE on the likelihood of *late* discontinuations. We expect β_2 to be negative.

Table 4
Severity of project discontinuations and prior timeliness of loss recognition. Tests to examine whether late discontinuations are associated with lower CSCORE. **Model 1:** OLS regression model using data of only discontinuation firms that declared losses on discontinuation.*

$$LossOnDiscontinuation_t = \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i}/3 + \beta_3 \times MarketToBook_{t-1} + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i}/3 + \beta_7 \times Dummy\_APB30\_year_t + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t$$

Model 2: Dichotomous logistic regression model 2 using data of only discontinuation firms.** **Model 3:** Ordered logistic regression model 2 using data of only discontinuation firms.***

$$LogLikelihood_t = \beta_1 + \beta_2 \times \sum_{i=1}^{3} CSCORE_{t-i}/3 + \beta_3 \times MarketToBook_{t-1} + \beta_4 \times LogSize_{t-1} + \beta_5 \times CashDeficiencyQuartileRank_{t-1} + \beta_6 \times \sum_{i=1}^{3} ROA_{t-i}/3 + \beta_7 \times Dummy\_APB30\_year_t + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t.$$

Variable	Predicted sign	Model 1		Predicted sign	Model 2		Model 3	
		Estimate	p-value‡		Estimate	p-value‡	Estimate	p-value‡
Intercept 1		0.046	<0.001		0.539	0.022	−0.830	0.002
Intercept 2							−0.315	0.162
Intercept 3							0.582	0.009
CSCORE	−	−0.036	0.003	−	−1.991	0.001	−2.05	<0.001
MarketToBook	?	0.003	<0.001	?	0.012	0.573	0.031	0.135
LogSize	?	−0.005	<0.001	?	−0.235	<0.001	−0.245	<0.001
CashDeficiencyQuartileRank	?	0.001	0.251	+	0.107	0.004	0.089	0.007
Profitability	?	−0.117	<0.001	?	−2.030	<0.001	−2.771	<0.001
Controls for fixed-effects for APB 30, SFAS 121, and SFAS 144			Yes			Yes		Yes
N			2278			3601		3601
F Value			37.3					
Model chi-square						240.1		285.6
Probability			<0.001			<0.001		<0.001
Percent Concordant						64.9%		63.8%
Adj/Pseudo *R*-squared			0.112			0.087		0.086

* Model 1 is an OLS regression. *LossOnDiscontinuation* is the discontinuation loss deflated by beginning-of-the-year assets.

** Model 2 is a logistic regression with an dichotomous dependent variable that equals one for firms that report *late discontinuations* (losses on discontinuation exceed 1% of beginning-of-the-year assets, $N = 1474$) and zero for firms that report *timely discontinuations* (losses on discontinuation are below 1% of beginning-of-the-year assets, $N = 2127$).

*** Model 3 is a logistic regression with an ordered dependent variable that equals three for firms that report *extremely late discontinuations* (losses on discontinuation exceed 5% of beginning-of-the-year assets, $N = 560$), *very late discontinuations* (losses on discontinuation exceed 3% but are below 5% of beginning-of-the-year assets, $N = 267$), one for firms that report *late discontinuations* (losses on discontinuation exceed 1% but are below 3% of beginning-of-the-year assets, $N = 647$), and zero for firms that report *timely discontinuations* (losses on discontinuation are below 1% of beginning-of-the-year assets, $N = 2127$).

‡ One-tailed test for directional hypotheses.

3.7. Results for Hypothesis H2

We present results for Eqs. (2) and (3) in Table 4. The first column shows the results of estimating Eq. (2). The negative coefficient on CSCORE (β_2) suggests that the losses on discontinuations decrease with timely-loss-recognition governance. In other words, timelier reporting of losses reduces the likelihood of late discontinuations.

The second and third columns of Table 3 present results of the two specifications of Eq. (3). The coefficient on aggregate CSCORE (β_2) is negative, which suggests that as CSCORE increases, the likelihood of *late*, *very late*, and *extremely late* closures declines. These results taken together with results for Hypothesis 1 suggest that timely loss recognition increases the likelihood of discontinuations of unprofitable projects and also increases the likelihood that such projects are discontinued in a timely manner.

3.8. Testing Hypothesis H3

In this hypothesis, we examine the economic consequences to the firm of reporting late discontinuations. Fig. 1b illustrates our research design. We expect late discontinuation firms to improve the timeliness of loss reporting and reduce capital expenditures in the following years.

We test these two conjectures using the following regressions:

$$\begin{aligned} ChangeCSCORE_{(t+2,t+1)-(t-1,t-2)} = {} & \beta_1 + \beta_2 \times DummyDiscontinuation_t + \beta_3 \times DummyLateDiscontinuation_t \\ & + \beta_4 \times MarketToBook_{t-1} + \beta_5 \times LogSize_{t-1} + \beta_6 \\ & \times CashDeficiencyQuartileRank_{t-1} + \beta_7 \times Dummy\_APB30\_year_t \\ & + \beta_8 \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t \\ & + \varepsilon_t, \end{aligned} \tag{4}$$

and

$$\begin{aligned} ChangeCAPEX_{(t+2,t+1)-(t-1,t-2)} = {} & \beta_1 + \beta_2 \times DummyDiscontinuation_t + \beta_3 \times DummyLateDiscontinuation_t \\ & + \beta_4 \times MarketToBook_{t-1} + \beta_5 \times LogSize_{t-1} + \beta_6 \\ & \times CashDeficiencyQuartileRank_{t-1} + \beta_7 \times Dummy\_APB30\_year_t + \beta_8 \\ & \times Dummy\_SFAS121\_year_t + \beta_9 \times Dummy\_SFAS144\_year_t + \varepsilon_t, \end{aligned} \tag{5}$$

where the dependent variable in Eq. (4) is the change in CSCORE from the two years prior to the two years after the discontinuation years. In Eq. (5), the dependent variable is the change in capital expenditure over the same period. To test H3, we use sample and control firm matched pairs with data for all four years.

In Eq. (4), the coefficient on *DummyDiscontinuation* (β_2) measures the changes in CSCOREs of timely-closure firms, while that on *DummyLateDiscontinuation* (β_3) measures the changes in CSCOREs of late closure firms. We do not expect principals of *timely* closure firms to demand changes in conservatism, so we expect β_2 to be zero. However, we expect principals of *late* closure firms to demand improvement in CSCORE, and we therefore expect the coefficient on *DummyLateDiscontinuation* (β_3) to be positive.

Similarly, in Eq. (4), the coefficient on *DummyDiscontinuation* (β_2) measures the changes in capital expenditures of *timely* closure firms. We do not expect principals of *timely* closure firms to constrain capital expenditures, so we expect β_2 to be zero. On the other hand; we expect principals of *late* closure firms to constrain further capital expenditures; therefore, we expect a negative coefficient on *DummyLateDiscontinuation* (β_3).

3.9. Results for Hypothesis H3

In column 1 of Table 5, we present results for Eq. (4). The coefficient on *DummyDiscontinuation* (β_2) is not different from zero, which suggests that principals do not demand changes in timely-loss-recognition governance for firms that promptly close unprofitable projects. On the other hand, the coefficient on

Table 5
Economic consequences of late discontinuations. **Model 1:** Shareholders of firms that report late discontinuations demand improvement in CSCORE.*

$$ChangeCSCORE_{(t+2,t+1)-(t-1,t-2)} = \beta_2 \times DummyDiscontinuation_t + \beta_3 \times DummyLateDiscontinuation_t + \beta_4 \times MarketToBook_{t-1} + \beta_5 \times LogSize_{t-1} + \beta_6 \times CashDeficiencyQuartileRank_{t-1} + \beta_8 \times Dummy\_APB30\_year_t + \beta_9 \times Dummy\_SFAS121\_year_t + \beta_{10} \times Dummy\_SFAS144\_year_t + \varepsilon_t$$

Model 2: Shareholders of firms that report late discontinuation constrain capital expenditure.*

$$ChangeCAPEX_{(t+2,t+1)-(t-1,t-2)} = \beta_2 \times DummyDiscontinuation_t + \beta_3 \times DummyLateDiscontinuation_t + \beta_4 \times MarketToBook_{t-1} + \beta_5 \times LogSize_{t-1} + \beta_6 \times CashDeficiencyQuartileRank_{t-1} + \beta_8 \times Dummy\_APB30\_year_t + \beta_9 \times Dummy\_SFAS121\_year_t + \beta_{10} \times Dummy\_SFAS144\_year_t + \varepsilon_t.$$

Variable	Predicted sign	Model 1		Predicted sign	Model 2	
		Estimate	*p*-value**		Estimate	*p*-value**
Intercept 1		0.271	<0.001		0.044	<0.001
DummyDiscontinuation	?	0.005	0.605	?	0.004	0.319
DummyLateDiscontinuation	+	0.029	0.015	−	−0.024	<0.001
MarketToBook	?	−0.284	<0.001	?	−0.002	0.043
LogSize	?	0.001	0.563	?	−0.005	<0.001
CashDeficiencyQuartileRank	?	0.003	0.500	?	−0.020	<0.001
Controls for fixed-effects for APB 30, SFAS 121, and SFAS 144			Yes			Yes
N			4222			4222
F Value			69.4			14.4
Probability			<0.001			<0.001
Adj *R*-squared			0.115			0.025

* Models use OLS regression. *DummyLateDiscontinuations* equals one if losses on discontinuation exceed 1% of beginning-of-the-year assets and zero otherwise; *DummyDiscontinuations* equals one for firms that report losses on discontinuation, which are below 1% of beginning-of-the-year assets and zero otherwise. The number of observations is smaller than the earlier firms because it includes only those sample and corresponding control firms for which data also are available two years after sample firms announce discontinuations.
** One-tailed test for directional hypotheses.

DummyLateDiscontinuation (β_3) is positive, which suggests that late discontinuation firms improve the timeliness of loss recognition, responding to principals' demands.

The results of Eq. (5), presented in column 2 of Table 5, show that there is no change in capital expenditures of firms that shelve projects in a timely manner; however, there is a significant decline in capital expenditure of firms that report late discontinuations.

3.10. Results of tests using the conservatism ratio

In this section, we report the results of tests using an alternate measure of the timeliness of the recognition of economic news in accounting earnings, the Conservatism Ratio (Callen et al., 2010). This measure is based on the idea that current earnings, market returns, and the book-to-market ratio all contain information about future earnings and returns (the *expected* components). Accordingly, in this model, expected earnings and returns are obtained from the current year's variables using a system of equations that assumes a first-order vector autoregressive process. The unexpected component of earnings, the *earnings news*, is measured as actual accounting earnings minus *expected earnings*. Similarly, returns are decomposed into the *expected* and *unexpected* portions, with the latter further decomposed into the *earnings shock* (i.e., the true economic news) and the shock to the discount rate (Vuolteenaho, 2002). The Conservatism Ratio (CR) is defined as the ratio of *earnings news* to *earnings shock* that measures the extent to which accounting earnings incorporate economic news in a timely manner.

We calculate CR for all firm years.[14] We restrict our sample to non-financial firms with market value greater than $ 10 million and Compustat data on special items ("SPI") for 1968 to 2007. We retain firms with data on current and lagged returns, earnings and the book to market ratio, and eliminate observations with extreme values of each of these variables (based on 1st and 99th percentiles). Our sample univariate statistics and the parameters in the variance–covariance matrix (obtained from an intermediate step in calculating CR) are similar to those reported by Callen et al. (2010). We derive firm-specific unexpected earnings from expected earning models estimated by Fama–French industry groups and use the unexpected earnings to estimate CR for each firm-year. Similar to Callen et al. (2010), we retain firm years with positive CR, which leaves us with a sample of 74,584 observations. Next, we retain firms that report discontinuations and have data to estimate CR for all three years prior to the discontinuation year. We construct a control sample of firms that report no discontinuations using the matching procedure described in Section 3. This leaves us with a matched-pair sample of 997 firms.

We find that the average CR in the three years preceding the discontinuation is not statistically different for the sample and control firms. Nevertheless, we confirm the findings of the tests on the relation between earnings timeliness and the magnitude of discontinuation losses reported in Table 4 when we use CR in place of CSCORE. Specifically, we find that among firms that report discontinuations losses, the magnitude of losses decreases with the level of CR. Moreover, CR is negatively associated with the likelihood that a firm reports late discontinuations. This provides additional support for our hypothesis that the prompt reporting of economic news in accounting earning reduces the likelihood that managers continue unprofitable projects.

4. Supplementary tests to examine validity of DO measure

In this section, we examine the validity of our empirical measure of "economic losses" on project discontinuations: "Net Income (loss) from discontinued operations" in Compustat. This variable includes both the operating losses of the discontinued division and the capital losses on its disposal, and is stated on an after-tax basis. Both those losses are components of our intended construct of unprofitability of discontinued operations – the first loss represents the current operating losses and the second reflects the present value of future operating losses (adjusted for holding costs of disposed assets).

The "DO" measure is subject to three potential limitations. First, "DO" may not accurately represent either the accounting information or the construct of unprofitability of discontinued operations that we set out to examine. Second, "Net Income (loss) from discontinued operations" is likely to contain operating losses of the discontinued division for only a part of the year, and this might reduce its comparability across firms. Third, we deflate "DO" by the total assets of the firm and use that ratio for our main tests. While this ratio measures the economic significance of discontinuation for the firm, it might not accurately reflect the ROA of the discontinued operations that should ideally be based on the book value of its assets.

In order to address those potential concerns and to test the statistical and construct validity of our total-assets deflated "DO" measure, we hand collect data from firms' 10-K filings. To economize on hand collection costs, we shortlist S&P 1500 firms with total assets greater than $ 1000M. Then, we retain observations consistent with SFAS 121 and SFAS 144 accounting regimes (but not with APB 18 regime), which leaves us with 431 observations. Of those observations, we could obtain data on operating losses of discontinued operations and their asset values (either value of assets held for sale or asset values of discontinued operations) for 238 observations, which we use to calculate return on assets (ROA) of the discontinued operations in the pre-disclosure year. We found data on disposal gains (losses) for 142 observations.

First, we test the statistical validity of data field "DO" in the Compustat database. "DO" matches the hand-collected data on a dollar-to-dollar basis for 97% of the 238 observations described above. This 97% matching is made up of matches with operating losses (59%) and matches with the sum of operating and disposal losses (38%). These tests establish the statistical validity of the "DO" measure.

Next, we examine the construct validity of total-assets deflated "DO" measure that we use for our main tests. We find that the ROA of the discontinued division in the year prior to the discontinuation year is highly correlated with DO deflated by total assets: The Pearson correlation coefficient is 0.24, and the Spearman

[14] We are grateful to the authors of Callen et al. (2010) for sharing the SAS programming code for calculating CR.

correlation coefficient is 0.54, both significant at *p*-level better than 0.01. Similarly, the deflated disposal losses are highly correlated with DO deflated by total assets: The Pearson correlation coefficient is 0.57, and the Spearman correlation is 0.82, both significant at *p*-level better than 0.01. Those tests establish the construct validity of "DO" measure.

Next, we test whether the two components of "DO" are correlated, which would suggest that we would obtain consistent results using DO or either of its components. We find that the ROA of discontinued operations in the year before the discontinuation year is highly correlated with the deflated disposal losses, both calculated using book value of discontinued assets: The Pearson (Spearman Rank) correlation coefficient is 0.42 (0.50), both significant at *p*-level better than 0.01.

Many firms discontinue profitable operations, which is apparently contrary to our conjecture that firms only close unprofitable operations. However, firms may close profitable operations that do not earn the cost of capital or meet the firms' internal hurdle rate of return. We test that conjecture next. We calculate the difference between the ROA of the rest-of-the-firm (i.e., without the discontinued division) and the ROA of the discontinued division in the year before the discontinuation year. First, we find that the average (median) difference in the two ROAs is 0.03 (0.02) indicating that firms discontinue projects with profitability lower than the rest of their operations. Moreover, as we expect, both deflated disposal values and our empirical measure (that is, the total-asset-deflated "DO" measure) are negatively associated with the difference of ROAs. The Pearson (Spearman Rank) correlation coefficients are −0.40 (−0.44) and −0.22 (−0.42), all significant at *p*-level better than 0.01. In other words, the lower the profitability of discontinued operations relative to that of the rest of the firm, the lower the disposal proceeds, and the more negative the total-asset-deflated "DO" measure.

5. Conclusion

In the normal course of business, firms undertake capital projects, some of which later turn out to be unprofitable. Managers receive information about expected cash flows from those unprofitable projects earlier than the principals. Managers can limit firms' economic losses by closing unprofitable projects in a timely manner. However, managers may continue to operate unprofitable projects to build "empires", to protect their performance-based bonuses, and to avoid signaling bad performance to retain their employment. Prior studies argue that prompt loss recognition can reduce such agency costs by improving monitoring of managers and by reducing incentives for managers to delay closures of unprofitable projects. However, no prior study has empirically examined this notion. Francis and Martin (2010) find that prompt loss recognition is associated with more profitable acquisition strategies and more prompt post-acquisition divestitures of unprofitable investments. We extend their study by examining whether timely loss recognition is associated with timely closures of unprofitable projects.

We use firms' reporting of discontinued operations as a proxy for the termination of unprofitable projects. We form a control group of firms that did not report any discontinuations, but belong to same industries as discontinuation firms and have similar size. We assume that industry- and size-matched control firms have similar investment opportunities and face similar economic shocks as discontinuation firms. We find that in the three years prior to reporting discontinuations, sample firms have timelier loss recognition than the control firms. Moreover, firms that announce large discontinuation losses have less effective timely-loss-recognition governance than the other firms.

We argue that after firms announce late discontinuations, principals would demand improved timeliness of loss recognition. As expected, the inter-temporal change in CSCORE is greater for late discontinuation firms than for the other firms in the same period. Moreover, we find evidence that the managers of late discontinuation firms are restrained from implementing further capital expenditure projects.

Our study provides empirical support for the notion that prompt loss recognition reduces agency costs by improving board of directors', lenders', and shareholders' monitoring of managers' investment activities. We extend Francis and Martin (2010) by providing empirical evidence that prompt loss recognition provides alternate corporate governance mechanism for checking managers' tendency to continue implementing unprofitable projects.

Appendix A. Measure of timeliness of loss recognition

A.1. Loss-term coefficient in CSCORE (Khan and Watts, 2009)

Basu's equation for measuring conservatism is as follows:

$$X_{it} = \beta_1 + \beta_2 \times D_{it} + \beta_3 \times R_{it} + \beta_4 \times D_{it} \times R_{it} + \varepsilon_{i,t}, \tag{A1}$$

where X is the annual earnings and R is the returns during the year. D takes a value of 0 if firms have positive returns and 1 if firms have negative returns. Effectively, β_4 measures the differential timeliness of recognition of economic loss in accounting earnings relative to that of economic gains.

Khan and Watts (2009) modify the measure using the following equation:

$$\begin{aligned} X_{it} = {} & \beta_{1t} + \beta_{2t} \times D_{it} + \beta_{3t} \times R_{it} \times (\mu_1 + \mu_2 \times Size_{it} + \mu_3 \times M/B_{it} + \mu_4 \times Lev_{it}) + \beta_{4t} \times D_{it} \times R_{it} \\ & \times (\lambda_1 + \lambda_2 \times Size_{it} + \lambda_3 \times M/B_{it} + \lambda_4 \times Lev_{it}) + \beta_{5t} \times (v_2 \times Size_{it} + v_3 \times M/B_{it} + v_4 \times Lev_{it}) \\ & + \beta_{6t} \times D_{it} \times (\omega_1 + \omega_2 \times Size_{it} + \omega_3 \times M/B_{it} + \omega_4 \times Lev_{it}) + \varepsilon_{it}, \end{aligned} \tag{A2}$$

where *Size* is the natural log of market value, M/B is the market to book ratio, and *Lev* is the leverage of the firm.

In Eq. (A2), the terms that are multiplied by D (the second, fourth, and sixth terms) are zero for gains observations (firms whose returns are positive). Because we focus on cross-sectional variation in the timeliness of loss recognition, we exclude the gain term and estimate the following equation on firms with negative returns.

$$\begin{aligned} X_{it} = {} & \beta_{1t} + \beta_{2t} \times R_{it} \times (\mu_1 + \mu_2 \times Size_{it} + \mu_3 \times M/B_{it} + \mu_4 \times Lev_{it}) + \beta_{3t} \times (v_2 \times Size_{it} + v_3 \\ & \times M/B_{it} + v_4 \times Lev_{it}) + \varepsilon_{it}. \end{aligned} \tag{A3}$$

We exclude finance firms and firms with share prices less than \$ 1, and we calculate regression parameters separately for each year (α_{1t}, α_{2t}, α_{3t}, α_{4t}, and α_{5t}) using Eq. (A4).

$$\begin{aligned} X_{it} = {} & \alpha_{1t} + \alpha_{2t} \times R_{it} + \alpha_{3t} \times Size_{it} \times R_{it} + \alpha_{4t} \times M/B_{it} \times R_{it} + \alpha_{5t} \times Lev_{it} \times R_{it} + \alpha_{6t} \times Size_{it} + \alpha_{7t} \\ & \times M/B_{it} + \alpha_{8t} \times Lev_{it} + \varepsilon_{it}. \end{aligned} \tag{A4}$$

Then we calculate CSCORE (loss recognition) for each firm year using coefficients estimated for that year as follows:

$$CSCORE_{i,t}(\text{loss recognition}) = \tilde{\alpha}_{2t} + \tilde{\alpha}_{3t} \times Size_{it} + \tilde{\alpha}_{4t} \times M/B_{it} + \tilde{\alpha}_{5t} \times Lev_{it}. \tag{A5}$$

We define variables similar to Khan and Watts (2009) as follows (data items in Compustat):

Earnings	Earnings per share (EPSFX) divided by beginning price (PRCC_F)
Returns	[change in price + dividends (DVPSX)]/beginning price. The variables are adjusted for stock splits using adjustment factor (AJEX)
M/B	Market value of equity [Price × Number of shares outstanding (CSHO)]/book value of equity (CEQ)
Size	Natural log of market value of equity
Leverage	Total Debt [Long term debt (DLTT) + debt in current liability (DLC)]/Market value of equity

All variables are winsorized at the 1st and 99th percentile by year.

Following is the comparison of coefficients on loss terms with those reported by Khan and Watts (2009) (obtained by adding coefficient on gains term and loss interaction terms in Table 3).

		Our calculations		Khan and Watts (2009)
		Mean across years	Median across years	
First term	$\tilde{\alpha}_{2,t}$	0.232	0.233	0.268
Size term	$\tilde{\alpha}_{3,t}$	−0.024	−0.024	−0.028
Market to book term	$\tilde{\alpha}_{4,t}$	0.009	0.006	−0.013 (NS)
Leverage term	$\tilde{\alpha}_{5,t}$	0.069	0.066	0.038

Following is the comparison of CSCORE (for loss observations) with those reported by Khan and Watts (2009) (obtained by adding coefficient on CSCORE and GSCORE in Table 4 Panel A).

	Our calculations		Khan and Watts (2009)
	Mean	Median	
CSCORE (for loss observations)	0.157	0.139	0.153

The slight differences from the Khan and Watts (2009) estimates are likely for the following reasons:

1. Unlike Khan and Watts (2009), we exclude finance firms (SIC Codes 6000 to 6999) from our analysis.
2. Unlike Khan and Watts (2009), we winsorize our data at 1st and 99th percentile by year.
3. Khan and Watts (2009) measure fiscal year returns over 12 months beginning in the month after the earnings announcement. We measure fiscal year returns over the fiscal year.
4. Our measurement period is 1972 to 2007 as against 1963 to 2005 in Khan and Watts (2009).

Appendix B. Definitions of variables

Discontinuations	When firms report non-zero gains and losses from discontinued operations (DO)
DummyDiscontinuation	Takes value one in the years in which firms announce a discontinuation and zero otherwise
Late discontinuations	When firms report losses from discontinued operations exceeding 1% of beginning-of-the-year assets (AT)
DummyLateDiscontinuation	Takes value one in the years in which firms announce a late discontinuation with large losses and zero otherwise
Sample firms	Firms that report discontinuations, but do not report discontinuations in the previous three years
Control firms	Firms that belong to the same industry as sample firms (have same 3-digit or 2-digit SIC code), are closest in asset size to sample firms four years prior to their reported discontinuations, and do not report any discontinuations
Assets	Total assets (AT)
Revenue	Revenue (SALE)
Market value	Market value of equity [Price (PRCCF) × Number of shares outstanding (CSHO)]
Net income	Income before extraordinary items (IB)
Capital Expenditure	Capital expenditure (CAPX)
Market to book ratio	Market value of equity/book value of equity (CEQ)

CashDeficiencyQuartile Rank	Inverse quartile rank of cash balance (CHE) by industry (3-digit SIC code) and year
LogSize	Natural log of market value of equity
Deflated Capital Expenditure	Capital Expenditure (CAPX)/beginning-of-the-year assets (AT)
Funds raised	Funds raised [debt issued (DLTIS) + Equity issued (SSTK)]/beginning-of-the-year assets
ROE	Income before extraordinary items (IB)/book value of equity (CEQ)
ROA	Operating Income After Depreciation (OIADP)/Beginning-of-the-year Assets (AT)
Asset Turnover	Revenue/Assets
Dummy_APB30_year	Takes value one if discontinuation year falls between 1973 and 1996 and zero otherwise
Dummy_SFAS121_year	Takes value one if discontinuation year falls between 1997 and 2001 and zero otherwise
Dummy_SFAS144_year	Takes value one if discontinuation year is after 2001 and zero otherwise

All variables are winsorized at the 1st and 99th percentile.

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Insider trading under trading ban regulation in China's A-share market☆

Chafen Zhu [a,*], Li Wang [b]

[a] School of Management, Zhejiang University, China
[b] University of Akron, USA

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ABSTRACT

This study examines the effects of China's 2008 trading ban regulation on the insider trading of large shareholders in China's A-share market. It finds no evidence of insider trading during the ban period (one month before the announcement of a financial report), due to high regulation risk. However, the ban only constrains the profitability of insider trades during the ban period, while trades outside it remain highly profitable. Informed insider trading before the ban period is 2.83 times more profitable than uninformed trading. The regulation has changed insider trading patterns, but has been ineffective in preventing insider trading by large shareholders due to rigid administrative supervision and a lack of civil litigation and flexible market monitoring. This study enhances understanding of large shareholders' trading behavior and has important implications for regulators.

1. Introduction

When China's A-share market was initially established, it comprised two types of stocks, tradable and non-tradable. Stocks owned by large shareholders and executives were mostly non-tradable and could not be traded in the secondary market. This issue of market segmentation between tradable and non-tradable

* Corresponding author.
E-mail address: zhuchafen@163.com (C. Zhu).

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stocks was resolved at the end of 2005 with the A-share market reform. To mitigate the supply pressure on the secondary market resulting from this change, the Chinese Securities Regulatory Commission (CSRC) established a lockup period of one to three years so that the non-tradable stocks could not be sold immediately. Since the beginning of 2007, the locked-up stocks have gradually become tradable. By the end of 2011, almost all of the non-tradable shares had become tradable, with insider trades happening more frequently. According to the Wind Database, during the 2007–2012 period, there were 24,152 executive transactions and 10,059 large shareholder transactions. Insider trades began to profoundly affect the stock market's development. However, due to the lack of a sound transaction monitoring system and mechanisms to protect investors' interests, insider trading became prominent in the A-share market. The current fight against insider trading is facing serious challenges. How to improve the effectiveness of insider trading regulation under the new circumstances is not only an important academic research issue, but also a regulatory challenge.

Earnings announcements are listed companies' most important periodic announcement. Information asymmetry between insiders and outsiders is amplified around the earnings announcement period, as it provides stronger incentives for insiders to use earnings information to trade. To keep insiders from trading on earnings information, most countries have implemented a mandatory regulation prohibiting insiders from trading during a short period before earnings announcements—often referred to as the trading ban regulation. In the United Kingdom, as early as 1977, regulators began prohibiting insider trading two months before an earnings announcement. In the United States, while there is no mandatory insider trading ban regulation, increased litigation risk has prompted many large companies to voluntarily implement trading ban policies. The Hong Kong Stock Exchange announced a new rule extending the board of directors' trading ban period from 30 to 60 days before the year-end earnings announcement on February 12, 2009. More than 200 listed companies jointly opposed the amendment and the event became the market's worst fight against the regulatory body since the 2002 "penny stock incident." However, as the Hong Kong Stock Exchange notes, other regulations such as penalties for insider trading often take years of investigation and have little success. In comparison, the trading ban regulation has eliminated trading opportunities during a period within which insiders are most likely to possess an information advantage. This regulation can effectively minimize the occurrence of insider trading, and thus has become a very useful tool for the regulators in restraining insider trading.

The CSRC enacted trading ban regulations on executives and large shareholders' trades in April 2007 and April 2008, respectively. The regulations prohibit executives from trading 10 days before earnings preannouncements and 30 days before the formal financial report is issued. In addition, large shareholders with more than 30% of shares are prohibited from purchasing 10 days before earnings preannouncements and 10 days before the formal financial report is issued. They are also prohibited from selling 30 days before the semi-annual and annual financial reports. Would insiders give up the chance to profit on earnings information under the trading ban regulation? Media reports on insider trading around the ban period are plentiful. For example, the chairman of Bishengyuan significantly reduced his holdings right before the trading ban period of the 2012 annual report, as the company was expected to have losses in 2012 and 2013, causing the stock price to drop 35% within 3 days. Faced with the trading ban regulation, insiders may adjust how they trade and conceal informative trading activities. What is the new insider trading pattern under the ban regulation? The game between insiders and regulators creates uncertainty regarding the regulation's effectiveness, but can a trading ban regulation effectively reduce insider trading profitability?

Table 1
Trading ban regulations.

Type of insider	Market	Earnings preannouncements	Annual and semi-annual financial reports	Quarterly financial reports
Directors, Supervisors, Managers (Executives)	Main board and SME board	Cannot buy or sell 10 days before	Cannot buy or sell 30 days before	Cannot buy or sell 30 days before
Largest shareholder $\geqslant$30% and ultimate controlling owner	Main board	Cannot buy 10 days before	Cannot buy 10 days before; cannot sell 30 days before	Cannot buy 10 days before
Largest shareholder $\geqslant$30% and ultimate controlling owner	SME board	Cannot buy or sell 10 days before	Cannot buy or sell 15 days before	Cannot buy or sell 15 days before

Using the Chinese corporate governance and regulatory environment as our setting, we are the first to examine the new insider trading patterns generated by the trading ban regulation. We also evaluate the regulation's effectiveness from an insider trading profitability perspective. Trading behavior is systematically different between executives and large shareholders, and the corresponding ban policies also differ. The largest shareholder is at the core of corporate governance, as the size of their transactions and market influence far exceed that of the executive transactions. Thus, we focus on largest shareholder transactions in this paper.

We find that during the trading ban period (one month before the announcement of a financial report), large shareholder trading is not evident due to high regulation risk. However, private companies' large shareholders choose to trade before the ban period while those of state-owned companies choose to trade after the ban period to exploit private earnings information. Private companies' large shareholders prefer to trade on annual or semi-annual reports, whereas those of state-owned companies prefer to trade on quarterly reports associated with lower regulation risk. Private and state-owned companies operate from different corporate governance backgrounds, and the different trading behavior identified above corresponds to the differences in information advantages, profit-seeking incentives and risk preferences of private and state-owned shareholders. From the perspective of regulation effectiveness, the trading ban regulation can constrain the profitability of insider trading within the ban period, but high profitability still exists for insider transactions immediately outside the ban period. In particular, insider informative trades before the ban period can achieve profits that are 2.83 times those of uninformed trades. The abnormal returns obtained by large shareholders of private companies and those with less than 30% ownership are particularly prominent.

