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Chapter: Advanced Perspectives on Financial Engineering, Economic Modeling and Portfolio Optimization

REGISTRATION SYSTEM REFORM AND ANALYST FORECAST ACCURACY: EVIDENCE FROM CHINA

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Annotation. The registration system reform (RSR) in China's capital market has gradually become the focus of academic discussion and attention. However, the existing literature has not yet offered systematic theoretical insights into how RSR influences analyst forecasts. To explore the impact of RSR on analyst forecasts, drawing on information spillover effect theory and limited attention theory, using the data from Chinese A-share companies that are listed under the approval system in 2015-2021 and a staggered difference-in-differences model, the spillover effect of the RSR on analyst forecast accuracy from the analysts' perspective was examined. The results show that the RSR has a positive spillover effect on analyst forecast accuracy. After the RSR, the analyst forecast accuracy for peer companies under the approval system has significantly improved. This spillover effect intensifies with the improvement of industry information that has been provided by companies under the registration system. The RSR induces a "catfish effect" on the disclosure quality of peers under the approval system, which compels them to elevate their information disclosure and enhances analyst forecast accuracy. The impact of the RSR on improving analyst forecast accuracy becomes pronounced when the same analyst follows companies under the registration system and peers under the approval system and when these peers are located in regions with superior institutional environments and with high internal control quality. The conclusions provide empirical evidence that supports the government's active promotion of the RSR and the optimization of the information environment in the capital market.

Keywords: registration system reform, analyst forecast accuracy, spillover effect, information disclosure.

JEL classification: G32, M41, L15.

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Introduction

The consistent improvement of the information disclosure environment in the capital market has been a common concern among regulators and academics. Enhancing analyst forecast accuracy significantly contributes to the overall information environment of the capital market. Research indicates that strengthening information disclosure supervision involves established guidelines to facilitate the exchange of information between corporations and investors (Admati, Pfleiderer, 2000). As a bridge for information transfer between companies and investors in the capital market, analysts not only facilitate the flow of corporate information to investors but also help companies understand industry trends and competitors (Francis, Soffer, 1997; Givoly, Lakonishok, 1979; Brown *et al.*, 2019). As industry experts, analysts' knowledge of sectoral and market dynamics enables institutional investors to understand and assess a company's performance trajectory and market conditions accurately (Kadan *et al.*, 2012; Bradshaw, 2012; Yan *et al.*, 2019). Consequently, establishing a comprehensive regulatory mechanism for information disclosure is crucial for enhancing analyst forecast accuracy and reducing information asymmetry between internal and external investors.

Previous studies on the value relevance of information disclosure regulation in capital markets have focused on developed nations, which reveal that such regulations prompt enterprises to disclose value-relevant information (Wang, 2016; Bens *et al.*, 2016; Bozanic *et al.*, 2017; Cunningham *et al.*, 2020). However, can these findings be generalized to emerging markets, particularly those with weak institutional frameworks and high levels of information asymmetry, such as China? In recent years, China, as the largest emerging market, has undergone an important institutional reform, namely, the implementation of the RSR in 2019. Unlike the approval system, one of the key changes in RSR is to enhance information disclosure, strengthen supervision of disclosure, and impose stringent penalties for securities violations, which can improve the overall informational environment of the capital market. As a result, an increasing number of companies have started to be listed under the registration system. These companies must comply with stringent information disclosure requirements. Data from the WIND database indicates that under the previous approval system, an average of 145 new companies went public in China each year. However, this number had surged to 382 by 2022. Given the rapid growth in the number of listed companies in China, insights gained from the Chinese context can prove instrumental in advancing disclosure regulation in other emerging economies. While the existing literature has extensively explored the economic consequences of RSR (Li, Li, 2022; Liao, 2024; Hu, Wang, 2023; Wu *et al.*, 2024; Qin, Xiao, 2023), limited research has been produced on how RSR affects the information environment of peer firms under the approval system, especially in emerging markets. First, the impact of the RSR on information disclosure is not only limited to the IPO stage (Li, Xu, 2024; Liao, 2024; Hu, Wang, 2023). It is also reflected in the strengthening of the post-IPO continuous regulatory responsibility for information disclosure by analysts and other relevant entities, which is an area where existing studies lack in-depth explorations. Second, prior research on analyst forecast accuracy has focused on microlevel factors, such as firm characteristics (Lehavy *et al.*, 2011; Abernathy *et al.*, 2018; Lobanova *et al.*, 2019; Peng *et al.*, 2022) and analysts' traits (Bradley *et al.*, 2017; Hwang *et al.*, 2019; Driskill *et al.*, 2020), which is likely to be affected by endogeneity. Research on how external factors, such as macroeconomic conditions and institutional changes, impact analyst forecast accuracy remains insufficient (Call *et al.*, 2019).

Among the vast amount of information that analysts need to process quickly in the capital market, industry information is considered the most efficacious source (Brown *et al.*, 2015). The information spillover effect within the industry has become a significant factor in improving analyst forecast accuracy

(Kini *et al.*, 2009). According to the information spillover effect theory, the information released by an organization during its activities can serve as the basis for production, construction, operation, management, analysis, and decision-making not only for that organization but also for the improvement of the information environment of other peer companies in the same industry. Analysts often refer to relevant information from peer firms (Jennings *et al.*, 2017; Hilary, Shen, 2013) and firms along the supply chain (Guan *et al.*, 2015; Luo, Nagarajan, 2015) when evaluating a company. With the continuous development of the RSR, public information has become the primary basis for analyst forecasts. However, companies do not operate in isolation; and the correlations between them create information interconnectedness, which leads to spillover effects (Dong *et al.*, 2017). Therefore, further examination is needed to determine whether firms under the registration system can generate valuable information that influences analysts' forecasts for their counterparts under the approval system. In the Chinese context, we explore whether the information disclosure regulation of firms under the registration system influences analyst forecast accuracy for peer firms under the approval system.

