

## Article

# How Does Transportation Infrastructure Improve Corporate Social Responsibility? Evidence from High-Speed Railway Openings in China

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**Abstract:** The socioeconomic impacts of infrastructure investment are worth examining in both academic and practical areas. Regarding Chinese high-speed railway construction, the existing literature mainly focuses on the macro-economic level consequences of high-speed railway openings, leaving the micro-economic level impacts commonly untested. Using archival data of Chinese listed companies from 2009 to 2018 and the difference-in-difference (DID) approach, this paper examines the influential effect of Chinese high-speed railway openings on corporate social responsibility (CSR) performance. Empirical results show that high-speed railway openings can significantly improve Chinese listed companies' CSR performance, and this positive effect is more salient when companies are experiencing lower information transparency. Mediating effect tests illustrate that the increased investor site visits caused by high-speed railway openings are one internal mechanism behind the main connection. Overall, from a micro-level perspective, this article provides additional evidence on the socioeconomic impact of transportation infrastructure investments.

**Keywords:** geographic proximity; high-speed railway openings; corporate social responsibility performance; information efficiency; investor site visit



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## 1. Introduction

Investment in transportation infrastructure has long been an essential way for the government to regulate economic development when the macro-economy is facing great uncertainties. In dealing with the global financial crisis in 2008, the Chinese central government initiated the “Four-trillion Yuan” plan to stimulate economic growth. Among the various investment areas, construction of railways, highways, and airports occupied the largest part. Under these circumstances, Chinese high-speed railways experienced their first large-scale rapid development. According to statistics from China State Railway Group Co., Ltd., the total operating mileage of Chinese high-speed railways reached 37,900 km at the end of 2020, making China the top country in constructing high-speed railways in the world, while the number was only around 640 km in 2008. By the end of the Chinese “13th Five-year Plan”, this high-speed railway construction wave had made approximately 99% of Chinese cities with a population larger than 200,000 reachable by high-speed train for the first time, including major Chinese cities such as Beijing and Shanghai. Compared with the already existing infrastructure networks such as airlines and the Internet, the newly constructed high-speed railway network provides a more suitable situation to examine the net socioeconomic impacts caused by a certain type of infrastructure in the last decade.

High-speed railway openings not only facilitate people's daily lives, but also cause significant influences on the economic system. The existing literature illustrates that high-speed railway openings have a positive effect in expanding regional demand, reducing relative distance between cities, and accelerating flows and reconstructions of resources

such as capital and labor [1–5]. Despite many studies debating the socioeconomic impacts of Chinese high-speed railway openings at the macro level, few research works have discussed the potential effects at the micro level represented by listed companies. Recent news reports focusing on management choices provide insights into the potential connection between high-speed railway openings and corporate social responsibility (CSR) performance. For example, in an interview with Xinhuanet in 2019, Zongmin Xuan, the chairman of Guangdong Yueyun Transportation Co., Ltd., indicated that, since high-speed trains make consumers' requirements for higher-quality travel services increase, to meet such needs, Yueyun is improving its consumer service system and purchasing more environmental protection equipment. Furthermore, as reported by the Securities Times in 2019, to promote the implementation of the targeted poverty alleviation projects, Guangzhou Phar. Holdings is using high-speed trains as a tool to propagate project-related information to passengers. Therefore, from the perspective of CSR, in this article we aim to provide evidence on how high-speed railway openings can affect the capital market, and on the evaluation of one major infrastructure investment, the high-speed railways.

Corporate social responsibility refers to companies taking actions to increase welfare for stakeholders that go beyond what is legally required, such as their employees, communities, and the natural environment. The current literature considers CSR a serious agency conflict between managers and shareholders, or a strategic investment to obtain stakeholders' support and "insurance-like" protections in the capital market [6,7]. Despite opposite views on the motivations for firms' engagement in CSR-related activities, information transparency generally plays an essential role in influencing listed companies' CSR performance [8,9]. Besides the company's own information disclosure quality, geographic proximity is also an important source of information asymmetry [10]. Locality bias arises when people are more likely to choose local companies instead of non-local ones as their investment targets, since local investors can easier gather and process firm-specific "soft information" with more personal social ties and lower costs [11,12]. By shortening the relative distance between two cities, high-speed railway trains can improve both the breadth and the depth of information exchange between market participants in different locations, further reducing information asymmetry among stakeholders. Thus, high-speed railway openings have potential effects on companies' CSR performance, and this paper provides discussions and empirical tests on the relationship.

Taking Chinese A-share listed companies during 2009 to 2018 as the research sample, and dividing the full sample into the control and the treatment groups by whether the company headquarters were accessible by high-speed train in the research period, this paper implements the difference-in-difference (DID) model to empirically examine the connection and the internal mechanism between high-speed railway openings and CSR performance. We find that: First, the CSR performance of Chinese A-share listed companies can be improved after company headquarters experience high-speed railway openings in the sample period. Second, the positive connection can be strengthened in companies with lower information transparency proxied by analyst coverage level and the KV index (defined as the dependence of a stock's market return on the stock's trading volume), suggesting that the improvement in information environment caused by high-speed railway openings is the internal mechanism. The main results remain solid under the placebo test, the timing regression method, and the exclusion of railway pivot cities. Third, we test the mediating role of investor site visits in explaining the positive effect of high-speed railway openings. After the openings of high-speed trains, the costs of site visit activities significantly decrease. More site visit activities let investors gather and disseminate firm-specific information to the capital market more easily, making outside stakeholders better understand and support firms' CSR activities in turn, and finally promoting the CSR performance of Chinese A-share listed companies. When focusing on different CSR dimensions, empirical results show that the positive effect of high-speed railway openings on CSR performance is largest in the supplier, customer, and consumer responsibility dimension and is the lowest in the social charitable responsibility dimension.