In summary, the trading ban regulation can only constrain insider trading to a certain extent. Large shareholders can adjust trading by following the regulation in appearance but executing informative trading around the ban period. The regulation has changed insider trading patterns, but it has not effectively prevented large shareholders from engaging in insider trading. The compromised effectiveness of the regulation is partially due to the fact that the regulatory tools used to prevent insider trading are very limited. Currently, there is a lack of civil litigation and other flexible market monitoring tools to deal with insider trading, and the monitoring function relies solely on the rigid administrative supervision of the CSRC, the loopholes which can be used by insiders to outwardly conform to the regulations while actually profiting from insider trading. To improve the effectiveness of insider trading regulations, administrative supervision must be integrated with a flexible market monitoring system. A civil litigation system also needs to be established against insider trading, and media monitoring should be used.

This paper has important theoretical contributions. First, the literature on insider trading focuses mainly on mature markets, and there is a considerable lack of research on emerging markets. The stock markets in China are emerging and in transition toward a market economy. Thus, regulatory enforcement and investor protection are relatively weak and corporate governance and market efficiency are merely adequate. Insider trading is facing fewer regulatory and market constraints, so trading behavior and the effectiveness of regulatory policies in China are significantly different from those in mature markets. This paper complements the literature by providing new evidence on insider trading and the regulation's effectiveness in emerging markets. The findings clarify how different institutional backgrounds and regulatory environments affect insider trading behavior. Second, the insider trading literature focuses mostly on executives, not large shareholders, mainly due to the fact that in Western markets, ownership is more dispersed and large shareholders do not have much of an information advantage. However, in China's A-share market, ownership is highly concentrated and the largest shareholders usually play a central role in corporate governance, obtaining important insider information by controlling the board of directors and management. Focusing on largest shareholder transactions, this study extends the literature by investigating how ownership attributes affect large shareholders' trading behavior. We find that large shareholders of private companies and state-owned entities trade differently under the trading ban regulation, possibly due to differences in their information advantages, profit-seeking incentives and risk preferences. Third, this study contributes to the research on the relationship between regulation and insider trading. The mandatory trading ban regulation is a key regulatory tool widely used around the world, except in the United States; however, relevant research is limited and focuses mainly on its economic consequences. Few have examined how this type of regulation affects insider trading behavior. This paper systematically studies how a newly introduced trading ban regulation affects large shareholders' trading behavior in China. We find that corporate governance and regulation risk systematically affect large shareholders'

trading patterns. The type of financial reports (annual or quarterly), state-owned or private companies and high or low ownership are all factors influencing large shareholders' trading patterns.

2. Literature review

To prevent insider trading around earnings announcements, most stock markets outside the United States use a mandatory trading ban regulation. However, in the United States, regulators do not set a mandatory trading ban period. The Insider Trading Sanctions Act of 1984, the Insider Trading and Securities Fraud Enforcement Act of 1988 and the Public Company Accounting Reform and Investor Protection Act of 2002 (hereafter SOX) have significantly increased regulatory penalties related to insider trading before earnings announcements. To respond to soaring regulation and litigation risk, many large companies have voluntarily set up trading ban periods. Bettis et al. (2000) find that 78% of their sample firms in the United States voluntarily set trading ban periods before earnings announcements. The general practice is to allow insiders to trade only 3 to 12 days after earnings announcements. How do significant changes in regulatory environment affect insider trading? Are mandatory or voluntary trading ban policies effective, and what are their economic implications? These questions are proving to be interesting research issues.

First, increased regulation risk has changed the timing of insider trades around earnings announcements. Trades before announcements have dropped significantly, while those after announcements have soared. Particularly, insider sales are postponed after negative earnings announcements because sales before bad news are more likely to trigger litigation than those before good news (Sivakumar and Waymire, 1994; Lustgarten and Mande, 1995; Garfinkel, 1997).

Second, the regulations have effectively constrained insider trading shortly before earnings announcements. Previous research suggests that insider trading in the short window before earnings announcements has become less evident (Elliot et al., 1984; Givoly and Palmon, 1985; Lustgarten and Mande, 1995; Sivakumar and Waymire, 1994). Garfinkel (1997) finds that after the Insider Trading and Securities Fraud Enforcement Act, earnings announcements have had higher information content, consistent with the decrease in insider trading before earnings announcements after the act. According to Brochet (2010), as SOX shortened the disclosure period for insider transactions to two days while increasing legal penalties, the information content of insider transaction disclosure announcements after the SOX era also increased. Meanwhile, insider sales before negative earnings news and stock price drops have also decreased.

However, insiders have not completely given up the use of inside information. Instead, their trading has become more sophisticated and subtle. Research using short-term windows finds that even though insider trading has become less evident in the short period before earnings announcements, insiders still use the earnings information to trade after announcements, and passive trading has become more prevalent (Elliot et al., 1984; Givoly and Palmon, 1985; Lustgarten and Mande, 1995; Sivakumar and Waymire, 1994). Studies focusing on long-term windows (Ke et al., 2003; Piotroski and Roulstone, 2005) find that insiders continue to use important future earnings information (such as an interruption of quarterly earnings' continuous growth) to trade, normally 3 to 9 quarters in advance. Huddart et al. (2007) find that insider trading is associated with regulation risk. In the United States, regulatory and judicial practices oppose insider trading before earnings announcements without explicitly opposing insider trading before the official filing of financial reports. Thus, regulation risk is highest shortly before earnings announcements, but relatively low before the filing of financial reports. They also find that insiders do not use information in earnings announcements, but they do use information in financial reports to trade.

As an important regulatory policy, the effectiveness of the trading ban regulation and its economic implications have gained the attention of academics and regulators. The regulation is thus expected to become a double-edged sword. On the one hand, the implementation of the ban period reduces insider trading profitability, protects the interests of external investors and thereby increases market liquidity. On the other hand, the implementation prohibits insider trading before earnings announcements, which is not conducive to conveying private inside information to the markets, thereby reducing the timely reflection of earnings information in stock prices. Empirically, Bettis et al. (2000) find that the United States' company-level ban regulation effectively curbs trading activity before earnings announcements and reduces trading profits within the ban period while improving market liquidity. Hillier and Marshall (2002) find that the United Kingdom's

two-month ban period regulation does not significantly increase the opportunity cost of insider trading, and the regulation's effect on reducing trading profits is limited. Kabir and Vermaelen (1996) find that the trading ban regulation launched by the Netherlands in 1987 has failed to improve market liquidity, and the speed with which stock prices reflect positive earnings information has also decreased.

In summary, the relevant insider trading literature focuses mostly on mature markets in the United States and the United Kingdom, creating a lack of research on emerging markets. Research on these mature markets finds that insider trading on earnings information is more subtle and complex due to increased regulations, and that trading ban policies, whether at the voluntary or mandatory country level, significantly affect insider trading behavior, trading profitability, market liquidity and price efficiency. The effects differ by market, making it necessary to examine the issues in specific markets and regulatory backgrounds.

Insider trading has become a relatively new research topic for the A-share market since 2007. Many relevant studies focusing on the short-term abnormal returns of insider trades find that large shareholders and executive trading can obtain significant short-term abnormal returns (Zeng, 2008; Zhu et al., 2011a; Cai, 2011). Zhu et al. (2011b) find that executive trading uses private information on stock mispricing and future earnings changes, so that executive trading can gain long-term abnormal returns. Zhu et al. (2014) find that aggregate insider trading strongly predicts future market returns while corporate governance affects the predictability of aggregate insider trading. Zhang and Zeng (2011) find that trading conducted by insiders' relatives is probably an alternative, subtle form of insider trading. Many studies also note that insiders can manipulate information disclosure to benefit their trading. Wu and Wu (2010) find that companies disclose good news before shareholders sell or postpone bad news after they sell. Wang and Lian (2009) find that the timing of large shareholders' sales interacts with that of management forecasts. Some research examines the effectiveness of the regulatory policies. Zeng and Zhang (2009) find that executive short-swing trading can obtain abnormal returns. Zhu et al. (2013) find that insiders can increase trading profits by delaying the disclosure of transaction information. In summary, the empirical evidence suggests that insiders in the Chinese markets can obtain abnormal returns. Likewise, relevant regulatory enforcement is loose, providing insiders with opportunities to obtain excess returns. The literature on Chinese stock markets mainly focuses on insider trading profitability, with little direct investigation of insider trading on specific events and the effectiveness of regulations. Research on the trading ban regulation is basically nonexistent.

3. Sample and descriptive statistics

The background of large shareholder trading in the A-share market, which is quite unique, is related to the tradable share reform and the lockup arrangement. Before the reform, non-tradable shares could not be sold in the secondary market, and the prices of non-tradable shares were significantly below those of tradable shares in the secondary market. The reform allowed non-tradable and tradable shareholders to negotiate and agree on compensation packages that the non-tradable shareholders would pay to obtain the right to trade. The compensation packages generally include paying cash dividends, granting bonus shares, insider stock lockup provisions and other commitments. Regulators did not interfere with the design of such compensation packages, but they did limit the minimum lockup period to one year for executives and large shareholders with more than 5% ownership. Most companies' largest shareholders committed to a lockup period of 2–3 years. The compensation package selected by each company is different, as is the time it takes to convert all of the non-tradable shares. To alleviate the effect of the lockup expiration on the secondary market, regulators required that insiders did not sell their stocks all at once after the lockup expired. Instead, executives were allowed to sell up to 25% of their shares each year and large shareholders with more than 5% ownership could not sell more than 5% of their total shares within 12 months and more than 10% of their total shares within 24 months.

Companies gradually started to remove the lockup and insiders started to trade in 2007. On April 10, 2007, the CSRC issued "Rules on Company Stocks Owned and Traded by Directors, Supervisors and Senior Management," which enacted the trading ban policy around earnings announcements. It was not until

Table 2
Time Difference between Earnings Disclosure Date and End of the Accounting Period.

	Mean	Median	Std.	p5	p95
Quarterly earnings	25.425	26	4.056	18	30
Semi-annual earnings	47.811	50	11.028	26	61
Annual earnings	89.597	90	22.986	45	119
All	45.281	30	27.997	20	110

April 2008[1] that the CSRC issued the "Advice on the Sale of Stocks after Removal of the Lock-up" and proposed a trading ban policy for large shareholders of listed companies on the main board. It stipulates that large shareholders with more than 30% ownership and ultimate controlling shareholders are prohibited from selling 30 days before annual and semiannual financial reports. In August 2008, the Shanghai and Shenzhen Stock Exchanges issued the "Guidance on Large Shareholders of Listed Companies Buying Stocks" (amended on September 24, 2008). It specifies that large shareholders with more than 30% ownership and ultimate controlling shareholders cannot buy stocks 10 days before earnings preannouncements and 10 days before formal financial reports, as shown in Table 1. The trading ban policies for the small and medium-sized enterprise (SME) board are different from those of the main board. Because there is a limited number of earnings preannouncements[2] and the lengths of the trading bans between the SME and main boards differ, here we only focus on the trading of the largest shareholders of the main board companies around formal financial reports (including quarterly, semi-annual and annual). The main board's trading ban on shareholders' selling is restricted to large shareholders with more than 30% ownership and specific types of financial reports (annual and semi-annual reports), so the policy can result in different regulation risks for shareholders' trading. Accordingly, we examine whether the differences in regulation risks result in different trading behavior.

Largest shareholders' trading data are sourced from the Wind database. The trading data are from January 1, 2007 to September 30, 2011. This includes shareholder trading data through the continuous auction system and the block trade platform. We exclude trading below RMB300,000[3] and trading of B-share companies and companies of the Growth Enterprise Market (GEM), leaving us with 1,965 transactions. We examine transactions around financial reports and decide to focus on transactions within [−60, 10] days of the disclosure date for financial reports, which further reduces the sample size. The [−60, 10] window covers the trading ban period, specifically, one month before and 10 days after.

According to the Chinese financial reporting disclosure requirements, quarterly earnings must be disclosed within one month after the quarter-end; semi-annual earnings within two months after the half-year-end; and annual earnings within four months after the year-end. Based on the statistics shown in Table 2, the actual disclosure dates are consistent with the disclosure requirements. Generally, the median and mean of the time difference between the formal report disclosure date and the end of the accounting period are 30 and 45.28 days, respectively. The later the disclosure of earnings, the more accurate insiders' private earnings information.

We provide the statistics for transactions within the [−60, 10] window of the disclosure date for financial reports in Table 3. We use the trading date of the largest shareholder minus the earnings disclosure date to obtain the "time gap." If we have several time gaps for the same transaction, because there are several earnings disclosures for each company, we use the time gap with the smallest absolute value. The results based on this method are shown as the "original results" in Table 3. A total of 48% of the transactions occurred in the [−60, 10] window, but transactions with time gaps greater than 10 are not likely to be using information from the

[1] There are two key reasons why regulations regarding large shareholder trading were issued later. First, the lockup period for large shareholders is usually longer than that for executives, so large shareholder trading was rare before 2008. Second, trading ban regulations in most jurisdictions (especially those in Hong Kong, as they are more influential for policies in mainland China) primarily focus on executive trading, so there is less to be learned about how to regulate large shareholder trading.

[2] Mandatory earnings preannouncements are limited to three situations (loss, earnings change of 50% or above and change of loss to profit).

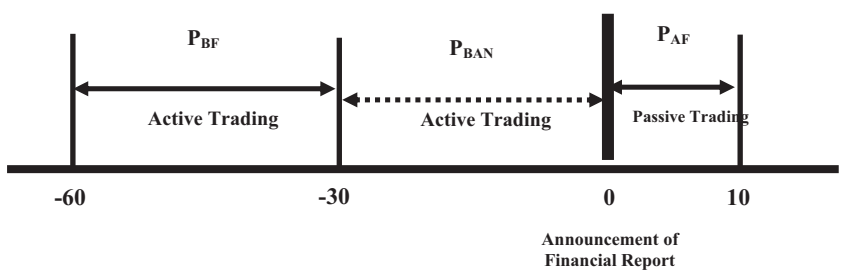
[3] The information content of transactions with small amounts is low, so they are excluded. The threshold of RMB300,000 is 1 quantile of the selling transactions amount and 5 quantiles of the buying transactions amount.

Table 3
Time gap between trading date of largest shareholders and earnings disclosure date.

Original result			Adjusted result for trades (10, 90]		Adjusted result for all trades		
Window	No. of trans.	%	Window	No. of trans.	Window	No. of trans.	%
			[−157, −120)	216	[−181, −120)	216	0.11
[−120, −90)	8	0.00	[−120, −90)	271	[−120, −90)	279	0.14
[−90, −60)	91	0.05	[−90, −60)	232	[−90, −60)	323	0.16
[−60, −30)	366	0.19	[−60, −30)	187	[−60, −30)	553	0.28
[−30, 0]	331	0.17	[−30, 0]	15	[−30, 0]	346	0.18
(0, 10]	248	0.13			(0, 10]	248	0.13
(10, 30]	439	0.22					
(30, 60]	368	0.19					
(60, 90]	114	0.06					
Total	1965	1.00	Total	921	Total	1965	1.00

previous earnings disclosure. Instead, they are probably using forthcoming earnings disclosures. Thus, we make an adjustment to calculate the time gap between the trading date and the forthcoming earnings disclosure for this type of transaction. The statistics based on this adjustment method are shown as the "adjusted results." Under the adjusted method, 58% of the transactions occur within the [−60, 10] window and there are 1,147 transactions. We think that the [−60, 10] window effectively captures insider trading around earnings disclosures.

To examine the effect of the trading ban regulation, the [−60, 10] window is further divided into three periods: within the ban period (P_{BAN}, one month before earnings disclosure, also referred to as the window period or the sensitive period), one month before the ban period (P_{BF}) and 10 days after the ban period[4] (P_{AF}).



The ways in which insiders use earnings information can be divided into active and passive trading (Hillier and Marshall, 2002; Huddart et al., 2007; Kolasinski and Li, 2010). Active trading is when insiders use earnings information to trade before an earnings announcement (P_{BF}, P_{BAN}), e.g., selling (buying) before bad (good) earnings news is announced. Passive trading is when insiders have knowledge of forthcoming earnings information, but postpone trading until after the earnings announcement, e.g., buying (selling) after the bad (good) earnings news is announced. Passive trading after an earnings announcement cannot be effectively

[4] There are two reasons why we use 10 days instead of 30 days after the trading ban period for P_{AF}. The first is to avoid overlapping transactions. Sometimes, the period between two earnings disclosures is very short, so one transaction can fall under multiple windows, e.g. 30 days after the previous announcement [0, 30] and 60 days before the next earnings announcement [−60, 0]. This results in overlapping observations. To be more specific, if we use the [−60, 30] window, this issue becomes very problematic as 192 transactions (28%) are double counted, in the [0, 30] and [−60, 0] windows. If we use the [−60, 10] window, only 38 transactions are double counted, in the [0, 10] and [−60, 0] windows. Second, the effect of the earnings announcement on the stock price is most evident 10 days after the announcement. If insiders choose to passively trade on earnings announcement information, they are most likely to trade within the 10 days when there is more stock price reaction. Hillier and Marshall (2002) also use the 10 days after an earnings announcement [0, 10] to study passive trading.

Table 4
Sample selection.

Sample selection process	Number of transactions
[−60, 10] Trading of largest shareholders	1147
Plus: (0, 10] trading that also falls into [−60, 0] of the next earnings disclosure	38
Less: trading two days before and after earnings preannouncements	15
Less: trading of SME board companies	159
Remaining trading of main board companies	1011
Less: trading before the trading ban regulation is enacted	241
Remaining trading of main board companies after the trading ban regulation is enacted	770

separated from liquidity-driven transactions, so it is allowed by regulations and referred to as safety trading (Kallunki and Peltoniemi, 2009). Active trading happens before an earnings announcement and is the focus of insider trading regulation.

In the sample selection process, 38 transactions fall within the [0, 10] window of the previous financial report and within the [−60, 0] window of the next financial report. We keep these 38 transactions for both windows, and doing so in our sensitivity tests does not change the results. We also exclude 15 transactions around earnings preannouncements, as they are more likely to be related to earnings preannouncements instead of financial reports. Because the lengths of the trading ban periods differ between the main and SME boards, we exclude the 159 transactions from SME board companies. There are 1,011 remaining transactions from main board companies, 770 of which happened after the trading ban policies were issued (April 20, 2008 to September 30, 2011) and 241 of which happened before the trading ban policies (January 1, 2007 to April 19, 2008). In our analysis, we mainly use the largest shareholders' transactions of main board companies after April 20, 2008 (see Table 4).

Before the trading ban regulation, because most companies' large shareholders' shares were still locked, such shareholders' trading was less frequent and there were only 241 transactions in the [−60, 10] window, as shown in Table 5. However, after the trading ban regulation, the transactions increased to 770, with selling transactions accounting for about 70% and buying transactions accounting for only 30% of all transactions. It is possible that after the long lockup period, insiders were very motivated to cash in their shares. The mean trading amounts per transaction for buying and selling are RMB62,443,280 and RMB61,684,930, respectively, which have significant wealth effects. The median percentages of ownership traded between buying and selling are 0.001 and 0.010, respectively, so the ownership bought is much smaller than that sold.

In Table 6, we find that trading in the [−30, 0] window decreased from 42% of the transactions before the regulation to 28% of the transactions after the regulation, with the decrease mainly due to selling. In contrast, trading in the [−60, −30] window increased from 41% before to 51% after the regulation. An important change caused by the regulation is that it moves trading to before the ban period. The ban regulation only prohibits the trading of large shareholders with more than 30% ownership and trading around annual and semi-annual reports. Thus, there are legitimate transactions even during the ban period, P_{BAN}. This is why

Table 5
Descriptive statistics for largest shareholder trading before and after the trading ban regulation in the [−60, 10] window.

		Percentage of ownership traded			Shares traded (in 10,000)			RMB amount traded (in 10,000)		
	N	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.
Pre-regulation										
Buy	11	0.020	0.013	0.020	2045.308	323.147	4907.351	17545.467	2480.280	47097.432
Sell	230	0.014	0.012	0.011	527.063	380.013	486.376	7222.429	4408.156	8292.952
Post-regulation										
Buy	223	0.004	0.001	0.006	753.047	138.000	2775.782	5686.873	1135.417	20799.101
Sell	547	0.013	0.010	0.012	531.782	315.740	623.555	5725.339	3034.803	7175.080
All										
Buy	234	0.004	0.001	0.008	813.795	141.352	2906.873	6244.328	1159.711	22665.096
Sell	777	0.013	0.010	0.011	530.385	339.000	585.997	6168.493	3512.287	7548.894

Table 6
Distribution of largest shareholders' trading windows before and after the trading ban regulation.

	P_{BF} [−60, −30)		P_{BAN} [−30, 0]		P_{AF} (0, 10]		All	
	No. of transactions	%	No. of transactions	%	No. of transactions	%	No. of transactions	%
Before the trading ban regulation (2007.1.1–2008.4.19)								
Buy	4	0.36	4	0.36	3	0.27	11	1
Sell	94	0.41	97	0.42	39	0.17	230	1
Total	98	0.41	101	0.42	42	0.17	241	1
After the trading ban regulation (2008.4.20–2011.9.30)								
Buy	96	0.43	90	0.40	37	0.17	223	1
Sell	293	0.54	123	0.22	131	0.24	547	1
Total	389	0.51	213	0.28	168	0.22	770	1

we still observe 213 transactions in the [−30, 0] window after the regulation, including 30 transactions (about 14%) actually violating the regulation.

In China, the ownership types of listed companies are diverse, and include private- and state-owned. State-owned listed companies can be controlled by diverse types of ultimate owners, such as the central SASAC, local state-owned parent companies, local state-owned conglomerates, the local SASAC and public universities. As Table 7 shows, the trading of large shareholders in private companies is most active and accounts for 41.7% of all transactions. The trading of local state-owned parent companies accounts for 31.4% of all transactions.

4. Empirical tests I: The effect of trading ban regulation on insider trading patterns

4.1. Hypothesis development

Under the trading ban regulation, insiders can move trades to before (active) or after (passive) the trading ban period to avoid the ban period. Studies of United States' markets find that passive trading is the main coping strategy, consistent with the increased regulation and litigation risk related to active trading (Elliot et al., 1984; Givoly and Palmon, 1985; Lustgarten and Mande, 1995; Sivakumar and Waymire, 1994; Ke et al., 2003). However, in China's A-share market with its different regulatory environment, it is possible that insider trading patterns under the ban regulation are different.

The severe regulatory penalties, flexible civil legal system and efficient judicial system in the United States provide an effective regulatory environment to combat insider trading. The American legal system has imposed severe penalties against insider trading. The Insider Trading Sanction Act of 1984 stipulates that insider traders will receive criminal fines whether they have profited from the transactions or not. The Insider Trading and Securities Fraud Sanctions Act of 1988 increased the individual criminal imprisonment term from 5 to 10 years and the individual maximum fines from $100,000 to $1 million. It also increased fines against an organization from $500,000 to $2.5 million and created a bounty system to encourage community oversight with the informant reporting insider trading receiving 10% of the penalty. Meanwhile, executives are responsible for subordinates' insider trading (Garfinkel, 1997). The 2002 SOX expands the penalties even further, increasing individual fines to $5 million at the upper limit and organizational fines to $25 million at the upper limit. Likewise, individual criminal imprisonment terms can be as long as 20 years. The United States Securities and Exchange Commission (SEC) has extensive power to enforce regulations against insider trading. The Insider Trading and Securities Fraud Sanctions Act of 1988 gives the SEC the power to impose civil penalties and prohibit executives involved in insider trading from serving in public companies (Shen, 2009). In civil litigation procedures, defendants usually have the burden of proof, which significantly increases the success rate of lawsuits against insider trading. Class action motivates lawyers and investors to launch legal actions against insider trading (Gao and Wang, 2000). Regarding insider trading before earnings announcements, the United States regulators do not impose mandatory and uniform trading ban periods; instead, they reserve substance-over-form discretion and rely on flexible civil litigation systems and stringent regulatory

Table 7
Ownership type of largest shareholder trading after the regulation.

Ownership type	Private-owned	State-owned entities (controlled by)					All
		Central SASAC	Local state-owned parent company	Local state-owned conglomerate	Local SASAC	Public university	
Number of transactions	321	121	242	53	29	4	770
%	41.7%	15.7%	31.4%	6.9%	3.8%	0.5%	100%

punishment as deterrents against insider trading. Even if insiders trade two months before earnings announcements and if there is an abnormal coincidence between the trading activity and the earnings information, the market and the regulators can still question whether there is insider trading. Regulatory scrutiny, litigation and the right to seek economic recovery are powerful weapons to prevent and detect insider trading activities. Under close regulatory and market monitoring, insider trading before earnings announcements faces high regulation and litigation risk. Studies note that insider trading before earnings announcements has become less evident, with more insiders choosing to trade after earnings announcements (Elliot et al., 1984; Givoly and Palmon, 1985; Lustgarten and Mande, 1995; Sivakumar and Waymire, 1994; Ke et al., 2003).

In China, the overall regulatory environment is less stringent, the securities-related civil judicial system is lacking and judicial enforcement is inefficient (Huang, 2005, 2012; Shen, 2009). These factors may have weakened the effectiveness of regulatory policies such as the trading ban regulation. There are no separate laws on insider trading, but there are stipulations against it in the Securities Act (effective in 1999 and amended in 2004, 2005 and 2013), the Criminal Law (effective in 1979 and amended in 1997, 1999, 2001, 2002, 2005, 2009 and 2011) and the Corporation Law (effective in 1994 and amended in 1999, 2004, 2005 and 2013). The Securities Act (2006) stipulates that illegal income from insider trading is confiscated in addition to possible administrative penalties up to five times the illegal income. For cases with illegal income less than RMB30,000, there is an administrative penalty between RMB30,000 and RMB600,000. For companies engaged in insider trading, the executives directly responsible for the incidents are given a warning and a penalty of RMB30,000 to RMB300,000. Cases involving serious violations of insider trading[5] are transferred to the judicial system to face criminal prosecution. The Criminal Law (1997) provides that serious cases involving insider trading or the leakage of inside information result in imprisonment or criminal detention of up to five years and a criminal fine of up to five times the illegal income. For very serious cases, the imprisonment term is between 5 and 10 years. The legal penalties for the Securities Act and the Criminal Law are relatively light and essentially principle-based. There are no corresponding operational judicial procedures to support, so it is difficult to enforce the laws (Huang, 2012). For example, the Securities Act (2006) suggests that insider trading leads to economic loss for investors, who may request a civil claim, but it does not provide details on how relevant civil lawsuits should be processed and, thus far, the court does not accept civil lawsuits for insider trading. In China, the legal system against insider trading depends on the CSRC's administrative and criminal sanctions, as civil litigation is lacking. However, the CSRC has limited enforcement power, financial resources and staff. It also lacks independence, so its effectiveness in enforcing insider trading is limited (Huang, 2012; Shen, 2009). In contrast, the court lacks experience related to securities litigation and the operational judicial interpretation of the laws, such that only a limited number of insider trading cases have been processed, and the processing cycle is long (Huang, 2012). From the perspective of regulatory and judicial practices, the CSRC only enforced penalties in 12 insider trading cases from 1990 to 2006 (Shen, 2009). From 2008 to 2011, it investigated 153 insider trading cases and imposed administrative penalties in only 31 cases, moving 39 cases to the judiciary system. From 2007 to 2011, the courts around the country finished only 22 cases related to insider trading and the administrative penalties and criminal fines in these cases were too light to have any deterrent effects (China Securities Journal, May 23, 2012).

On November 16, 2010, the State Council released the Advice on the Sanction and Prevention of Insider Trading in Capital Markets (hereinafter, "Advice") to the CSRC, the Ministry of Public Security, the

[5] When the amount of insider trading is above RMB500,000, insider trading profit is above RMB150,000 or there has been frequent insider trading.

Ministry of Supervision, the SASAC and the Prevention of Corruption Bureau. It urges the ministries to work together to prevent insider trading activities. The Advice notes that "the current fight against insider trading in capital markets is facing serious challenges." Since the Advice was released, different ministries have increased their joint sanction efforts. On March 29, 2012, the Supreme Court and the Supreme Procuratorate issued the Interpretations on the Application of Laws Related to Criminal Cases of Insider Trading and Leakage of Inside Information. This is the first legal interpretation regarding insider trading, and it provides systematic judicial interpretation of individuals with inside information and individuals who obtain inside information illegally, the sensitive period of inside information and the standards of insider trading conviction and penalties. Unfortunately, it does not mention civil action, which is still a serious deficiency in the legal system for insider trading.

At present, China's fight against insider trading depends on relatively rigid administrative regulations without effective civil litigation and market monitoring, and legal enforcement is weak (Huang, 2012; Shen, 2009). Current administrative regulations with rigid ban periods have limitations, as long as the transactions fall outside the ban period. Even when earnings information is used, insiders can easily bypass the regulatory penalties and thus do not have to worry about civil lawsuits. We predict that to avoid regulation risk, insiders will not trade within the trading ban periods P_{BAN}, but will actively trade around the trading ban period, P_{BF}.

Hypothesis 1. Active insider trading is not evident during the trading ban period, P_{BAN}, due to regulation risk.

Hypothesis 2. Active insider trading is evident around the trading ban period, P_{BF}, due to the lack of civil action against and market monitoring of insider trading.

Large shareholders in private and state-owned companies are significantly different in terms of their ability to obtain inside information, profit-seeking incentives and risk preferences. These differences could result in different trading behavior (Zhu et al., 2014).

From an information advantage perspective, large shareholders in private companies are often more involved in business operations and have much tighter control over the listed companies' operating decisions and the selection of the executives. This gives them a more substantial information advantage than large shareholders in state-owned entities, among them the largest shareholders of local state-owned parent companies have relatively more control over the operating decisions of the listed companies. The large shareholders of other state-owned entities may be overloaded by monitoring too many companies or still be bothered by administrative orientation, and thus have weaker control over the listed companies and less of an information advantage.

Differences in information advantages can affect insiders' choice of active or passive trading. Active trading in P_{BF} requires large shareholders to obtain earnings information in advance, so shareholders need to have a stronger information advantage. The large shareholders of private companies may be more capable of engaging in active trading because they seem to have a more significant information advantage.

In addition to information advantages, trading incentives and risk preferences are important reasons for different trading behavior. The large shareholders of private companies can enjoy the entire trading profit, and thus they pay more attention to active trading for profit and are more willing to take risks for high returns. In contrast, the profits of state-owned large shareholders, including stock trading profits, ultimately belong to the state. Hence, their incentive to trade is weak as they cannot retain the profits. In addition, the chairmen or the CEO of the large shareholders who made the stock trading decisions is often government official (Fan et al., 2007) who are more concerned about their bureaucratic career in the government, more risk averse and less willing to be exposed to the regulation risk generated by insider trading. Zhu et al. (2014) note aggregate insider trading's ability to predict future market returns and find that the predictive power of insider trading by the largest shareholders in state-owned companies is significantly weaker than that of the largest shareholders in private companies.

Hypothesis 3. From information advantage, profit-seeking incentive and risk preference perspectives, the largest shareholders of private companies are more capable of and motivated to engage in active trading than the largest shareholders of state-owned companies.