Unlike other jurisdictions worldwide, the RSR in China was progressively implemented across the process of shifting from the Science and Technology Innovation Board (Sci-tech Innovation Board) to the Growth Enterprise Market (GEM Board) to the Main Board, which offers a unique opportunity to study how institutional environments influence the information disclosure environment. First, China uniquely underwent a period where the registration and approval system coexisted in the global capital market. Prior to the official implementation of the registration system by the Sci-tech Innovation Board in 2019, China's capital market primarily adopted the approval system. Subsequently, China gradually extended the registration system to the GEM Board and eventually to the Main Board, with the full transition to a registration system era completed in February 2023. Second, the staggered introduction of the registration system enables us to assess rigorously how information disclosure evolves over time within industries that are affected by the registration system (treatment group) versus those that are unaffected (control group). We bolster our causal inferences by employing panel data models that control for industry-fixed effects, year-fixed effects, and time-variant firm and analyst characteristics.

The contributions of this study are as follows. First, it extends the main body of research on the spillover effect of the RSR. We attempt to broaden the scope of the spillover effect from the company level to the analyst level. We examine whether the RSR affects the behavior of other information users in the capital market from the perspective of information intermediary analysts to facilitate a comprehensive assessment of the policy effects that are engendered by the RSR. Second, it enriches the research on the factors that influence analyst forecast accuracy. Notably, insufficient empirical evidence exists regarding whether institutional changes can spill over to affect analyst forecast accuracy for other firms within the same industry. We provide empirical evidence that the RSR influences analyst forecast accuracy for peer companies under the approval system, thus aiming to expand the research scope on analyst forecast accuracy. Last, our findings unveil the significant effect of the RSR, thus holding substantial practical implications for the full implementation of the RSR. Given the crucial role of analyst forecast accuracy in the capital market's information environment, we use it as a starting point to examine the effect of RSR on the overall information environment.

The remainder of this study is organized as follows. Section 1 describes the hypothesis development. Then, Section 2 introduces the research design. Section 3 provides empirical results. Subsequently, Section 4 offers further analysis. Next, Section 5 is a discussion of the results. Section 6 presents the conclusion and implications.

1. Theoretical Analysis and Hypothesis Development

Information spillover effect theory holds that a company's information disclosure behavior will affect not only companies in the same industry but also other entities, such as analysts. As professional information intermediaries, analysts' forecast reports play a crucial guiding role for investors in the capital market. Analysts often need to follow multiple companies to make a forecast. Companies within the same industry typically operate under similar external conditions, are influenced by the same macroeconomic factors, and face similar competitive dynamics. Moreover, such information tends to spread throughout the industry, thus implying that developments affecting one company also have implications for others in the same industry (Hilary, Shen, 2013). This valuable industry information can engender spillover effects that influence analysts' earnings forecasts. Piotroski, Roulstone (2004), Kadan *et al*. (2012), and Brown *et al*. (2015) discovered that market mispricing largely depends on industry trends and an in-depth knowledge of peer companies. Consequently, analysts with extensive industry experience typically provide accurate forecasts (Kadan *et al.*, 2012; Bradshaw, 2012), which subsequently have a substantial impact on market prices (Bradley *et al.*, 2017).

Companies under the registration system can provide a valuable reference for analysts to forecast the performance of peers under the approval system, thereby enhancing the analyst forecast accuracy for those peers. Studies have indicated that information intermediaries can gain insights into unregulated companies by examining the disclosures of regulated ones, thus resulting in information spillover effects (Garmaise, Natividad, 2016; Jung *et al.*, 2015). In theory, the RSR can provide analysts with valuable information in terms of quantity and quality. On the one hand, from the perspective of the quantity of information, the incremental industry information generated by companies that are listed under the registration system can improve analyst forecast accuracy for peers under the approval system. When numerous companies are under the registration system within an industry, the amount of information they disclose steadily increases. Moreover, the transparency of information rises as these companies remain listed for extended periods. This condition can generate reliable industry information, thus helping analysts gain deep insights and a comprehensive understanding of industry trends. If analysts can utilize the incremental industry information produced by companies under the registration system to forecast the earnings of peers under the approval system, such information can significantly improve analyst forecast accuracy for these peers.

On the other hand, the quality of specific industry information provided by companies under the registration system can impact analyst forecast accuracy. Compared with the approval system, the registration system emphasizes information disclosure as its core principle. The "Ongoing Supervision Measures" stipulate that companies are required to disclose industry information fully. Violations of these disclosure regulations are directly tied to the delisting mechanism. A series of stringent disclosure regulations under the RSR will significantly improve the transparency of information disclosed by companies under the registration system. However, certain differences exist in the quality of information disclosure among companies in different industries. A high quality of disclosed industry information entails improved availability of information to analysts, thus ultimately leading to accurate earnings forecasts (Hilary, Shen, 2013). Therefore, if the information disclosed by companies under the registration system improves the quality of industry information accessible to analysts, it will enhance the forecast accuracy of analysts covering peer companies under the approval system.

Meanwhile, the high-quality information disclosure by companies under the registration system can induce a "catfish effect". The emergence of these companies in the industry is akin to the introduction of a catfish: they potentially compel their peers under the approval system to enhance their disclosure

proactively, thus benefiting analyst forecast accuracy. For companies, extensive capital market disclosure equates to intensified competition. According to limited attention theory, investors' attention is finite. When the disclosure levels of companies under the registration system in the industry increase, investors will pay added attention to these listed companies and correspondingly reduce their attention to peer firms under the approval system. Given that companies under both systems within the same industry are competitors, peer companies under the approval system, which are pressured by the competitive environment created by companies under the registration system, may also improve the quality of their information disclosure, thereby enhancing the accuracy of analysts' earnings forecasts. Therefore, the RSR triggers the catfish effect, which leads peer companies under the approval system to enhance the quality of their information disclosure. This move indirectly improves analyst forecast accuracy and the information environment of China's capital market. Ultimately, it fulfills the objectives of the RSR. Based on the above analysis, the following hypothesis is proposed:

Hypothesis H1: The RSR can enhance analyst forecast accuracy for peer companies under the approval system.

