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**Has Big Data Empowerment Improved
Corporate Governance?- A Study Based on
the Shenzhen Stock Exchange's "E-
Platform"**



Abstract: - In recent years, the continuous development and application of big data technology has promoted the popularity of digital media platforms, and the establishment of official websites represented by the SZSE's e-platform has served as a medium of information dissemination to attract and encourage more and more people to actively monitor and participate in the decision-making governance of companies through online means. Therefore, the paper focuses on the effectiveness of the e-platform policy in empowering citizens to participate as an external governance force in corporate governance. The empirical research and analysis of this paper reveals that empowered citizens who speak online and communicate with company managers help to improve information disclosure and reduce information asymmetry, while managers are rewarded and pressurized to reduce irrational behaviour and thus improve the effectiveness of corporate governance. The paper combines the background of the times to break through the traditional concept of corporate governance research, providing ideas and inspiration for the introduction and improvement of big data technology in future corporate governance research, and improving the effectiveness of corporate governance in the new trend.

Keywords: information asymmetry, irrational behavior of managers, corporate governance, SZSE e-platform

1. Introduction

The widespread adoption and diffusion of digital technology is driving more and more companies to actively undergo digital transformation to adapt to the rapidly changing business environment, and this transformation is leading to a new form of corporate governance (Chen and Hu, 2022). Traditional corporate governance models rely heavily on internal governance bodies such as boards of directors, supervisory boards and general meetings, but the limitations of these bodies make agency problems a potential problem for the efficiency of corporate governance (Jensen and Meckling, 1976; Fosberg, 2004). However, the digital transformation of companies is breaking down traditional decision-making hierarchies and introducing social agents empowered by big data to actively participate in them, which expands corporate governance to a digital space where social agents participate rather than being confined to the offline company.

However, most current research has focused only on the impact of digital technologies on corporate market performance indicators, and less on the impact of big data empowering social agents essentially on corporate governance. For example, the existing literature has mainly focused on exploring the impact of information dissemination on social media on stock price volatility and changes in market trading volumes (Antweiler, 2004;

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Wysocki, 1999). While these studies shed light on the direct impact of digital technologies in the stock market, they fail to delve into the nature of the impact of big data empowered social agents on corporate governance.

In this new governance model, digital media platforms play a two-way role as information communication channels between companies and social groups. On the one hand, digital media platforms act as a medium to make the flow of information and decision-making more equal and rapid between companies and the public; on the other hand, they also act as a communication channel to fully empower the public as external advisors and monitors to actively participate in the communication and interaction with corporate managers. The new trend is leveraging digital technology's power to influence and improve corporate governance through a more transparent degree of information and efficient communication (Chen and Hu, 2022; Qi et al., 2020).

Therefore, it is necessary to further explore the impact of big data empowering social actors to participate in corporate decision-making and management processes on corporate governance models. Using the Shenzhen Stock Exchange's creation of an official "Investor-Listed Company" interactive communication platform as an exogenous policy shock, this paper aims to investigate the impact of the implementation of the e-platform policy on improving corporate governance outcomes using a difference-in-difference approach. The study will focus on two key aspects: reducing information asymmetry and avoiding irrational behavior of corporate managers.

This paper provides empirical evidence on the improved effectiveness of big data empowerment on corporate governance, using the e-platform policy as an entry point, which has important practical implications in the context of digital media platforms' current popularity and rise. While the ability and willingness of social agents to participate in corporate governance continue to grow, this study follows this trend and aims to explore the essential impact of social agents' participation in corporate governance, filling the gap in current research in this area. And this paper attempts to go to reveal the effectiveness of social agents' participation in corporate decision-making, providing new insights to improve the effectiveness and sustainability of corporate governance.

2. Literature Review and Hypothesis Development

2.1 Literature Review

In recent years, many scholars studying the field of corporate governance have generally regarded agency issues as the central key to resolving the current situation in this field. Most listed companies have a specific organizational structure and governance mechanism that divides power between shareholders and managers, which leads to and exacerbates the conflict of interests between shareholders and managers. (Jensen and Meckling, 1976; Forsberg, 2004) On the one hand, shareholders are not able to monitor the behavior of managers all the time (Fama and Jensen, 1983), which means that maximally empowered managers can make biased decisions due to a blind ego mentality that affects the quality of decisions (Schrand and Zechman, 2011), and they may act opportunistically for their own benefit (Fosberg, 2004). For example, Malhotra et al. (2008) describe how Boston Scientific's management blindly and overconfidently overestimated Guidant's potential value, disregarded the interests of investors and the company's long-term development, and focused on the goal of crushing the competition at a high price, while underestimating the subsequent significant investment risks associated with Guidant's product defects and safety issues, thereby costing the company's shareholders dearly since the company's shareholders paid a heavy price through an irrational takeover. On the other hand, managers have