4.2. Empirical model

We use Huddart et al. (2007) model to examine whether insider trades use earnings information by investigating the relationship between net trading size and earnings news after the enactment of the trading ban regulation.

$$\mathrm{Trade_{BF}}(\mathrm{Trade_{BAN}}) = a0 + a1Eacar + a2Pbrank + a3Prior\_ret + a4Size + a5Yeardum + \varepsilon \quad (1)$$

$$\mathrm{Trade_{AF}} = b0 + b1Eacar + b2Pbrank + b3Prior\_ret + b4Size + b5Yeardum + \varepsilon \quad (2)$$

Model 1 examines the active trading activities during the trading ban period, P_{BAN}, and before the trading ban period, P_{BF}. In active trading, when forthcoming earnings news is positive (negative), insiders are likely to buy (sell) in advance, so insiders' net buying and the forthcoming earnings news should be positively related and the coefficient of Eacar, a_1, is expected to be positive. Model 2 examines passive trading after the ban period, P_{AF}. In passive trading, when announced earnings news is positive (negative), the stock price increases (decreases) and insiders are likely to sell (buy), so insiders' net buying and announced earnings news should be negatively related and the coefficient of Eacar, b_1, is expected to be negative. Following Huddart et al. (2007), we control for P/B, previous buy-and-hold returns and company size.

Because different companies remove the lockup restriction at different times, some of the largest shareholders were still in lockup and could not trade during the sample period (April 2008 to September 2011). This resulted in many observations with no trading activities (dependent variable equals 0). Including the observations with no trading either because shareholders did not want to trade or because they were in lockup, the sample comprises 18,300 firm-quarter observations. We call this the large sample. If we include only firm-quarter observations with trading activities, then the sample sizes within 1 month before and 10 days after the ban period are 170, 290 and 125, respectively, with a total of 585 firm-quarter observations. This sample is called the small sample, as it is only 3.2% of the large sample. We test the models using both samples and the results are consistent. The direction and the magnitude of the independent variables' coefficients are similar, but the difference is that the adjusted R^2 of the large sample test is much lower than that of the small sample test. This is mainly due to the large number of observations with no trading activities in the large sample. The results reported in this study are mainly based on the small sample regression tests (see Table 8).

4.3. Empirical results

Table 9 shows the variables' descriptive statistics. The means suggest that net selling is evident for all three windows, and that the magnitude of $\mathrm{Trade_{BAN}}$ is smaller than that of $\mathrm{Trade_{BF}}$ and $\mathrm{Trade_{AF}}$. The mean and median of Prior_ret are both positive, and combined with the net selling evidence, the results suggest that large shareholders tend to sell after price increases, which is consistent with contrarian trading. The mean of Dg

Table 8
Variable definitions.

Variable	Definition
$\mathrm{Trade_{BF}}$	The net buying of the largest shareholders in company *i* in period P_{BF}, which is the buying percentage minus the selling percentage of stock ownership
$\mathrm{Trade_{BAN}}$	The net buying of the largest shareholders in company *i* in period P_{BAN}, which is the buying percentage minus the selling percentage of stock ownership
$\mathrm{Trade_{AF}}$	The net buying of the largest shareholders in company *i* in period P_{AF}, which is the buying percentage minus the selling percentage of stock ownership
Eacar	Cumulative abnormal returns one day before and one day after the disclosure date of the financial report [−1, 1]; positive (negative) value of CAR means unexpected good (bad) earnings news. The calculation of excess returns is based on the standard market model
Dg	1 if the largest shareholder is state-owned; else 0
Pbrank	All of the companies listed on the main board are ranked into five groups based on P/B at the end of each quarter
Prior_ret	Buy and hold returns for the six months before the beginning date of corresponding P_{BF}, P_{BAN}, P_{AF}
Size	Company size, calculated as the natural log of the market value of the listed company
Yeardum	Dummy variables for years

Table 9
Descriptive statistics of firm-quarter observations.

	N	Mean	Median	Std.	p5	p95
$Trade_{BAN}$	170	−0.006	−0.002	0.016	−0.048	0.010
$Trade_{BF}$	290	−0.011	−0.009	0.020	−0.050	0.010
$Trade_{AF}$	125	−0.012	−0.010	0.016	−0.044	0.008
Eacar	500	−0.004	−0.007	0.043	−0.072	0.067
Pbrank	506	2.567	2.000	1.328	1	5
Prior_ret_Ban	505	0.136	0.143	0.447	−0.670	0.872
Prior_ret_BF	505	0.091	0.161	0.479	−0.740	0.838
Prior_ret_AF	505	0.114	0.170	0.510	−0.845	0.913
Size	506	15.402	15.175	1.239	13.962	17.836
Dg	506	0.636	1.000	0.482	0	1

Table 10
Active insider trading within the trading ban period.

Dependent variable: $Trade_{BAN}$	Full sample		Private company		State-owned company		Full sample	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.036	−2.51**	0.010	0.33	−0.044	−2.92***	−0.037	−2.53**
Eacar	0.025	0.97	0.043	0.90	0.014	0.42	0.043	0.96
Dg							0.002	0.66
Eacar*Dg							−0.030	−0.50
Pbrank	0.000	−0.17	0.001	0.27	0.000	−0.16	0.000	−0.03
Prior_ret	0.002	0.58	0.003	0.37	0.003	0.82	0.002	0.56
Size	0.003	2.94***	0.000	−0.22	0.003	3.12***	0.002	2.92***
Y2009	−0.012	−3.88***	−0.019	−3.55***	−0.010	−2.65***	−0.012	−3.80***
Y2010	−0.011	−3.38***	−0.015	−2.07**	−0.011	−2.93***	−0.012	−3.39***
Y2011	−0.021	−2.89***	−0.033	−3.20***	−0.005	−1.45	−0.020	−2.85***
R^2	0.138	4.77***	0.161	2.48**	0.103	2.8***	0.132	3.78***
N	166		55		111		166	

Dependent variable: $Trade_{BAN}$	Quarterly financial report		Annual (semi-annual) financial report		Full sample	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.026	−1.57	−0.065	−1.89*	−0.036	−2.63***
Eacar	0.043	1.38	0.023	0.53	0.036	1.16
Annual-dummy					0.005	1.82*
Eacar* Annual-dummy					−0.039	−0.70
Pbrank	0.001	0.49	−0.001	−0.82	0.000	0.03
Prior_ret	0.001	0.22	0.014	2.19**	0.002	0.46
Size	0.002	2.05**	0.004	2.00*	0.002	3.00***
Y2009	−0.014	−4.02***	−0.008	−1.35	−0.013	−4.17***
Y2010	−0.017	−3.58***	−0.004	−0.64	−0.012	−3.83***
Y2011	−0.025	−3.23***	−0.012	−0.85	−0.021	−3.00***
R^2	0.204	4.95***	0.085	1.74*	0.15	4.23***
N	109		57		166	

Note: $Trade_{BAN}$ is the largest shareholder's net buying of company *i*'s stock within the ban period P_{BAN}. Dg is a dummy variable that equals 1 if the largest shareholder is state-owned; else 0. Annual-dummy is a dummy variable that equals 1 if the financial report is annual or semi-annual; else 0. *t*-values are white-adjusted (White, 1980).

* Denote significance levels at 10%.

** Denote significance levels at 5%.

*** Denote significance levels at 1%.

suggests that there is more trading from shareholders of state-owned companies than from those of private companies.

Table 10 shows the active insider trading within the ban period, P_{BAN}. The coefficient of Eacar is positive but not significant, so there is no significant association between shareholders' net buying and the upcoming

Table 11
Active insider trading one month before the trading ban period.

Dependent variable: $Trade_{BF}$	Full sample		Private company		State-owned company		Full sample	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.033	−2.87***	0.028	0.82	−0.043	−3.69***	−0.031	−2.68***
Eacar	0.056	2.45**	0.099	2.67***	0.008	0.31	0.099	2.68***
Dg							0.007	2.84***
Eacar*Dg							−0.084	−1.78*
Pbrank	−0.002	−2.00**	−0.004	−2.26**	0.000	0.45	−0.002	−1.72*
Prior_ret	−0.005	−1.27	0.001	0.11	−0.004	−0.91	−0.003	−0.88
Size	0.002	3.19***	−0.002	−0.93	0.003	3.99***	0.002	2.45**
Y2009	−0.004	−1.03	−0.007	−0.98	−0.004	−0.85	−0.005	−1.17
Y2010	−0.005	−1.51	0.004	0.74	−0.012	−2.72***	−0.006	−1.58
Y2011	−0.008	−1.18	−0.019	−2.11**	−0.003	−0.47	−0.008	−1.28
R^2	0.112	6.15***	0.148	3.65***	0.11	4.13***	0.148	6.48***
N	287		108		179		287	
Dependent variable: $Trade_{BF}$	Private company and quarterly financial report		Private company and annual (semi-annual) financial report		State-owned company and quarterly financial report		State-owned company and annual (semi-annual) financial report	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	0.144	1.99*	−0.004	−0.11	−0.018	−1.79*	−0.072	−2.61**
Eacar	0.148	1.07	0.114	3.11***	0.001	0.07	0.035	0.64
Pbrank	−0.005	−0.83	−0.003	−1.79*	−0.001	−1.01	0.002	1.33
Prior_ret	−0.014	−0.96	0.008	1.17	−0.003	−0.62	0.004	0.60
Size	−0.010	−2.02	0.000	−0.13	0.001	2.64***	0.004	2.45**
Y2009	−0.005	−0.30	−0.004	−0.68	−0.004	−0.58	−0.006	−0.88
Y2010	0.008	0.51	0.007	1.07	−0.015	−2.90***	−0.009	−1.17
Y2011	0.001	0.03	−0.019	−2.16**	−0.014	−2.88***	0.001	0.07
R^2	0.277	2.64***	0.117	2.43**	0.362	8.13***	−0.027	0.67
N	31		77		90		89	

earnings news. Even though some of the largest shareholders were allowed to trade one month before the disclosure date of the financial report, their concern about high market attention and regulation risk prompted them to avoid the risk involved in using the upcoming earnings information. Thus, the trading ban regulation seems to have a deterrent effect. Consistent with Hypothesis 1, active trading is not obvious during the ban period. Large shareholders seem to avoid insider trading within the sensitive ban period given the associated regulation risk.

The same results can be observed after the sample is divided into state-owned and private companies. When the sample is divided into quarterly and annual earnings, we find that the coefficient of Eacar within the quarterly ban period is almost significant, but the coefficient of Eacar within the annual ban period is not. The results suggest that insider trading within the quarterly ban period is more evident than that within the annual ban period. The difference in regulation risk between the two types of financial reports probably influenced the insiders' trading choices.

Table 11 reports the results of active insider trading one month before the ban period. The result of the full sample shows that the coefficient of Eacar is 0.056, significant at the 5% level, indicating that insiders use upcoming earnings information to engage in active trading. The results of the state-owned and private-company samples suggest that active insider trading is evident among the large shareholders of private companies, but not among the large shareholders of state-owned companies. The significant coefficient of the interaction term Eacar*Dg suggests that the difference is significant. When the sample is divided into quarterly and annual (semi-annual) earnings reports, the results suggest that the large shareholders of private companies actively traded before the ban period of the annual, but not of the quarterly, financial report. The information content of annual earnings is higher than that of quarterly earnings; however, using annual earnings information to trade beforehand generates a higher regulation risk than using quarterly earnings information. The choice made by the large shareholders of private companies to actively trade before the ban period of an annual financial report is related to their risk preference and stronger profit-seeking incentive.

The above findings support Hypotheses 2 and 3. In China, moving trading before the ban period is an important strategy for insiders to deal with the ban regulation. Although this does not appear to violate the ban period regulation, active trading before the ban period has in fact used earnings information. Because the large shareholders of private companies have more information advantages, a higher risk preference and stronger profit-seeking incentives, their active trading before the ban period is more evident.

Table 12 reports the results of passive insider trading 10 days after the announcement of a financial report. The results of the full sample show that the coefficient of Eacar is 0.013, but it is not significant, which suggests that passive insider trading is not evident. The results of the state-owned and private company sub-samples suggest that passive trading is significant for the large shareholders of the former, and not the latter. The coefficient of the interaction term Eacar*Dg confirms that the difference is statistically significant. When the sample is divided into quarterly and annual financial reports, we find that large shareholders of state-owned companies passively traded after quarterly financial reports, but not after annual financial reports. Trading around quarterly financial reports is subject to lower regulation risk and market attention than around annual reports. Thus, even with passive trading, the large shareholders of state-owned companies chose to trade around quarterly announcements with lower regulation risk.

In summary, under the trading ban regulation, the large shareholders of private companies mainly choose to actively trade before the ban period, whereas those of state-owned companies choose to passively trade after the ban period. In addition, the large shareholders of private companies prefer to use annual (semi-annual) earnings information with higher information content while those of state-owned companies prefer to use quarterly earnings information with lower regulation risk. It is possible that the differences in information advantages, profit-seeking incentives and risk preferences between the two types of large shareholders have driven the results.

5. Empirical tests II: The deterrence effects of the trading ban regulation on insider trading profitability

The trading ban regulation's intention is to prohibit insider trading when insiders have superior information advantages, to protect the interests of external investors. Its main purpose is to limit insiders' trading profits around the announcement of a financial report.

Table 12
Passive trading 10 days after the ban period.

Dependent variable: $Trade_{AF}$	Full sample		Private company		State-owned company		Full sample	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.051	−2.60**	−0.032	−0.83	−0.043	−2.34**	−0.049	−2.40**
Eacar	0.013	0.46	0.042	1.31	−0.035	−2.52**	0.054	1.28
Dg							0.005	1.97*
Eacar*Dg							−0.093	−1.80*
Pbrank	−0.002	−2.00**	0.000	−0.15	−0.003	−3.01***	−0.002	−2.05**
Prior_ret	−0.008	−2.42**	−0.014	−3.08***	0.001	0.25	−0.007	−2.37**
Size	0.003	2.67***	0.002	0.66	0.003	2.68***	0.003	2.35**
Y2009	−0.007	−2.09**	−0.011	−2.09**	−0.007	−2.57**	−0.008	−2.39**
Y2010	−0.009	−2.44**	−0.003	−0.62	−0.015	−3.93***	−0.010	−2.63***
Y2011	−0.010	−1.48	−0.013	−1.05	−0.006	−1.88*	−0.009	−1.37
R^2	0.243	6.64***	0.292	4.06***	0.392	7.45***	0.267	5.98***
N	124		53		71		124	
Dependent variable: $Trade_{AF}$	Private company and quarterly financial report		Private company and annual (semi-annual) financial report		State-owned company and quarterly financial report		State-owned company and annual (semi-annual) financial report	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.041	−0.84	−0.008	−0.15	−0.056	−2.19**	−0.039	−2.13**
Eacar	0.003	0.08	0.098	1.61	−0.066	−2.11**	0.015	0.53
Pbrank	−0.002	−0.87	0.001	0.23	−0.003	−2.05**	−0.002	−2.21**
Prior_ret	0.016	1.49	−0.021	−2.59**	0.006	1.35	−0.005	−2.05**
Size	0.004	1.22	0.000	0.08	0.004	2.66***	0.003	2.30**
Y2009	−0.042	−3.16***	−0.012	−1.80*	−0.016	−2.95***	−0.001	−0.66
Y2010	−0.031	−1.90*	0.004	0.46	−0.018	−2.54**	−0.020	−3.74***
Y2011	−0.041	−2.55**	−0.003	−0.15	−0.016	−2.72***	0.001	0.27
R^2	0.27	2.48**	0.209	1.87*	0.379	4.48***	0.532	5.72***
N	29		24		41		30	

5.1. The effects of the trading ban regulation on overall trading profitability

In this study, we examine the deterrent effect of the trading ban regulation from an insider trading profitability perspective. We use the Fama and French (1993) three-factor model to calculate cumulative abnormal returns (TCAR) for three or six months after the trade. TCAR represents trading profit from every trade. We then compare the mean difference of TCAR in P_{BF}, P_{BAN} and P_{AF}. For buying, TCAR represents abnormal returns gained since the trade and for selling, the loss avoided since the trade. Thus, we multiply TCAR by (−1) to make the TCAR of the sale positive. We calculate TCAR for both three months (TCAR90) and six months (TCAR180). TCAR90 measures the short-term trading profit when insiders use recent earnings information to trade, so TCAR90 can better capture insider trading profit. The empirical results of TCAR90 and TCAR180 are similar, so we mainly report the results of TCAR90 in this study.

To examine the trading ban regulation's effects on trading profitability, we include data before the regulation in Table 13. Before the regulation, the mean insider trading profitability one month before earnings announcements (the ban period) was 7.4%. This is similar to the results of one month before the ban period. The results suggest that large shareholders' insider trading before earnings announcements is evident.

After the regulation, the trading profitability, mean or median, during the ban period P_{BAN} is evidently lower than in the other two periods. The mean of TCAR90 in P_{BAN} is only 2.2% while before and after the ban period it is 8.6% and 10.0%, respectively. The results suggest that the ban regulation's deterrent effect is apparent. The results are also consistent with the findings reported in previous tables, which suggest that, after the regulation, insider trading during the ban period decreased, but there was stealth insider trading before or after the ban period.

$$\text{Empirical Model}:$$
$$TCAR = a0 + a1DP_{BF} + a2DP_{AF} + a3Tradesz + a4Bfret + a5Pbrank + a6Size + a7Yeardum + \varepsilon$$

Next, we use the empirical model specified above to further examine the trading ban regulation's effect on the largest shareholders' trading profitability. In this model, we include two dummy variables, DP_{BF} and DP_{AF}. When trading happened one month before the ban period, $DP_{BF} = 1$; else, $DP_{BF} = 0$. When trading happened 10 days after the ban period, $DP_{AF} = 1$; else, $DP_{AF} = 0$. The base group's trading occurred during the ban period, P_{BAN}.

Tradesz is the size of the trade, measured by percentage of ownership.

Bfret is the cumulative abnormal return one month before the trade. The calculation of Bfret is similar to that of TCAR. For selling activities, Bfret is cumulative abnormal returns times (−1).

Pbrank is the rank of the P/B ratio. All of the main board companies are ranked in five groups based on each quarter-end P/B ratio.

Table 13
Comparison of large shareholders' trading profits.

		TCAR90		TCAR180	
	N	Mean	Median	Mean	Median
Pre-regulation					
P_{BF}	98	0.091	0.106	0.099	0.087
P_{BAN}	101	0.074	0.089	0.097	0.118
P_{AF}	42	0.129	0.142	0.182	0.220
Post-regulation					
P_{BF}	389	0.086	0.077	0.124	0.095
P_{BAN}	213	0.022	0.028	0.033	0.015
P_{AF}	168	0.100	0.087	0.179	0.183

Note: TCAR90 (TCAR180) is the cumulative abnormal returns three months (six months) after the trade; P_{BF}, P_{BAN} and P_{AF} are one month before, one month of and 10 days after the trading ban period (which is one month before the earnings announcement), respectively.

Table 14
Descriptive statistics based on transactions.

	N	Mean	Median	P5	P95	Std.
TCAR90	770	0.071	0.066	−0.243	0.384	0.196
TCAR180	770	0.111	0.088	−0.335	0.588	0.300
Tradesz	770	0.010	0.007	0.000	0.037	0.011
Bfret	770	−0.005	−0.005	−0.207	0.204	0.123
Pbrank	770	2.643	3.000	1.000	5.000	1.376
Size	770	15.307	15.124	13.854	17.425	1.158
Dg	770	0.584	1.000	0.000	1.000	0.493
Control	770	0.668	1.000	0.000	1.000	0.471
Annual–dummy	770	0.478	0.000	0.000	1.000	0.500

Note: Control is a dummy variable equal to 1 if the shareholders' ownership is more than 30%, else 0.

Table 15
Effects of the trading ban regulation on large shareholders' trading profitability.

Dependent variable: TCAR90	Full sample		Quarterly financial report		Annual (semi-annual) financial report	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.190	−2.07**	−0.143	−1.44	−0.261	−1.40
DP_{BF}	0.046	2.83***	0.035	1.60	0.050	1.84*
DP_{AF}	0.064	3.27***	0.082	3.48***	0.040	1.20
Tradesz	2.342	3.44***	1.556	1.46	2.961	3.44***
Bfret	0.089	1.40	0.047	0.54	0.168	1.66*
Pbrank	0.036	6.27***	0.044	5.82***	0.031	3.60***
Size	0.009	1.53	0.004	0.69	0.016	1.34
Y2009	−0.034	−1.68*	0.005	0.19	−0.083	−2.70***
Y2010	−0.042	−1.95*	−0.050	−1.69*	−0.056	−1.65*
Y2011	−0.070	−2.43**	−0.113	−3.28***	−0.060	−1.37
R^2	0.091	9.55***	0.13	7.64***	0.073	4.20***
N	770		402		368	

Dependent variable: TCAR90	Private company		State-owned company		Stock ownership <30%		Stock ownership ⩾30%	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Intercept	−0.373	−2.07**	−0.175	−1.66*	−0.468	−2.15**	−0.082	−0.80
DP_{BF}	0.092	3.33***	0.023	1.13	0.035	1.38	0.046	2.32**
DP_{AF}	0.080	2.58**	0.054	2.04**	0.011	0.33	0.073	3.03***
Tradesz	1.517	1.64	2.938	2.80***	1.743	1.53	2.361	2.81***
Bfret	0.021	0.22	0.148	1.71*	0.125	1.24	0.059	0.73
Pbrank	0.042	4.64***	0.029	3.90***	0.054	5.54***	0.022	3.20***
Size	0.023	1.86*	0.007	1.14	0.031	2.07**	0.002	0.31
Y2009	−0.105	−3.59***	0.007	0.28	−0.128	−3.54***	0.003	0.13
Y2010	−0.129	−3.54***	0.001	0.04	−0.181	−5.30***	0.037	1.37
Y2011	−0.062	−1.45	−0.093	−2.77***	−0.147	−2.49**	−0.042	−1.31
R^2	0.115	5.61***	0.086	5.70***	0.192	7.75***	0.078	5.83***
N	320		450		256		514	

Based on individual transactions, the average large shareholder trading profitability three (six) months after the trade is 7.1% (11.1%) and the average trading ownership for each transaction is 1%. A total of 66.8% of the trades is from shareholders with more than 30% ownership and 58.4% (41.6%) of the trades are from the large shareholders of state-owned (private) companies. The number of trades around annual financial reports is similar to that around quarterly financial reports (see Table 14).

As shown in Table 15, the coefficient of DP_{BF} is 0.046 and the coefficient of DP_{AF} is 0.064, both significant at 1%, suggesting that trading during the ban period is significantly lower than that before or after the ban period. These results reflect the deterrent effect of the trading ban regulation. During the trading ban period

(or the sensitive period), even if some large shareholders are allowed to trade, they choose trades with low information content and for liquidity to avoid regulation risk and criticism from investors. The deterrent effect is apparent, but the large shareholders do not give up. Through moving the trades back or forward, they continue to use earnings information; thus, trading profit around the ban period remains quite high.

When differentiating between the types of financial reports, we find that the deterrent effect exists for both the quarterly and the annual (semi-annual) financial reports, with a slight difference. Trading profitability *after* the ban period is significantly higher for quarterly earnings while that *before* the ban period is significantly higher for annual earnings. This is consistent with the evidence reported above, that the large shareholders of private companies prefer to trade before the ban period of annual financial reports while those of state-owned companies prefer to trade after the ban period of quarterly financial reports.

We also find that the deterrent effect exists for insider trades by large shareholders of both state-owned and private companies. Large shareholders of state-owned companies do not obtain significantly more trading profit before the ban period than during it, suggesting that these shareholders generally do not move trading to before the ban period. In addition, we find that the deterrent effect is more evident in trading by shareholders with greater than 30% ownership than it is in trading by those with less than 30% ownership. Shareholders with higher ownership are among the insiders targeted by the ban regulation. Shareholders with less than 30% ownership obtain lower trading profits during than around the ban period, but the differences are not significant so the regulation has a limited effect on them.

5.2. Trading profitability of informed trades under the ban regulation

Do all trades conducted before the announcement of a financial report exploit earnings information? The answer is No. Following Hillier and Marshall (2002), we divide the trades *before* the announcement of a financial report into informed and uninformed trades. Buying before good and selling before bad earnings news are considered to be informed trades while other trades are considered to be uninformed. Informed trades are systematically associated with earnings information and thus strongly indicate insider trading. In contrast, uninformed trades are not, so they can be considered as normal trading. By comparing trading profitability between informed and uninformed trades, we quantify the abnormal returns earned by exploiting inside information and more clearly assess the deterrent effect of the ban regulation from a trading profit perspective.

We only focus on informed and uninformed trades before the announcement of a financial report. This focus is because: insider trading before an earnings news announcement is the main concern of regulators and investors; informed trades after an earnings news announcement (e.g. selling after exceptionally good news) are difficult to separate from normal selling for liquidity (Garfinkel, 1997); and Kolasinski and Li (2010) suggest that uninformed trades after an earnings news announcement (buying after good earnings news) could trade on the market's incomplete response to the news and earn abnormal returns as well.

As Table 16 shows, during P_{BF}, the average TCAR90 earned from informed trades is 11.9% while that from uninformed trades is only 4.2%. The trading profitability of informed trades is 2.83 times that of uninformed trades. In addition, the frequency and the size of informed trades are much higher than those of uninformed trades. The evidence further confirms that large shareholders in China move insider trading to before the trading ban period. During P_{BAN}, the average TCAR90 gained from informed trades is 7.5%, whereas that gained from uninformed trades is −2.4%. The trading profit of informed trades is still higher than that of uninformed trades; however, both types of trading profitability are lower than that during the P_{BF} period.

In summary, during the trading ban period, the trading profits of both informed and uninformed trades are suppressed. However, before the ban period, large shareholders obtain considerable abnormal returns through informed trades.

As indicated by Dg in Table 17, the average trading profitability (TCAR90) of informed trades by large shareholders in private companies before (during) the ban period is 14.3% (11.6%). In comparison, the trading profitability of informed trades by large shareholders in state-owned companies before (during) the ban period is 9.4% (5.3%). The large shareholders of private companies earn higher profits through informed trades, and the proportion of their informed trades is also higher.

We further divide large shareholders based on their level of ownership and find that those with less than 30% ownership (Control = 0) earn lower profits than their counterparts with more than 30% ownership

Table 16
Comparison of trading profitability between informed and uninformed trades.

		TCAR90		TCAR180		Tradesz	
	N	Mean	Median	Mean	Median	Mean	Median
P_{BF}							
Informed trade = 0	172	0.042	0.044	0.056	0.045	0.009	0.007
Informed trade = 1	215	0.119	0.106	0.178	0.154	0.012	0.009
P_{BAN}							
Informed trade = 0	102	−0.024	−0.016	−0.031	−0.044	0.007	0.003
Informed trade = 1	106	0.075	0.062	0.103	0.054	0.009	0.004

Note: P_{BF} and P_{BAN} are one month before and one month during the ban period, respectively. Tradesz is the size of the trade, measured by percentage of ownership. TCAR90 (TCAR180) is cumulative abnormal returns three (six) months after the trade.

Table 17
Comparison of Trading Profitability between Informed and Uninformed Trades – Further Analysis.

			TCAR90					TCAR90	
		N	Mean	Median			*N*	Mean	Median
P_{BF}					P_{BAN}				
Annual report = 0	Informed trade = 0	70	0.012	−0.003	Annual report = 0	Informed trade = 0	68	−0.033	−0.043
	Informed trade = 1	84	0.129	0.103		Informed trade = 1	79	0.076	0.057
Annual report = 1	Informed trade = 0	102	0.063	0.064	Annual report = 1	Informed trade = 0	34	−0.008	0.006
	Informed trade = 1	131	0.113	0.107		Informed trade = 1	27	0.071	0.069
P_{BF}					P_{BAN}				
Dg = 0	Informed trade = 0	59	0.077	0.067	Dg = 0	Informed trade = 0	32	−0.071	−0.012
	Informed trade = 1	112	0.143	0.127		Informed trade = 1	37	0.116	0.079
Dg = 1	Informed trade = 0	113	0.024	0.014	Dg = 1	Informed trade = 0	70	−0.003	−0.019
	Informed trade = 1	103	0.094	0.086		Informed trade = 1	69	0.053	0.047
P_{BF}					P_{BAN}				
Control = 0	Informed trade = 0	61	0.021	0.022	Control = 0	Informed trade = 0	41	−0.044	−0.068
	Informed trade = 1	77	0.132	0.104		Informed trade = 1	32	0.109	0.072
Control = 1	Informed trade = 0	111	0.054	0.067	Control = 1	Informed trade = 0	61	−0.011	0.012
	Informed trade = 1	138	0.112	0.108		Informed trade = 1	74	0.060	0.058

(Control = 1) for uninformed trades, but they earn higher profit through informed trades. During (before) the ban period, shareholders with less than 30% ownership earn, on average, 10.9% (13.2%) of abnormal returns through informed trades—much higher than the 6.0% (11.2%) earned through informed trades by shareholders with more than 30% ownership.

Table 18 examines the excess profitability of informed over uninformed trades. The coefficient of the Informed-Dummy variable is 0.072 and significantly positive, indicating that large shareholders earn 7.2% higher abnormal returns than uninformed trades by exploiting inside earnings information. In addition, we find that the excess profitability obtained through informed trades before quarterly financial reports is higher than that obtained before annual financial reports. The large shareholders of private companies earn an additional 11.2% abnormal returns through informed trades—higher than the additional 5.3% abnormal returns earned by the shareholders of state-owned companies. We also find that shareholders with less than 30% ownership obtain an additional 11.6% abnormal returns—much higher than the 4.6% obtained by shareholders with more than 30% ownership.

In summary, even under the trading ban regulation, large shareholders can change their trading behavior and earn economically significant abnormal returns by exploiting earnings information. The high profitability through insider trading is especially evident among large shareholders of private companies and shareholders with less than 30% ownership.

Table 18
Excess profitability of informed over uninformed trades.

Dependent variable	Full sample		Quarterly financial report		Annual (semi-annual) financial report	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
TCAR90						
Intercept	−0.133	−1.37	−0.028	−0.28	−0.320	−1.50
Informed–Dummy	0.072	4.94***	0.082	3.95***	0.057	2.62***
Tradesz	2.105	2.73***	1.411	1.09	2.355	2.62***
Bfret	0.064	0.86	−0.012	−0.12	0.182	1.62
Pbrank	0.032	5.00***	0.034	3.86***	0.032	3.31***
Size	0.005	0.87	−0.003	−0.55	0.021	1.59
Y2009	−0.027	−1.18	0.011	0.34	−0.091	−2.58**
Y2010	−0.036	−1.44	−0.029	−0.82	−0.085	−2.15**
Y2011	−0.087	−2.65***	−0.111	−2.48**	−0.111	−2.42**
R^2	0.106	9.79***	0.147	7.45***	0.081	4.22***
N	595		301		294	

Dependent variable	Private company		State-owned company		Ownership <30%		Ownership ⩾30%	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
TCAR90								
Intercept	−0.399	−2.03*	−0.085	−0.77	−0.550	−2.32**	0.009	0.08
Informed–Dummy	0.112	4.74***	0.053	2.80***	0.116	4.79***	0.046	2.51**
Tradesz	1.471	1.46	2.584	2.29***	0.852	0.71	2.697	2.66***
Bfret	−0.059	−0.58	0.187	1.82*	0.101	0.89	0.033	0.34
Pbrank	0.050	5.14***	0.018	1.98**	0.054	5.10***	0.016	2.03**
Size	0.024	1.82*	0.002	0.34	0.034	2.11**	−0.003	−0.43
Y2009	−0.117	−3.38***	0.014	0.50	−0.116	−2.71***	0.010	0.33
Y2010	−0.154	−3.69***	0.020	0.64	−0.165	−3.98***	0.049	1.56
Y2011	−0.149	−3.06***	−0.060	−1.51	−0.131	−1.93*	−0.073	−2.13**
R^2	0.193	8.12***	0.067	4.19***	0.255	9.97***	0.081	5.20***
N	240		355		211		384	

Note: We combine trades in P_{BF} and P_{BAN} for the tests shown in this table. Informed-Dummy is a dummy variable, 1 if it is an informed trade; else, 0.