2. Research Design

2.1 Sample Selection and Data Sources

We select Chinese A-share companies that are listed under the approval system (i.e., the Main Board) from 2015 to 2021 as our initial research sample. For analysts issuing multiple forecasts for the same firm year, we retain only their latest forecasts to exclude stale forecasts. We also require that any forecast should be issued no earlier than one year ahead and no later than 30 days before the fiscal year-end. Forecasts with missing analysts' names, report dates, or earnings forecast data are excluded. Finally, we eliminate observations from the financial industry, those labeled as ST, and those with missing other financial data. We address the impact of reverse causality by using lagged analyst forecasts, thus ultimately yielding 26,881 analyst-firm-year observations. All financial data are sourced from the China Stock Market Accounting Research (CSMAR) database.

2.2 Model Construction

We test the hypothesis by establishing the staggered difference-in-differences (DID) model as follows.

$$Frror_{i,j,t+1} = \alpha_0 + \alpha_1 Did_{j,t} + \sum Controls + \sum Year + \sum Indy + \varepsilon \tag{1}$$

Where $Frror_{i,j,t+1}$ is the dependent variable. We follow Hwang *et al.* (2019) and estimate equation (2) described below.

$$Frror_{i,j,t+1} = \frac{|Feps_{i,j,t+1} - Aeps_{j,t+1}|}{P_{i,j}} \tag{2}$$

Where $Feps_{i,j,t+1}$ is the earnings per share of analyst *i* following company *j* in year *t+1*. $Aeps_{j,t+1}$ denotes the actual earnings per share for company *j* in year *t+1*. $P_{i,j}$ represents the closing price of company *j* on the trading day before analyst *i* publishes the report. A low value of $Frror_{i,j,t+1}$ entails high analyst forecast accuracy.

The independent variable, $Did_{j,t}$, equals 1 if the subindustries in which company *j* belongs under the approval system observe the first company listed under the registration system in year *t* and any subsequent year. Otherwise, it equals 0. The subindustries are based on the CSRC's 2012 industry classification using a letter followed by a two-digit code.

Table 1. Variable Definition

Variables		Variable definition
Dependent variable	*Frror*	Analyst forecast accuracy, as shown in equation (2).
Independent variable	*Did*	1 if the subindustries in which company *j* belongs under the approval system observe the first listed company under the registration system in year *t* and any subsequent year. Otherwise, it is 0.
Control variables	*Size*	Natural logarithm of total assets.
	Lev	Total liabilities divided by total assets.
	Roe	Owner's equity divided by total assets.
	Soe	1 for state-owned enterprises and 0 otherwise.
	Duality	1 for companies with the same person serving as chairman and CEO and 0 otherwise.
	Inst	The proportion of the number of shares held by institutional investors to the total shares.
	Indirector	The proportion of the number of independent directors to the total number of directors.
	Follow	The natural logarithm of the number of companies followed by analyst *i* in year *t*.
	Horizon	The natural logarithm of the number of days between analyst *i*'s latest forecast and annual report for the firm followed by analyst *i* in year *t*.
	Brokersize	The natural logarithm of the number of analysts employed by analyst *i*'s brokerage house in year *t*.
	Star	1 if companies followed by a star analyst, which is based on the star analyst rankings published by "New Fortune" magazine, and 0 otherwise.

Source: compiled from CSMAR database.

Following Jennings *et al*. (2017) and Dhaliwal *et al*. (2012), we also control for analyst- and firm-level variables that can affect analyst forecast accuracy. Furthermore, we include industry (*Indy*) and year (*Year*) fixed effects. Detailed definitions of all of the variables are reported in *Table 1*. All continuous variables are winsorized at the 1% and 99% levels.

3. Results Analysis

3.1 Descriptive Statistics

Table 2 reports the descriptive statistics of our main variables. The mean value of *Frror* is 0.0229, with a standard deviation of 0.0420, thus indicating considerable variability in forecast accuracy among different analysts. The mean value of *Did* is 0.3280, which implies that 32.8% of the observations are from industries that comprise companies that are listed under the registration system.

Table 2. Descriptive Statistics

Variables	Obs.	Mean	S.D.	Min	Median	Max
Frror	26, 881	0.0229	0.0420	0.0001	0.0095	0.2910
Did	26, 881	0.3280	0.4690	0.0000	0.0000	1.0000
Star	26, 881	0.1100	0.3130	0.0000	0.0000	1.0000
Follow	26, 881	3.2200	1.3200	0.0000	3.0000	5.9600
Horizon	26, 881	5.2000	0.3630	4.4100	5.1500	6.0500

Table 2 (*continuation)*. Descriptive Statistics

Variables	Obs.	Mean	S.D.	Min	Median	Max
Brokersize	26, 881	6.0400	0.7020	3.6100	6.2600	7.0300
Size	26, 881	23.5000	1.4900	21.0000	23.2000	27.9000
Lev	26, 881	0.4550	0.1830	0.0942	0.4570	0.8470
Roe	26, 881	0.1260	0.0776	-0.1190	0.1200	0.3620
Inst	26, 881	0.5710	0.2350	0.0492	0.6210	0.9540
Soe	26, 881	0.3810	0.4860	0.0000	0.0000	1.0000
Duality	26, 881	0.2690	0.4430	0.0000	0.0000	1.0000
Indirector	26, 881	0.0038	0.0006	0.0033	0.0036	0.0060

Source: authors' own results.

3.2 Univariate Test

As indicated in *Table 3*, the mean (and median) deviations of analyst forecasts for companies under the approval system are significantly lower at the 1% level when peers under the registration system are within the same industry (*Did* = 1), compared with those without such peers (*Did* = 0). Consequently, the RSR exhibits a positive spillover effect on analyst forecast accuracy for companies under the approval system within the same industry, thus providing preliminary support for H1.

Table 3. Univariate Analysis

	Full sample (N=26, 881)		*Did*=1 (N=8, 814)		*Did*=0 (N=18, 067)		Diff	
Variable	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Frror	0.0232	0.0097	0.016	0.006	0.026	0.011	-0.010***	-0.005***

Notes: ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

3.3 Regression Results

Table 4 presents the regression results for Eq. (1). The results in column (1) reveal that, before including any control variables, the coefficient of *Did* is -0.0237 and significant at the 1% level. In column (2), the coefficient of *Did* is -0.0226 and significant at the 1% level, thus suggesting that RSR has contributed to a 2.26% average increase in analyst forecast accuracy for peer companies under the approval system. Furthermore, the economic significance of these results suggests that the presence of listed companies under the registration system in an industry leads to a 0.99 unit increase in analyst forecast accuracy for peers under the approval system (0.99 = regression coefficient (0.0226) / the mean value of *Frror* (0.0229, as seen in *Table 2*)). These results verify H1, thus implying that RSR exerts a positive externality by substantially improving analyst forecast accuracy for peer companies under the approval system.