This paper contributes to the existing literature in the following ways: First, using high-speed railway openings as an exogenous shock, this study discusses and empirically examines a potential influential factor of listed companies' CSR performance. Current studies mainly focus on micro-economic firm-level factors, such as the company's surplus assets as well as firm managers' personal characteristics, and their influential powers in promoting or impeding firms' CSR activities [13–17]. In addition, besides the internal factors, companies' external information transparency also plays a significant role. Since CSR activities can be motivated either by reputational capital accumulating or by private benefit chasing, companies' shareholders and stakeholders will react positively or negatively to CSR activities once they are better informed of such managerial decisions through multiple information exchange channels, and further encourage or constrain firms' CSR activities [8,9]. Therefore, holding other things equal, by alleviating or aggravating information asymmetry, changes in companies' external information environment will lead to better or worse CSR performance, depended on the initial motivation for firms' CSR activities. In finding such factors affecting CSR performance through changing enterprises' information environment, while recent studies emphasize the role of the country-level economic policy uncertainty [18,19], significant regional economic changes, especially transportation infrastructure investment, can also have impacts because such construction effectively decreases field investigation difficulties, accelerates information exchanges, and thus improves the firm-level information environment. From the perspective of high-speed railway openings, this study narrows the research gap between the regional economic factors and listed companies' CSR performance. Second, this study expands the research on the evaluation and social impacts of high-speed railway openings, providing a micro-level indicator for regulators to assess infrastructure investment performance. Most literature works consider railway investment to be a vital way to influence the regional economy and mainly examine the macro-level effects of high-speed railway openings [1–5], leaving the micro-level influences rarely tested. Based on Chinese listed companies' CSR practices, this paper provides additional evidence to fill the current research void. Third, this paper examines one internal mechanism of high-speed railway openings in promoting listed firms' CSR performance, offering empirical evidence on the improvement of firm-specific information transparency caused by the high-speed railway openings.

The remaining parts of this paper are designed as follows: a literature review and hypothesis development are presented in Section 2; Section 3 introduces the research design; empirical results are illustrated in Section 4; and Section 5 concludes the paper.

## 2. Literature Review and Hypothesis Development

### 2.1. Influences of Geographic Proximity and High-Speed Railway Openings in China

Geographic proximity creates comparative advantages for locals, and distance does matter when people are making investment decisions [11,20]. Ivkovic and Weisbenner [21] find that when choosing investment portfolios, American households show a strong preference for regionally close stocks. This locality bias also appears in individual investors' international investment decisions [22]. One explanation for this unique phenomenon is that local investors are more likely to exploit value-relevant "soft information", which is more subtle and arises from personal social connections, about nearby companies [11,12].

In fact, not only individual investors, but also capital market specialists are influenced by relative distance. Benefiting from suffering lower transaction costs and securing higher interest rates brought by information advantages, local investment banks have better performance in underwriting municipal bonds [12]. In dealing with trading stocks, local institutional investors and investment advisors tend to experience higher excess returns [23]. Geographic proximity also helps analysts and auditors develop firm-specific knowledge. Obtaining much detailed information from various social ties, local auditors tend to provide higher-quality audit services [24], and local analysts can release more accurate earnings predictions as well as begin the IPO coverages in a more timely manner than non-local ones [25,26].

Through different channels, high-speed railway openings have both positive and negative effects on the economic growth in China. On the one hand, by expanding regional demand and output, improving the accessibility of both cities and regional markets, and reducing unemployment especially for workers who are familiar with non-routine cognitive skills that involve more abstract thinking, problem solving, and complex communication activities, high-speed railway openings have significantly facilitated Chinese economic growth in recent decades [1–3]. On the other hand, high-speed railway openings may cause spatial restructuring of population and industries along the route, making resources move from peripheral counties to central cities. This reallocation effect will impede China's economic growth to some extent [4,5]. Despite the existing debate at the macro level, one certain influence of high-speed railways is that high-speed railway openings significantly promote geographic connectivity and reduce communication barriers, assisting face-to-face information exchange in people's knowledge-generating process [27,28].

## 2.2. Influential Factors of CSR-Related Activities

When chasing benefits for a broader set of stakeholders other than just their shareholders, companies are said to be practicing corporate social responsibility. The existing literature finds that when making CSR-related decisions, firms are mainly influenced by the availability of economic resources, their managers' personal characteristics, and stakeholders' behaviors.

Compared with other types of investment, CSR-related activities are not always at the top of a firm's investment hierarchy [29]. Financial constraint is one possible reason in explaining firms' lagged investments in CSR activities. Based on the value of real estate owned by companies, Sun and Gunia [13] illustrate that a firm's CSR concerns decrease with the increase in the company's available economic resources, but the CSR concerns increase more significantly when available economic resources decrease to the same extent. This asymmetric reaction implies that CSR-related activities depend greatly on the satisfaction of firms' core business needs.