6. Conclusion

How to improve the effectiveness of insider trading regulations is not only an important academic topic, but also a regulatory challenge that must be addressed. A trading ban is an important regulatory tool used by many countries to curtail insider trading; however, it has generated limited research. This study focuses on insider trading conducted by the largest shareholders and investigates insider trading patterns under the ban regulation, providing a comprehensive examination of the effectiveness of the ban regulation.

The results suggest that due to regulation risk, insider trading during the trading ban period is limited. However, large shareholders continue to exploit earnings information either by moving the trading before the ban period (private companies) or after the ban period (state-owned companies). In addition, large shareholders of private companies prefer to use annual (semi-annual) earnings information, whereas those of state-owned companies prefer to trade after the announcement of the less risky quarterly financial report. The differences in the shareholders' trading patterns are related to the differences in their information advantages, profit-seeking incentives and risk preferences.

Regarding the regulation's effectiveness, trading profitability is significantly lower during the ban period than before or after it, suggesting that the ban regulation has a deterrent effect. However, the results also suggest that trading profitability before or after the ban period is significantly higher. We further divide trades into those that are informed and those that are uninformed to better quantify the excess returns earned by exploiting inside earnings information. We find that the informed trading profit is 2.83 times the uninformed

trading profit, particularly for large shareholders in private companies and shareholders with less than 30% ownership.

In summary, our study finds that the trading ban regulation is effective in curbing insider trading during the ban period. However, large shareholders can move trading to before or after the ban period to continue earning substantial abnormal returns. The regulation does not fundamentally increase the cost of insider trading by large shareholders. The regulation is especially not effective for large shareholders in private companies and shareholders with less than 30% ownership.

The compromise of the regulation's effectiveness is related to the overall regulatory environment in China. Currently, the regulation on insider trading emphasizes rigid administrative regulations without using more flexible civil litigation and market monitoring. If investors, attorneys and the media are given the right to question and bring litigation against insider trading, the threshold of bringing litigation is lowered and the process of litigation is streamlined so that insiders can restrain informed trading around the ban period in the presence of higher litigation risk. To improve the effectiveness of insider trading regulations, a stringent administrative monitoring system must be integrated with a market monitoring system.

This study contributes to the literature in three ways. First, it systematically examines the insider trading behavior of large shareholders and explores how ownership nature affects large shareholders' trading behavior, adding to our current understanding of the latter. Second, this study contributes to the research on the relationship between regulation and insider trading. The literature on mandatory trading ban regulation is very limited and herein we systematically investigate how a new, mandatory trading ban regulation affects large shareholder trading behavior in the emerging market of China. We find that several factors significantly affect how large shareholders deal with the new regulation, such as annual or quarterly earnings reports with different regulation risks, state or private ownership and high or low ownership. Third, the literature, based largely on studies of the United States' markets, consistently documents that insider trading regulation can effectively reduce insider trading before earnings announcements and insiders are forced to choose passive trading. However, we find that in China, under the less mature legal environment, the effectiveness of the specific ban regulation tool is very limited. Insiders simply move trading ahead to avoid the bright line ban period. The findings suggest that a more mature legal system is probably more important than specific tools, and the overall legal environment can either enhance or reduce the effectiveness of specific regulation tools.

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Information environment, market-wide sentiment and IPO initial returns: Evidence from analyst forecasts before listing

Hongjun Zhu [a,1], Cheng Zhang [b,2], He Li [c,*], Shimin Chen [d,3]

[a] *Institute of Accounting and Finance, Shanghai University of Finance and Economics, China*
[b] *Post-doctoral Research Station of Bank of Communications, Post-doctoral Research Station of Renmin University of China, China*
[c] *School of Accountancy, Shanghai University of Finance and Economics, China*
[d] *China Europe International Business School, China*

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ABSTRACT

Measuring the information environment of firms using analyst (price) forecast bias and forecast dispersion before listing, we empirically examine the interactive influence of the information environment and market-wide sentiment on the initial returns of initial public offerings (IPOs). We find the smaller the analyst forecast bias/dispersion, the lower the effect market-wide sentiment has on IPO initial returns. This finding indicates that information asymmetry is a basic reason for noise trading occurs and demonstrates the positive effect of financial analysts during IPOs. In addition, the effect of analyst forecasts is more pronounced during periods of rising markets and when IPO prices are not regulated.

* Corresponding author at: Room 116, School of Accountancy, Shanghai University of Finance and Economics, No. 777, Guoding Road, Yangpu District, Shanghai 200433, China. Tel.: +86 010 8806 1713, +86 136 6139 2170.

E-mail addresses: hjzhu@mail.shufe.edu.cn (H. Zhu), zhangcheng_shufe@163.com (C. Zhang), kily8878860@163.com (H. Li), cshimin@ceibs.edu (S. Chen).

[1] Tel.: +86 021 6590 4421, +86 139 1804 9314.
[2] Tel.: +86 021 3216 9999 (1056), +86 136 1185 4816.
[3] Tel.: +86 021 2890 5616, +86 138 1778 2370.

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1. Introduction

In modern finance theory, stock prices are not only influenced by value-relevant information, but also significantly affected by investor sentiment. Real-world investors are not always as rational as traditional theory assumes. Cognitive bias and emotional behavior influence investors to form biased expectations or judgments during valuation and incur price fluctuations through noise trading. Noise trading leads to valuation errors in the capital market and harms the efficiency and stability of the capital market (Brown and Cliff, 2004, 2005; Baker and Wurgler, 2006; Wang and Sun, 2004).

The influence of investor sentiment on stock prices is more pronounced during initial public offerings (IPOs). The serious information asymmetry that investors face during IPOs makes them more susceptible to emotional factors and causes false investment decisions. However, short-selling constraints during IPOs make stock prices reflect only the expectations of optimistic investors and exaggerate the influence of sentiment. Foreign studies of IPO initial returns have found that rational factors such as information asymmetry, controlling rights and litigation risk are insufficient in explaining IPO initial returns and that investor sentiment plays a prominent role (Ljungqvist et al., 2006; Derrien, 2005; Cornelli et al., 2006). These studies have proposed that the over-optimism of investors in the secondary market pushes stock prices above their intrinsic value and leads to irrational initial returns.

The Chinese stock market has a shorter history than mature capital markets and its market mechanisms remain imperfect (China Securities Regulatory Commission, 2008). IPO initial returns in China were once the most anomalous returns around the world and have drawn a great deal of attention from researchers, practitioners and regulators. Meanwhile, the high offering prices, high price-to-earnings ratios and enormous funds raised during IPOs have attracted a great deal of attention from Chinese investors. One report from the Shenzhen Stock Exchange shows that most of the traders involved on the initial offering date are individuals and cover 90% of the total trading amount on the buy side. As a result of this individual majority, stock prices are highly affected by sentiment in China. Much evidence has shown that IPO initial returns are highly affected by investor sentiment from the secondary market and that price premiums on initial offering dates are caused by over-optimistic behavior (Song and Liang, 2001; Cao and Dong, 2006; Jiang, 2007).

Trading activity caused by investor sentiment constitutes noise trading in the capital market. Based on Black's (1986) definition of noise trading, information insufficiency and asymmetry are the basic premises of noise trading. In other words, investors are not priori irrational, but are rather forced to make investment decisions based on sentiment because information asymmetry makes information lack relevance and reliability. As a result, sentiment factors affect trading behavior and make stock prices deviate from their intrinsic value. Consequently, this paper tries to determine whether improving the information environment and decreasing the information asymmetry between companies and investors can decrease noise trading and hence decrease the effect of investor sentiment on stock prices.

Sell-side financial analysts are an important part of the information environment. Taking advantage of their privileged information sources and professional analysis, analysts produce earnings forecasts and investment ratings for investors. Analyst reports are especially important information sources for individuals, who suffer from information asymmetry. As Chinese analysts continue developing, they are playing an increasingly important role in market pricing (Huang and Ding, 2011). Numerous studies have confirmed that analyst forecasts reduce information asymmetry between companies and investors (Zhu et al., 2007). However, studies have focused only on listed firms and the information role of analyst forecasts for pre-listing firms remains unknown. Contrary to the constraints placed on analyst forecasts for pre-listing firms in foreign countries, there is no such prohibition in the Chinese stock market. Analysts can follow pre-listing firms and forecast offering prices. This paper examines whether analyst during the pre-IPO period can improve pricing efficiency and stabilize the market.

Based on the actual conditions of the Chinese stock market, this paper follows classic theories related to IPO initial returns in behavioral finance, uses analyst (price) forecast bias and forecast dispersion to measure the quality of the information environment, and examines the interactive influence of the information environment and market-wide sentiment on IPO initial returns. To verify the influence of market sentiment on IPO initial returns, this paper finds that the smaller the analyst forecast bias or dispersion, the lower the effect market-wide sentiment has on IPO initial returns. These findings indicate that information asymmetry is a basic

reason for noise trading and demonstrate the positive effect of financial analysts during IPOs. In addition, the effect of analyst forecasts is more pronounced during periods of rising markets than periods of falling markets. This indicates that rising markets may enhance investment willingness and that a high amount of investor attention effectively explains value-relevant information. Finally, this paper finds that analyst forecasts have a more pronounced effect when IPO prices lack regulation, indicating that regulation also plays an important role.

This paper makes three main contributions to the existing literature. First, it enriches the research related to IPO initial returns. It also details the noise trading generation process and demonstrates that improving the information environment can restrain noise trading and reduce the influence of market-wide sentiment on initial returns. These findings are conducive to understanding anomalous returns and, more importantly, identifying effective ways to decrease the sentimental premium for IPO firms. In addition, this paper uses analyst forecasts as a proxy for the external information environment and thus provides a different perspective of the information environment from that of other studies.

Second, this paper contributes to the analyst forecast literature. Due to the analyst following constraint placed on pre-listing firms, studies have focused only on the analyst forecasts of listed firms and confirmed the intermediary role of analysts' information. Contrary to listed firms, pre-listing firms face a more severe information asymmetry problem and the demand for analysts as intermediaries are more urgent. Based on this special institutional setting in China, this paper verifies the intermediary role of analysts for pre-IPO firms.

Third, this paper provides empirical evidence for behavioral finance theory. It focuses on the basic question of behavioral finance: how does investor sentiment affect stock prices? Although basic behavioral finance theory observes that information asymmetry is an important objective reason for noise trading, empirical results remain scarce. Taking advantage of the special research setting of the Chinese IPO market, our paper provides empirical evidence for the theory and thus contributes to the existing literature.

Zhu et al. (2013) also investigate the relationship between market sentiment and Chinese IPO initial returns and determine that the better the accounting quality, the weaker the influence of market sentiment on initial returns. However, they focus on the internal information environment, which reduces the influence of market sentiment on initial returns. This paper focuses on analyst forecasts before listing and emphasizes the effect of the external information environment. As the Chinese stock market has developed, analysts have become an indispensable component of the information environment and have essential implications for investor behavior. In this sense, our paper is a supplement to that of Zhu et al. (2013) and enriches our understanding of the information environment for IPO firms.

The remainder of this paper is structured as follows. Part II summarizes the related literature. Part III develops our hypotheses. Part IV describes our research design. Part V provides the empirical results. Part VI concludes the paper.

2. Literature review

2.1. IPO initial return literature

IPO initial returns are among the most long-standing anomalies in the capital market. Studies have produced two theories as to their origin, primary market underpricing theory and secondary market overpricing theory. Primary market underpricing theory considers information asymmetry between subscribers (Rock, 1986; Benveniste and Wilhelm, 1990; Loughran and Ritter, 2004; Ibbotson, 1975) and agency problems (Brennan and Franks, 1997; Stoughton and Zechner, 1998) to lead to valuation risk during IPOs. To maintain the offering process, companies must keep the offering price under its intrinsic value. When stocks enter the secondary market, their prices soon return to their intrinsic value and IPO initial returns are formed.

The basic assumption of primary market underpricing theory is that the secondary market is efficient and stock prices reflect value-relevant information in a fair and timely manner. However, this assumption does not always hold. IPO initial returns caused by the Internet bubble in the early 21st century made researchers suspicious of the theory. They re-examined IPO initial returns from the perspective of the pricing mechanism in the secondary market and ultimately proposed secondary market overpricing theory. The theory observes that high IPO initial returns are caused not by under-valuated offering prices, but by optimistic trading behavior on

the initial offering date (Purnanandam and Swaminathan, 2004; Ljungqvist et al., 2006). Derrien (2005) finds that individuals' demand for new issues is positively related to pre-IPO market returns and IPO initial returns. Cornelli et al. (2006) use offering prices in the pre-listing market to measure investor optimism, which they determine to be positively related to IPO initial returns and negatively related to long-term returns.

According to the IPO initial return calculation method, the offering and trading prices on an initial date codetermine the initial return. Consequently, primary market underpricing theory and secondary market overpricing theory are both reasonable. In fact, the principal factor influencing IPO initial returns differs between markets and periods.

IPO initial returns in China were once the most anomalous returns around the world and attracted a great deal of attention from researchers, practitioners and regulators. Contrary to mature markets, IPOs in the Chinese stock market have some specific characteristics.

The pricing process of Chinese IPOs is not market driven. Issuer, offering price and share placement qualifications are highly regulated by the Chinese Securities Regulatory Commission. These regulations offset the incentives of issuers and hence decrease pricing efficiency. For example, under the current inquiry system, underwriters cannot decide the share of allotment and their incentive to discover intrinsic value is highly weakened. Therefore, the basic premise of primary market underpricing theory does not hold in the Chinese stock market and pre-listing firms in China are unwilling to lower the offering price (Han and Wu, 2007). In contrast, regulation is one of the most significant contributors to price suppression (Liu and Xiong, 2005; Zhu and Qian, 2010) and price suppression in China is a result of government intervention (Tian, 2010).

Chinese investors, especially individuals, show extraordinary enthusiasm for new issues. High offering prices, price-to-earnings ratios and raised fund amounts often co-exist during IPOs. Many studies have discovered that investor sentiment and secondary market overpricing theory have significant explanatory power for IPO initial returns in China. For example, Song and Liang (2001) find that measurements of secondary market activity are significantly related to IPO initial returns. Cao and Dong (2006) observe that, relative to trading prices, offering prices provide more information about intrinsic value and that artificially high trading prices in the secondary market contribute to anomalous initial returns. Jiang (2007) compares the different factors that influence initial returns and finds that optimism and investor activity in the secondary market are the most prominent factors. However, the author also finds that market efficiency theory and information asymmetry theory are inadequate for explaining initial returns. All of the preceding studies demonstrate that investor sentiment is an influencing factor. However, the reasons for noise trading must be analyzed further.

Trading driven by sentiment constitutes noise trading in the capital market. Black (1986) introduces the concept of noise trading into the capital market. According to its definition, in a situation of information insufficiency and asymmetry, investors may account for value-irrelevant information in their trading behavior. Such trading is known as noise trading. Studies of irrational trading behavior have mainly focused on subjective reasons. However, according to the preceding definition, the generation of noise trading is inseparably correlated with the information environment faced by investors. Noise trading has both subjective and objective causes, but studies have rarely discussed the latter. This paper tries to determine the objective causes. We try to verify whether improving the information environment can reduce noise trading and hence lower the influence of investor sentiment on stock prices.

2.2. Studies of the relationship between the information environment and analyst forecasts

Sell-side financial analysts are important information intermediaries and an essential part of the information environment. With their privileged information sources and professional analysis, analysts produce earnings forecasts and investment ratings for investors. Due to their information asymmetry, individuals find analyst reports to be especially important information sources. Previous studies have discovered that analyst forecasts affect investor expectations significantly (Fried and Givoly, 1982). This influence depends on the forecast quality. Brown and Rozeff (1979) and Brown et al. (1987) find that the influence of analyst forecasts on market expectations is positively related to the accuracy of the forecasts. As security analysts have developed and improved, their influence in China has also improved. Huang and Ding (2011) find that as the accuracy of analyst forecasts increased after 2005, analyst forecasts have become a better proxy for market expectations than management forecasts or expectations calculated by the random walk model.

Studies have found that analyst forecasts and the information environment are interrelated and interact. Companies are first-hand information sources and analyst forecast quality is highly correlated with the information environment. Lang and Lundholm (1996) find that the higher the quality of corporate information disclosure, the greater the analyst following and the more accurate the forecasts. Li and Jia (2009) also find that the improvement of corporate disclosure quality and institutional backgrounds can significantly enhance analyst forecast accuracy and lower forecast dispersion. However, the information collection and production processes led by analysts improve the transfer of information between companies and investors. These activities improve the information environment and lower the information asymmetry between insiders and outsiders. For example, Zhu et al. (2007) find that analyst following improves the informativeness of stock prices and hence lowers stock price synchronicity.

Given the relationship between analyst forecasts and the information environment, researchers usually use analyst following or forecasts as proxies for the quality of the information environment. Lang et al. (2003) use analyst following and forecast accuracy to measure the information environment. Gebhardt et al. (2001) use forecast dispersion to measure the information environment. He et al. (2012) use analyst forecast bias and forecast dispersion to measure the information environment.

Researchers have not yet determined the relationship between analyst forecasts and offering prices or IPO initial returns due to the analyst forecast regulations in most countries. Taking the U.S. stock market as an example, analysts are forbidden to publish forecasts from the pre-IPO period up to 40 days after listing. In contrast, analyst forecasts before listing are permitted in China, creating an opportunity for researchers. Chu and Cang (2008) investigate the relationship between forecast dispersion before listing and IPO initial returns based on valuation risk and find the two to be positively related. Yao (2011) finds a positive relationship between analyst optimism before listing and initial returns. Chu and Cang (2008) and Yao (2011) base their studies on primary market underpricing theory and secondary market overpricing theory, respectively. However, the complexity of the factors influencing IPO initial returns makes it difficult to distinguish between the two theories and a gap in the research remains.

3. Hypothesis development

According to the analytical framework for IPO initial returns in the behavioral finance field, initial returns are mainly caused by over-optimistic trading behavior in the secondary market. First, although expectations vary across investors, short-selling constraints during IPOs prohibit pessimistic investors from trading. As such, price reflects only optimistic expectations. Second, resource scarcity and historical high yields for new issues exaggerate investor optimism. Consequently, transaction prices on initial trading dates are unilaterally determined by optimistic investors and quickly rise above their intrinsic value.

High overall market yields are among the most important causes of investor optimism. The current high level of market returns makes investors overestimate the market's persistence and form overly optimistic expectations of company prospects, thereby enhancing investors' intent for new issues (Derrien, 2005).

The trading activity driven by investor sentiment constitutes noise trading in the stock market. Noise trading not only makes stock prices unfairly reflect value relevant information but also harms the efficiency of the capital markets. According to Black's (1986) definition of noise trading, information insufficiency and asymmetry are the primary causes of noise trading. In other words, investors are not priori irrational. Information asymmetry makes their decision-making process lack sufficient information, which introduces the sentiment signal into investment decisions.

Relative to listed firms, IPO firms disclose finite information to the market. This makes the information asymmetry more severe and the valuation risk higher. As a result, noise trading is more frequent and the influence of sentiment on stock price is more severe. Finally, high IPO initial returns are formed. Improving the information environment and decreasing information asymmetry may enhance the sufficiency and certainty of information during the decision-making process, and hence increase the weight investors place on value-relevant information and decrease the influence of investor sentiment on IPO initial returns.

As important information intermediaries between listed firms and investors, analysts play an essential role in the information environment. Through privileged information channels and professional information

analysis, analysts publish earnings forecasts and investment ratings for the market. Analyst forecasts are important information sources and significantly affect market expectations.

Analyst forecasts are highly correlated with the information environment. Companies are first-hand information sources that include not only public disclosure but also private disclosure during field studies. As a result, analyst forecast quality is highly correlated with a company's information environment. However, the information collection and production processes led by analysts improve the transfer of information between companies and investors and hence lower the information asymmetry between insiders and outsiders (Lang and Lundholm, 1996; Li and Jia, 2009).

For these reasons, researchers usually use analyst forecast characteristics as proxies for the quality of the information environment (Lang et al., 2003; Gebhardt et al., 2001; He et al., 2012). Following previous studies, this paper uses analyst forecast bias and forecast dispersion to measure the quality of the information environment. As no constraints are placed on analyst forecasts for pre-listing firms, the Chinese stock market is an ideal context for investigating the function of analyst forecasts (proxies of the information environment) to limit the influence of market sentiment on noise trading.

According to the preceding analysis, we expect the improvement of the information environment to decrease the asymmetry between firms and investors, and thus weaken the effect of market-wide sentiment on IPO initial returns. Using analyst forecast characteristics as proxies for the information environment, we propose the following hypotheses.

Hypothesis 1.1. Lower analyst forecast bias significantly reduces the influence of market-wide sentiment on IPO initial returns.

Hypothesis 1.2. Lower analyst forecast dispersion significantly reduces the influence of market-wide sentiment on IPO initial returns.

In the capital market, market efficiency is closely related to the attention investors pay to information. Classic behavioral finance theory observes that investor attention is usually limited when he or she is faced with complicated tasks and complex information (Aboody et al., 2010). Consequently, investor attention varies with market conditions and is usually high during periods when the market is rising (Karlsson et al., 2009; Hou et al., 2008). During these periods, investors' belief in potential gains for new issues makes them willing to participate in new issue offerings. Consequently, value-relevant information including analyst forecasts gains more attention than it would during periods of market decline. Paying a lot of attention makes investors fully understand the value-relevant messages of analyst forecasts and ensures that the information environment plays a more prominent role. In contrast, investors' willingness to participate in new issue offerings declines when the market drops. Consequently, value-relevant information such as analyst forecasts receives less attention and the role of the information environment declines. Therefore, we propose the following hypotheses.

Hypothesis 2.1. The role of lower analyst forecast bias in reducing the influence of market-wide sentiment on IPO initial returns is more prominent during periods in which the market is rising.

Hypothesis 2.2. The role of lower analyst forecast dispersion in reducing the influence of market-wide sentiment on IPO initial returns is more prominent during periods in which the market is rising.

According to the preceding analysis, improvement of the information environment may reduce the influence of market-wide sentiment on IPO initial returns. In fact, IPO initial returns include the influence of both offering and trading prices. It is possible that both primary market underpricing theory and secondary market overpricing theory apply. Studies of primary market underpricing theory have argued that offering-price discounts are caused not by firms in China but by regulators. To keep the Chinese stock market stable in its early stages, the China Securities Regulatory Commission regulated offering prices based on the price-to-earnings ratio. For example, the price-to-earnings ratio was kept below 20 during 2002–2004. The upper limit of the price-to-earnings ratio was canceled when the new security law was promulgated and the inquiry system

was enforced. However, the China Securities Regulatory Commission continued to set guidelines for offering prices and recommended that the price-to-earnings ratio remains below 30. In late 2009, the offering price regulation was completely canceled and IPO pricing entered an age of marketization.

The regulation of the price-to-earnings ratio during IPOs produces value-relevant information and especially good news that is otherwise insufficiently reflected in stock prices. Primary market underpricing theory is therefore likely to play a more important role in initial returns. Consequently, the effect of the information environment on noise trading in the secondary market may be weaker during regulatory periods. On the contrary, regulations disappear during marketization periods and the influence of market-wide sentiment on IPO initial returns becomes stronger. Therefore, we propose the following hypotheses.

Hypothesis 3.1. The role of lower analyst forecast bias in reducing the influence of market-wide sentiment on IPO initial returns is more prominent during marketization periods than during regulatory periods.

Hypothesis 3.2. The role of lower analyst forecast dispersion in reducing the influence of market-wide sentiment on IPO initial return is more prominent during marketization periods than during regulatory periods.

4. Research design

4.1. Sample selection

We select IPO firms from the Chinese A-share market during 2001–2011 and obtain 1326 observations. We remove 27 financial industry observations and 13 special listings from the sample (including 1 private placement listing, 2 leftover historical listings and 10 stock swap listings). We also remove sample firms followed by three or fewer analysts before listing and ultimately obtain 949 observations. We source financial and analyst forecast data before IPOs from the WIND database; IPO, financial and stock trading data after listing from the CSMAR database; and investment account data from the CCER database.

4.2. Empirical model and variable definitions

In examining our hypotheses, we establish the following econometric models to investigate the influence of analyst forecast bias and forecast dispersion on IPO initial returns:

$$\begin{aligned} IR = {} & \beta_0 + \beta_1 \times SENT + \beta_2 \times Lerr + \beta_3 \times Lerr \times SENT + \beta_4 \times PE + \beta_5 \times TA + \beta_6 \times ROE \\ & + \beta_7 \times LEV + \beta_8 \times Growth + \beta_9 \times Shriss + \beta_{10} \times Age + \beta_{11} \times Regu + \beta_{12} \times Delay \\ & + \beta_{13} \times ZXB + \beta_{14} \times CYB + Ind\_Dummy + Year\_Dummy + \varepsilon \end{aligned} \quad (1)$$

$$\begin{aligned} IR = {} & \beta_0 + \beta_1 \times SENT + \beta_2 \times Ldisp + \beta_3 \times Ldisp \times SENT + \beta_4 \times PE + \beta_5 \times TA + \beta_6 \times ROE \\ & + \beta_7 \times LEV + \beta_8 \times Growth + \beta_9 \times Shriss + \beta_{10} \times Age + \beta_{11} \times Regu + \beta_{12} \times Delay \\ & + \beta_{13} \times ZXB + \beta_{14} \times CYB + Ind\_Dummy + Year\_Dummy + \varepsilon \end{aligned} \quad (2)$$

We define the variables as follows.

4.2.1. IPO initial return

The independent variable *IR* refers to the IPO initial return and reflects the percentage change from the offering price to the close price on the initial date. *IR* = (Close price on initial date − Offering price)/Offering price.

4.2.2. Market-wide sentiment

Studies have measured investor sentiment through direct and indirect methods. Among the direct methods are questionnaires submitted to investors. Although such a method directly reflects the ex ante sentiment, sample selection bias and measurement error (i.e., the feedback from questionnaire subjects deviates from reality) make it problematic. Indirect methods measure sentiment through ex postmeasurement, including market

returns, trading volume, stock turnover, percentage of stock raising, short selling ratios and close-end fund discounts. Relative to direct methods, indirect methods are easy to obtain and replicate.

Lacking authoritative and continuous questionnaires to capture investor sentiment in China, researchers have usually measured sentiment indirectly. We choose measurements based on the following rules. The first rule is applicability. Due to differences in institutional background and market environment, foreign market measurements are not applicable to China. For example, Lee et al. (1991) find that close-end fund discounts are significantly affected by sentiment and have become popular measurements. However, close-end funds in China remain very small, lack liquidity and are inconvenient for reflecting investor sentiment (Liu and Xiong, 2005). The second rule is pertinence. Because individuals play an important role in the Chinese stock market, the measurement we choose should reflect the variability of individual investors' sentiments. Measurements such as monthly net purchased funds and cash holding percentage by funds reflect only the sentiments of institutional investors and are unsuitable for our context. The third rule is availability. Availability determines the cost and replicability of our research. Accordingly, we choose the following two measurements.

The first measurement is *Mret*, which stands for pre-IPO market returns (120 trading days before listing). As a sentiment signal, market returns have an important influence and implications for investor sentiment and trading behavior. Fisher and Statman (2002) find that investor sentiment and market returns are positively related. Derrien (2005) also observes that high market returns before listing enhance the demand for new issues and result in high IPO initial returns. Accordingly, we expect *Mret* to be positively related to initial returns.

The second measurement is *NewAcct*, which stands for the number of investment accounts opened during the IPO month. *NewAcct* refers to the willingness of over-the-counter investors' participation and directly reflects market-wide sentiment. Han and Wu (2007) use monthly opened investment accounts to measure investor sentiment. Shiller (2005) identifies the increase in stock market participants as an important cause of the bull market. Accordingly, we expect *NewAcct* to be positively related to IPO initial returns.

4.2.3. Analyst forecasts

We use analyst forecast bias and forecast dispersion to measure the information environment of IPO firms. We obtain analyst forecast data before listing (i.e., before the offering price is determined) from the WIND database.[4] We use the middle point of the interval forecast as the forecast value to calculate the forecast bias and forecast bias.

We define analyst forecast bias as shown in Eq. (3). Err_i refers to the analyst consensus forecast bias of firm i. $Forecast\_P_{i,j}$ stands for the offering price forecast of firm i from analyst j. $P_{i,0}$ stands for the offering price of firm i. We define analyst forecast dispersion as shown in equation (4). $Disp_i$ stands for the forecast dispersion of firm i.

$$Err_i = \frac{\text{Median}(Forecast\_P_{i,j}) - P_{i,0}}{P_{i,0}}. \tag{3}$$

$$Disp_i = \frac{\text{Std}(Forecast\_P_{i,j})}{\text{Median}(Forecast\_P_{i,j})}. \tag{4}$$

To ensure the empirical results provide economic implications, we transform the continuous measurements according to the following equation and finally obtain $Lerr_i$ (which stands for a low level of forecast bias) and $Ldisp_i$ (which stands for a low level of forecast dispersion):

$$Lerr_i = \frac{\text{Max}(Err_i) - Err_i}{\text{Max}(Err_i) - \text{Min}(Err_i)}. \tag{5}$$

$$Ldisp_i = \frac{\text{Max}(Disp_i) - Disp_i}{\text{Max}(Disp_i) - \text{Min}(Disp_i)}. \tag{6}$$

$\text{Max}(Err_i)$ and $\text{Min}(Err_i)$ refer to the maximum and minimum forecast bias values in the total sample, respectively. $\text{Max}(Disp_i)$ and $\text{Min}(Disp_i)$ refer to the maximum and minimum forecast dispersion values in the total

[4] In our paper, the term "analysts" refers to sell-side analysts.

sample, respectively. According to the preceding formula transformation, $Lerr_i$ and $Ldisp_i$ are newly constructed continuous variables and vary between 0 and 1. The larger the variable $Lerr_i$, the lower the level of analyst forecast bias. Based on the preceding analysis, a lower forecast bias, indicating a higher-quality information environment, helps to limit the frequency of noise trading and weaken the influence of market-wide sentiment on IPO initial returns. In addition, relative to optimistic forecasts, pessimistic forecasts play a more prominent role in weakening the influence of market-wide sentiment on initial returns. Accordingly, we expect β_3 to be significantly negative in models (1) and (2).

4.2.4. Control variables

IPO initial returns are influenced by both primary market underpricing and secondary market overpricing. We focus on the latter. Consequently, we add *PE* (the offering price-to-earnings ratio) to control for the effect of the offering price and calculate the offering price-to-earnings ratio according to the fully diluted method. All other things being equal, the higher the offering price, the lower the initial return. Accordingly, we expect β_4 to be significantly negative.