We observe that RSR enhances analyst forecast accuracy for peer companies under the approval system. However, star analysts, with their extensive work experience and access to a broader range of information sources, inherently possess higher forecast accuracy than general analysts (Clement, 1999). Therefore, an alternative explanation may be that this effect is primarily attributed to star analysts engaging in forecasting after the RSR, rather than to the information spillover effect from companies under the registration system within the industry. We rule out the possibility that star analysts are the main drivers of the accuracy improvement by replacing the explanatory variable with a dummy for *Star*.

The results in column (3) show that the coefficient between *Star* and *Did* is insignificant, thus suggesting that RSR does not significantly increase the likelihood of forecasts by star analysts. Moreover, the interaction coefficient of *Star* * *Did* in column (4) is insignificant, thereby indicating that after RSR, no significant difference exists in the analyst forecast accuracy between star and non-star analysts for peer companies under the approval system.

Table 4. Regression Results

Variables	*Frror*		*Star*	*Frror*	*Frror* (*Star*=1)	*Frror* (*Star*=0)
	(1)	(2)	(3)	(4)	(5)	(6)
Did	-0.0237*** (-17.2868)	-0.0226*** (-16.7921)	-0.0027 (-0.3194)	-0.0228*** (-16.8969)	-0.0243*** (-6.5589)	-0.0225*** (-15.5775)
*Star * Did*				0.0021 (1.5625)		
Star		-0.0021*** (-2.8793)		-0.0029*** (-2.9249)		
Follow		-0.0002 (-0.7706)	-0.0341*** (-21.8989)	-0.0002 (-0.8454)	0.0007 (1.1121)	-0.0003 (-1.2991)
Horizon		0.0001 (0.1204)	0.0374*** (7.0950)	0.0001 (0.1241)	-0.0003 (-0.1996)	0.0002 (0.3072)
Brokersize		0.0014*** (4.5174)	0.0844*** (41.2938)	0.0014*** (4.5226)	0.0021 (1.3859)	0.0014*** (4.3661)
Size		0.0033*** (15.5104)	-0.0068*** (-3.4000)	0.0033*** (15.4726)	0.0040*** (6.4371)	0.0032*** (14.1463)
Lev		0.0235*** (13.4265)	0.0652*** (4.4979)	0.0235*** (13.4367)	0.0187*** (4.0639)	0.0241*** (12.7572)
Roe		0.0086* (1.9498)	0.0895*** (3.4712)	0.0086** (1.9622)	-0.0028 (-0.2329)	0.0093** (1.9767)
Inst		-0.0115*** (-9.6581)	0.0041 (0.4274)	-0.0115*** (-9.6640)	-0.0103*** (-2.8922)	-0.0117*** (-9.2759)
Soe		-0.0046*** (-7.7061)	0.0018 (0.3613)	-0.0046*** (-7.7083)	-0.0003 (-0.2126)	-0.0051*** (-7.9993)
Duality		-0.0013** (-2.3553)	0.0003 (0.0618)	-0.0013** (-2.3512)	0.0026 (1.6412)	-0.0018*** (-3.0492)
Indirector		2.6395*** (5.0840)	-1.4180 (-0.4430)	2.6372*** (5.0787)	5.7283*** (3.5040)	2.3137*** (4.2309)
Constant	0.0307*** (56.7237)	-0.0693*** (-11.6298)	-0.3634*** (-6.9985)	-0.0691*** (-11.5750)	-0.1026*** (-5.6455)	-0.0664*** (-10.4599)
Indy	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	26881	26881	26881	26881	2961	23920
r2_a	0.1701	0.1933	0.0818	0.1933	0.2065	0.1933
Inter-group difference test					-0.0018 (0.153)	

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

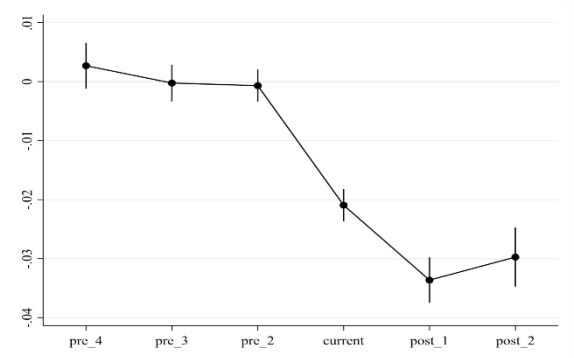
Additionally, the results in columns (5) and (6) of *Table 4* show that the coefficients between *Frror* and *Did* are significantly negative for the star analyst group (*Star* = 1) and the non-star analyst group (*Star* = 0), with no significant differences in the coefficients between the two groups. These findings suggest that the

rich experience of star analysts is not the primary driver of the improvement in forecast accuracy, but rather the spillover effect of information from companies under the registration system.

3.4 Robustness Test

3.4.1 Parallel Trend Test

A prerequisite for using the DID model is satisfying the parallel trend assumption, which implies that analyst forecast accuracy should be consistent between the treatment and control groups before the listing of companies under the registration system in the industry. We conduct a dynamic parallel trend test, using the year preceding the first company listing in the subindustries under the registration system (*Pre_1*) as the benchmark. The findings are illustrated in *Figure 1*. In this context, *Pre_t* denotes the t year before the listing of companies under the registration system in the subindustries, *Current* signifies the year of listing, and *Post_t* represents the t year after the listing.



Source: authors' own results.

Figure 1. **Parallel Trend Test**

The results presented in *Figure 1* indicate no significant difference in analyst forecast accuracy (*Frror*) between the treatment and control groups during the four years (*Pre_4*), three years (*Pre_3*), and two years (*Pre_2*) preceding the RSR compared with the benchmark year (*Pre_1*). This outcome confirms the validity of the parallel trend assumption.