comprehensive information about the company's operations and use the right to selectively disclose information to manipulate investor perceptions to protect their image, while investors are only passively informed by external disclosures (Almulhim, 2023). Wruck and Wu (2021) confirm that managers can manipulate investor sentiment by changing the timing of information releases to maximize their rewards. Welker (1995) also confirms that managerial manipulation of disclosure can exacerbate information asymmetries between managers and investors.

The development and spread of digital technology have brought companies and social groups closer together to build an Internet ecological network that reconfigures the core issues of corporate governance and creates new opportunities and challenges for corporate governance research. Information about a company's production and operations, together with news and commentary published on digital media platforms, constitute a data set that extends the scope of corporate governance to a digital space in which many social actors participate, rather than being confined to the offline company. In the context of big data integration, digital media platforms act as intermediaries between companies and social groups in both directions: enhancing information exchange and the effectiveness of external regulation. (Chen and Hu, 2022; Qi et al., 2020)

Digital media platforms provide efficient, convenient and extensive diversified communication channels for information disclosure. On the one hand, new media platforms are more focused on the market-oriented analysis of companies in real time and use big data technology to reach a global audience, which means that market participants have access to more and more understandable information about companies in a timely manner, which increases the transparency of corporate information. You et al. (2017) confirm that publicly disseminated financial information about companies has an impact on reducing information asymmetry between firms and investors has an impact. On the other hand, the creation of online communication platforms provides a convenient channel for investors and management to exchange views directly. The different opinions and demands of investors and various social groups can be passed on to the company's managers, who in turn provide feedback and take the initiative to disclose additional information. Increased interactive communication between investors and managers can help improve information accuracy. (Chen and Hu, 2022; Qi et al., 2020; You et al., 2017; Tan et al., 2016) You et al. (2017) point out that some media articles are of dubious authenticity just to attract readers to get clicks, and that some articles are advertising articles with a subjective bias towards the company of interest. However, Fang and Peress (2009) confirm that although the content on media platforms does not fully reflect the truth, it has an important impact on information disclosure that cannot be ignored.

Digital media platforms are improving the dissemination and exchange of information while empowering more social actors to participate in the external oversight of corporate governance. Digital media platforms are widely visible and influential, which can have a monitoring effect on the behaviour and decisions of managers. Digital media platforms publish dynamic information about managers' behavior and decisions, exposing their behaviour to public scrutiny and evaluation, which increases the transparency of managers' behaviour and limits their egotistical behaviour to a certain extent. Moreover, when public dissatisfaction and concerns about managerial behaviour are expressed through digital media platforms, the high level of exposure and public pressure can have an impact on managers and companies, forcing managers to respond to feedback and modify their behaviour for their own reputation and capital considerations (Li and Shen, 2010; Qi et al., 2020; Liu and McConnell. 2013). Negative reports about companies published on digital platforms can be effective in controlling some irregularities

and insider trading (Dyck et al., 2008; DAI, et al., 2015)) You et al. (2017) explain that negative reports can have serious repercussions for managers and may even lead to their departure. When managers realise that digital media platforms are key platforms for building and exposing their image, they are more likely to pay attention and listen to public opinion to discipline and correct their individualistic and opportunistic behaviours in a timely manner (Liu and McConnell, 2013; Chen and Hu, 2022). However, some company executives use social media to manipulate public opinion and create false propaganda to lure investors in order to manipulate the market. For example, Gedye (2018) mentions Elon Musk tweeting fraudulent information about Tesla's privatization to mislead investors. However, Liu and McConnell (2013) still agree that most media coverage positively impacts effectively controlling managers' behaviour.