Next, we follow previous studies in controlling for the factors that influence primary market underpricing. *TA* refers to the natural logarithm of the total assets at the end of the previous year before listing. Booth and Chua (1996) observe that large firms are more transparent and easily evaluated than small firms. As such, assets and IPO initial returns are negatively related. *LEV* refers to the leverage ratio at the end of the previous year before listing. Chen et al. (2004) use the leverage ratio to measure ex-ante risk and find the leverage ratio to be positively related to IPO initial returns. *Growth* refers to sales growth at the end of the previous year before listing. Growth companies are difficult to evaluate due to their volatile financial performance. *Shriss* refers to the proportion of new issues after listing. Beatty and Ritter (1986) observe that small issues are easy to manipulate. As such, companies must use higher discounts to compensate for investor risk. Meanwhile, price manipulation always leads to stock trading premiums. As a result, we predict that IPO initial returns are higher for small-issue stocks. *Age* refers to the number of days (divided by 360) between a company's establishment and its IPO. Ritter (1984) observes that the longer a company is established, the more information investors should obtain and the easier the evaluation should be. We expect firm age to be negatively related to initial returns. We add *ROE* (i.e., the return on equity at the end of the previous year before listing) to control for the influence of profitability.

In light of the significant influence of the institutional background on IPO initial returns, we add an institutional variable to control for its potential effect. First, *Regu* is a dummy variable representing offering-price regulation. It equals 1 if the offering price is determined according to regulation and 0 if the offering price is determined through a market-oriented mechanism. In this paper, the sample period covers four periods. The first period is the trial period for market-oriented pricing (before October 2001), during which offering prices were independently determined by the listing firm and the underwriter. *Regu* equals 0 if the firm issued during this period. The second period is the offering-price limitation period (between November 2001 and December 2004), during which offering prices had to be lower than 20 times the earnings per share under the regulation of the China Securities Regulatory Commission. *Regu* equals 1 if the firm issued during this period. The third period is the offering-price limitation canceling period (from January 2005 to June 2009), during which the China Securities Regulation Commission canceled the offering-price upper-limit regulation and provided guidelines for new issues. The usual upper limit was 30 times the offering-price-to-earnings ratio. Accordingly, *Regu* equals 1 if the firm issued during this period and the offering-price-to-earnings ratio is between 28 and 32, and 0 otherwise. The fourth period is the market-oriented pricing period (after July 2009), during which offering-price regulations were canceled. *Regu* equals 0 if the firm issued during this period. Offering-price regulation restricts the upper limit of the price and results in a high initial return. As such, we expect *Regu* to be positively related to initial returns.

Second, Mok and Hui (1998) state that the waiting period before listing is too long in China and that a long waiting period increases the risk for investors. As such, a company must lower the offering price and provide a high premium to compensate for investor risk. Accordingly, we add *Delay* to control for the waiting period. It equals the number of days (divided by 360) between the firm's offering and listing. We expect *Delay* to be negatively related to initial returns.

Third, the capital market in China includes a main board, a small- and medium-sized enterprises board and a growth enterprise market. The listing rules and pricing processes vary with the type of market. However, firm characteristics also vary with the type of market. Relative to firms listed on the main board, firms listed on the small- and medium-sized enterprises board or in the growth enterprise market are usually smaller and growing faster. Accordingly, we add two dummy variables, *ZXB* (which equals 1 if the firm is listed on the small- and medium-sized enterprises board and 0 otherwise) and *CYB* (which equals 1 if the firm is listed in the growth enterprise market and 0 otherwise), to capture the listing board characteristics.

We also add dummy variables to control for the influence of industry factors. Table 1 summarizes the variables.

5. Empirical results

5.1. Descriptive statistics

Table 2 shows the descriptive statistics. All of the continuous variables are winsorized at the 1% level to eliminate the influence of extreme values. Although the mean value of IPO initial returns for Chinese new issues declines from 2001 to 2011, it remains higher than that of mature capital markets. The standard deviation of initial returns is 79.1%, indicating a large difference between firms. More than 90% of new issues gain positive initial returns and only 93 new issues fall on debut (mainly in 2010 and 2011). The mean value of cumulative returns 120 trading days before listing is 23.9%, with a standard deviation of 35.7%. Seventy-six percent of the total sample is issued when the market is rising and 24% is issued in periods of falling markets. New issues in China cannot time their listing due to the offering regulations. This institutional background is convenient for our research. Although the mean value of investment accounts opened during the month of listing is about 705,300, the minimum is 47,000 and maximum is about 4.2 million. In addition, the average analyst following is about eight. The average forecast bias is 24.8% of the offering price and the maximum value is 3.25 times the offering price. The average forecast dispersion is 17% of the offering price. The analysts are generally optimistic; the forecast optimism is positive and significant at the 1% level.

Table 1
Variable definitions.

Variable	Definition
IR	IPO initial return. Reflects the percentage change in price from the offering price to the close price on the initial date. *IR* = (Close price on initial date–Offering price)/offering price
Mret	Market return pre-IPO (120 trading days before listing)
NewAcct	Number of investment accounts opened during the month of IPO (natural logarithm)
Err	Forecast bias. *Err* = (Median value of analyst forecasts of offering price–Offering price)/Offering price
Lerr	*Lerr* = (Maximum *Err*–Forecast bias)/(Maximum *Err*–Minimum *Err*)
Disp	Forecast dispersion. *Disp* = Standard deviation of analyst forecasts of offering price/Median value of analyst forecasts of offering price
Ldisp	*Ldisp* = (Maximum *Disp*–Forecast dispersion)/(Maximum *Disp*–Minimum *Disp*)
PE	Offering price-to-earnings ratio, calculated according to the fully diluted method
Lnta	Natural logarithm of total assets at the end of the previous year before listing
ROE	Return on equity at the end of the previous year before listing
LEV	Leverage ratio at the end of the previous year before listing
Growth	Sales growth at the end of the previous year before listing
Shriss	Proportion of new issues after listing
Age	Number of days (divided by 360) between establishment and listing
Regu	Dummy variable representing offering-price regulation. Equals 1 if the offering price is determined under regulation and 0 if it is determined by market mechanism
Delay	Waiting period. Equals the number of days (divided by 360) between the firm's offering and listing
ZXB	Equals 1 if the firm is listed on the small- and medium-sized enterprises board and 0 otherwise
CYB	Equals 1 if the firm is listed in the growth enterprise market and 0 otherwise

Table 2
Descriptive statistics.

Variable	*N*	Mean	Std. Dev.	Min.	Median	Max.
IR	949	0.700	0.791	−0.118	0.436	3.807
Mret	949	0.239	0.357	−0.377	0.205	1.549
NewAcct	949	4.256	0.663	1.548	4.148	6.042
nFollow	949	8.256	3.821	3.000	8.000	26.000
Err	949	0.248	0.405	−0.269	0.127	3.255
Lerr	949	0.882	0.092	0.198	0.910	1.000
Disp	949	0.170	0.078	0.016	0.163	0.534
Ldisp	949	0.682	0.145	0.000	0.694	0.969
PE	949	45.965	20.387	12.220	42.560	108.700
Shriss	949	0.248	0.046	0.100	0.250	0.444
TA	949	11.044	1.132	9.358	10.832	15.483
ROE	949	0.265	0.101	0.055	0.253	0.597
LEV	949	0.487	0.163	0.120	0.495	0.839
Growth	949	0.285	0.285	−0.236	0.231	1.396
Age	949	4.086	3.162	0.819	2.775	14.333
Delay	949	0.035	0.014	0.022	0.031	0.108
ZXB	949	0.601	0.490	0	1	1
CYB	949	0.272	0.445	0	0	1
Regu	949	0.126	0.333	0	0	1

5.2. Test of Hypothesis 1

5.2.1. Empirical results

First, we examine the influence of market-wide sentiment and analyst forecasts on IPO initial returns. Table 3 shows the results. We use cumulative market returns before listing to measure market sentiment in columns (1)–(3), and use the number of new accounts opened in the month of listing to measure market sentiment in columns (4)–(6). After controlling for other factors, we find market-wide sentiment to be positively related to IPO initial returns. The coefficient of cumulative market return (*Mret*) is 0.725 and the coefficient of new accounts (*Acct*) is 0.272. The positive relationship between market sentiment and initial returns infers that secondary market over-pricing is the main cause of IPO initial returns. The coefficient would be negative if the primary market underpricing theory dominates. We add *Lerr* to columns (2) and (5) to determine the influence of analyst forecast bias. The results show that the lower the analyst forecast bias, the weaker the initial return. We add *Ldisp* to columns (3) and (6) to determine the influence of forecast dispersion. The results show that the lower the analyst forecast dispersion, the weaker the initial return. All of these results demonstrate that forecast bias and dispersion may lower initial returns.

Among the control variables, *TA* and *ROE* are negatively related to IPO initial returns. This result indicates that the transparent information environment of a large firm decreases the asymmetry between firms and investors and hence lowers the initial returns. The higher the profitability, the lower the initial return. The sales growth rate raises the level of initial returns due to its high financial volatility and valuation difficulty. The offering price-to-earnings ratio (*PE*) and proportion of new issues (*Shriss*) are negatively related to initial returns. The regulation and waiting periods have positive effects on initial returns. In addition, the initial returns of firms listed on the small- and medium-sized enterprises board and in the growth enterprise market are lower than those of firms listed on the main board due to the differences in size, growth and offering price level.

To further investigate the influence of analyst forecasts, we add the interaction of analyst forecast characteristics and market-wide sentiment to the empirical model. Table 4 shows the results. Columns (1) and (2) investigate the influence of the interaction on initial returns and indicate a negative relationship for both measurements. The coefficient of the interaction of analyst forecast bias and market-wide sentiment shows that a lower analyst forecast bias significantly decreases trading frequency in an improved information environment and thus weakens the influence of market-wide sentiment on IPO initial returns. The coefficient of the interaction is significantly negative as expected.

Table 3
The influence of individual factors on IPO initial returns.

SENT=	*Mret*			*Acct*		
	(1)	(2)	(3)	(4)	(5)	(6)
SENT	0.725***	0.620***	0.716***	0.272***	0.226***	0.267***
	(10.09)	(9.80)	(10.04)	(6.06)	(5.77)	(6.01)
Lerr		−4.334***			−4.482***	
		(−16.72)			(−16.79)	
Ldisp			−0.552***			−0.575***
			(−4.22)			(−4.25)
TA	−0.213***	−0.186***	−0.213***	−0.209***	−0.182***	−0.210***
	(−8.23)	(−8.18)	(−8.33)	(−7.82)	(−7.74)	(−7.91)
ROE	−1.142***	−1.164***	−1.054***	−1.189***	−1.205***	−1.097***
	(−6.02)	(−7.01)	(−5.57)	(−6.06)	(−7.03)	(−5.61)
LEV	0.105	0.170	0.140	0.182	0.239**	0.218
	(0.79)	(1.47)	(1.07)	(1.34)	(2.00)	(1.61)
Growth	0.290***	0.190***	0.269***	0.260***	0.162***	0.239***
	(4.32)	(3.22)	(4.03)	(3.76)	(2.66)	(3.47)
PE	−0.008***	−0.004***	−0.008***	−0.005***	−0.002**	−0.006***
	(−6.36)	(−4.10)	(−6.85)	(−4.32)	(−2.06)	(−4.84)
Shriss	−0.833*	−1.278***	−0.873**	−0.578	−1.078***	−0.624
	(−1.89)	(−3.31)	(−2.00)	(−1.27)	(−2.70)	(−1.38)
Age	0.003	0.001	0.004	0.002	−0.000	0.003
	(0.59)	(0.16)	(0.75)	(0.35)	(−0.08)	(0.52)
Delay	1.348	2.977**	1.547	2.422	3.917***	2.608
	(0.88)	(2.21)	(1.01)	(1.50)	(2.77)	(1.63)
Regu	0.351***	0.162**	0.342***	0.329***	0.137**	0.320***
	(4.88)	(2.54)	(4.79)	(4.41)	(2.07)	(4.32)
ZXB	−0.159**	−0.132*	−0.163**	−0.185**	−0.153**	−0.188**
	(−2.00)	(−1.90)	(−2.07)	(−2.25)	(−2.13)	(−2.31)
CYB	−0.235**	−0.224***	−0.250***	−0.269***	−0.253***	−0.284***
	(−2.55)	(−2.78)	(−2.74)	(−2.83)	(−3.04)	(−3.01)
Cons	4.272***	6.556***	4.726***	2.966***	5.546***	3.460***
	(10.62)	(17.37)	(11.45)	(6.36)	(12.73)	(7.26)
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	949	949	949	949	949	949
R2_Adj	0.605	0.698	0.612	0.578	0.677	0.586
F	38.223	55.677	38.400	34.261	50.771	34.483
p	0.000	0.000	0.000	0.000	0.000	0.000

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

Columns (3) and (4) verify whether analyst forecast dispersion weakens the influence of market-wide sentiment on initial returns. The results also show that lower analyst forecast dispersion may significantly decrease trading frequency and thus weaken the influence of market-wide sentiment on IPO initial returns. Hypothesis 1 is thus supported.

5.2.2. Robustness checks

We conduct the following robustness checks to enhance the reliability of our results.

First, we change the calculation window for cumulative market returns. We calculate the cumulative market returns for the 90 (120 in the preceding analysis) trading days before listing to measure market sentiment. The results are shown in columns (1) and (2) of Table 5. Although we change the calculation window, market-wide sentiment continues to have a positive effect on IPO initial returns and a lower analyst forecast bias and dispersion significantly weaken the influence of market-wide sentiment on IPO initial returns.

Second, we use industry cumulative returns to measure investor sentiment. Researchers have discovered remarkable price co-movements within industries and have observed that investor sentiment plays an

Table 4
Test of Hypothesis 1.

SENT=	*Mret* (1)	*Acct* (2)	*SENT*=	*Mret* (3)	*Acct* (4)
SENT	2.307***	0.856***	*SENT*	1.473***	0.607***
	(5.42)	(3.89)		(6.60)	(4.73)
Lerr	−3.497***	−1.076	*Ldisp*	−0.220	1.701**
	(−10.56)	(−0.89)		(−1.38)	(2.08)
SENT × *Lerr*	−2.004***	−0.742***	*SENT* × *Ldisp*	−1.158***	−0.514***
	(−4.01)	(−2.90)		(−3.58)	(−2.82)
TA	−0.181***	−0.183***	*TA*	−0.208***	−0.207***
	(−8.04)	(−7.82)		(−8.16)	(−7.84)
ROE	−1.174***	−1.200***	*ROE*	−1.028***	−1.090***
	(−7.13)	(−7.03)		(−5.46)	(−5.60)
LEV	0.160	0.226*	*LEV*	0.111	0.190
	(1.40)	(1.90)		(0.85)	(1.40)
Growth	0.191***	0.159***	*Growth*	0.271***	0.241***
	(3.27)	(2.63)		(4.10)	(3.51)
PE	−0.004***	−0.002**	*PE*	−0.008***	−0.005***
	(−3.99)	(−2.18)		(−6.46)	(−4.64)
Shriss	−1.171***	−1.042***	*Shriss*	−0.901**	−0.636
	(−3.05)	(−2.62)		(−2.08)	(−1.42)
Age	0.002	−0.000	*Age*	0.006	0.004
	(0.34)	(−0.02)		(1.01)	(0.70)
Delay	2.876**	3.812***	*Delay*	1.786	2.889*
	(2.15)	(2.70)		(1.18)	(1.81)
Regu	0.147**	0.128*	*Regu*	0.346***	0.313***
	(2.31)	(1.94)		(4.87)	(4.25)
ZXB	−0.143**	−0.165**	*ZXB*	−0.166**	−0.188**
	(−2.07)	(−2.31)		(−2.12)	(−2.32)
CYB	−0.229***	−0.265***	*CYB*	−0.253***	−0.283***
	(−2.87)	(−3.19)		(−2.79)	(−3.01)
Cons	5.869***	2.778***	*Cons*	4.407***	1.891***
	(14.25)	(2.65)		(10.50)	(2.59)
Ind	Yes	Yes	*Ind*	Yes	Yes
Year	Yes	Yes	*Year*	Yes	Yes
N	949	949	*N*	949	949
R2_Adj	0.703	0.680	*R2_Adj*	0.617	0.589
F	55.610	50.144	*F*	38.263	34.095
p	0.000	0.000	*p*	0.000	0.000

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

important role (He, 2001). It can be inferred that investor sentiment varies with the type of industry and that industry cumulative returns may be a better measurement of sentiment. Accordingly, we use industry cumulative returns in the 120 trading days before listing to measure sentiment. The results are shown in columns (3) and (4) of Table 5 and continue to support Hypothesis 1.

Third, we use the mean value of analyst forecasts as the consensus analyst forecast and recalculate analyst forecast bias and forecast dispersion. The results are shown in columns (5)–(8) of Table 5 and our findings are still consistent.

5.3. Test of Hypothesis 2

To investigate whether the effect of analyst forecasts (i.e., weakening the influence of market-wide sentiment on initial returns) depends on investor attention, we use cumulative market returns before listing to measure the market condition and divide the sample period into periods of rising markets and falling markets. Table 6 shows the results.

Table 5
Robustness checks.

SENT= *Forecast Characteristic=*	*Mret_90d* *Opt_med* (1)	*Mret_90d* *Disp_med* (2)	*Iret_120d* *Opt_med* (3)	*Iret_120d* *Disp_med* (4)	*Mret_120d* *Opt_mean* (5)	*Mret_120d* *Disp_mean* (6)	*NewAcct* *Opt_mean* (7)	*NewAcct* *Disp_mean* (8)
SENT	3.767***	0.975***	1.779***	1.312***	2.290***	1.425***	0.862***	0.603***
	(5.09)	(2.71)	(4.04)	(5.58)	(5.49)	(7.67)	(3.92)	(5.55)
Lerr	−3.798***		−3.954***		−3.830***		−1.325	
	(−12.07)		(−12.91)		(−11.50)		(−1.10)	
SENT × Lerr	−3.918***		−1.464***		−1.985***		−0.757***	
	(−4.66)		(−2.83)		(−4.06)		(−2.98)	
Ldisp		−0.431***		−0.280*		−0.205		1.917**
		(−2.66)		(−1.79)		(−1.44)		(2.57)
SENT × Ldisp		−0.948*		−1.071***		−1.212***		−0.565***
		(−1.82)		(−3.12)		(−4.14)		(−3.38)
TA	−0.182***	−0.215***	−0.185***	−0.215***	−0.174***	−0.207***	−0.176***	−0.207***
	(−7.78)	(−8.02)	(−8.13)	(−8.32)	(−7.81)	(−8.15)	(−7.59)	(−7.85)
ROE	−1.216***	−1.052***	−1.143***	−1.000***	−1.131***	−1.021***	−1.155***	−1.083***
	(−7.11)	(−5.32)	(−6.87)	(−5.25)	(−6.95)	(−5.46)	(−6.84)	(−5.59)
LEV	0.217*	0.210	0.205*	0.178	0.156	0.109	0.222*	0.187
	(1.82)	(1.53)	(1.77)	(1.35)	(1.37)	(0.84)	(1.89)	(1.38)
Growth	0.171***	0.241***	0.174***	0.250***	0.185***	0.271***	0.154**	0.239***
	(2.82)	(3.46)	(2.94)	(3.74)	(3.19)	(4.10)	(2.57)	(3.50)
PE	−0.003**	−0.006***	−0.004***	−0.008***	−0.004***	−0.008***	−0.002*	−0.006***
	(−2.45)	(−5.07)	(−3.65)	(−6.30)	(−3.65)	(−6.49)	(−1.85)	(−4.73)
Shriss	−1.220***	−0.852*	−1.085***	−0.756*	−1.181***	−0.909**	−1.046***	−0.652
	(−3.06)	(−1.86)	(−2.79)	(−1.72)	(−3.11)	(−2.10)	(−2.66)	(−1.46)
Age	0.001	0.004	0.001	0.006	0.002	0.006	0.000	0.004
	(0.10)	(0.61)	(0.22)	(0.99)	(0.45)	(1.04)	(0.10)	(0.72)
Delay	2.382*	0.835	2.876**	1.743	3.253**	1.817	4.126***	2.970*
	(1.71)	(0.52)	(2.12)	(1.13)	(2.46)	(1.20)	(2.95)	(1.86)
Regu	0.155**	0.365***	0.171***	0.359***	0.132**	0.345***	0.114*	0.310***
	(2.35)	(4.88)	(2.66)	(5.00)	(2.10)	(4.89)	(1.74)	(4.22)
ZXB	−0.152**	−0.170**	−0.143**	−0.170**	−0.134*	−0.168**	−0.155**	−0.189**
	(−2.12)	(−2.07)	(−2.04)	(−2.15)	(−1.96)	(−2.16)	(−2.19)	(−2.34)
CYB	−0.248***	−0.274***	−0.237***	−0.264***	−0.222***	−0.256***	−0.256***	−0.286***
	(−2.98)	(−2.87)	(−2.93)	(−2.88)	(−2.81)	(−2.84)	(−3.12)	(−3.06)
Cons	6.074***	4.696***	6.193***	4.460***	6.022***	4.381***	2.899***	1.880***
	(14.67)	(10.78)	(15.28)	(10.53)	(14.75)	(10.63)	(2.77)	(2.86)
Ind	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	949	949	949	949	949	949	949	949
R2_Adj	0.679	0.576	0.696	0.608	0.710	0.620	0.687	0.592
F	49.933	32.465	53.991	36.853	57.524	38.738	51.716	34.521
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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

Columns (1) and (2) of Table 6 use cumulative market returns to measure market sentiment and re-estimate model (1) for different sample periods. During the rising market periods, the coefficient of sentiment is significantly positive and the coefficient of the interaction term is significantly negative. Thus, market-wide sentiment is the primary cause of initial returns and a lower analyst forecast bias significantly weakens the influence of sentiment on those returns. However, during the declining market periods, the coefficient of the interaction term is insignificant. Columns (3) and (4) use new accounts opened during the month of listing to measure market sentiment and obtain similar results.

Columns (5)–(8) use cumulative market returns and the number of new accounts to measure market-wide sentiment and re-estimate model (2) for both periods to investigate whether lower analyst forecast dispersion

Table 6
Test of Hypothesis 2.

SENT=	*Mret*		*Acct*		*SENT*=	*Mret*		*Acct*	
	Market Rise (1)	Market Decline (2)	Market Rise (3)	Market Decline (4)		Market Rise (5)	Market Decline (6)	Market Rise (7)	Market Decline (8)
SENT	2.096***	8.005*	0.814***	0.077	*SENT*	1.553***	−1.518	0.567***	0.612
	(4.24)	(1.81)	(3.36)	(0.05)		(5.60)	(−1.09)	(4.04)	(0.67)
Lerr	−3.689***	−1.959*	−1.235	−0.458	*Ldisp*	−0.047	0.363	1.640*	3.751
	(−9.05)	(−1.76)	(−0.90)	(−0.07)		(−0.21)	(1.04)	(1.76)	(0.80)
SENT × *Lerr*	−1.806***	−7.841	−0.704**	−0.272	*SENT* × *Ldisp*	−1.418***	3.854**	−0.491**	−0.977
	(−3.02)	(−1.56)	(−2.48)	(−0.16)		(−3.42)	(1.99)	(−2.42)	(−0.83)
TA	−0.185***	−0.148***	−0.191***	−0.146***	*TA*	−0.220***	−0.141***	−0.223***	−0.151***
	(−6.84)	(−3.42)	(−6.84)	(−3.24)		(−7.07)	(−3.22)	(−6.99)	(−3.33)
ROE	−1.206***	−1.137***	−1.213***	−0.980***	*ROE*	−1.034***	−1.039***	−1.094***	−0.937***
	(−6.03)	(−3.78)	(−5.89)	(−3.18)		(−4.45)	(−3.47)	(−4.59)	(−3.02)
LEV	0.153	0.095	0.228	0.135	*LEV*	0.076	0.067	0.166	0.152
	(1.12)	(0.44)	(1.61)	(0.61)		(0.48)	(0.31)	(1.03)	(0.68)
Growth	0.216***	0.054	0.186**	0.054	*Growth*	0.332***	0.045	0.307***	0.063
	(3.03)	(0.50)	(2.54)	(0.49)		(4.07)	(0.42)	(3.68)	(0.56)
PE	−0.004***	−0.004	−0.003***	−0.003	*PE*	−0.007***	−0.006**	−0.006***	−0.004
	(−3.56)	(−1.45)	(−2.71)	(−0.90)		(−5.22)	(−2.29)	(−4.47)	(−1.64)
Shriss	−1.204***	−1.098	−1.049**	−1.374	*Shriss*	−0.924*	−0.879	−0.664	−1.124
	(−2.73)	(−1.32)	(−2.32)	(−1.60)		(−1.83)	(−1.06)	(−1.28)	(−1.31)
Age	0.001	0.002	−0.002	0.005	*Age*	0.005	0.001	0.002	0.005
	(0.16)	(0.18)	(−0.28)	(0.51)		(0.74)	(0.07)	(0.31)	(0.54)
Delay	3.243**	3.675	3.934**	2.395	*Delay*	1.673	3.032	2.578	1.588
	(2.19)	(0.88)	(2.55)	(0.53)		(0.99)	(0.73)	(1.46)	(0.36)
Regu	0.256***	−0.325**	0.205***	−0.139	*Regu*	0.452***	−0.211	0.373***	−0.132
	(3.40)	(−2.48)	(2.66)	(−1.08)		(5.29)	(−1.58)	(4.27)	(−1.01)
ZXB	−0.171*	0.012	−0.200**	0.012	*ZXB*	−0.203**	0.013	−0.213**	−0.011
	(−1.93)	(0.11)	(−2.19)	(0.10)		(−1.99)	(0.12)	(−2.04)	(−0.09)
CYB	−0.283***	−0.009	−0.323***	−0.014	*CYB*	−0.327***	0.020	−0.353***	−0.018
	(−2.78)	(−0.07)	(−3.09)	(−0.10)		(−2.79)	(0.15)	(−2.95)	(−0.13)
Cons	6.084***	4.306***	3.108***	3.469	*Cons*	4.456***	2.289***	2.277***	0.290
	(12.59)	(3.62)	(2.67)	(0.57)		(8.84)	(2.84)	(2.74)	(0.07)
Ind	Yes	Yes	Yes	Yes	*Ind*	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	*Year*	Yes	Yes	Yes	Yes
N	718	231	718	231	*N*	718	231	718	231
R2_Adj	0.716	0.370	0.699	0.331	*R2_Adj*	0.623	0.373	0.604	0.323
F	45.048	4.859	41.627	4.248	*F*	29.891	4.915	27.681	4.141
p	0.000	0.000	0.000	0.000	*p*	0.000	0.000	0.000	0.000

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

weakens the influence of sentiment on initial returns. The results show that lower analyst forecast dispersion weakens only the influence of sentiment on initial returns during the periods of rising markets (columns (5) and (7)). The coefficient of the interaction term is insignificant (column (8)) or significantly positive (column (6)) during the periods of declining markets.

5.4. Test of Hypothesis 3

To analyze the effect of analyst forecasts across different periods of regulation, we divide the sample period into pricing regulated and marketization periods based on the regulation rules. The specific method is described in the definition of *Regu*. Table 7 shows the results.

Columns (1) and (2) use cumulative market returns to measure sentiment and investigate the effect of analyst forecasts across different sample periods. The results show that sentiment has a significant positive effect on initial returns during the marketization period. However, the coefficient is not significant

Table 7
Test of Hypothesis 3.

SENT=	*Mret*		*Acct*		*SENT*=	*Mret*		*Acct*	
	Regulated	Market-oriented	Regulated	Market-oriented		Regulated	Market-oriented	Regulated	Market-oriented
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
SENT	0.368	3.778***	−0.144	1.072***	*SENT*	1.273*	1.642***	0.702	0.547***
	(0.35)	(6.18)	(−0.26)	(3.34)		(1.70)	(6.48)	(1.61)	(3.67)
Lerr	−5.762***	−2.239***	−9.137**	0.960	*Ldisp*	−0.449	−0.095	0.344	2.004**
	(−5.77)	(−5.87)	(−2.57)	(0.60)		(−0.51)	(−0.64)	(0.10)	(2.22)
SENT × *Lerr*	0.455	−3.578***	0.725	−1.052***	*SENT* × *Ldisp*	−0.356	−1.429***	−0.134	−0.579***
	(0.34)	(−5.19)	(1.02)	(−2.90)		(−0.31)	(−4.03)	(−0.20)	(−2.77)
TA	−0.390***	−0.172***	−0.417***	−0.172***	*TA*	−0.412**	−0.189***	−0.470***	−0.188***
	(−3.10)	(−7.91)	(−3.28)	(−7.56)		(−2.43)	(−8.12)	(−2.72)	(−7.77)
ROE	−0.252	−1.179***	−0.865	−1.169***	*ROE*	−0.214	−1.013***	−0.998	−1.030***
	(−0.27)	(−7.45)	(−0.91)	(−7.06)		(−0.17)	(−5.95)	(−0.77)	(−5.82)
LEV	0.637	0.177	1.127*	0.212*	*LEV*	−0.073	0.165	0.540	0.209*
	(1.01)	(1.61)	(1.77)	(1.84)		(−0.09)	(1.40)	(0.63)	(1.70)
Growth	0.103	0.200***	0.065	0.198***	*Growth*	0.476	0.241***	0.373	0.234***
	(0.37)	(3.47)	(0.23)	(3.28)		(1.31)	(3.90)	(1.00)	(3.63)
PE	0.096	−0.005***	−0.035	−0.003***	*PE*	0.387**	−0.007***	0.237	−0.005***
	(0.79)	(−5.03)	(−0.28)	(−2.78)		(2.47)	(−6.99)	(1.48)	(−5.06)
Shriss	−1.379	−0.978***	−1.975	−0.863**	*Shriss*	−2.185	−0.729*	−2.666	−0.504
	(−0.66)	(−2.65)	(−0.92)	(−2.24)		(−0.77)	(−1.85)	(−0.92)	(−1.23)
Age	0.007	0.002	−0.016	0.005	*Age*	0.016	0.006	−0.018	0.009
	(0.30)	(0.42)	(−0.74)	(1.01)		(0.55)	(1.14)	(−0.63)	(1.61)
Delay	9.456	2.715**	13.585*	2.627*	*Delay*	3.144	2.051	10.011	2.024
	(1.24)	(2.11)	(1.76)	(1.90)		(0.31)	(1.49)	(0.97)	(1.38)
ZXB	−0.961**	−0.126*	−0.985**	−0.133*	*ZXB*	−0.587	−0.145**	−0.627	−0.156**
	(−2.13)	(−1.92)	(−2.15)	(−1.93)		(−0.97)	(−2.07)	(−1.02)	(−2.14)
CYB		−0.186**		−0.217***	*CYB*		−0.199**		−0.227***
		(−2.45)		(−2.73)			(−2.44)		(−2.67)
Cons	9.701**	4.864***	14.919***	1.338	*Cons*	−2.875	3.984***	−1.004	1.873**
	(2.30)	(11.54)	(2.79)	(0.95)		(−0.57)	(10.38)	(−0.18)	(2.45)
Ind	Yes	Yes	Yes	Yes	*Ind*	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	*Year*	Yes	Yes	Yes	Yes
N	120	829	120	829	*N*	120	829	120	829
R2_Adj	0.646	0.577	0.634	0.537	*R2_Adj*	0.361	0.515	0.334	0.474
F	7.777	29.999	7.446	25.625	*F*	3.102	23.539	2.869	20.116

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

during the regulated period. This is consistent with our preceding analysis. When regulation of the offering-price-to-earnings ratio is canceled during the marketization period, investor sentiment in the secondary market is the primary cause of high IPO initial returns. In addition, the interaction is significantly negative during the marketization period. This finding indicates that lower analyst forecast bias significantly weakens the influence of market-wide sentiment on initial returns. However, the coefficient of the interaction term is insignificant during the regulated period. We also use the number of new accounts opened during the listing month to measure sentiment and find similar results. Sentiment has a significant positive effect on initial returns only during the marketization period and lower analyst forecast bias only weakens the relationships during this period.