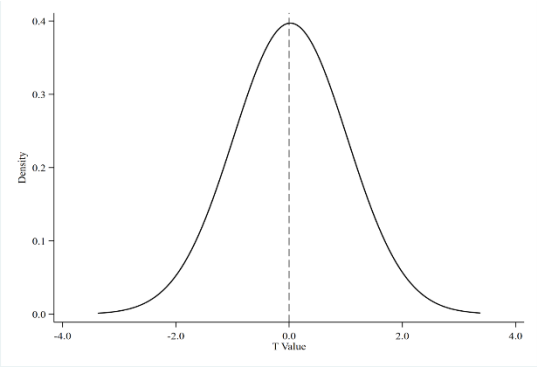
3.4.2 Placebo Test

We alleviate potential biases arising from sample selection by using the Bootstrap method. This method entails repeating 1,000 random samplings to reassign the samples from the treatment group and the periods that are affected by the policy followed by conducting regression analysis. As depicted in *Figure 2*, the results show that the estimated coefficients adhere to an approximately normal distribution, which is consistent with the expectations of the placebo test.

3.4.3 PSM-DID and EB-DID Tests

We mitigate potential systematic biases between the treatment and control groups by employing the propensity score matching (PSM) method with a 1:1 without replacement matching algorithm, along with the entropy balancing (EB) approach. These methodologies are used to match samples from the treatment and control groups before performing DID estimation. The results are presented in columns (1) and (2) of *Table 5*. Column (1) presents the regression results for the PSM-DID, while column (2) presents

the regression results for the EB-DID. The coefficients of *Did* are significantly negative at the 1% level, thus indicating the robustness of our findings.



Source: authors' own results.

Figure 2. **Placebo Test**

3.4.4 Omitted Variable

The association between analysts and firms may be affected by certain unobserved factors that can also affect analyst forecast accuracy. We mitigate endogeneity concerns stemming from omitted variables by controlling for fixed effects of firm, analyst, and analyst-firm, respectively. The results in columns (3) - (5) of *Table 5* reveal that the coefficients of *Did* are significantly negative at the 1% level, thus suggesting that RSR substantially enhances analyst forecast accuracy for peers. Our main conclusions remain robust.

3.4.5 Replacement of the Dependent Variable

We ensure the robustness of our results by replacing the measurement indicator of the dependent variable. Following Clement (1999), we use the proportional mean adjustment method as a means to assess analyst forecast accuracy (described in equation (3) below).

$$PMAFF_{i,\,j,\,t+1} = \frac{Bias_{i,\,j,\,t+1} - \overline{Bias_{j,\,t+1}}}{Bias_{j,\,t+1}} \tag{3}$$

Where $Bias_{i,\,j,\,t+1}$ is the absolute forecast error of analyst *i* following firm *j* in year *t+1*. $\overline{Bias_{j,\,t+1}}$ is the mean value of absolute forecast error of all analysts following firm *j* in year *t+1*. The smaller the value of $PMAFF_{i,\,j,\,t+1}$, the more accurate analyst forecasts are. The results in column (6) of *Table 5* show that the coefficient of *Did* is significantly negative at the 1% level, thus supporting H1.

Table 5. Robustness Test

Variables	PSM-DID	EB-DID	Analyst fixed effects	Company fixed effects	Analyst-company fixed effects	*PMAFF*
	(1)	(2)	(3)	(4)	(5)	(6)
Did	-0.0222*** (-10.5137)	-0.0146*** (-4.7133)	-0.0214*** (-13.7370)	-0.0159*** (-14.3020)	-0.0136*** (-4.4072)	-0.2664*** (-3.9578)
Constant	-0.0869*** (-6.4098)	-0.0631*** (-2.6542)	-0.0695*** (-9.1343)	-0.1931*** (-6.2721)	-0.1714 (-1.6302)	0.9274** (1.9656)
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 5 (*continuation*). Robustness Test

Variables	PSM-DID	EB-DID	Analyst fixed effects	Company fixed effects	Analyst-company fixed effects	*PMAFF*
	(1)	(2)	(3)	(4)	(5)	(6)
Indy/Year	Yes	Yes	Yes	Yes	Yes	Yes
N	7555	26881	26881	26881	26881	26881
r2_a	0.2413	0.1830	0.2231	0.6053	0.5889	0.0012

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

4. Further Analysis

4.1 Quality of Industry Information

4.1.1 Industry Incremental Information

We further examine whether the spillover effect of RSR on analyst forecast accuracy is enhanced by the incremental industry information disclosed by companies under the registration system. If the above analysis is true, then the number of listed companies under the registration system disclosing a great amount of incremental industry information increases as the spillover effect is increasingly pronounced (Breue, 2021). Following Breuer *et al*. (2022), we define three variables, namely, *Rsnm*, $\Delta Rsnm$, and *Rsratio*, to measure the industry incremental information after the RSR. Specifically, *Rsnm* represents the number of companies under the registration system in the industry in a given year. $\Delta Rsnm$ indicates the change in the number of companies under the registration system in the industry compared with last year. *Rsratio* represents the proportion of companies under the registration system relative to the total number of companies in the industry in a given year. Large values of *Rsnm*, $\Delta Rsnm$ and *Rsratio* signify that an increased amount of incremental industry information is generated after the RSR.

Table 6. Industry Incremental Information

Variables	*Frror*			
	(1)	(2)	(3)	(4)
Did	-0.0209*** (-15.6317)	-0.0199*** (-14.3238)	-0.0188*** (-13.7308)	-0.0106*** (-6.9827)
*Rsnm * Did*	-0.0003*** (-7.7865)			
$\Delta Rsnm$ * Did*		-0.0005*** (-8.4135)		
*Rsratio * Did*			-0.0295*** (-8.6661)	
*Length * Did*				-0.0000*** (-13.2345)
Constant	-0.0699*** (-11.6858)	-0.0700*** (-11.7097)	-0.0694*** (-11.6186)	-0.0684*** (-11.4856)
Controls	Yes	Yes	Yes	Yes
Indy/Year	Yes	Yes	Yes	Yes
N	26881	26881	26881	26881
r2_a	0.1946	0.1945	0.1954	0.2007

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

In columns (1) - (3) of *Table 6*, the coefficients of the interaction terms *Rsnm* * *Did,* $\Delta Rsnm$ * *Did* and *Rsratio* * *Did* are all significantly negative. This outcome indicates that as the amount of industry incremental information increases after the RSR, analyst forecast accuracy for peer companies under the approval system improves.