Managers' personal characteristics are influential in firms' CSR decisions. Since doing well in CSR-related activities can bring private benefits to managers, altruistic managers are more likely to invest in CSR projects even if they do not actually increase the shareholder value and the firm value [14]. The conflict between managers and shareholders in doing CSR activities is considered a reflection of serious agency problems in the firm [6]. Besides the motivation to chase private interests, following political preference is another incentive for managers to engage in CSR activities. Using data from the U.S., Giuli and Kostovetsky [15] illustrate that firms score significantly higher in CSR areas when their top-tier managers are Democrats rather than Republicans. The reason behind this difference is that the Democratic Party emphasizes CSR-related issues such as employee protection and environmental protection more. In addition, family structure also plays an important role. By instilling pro-social values and internalizing women's general preferences for common good in the CEO, respectively, being married and having daughters are both positively connected with firms' CSR ratings [16,17].

Although doing well in CSR activities can be considered as managers pursuing personal reputations at the expense of shareholders' welfare, recent empirical results find that outside and inside stakeholders do react positively to firms' CSR decisions. For example, Flammer [30] illustrates that labor productivity increases after the adoption of firms' CSR proposals. As for outside stakeholders, CSR activities provide opportunities for companies to better communicate with their non-investing stakeholders and to get their support in firms' investment decisions. By doing well in CSR-related areas, firms can more easily alleviate financial constraints, lower crash risks of their trading stocks, and have higher announcement returns on their merger & acquisition (M&A) transactions [31–34]. Besides the potential benefits that companies can obtain immediately from their CSR investments, reputational capital built by engaging in CSR activities can hedge companies' value losses from future negative events [7]. Therefore, motivated by obtaining scarce resources from

various stakeholders, firm managers may choose to achieve companies' operating success and social welfare simultaneously [35].

### 2.3. Hypothesis Development

The motivations for firm managers' CSR investments can generally be explained by agency theory and stakeholder theory. Under the agency theory perspective, CSR is considered an agency problem and will cause damage to the firm value [6]. Thus, by improving the quality of corporate internal and external governance, firms are likely to limit their CSR investments and create lower CSR performance [9]. On the contrary, stakeholder theory believes that it is not a zero-sum game for companies to pursue profits and to be socially supportive [35]. However, although CSR investments can increase firm value and shareholder value in the long run based on stakeholder theory, a prerequisite for a firm's CSR activities to be value-creating is that a broader set of stakeholders must realize that the company is doing well in CSR-related areas [36].

Distance will cause higher costs for both shareholders and stakeholders to monitor companies and to obtain detailed firm-specific information, generating economically significant location-based information asymmetry [10,37]. By reducing the relative distance, high-speed railway openings can accelerate information flows among companies and their shareholders as well as stakeholders, improving both the monitoring efficiency and the information efficiency of the capital market. Therefore, if managers are using CSR to pursue their private benefits, high-speed railway openings will help outside monitors, such as sell-side analysts, to uncover managers' misbehaviors more quickly and to constrain companies' discretionary spending on CSR activities. Moreover, if managers do consider CSR a valuable tool to accumulate reputational capital among firms' stakeholders, then the improved information efficiency brought by high-speed railway openings can decrease the information asymmetry problem between insiders and outsiders, increasing stakeholders' awareness and in turn encouraging firms' CSR investment performance. Based on the analysis above, we give hypotheses H1a and H1b considering the opposite scenarios:

**Hypothesis 1 (H1a).** *A company's CSR performance will decrease after the opening of high-speed railway trains in the company's headquarter city.*

**Hypothesis 1 (H1b).** *A company's CSR performance will increase after the opening of high-speed railway trains in the company's headquarter city.*

Investors face more difficulties in collecting and processing firm-specific information when the company is experiencing a lower-level information transparency [33]. One direct economic consequence of high-speed railway openings is that the relative distance between two places is shortened significantly, making it easier and faster for people to visit other cities [38]. For capital market participants such as sell-side analysts and institutional investors, the corporate site visit is an important venue to collect firm-specific information and to participate in corporate governance practices [39–41]. Thus, once the company headquarter city is reachable by high-speed trains, stakeholders can gather firm-relevant soft information through multiple channels, such as corporate site visits and sell-side analysts' research reports. Furthermore, the improvement in information transparency will lead to better or worse CSR performance, depending on the motivation behind firms' CSR activities. Therefore, in companies that have lower-level information transparency, the effect of high-speed railway openings is predicted to be more salient. Based on the analysis above, hypothesis H2 is presented as follows:

**Hypothesis 2 (H2).** *The influence of high-speed railway opening on CSR performance is more obvious when the company has worse information transparency.*

### 3. Research Design

#### 3.1. Model Specification

##### 3.1.1. Baseline Regression Models

The difference-in-difference (DID) method is commonly implemented to test the net effect of an exogenous shock when such a shock only influences some of the companies in the market. Considering that not all Chinese public companies experienced high-speed railway openings in the research period, and that for those who experienced such a large regional infrastructure construction event, the years when this exogenous shock happened vary from company to company, we use the difference-in-difference (DID) method to empirically examine our hypotheses. Specifically, following existing literature focusing on the influential factors of CSR activities [8,9], we construct Model (1) to examine the influence of high-speed railway openings on Chinese public firms' CSR performance. In order to achieve robust results, we use both the firm-level clustered OLS method and the fixed effect method to regress Model (1).