Columns (5)–(8) use analyst forecast dispersion as the independent variable to investigate the effect of analyst forecasts across different sample periods. Hypothesis 3 remains highly supported.

6. Conclusion

Speculative sentiment and lack of rationality are long-standing drawbacks in the Chinese stock market, especially during IPOs. Trading driven by sentiment not only induces prices that deviate from their intrinsic value, but also exacerbates market volatility. Normalizing investor behavior and improving market rationality are essential for the development of the Chinese stock market.

This paper investigates the influence of sentiment on stock prices during IPOs and determines that market-wide sentiment has a significant effect on IPO initial returns. We use analyst forecast bias and forecast dispersion to measure the information environment and investigate whether an improvement of that environment weakens the influence of sentiment on stock prices. We find that lower analyst forecast bias and forecast dispersion decrease noise trading and thus weaken the influence of sentiment on IPO initial returns.

These results have several implications. First, noise trading is caused by the subjective reasons of investors and the objective information environment faced by those investors. Information asymmetry is an important cause of noise trading and results in the deviation of stock prices from their intrinsic value. Improving the information environment and information transparency is the effective way of decreasing noise trading. Accordingly, the improvement of information disclosure quality is the key point of IPO reforms.

Second, the results affirm the positive role played by analysts. Although we cannot rule out that analyst forecast bias is caused by a conflict of interest among stakeholders, the empirical results show that, as information intermediaries, analysts lower the information asymmetry between firms and investors. Encouraging the development of intermediaries such as analysts may accelerate the improvement of the information system in the capital market.

Third, we find that the analyst's role as an intermediary works only during marketization periods. Therefore, we can infer that pricing regulation is essential for information system effectiveness. The regulation of offering prices ignores differences in firm characteristics and leads to price distortion. Consequently, the government should change its role from participant to regulator during periods of market-oriented reform, after which the market can truly be rectified and improved.

Finally, we find that investor attention is the premise for information acquisition. Strengthening investor education and guiding investors to establish correct investment concepts and sustain their attention are necessary steps in the development of the capital market.

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Does EVA performance evaluation improve the value of cash holdings? Evidence from China

Yongjian Shen [a,*], Lei Zou [b], Donghua Chen [b]

[a] School of Accounting, Nanjing University of Finance and Economics, China
[b] School of Business, Nanjing University, China

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ABSTRACT

This paper investigates the influence of the economic value added (EVA) performance evaluation, issued in 2010 by the State-owned Assets Supervision and Administration Commission of the State Council, on the value of the cash holdings of central state-owned enterprises (CSOEs). We find that EVA performance evaluation has some influence on the overinvestment of CSOE cash holdings and significantly increases the value of CSOE cash holdings compared with the cash holdings of local state-owned enterprises. The greater value of CSOE cash holdings derives from underinvestment modification and overinvestment restraint. The value of cash holdings increases more for companies with better accounting performance. Thus, the EVA performance evaluation policy increases CSOE efficiency. This study contributes to the emerging literature related to cash holdings and the economic consequences of the EVA performance evaluation policy. It expands the literature related to investor protection in countries experiencing economic transition.

1. Introduction

Jensen and Meckling (1976) find that managers routinely waste their firm's cash for personal benefit. Furthermore, Jensen (1986) observes that managers hold on to excess cash for personal benefit. These arguments have been widely cited in the domestic and overseas literature. Due to the separation of ownership and control, managers often consume corporate cash to maximize their own benefits or act in a way that fails to maximize the benefits of stockholders. The agency costs resulting from the separation of ownership and

* Corresponding author.
E-mail address: Yjshen@njue.edu.cn (Y. Shen).

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control rights may be more serious in state-owned enterprises (SOEs) in China due to a lack of individual shareholders. The consumption of cash is likely to be an important component of agency costs.

Cash is very important to the management and operation of a corporation. Cash holdings provide money to meet the daily needs of a corporation and decrease financial risk. In addition, a firm's value rises when its cash is invested. Compared with other kinds of assets, cash is a form of profit and can be easily transformed into a personal benefit at a lower cost (Myers and Rajan, 1998). Given the separation of ownership and control, inside managers can affect the decisions made in relation to cash holdings via residual control. They hold more cash and accept projects that are harmful to shareholder interests, which decreases the value of the cash holdings and decreases their firm's market value to a point lower than book value (Jensen, 1986).

There are two factors that affect the value of cash holdings. The first is financial characteristics, including financing constraints, growth opportunities and investment opportunities. A firm's level of cash holdings affects its market value, which increases as cash holdings rise. The connection becomes stronger if a firm faces better growth opportunities (Saddour, 2006). In theory, a shareholder believes that $1 of a firm's cash holdings is equivalent to its book value. However, for a firm with better investment opportunities, a premium exists in its cash holdings (Pinkowitz and Williamson, 2007). The second factor is corporate governance. The effectiveness of a firm's corporate governance reflects the market value of its cash holdings, which in turn influence the firm's value. Firms with good corporate governance enjoy twice the cash market value of firms with poor corporate governance. The negative effect on operating performance resulting from holding large amounts of cash is suppressed in firms with good corporate governance (Pinkowitz et al., 2006; Dittmar and Jan, 2007).

Agency problems are common and agency costs decrease the value of cash holdings. Therefore, managers who restrain their self-interest may significantly increase the value of their firm's cash holdings. When discussing how manager's performance evaluations influence the value of their firm's cash holdings, it should be made clear that appropriate evaluation is the premise for encouraging managers to increase the service efficiency of their funds. Choosing a core performance evaluation index is the key point in a manager performance evaluation system. When a manager's income is positively related to the performance of his or her firm, economic value added (EVA) can operate as a performance evaluation index that encourages managers to make efficient investment decisions that raise the value of their firms (Rogerson, 1997). In addition, when EVA is included in a manager's compensation incentives, that manager will cut down financing decisions out of self-interest, which has little effect on any increase in firm value (Stern and Stewart, 2004). This paper considers whether an effective manager performance evaluation system decreases agency costs and improves the value of a firm's cash holdings.

Given China's unique institutional background, central SOEs (CSOEs) play an important role in economic growth and the development of a healthy securities market. Although CSOEs have undergone many reforms, many problems remain unsolved. For a long time, CSOEs failed to focus on their main businesses, electing instead to pursue large-scale projects and lowering the efficiency of their funds as a result. To correct this development pattern and protect small investors, the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council issued its *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises* in 2010. Since then, the performance of CSOE heads has been evaluated based on the EVA index.

The main change in this regulation was the use of EVA. EVA comprises 40% of the core index of return of assets. The key point in manager performance evaluations therefore changed from profit to value, forcing CSOEs to focus on value management rather than strategic management. In addition to total profits, capital efficiency is an important factor influencing EVA. In short, EVA value, which represents the value of a firm, grows as the firm's capital efficiency improves. The wise management of capital, achieved by decreasing the cost of occupied capital and improving the efficiency of used capital, is an important approach to improving firm value. Meanwhile, as mentioned in the *Notice on accomplishing the financial budget management and preparation of statement work at central enterprises* in 2013, CSOEs are required to stick to the rule that cash is king in budget management, highlighting the importance of capital management. This regulation asks CSOEs to put cash management first, detail their capital budgets and arrange their financial resources efficiently. In a macro-policy setting, we research cash holdings in CSOEs from an EVA perspective of value creation. The relationship between EVA and cash holdings in CSOEs is readily apparent. Furthermore, it would

be helpful to explore the intention behind the policy and analyze the association between value creation and cash holdings in CSOEs.

The literature related to the value of cash holdings has focused mainly on financial characteristics, corporate governance and financial constraints. These aspects are representative of a firm's internal or external environment. Exploring the factors that influence the value of cash holdings from internal or external environment perspectives reveals their systematic nature and comparability. The sample in this study consists of listed companies that are controlled by CSOEs and matched with local SOEs (LSOEs). The SASAC chose EVA as its index to evaluate the performance of the heads of CSOEs. Combining our sample with this policy context, we research the influence of EVA on the value of CSOE cash holdings. We also try to reveal the intention behind the policy and determine whether it works according to the information we acquire.

This paper makes the following contributions. First, in terms of the EVA evaluation index, whether the heads of CSOEs change their previous management theory to create firm value remains unknown. Because cash has the highest liquidity in a firm, this paper pays attention to factors that affect cash value. It helps to clarify the connection between EVA and the value of cash holdings and provides a theoretical basis and tests for the effect of the policy.

Second, this paper tests the economic consequences of EVA evaluation carried out in CSOEs from a cash holdings perspective. It enriches the literature related to the value of cash holdings while connecting it with the EVA literature.

Third, this paper can be broadly classified as a study of corporate governance and the value of cash holdings. It analyzes how the EVA evaluation index influences the value of cash holdings in detail and therefore extends the literature in that field.

The following features may enhance the validity of our research beyond the contributions just mentioned. First, firms in China can be divided into several classes according to administrative level, such as enterprises of the central government, enterprises of provinces or ministries, enterprises of prefectures or departments and enterprises of counties or divisions. The higher the administrative level of a firm, the stronger its influence on the Chinese macro-economy. CSOEs are crucial participants and their operating efficiency plays an important role in this macro-economy. Second, investors in the Chinese stock market are widely considered to be poorly protected. According to the EVA evaluation index, corporate governance can ensure better investor protection. It not only improves the level of investor protection in the Chinese market, but also provides an empirical reference for other emerging markets.

The rest of this paper is arranged as follows. Section 2 contains the literature review. Section 3 reveals the institutional background, theoretical analysis and research hypotheses. Section 4 presents the research design, including the sample selection, model design and variable definitions. Section 5 describes the descriptive statistics. Section 6 reports the empirical test results. Section 7 offers a conclusion and presents the limitations of the paper.

2. Literature review

This paper focuses on cash, the value of cash holdings and EVA performance evaluation. In this section, we review the literature related to cash holdings and EVA performance evaluation.

2.1. Cash holdings and the value of holdings

Studies of cash holdings and their value have an important position in corporate finance. The scale of cash holdings and efficiency of cash use play important roles in a firm's value because cash is a firm's most essential liquid asset. Bates et al. (2009) classify the reasons why firms hold cash into three motives. The first is the transaction motive. John (1993) and Opler et al. (1999) find that cash holdings affect a firm's Tobin Q, R&D ratio, advertising expenditures, capital expenditures, scale, debt ratios, cash-to-cash cycles and cash flows. Kim et al. (1998) models a firm's investment decisions on its liquid assets and discovers that the optimal amount of liquidity is determined by a tradeoff between the low return of liquid assets and the benefit of decreasing the need for costly external financing. Opler et al. (1999) find that the firms with the best access to capital markets, such as large firms and firms with higher credit ratings, tend to hold lower ratios of cash

to total non-cash assets. The research has also shown that firms that do well tend to hold more cash than predicted by the static tradeoff model, in which managers maximize shareholder wealth.

The second motive is the precautionary motive. According to Opler et al. (1999), firms are expected to hold more cash when they are short on cash flow or find it difficult to obtain external capital, as they incur higher costs if their financial conditions worsen. Almeida et al. (2004) find that financially constrained firms tend to invest in cash assets and that the opposite is true for unconstrained firms. Han and Qiu (2007) argue that the cash holdings of financially constrained firms are positively related to cash flow volatility, providing evidence for the precautionary motive for a firm's cash holdings. Acharya et al. (2012) conclude that the correlation between cash holdings and credit risk is robustly positive. This puzzling finding can be explained by the precautionary motive for saving cash.

The third motive is the agency motive. Jensen (1986) finds that in firms lacking investment opportunities, managers who are motivated by tunneling prefer to keep cash in their firms rather than pay dividends to investors. In terms of investor protection (Dittmar et al., 2003), evidence has shown that firms in countries where investor rights are poorly protected hold up to twice as much cash as those with good investor protection. In addition, when investor protection is poor, the factors that generally drive the need for cash holdings, such as investment opportunities and asymmetric information, become less important. Dittmar and Jan (2007) and Pinkowitz et al. (2006) find that serious agency problems devalue firms' cash holdings. Evidence from Dittmar and Jan (2007) and Harford et al. (2008) shows that managers who are motivated by tunneling are inclined to set up an equilibrium of excess cash holdings and are always good at consuming excess cash. Nikolov and Whited (2011) discover that the agency problem of perquisite consumption is better than firm size at explaining a cash holdings equilibrium and that the agency problem of firm size is better at explaining firm value. Liu and Mauer (2011) find that risk premiums are positively related to cash holdings but negatively related to the value of cash holdings.

Other scholars have researched cash holdings in different ways. Chen et al. (2012) find that cash holdings in the Chinese stock market decrease after the split-share reform. This appears to be more significant for firms with poorer corporate governance and stronger financial constraints. Based on questionnaires posted to CFOs in 29 countries, Lin et al. (2010) conclude that a line of credit is the key point influencing financial liquidity.

Scholars also make contributions to the value of cash holdings. Faulkender and Wang (2006) test abnormal stock returns in different fiscal years. They consider the marginal value of cash declines given more cash holdings, higher financial leverage and easier access to the capital market. Cash dividends also decrease the marginal value compared with stock repurchases. Some research has determined the average cash value in all firms to be \$0.94. In theory, shareholders estimate that \$1 in cash is equal to its book value. However, cash holdings in firms with better investment opportunities enjoy a premium (Pinkowitz and Williamson, 2007), meaning that \$1 in cash is worth more than its book value. The opposite is also true. Many researchers have focused on how corporate governance influences the value of cash holdings. Agency theory argues that cash value is lower in countries in which investor protection is poor, as controlling shareholders are more likely to benefit from cash assets. In response to this theory, Pinkowitz et al. (2006) believe that the relationship between cash holdings and firm value is weaker in countries with poorer investor protection. Firms with poor corporate governance hold less cash because managers tend to consume cash more quickly rather than keep it in case of financial crisis (Harford et al., 2008). Dittmar and Jan (2007) find that \$1 in cash in poorly governed firms ranges from only \$0.42 to \$0.88 in value. However, the amount rises to \$2 in well-governed firms. Moreover, when a firm's corporate governance is poor, it is easier for managers to waste cash on projects that do obvious damage to the firm's value.

Scholars in China have also devoted themselves to such research. Zhang and Wu (2006) conclude that the relation between cash and cash flow sensitivity is significantly positive in Chinese firms regardless of whether they face financial constraints. Under the economic conditions in China, better corporate governance lowers cash holdings (Xin and Xu, 2006). In terms of local government governance, firms positioned in areas in which the local government is properly governed hold less cash (Chen et al., 2011). In terms of agency problems, agency costs play a role in the following relationship (Jiang and Bi, 2006). When agency costs are high, excess cash holdings are negatively related to firm value. The relationship turns positive when agency costs decrease. In terms of the separation of control and ownership rights, Shen et al. (2008) find that state-owned controlling shareholders prefer high levels of cash holdings. The value of cash holdings in these firms is RMB0.769. When

there is separation in the two rights or state-owned controlling shareholders change, the value rises to RMB1.206. The market value of cash holdings in Chinese listed firms is generally lower than the book value, which is more significant in listed SOEs.

As mentioned previously, scholars have mostly focused on corporate governance and the legal environment and have discussed whether the two influence the value of cash holdings. Little attention has been paid to performance evaluation. The regulation of the EVA performance evaluation, issued by the SASAC in 2010, is exogenous across firms in China. The EVA evaluation reflects a distinctly different idea compared with past evaluations. The regulation enforced by the SASAC provides an excellent opportunity to determine whether the EVA evaluation affects the management theory of the heads of CSOEs and the value of cash holdings. Based on its results, this study should enrich the literature related to what influences the value of cash holdings.

2.2. EVA performance evaluation

Stern Stewart introduced the EVA performance evaluation more than 20 years ago.[1] The company believes that EVA is more persuasive than other performance indicators in terms of driving stock prices, creating wealth and interpreting changes in shareholder wealth (Stewart, 1994). The empirical findings of the correlation between EVA and accounting performance have been diverse. Chen and Dodd (1997), Lehn and Makhija (1997) and Kleiman (1999) find that EVA supports value creation capabilities. Machuga et al. (2002) find that EVA can more accurately forecast future profits than Earning Per Share (EPS). Lovata and Costigan (2002) find that defensive companies with low levels of insider ownership and institutional investors with large cash holdings are more inclined to use the EVA performance evaluation system. However, Biddle et al. (1997) find no evidence to support EVA.

Conclusions as to whether EVA can improve corporate value and whether stock prices have more relevance have been diverse. However, this does not affect our analysis of the effect of EVA on the value of cash holdings. An EVA calculation must consider all of the costs involved, including the cost of equity capital. Therefore, an EVA performance evaluation affects an enterprise's entire asset structure, and the enterprise must adjust its cash holdings accordingly. The literature has not yet linked these two phases.

The SASAC deemed EVA an effective performance evaluation mechanism that is able to improve business efficiency and protect shareholder interests and is within the scope of SOEs to enforce. In this paper, we focus on whether the EVA performance evaluation changes the philosophy of the heads of CSOEs in a way that increases the value of their cash holdings. The literature thus far has not provided a clear answer to this point. Therefore, this paper attempts to analyze the relationship between EVA performance evaluation and the corporate value of cash holdings, link the fragmented literature related to EVA and the value of cash holdings and test the effect of the EVA performance evaluation in practice.

3. Institutional background, theoretical analysis and hypotheses

We begin by considering the executive pay reform process of Chinese companies. Employee pay was under strict control before China's reform and opening-up policies were launched in 1978. Factory director wages were also subject to the rigid wage system. Wages were bonded to some non-financial indexes, including enterprise location, industry, political rank (central or local), director's administrative level, firm size, job type and personal qualifications (Yueh, 2004). The State Council approved the "annual salary system," combining the basic and risky salaries of the Shanghai Hero Pan Company in 1992, thereby beginning the substantive reform of the executive pay system. Although SOEs had undertaken many non-financial goals, their operating performance was generally measured by financial indexes (Yueh, 2004).

Although China holds a theoretically positive attitude toward the value of managers, it regulates managers in practice, bonding their salaries with those of employees. Around 2004, the State Council and SASAC issued

[1] Before the document is issued, the salary decisions made inside the companies probably make implicit use of value-making indexes to evaluate the executives based on accounting performance. The release of the document may make these implicit value-making indexes explicit.

their *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises* and *Interim Measures for Compensation of Persons-in-Charge at Central Enterprises* and subsequently put them into practice. They determine that the salaries of heads of CSOEs comprise basic and performance salaries in addition to long-term incentive units and raise a specific measure to bond the regulation of their salaries with business performance. The *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises* entered into effect on January 1, 2007 and encourages enterprises to use the EVA index to appraise their annual business performance. Enterprises using the EVA index and attaining EVA growth are rewarded. According to the *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises*, the SASAC can only encourage enterprises to use the EVA index. The enterprises are free to decide whether to use it based on the systems they have in place. Considering the spillover effect of the *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises*, other enterprises may imitate the CSOEs and use EVA as an appraisal index.[2] This document may only expose the implicit evaluation of the executives' value creation. The Shandong Department of Finance published the EVAs of all of the SOEs and community-owned enterprises and some private enterprises for three years beginning in 2006 to maximally decrease the profit manipulation of executives and accounting distortion performance and coordinate the SASAC and enterprises to comprehensively evaluate executive performance. In 2010, the SASAC issued *Order No. 22*, requiring CSOEs to appraise executive performance using a combination of accounting profit and EVA. EVA has a weight of around 40%.

Throughout the reform of the Chinese enterprise and "annual salary system," salary contracts have generally been based on accounting profit assessments. Although accounting performance is more easily manipulated for managers' interests,[3] we do not deny that such manipulation can act as an incentive for executives to work harder. As managers decide salaries, their interests complement those of shareholders. Determining how to encourage executives to improve short-term accounting performance without encouraging a loss in enterprise value is one of the most important tasks for managers. A series of indexes can measure the enterprise value including stock prices, return on equity and EVA. Nevertheless, the systemic risk of the stock market is beyond the control of executives (Sloan, 1993; Garvey et al., 2002). As a result, performance indexes, which are bonded with the systemic risk of the stock market, go against executive incentives. Compared with stock market indexes, the EVA index is under executive control, which reflects the effort level of the executives. Compared with accounting indexes, the EVA index is less likely to be manipulated and is able to reflect executives' efforts to ensure the long-term growth of their enterprises. When it is unsafe to observe CEOs' performance, EVA may offer a better option by partly observing the controllable output (changes in stockholder wealth) of their observable effort (CEOs' effort) (Jensen and Murphy, 1990).

EVA is a corporate finance, decision and compensation incentive system registered and carried out by Stern Stewart. At its core, it is an evaluation methodology based on net operating profit and the total cost of capital-making profit. It is calculated as follows: EVA = Net profit after tax − Total capital cost = Net profit after tax − Capital × Cost of capital. According to the new conception of value creation, an enterprise's value creation must be evaluated via EVA (Stewart, 1994). EVA truly reflects whether an enterprise is creating or losing value in a certain period, considering all of the capital costs including equity capital. Occupation of funds is a factor that influences EVA. The higher the amount of occupied of funds, the lower the EVA, ceteris paribus. Meanwhile, the cash that enterprises hold comprises a large proportion of occupied funds. Therefore, cash holdings and the efficiency of their investment are important factors influencing EVA. This paper focuses on cash holding value.

[2] EVA has also undergone great improvement in China. Baosteel and Tsingtao Beer successfully introduced EVA at the end of 2002 and took it as an opportunity to re-engineer their organizational construction and management processes and establish EVA salary and financial management systems. The government implemented an annual salary policy in Tsingtao Beer in 1999. However, the annual salary system based on accounting numbers unfairly ignored the costs of capital. Combining EVA and accounting numbers increased the transparency of the company, its investment efficiency and the value of its human resources (2002, http://business.sohu.com). Other famous enterprises that have adopted EVA include China Construction Bank, Li-Ning, China Construction and FAW Group.

[3] Before the document is issued, the salary decisions made inside the companies probably make implicit use of value-making indexes to evaluate the executives based on accounting performance. The release of the document may make these implicit value-making indexes explicit.

Three kinds of motivations account for cash holding performance: transaction motivation (Miller and Orr, 1966; Mulligan, 1997), precautionary motivation (Opler et al., 1999; Riddick and Whited, 2009; Bates et al., 2009) and agency cost motivation (Jensen, 1986; Dittmar and Jan, 2007). The earnings from cash holdings maintain currency for daily operations, decrease the chance of a financial dilemma and ensure that an investment policy is not affected by a lack of money. However, cash holdings involve certain managerial and opportunity costs. Too high a cash holding may influence executives' investment behavior and create agency costs (Jensen and Meckling, 1976). As such, the earnings and costs of cash holdings must be balanced.

According to the principal-agent model presented by Jensen and Meckling (1976), executives allocate enterprise resources out of personal interest due to information asymmetry and limited rationality, including cash. When an enterprise's performance harms stockholder interests, the motivation of its executives' cash holding behavior assimilates the theory of free cash flow. According to this theory, massive cash holdings complement executives' interests. The separation of the two rights pushes executives to use their residual control rights to hold cash. It allows executives to fulfill self-serving behavior such as perquisite consumption and adding subsidies. Meanwhile, massive cash holdings result in blind investment, which focuses on expansion rather than stockholder interests.

Against China's institutional background, the CSOE as an institutional outcome both exhibits the characteristics of an enterprise and differs from enterprises in many ways. CSOEs do not have a clear property rights system, which results in the circumstance of "undeserved owners." Jensen and Meckling (1976) believe that the relationship between stockholders and managers is essentially a contract. By signing contracts, principals authorize agents to perform certain responsibilities on behalf of the principals themselves and bestow certain decision-making powers upon those agents. The loss of company value associated with this principal-agent relationship is known as an agency cost. In CSOEs, where property rights and principals are uncertain, a serious agency problem may arise between principals and agents that may incur agency costs. Meanwhile, CSOE executives enforce a compensation regulation (Chen et al., 2005) that weakens the incentive institution effect, forcing executives to add income from residual controls in compensation. In this circumstance, CSOE executives prefer to expand their enterprises to fulfill more self-serving behavior such as perquisite consumption, which raises their enterprises' agency costs and influences their value. In more microcosmic terms, it lowers the efficiency of cash use, wastes money on projects and investments that damage the company's value and lowers the company's cash-holding value. As CSOEs are at the highest level of China's enterprise administration system, their agency problems are self-evident. This paper seeks to determine whether the agency problems of executives affect their behavior and the value of their cash holdings. It also considers whether EVA evaluation can change the behavior of executives and enhance their companies' cash-holding value.

Designing a set of reasonable incentive measures to decrease the loss of enterprise value resulting from agency costs is an important part of principal-agent theory. Therefore, alleviating the agency problems between CSOE owners and executives is a way of enhancing CSOEs' value-making capacity, investment efficiency and cash-holding value. Establishing effective regulation and incentive institutions against such a background and synchronizing the interests of owners and executives are the keys to solving these problems. An appropriate evaluation of executive performance is the premise of an effective incentive. When the indexes of performance evaluation have been confirmed, executive behavior reaches a benchmark and executives perform in a way that maximizes their own interests. Therefore, favorable performance evaluation indexes alleviate agency problems and guide executives to make decisions and organize their enterprises' manufacturing and operating performance on behalf of stockholder interests.

EVA evaluation began in 2010. The EVA index was added on the basis of accounting performance evaluation and had a greater weight. EVA is adjusted on the basis of accounting performance and equals the economic profit less the capital costs, including the equity capital cost. Therefore, the added EVA evaluation affects executives as much as capital costs do. Capital costs comprise the occupied capital and weighted average cost of capital. Executives have three approaches to enhancing EVA. First, they can efficiently operate their existing businesses and capital and increase their operating income. Second, they can be more prudent in terms of investment, which becomes efficient only when the return on investment exceeds the cost of capital. Third, they can increase the operating efficiency of capital and add the current turnover of capital. Executives increase both EVA and accounting profit when they increase their operating income. Decreasing the occupied

capital also influences EVA. Cash holdings comprise the greater part of the occupied capital. Therefore, cash holdings and investments are the key points to increasing EVA.

Even more crucial is that the EVA evaluation policy implemented by the SASAC also transmits a signal to the heads of CSOEs, which means that the SASAC focuses on evaluating both the value-making abilities and accounting performance of enterprises. The SASAC hopes to enhance the value-making abilities of enterprises by enhancing the performance evaluation model and protecting stockholder interests to a greater degree. The heads of CSOEs can observe the SASAC's intention and may adjust their enterprises' operations and management based on their charges. Of course, they must balance their own gains and losses, which can take the forms of personal salaries, control powers and chances of promotion.

China advanced a series of macroscopic regulations to prevent the polarization of employee income and demonstrate the principal of fairness. In practice, the government regulates executive income and some employee income (Chen et al., 2005). The main measure of this regulation is to bond executive and employee income and set a directional line for employee income. For example, in 2002, the SASAC issued the rule that executive salaries cannot exceed 12 times the salaries of employees, followed by the provinces. In 2004 and 2009, the SASAC and Ministry of Human Resources and Social Security issued and implemented their *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises* and *Guiding Opinions on Further Regulating the Salary Management of Persons-in-Charge at Central Enterprises*, which clearly state that SOE executive salaries must comprise a basic annual salary, a performance salary and income from mid-/long-term incentives. The basic annual salary is bonded with the average salary of employees at central enterprises. These regulations have been broken to differing degrees over the growth of China's economy and the growth of SOE profits. Tremendously overpriced salaries have occasionally appeared and serve as the best examples of these breakthroughs. Therefore, salaries remain one of the most important ways of incentivizing executives. Although executives can achieve control power to maximize their self-interest through perquisite consumption, the compensation incentive remains a relatively important incentive measure and executives do not waive higher salaries in exchange for personal control power.

The incentive of political promotion is as meaningful as monetized salary incentives and personal control power. The heads of CSOEs are located near or directly within China's political center and have greater potential for political promotion. Many heads of CSOEs have been directly promoted as provincial officials. For example, Finance Minister Xie Louwei served as the president of CIC and the Governor of Fujian Province used to be the CEO of Sinopec. CSOEs have become incubators for economic officials and political promotion may be more of an incentive for the heads of CSOEs than making money or achieving personal profit. The SASAC is the evaluation and regulation institution of the heads of CSOEs. Its evaluation of these heads can decide their promotion to a great degree. Therefore, the heads of CSOEs have reasons to improve the operating ideas of their enterprises and maximize value according to the wishes of the SASAC. As such, creating value has become a central effort of the heads of CSOEs in the daily operating process.

CSOE executives are in the optimal position of choosing what should be evaluated and created to maximize their own interests. The SASAC introduced the *Interim Measures for Business Performance Appraisals of Persons-in-Charge at Central Enterprises* in 2010, with the objective of choosing reasonable performance evaluation indexes to solve the agency problem between CSOE stockholders and executives. The SASAC formerly used return on equity as the main performance evaluation index before EVA. Indexes based on accounting performance may push enterprises to go after net profit and ignore the costs of equity capital. As a result, the value of an enterprise's stockholders suffers as the enterprise expands. CSOEs generally enjoy loose funding policies and endure lower cost of debt capital. Therefore, executives can easily ignore the costs of capital when making operating decisions. EVA comprehensively accounts for the total capital costs and eliminates the disadvantage of classic accounting computation, which occupies the money of stockholders for free. As rational "economic men," CSOE executives have a greater motive to think about the costs of equity and debt capital and spend more money on projects that may truly increase the value of their enterprises after the evaluation policy has been taken into account.

According to the premise of the separation of ownership and control rights, inside executives use residual control power to affect cash-holding decisions and encourage investments that damage stockholder value through abnormally high cash holdings (Jensen, 1986) and to maximize their personal control power. It is relatively easy for SOEs to gain the credit support of banks and equity capital from the capital market, which

may increase cash holdings. Increased cash holdings have two effects on investment, overinvestment and underinvestment, both of which decrease a company's value and cash holdings.

The heads of CSOEs may use cash holdings more prudently and consider the costs of capital after an EVA evaluation. Furthermore, overinvestment and underinvestment may be curbed to a certain level. Therefore, we present our first hypothesis as follows:

H1(a). The SASAC's EVA evaluation policy lowers the overinvestment of CSOEs.

H1(b). The SASAC's EVA evaluation policy lowers the underinvestment of CSOEs.

The corporate value of cash holdings often decreases due to underinvestment and overinvestment (Jensen, 1986). If overinvestment or underinvestment improves after an EVA performance evaluation, then the value of the CSOE's cash holdings is enhanced due to the efforts of the head of the CSOE to actively or passively improve its business philosophy.

There are two ways to improve EVA. The first is to lower capital productivity. The second is to decrease the weighted cost of capital calculated from the costs of debt and equity. The more cash held by an enterprise, the larger the enterprise's occupied capital. Cash returns and even negative cash returns are almost zero. The cost of capital remains the same under the weighted condition. The more cash held by an enterprise, the more the occupied capital is wasted. The higher the cost of capital, the lower the EVA.

However, cash holdings also have a transaction motivation (Miller and Orr, 1966; Mulligan, 1997) and precautionary motivation (Opler et al., 1999; Riddick and Whited, 2009; Bates et al., 2009). Miller and Orr (1966) support the cash transaction motivation. Mulligan (1997) argues that an enterprise stores less cash due to the cost savings motivation of economic scale. Precautionary motivation supporters believe that when companies enter the capital market, they hold more cash to cope with unexpected situations (Opler et al., 1999; Riddick and Whited, 2009). If enterprises face risks such as a higher risk of cash flows, they will retain a large amount of cash to deal with these risks. Therefore, a certain amount of cash held by a company is accompanied by more investment opportunities (Mikkelson and Partch, 2003).