Moreover, following Wang (2023), we also define *Length* as the number of days between the date that the first company in the subindustry was listed under the registration system and the date that the analyst's forecast report was written. Large values of *Length* indicate a long duration during which companies in the subindustry have been listed under the registration system. This outcome provides analysts with reliable industry information. It can also enhance analyst forecast accuracy for peer companies under the approval system. In column (4) of *Table 6*, the coefficient of the interaction term *Length* * *Did* is significantly negative, which is consistent with our expectations.

4.1.2 Industry Information Transparency

According to the information effect hypothesis, information quality is an important prerequisite for information to have a positive effect on analyst forecast accuracy (Cowan, Salotti, 2020). Following Kim, Verrecchia (2001), we use two indicators, which are collectively referred to as the KV index, to measure the quality of information disclosure by companies under the registration system. Then, we calculate the average KV index values for companies that are listed under the registration system within each industry. If these average values are lower than the annual average KV index values across all industries, the variable *KV* equals 1, thus indicating a high level of industry information transparency. Otherwise, the variable *KV* equals 0, thereby indicating a low level of industry information transparency. The regression results in columns (1) and (2) of *Table 7* show that the coefficients of *KV1* and *KV2* are significantly negative at the 1% and 5% levels, respectively, thereby indicating that the improved information disclosure environment after the RSR leads to accurate analyst forecasts for peer companies under the approval system. Therefore, companies that are listed under the registration system can provide valuable information for analysts to forecast peer companies under the approval system, thereby exerting positive spillover effects on analyst forecast accuracy.

Table 7. Industry Information Transparency

Variables	*Frror*	
	(1)	**(2)**
KV1	-0.0060*** (-4.2279)	
KV2		-0.0031** (-2.2179)
Constant	-0.0405*** (-4.8454)	-0.0447*** (-5.4263)
Controls	Yes	Yes
Indy/Year	Yes	Yes
N	8814	8814
r2_a	0.1754	0.1736

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

4.2 Catfish Effect or Free-rider Effect

One of the primary intentions behind information disclosure regulation is to enhance the quality of information disclosure across the entire capital market (Dye, 1990; Leuz, Wysocki, 2016). We introduce the concept of the catfish effect: companies that are listed under the registration system can be seen as a catfish that is introduced into an industry. These companies have the potential to improve the information disclosure quality of peer companies under the approval system, thereby facilitating analyst forecasts for these companies. Conversely, public choice theory suggests the free-rider effect. The stringent information disclosure regulations imposed on companies that are listed under the registration system can lead peer companies under the approval system to become free riders in terms of information disclosure. Breuer *et al*. (2022) and Goldstein, Yang (2017) suggested that when certain companies are subject to strict information disclosure regulations, unregulated peer companies may opt to become free riders, thus potentially causing these unregulated companies to reduce their disclosure efforts. Specifically, regulators impose stringent requirements on companies that are listed under the registration system to ensure the authenticity and completeness of their disclosed information. Peer companies under the approval system, which are not subject to such regulations, may become free riders. They can utilize the relevant information disclosed by their industry counterparts under the registration system without any cost. Undoubtedly, this scenario will lead to a decline in the level of information disclosure among these unregulated peer companies within the industry.

From the analysts' perspective, the aforementioned conclusion incorporates the free-rider effect. Even if companies under the approval system engage in free-riding behavior that diminishes their level of information disclosure, analysts may still be able to forecast these companies' performance accurately by leveraging valuable industry information provided by companies under the registration system. If such a free-rider effect exists, it could hinder the improvement of the overall information disclosure environment within the capital market. This effect can widen the information disclosure gap between regulated companies under the registration system and unregulated peers under the approval system, increase the operational costs for regulators (De Fontenay, 2016), and ultimately undermine the effectiveness of information disclosure regulation across the market (Admati, Pfleiderer, 2000).

Given this situation, whether the RSR will trigger a catfish effect or a free-rider effect among peer companies under the approval system remains uncertain. Hence, we construct the following model, as shown in Eq. (4) and (5):

$$M = \alpha_0 + \alpha_1 Did_{j,t} + \sum Controls + \sum Year + \sum Indy + \varepsilon \tag{4}$$

$$Frror_{i,j,t+1} = \alpha_0 + \alpha_1 Did_{j,t} + \alpha_2 M + \sum Controls + \sum Year + \sum Indy + \varepsilon \tag{5}$$

We employ two indicators to measure the quality of information disclosure among peer companies under the approval system: (1) Discretionary accrual (*DA*) is calculated using the modified Jones model following Dechow *et al*. (1995). A large *DA* indicates a low level of information disclosure quality. (2) Earnings aggressiveness (*EA*) serves as a proxy for the transparency of corporate accounting information following Bhattacharya *et al*. (2003). A large *EA* suggests a great degree of information opacity. The regression results are presented in *Table 8*. The coefficients of *Did* in columns (2) and (4) are significantly negative at the 1% level, thus suggesting that the RSR significantly enhances the information disclosure quality of peer companies under the approval system. Columns (3) and (5) show that the coefficients of *DA* and *EA* are significantly positive, whereas the coefficients of *Did* are significantly negative. This

evidence refutes the possibility of a free-rider effect and confirms the existence of a catfish effect. Consequently, the RSR motivates peer companies under the approval system to enhance their level of information disclosure, thereby improving the analyst forecast accuracy for them.