$$\text{CSR}_{i,t+1} = \alpha_0 + \alpha_1 \text{Open}_{i,t} + \alpha_2 \text{CRH}_{i,t} + \alpha_3 \text{Size}_{i,t} + \alpha_4 \text{ROA}_{i,t} + \alpha_5 \text{Cash}_{i,t} + \alpha_6 \text{Lev}_{i,t} + \alpha_7 \text{Tax}_{i,t} + \alpha_8 \text{MB}_{i,t} + \alpha_9 \text{R\&D}_{i,t} + \alpha_{10} \text{Age}_{i,t} + \alpha_{11} \text{State}_{i,t} + \alpha_{12} \text{Inshold}_{i,t} + \alpha_{13} \text{GDP}_{i,t} + \text{Year} + \text{Ind} + \varepsilon \quad (1)$$

where the dependent variable CSR represents Chinese listed companies' annual CSR score ranked by the Hexun website ([www.hexun.com](http://www.hexun.com), accessed on 28 November 2019). According to Hexun's official website, the annual CSR score consists of independent scores in five dimensions, namely the shareholder responsibility; the employee responsibility; the supplier, customer, and consumer responsibility; the environmental responsibility; and the social charitable responsibility. Each firm's annual CSR score is calculated using information from the company's self-released annual report and CSR report, making the score comprehensive and objective with few biases. More detailed information on Hexun's CSR ranking system is provided in the Appendix A. CSR is one-year later than other variables because firms' investments in CSR might show up with some lag [9]. The variable Open is the independent variable, representing the opening of a high-speed railway in the city where the listed company's headquarters are located. If the headquarter city is accessible by high-speed trains in the observation year, then the variable is 1, and 0 otherwise. CRH is a control variable to control differences between companies that experienced high-speed railway openings in the full sample period and those that did not. Following Zhang et al. and Adhikari [8,9], firm size, return on asset, cash holding ratio, leverage, and effective tax rate are used to control the availability of economic resources at the firm level; market-to-book value, R&D intensity, and firm age control the different life cycles of public companies since firms in different life cycles may choose diversified CSR strategies [19]; the equity nature of the firm's ultimate controller is used to control the SOE effect since the State-owned Assets Supervision and Administration Commission (SASAC) will provide favorable evaluation scores for state-owned enterprises taking more social responsibility [42]; institutional investor shareholding ratio is used to control the corporate governance quality [43]; and the annual GDP in the company's location region is chosen to control differences in regional economic development. Year and Ind are year dummy and industry dummy, respectively, and  $\varepsilon$  is the residual term. Detailed definitions of dependent, independent, and control variables are given in Table 1. According to H1, the regression coefficient  $\alpha_1$  is what we are interested in.

Next, Model (2) is built to test our hypothesis H2, that is, the moderating effect of companies' information transparency. Compared with Model (1), the variable measuring companies' information transparency and its interaction term with the variable Open are added into the linear regression model, while all the control variables remain unchanged. Both the firm-year clustered OLS method and the fixed effect method are implemented to test Model (2).

$$\begin{aligned} \text{CSR}_{i,t+1} = & \alpha_0 + \alpha_1 \text{Open}_{i,t} + \alpha_2 \text{Low\_coverage}_{i,t} (\text{Low\_disclosure}_{i,t}) + \alpha_3 \text{Open}_{i,t} \times \text{Low\_coverage}_{i,t} \\ & (\text{Low\_disclosure}) + \alpha_4 \text{CRH}_{i,t} + \alpha_5 \text{Size}_{i,t} + \alpha_6 \text{ROA}_{i,t} + \alpha_7 \text{Cash}_{i,t} + \alpha_8 \text{Lev}_{i,t} + \alpha_9 \text{Tax}_{i,t} + \alpha_{10} \text{MB}_{i,t} + \alpha_{11} \text{R\&D}_{i,t} \\ & + \alpha_{12} \text{Age}_{i,t} + \alpha_{13} \text{State}_{i,t} + \alpha_{14} \text{Inshold}_{i,t} + \alpha_{15} \text{GDP}_{i,t} + \text{Year} + \text{Ind} + \varepsilon \end{aligned} \quad (2)$$

where the variable *Low\_coverage* and the variable *Low\_disclosure*, measured by the analyst coverage level and the annual KV index of the company's trading stock, respectively, following Zhang et al. and Kim and Verrecchia [8,44], represent the information transparency of Chinese public companies. Theoretically, a higher level of sell-side analyst coverage represents a higher level of information transparency. However, on the contrary, a higher KV index means a lower information transparency [44]. Thus, we use the opposite value of analyst coverage and the original value of KV index to proxy public companies' information transparency. According to hypothesis H2, holding other things equal, if high-speed railway openings do improve the firm's information transparency and further cause influences on the firm's CSR performance, then the effect of high-speed railway openings on CSR performance should be more salient in companies that originally experience a lower level of information transparency. Thus, an effectively positive  $\alpha_3$  in Model (2) is what the hypotheses expect.