Much of the current literature focuses on the impact of social media, represented by Twitter and Yahoo Finance, on direct market performance in terms of stock prices and trading volumes (Antweiler, 2004; Wysocki, 1999). While improved market performance indicators on stock message boards may be an indication of improved corporate governance, researchers have overlooked the intrinsic impact of social media on corporate governance. It is the reason that Tumarkin et al. (2001) hold the opposite view that message board messages have a short-lived and limited impact on company stock prices. Therefore, the paper attempts to fill the literature gap by examining the effect of social media platforms on improving corporate governance from the perspective of mitigating agency problems.

2.2 Hypothesis Development

The "Investor-Listed Company" interactive platform, which was regulated and hosted by the Shenzhen Stock Exchange (SZSE) in China in 2010, was chosen as the subject of this study to ensure that the findings are accurate and convincing. The interactive platform of the Shenzhen Stock Exchange compensates for the shortcomings of other entertaining social media platforms in the investment field by focusing fully on the information needs of investors and the enforceability of managers' responses, and the high authority and professionalism of the interactive platform of the Shenzhen Stock Exchange as an officially recognized platform, which facilitates the efficiency of information communication and effective monitoring between investors and managers (Hu, 2010; Tan et al., 2016).

Listed companies are required to provide accurate, complete, detailed and timely information disclosure when responding to requests from individual investors and analysts who are concerned about the company's development on the e-platform, which operates under the supervision of the regulatory authorities, so that posters can better understand the company's operations and future development plans. This approach ensures the quality of the information disclosed by the company and increases the transparency of the information, improving the traditional situation where investors are passively subjected to information blackout. In addition, all communication information is saved and publicly posted on the platform, constituting a big data source for company feedback, which is later analyzed through big data technology, enabling the company to understand market trends and needs, so that it can adjust its strategies, optimize its decisions and maximize the value of information, thereby improving corporate governance.

Based on the above analysis, the article proposes hypothesis 1 :

Hypothesis 1: The SZSE's e-platform policy improves corporate governance effects by reducing information asymmetries

Based on the above analysis, the article proposes hypothesis 2:

The SSE's e-platform creates a convenient channel for investors to be empowered to actively participate in monitoring managers' decisions. Under the dual supervision of the Shenzhen Stock Exchange and the market regulator, the e-platform enables corporate managers to regulate their behavior out of concern for their own image through a reputation and pressure mechanism. On the one hand, managers will respond to the regulator's mandatory requirement to give factual answers to investors' questions, which helps to maintain investor trust and satisfaction to ensure performance and to avoid the double damage to reputation and remuneration caused by hiding information exposure for their own benefit. On the other hand, managers will also respond to the platform's mandatory requirement to follow up on posters' feedback in a timely manner, which prevents investors' dissatisfaction with managers' egos or poor decisions from festering and causing serious public pressure on the company's image. The platform therefore monitors and circumvents irrational behaviour of managers that is detrimental to the company through feedback and constraints, thus improving the effectiveness of corporate governance.

Hypothesis 2: The SZSE's e-platform Policy improves corporate governance by reducing irrational behavior of corporate managers

3. Empirical Research Design

3.1 Sample Selection and Data Sources

This paper examines the impact of the SZSE's e-platform policy on corporate governance by selecting a representative sample of companies listed on the Shenzhen and Shanghai exchanges in China as the intervention and control groups respectively. As the SZSE e-platform platform was established on 1 January 2010 in the context of the digital economy, this paper selects A-share companies listed on the two exchanges that underwent digital transformation between 1 January 2005 and 31 December 2013, and after excluding B-share companies, excluding the financial sector, excluding ST and *ST status and delisted companies, and excluding the sample with missing data. The initial sample of 5104 companies was obtained.

All corporate governance data in this paper were obtained from the official and timely disclosure of the Shenzhen CSMAR database. This paper uses stata16 software to conduct the empirical analysis.

3.2 Model setting

The paper avoids the endogeneity problems associated with traditional policy assessment methods using a more scientific difference-in-difference model to assess the actual effects of the e-platform policy more accurately by eliminating the effects of factors common to both the intervention and control groups on corporate governance effects (Ye and Wang, 2013; Tan et al., 2016). Therefore, the paper refers to Qi et al. (2020) to design a linear regression model based on the research hypothesis:

Corporate Governance_{it}

$$= \beta_0 + \beta_1 \text{Shenzhen e – platform Policy effects}_{it} + \sum \text{controls} + \sum \text{IND} + \sum \text{year} + \varepsilon_{it}$$

In the above model, Corporate Governance_{it} indicates the overall corporate governance score (level of corporate governance), Shenzhen e – platform Policy effects_{it} indicates Shenzhen e-platform policy impact effect.