Under the pressure of the EVA performance evaluation, management seeks to decrease the cost of capital and maintain normal business operations. Therefore, its ultimate goal is to control cash within a reasonable scope to improve the value of the enterprise and its personal interests. Cash holding management can also increase the value of cash holdings to some extent.

Because EVA performance evaluation is only enforced within CSOEs, the effect of a CSOE's operating philosophy and management style may be stronger than that of an LSOE. Therefore, the CSOEs' performance evaluation mode has a stronger effect on cash holdings than that of general SOEs. In summary, we make the following hypotheses.

H2(a). The value of a CSOE's cash holdings increases following an EVA performance evaluation.

H2(b). Compared with those of a non-CSOE, the value of CSOE's cash holdings increases following an EVA performance evaluation.

4. Research design

4.1. Research sample

As this paper focuses on the association between EVA evaluation performance and the value of CSOE cash holdings, we choose A-share listed companies under the control of central enterprises as our research sample. Considering that the share reform process may affect the value of a company, we use data from the 2006–2011 period. When the SASAC of the State Council was first established in 2003, it managed 196 enterprises. Through recombination, this number decreased to 117 by the end of November 2011. According to the list of state-controlled stock codes, the sample comprises 1128 companies. After excluding companies with missing data and ST and *ST companies, the number of companies decreases to 987. To investigate the effect of the EVA appraisal system, we compare CSOEs with general SOEs. Therefore, non-CSOEs are also included in the

analysis. We use the difference-in-difference method to test the implementation of the EVA performance evaluation policy. To avoid the disparity inherent in CSOEs and LSOEs, we adhere to the principle of same year, same industry and similar total assets and find 987 matching samples for the 987 companies. The final sample is 1974. Considering the influence of outliers, we winsorize the continuous variables at the 0.01 level. We obtain company financial data from the WIND advisory financial and CCER databases.

4.2. Model design

The regression model and variable design used in this paper mainly follow those used by Pinkowitz and Williamson (2007). To test our first hypothesis, we design the following model:

$$\text{Overinvest} = \alpha_1 + \beta_1 \text{central} + \beta_2 \text{imp} + \beta_3 \text{imp} * \text{central} + \text{other variables} + \varepsilon \quad \text{(Model(1))}$$

Our model relating factors to the value of cash holdings relies on a study by Pinkowitz et al. (2006). To test H2, we include the dummy variable imp of the EVA evaluation year in our model and modify the design as follows:

$$V = \alpha_1 + \beta_1 \text{cash} + \beta_2 \text{imp} + \beta_3 \text{imp} * \text{cash} + \text{other variables} + \varepsilon \quad \text{(Model(2))}$$

$$V = \alpha_1 + \beta_1 \text{cash} + \beta_2 \text{imp} + \beta_2 \text{central} + \beta_2 \text{imp} * \text{cash} + \beta_2 \text{central} * \text{cash} + \beta_2 \text{imp} * \text{central} + \beta_3 \text{imp} * \text{central} * \text{cash} + \text{other variables} + \varepsilon \quad \text{(Model(3))}$$

4.3. Variable definitions

Corporate market value is treated as dependent variable V. Due to the past split-share structure of the Chinese capital market, it consists of the market value of circulating shares, the value of non-tradable shares and the value of corporate debt. As the value of corporate debt lacks market data, we use the book value of liabilities instead. Due to the share reform of CSOEs and other reasons, the value of non-tradable shares does not have a corresponding market price and the transfer price of non-tradable shares is generally based on net assets. Therefore, following Xia and Fang (2005), we use the product of non-tradable shares and net assets per share as the value of non-tradable shares.

Following Faulkender and Wang (2006), we define cash holdings as cash and tradable financial assets. Before International Accounting Standards (IAS) were introduced to China, similar tradable financial assets were reflected in short-term investment items. After IAS were introduced, they were reflected in tradable financial asset items. As the sample period in this paper begins in 2006, we add the two together, along with monetary funds. The result can be considered a proxy variable for cash holdings.

We calculate the EVA for each company according to the *Temporary regulations of performance evaluation on the central state enterprise legal person*, which were revised and implemented by the SASAC. EVA is equal to the net operating profit after tax less the capital costs. The formula is written as follows: EVA = the net operating profit after tax − the capital costs = the net operating profit after tax-adjusted capital * average cost of capital rate. The net operating profit after tax is calculated as follows: net profit + (interest expense + research and development expenses adjustments − non-recurring income adjustments * 50%) * (1–25%). The adjusted capital is calculated as follows: average owner's equity + average liabilities − average interest-free liabilities-average construction-in-process. The average cost of capital rate, which should be 5.5% in principle, can be adjusted slightly in accordance with the circumstances. It should stay the same three years after confirmation.[4] Following the regulation, we adjust the net operating profit after tax and the capital, with a cost-of-capital rate of 5.5% required in principle. We then calculate EVA manually. To control for the influence of enterprise scale on EVA, we use the rate equal to EVA divided by the capital used as a variable of EVA.

As we account for the effect of the EVA performance evaluation on the value of cash holdings and excessive investment, we calculate the excess investment variable. The measurement of excessive investment mainly

[4] The 22nd *Temporary regulations of performance evaluation on the central state enterprise legal person*, revised and implemented by the SASAC.

refers to the model put forward by Richardson (2006). The total investment consists of value and new investments. The value investment is equal to the depreciation and amortization of the previous period. The new investment is divided into expected and unexpected investments. The expected investment is relevant to corporate growth opportunities, financing constraints and other factors. The unexpected investment is equal to the new investment less the expected investment. In regression Model (1), the dependent variable NI_t is the new investment (equal to the total investment less the value investment). The fitted values $NI^{*}t$ reflect the expected investment. The residual ε is the unexpected overinvestment. A positive sign indicates excess investment.

$$NI_t = \alpha_1 + \beta_1 Growth_{t-1} + \beta_2 Cf_{t-1} + \beta_3 \Delta Debt_t + \beta_4 \Delta Equity_t + \beta_5 Lev_{t-1} + \beta_6 Ar_{t-1} + \sum Ind + \sum Year + \varepsilon \quad (Model(4))$$

Our study is an event study that focuses on the influence that the EVA performance evaluation policy had on the value of CSOE cash holdings in 2010. The key to an event study is whether the event window is "clean" and whether something that can affect the cash holding value exists or a similar event occurs. We review the events of the capital market during 2010 and find that the Central Bank raised the RRR six times in 2010,[5] from 15.5% at the end of 2009 to 18.5% at the end of 2010. Studies have shown that monetary policy is an important factor affecting cash holdings (Chen and Chen, 2012). Thus, we control for the monetary policy per year (RRR). If the monetary policy is adjusted several times, we take its maximum value.

Differences in a company's operating, investment and financing capacities may affect any changes in the company's value. To estimate the value of the cash holdings, we require control variables that may affect company value. Cf is the company's annual operating cash flow. Na is the company's net assets, or the balance of assets less its cash and trading financial assets. GI is the annual dividend and interest paid by the company, represented by the dividend and interest in the cash flow statement. Capex is the company's capital expenditure, represented by the cash used to build and dispose of fixed, intangible and other long-term assets. X_t is the level of variable x in year t. dX_t is the change in variable x from years $t-1$ to t, or $X_t - X_{t-1}$, and dX_{t+1} is the change in variable x from years t to $t+1$, or $X_{t+1} - X_t$. Referring to the research of Pinkowitz et al. (2006), we standardize all of the variables by dividing them by total assets. To control for year and industry effects, we add year and industry control variables to our model, represented by Year and Industry, respectively. The specific variables are defined in Table 1.

5. Descriptive statistics

5.1. Descriptive statistics: Analysis of main variables

Table 2 shows the descriptive statistics for the main variables. The mean value of CSOEs is 1.611. The mean value of non-CSOEs is higher, at 1.667. This illustrates that the total market value of non-CSOEs exceeds that of CSOEs. The mean value of Cash is 0.152 for CSOEs and 0.16 for non-CSOEs. The mean value of EVA, which represents the value creation of CSOEs, is 0.021, indicating that companies create EVA by 2.1% on average. Table 2 shows the descriptive statistics for the main variables.

Considering the two cases of enterprise value creation and value loss and the effect of policy implementation, we investigate the descriptive statistics for CSOEs by group. Table 3 shows the descriptive statistics for the main variables in enterprises that create value and suffer value loss. The descriptive statistics for the main variables in different years are shown in Tables 4 and 5.

According to Table 3, 416 enterprises suffer value loss, accounting for 42% of the 987 observations. The enterprises that create value account for 58%, indicating that the majority of CSOEs create value. However, the 42% value loss rate reveals that the value creation ability of CSOEs requires improvement. The mean value of 1.686 for the enterprises that create value exceeds that of 1.506 for the enterprises that suffer value damage. The level of cash holdings in enterprises that create value is also higher.

[5] In 2007, the Central Bank began to raise the RRR to control the currency circulation of the commercial banks. It did so 10 times in 2007, 10 times in 2008 and 6 times in 2010.

Table 1
Variable definitions.

Variable	Name	Definition
V	Market value of the company	(Company's equity value + creditor value)/total assets
EVA	Economic value added rate	Economic value added/capital occupancy
Imp	Implementation	Dummy variable that takes the value of 1 for all of the years after year 2009 and 0 otherwise
VC	Value creation	Dummy variable that takes the value of 1 if EVA exceeds 0 and 0 otherwise
Cash	Level of cash holding	Cash and cash equivalents/total assets at the end of year t
Cf_t	Cash flow from operating activities	Cash flow from operating activities/total assets at the end of year t
dCf_t	Change in cash flow from operating activities	(CFO at the end of year t − CFO at the end of year $t-1$)/total assets
dCf_{t+1}	Change in cash flow from operating activities	(CFO at the end of year $t+1$ − CFO at the end of year t)/total assets
dNa_t	Change in net assets	(Net assets at the end of year t − net assets at the end of year $t-1$)/total assets
dNa_{t+1}	Change in net assets	(Net assets at the end of year $t+1$ − net assets at the end of year t)/total assets
GI_t	Dividend and interest paid	Dividend and interest paid in year t/total assets
dGI_t	Change in dividend and interest paid	(Dividend and interest paid in year t − dividend and interest paid in year $t-1$)/total assets
dIt_{t+1}	Change in dividend and interest paid	(Dividend and interest paid in year $t+1$ − dividend and interest paid in year t)/total assets
$Capex_t$	Capital expenditures	Capital expenditures at the end of year t/total assets
$dCapex_t$	Change in capital expenditures	(Capital expenditures at the end of year t − capital expenditures at the end of year $t-1$)/total assets
$dCapex_{t+1}$	Change in capital expenditures	(Capital expenditures at the end of year $t+1$ − capital expenditures at the end of year t)/total assets
Mp	Monetary policy	RRR per year
TI_t	Total investment	(Cash used to build fixed assets, intangible assets and long-term assets in the current period + cash for equity investment + cash for debt investment)/total assets in the previous period
MI_t	Hedging investment	(Depreciation of fixed assets + amortization of intangible assets in the previous period)/total assets in the previous period
NI_t	New investment	(Total investment − hedging investment)/total assets in the previous period
NI^*_t	Expected investment	Fitted value of the model
Overinvest	Overinvest	Residuals of Model (4)
$GROWTH_{t-1}$	Growth	Tobin's Q value in the previous period
ΔDEBT	New debt	(New loans + new bonds in the current period)/total assets in the previous period
$\Delta EQUITY_t$	New equity financing	New equity financing in the current period/total assets in the previous period
LEV_{t-1}	Debt ratio	Asset − liability ratio in the previous period
$SIZE_{t-1}$	Size	Natural logarithm of total assets in the previous period
AR_{t-1}	Excess return on equity	The previous yield − the previous market yield
Industry	Industry dummy variables	Classified by one-digit industry codes of CSRC
Year	Year dummy variables	Five dummy variables from 2007 to 2011

Table 4 shows that the mean company value of CSOEs is 1.1 in 2006 and has no fixed pattern in the years afterward. The lowest company value is 1.098, indicating that the Asian Financial Crisis had a negative effect on corporate growth, consistent with the macroeconomic environment circumstance. In addition, from the end of 2008–2010, the development and implementation of the national "4 trillion" investment policy also affect company value. The mean value rebounds to 1.841 in 2009 and reaches its highest level of 2.019 in 2010.

The mean level of CSOE cash holdings fluctuates between 2006 and 2011, reaching its lowest level of 0.145 in 2008 and its highest level of 0.164 in 2009. From 2006 to 2009, EVA maintains a relatively stable mean value, with a maximum of 0.015 and a minimum of 0.010, representing a range of no more than 20% and a small

Table 2
Descriptive statistics for the main variables.

Variable	Number of observations	Mean	Median	Standard deviation
CSOEs				
V	987	1.611	1.253	1.029
Cash	987	0.152	0.122	0.12
EVA	987	0.021	0.009	0.076
Cf	987	0.048	0.047	0.078
Gl	987	0.034	0.03	0.025
Capex	987	0.061	0.043	0.055
Non-CSOEs				
V	987	1.667	1.399	0.997
Cash	987	0.16	0.133	0.109
Cf	987	0.063	0.058	0.077
Gl	987	0.027	0.024	0.018
Capex	987	0.061	0.049	0.058

Table 3
Descriptive statistics for main variables in enterprises that create value and suffer value loss.

Variables	Value loss		Value creation	
	Number of observations	Mean	Number of observations	Mean
V	416	1.506	571	1.686
Cash	416	0.128	571	0.169
EVA	416	−0.04	571	0.065

Note: if EVA > 0, it is an enterprise that creates value; otherwise, it is an enterprise that suffers value damage.

Table 4
Descriptive statistics for the main variables by year.

Year	*V*	Cash	EVA
2006	1.1	0.142	0.012
2007	1.969	0.147	0.015
2008	1.098	0.145	0.01
2009	1.841	0.164	0.013
2010	2.019	0.159	0.029
2011	1.543	0.151	0.026

Table 5a
Panel A: Effect of the implementation of policy on CSOE efficiency.

Variables	Before 2010		After 2010		The mean test (*T*)
	Number of observations	Mean	Number of observations	Mean	
V	661	1.511	326	1.812	24.63***
Cash	661	0.15	326	0.155	23.44***
EVA	661	0.017	326	0.028	7.33***
ROA	661	0.045	326	0.051	17.90***
ROE	661	0.069	326	0.096	18.61
OROA	661	0.037	326	0.043	15.06***
AR	661	−0.003	326	0.002	2.41**
Overinvest	661	−0.011	326	−0.002	1.36

Note: * represents significance at the 0.1 level.
** Represents significance at the 0.05 level.
*** Represents significance at the 0.01 level.

Table 5b
Panel B: Efficiency of CSOEs and non-CSOEs before and after the policy implementation.

Policy implementation	Indexes	CSOEs	Non-CSOEs	Mean value test
Before	ROA	0.045	0.054	17.57***
	ROE	0.069	0.088	10.77***
	OROA	0.037	0.046	13.97***
	AR	−0.0033	−0.003	4.01***
	Overinvest	−0.011	0.004	1.36
After	ROA	0.05	0.047	19.26***
	ROE	0.096	0.058	14.54***
	OROA	0.043	0.039	17.51***
	AR	0.0019	0.0018	3.10***
	Overinvest	−0.002	−0.01	0.59

Note: ROA = total profit/total assets, ROE = net profit/net assets, OROA = operating profit/total assets and AR = annual return on equity − market returns. Overinvest is the excess investment variable, calculated according to the Richardson (2006) model.
* Represents significance at the 0.1 level.
** Represents significance at the 0.05 level.
*** Represents significance at the 0.01 level.

degree of fluctuation. However, the mean value of EVA changes drastically in 2010 and after 2011, reaching 0.029 and 0.026, respectively, an obvious increase compared with previous values.

5.2. Does the EVA performance evaluation policy improve company efficiency?

Table 5 shows the descriptive statistics for the main variables before and after policy implementation. The SASAC implemented the EVA performance evaluation of the heads of CSOEs in 2010. The number of observations after 2010 is 326, accounting for 33% of the total sample. The mean company value of CSOEs is 1.511 before 2010 and rises to 1.812 after 2010. The difference in company value before and after the implementation of the policy is obvious. Through differences tests, we find the value of t, representing the difference in company value, which is 24.63 around 2010 and significant at the 0.01 level. The implemented policy thus improves the value of the CSOEs and enterprise growth changed around 2010.

The level of CSOE cash holdings is 0.15 before 2010 and rises to 0.155 after 2010, showing no obvious difference in mean value. The value-creating ability of CSOEs, i.e., the mean value of EVA, is 0.017 before 2010 and rises to 0.028 after 2010 without obvious improvement. Through significance testing, we find that the value of t representing the difference of EVA is −2.055 around 2010 and significant at the 0.05 level. The policy was therefore effectively implemented and improves the value-creating ability of the CSOEs. We also examine the effect of the EVA performance evaluation policy on accounting and market performance. The test results show that after the policy implementation, ROA, ROE and OROA (operating profit/total assets) increase significantly at the 0.01 level. AR also significantly increases at the 0.05 level. Univariate test results show that the EVA performance evaluation system improves CSOE efficiency.

We test the efficiency of the CSOEs and non-CSOEs before and after the policy implementation. Table 5 Panel B shows the test results.

Table 6
Pearson correlation coefficients of the main variables.

Variables	V	Cash	EVA	Imp
V	1			
Cash	0.2100***	1		
EVA	0.2033***	0.2211***	1	
Imp	0.1372***	0.0198	0.0653**	1

Note: * represents significance at the 0.1 level.
** Represents significance at the 0.05 level.
*** Represents significance at the 0.01 level.

As Table 5 Panel B shows, before the policy implementation, ROE of CSOEs is significantly lower than that of non-CSOEs. However, ROE of CSOEs is significantly higher after the policy implementation. The results indicate that the implemented policy improves accounting performance. Judging from the market performance, the excess returns on CSOE stocks are significantly higher around the policy implementation.

5.3. Correlation analysis of the main variables

We conduct a correlation analysis of the main CSOE variables. The Pearson correlation coefficient matrix in Table 6 shows that the variable correlations are consistent with expectations and also provide a basis for the study's hypotheses. Cash and *V* have a significant positive correlation at the 1% level, consistent with the findings of previous studies. This indicates a positive correlation between a company's cash holdings and value, and that an increase in the former can increase the latter. EVA and V also have a significant positive correlation at the 1% level, indicating that the stronger a company's ability to create value, the higher the company's value. Furthermore, Imp and *V* have a significant positive correlation at the 1% level, indicating that the implemented policy effectively improves company value. EVA and Cash are significantly associated at the 1% and 5% levels, as are Imp and EVA. Other control variables are also significantly correlated at a certain level. In addition, to avoid the effects of multicollinearity on the results, we investigate the variance inflation factors (VIFs) of the variables used in the regression. The VIFs of the variables are less than 5.

6. Empirical tests

6.1. Test of H1

We conduct an OLS multiple regression for the effect of the level of cash holdings of the CSOEs, LSOEs and entire sample on overinvestment and underinvestment before and after the policy implementation. Table 7 Panel A shows the results.

As shown in regression (1) in Table 7 Panel A, the cash regression coefficient of 0.129 is significantly positive at the 0.05 level, indicating that the more cash a SOE holds before the implementation of the EVA performance evaluation policy, the more it overinvests. The regression coefficient of the interaction term imp * cash is −0.053, indicating that the effect of cash holdings on overinvestment is weakened but not significantly so after the policy implementation. The EVA performance evaluation policy has less of an effect on the LSOEs and overinvestments. Regression (2) focuses on CSOEs. The cash regression coefficient is 0.172 and is significant at the 0.01 level. The regression coefficient of imp * cash is −0.13, which is also significant at the 0.01 level. The results show that the more cash holdings a CSOE has, the more likely it is to overinvest before policy implementation. In addition, the influencing factor is 0.042 (0.172 −0.13), indicating that the effect of cash holdings on overinvestments is significantly weakened after the policy implementation. However, in regression (3), which focuses on LSOEs, we find no significant change before and after the policy implementation.

To further examine the effect of the EVA performance evaluation policy on CSOE overinvestment and underinvestment, we divide the CSOE sample into overinvestment and underinvestment sub-samples, corresponding with regression (4) and regression (5), respectively. In regression (4), the cash regression coefficient is 0.257 and the imp * cash regression coefficient is −0.158. Both values are significant at the 0.01 level, indicating that the EVA policy implementation significantly decreases the effect of CSOEs' cash holdings on overinvestment. However, in regression (5), we do not find the CSOEs' cash holdings to have a great effect on underinvestment before or after the implementation of the EVA performance evaluation policy.

In regression (6), we examine the differences in CSOEs and LSOEs before and after policy implementation. The regression coefficient of imp * central * cash is 0.198. It fails to pass the significance test, probably because the cash holdings influence different investments in different directions before and after the policy implementation. Regressions (7) and (8) investigate the effects of the two types of enterprises on overinvestment and underinvestment before and after the policy implementation. The regression coefficient of imp * central * cash is −0.233 in regression (7) and significant at the 0.01 level. The result shows that the effect of CSOEs' cash holdings on overinvestment is significantly weakened after the implementation of the EVA policy compared with those of LSOEs. The regression coefficient of imp * central * cash is 0.266 in regression (8) and fails to

pass the significance test. This indicates that the level of CSOEs' cash holdings does not improve underinvestment after the EVA policy implementation compared with LSOEs.

We use the difference-in-difference method, which has its own inherent limitations (Bertrand et al., 2004), to investigate the economic consequences of the CSOEs after EVA performance evaluation. The effects of the cash holdings of CSOEs and LSOEs on investment may have their own systemic differences. Using the interaction term imp * central * cash may not allow us to solve this problem. Thus, we conduct a falsification test as a supplement to the difference-in-difference method. We cross-multiply the dummy variables and the central * cash variable of each year to set a multitude of three intersecting variables. If we do not find the same result before and after the policy implementation, we confirm the empirical results obtained from the difference-in-difference method and conclude that the policy implementation leads to a systemic change in the two types of enterprises. Table 7 Panel B shows the regression results. From 2006 to 2009, the cross-variable regression coefficients are insignificant regardless of overinvestment or underinvestment. This verifies the empirical results obtained from the difference-in-difference method to some extent. Thus, the regression results in Table 7 support H1.

6.2. Test of H2

After validating H1, we further investigate the effect of the level of cash holdings on firm value. Table 8 shows the results.

According to Table 8 Panel A, the regression coefficients of cash are 1.118 and 1.262 in regressions (1) and (2) before and after the EVA performance evaluation of CSOEs, respectively, and significant at the 0.01 and 0.05 levels, respectively. In regression (3), the regression coefficient of imp * cash is 1.157 and significant at the 0.01 level. This indicates that the effect of cash on firm value increases significantly after CSOEs' implementation of the EVA assessment. Compared with no assessment, firm value increases 1.157 units when the ratio of monetary capital to total assets increases by 1 unit and is economically significant. In contrast, the regression coefficients of the cash variable and imp * cash are not significant in regression (4) for LSOEs.

In regression (5), which covers the entire sample, the regression coefficient of imp * central * cash is 1.701 and significant at 0.05 level, indicating that the value of CSOEs' cash holdings improves significantly after the EVA performance evaluation compared with that of LSOEs.

We also conduct a falsification test for the value of the cash holdings. Table 8 Panel B shows the specific regression results.

As shown in the falsification test results in Table 8 Panel B, from 2006 to 2009, the interaction term has no significant positive relationship with the dependent variable, reinforcing the conclusion of regression (5) in Table 8 Panel A. Compared with the value of the cash holdings of LSOEs, the value of CSOEs' cash holdings significantly increases after the implementation of the EVA policy.

Therefore, the regression results shown in Table 8 support H2.

6.3. Does curbing overinvestment or improving underinvestment account for the increase in value of the cash holdings?

In our analysis, we find that CSOEs significantly decrease their overinvestment levels and improve the value of their cash holdings after implementing the EVA performance evaluation, beginning in 2010. In the theoretical analysis, our claim is that the EVA performance evaluation ultimately affects the value of the cash holdings by improving corporate investment. We conduct a test to determine whether the EVA performance evaluation policy improves the value of the cash holdings by curbing overinvestment or improving underinvestment. Table 9 shows the results.

Table 9 shows the value of the cash holdings under different investment conditions. In regression (1), which focuses on the CSOE overinvestment sub-sample, the regression coefficient of cash is 1.814 and significant at the 0.01 level. This indicates that cash holdings have a positive effect on the value of CSOEs that invest excessively before the policy implementation and no significantly positive effect on the value after the policy implementation. In regression (2), which focuses on the CSOE underinvestment sub-sample, the regression coefficient of cash is −0.566, indicating that cash holdings have a negative yet insignificant effect on CSOE value before the policy implementation. The regression coefficient of imp * cash is 1.317 and significant at

Table 7a
Panel A: OLS multiple regression of the effect on overinvestment before and after implementation of the EVA performance evaluation policy.

Variables	Regression (1)	Regression (2)	Regression (3)	Regression (4)	Regression (5)	Regression(6)	Regression (7)	Regression (8)
	CSOEs and local enterprises	CSOEs	Local enterprises	CSOEs	CSOEs	CSOEs and local enterprises	CSOEs and local enterprises	CSOEs and local enterprises
	Whole sample	Whole sample	Whole sample	Overinvestment	Underinvestment	Whole sample	Overinvestment	Underinvestment
Cash	0.129**	0.172***	0.199	0.257***	−0.040	0.148*	0.162***	0.075
	(1.970)	(5.148)	(1.573)	(7.263)	(−0.759)	(1.654)	(4.545)	(0.412)
Imp	−0.003	0.028**	−0.065	0.001	0.026*	−0.057*	−0.013	−0.065
	(−0.138)	(2.414)	(−1.299)	(0.0781)	(1.792)	(−1.722)	(−0.956)	(−1.016)
Central						0.036	−0.010	0.109**
						(1.473)	(−0.952)	(2.298)
imp_cash	−0.053	−0.130***	0.056	−0.158***	−0.005	0.059	0.070	−0.262
	(−0.513)	(−2.698)	(0.271)	(−2.922)	(−0.0691)	(0.389)	(1.214)	(−0.754)
central_cash						−0.069	0.100**	−0.332
						(−0.571)	(2.171)	(−1.233)
imp_central						0.088**	0.010	0.095
						(2.186)	(0.598)	(1.247)
imp_central_cash						−0.164	−0.233***	0.266
						(−0.791)	(−2.936)	(0.587)
Cf	2.481***	2.307***	2.840***	1.888***	2.155***	2.519***	1.884***	2.331***
	(23.81)	(41.33)	(13.52)	(24.55)	(25.41)	(24.13)	(38.00)	(9.311)
dcf_t	−2.534***	−2.370***	−2.712***	−2.024***	−2.245***	−2.561***	−2.035***	−2.409***
	(−30.97)	(−62.29)	(−16.22)	(−35.64)	(−34.29)	(−31.31)	(−47.56)	(−11.41)
dcf_t_1	0.031	0.006	−0.098	−0.046	−0.027	0.022	0.000	0.027
	(0.580)	(0.201)	(−0.795)	(−1.209)	(−0.751)	(0.410)	(0.0114)	(0.283)
dna_t	−0.266***	−0.139***	−0.665***	0.067***	−0.267***	−0.303***	0.097***	−0.574***
	(−6.556)	(−7.532)	(−6.781)	(2.893)	(−11.24)	(−7.318)	(5.292)	(−7.455)
dna_t_1	0.021	0.005	0.039	0.003	0.020*	0.014	−0.002	0.050
	(1.235)	(0.638)	(0.708)	(0.443)	(1.711)	(0.789)	(−0.390)	(1.259)
Capex	−0.990***	−1.187***	−1.014***	−1.033***	−1.080***	−1.023***	−0.911***	−0.714***
	(−7.396)	(−16.49)	(−4.064)	(−9.589)	(−12.42)	(−7.666)	(−12.97)	(−3.027)
capex_t	−0.052	0.027	−0.041	0.096	0.090	0.002	0.126*	0.032
	(−0.380)	(0.396)	(−0.158)	(1.017)	(1.136)	(0.0132)	(1.860)	(0.138)
capex_t_1	0.030	−0.018	0.080	0.015	−0.107	0.027	0.079*	−0.095
	(0.319)	(−0.371)	(0.427)	(0.252)	(−1.609)	(0.284)	(1.879)	(−0.541)
Gl	−0.843**	−0.074	−2.515***	0.128	−0.230	−1.204***	0.123	−2.681***
	(−2.578)	(−0.493)	(−3.064)	(0.778)	(−1.015)	(−3.506)	(0.934)	(−3.580)
dgl_t	−0.185	0.170	−0.351	−0.010	0.401	0.099	0.134	−0.078
	(−0.466)	(0.968)	(−0.385)	(−0.0545)	(1.468)	(0.245)	(0.895)	(−0.0876)
dgl_t_1	−0.372	−0.107	−1.079	0.022	−0.440**	−0.651**	−0.100	−1.318**
	(−1.279)	(−0.739)	(−1.636)	(0.143)	(−2.032)	(−2.199)	(−0.892)	(−2.082)

(*continued on next page*)

Table 7a (*continued*)

Variables	Regression (1)	Regression (2)	Regression (3)	Regression (4)	Regression (5)	Regression(6)	Regression (7)	Regression (8)
	CSOEs and local enterprises	CSOEs	Local enterprises	CSOEs	CSOEs	CSOEs and local enterprises	CSOEs and local enterprises	CSOEs and local enterprises
	Whole sample	Whole sample	Whole sample	Overinvestment	Underinvestment	Whole sample	Overinvestment	Underinvestment
dv_t_1	0.004	0.004*	0.010	−0.001	0.006*	0.004	−0.002	0.002
	(0.918)	(1.729)	(1.039)	(−0.331)	(1.802)	(0.846)	(−1.073)	(0.235)
Rate	−0.043	0.109	−0.073	0.320**	−0.002	−0.022	0.340***	−0.151
	(−0.177)	(0.902)	(−0.156)	(2.212)	(−0.0134)	(−0.0908)	(3.410)	(−0.329)
Constant	−0.078	−0.158***	0.050	−0.107**	−0.246***	−0.079	−0.093***	−0.131
	(−0.930)	(−3.828)	(0.318)	(−2.330)	(−4.303)	(−0.948)	(−2.823)	(−0.783)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	1974	987	987	491	496	1974	1008	966
R-squared	0.400	0.853	0.304	0.807	0.764	0.408	0.764	0.190