**Table 1.** Definitions of variables.

Variable	Calculation Method
CSR	Corporate social responsibility performance ranked by the Hexun website ( <a href="http://www.hexun.com">www.hexun.com</a> , accessed on 28 November 2019)
Open	Equals 1 if the company's headquarter city is accessible by high-speed railway in the sample year, and 0 otherwise
CRH	Equals 1 if a company's headquarter city experienced a high-speed railway opening in the sample period, and 0 otherwise
Low_coverage	$(-1) \times (\text{analyst coverage level})$
Low_disclosure	Annual KV index calculated using Model (3)
Size	The natural logarithm of total asset
ROA	Net income/average total asset
Cash	$(\text{Cash} + \text{cash equivalents})/\text{total asset}$
Lev	Total liability/total asset
Tax	Income tax expenses/earnings before income tax
MB	Market value/total asset
R&D	R&D expenses/sales revenue
Age	The number of years since the company went public
State	Equals 1 if the company is ultimately controlled by the government, and 0 otherwise
Inshold	Institutional investor shareholding ratio
GDP	Annual GDP of the company's location region (in trillion Yuan)
Year	Year dummy
Ind	Industry dummy

Following He and Tian [45], a firm's analyst coverage level is measured by the annual number of research reports released by sell-side analysts who are following the company. Moreover, according to Kim and Verrecchia [44], Model (3) is used to calculate listed companies' annual KV index.

$$\text{Ln} |(P_t - P_{t-1})/P_{t-1}| = \alpha + \beta(\text{Vol}_t - \text{Vol}_0) + \varepsilon \quad (3)$$

where *P* and *Vol* represent the stock price and the stock's trading volume in a trading day. Specifically, *Vol*<sub>0</sub> is a stock's annual average trading volume. According to the definition of the KV index, the left side of Model (3) measures a stock's market daily return, and the right side measures the stock's daily trading volume. After regressing Model (3) using the stock's daily trading data, the regression coefficient  $\beta$  captures the annual KV index of each public company during the sample period. A smaller  $\beta$  means a lower correlation

between company stock return and the stock's trading volume, suggesting that investors can use more firm-specific information other than just the trading volume to make their own investment decisions, and thus represents a higher level of information transparency.

### 3.1.2. Robustness Test Methods

To ensure the robustness of the baseline empirical results, four robustness test methods are implemented, namely the placebo test, with the timing regression approach, excluding firm-year observations in railway pivot cities, and excluding an alternative explanation for the positive effect of high-speed railway openings on CSR performance.

First, considering that the significant effect of high-speed railway openings can be caused by some non-observable factors and by time trends in the high-speed railway opening periods, we assume that the opening year in the placebo test is two years before the real opening year of the high-speed railway and rerun Model (1). If causality does exist between high-speed railway openings and CSR performance, then it is expected to find insignificant regression coefficients when the high-speed trains are not exactly reachable in the company's headquarter city.

Second, although the variable *Open* in the baseline regression Model (1) captures the net effect of high-speed railway openings, it cannot fully reflect CSR performance changes in the nearby years before and after the opening of high-speed trains. Following Chen et al. [46], we use the timing regression approach to further examine both the dynamic influences of high-speed railway openings on CSR performance and the parallel trend assumption. The empirical Model (4) is thus constructed as follows:

$$\begin{aligned} \text{CSR}_{i,t+1} = & \alpha_0 + \alpha_1 \text{Before}^2 + \alpha_2 \text{Before}^1 + \alpha_3 \text{Current} + \alpha_4 \text{After}^1 + \alpha_5 \text{After}^2 + \alpha_6 \text{After}^3 + \alpha_7 \text{Size}_{i,t} + \alpha_8 \text{ROA}_{i,t} \\ & + \alpha_9 \text{Cash}_{i,t} + \alpha_{10} \text{Lev}_{i,t} + \alpha_{11} \text{Tax}_{i,t} + \alpha_{12} \text{MB}_{i,t} + \alpha_{13} \text{R\&D}_{i,t} + \alpha_{14} \text{Age}_{i,t} + \alpha_{15} \text{State}_{i,t} + \alpha_{16} \text{Inshold}_{i,t} + \alpha_{17} \text{GDP}_{i,t} \\ & + \text{Year} + \text{Ind} + \varepsilon \end{aligned} \quad (4)$$

where the variables *Before*<sup>2</sup>, *Before*<sup>1</sup>, *Current*, *After*<sup>1</sup>, *After*<sup>2</sup>, and *After*<sup>3</sup> are all dummy variables. *Before*<sup>n</sup> and *After*<sup>n</sup> represent the *n*th year before and after the high-speed railway openings, respectively. The definitions of other control variables are not changed. It is expected that the coefficients of the variable *Before*<sup>n</sup> should be insignificant.

Third, according to the "Mid-term to Long-term Chinese Railway Network Planning" jointly released by the National Development and Reform Commission, the Ministry of Transport, and the China State Railway Group Co., Ltd. in 2016, the top eight railway pivot cities in China are Beijing, Shanghai, Guangzhou, Wuhan, Chengdu, Shenyang, Xi'an, and Tianjin. Because these pivot cities are strategically influential in the national high-speed railway network planning, the endogeneity problem can be a serious concern in firms located in the railway pivot cities. We therefore restrict the firm-year observations in railway non-pivot cities to mitigate the potential endogeneity problem. To show the robustness of the baseline results, it is expected to find the same conclusions in both the full sample regressions and the non-pivot city sample regressions.