3.3 Variable Description

3.3.1 Dependent variable - level of corporate governance

This paper refers to the way in which Qi et al. (2020) selected indicators on corporate governance: the shareholder shareholding variable was selected to measure the independence of the company's board members; the level of separation of powers and the presence of effective controllers as listed executives were selected to measure the company's board structure; and the ratio of remuneration of the top three executives was selected to measure the relevance of the company's management interests to shareholders' interests.

Referring to the metric of Luo (2012) and Qi et al. (2020), the specific signs and measures of the variables are defined as shown in the table 1 :

Table1-Dependent variable

Variable name	Variable symbols	Variable measures
Percentage of shareholding of the largest shareholder	Top1	The ratio of shares held by the largest shareholder to the total number of shares in the company
Squared shareholdings of top ten shareholders and	Herfindahl10	The ratio of shares held by top ten shareholders to total shares of the company squared
Squared shareholding of top five shareholders	Herfindahl5	The ratio of shares held by the top five shareholders to the total shares of the company squared
Total remuneration of top three executives as a percentage of total remuneration of all executives	Proportion	The ratio of total remuneration of top three executives to total remuneration of all executives
Level of separation of powers	Separation	The ratio of control to ownership
Situations where the Actual controller is a listed executive	Position	A value of 1 if one person holds both positions of actual controller and listed executive, otherwise 0

In this paper, the plausibility of the six selected indicators of corporate governance variables was verified using principal component analysis using the statistical software stata16. Firstly, a KMO test was conducted on the variables and the result showed a coefficient of 0.715, indicating that the correlation between the variables was strong and suitable for principal component analysis. Once the KMO value is met, a principal components analysis was conducted on the variables and the results showed that the top five principal components explained 99.23% of the total variance of the corporate governance indicators, indicating that the variables selected above can be used as key governance factors to measure the level of corporate governance.

Table2- Principal Components Analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.98142	1.84596	0.4259	0.4259
Comp2	1.13546	0.04710	0.1622	0.5881
Comp3	1.08835	0.18620	0.1555	0.7436
Comp4	0.90215	0.06322	0.1289	0.8725
Comp5	0.83893	0.78529	0.1198	0.9923
Comp6	0.05364	0.05358	0.0077	1.0000
Comp7	0.00006	.	0.0000	1.0000

3.3.2 Independent variable - SZSE e-platform Policy Effect

The specific symbols and measures of the variables are defined with reference to the metrics of Ye (2013) and Tan et al.(2016), as shown in the table3:

Table3-Independent variable

Variable name	Variable symbols	Variable measures
SZSE e-platform Policy Effect	Policy effect	Setting SZSE e-platform Policy as an intervention group, implemented as "1"

3.3.3 Control variables

This paper refers to the way in which Qi et al.(2020) and Tan et al.(2012) chose control variables in their study of corporate governance to improve the accuracy and credibility of this paper's findings: Controlling company size to eliminate the impact on governance effectiveness of the complex oversight structure required by larger companies; and controlling financial leverage to eliminate the impact on governance effectiveness of the financial pressures and risks faced by companies with high financial leverage; Controlling yields to eliminate the impact on governance of market pressures and competition faced by companies with higher yields; and controlling company growth rates to avoid the negative impact on governance of the large capital requirements faced by companies with higher growth rates to support future growth; Controlling for the nature of ownership to eliminate the effect on governance of different ownership and control structures that may result from companies with different ownership; controlling for the age of the company to eliminate the effect on governance of older companies with proven experience in handling business; controlling for institutional shareholding to eliminate the

effect on governance of companies with higher institutional shareholding that are more visible to institutional investors; controlling for analyst attention to eliminate the effect on corporate governance of high market interest in the company.