Table 8. Catfish Effect

Variables	*Frror*	*DA*	*Frror*	*EA*	*Frror*
	(1)	(2)	(3)	(4)	(5)
Did	-0.0226*** (-16.7921)	-0.0128*** (-8.8800)	-0.0224*** (-16.5937)	-0.0132*** (-8.7526)	-0.0225*** (-16.6226)
DA			0.0146*** (3.6294)		
EA					0.0063* (1.7283)
Constant	-0.0693*** (-11.6298)	0.1642*** (13.9324)	-0.0717*** (-11.8113)	0.0590*** (5.1696)	-0.0697*** (-11.6740)
Controls	Yes	Yes	Yes	Yes	Yes
Indy/Year	Yes	Yes	Yes	Yes	Yes
N	26881	26881	26881	26881	26881
r2_a	0.1933	0.1528	0.1938	0.1731	0.1933

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

4.3 Heterogeneity Analysis

4.3.1 Analysts simultaneously following companies that are listed under the registration and approval system

We predict that analyst forecast accuracy is likely to be enhanced when analysts utilize information from companies that are listed under the registration system to predict outcomes for peer companies under the approval system. Therefore, the above spillover effect may be increasingly pronounced when analysts follow companies from both systems within the same industry. Following Guan *et al*. (2015), we employ the variable *Multi_Analyst* to indicate whether analyst *i* is simultaneously following multiple companies. *Multi_Analyst* equals 1 if analyst *i* who follows company j under the approval system also follows at least one peer company under the registration system. Otherwise, it is 0.

The results in column (1) of *Table 9* reveal that the coefficient of *Multi_Analyst * Did* is significantly negative at the 1% level, thus indicating that the RSR has a profound impact on improving forecast accuracy for analysts who follow both types of companies within the same industry compared with analysts who exclusively follow companies under the approval system.

4.3.2 Differences in Institutional Environment

Research has shown that the institutional environment of a region can substantially impact the effectiveness of policy implementation (Ball *et al.*, 2003; Ball *et al.*, 2000; Hung, 2000). The spillover effects of RSR may vary depending on the region's institutional environment. If the institutional environment of the region where listed companies are located is favorable, the strict external supervision that these companies face may enhance the effectiveness of the RSR. Therefore, the RSR may have strong positive externalities and exert a great influence on analyst forecast accuracy.

We use the "Development of Market Intermediaries and Legal Institutional Environment" index from Fan Gang's China Marketization Index (2021) to measure the institutional environment of the company, which is denoted as *Mkt*. A large value of *Mkt* indicates a superior institutional environment. The regression results in column (2) of *Table 9* reveal that the coefficient of *Mkt * Did* is significantly negative at the 5% level, thus suggesting that the positive spillover effect of RSR on analyst forecast accuracy for peer companies under the approval system is pronounced in regions with a favorable institutional environment.

4.3.3 Internal Control Quality

Companies with high-quality internal control have a low risk of information disclosure issues and improved information disclosure quality, thereby potentially enhancing analyst forecast accuracy. We expect that firms with high-quality internal control will strengthen the positive spillover effects of RSR on analyst forecast accuracy compared with those with low-quality internal control. We use the Chinese Listed Companies' Internal Control Index from the Debo Database to measure the quality of internal control (*IC*). *IC* equals 1 if the company's internal control index exceeds the annual average of the industry. Otherwise, it is 0.

Table 9. Heterogeneity Analysis

Variables	*Frror*		
	(1)	(2)	(3)
Did	-0.0222*** (-16.4334)	-0.0162*** (-5.6635)	-0.0191*** (-13.5406)
*Multi_Analyst * Did*	-0.0025*** (-3.5757)		
*Mkt * Did*		-0.0005** (-2.3546)	
*IC * Did*			-0.0068*** (-9.6416)
Constant	-0.0697*** (-11.6732)	-0.0687*** (-11.4777)	-0.0760*** (-12.4814)
Controls	Yes	Yes	Yes
Indy/Year	Yes	Yes	Yes
N	26881	26881	26881
r2_a	0.1934	0.1934	0.1952

Notes: T-statistics are reported in parentheses, ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

Source: authors' own results.

The regression results in column (3) of *Table 9* indicate that the coefficient of *IC * Did* is significantly negative at the 1% level, thus suggesting that the spillover effect of RSR on analyst forecast accuracy is more pronounced in peer firms with superior internal control quality under the approval system than those with inferior internal control quality.

5. Discussion

This study examines whether the information spillovers from the RSR improve the analyst forecast accuracy for peer companies under the approval system.

First, the regression results in *Table 4* show that RSR exerts a positive externality by substantially improving analyst forecast accuracy for peer companies under the approval system. These results corroborate *Hypothesis H1*, which supports the finding by Garmaise and Natividad (2016) and Jung *et al.*

(2015) that information intermediaries can gain insights about unregulated entities by examining the disclosures of regulated ones, thus resulting in information spillover effects. The tests of the results in *Tables 4* and *5* further confirm that *Hypothesis H1* is true. The RSR emphasizes information disclosure supervision, thereby aiming to improve the overall information environment of the capital market. Strengthening information disclosure supervision aims to promote information exchange between companies and investors (Admati, Pfleiderer, 2000). As a bridge for information communication between companies and investors in the capital market, analysts not only promote the flow of information from companies to investors but also help companies understand industry trends and information about competitors (Brown *et al.*, 2019). Therefore, as the RSR increasingly tightens the requirements for information disclosure supervision, the value of analysts as information intermediaries will continue to rise.

Second, the regression results in *Tables 6* and *7* show that the spillover effect of RSR on analyst forecast accuracy is amplified by the quality of industry information disclosed by companies under the registration system. These companies can offer valuable reference material for analysts who forecast the performance of peers under the approval system, thereby enhancing analyst forecast accuracy. According to information spillover effect theory, high-quality information is an important prerequisite for information to have a positive effect and improve analyst forecast accuracy (Cowan, Salotti, 2020). Analysts serve as vital intermediaries in reducing information asymmetry within securities markets and enhancing stock pricing efficiency. Publicly disclosed information by firms that are subject to the RSR effectively spreads among analysts, thus bolstering the precision of their predictions for industry counterparts. This outcome enhances capital market efficiency and alleviates information asymmetry between companies and investors.