Finally, an alternative explanation for the internal mechanism is that through increased corporate site visit activities, high-speed railway openings cause an effect on CSR performance by improving corporate governance quality instead of by improving the information transparency of the company, since major market participants such as institutional investors can use site visits to implement corporate governance practices [40]. To alleviate such a concern and to further stabilize the hypothetical argument on the information transparency mechanism, we use listed companies' internal control quality index provided by the DIB database to proxy companies' corporate governance quality, and we build the following Model (5) to examine whether the alternative mechanism effectively holds.



$$CSR_{i,t+1} = \alpha_0 + \alpha_1 Open_{i,t} + \alpha_2 Low\_IC_{i,t} + \alpha_3 Open_{i,t} \times Low\_IC_{i,t} + \alpha_4 CRH_{i,t} + \alpha_5 Size_{i,t} + \alpha_6 ROA_{i,t} + \alpha_7 Cash_{i,t} + \alpha_8 Lev_{i,t} + \alpha_9 Tax_{i,t} + \alpha_{10} MB_{i,t} + \alpha_{11} R\&D_{i,t} + \alpha_{12} Age_{i,t} + \alpha_{13} State_{i,t} + \alpha_{14} Inshold_{i,t} + \alpha_{15} GDP_{i,t} + Year + Ind + \varepsilon \quad (5)$$

where the variable *Low\_IC* represents the level of corporate governance quality. Because a higher value of the DIB internal control index means a better corporate governance quality, the variable *Low\_IC* equals one if a company's annual internal control index is lower than the industrial median in the observation year, and zero otherwise. Similar to the methodology for testing our hypothesis H2, if high-speed railway openings do improve the firm's corporate governance quality and further cause influences on the firm's CSR performance, then the effect of high-speed railway openings on CSR performance should be more salient in companies originally having lower corporate governance quality.

### 3.1.3. Further Analysis Design

As discussed in the hypothesis development section, one potential way that high-speed railway openings will improve listed companies' information environment is that high-speed trains significantly shorten the relative distance between two places, making capital market participants, such as sell-side analysts and institutional investors, able to implement corporate site visit activities more easily. With increased corporate site visit activities, stakeholders can get more detailed information about companies' CSR activities, and eventually choose to support or to constrain managers' CSR-related choices.

To test this specific potential channel explaining the connection between high-speed railway openings and Chinese public firms' CSR performance, Model (6), Model (7), and Model (8) are constructed following Baron and Kenny [47]. According to the principles of the mediating effect test,  $\alpha_1$  in three models and  $\alpha_2$  in Model (8) are what we are interested in. If the four regression coefficients are all statistically significant, then a partial mediating effect exists; and if only  $\alpha_1$  in Model (8) shows no significance, then a complete mediating effect holds. The variable *Visit* is the annual number of investor site visit activities received by each listed company.

$$CSR_{i,t+1} = \alpha_0 + \alpha_1 Open_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Lev_{i,t} + \alpha_6 Tax_{i,t} + \alpha_7 MB_{i,t} + \alpha_8 R\&D_{i,t} + \alpha_9 Age_{i,t} + \alpha_{10} State_{i,t} + \alpha_{11} Inshold_{i,t} + \alpha_{12} GDP_{i,t} + Year + Ind + \varepsilon \quad (6)$$

$$Visit_{i,t} = \alpha_0 + \alpha_1 Open_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 ROA_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Lev_{i,t} + \alpha_6 Tax_{i,t} + \alpha_7 MB_{i,t} + \alpha_8 R\&D_{i,t} + \alpha_9 Age_{i,t} + \alpha_{10} State_{i,t} + \alpha_{11} Inshold_{i,t} + \alpha_{12} GDP_{i,t} + Year + Ind + \varepsilon \quad (7)$$

$$CSR_{i,t+1} = \alpha_0 + \alpha_1 Open_{i,t} + \alpha_2 Visit_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 Cash_{i,t} + \alpha_6 Lev_{i,t} + \alpha_7 Tax_{i,t} + \alpha_8 MB_{i,t} + \alpha_9 R\&D_{i,t} + \alpha_{10} Age_{i,t} + \alpha_{11} State_{i,t} + \alpha_{12} Inshold_{i,t} + \alpha_{13} GDP_{i,t} + Year + Ind + \varepsilon \quad (8)$$

Next, using Model (9), we further test the effects of high-speed railway openings on five separate CSR dimensions. The dependent variables  $CSR_{sha}$ ,  $CSR_{emp}$ ,  $CSR_{sup}$ ,  $CSR_{env}$ , and  $CSR_{soc}$  represent Hexun's separate annual CSR scores on the shareholder responsibility; the employee responsibility; the supplier, customer, and consumer responsibility; the environmental responsibility; and the social charitable responsibility of each Chinese public company, respectively. All control variables are the same as those in Model (1).

$$CSR_{sha}(CSR_{emp}/CSR_{sup}/CSR_{env}/CSR_{soc}) = \alpha_0 + \alpha_1 Open_{i,t} + \alpha_2 CRH_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 Cash_{i,t} + \alpha_6 Lev_{i,t} + \alpha_7 Tax_{i,t} + \alpha_8 MB_{i,t} + \alpha_9 R\&D_{i,t} + \alpha_{10} Age_{i,t} + \alpha_{11} State_{i,t} + \alpha_{12} Inshold_{i,t} + \alpha_{13} GDP_{i,t} + Year + Ind + \varepsilon \quad (9)$$

Third, following Miller and Rodgers [48], we use the standardized regression method to further compare the explanatory powers among variables in Model (1). We first standardize all variables in Model (1), and then rerun the model. By calculating the relative weights, we can finally get the explanatory power of each variable in Model (1).