The specific symbols and measures of the variables are defined with reference to the metric of Qi et al.(2020) and Tan et al.(2016), as shown in the table4:

Table4:- Control variables

Variable name	Variable symbols	Variable measures
Size of company	Firm-Size	Natural logarithm of the total assets of listed companies at the end of the year
Financial leverage	leverage	Total liabilities/total assets of listed companies at the end of the year
Profitability	ROA	Net profit of listed companies for the year / Total assets at the end of the year
Company growth rate	Growth	Annual operating revenue of listed companies / Prior year operating revenue - 1
Nature of property	SOE	1 for state-owned enterprises, 2 for private enterprises, 3 for foreign enterprises and 4 for others
Company age	Firm-Age	Year of establishment to date
Institutional shareholding ratio	Insthold	Ratio of number of shares held by institutional investors to total share capital
Analyst Attention	Forecast Follow	Number of analysts who have issued analyst reports on the target company in a given year, plus one and taken as the logarithm

3.3.4 Intermediate effect variables

The different information and expectations between buyers and sellers can cause transaction prices to deviate from the real value of an asset, therefore the paper uses the bid-ask spread variable to measure the degree of information asymmetry between buyers and sellers in the market (Almulhim, 2023;Goh et al.,2014). Moreover, the accounting information-based approach uses the degree of surplus management to measure whether corporate managers are

acting irrationally (Huang and Xia,2009).

The specific symbols and measures of the variables are defined with reference to the metric of Fang and Peress(2009) and (Huang and Xia,2009). as shown in the table5:

Table5- Intermediate effect variables

Variable name	Variable symbols	Variable measures
Bid-Ask spread	Spread	Difference between the ask and the bid prices divided by the midpoint.
Degree of surplus management	Jones	Basic Jones Model

4 Analysis and discussion of empirical results

4.1 descriptive statistical analysis

In this paper, descriptive statistics are analyzed for both the SZSE and SSE samples (Table 6 and Table 7). The data results show that: the standard deviation and the means of company size and company age are similar for SZSE and SSE, reflecting the fact that the basic characteristics of the companies included in the sample that are listed on different exchanges respectively are similar, which may also mean that these companies have relatively similar levels of development and stability; The mean and standard deviation of the sum of the squared shareholdings of the top five and top ten shareholders, the sum of the remuneration of the top three executives as a proportion of the total remuneration of all executives, the level of separation of powers, and the presence of the effective controller as a listed executive are also similar between the SZSE and the SSE, reflecting the similar characteristics of the organizational and governance structures of the companies in the two sample groups; there are also only minor differences between the averages of the SZSE and SSE variables in terms of the financial performance of companies. Although there are cases where the maximum and minimum values of some variables may differ significantly between the samples of the two exchanges, the overall difference between the variables in the two samples is not significant. Therefore, the selection of a control group of listed companies that have undergone digital economization on the SSE for the purpose of studying the policy effects of the interactive platform on the SZSE (listed companies with data economization on the SZSE) is reasonable and representative, which provides a relatively stable and manageable support for the comparison and analysis of subsequent experiments.

Table6-Results of descriptive statistical analysis of the sample(Shenzhen Stock Exchange)

Variable	N	Mean	Sd	Min	P50	Max
Top1	25060	36.36	15.39	3.62	34.75	89.41
Herfindahl10	25060	0.18	0.12	0.00	0.15	0.80
Herfindahl5	25060	0.18	0.12	0.00	0.15	0.80
Proportion	25004	46.86	13.35	15.48	45.03	100.00
Separation	23735	6.19	8.32	0.00	0.02	39.01
Position	25060	0.09	0.29	0.00	0.00	1.00

Firm-Size	25060	21.63	1.09	16.94	21.47	26.66
leverage	25060	0.44	0.23	0.01	0.44	8.26
ROA	25060	0.05	0.07	-2.01	0.04	2.64
Growth	25060	0.05	0.07	-0.96	0.04	2.93
Firm-Age	25060	14.15	5.25	2.42	13.77	46.73
Insthold	25060	16.68	21.95	0.00	4.62	94.42
Forecast Follow	20932	10.59	10.34	1.00	7.00	64.00
Spread	25060	0.19	0.09	0.05	0.17	1.60
Jones	25060	-0.02	0.16	-2.49	-0.03	3.51

Table7-Results of descriptive statistical analysis of the sample(Shanghai Stock Exchange)