Third, the regression results in *Table 8* show that RSR can induce the catfish effect, which potentially improves the information disclosure quality of peer companies under the approval system and facilitates analyst forecast accuracy for these companies. One of the primary intentions behind information disclosure regulation is to enhance the quality of information disclosure across the entire capital market (Dye, 1990; Leuz, Wysocki, 2016). However, according to the public choice theory, stringent information disclosure regulations for companies under the registration system can lead peer companies under the approval system to exhibit free-riding behavior, which diminishes their level of information disclosure. This evidence refutes the possibility of a free-rider effect and confirms the existence of a catfish effect.

Fourth, the regression results in *Table 9* reveal that compared with analysts who exclusively follow companies under the approval system, RSR has a profound impact on improving forecast accuracy for analysts who follow both types of companies within the same industry. According to limited attention theory, analysts focus their attention by reducing the competition among different information sources to manage the overload from multiple unrelated pieces of information. Analysts tend to prioritize collecting similar or homogeneous information from peer firms to alleviate the constraints imposed by limited attention and improve the quality of information obtained from listed companies (Piotroski, Roulstone, 2004). Consequently, analysts are incentivized to focus on companies listed under the registration system within a specific industry.

Conclusions and Implications

Conclusion

We consider the RSR as an exogenous shock to examine the spillover effects on analyst forecast accuracy in China. The following conclusions can be drawn: RSR has a positive spillover effect on

improving analyst forecast accuracy for peer firms under the approval system. Moreover, the spillover effect is strong when ample industry incremental information and high-quality industry information provided by firms listed under the registration system are available. Subsequently, RSR demonstrates a catfish effect, thus enhancing information disclosure among peer firms under the approval system and improving analyst forecast accuracy. Lastly, heterogeneity analysis indicates that the spillover effect of RSR on analyst forecast accuracy is pronounced for analysts who follow both companies under the registration system and peers under the approval system, in regions with superior institutional frameworks, and companies with high internal control quality.

Implications

The findings of this study have several practical implications. First, regarding the difference in how investors interpret and utilize information, small- and medium-sized investors can benefit from this information by selecting analysts who specialize in companies listed under the registration system within the same industry. This selection will enable them to make informed investment decisions and promote efficient allocation of capital market resources. Simultaneously, the quality of the regional institutional environment can be enhanced by improving laws and regulations, strengthening law enforcement, and improving government transparency. This approach creates favorable conditions for the in-depth implementation of RSR. Consequently, this will help improve the transparency of the entire market, enhance investor information access, and promote the healthy development of the capital market. Therefore, regulatory authorities should vigorously promote the comprehensive implementation of RSR to provide convenience for investors.

Second, companies listed under the registration system can effectively promote their peers under the approval system to enhance their information disclosure, thereby improving analyst forecast accuracy. As RSR gradually evolves in line with the needs of China's capital market, its full implementation must be supported and promoted. Additionally, establishing an analyst information exchange and sharing platform should be considered to enable analysts to gain a comprehensive understanding of industry dynamics and company conditions. Furthermore, this platform can promote information sharing and exchange among analysts, thereby improving the forecast accuracy for the entire industry.

Third, regulators should endeavor to strengthen regulatory mechanisms for information disclosure and encourage companies to disclose important information in a proactive, timely, and accurate manner, thereby enhancing market efficiency. In addition, regulators should establish an effective supervision mechanism to enhance overall market transparency. This solution can regularly inspect and evaluate the quality of companies' information disclosure, and impose penalties or public criticism on those that fail to meet the requirements. Additionally, local governments can strengthen their cooperation with enterprises and intermediaries by regularly assessing and inspecting companies' internal controls. They can also encourage companies to adopt advanced internal control technologies and methods, such as blockchain technology and smart contracts, to improve the effectiveness and transparency of internal controls. The credibility of information disclosure can be further developed by improving the quality of companies' internal controls, ultimately enhancing analyst forecast accuracy.

Limitations and Future Directions

This study also has certain limitations. Given the relatively short period since the comprehensive implementation of the registration system, we cannot observe the information disclosure of peer companies that transitioned from the approval system to the registration system. We could not assess

analyst forecasts after this transition. Furthermore, analysts may only represent one dimension of the spillover effects. Other spillover effects of RSR may also exist among other financial intermediaries, such as auditors or banks, which can provide considerable scope for future research.

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REGISTRACIJOS SISTEMOS REFORMA IR ANALITIKŲ PROGNOZĖS TIKSLUMAS: ĮRODYMAI IŠ KINIJOS

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Santrauka. Registracijos sistemos reforma (RSR) Kinijos kapitalo rinkoje palaipsniui tapo akademinių diskusijų objektu. Tačiau esamoje literatūroje dar nepateikta sisteminių teorinių įžvalgų apie tai, kaip RSR veikia analitikų prognozes. Siekta ištirti RSR poveikį analitikų prognozėms remiantis informacijos šalutinio poveikio teorija ir riboto dėmesio teorija. Naudoti Kinijos A akcijų bendrovių, kurios yra įtrauktos į patvirtinimo sistemą 2015–2021 m., duomenys. Taikant laipsniško skirtumų skirtumo modelį buvo išnagrinėtas RSR šalutinis poveikis analitikų prognozių tikslumui iš analitikų perspektyvos. Rezultatai atskleidė, kad RSR turi teigiamą šalutinį poveikį analitikų prognozių tikslumui. Po RSR analitikų prognozės tikslumas lygiavertėms įmonėms pagal patvirtinimo sistemą žymiai pagerėjo. Šis šalutinis poveikis stiprėja tobulinant pramonės informaciją, kurią bendrovės teikė pagal registracijos sistemą. RSR poveikis analitikų prognozių tikslumo gerinimui tampa ryškus, kai tas pats analitikas stebi įmones pagal registracijos sistemą ir kolegas pagal patvirtinimo sistemą ir kai kolegos yra regionuose, kuriuose yra geresnė institucinė aplinka ir aukšta vidaus kontrolės kokybė. Išvadose pateikiami empiriniai įrodymai, patvirtinantys vyriausybės aktyvų RSR skatinimą ir informacinės aplinkos optimizavimą kapitalo rinkoje.

Reikšminiai žodžiai: registracijos sistemos reforma; analitikų prognozės tikslumas; šalutinis poveikis; informacijos atskleidimas.