### 3.2. Sample Selection

Chinese A-share public companies' annual CSR evaluation data were collected from a professional third party (the Hexun website), and high-speed railway opening data were manually collected from China State Railway Group Co., Ltd. Other firm-level financial data were gathered from the CSMAR database. The archival data of investor site visits were collected from the WIND database. The annual internal control index data were gathered from the DIB database. The following filter processes were implemented to finally construct the regression sample: (1) firms operating in the financial sector are excluded from the full sample; (2) firm-year samples with missing data are deleted; and (3) firms being ST (special treatment) or PT (particular transfer) by the regulator are also excluded from the regression sample. The final regression sample contains 18,596 firm-year observations. All continuous variables are winsorized at upper and lower 1% level to mitigate extreme value impacts.

Specifically, based on the information disclosure regulation practices implemented by the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE), only SZSE requires that listed companies fully disclose the site visit recordings since 2013. Thus, when empirically testing the mediating effect of investor site visits, we restrict our regression sample in SZSE listed companies from 2013 to 2018. The sample examining the mediating effect of investor site visits contains 4322 firm-year observations.

## 4. Empirical Results

### 4.1. Descriptive Statistics

Table 2 below provides descriptive statistics of the regression sample. On average, the annual CSR score of Chinese listed companies is around 26, with a maximum of 75.41 and a minimum of  $-3.67$ . The mean of the variable CRH is 0.84, illustrating that around 84% of observations experience high-speed railway openings in the company's headquarter city during the sample period. Nearly 68% of firm-year data are gathered after high-speed trains are reachable in each company's headquarter city. The absolute value of Low\_coverage is 16.15 and the standard deviation is 21.56, meaning that Chinese public companies receive diversified analyst followings from 2009 to 2017. The mean of Low\_disclosure suggests that companies in the regression sample have relatively better information transparency.

**Table 2.** Descriptive statistics.

Variable	N	Mean	Std. Dev	Min	Med	Max
CSR	18,596	25.89	16.81	$-3.67$	22.52	75.41
Open	18,596	0.68	0.47	0.00	1.00	1.00
CRH	18,596	0.84	0.37	0.00	1.00	1.00
Low_coverage	18,596	$-16.15$	21.56	$-219.00$	$-8.00$	0.00
Low_disclosure	18,596	0.11	0.14	$-0.02$	0.07	0.78
Size	18,596	22.01	1.25	19.82	21.83	25.88
ROA	18,596	0.05	0.05	$-0.13$	0.04	0.21
Cash	18,596	0.20	0.15	0.02	0.16	0.73
Lev	18,596	0.41	0.21	0.05	0.41	0.88
Tax	18,596	0.17	0.15	$-0.46$	0.16	0.78
MB	18,596	2.81	1.94	0.93	2.20	11.70
R&D	18,596	2.99	3.96	0.00	2.08	21.85
Age	18,596	8.87	6.86	0.00	7.00	27.00
State	18,596	0.38	0.49	0.00	0.00	1.00
Inshold	18,596	5.53	5.45	0.03	3.81	25.84
GDP	18,596	3.68	2.28	0.04	2.88	8.97

### 4.2. Baseline Regression Results

Baseline regression results of Model (1) are presented in column (1) and column (2) of Table 3, respectively. Coefficients of the variable Open are significantly positive at 1% and 5% significance level when using the firm-level clustered OLS and the fixed effect method, respectively, proving that, consistent with our hypothesis H1b, high-speed railway open-

ings in the company's headquarter city can effectively improve the company's annual CSR performance. For the control variables, companies with more assets, higher asset returns, and larger market values generally have better performance in CSR-related activities.

**Table 3.** Baseline regression results.

Variable	OLS CSR	FE CSR
Open	1.616 *** (2.97)	0.944 ** (2.01)
CRH	−1.032 (−1.49)	
Size	4.980 *** (24.31)	2.756 *** (7.17)
ROA	86.108 *** (24.43)	39.649 *** (11.05)
Cash	−0.916 (−0.77)	−2.198 ** (−1.97)
Lev	−6.733 *** (−5.83)	−0.292 (−0.21)
Tax	0.261 (0.29)	−4.425 *** (−5.24)
MB	0.609 *** (6.54)	0.507 *** (5.25)
R&D	−0.046 (−1.06)	−0.047 (−0.79)
Age	−0.061 * (−1.85)	−1.735 *** (−13.54)
State	2.739 *** (5.41)	−0.342 (−0.25)
Inshold	0.104 *** (3.39)	0.135 *** (4.49)
GDP	−0.002 (−0.03)	0.541 ** (2.22)
Constant	−84.599 *** (−17.92)	−25.685 *** (−2.76)
Year & Ind	Controlled	Controlled
N	18,596	18,596
Adj. R2	0.286	0.172

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

Table 4 shows empirical results examining hypothesis H2. Interaction terms  $\text{Open} \times \text{Low\_coverage}$  and  $\text{Open} \times \text{Low\_disclosure}$  are all significantly positive under the firm-level clustered OLS and fixed effect regression methods. As predicted, the results in Table 4 illustrate that the positive effect of high-speed railway openings on CSR performance is more salient when the company's information transparency is at a lower level. One explanation for this is that by improving listed companies' information transparency, mitigating information asymmetry problems among various stakeholders, and reducing external regulation costs, high-speed railway openings have more significant effects in promoting CSR performance in companies that are originally experiencing a lower level of information transparency compared with companies that already have a better information environment.