Variable	N	Mean	Sd	Min	P50	Max
Top1	22298	38.65	16.41	4.44	37.71	88.55
Herfindahl10	22298	0.19	0.14	0.00	0.16	0.78
Herfindahl5	22298	0.19	0.14	0.00	0.16	0.78
Proportion	22278	45.87	14.20	9.10	43.85	100.00
Separation	21025	5.81	8.41	0.00	0.00	43.34
Position	22298	0.12	0.33	0.00	0.00	1.00
Firm-Size	22298	22.36	1.35	16.58	22.16	28.41
leverage	22298	0.54	0.76	0.03	0.54	55.41
ROA	22298	0.03	0.08	-4.16	0.03	0.71
Growth	22298	0.04	0.07	-1.34	0.03	0.79
Firm-Age	22298	15.54	4.33	2.01	15.56	30.47
Insthold	22298	18.10	22.20	0.00	5.27	97.57
Forecast Follow	18564	11.06	10.65	1.00	7.00	65.00
Spread	22298	0.20	0.09	0.04	0.18	1.18
Jones	22298	-0.03	0.13	-1.80	-0.03	2.59

4.2 Parallel trend test

The paper to ensure higher quality and reliability of the research design and data analysis, a parallel trend test was first conducted to verify the validity of the core hypothesis of the difference-in-difference method. The interaction term test was used as a test of the parallel trend hypothesis, and the results showed that the interaction term coefficients of the experimental group (Shenzhen Stock Exchange), which was affected by the implementation of the policy, and the control group (Shanghai Stock Exchange), which was not affected by the implementation of the policy, did not differ (not significant) prior to the occurrence of the policy. The parallel trend hypothesis is met, indicating that the study design is feasible using the difference-in-difference method to evaluate the ease of interaction policy.

Table8- Parallel trend test

Variables	Governance
Pre_3	-0.215 (0.406)
Pre_2	0.0694 (0.413)
Current	0.693* (0.358)
Post_1	0.605* (0.348)
Post_2	0.311 (0.351)
Post_3	0.0932 (0.353)
Firm-Size	1.063*** (0.137)
ROA	0.685 (0.627)
leverage	-0.229* (0.118)
Constant	-4.793* (2.905)
Observations	28,852
R-squared	0.147
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.3 Difference-in-Difference results

In this paper, 2010 is set as the start of the policy intervention in the Shenzhen e-platform, and the experiment uses a difference-in-difference model to process data on corporate governance indicators for the experimental group (Shenzhen Stock Exchange), which is affected by the policy implementation, and the control group (Shanghai Stock Exchange), which is not affected by the policy implementation, during the period 2005.1.1-2013.12.31. In the regression analysis, the interaction term coefficients are significantly non-zero and have a positive sign. The confidence intervals for the effect estimates do not include zero, indicating a significant positive impact of the Shenzhen e-platform policy on corporate governance. However, the results of DID may be confounded by other potentially influential factors, therefore, the empirical study needs to perform some robustness tests to verify the reliability of the results.

Table9- DID empirical results

Variables	Governance
Treat	-0.451 (0.367)
Time	0.0642 (0.400)
DID	0.631* (0.292)
Growth	5.433* (2.207)
Firm-Size	0.898*** (0.140)
ROA	0.212 (0.259)
Leverage	-0.0343 (0.106)
Firm-Age	-0.291*** (0.0331)
SOE	1.866*** (0.342)
Constant	0.326 (2.977)
Observations	28,843
R-squared	0.195
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.4 PSM-DID test

To refine and test the DID results, a PSM-DID test was designed and conducted to further mitigate the endogeneity problem caused by selection bias. The study used the PSM method to match each treatment group sample to a specific control group sample to minimize the baseline difference between the two groups, with the aim of improving and validating the accuracy of the DID analysis. The results of the DID regression after completing the matching indicate that the baseline regression results remain robust when selection bias issues are taken into account.

Table10- PSM-DID test

Variables	Governance
Treat	-0.807** (0.372)

Time	-0.551 (0.447)
DID	0.873*** (0.328)
Growth	4.064 (6.778)
Firm-Size	0.861*** (0.157)
ROA	3.211 (5.719)
Leverage	0.328 (0.347)
Firm-age	-0.319*** (0.0352)
SOE	1.927*** (0.353)
Constant	1.247 (3.318)
Observations	19137
R-squared	0.196
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.5 Placebo test

The results of the DID method suggest that the implementation of the Shenzhen e-platform policy did have a positive policy effect, but whether this policy effect was influenced by other policies or factors requires further placebo testing.

4.5.1 Placebo test-Advance the point at which the policy occurs

The research sample of this paper is during the period 2005.1.1-2013.12.31, the year of implementation of the Shenzhen e-platform policy is 2010, so this placebo assumes that the timing of the policy occurred before 2010, the results show that it is not significant, which means that the test passes.