Note: The dependent regression variable in this table is overinvest. Regression (1) is for the entire sample of CSOEs and LSOEs; regression (2) is for the entire sample of CSOEs; regression (3) is for the entire sample of LSOEs; regression (4) is for the overinvestment sample of CSOEs (overinvest greater than zero); regression (5) is for the underinvestment sample of CSOEs (overinvest less than zero); regression (6) is for the entire sample of CSOEs and LSOEs; regression (7) is for the overinvestment sample of CSOEs and LSOEs; and regression (8) is for the underinvestment sample of CSOEs and LSOEs, with *t*-statistics in brackets.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 7b
Panel B: Falsification test for the effect of the cash holdings of CSOEs and LSOEs on investment before and after performance evaluation.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment
Cash	0.187***	−0.035	0.176***	−0.020	0.216***	−0.042	0.199***	0.034	0.160***	−0.006	0.200***	0.032
	(5.929)	(−0.204)	(5.541)	(−0.116)	(6.855)	(−0.241)	(6.190)	(0.178)	(5.068)	(−0.0348)	(6.243)	(0.198)
y2006	−0.001	−0.098										
	(−0.0786)	(−1.205)										
Central	−0.008	0.141***	−0.012	0.153***	−0.003	0.142***	−0.008	0.150***	−0.010	0.140***	−0.008	0.117***
	(−0.823)	(3.263)	(−1.283)	(3.488)	(−0.336)	(3.251)	(−0.899)	(3.371)	(−1.154)	(3.104)	(−0.866)	(2.804)
y2006_cash	0.025	0.210										
	(0.302)	(0.469)										
central_cash	0.015	−0.206	−0.010	−0.186	0.008	−0.169	0.026	−0.229	0.083**	−0.191	0.028	−0.300
	(0.350)	(−0.861)	(−0.244)	(−0.799)	(0.201)	(−0.694)	(0.617)	(−0.900)	(2.026)	(−0.754)	(0.675)	(−1.299)
y2006_central	−0.002	−0.003										
	(−0.0966)	(−0.0295)										
y2006_central_cash	0.078	−0.068										
	(0.746)	(−0.110)										
y2007			−0.031**	0.039								
			(−2.156)	(0.510)								
y2007_cash			0.058	0.335								
			(0.803)	(0.667)								
y2007_central			0.018	−0.031								
			(0.834)	(−0.300)								
y2007_central_cash			0.169*	−0.500								
			(1.781)	(−0.699)								
y2008					0.033**	0.025						
					(2.121)	(0.362)						
y2008_cash					−0.162**	0.224						
					(−2.174)	(0.560)						
y2008_central					−0.024	−0.022						
					(−1.085)	(−0.237)						
y2008_central_cash					0.082	−0.280						
					(0.806)	(−0.504)						
y2009							0.014	0.043				
							(0.878)	(0.670)				
y2009_cash							−0.055	−0.151				
							(−0.816)	(−0.445)				
y2009_central							0.004	−0.067				
							(0.198)	(−0.764)				
y2009_central_cash							−0.010	0.091				
							(−0.113)	(0.184)				
y2010									−0.044***	0.017		
									(−2.718)	(0.258)		
y2010_cash									0.157**	−0.018		
									(2.232)	(−0.0469)		
y2010_central									0.023	−0.015		
									(1.044)	(−0.176)		
y2010_central_cash									−0.346***	−0.037		
									(−3.500)	(−0.0730)		
y2011											0.047***	−0.046
											(2.746)	(−0.494)
y2011_cash											−0.045	−1.026*
											(−0.617)	(−1.704)
y2011_central											−0.010	0.130
											(−0.464)	(1.111)
y2011_central_cash											−0.006	1.011
											(−0.0627)	(1.366)

(*continued on next page*)

Table 7b (*continued*)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment	Overinvestment	Underinvestment
Cf	1.877***	2.359***	1.892***	2.365***	1.885***	2.357***	1.882***	2.366***	1.917***	2.369***	1.905***	2.415***
	(37.48)	(9.389)	(38.39)	(9.390)	(37.76)	(9.367)	(37.71)	(9.384)	(38.79)	(9.335)	(38.26)	(9.661)
dcf_t	−2.031***	−2.403***	−2.037***	−2.394***	−2.035***	−2.407***	−2.033***	−2.391***	−2.063***	−2.399***	−2.051***	−2.422***
	(−47.30)	(−11.37)	(−48.12)	(−11.31)	(−47.42)	(−11.32)	(−47.27)	(−11.27)	(−48.57)	(−11.21)	(−48.01)	(−11.53)
dcf_t_1	0.006	0.053	−0.008	0.065	0.000	0.057	0.003	0.056	−0.008	0.064	0.005	0.028
	(0.264)	(0.557)	(−0.365)	(0.689)	(0.0209)	(0.599)	(0.123)	(0.585)	(−0.366)	(0.670)	(0.233)	(0.303)
dna_t	0.087***	−0.582***	0.101***	−0.586***	0.091***	−0.569***	0.087***	−0.567***	0.101***	−0.570***	0.093***	−0.563***
	(4.663)	(−7.539)	(5.411)	(−7.588)	(4.858)	(−7.414)	(4.655)	(−7.320)	(5.551)	(−7.414)	(5.086)	(−7.365)
dna_t_1	−0.003	0.043	−0.005	0.052	−0.004	0.046	−0.004	0.049	−0.001	0.048	−0.003	0.052
	(−0.534)	(1.079)	(−0.809)	(1.302)	(−0.625)	(1.154)	(−0.644)	(1.245)	(−0.240)	(1.199)	(−0.565)	(1.322)
Capex	−0.894***	−0.694***	−0.900***	−0.690***	−0.906***	−0.708***	−0.899***	−0.707***	−0.921***	−0.711***	−0.896***	−0.753***
	(−12.60)	(−2.923)	(−12.87)	(−2.897)	(−12.78)	(−2.986)	(−12.66)	(−2.971)	(−13.31)	(−2.997)	(−12.73)	(−3.208)
capex_t	0.114*	0.007	0.118*	0.018	0.119*	−0.002	0.126*	0.014	0.128*	0.012	0.114*	0.037
	(1.655)	(0.0311)	(1.730)	(0.0800)	(1.729)	(−0.00673)	(1.820)	(0.0592)	(1.908)	(0.0532)	(1.677)	(0.162)
capex_t_1	0.079*	−0.082	0.076*	−0.067	0.079*	−0.103	0.079*	−0.096	0.077*	−0.084	0.086**	−0.056
	(1.876)	(−0.465)	(1.822)	(−0.378)	(1.870)	(−0.582)	(1.858)	(−0.545)	(1.854)	(−0.474)	(2.043)	(−0.323)
Gl	0.140	−2.734***	0.115	−2.661***	0.111	−2.624***	0.106	−2.569***	0.105	−2.580***	0.133	−2.695***
	(1.059)	(−3.639)	(0.891)	(−3.569)	(0.846)	(−3.519)	(0.804)	(−3.432)	(0.812)	(−3.448)	(1.019)	(−3.649)
dgl_t	0.087	−0.072	0.103	−0.257	0.110	−0.235	0.152	−0.276	0.104	−0.205	0.015	0.032
	(0.576)	(−0.0809)	(0.694)	(−0.290)	(0.733)	(−0.263)	(0.971)	(−0.301)	(0.710)	(−0.230)	(0.102)	(0.0363)
dgl_t_1	−0.098	−1.074*	−0.135	−1.027	−0.129	−1.180*	−0.085	−1.148*	−0.095	−1.063*	−0.093	−1.354**
	(−0.866)	(−1.712)	(−1.209)	(−1.623)	(−1.123)	(−1.835)	(−0.755)	(−1.816)	(−0.869)	(−1.687)	(−0.835)	(−2.165)
dv_t_1	−0.001	−0.005	0.003*	−0.011	0.000	−0.001	0.000	−0.004	−0.002	−0.006	0.000	−0.002
	(−0.334)	(−0.471)	(1.655)	(−1.146)	(0.235)	(−0.112)	(0.0944)	(−0.456)	(−1.014)	(−0.635)	(0.0967)	(−0.216)
Rate	0.258**	−1.127**	0.200***	−0.435	0.190***	−0.484	0.191***	−0.491*	0.312***	−0.510	−0.012	−0.196
	(2.344)	(−2.271)	(3.131)	(−1.459)	(2.963)	(−1.641)	(2.982)	(−1.666)	(4.646)	(−1.566)	(−0.146)	(−0.551)
Constant	−0.074**	0.004	−0.071**	−0.136	−0.068**	−0.129	−0.072**	−0.124	−0.081***	−0.129	−0.041	−0.142
	(−2.164)	(0.0214)	(−2.268)	(−0.833)	(−2.175)	(−0.789)	(−2.277)	(−0.754)	(−2.647)	(−0.779)	(−1.293)	(−0.868)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	1008	966	1008	966	1008	966	1008	966	1008	966	1008	966
R-squared	0.759	0.184	0.765	0.185	0.760	0.184	0.758	0.183	0.770	0.182	0.763	0.202

Note: The dependent variable of this table is the value of the company V. Regressions (1), (3), (5), (7), (9) and (11) are for the overinvestment sub-sample and regressions (2), (4), (6), (8), (10) and (12) are for the underinvestment sub-sample, with *t*-statistics in brackets.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 8a
Panel A: OLS multiple regression for EVA policy implementation, cash holdings and corporate value.

Variables	(1) Before CSOEs' policy implementation	(2) After CSOEs' policy implementation	(3) CSOEs	(4) LSOEs	(5) CSOEs and LSOEs
Cash	1.118***	1.262**	1.072***	0.476	0.167
	(3.021)	(2.439)	(2.773)	(1.283)	(0.438)
Imp			−0.142	−0.298**	−0.178
			(−1.002)	(−2.086)	(−1.294)
Central					−0.275***
					(−2.708)
imp_cash			1.157**	0.083	−0.042
			(2.042)	(0.142)	(−0.0667)
central_cash					0.456
					(0.898)
imp_central					−0.005
					(−0.0292)
imp_central_cash					1.701**
					(1.995)
cf	2.410***	5.064***	3.386***	1.730***	2.283***
	(3.343)	(4.797)	(5.084)	(2.806)	(5.165)
dcf_t	−1.008**	−0.955	−0.906*	−0.682	−1.290***
	(−2.018)	(−1.303)	(−1.958)	(−1.388)	(−3.696)
dcf_t_1	0.618*	4.226***	1.187***	−0.626*	−0.115
	(1.740)	(6.366)	(3.410)	(−1.734)	(−0.513)
dna_t	−0.093	0.125	0.061	−0.337	0.145
	(−0.420)	(0.247)	(0.275)	(−1.227)	(0.839)
dna_t_1	0.055	2.117***	0.456***	−1.064***	0.116
	(0.626)	(11.44)	(5.189)	(−6.571)	(1.574)
capex	−1.824**	−3.786**	−2.459***	−3.970***	−3.031***
	(−1.994)	(−2.564)	(−2.819)	(−5.431)	(−5.344)
capex_t	1.304	2.236	1.506*	2.859***	2.165***
	(1.545)	(1.373)	(1.805)	(3.809)	(3.716)
capex_t_1	0.464	−1.898	0.253	−0.315	−0.008
	(0.780)	(−1.494)	(0.424)	(−0.588)	(−0.0208)
gl	0.876	−3.625	−0.323	0.882	0.752
	(0.473)	(−1.106)	(−0.182)	(0.374)	(0.525)
dgl_t	−2.630	−0.248	−3.601*	−0.059	−2.826*
	(−1.307)	(−0.0543)	(−1.769)	(−0.0226)	(−1.722)
dgl_t_1	4.363**	−1.308	0.919	−5.650***	1.030
	(2.469)	(−0.351)	(0.525)	(−2.954)	(0.829)
dv_t_1	−0.100***	−1.450***	−0.250***	0.261***	−0.021
	(−3.690)	(−16.34)	(−8.930)	(9.310)	(−1.029)
Rate	6.390***	2.340	2.442*	2.270	4.241***
	(4.547)	(0.544)	(1.675)	(1.642)	(4.134)
Constant	−0.303	0.802	0.819	2.192***	1.325***
	(−0.589)	(0.667)	(1.613)	(4.690)	(3.690)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	661	326	987	987	1974
R-squared	0.178	0.654	0.239	0.194	0.124

Note: The dependent variable of this table is the value of the company *V*. Regression (1) is for the CSOE observations before policy implementation; regression (2) is for the CSOE observations after policy implementation; regression (3) is for the CSOE sub-sample; regression (4) is for the LSOE sub-sample; and regression (5) is for both the CSOE and LSOE observations, with *t*-statistics in brackets.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

the 0.1 level, indicating that the effect of the cash holdings on the value of CSOEs that invest insufficiently increases significantly after the policy implementation. The influencing factor of cash on CSOE value is between 1.317 and 0.566 after the policy implementation.

Table 8b
Panel B: Falsification test for the value of cash holdings.

Variables	Regression (1) 2006	Regression (2) 2007	Regression (3) 2008	Regression (4) 2009	Regression (5) 2010	Regression (6) 2011
Cash	0.041	0.449	0.046	−0.005	0.339	−0.093
	(0.124)	(1.347)	(0.138)	(−0.0156)	(0.984)	(−0.280)
y2006	−0.788***					
	(−4.246)					
Central	−0.290***	−0.145	−0.333***	−0.272***	−0.247***	−0.306***
	(−3.181)	(−1.564)	(−3.665)	(−2.912)	(−2.652)	(−3.406)
y2006_cash	0.762					
	(0.864)					
central_cash	1.326***	0.721	1.340***	1.188**	0.601	1.069**
	(2.977)	(1.622)	(3.023)	(2.537)	(1.298)	(2.422)
y2006_central	0.284					
	(1.308)					
y2006_central_cash	−2.569**					
	(−2.240)					
y2007		0.826***				
		(5.472)				
y2007_cash		−0.794				
		(−0.953)				
y2007_central		−0.442**				
		(−2.131)				
y2007_central_cash		0.933				
		(0.850)				
y2008			−0.671***			
			(−4.416)			
y2008_cash			0.329			
			(0.414)			
y2008_central			0.258			
			(1.239)			
y2008_central_cash			−1.472			
			(−1.358)			
y2009				0.391***		
				(2.617)		
y2009_cash				0.007		
				(0.0102)		
y2009_central				−0.051		
				(−0.255)		
y2009_central_cash				−0.342		
				(−0.354)		
y2010					0.470***	
					(3.101)	
y2010_cash					−1.154	
					(−1.559)	
y2010_central					−0.256	
					(−1.268)	
y2010_central_cash					2.562**	
					(2.565)	
y2011						−0.979***
						(−5.795)
y2011_cash						1.164
						(1.396)
y2011_central						0.273
						(1.232)
y2011_central_cash						−0.068
						(−0.0582)
Cf	2.332***	2.169***	2.111***	2.316***	2.111***	2.127***
	(5.327)	(4.991)	(4.878)	(5.268)	(4.802)	(4.884)

(*continued on next page*)

Table 8b (*continued*)

Variables	Regression (1) 2006	Regression (2) 2007	Regression (3) 2008	Regression (4) 2009	Regression (5) 2010	Regression (6) 2011
dcf_t	−1.349***	−1.059***	−1.021***	−1.418***	−1.084***	−1.187***
	(−3.915)	(−3.096)	(−2.993)	(−4.081)	(−3.127)	(−3.465)
dcf_t_1	−0.165	−0.020	0.065	−0.138	0.001	−0.137
	(−0.742)	(−0.0923)	(0.295)	(−0.616)	(0.00329)	(−0.617)
dna_t	0.130	0.004	0.063	0.125	0.153	0.085
	(0.756)	(0.0226)	(0.370)	(0.725)	(0.894)	(0.499)
dna_t_1	0.111	0.143**	0.180**	0.142*	0.123*	0.118
	(1.517)	(1.983)	(2.479)	(1.947)	(1.677)	(1.632)
capex	−3.052***	−2.727***	−2.911***	−3.130***	−3.023***	−3.190***
	(−5.427)	(−4.883)	(−5.243)	(−5.537)	(−5.363)	(−5.699)
capex_t	2.067***	1.994***	2.460***	2.403***	2.267***	2.365***
	(3.585)	(3.478)	(4.312)	(4.130)	(3.920)	(4.112)
capex_t_1	0.062	0.122	−0.041	−0.060	0.012	0.045
	(0.158)	(0.314)	(−0.106)	(−0.152)	(0.0295)	(0.115)
gl	−0.374	0.377	2.033	0.484	1.496	0.504
	(−0.265)	(0.270)	(1.460)	(0.342)	(1.058)	(0.360)
dgl_t	−1.398	−3.175**	−1.881	−0.871	−2.814*	−1.070
	(−0.856)	(−1.975)	(−1.173)	(−0.520)	(−1.732)	(−0.658)
dgl_t_1	0.882	0.397	0.655	1.365	1.114	0.972
	(0.720)	(0.325)	(0.532)	(1.106)	(0.907)	(0.797)
dv_t_1	−0.031	−0.057***	−0.045**	−0.041**	−0.026	−0.036*
	(−1.527)	(−2.772)	(−2.237)	(−2.131)	(−1.311)	(−1.874)
Rate	−2.243**	4.483***	3.479***	3.661***	2.171***	7.610***
	(−2.043)	(6.843)	(5.386)	(5.574)	(3.068)	(9.355)
Constant	2.323***	0.997***	1.472***	1.254***	1.442***	0.817**
	(6.197)	(2.922)	(4.355)	(3.651)	(4.190)	(2.358)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	1974	1974	1974	1974	1974	1974
R-squared	0.140	0.154	0.160	0.131	0.134	0.149

Note: The dependent variable of this table is the value of the company *V*. *t*-statistics are in brackets.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Regressions (3) and (4) compare CSOEs with general SOEs according to the different investment conditions. The regression coefficient of imp * central * cash is 2.636 in regression (3) and significant at the 0.05 level. Among the overinvestment observations, the value of CSOE cash holdings significantly increases after the policy implementation compared with that of the LSOEs' cash holdings. However, in regression (4), which focuses on overinvestment observations, the regression coefficient of the interaction term is insignificant.

The regression results in Table 9 show that the increase in the value of the cash holdings may be attributed to the improved underinvestment of CSOEs. However, in the full sample, it may be attributed to CSOEs' overinvestment inhibition compared with LSOEs.

6.4. Effect of accounting performance on the value of the cash holdings

After the implementation of the EVA performance evaluation, company managers improved their enterprises' investment structures out of personal interest and invested money in profitable projects. Does a company's accounting performance affect its investment performance and thereby the value of its cash holdings? The rate of net profit to equity (ROE), an accounting indicator, has relatively close links with the cost of equity capital. We divide the sample according to the annual industry median. We define a company as high performance if its ROE exceeds the annual industry median; otherwise, we define it as low performance. Table 10 shows the sub-sample regression results.

Table 9
Overinvestment and the value of corporate cash holdings.

Variables	Regression (1) Overinvestment of CSOEs	Regression (2) Underinvestment of CSOEs	Regression (3) Overinvestment	Regression (4) Underinvestment
Cash	1.814***	−0.566	0.604	−0.258
	(3.345)	(−0.974)	(1.128)	(−0.460)
Imp	−0.183	−0.079	0.113	−0.466**
	(−0.770)	(−0.488)	(0.556)	(−2.368)
Central			−0.294*	−0.194
			(−1.951)	(−1.333)
imp_cash	0.951	1.317*	−1.039	0.696
	(1.131)	(1.706)	(−1.255)	(0.654)
central_cash			0.849	−0.615
			(1.249)	(−0.744)
imp_central			−0.386	0.362
			(−1.529)	(1.546)
imp_central_cash			2.636**	0.991
			(2.315)	(0.712)
cf	5.656***	0.347	3.184***	0.523
	(4.855)	(0.367)	(4.413)	(0.681)
dcf_t	−1.480*	−0.248	−1.646***	−0.611
	(−1.651)	(−0.340)	(−2.616)	(−0.943)
dcf_t_1	2.273***	−0.000	−0.107	−0.211
	(3.852)	(−0.00114)	(−0.311)	(−0.720)
dna_t	0.669*	−0.413	0.582**	−0.134
	(1.790)	(−1.557)	(2.225)	(−0.567)
dna_t_1	0.475***	0.537***	0.090	0.216*
	(3.947)	(4.116)	(0.956)	(1.775)
Capex	−5.523***	−1.273	−3.331***	−2.613***
	(−3.319)	(−1.313)	(−3.275)	(−3.608)
capex_t	2.103	1.757**	2.517**	1.906***
	(1.366)	(1.984)	(2.517)	(2.712)
capex_t_1	0.096	−0.042	0.456	−0.531
	(0.101)	(−0.0570)	(0.767)	(−0.989)
gl	3.712	−9.306***	4.886**	−6.398***
	(1.422)	(−3.678)	(2.536)	(−2.783)
dgl_t	−4.663*	0.088	−4.435**	0.400
	(−1.669)	(0.0289)	(−2.094)	(0.147)
dgl_t_1	1.336	−4.460*	2.272	−2.045
	(0.528)	(−1.849)	(1.378)	(−1.053)
dv_t_1	−0.324***	−0.202***	−0.084***	0.055*
	(−7.436)	(−5.918)	(−3.022)	(1.882)
Rate	3.393	1.478	5.530***	3.579**
	(1.445)	(0.866)	(3.677)	(2.539)
Constant	0.211	1.532**	0.902*	1.455***
	(0.275)	(2.407)	(1.782)	(2.825)
Industry	Controlled	Controlled	Controlled	Controlled
Observations	491	496	1008	966
R-squared	0.310	0.237	0.178	0.115

Note: The dependent variable of this table is the value of the company *V*. Regression (1) is for the overinvestment sub-sample of CSOEs; regression (2) is for the underinvestment sub-sample of CSOEs; regression (3) is for the overinvestment sub-samples of both CSOEs and LSOEs; and regression (4) is for the underinvestment sub-samples of both CSOEs and LSOEs, with *t*-statistics in brackets.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Regression (1) in Table 10 shows that the regression coefficients of cash and imp * cash are 1.239 and 1.715, respectively, and are both significant at the 0.05 level. Among the CSOEs with high accounting performance, cash holdings have a significant positive effect on CSOEs' value before and after the implementation of the

Table 10
Value of cash holdings according to accounting performance.

Variables	(1) High performance of CSOEs	(2) Low performance of CSOEs	(3) High performance of full sample	(4) Low performance of full sample
Cash	1.239**	0.431	−0.097	−0.165
	(2.131)	(0.859)	(−0.176)	(−0.309)
Imp	−0.275	−0.105	0.034	−0.503***
	(−1.218)	(−0.647)	(0.174)	(−2.664)
Central			−0.579***	−0.093
			(−3.828)	(−0.655)
imp_cash	1.715**	0.179	−0.959	1.045
	(1.970)	(0.264)	(−1.075)	(1.215)
central_cash			1.194*	−0.103
			(1.667)	(−0.133)
imp_central			−0.237	0.308
			(−0.970)	(1.353)
imp_central_cash			3.194***	−0.274
			(2.679)	(−0.228)
cf	4.989***	0.711	3.729***	0.147
	(4.695)	(0.833)	(5.880)	(0.226)
dcf_t	−1.429*	−0.220	−2.129***	−0.393
	(−1.793)	(−0.436)	(−4.021)	(−0.850)
dcf_t_1	1.846***	0.203	0.343	−0.435
	(3.617)	(0.449)	(1.145)	(−1.310)
dna_t	0.862**	−0.781***	0.573**	−0.411*
	(2.251)	(−3.043)	(2.174)	(−1.702)
dna_t_1	1.325***	0.306***	0.864***	−0.106
	(6.833)	(3.457)	(6.012)	(−1.206)
Capex	−5.554***	−0.472	−4.035***	−2.297***
	(−3.564)	(−0.497)	(−4.550)	(−3.107)
capex_t	3.019*	0.724	2.996***	1.467**
	(1.948)	(0.832)	(3.187)	(1.996)
capex_t_1	−1.796*	0.856	−1.011*	0.091
	(−1.779)	(1.272)	(−1.680)	(0.173)
gl	2.574	−7.888***	5.587***	−8.560***
	(0.946)	(−3.602)	(2.883)	(−3.894)
dgl_t	−2.798	−2.763	−4.629**	−0.938
	(−0.797)	(−1.235)	(−1.982)	(−0.411)
dgl_t_1	0.794	−1.229	0.559	0.871
	(0.280)	(−0.618)	(0.340)	(0.466)
dv_t_1	−0.232***	−0.296***	−0.031	−0.013
	(−5.599)	(−8.583)	(−1.131)	(−0.464)
Rate	3.367	3.192*	3.402**	6.104***
	(1.454)	(1.899)	(2.381)	(4.231)
Constant	1.480*	0.376	1.365***	1.533***
	(1.711)	(0.674)	(2.760)	(3.013)
Industry	Controlled	Controlled	Controlled	Controlled
Observations	485	502	978	996
R-squared	0.319	0.310	0.216	0.126

Note: The dependent variable of this table is the value of the company *V*. High and low performances are divided according to the annual industry median. High performance is determined when a company's ROE exceeds the annual industry median, otherwise, low performance is determined. Regression (1) is for high-performance CSOEs; regression (2) is for low-performance CSOEs; regression (3) is for high-performance CSOEs and LSOEs; and regression (4) is for low-performance CSOEs and LSOEs, with *t*-statistics in brackets.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 11
Comparison of the value of cash holdings in enterprises that create value and suffer value loss.

Variables	EVA > 0			EVA < 0		
	Before implementation	After implementation	Before and after implementation	Before implementation	After implementation	Before and after implementation
	Regression (1)	Regression (2)	Regression (3)	Regression (4)	Regression (5)	Regression (6)
Cash	1.283***	1.653**	1.102**	0.130	0.063	0.140
	(2.611)	(2.382)	(2.168)	(0.200)	(0.0738)	(0.223)
Imp			−0.137			−0.165
			(−0.693)			(−0.890)
imp_cash			1.074			0.693
			(1.443)			(0.820)
cf	3.630***	7.375***	5.672***	−0.021	0.133	−0.125
	(3.526)	(4.926)	(6.173)	(−0.0184)	(0.0752)	(−0.123)
dcf_t	−1.454*	−1.153	−1.512**	−0.156	−0.359	0.043
	(−1.858)	(−1.133)	(−2.228)	(−0.245)	(−0.302)	(0.0716)
dcf_t_1	0.690	5.716***	1.809***	0.568	0.943	0.454
	(1.455)	(6.288)	(3.972)	(0.991)	(1.010)	(0.876)
dna_t	0.238	1.039	0.555*	−0.474	−1.205	−0.549*
	(0.699)	(1.480)	(1.649)	(−1.551)	(−1.537)	(−1.865)
dna_t_1	0.461*	2.226***	1.327***	0.165*	1.120**	0.308***
	(1.844)	(10.22)	(7.556)	(1.683)	(2.172)	(3.165)
capex	−4.024***	−3.112	−5.116***	−0.964	−2.879	−1.413
	(−2.875)	(−1.280)	(−3.884)	(−0.776)	(−1.536)	(−1.319)
capex_t	2.465*	2.143	2.816**	0.162	1.478	0.606
	(1.898)	(0.909)	(2.259)	(0.152)	(0.680)	(0.599)
capex_t_1	−0.499	−1.215	−1.277	0.967	−1.470	1.156
	(−0.544)	(−0.703)	(−1.484)	(1.222)	(−0.785)	(1.523)
gl	6.299**	−3.399	3.410	−7.978***	−6.603	−8.497***
	(2.366)	(−0.767)	(1.391)	(−2.981)	(−1.342)	(−3.450)
dgl_t	−2.828	−2.855	−2.785	−2.352	−0.609	−4.069
	(−0.922)	(−0.476)	(−0.938)	(−0.864)	(−0.0820)	(−1.547)
dgl_t_1	10.771***	−4.625	5.101**	−2.842	−1.869	−3.977*
	(4.044)	(−0.945)	(2.025)	(−1.224)	(−0.309)	(−1.777)
dv_t_1	−0.106***	−1.431***	−0.271***	−0.125***	−1.447***	−0.237***
	(−2.875)	(−12.00)	(−7.318)	(−3.072)	(−10.82)	(−5.955)
Rate	6.417***	6.073	2.098	7.487***	−2.687	4.620**
	(2.978)	(1.021)	(0.967)	(4.048)	(−0.445)	(2.554)
Constant	0.224	−0.236	2.215**	0.165	1.951	0.678
	(0.214)	(−0.159)	(2.038)	(0.300)	(1.325)	(1.216)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	368	203	571	293	123	416
R-squared	0.234	0.685	0.328	0.226	0.704	0.281

Note: Regressions (1), (2) and (3) are for the EVA > 0 sub-sample and regressions (4), (5) and (6) are for the EVA < 0 sub-sample, with *t*-statistics in brackets.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

EVA performance evaluation policy. After the policy implementation, the value of cash holdings increases significantly. Among the CSOEs with low accounting performance, the value of cash holdings is negative and does not improve after the implementation of the EVA performance evaluation.

We find similar results for LSOEs. In the high-performance companies, the value of CSOE cash holdings increases significantly after the implementation of the EVA policy compared with that of LSOE cash holdings. The results of regressions (3) and (4) provide evidence of this. We divide the companies into high- and low-performance groups according to the 5.5% rate of equity capital cost, which is regulated by the SASAC, and find no significant results regardless of performance group.

We also analyze the value of CSOE cash holdings under different EVA levels. Table 11 shows the results.

According to Table 11, cash holdings have a significant positive effect on company value in the value creation sub-sample from regressions (1)–(3). However, the positive effect of cash holdings on company value does not pass the significance test in the value loss sub-sample from regressions (4)–(6). Furthermore, we examine the changes in cash holding value before and after the policy implementation. Looking at the value creation sub-sample from regressions (1)–(3), the regression coefficient of cash in regression (2) is greater than that in regression (1). However, the regression coefficient of the interaction term imp_cash is insignificant. The case is the same in the value loss sub-sample.

The regression results in Table 11 show that value creation is an important factor affecting cash value. However, the EVA policy implementation does not significantly change the cash holdings value of enterprises that create value.

7. Conclusions and limitations

7.1. Conclusions

CSOEs account for a significant proportion of the Chinese economy. Motivating heads of CSOEs to work hard and protecting the state-owned assets and interests of shareholders are important economic targets of state regulators. As a performance supervisor, the SASAC is focused on evaluation and value creation, and assesses the heads of CSOEs to these ends. However, accounting performance may not be a perfect indicator of how CSOEs can fundamentally improve the philosophies and efficiency of their businesses. In addition, CSOEs are often large because their monopolies lead them to hold large amounts of cash, whether intentionally or unintentionally. Facing serious agency problems, an enterprise may abuse its cash or store large amounts of cash needlessly, resulting in a decline in corporate investment efficiency and ultimately leading to a fall in the value of its cash holdings. The SASAC must determine how to motivate executives to work hard, improve the investment efficiency of enterprises and enhance the value of their cash holdings. In 2010, it decided to fully implement EVA performance evaluations of CSOEs in an effort to improve business efficiency.

This study considers the background and transition of China's economic system. In 2010, the SASAC implemented an EVA performance evaluation policy to raise the value of cash holdings in CSOEs and protect shareholder equity. We adopt a difference-in-difference method and conduct comparison tests to determine the changes in the value of cash holdings between CSOEs and LSOEs before and after the policy execution from 2006 to 2011. The investment structure of CSOEs improved after the 2010 implementation of the EVA performance evaluation, resulting in significant increases in the value of their cash holdings. The findings of our falsification test and difference-in-difference method are consistent.

This paper makes the following contributions. First, it empirically tests the EVA performance evaluation policy implemented by the SASAC in 2010 to determine whether it improved business efficiency and the value of cash holdings in practice. This provides empirical evidence for EVA performance evaluation policy and its wider applications. Second, it enriches and develops the literature related to the value of cash holdings. It considers whether EVA performance evaluation can increase that value in transition economies such as China and enriches the economic consequences of EVA research areas. Third, it enriches the theoretical research literature related to investor protection and the mitigation of agency costs in transition economies and emerging markets.

7.2. Limitations

This paper considers the EVA performance evaluation policy implemented by the SASAC in 2010 for CSOEs to be an exogenous event. Although it is undeniable that some companies (including CSOEs and LSOEs) voluntarily implemented the EVA performance evaluation before 2010, it is impossible to determine the years in which these implementations occurred. This may affect our conclusions to some extent. In addition, we do not investigate the EVA performance evaluations of CSOE subsidiaries in our sample, as it is difficult to obtain this information, which may also affect our conclusions.

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