Table11- Placebo test-Advance the point at which the policy occurs

Variables	Governance
Post	-1.488*** (0.373)
Treat	-0.825** (0.399)

DID	0.347 (0.336)
Firm-Size	1.017*** (0.195)
ROA	-18.83** (7.500)
Leverage	-1.372* (0.801)
Growth	27.42*** (8.495)
Firm-Age	-0.378*** (0.0484)
Constant	0.846 (4.093)
Observations	8054
R-squared	0.215
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.5.2 Placebo test-Randomization of treatment groups

Although the results of the placebo test conducted in this paper to advance the time of occurrence of the Shenzhen e-platform policy indicate that the sample is not long enough to lead to a short interval of random sampling, which leads to inaccurate results and affects the robustness of the experiment. Therefore, the results of the DID regression analysis conducted after a certain number of random sampling of the treatment group variables again in this paper show a 5% significance, which indicates that Shenzhen e-platform policy has some impact on corporate governance.

Table12- Placebo test-Randomization of treatment groups

Variables	Governance
Post	-0.408 (0.455)
Treat	-0.927** (0.373)
DID	-0.692** (0.333)
Firm-Size	1.069*** (0.152)
ROA	3.461** (5.182)

Leverage	0.355 (0.350)
Growth	3.263 (6.152)
Firm-Age	-0.301*** (0.0359)
Constant	-2.978 (3.214)
Observations	19137
R-squared	0.182
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.6 Intermediary mechanism test

4.6.1 Intermediary mechanism test - reduced information asymmetry

According to the mediation mechanism test in Table 13 to test the effect of the e-platform policy on information asymmetry, the DID coefficient is 0.00764 with a significance of 10%, which indicates that the SZSE e-platform policy reduces information asymmetry and thus improves corporate governance.

Table13- Intermediary mechanism test - reduced information asymmetry

Variables	Governance
Treat	-0.0874 (0.378)
Post	-0.157 (0.193)
DID	0.447** (0.217)
Spread_DID	0.00764* (0.00410)
Spread	0.0472*** (0.00240)
Firm-Size	0.873*** (0.150)
ROA	4.504*** (1.612)
Leverage	-0.125 (0.107)
SOE	0.993*** (0.341)

Constant	-4.590 (3.230)
Observations	27,776
R-squared	0.187
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4.62 Intermediary mechanism test - irrational behavior of managers reduced

According to the mediating mechanism test in Table 14 to test the impact of the e-platform policy on managers' irrational behavior, the DID coefficient is -2.129 with a significance of 5%, which indicates that the more influential the e-interaction policy is, the less the company managers engage in irrational behaviour, which means that the Shenzhen e-platform platform reduces the degree of managers' irrational behavior.

Table14- Intermediary mechanism test - irrational behavior of managers reduced

Variables	Governance
Treat	-0.557 (0.387)
POST	-2.871*** (0.327)
DID	1.207*** (0.292)
Jones_DID	-2.129** (0.997)
Jones	2.536*** (0.646)
Firm-Size	1.118*** (0.148)
ROA	0.562 (0.573)
Leverage	-0.192* (0.115)
SOE	1.413*** (0.359)
Constant	-6.634** (3.115)
Observations	25,777
R-squared	0.170
Cluster-Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

5. Conclusion

The article empirically tests and analyses the effects of e-platform policies to empower citizens to participate in corporate governance as an external governance force, obtaining results that find that policies improve corporate governance effects by reducing information asymmetry and irrational behaviour of managers. The study fills the gap in the impact of digital technology development on the effectiveness of corporate governance. However, this paper is at a preliminary stage of research on the effect of digital technology empowerment on corporate governance, and the research methodology needs to be innovated and improved in the future. The small number of companies that have undergone digital transformation in China and the immaturity of the study makes the sample size small. Moreover, this paper does not provide a detailed breakdown of the industries and types of companies, which affects the generalizability and applicability of the findings. The digital divide between different regions of China means that some social groups are not using digital technology to participate in information exchange and corporate governance. And digital technology is developing at a rapid pace that the findings of the study may soon change accordingly. Therefore, it is important to further study the differences in the nature of the impact of big data empowering the public on corporate governance in different countries and industries with the continuous improvement of digital technology in the future, and to explore in depth how to maximize the positive impact and minimize the negative impact to improve the efficiency and effectiveness of corporate governance by combining case studies.

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