**Table 4.** Moderating effect of low information transparency.

Variable	OLS CSR	FE CSR	OLS CSR	FE CSR
Open	2.039 *** (3.51)	1.950 *** (3.84)	1.160 * (1.90)	0.413 (0.77)
Low_coverage	−0.084 *** (−5.33)	−0.101 *** (−6.72)		
Open × Low_coverage	0.028 * (1.68)	0.065 *** (3.94)		
Low_disclosure			−1.303 (−0.80)	−3.157 ** (−2.29)
Open × Low_disclosure			3.694 ** (1.97)	4.376 *** (2.76)
CRH	−1.018 (−1.48)		−1.015 (−1.47)	
Size	4.421 *** (20.25)	2.407 *** (6.23)	5.024 *** (24.24)	2.760 *** (7.15)
ROA	79.138 *** (22.10)	34.400 *** (9.56)	85.810 *** (24.42)	39.725 *** (11.08)
Cash	−0.945 (−0.80)	−1.977 * (−1.78)	−1.030 (−0.87)	−2.034 * (−1.84)
Lev	−6.501 *** (−5.65)	−0.495 (−0.35)	−6.765 *** (−5.86)	−0.275 (−0.20)
Tax	0.551 (0.62)	−4.174 *** (−4.96)	0.234 (0.26)	−4.441 *** (−5.25)
MB	0.502 *** (5.37)	0.422 *** (4.34)	0.619 *** (6.59)	0.512 *** (5.24)
R&D	−0.056 (−1.31)	−0.059 (−1.01)	−0.048 (−1.09)	−0.048 (−0.82)
Age	−0.042 (−1.30)	−1.690 *** (−13.39)	−0.058 * (−1.76)	−1.723 *** (−13.46)
State	2.862 *** (5.64)	−0.094 (−0.07)	2.750 *** (5.43)	−0.362 (−0.26)
Inshold	0.018 (0.57)	0.079 ** (2.52)	0.099 *** (3.16)	0.132 *** (4.33)
GDP	−0.023 (−0.29)	0.549 ** (2.28)	−0.000 (−0.00)	0.530 ** (2.18)
Constant	−73.453 *** (−14.78)	−19.358 ** (−2.09)	−85.384 *** (−17.80)	−25.657 *** (−2.74)
Year & Ind	Controlled	Controlled	Controlled	Controlled
N	18,596	18,596	18,596	18,596
Adj. R <sup>2</sup>	0.290	0.176	0.287	0.172

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

### 4.3. Robustness Tests

#### 4.3.1. Placebo Test

Table 5 shows the placebo test results. The variable Placebo\_Open measures the assumed high-speed openings in the placebo test, and other variable definitions are the same as those illustrated in Table 2. Regression coefficients of Placebo\_Open are insignificant under both the firm-level clustered OLS and the fixed effect method. Therefore, results in Table 5 suggest that the baseline results are not influenced by unobservable economic changes or time trends.

**Table 5.** Placebo test.

Variable	OLS CSR	FE CSR
Placebo_Open	1.095 (1.45)	0.397 (0.65)
CRH	−0.728 (−0.84)	
Size	4.986 *** (24.32)	2.755 *** (7.18)
ROA	86.176 *** (24.44)	39.695 *** (11.04)
Cash	−0.873 (−0.74)	−2.184 * (−1.96)
Lev	−6.729 *** (−5.82)	−0.278 (−0.20)
Tax	0.290 (0.32)	−4.413 *** (−5.23)
MB	0.610 *** (6.55)	0.504 *** (5.21)
R&D	−0.042 (−0.97)	−0.045 (−0.77)
Age	−0.061 * (−1.86)	−1.689 *** (−13.43)
State	2.765 *** (5.45)	−0.333 (−0.24)
Inshold	0.102 *** (3.33)	0.135 *** (4.47)
GDP	0.003 (0.04)	0.550 ** (2.26)
Constant	−85.262 *** (−18.08)	−25.842 *** (−2.76)
Year & Ind	Controlled	Controlled
N	18,596	18,596
Adj. R2	0.286	0.171

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

#### 4.3.2. Timing Regression Approach

Table 6 presents the timing regression results. While regression coefficients of Before<sup>2</sup> and Before<sup>1</sup> are insignificant, coefficients of After<sup>2</sup> and After<sup>3</sup> are all significantly positive at the 1% level. Results in Table 6 illustrate that before the high-speed railway openings, no salient difference exists between companies that are subsequently accessible by high-speed trains and those that are not. However, CSR performance improves significantly from the second year after high-speed railway opening, suggesting that the real effect of high-speed railway opening has some lag.

#### 4.3.3. Excluding Firm-Year Observations in Railway Pivot Cities

Table 7 provides the regression results using the sample excluding railway pivot cities in China. The coefficients of the variable Open in Model (1) and the interaction terms in Model (2) are all significantly positive, the same as those in the baseline regression results. Overall, results in Table 7 prove that our main conclusions are robust using the narrowed sample.

**Table 6.** Timing regression approach.

Variable	CSR
Before2	−0.485 (−0.88)
Before1	0.215 (0.42)
Current	0.309 (0.65)
After1	0.571 (1.35)
After2	1.384 *** (3.29)
After3	1.252 *** (3.35)
Size	2.766 *** (7.20)
ROA	39.801 *** (11.08)
Cash	−2.217 ** (−1.99)
Lev	−0.240 (−0.17)
Tax	−4.397 *** (−5.20)
MB	0.508 *** (5.24)
R&D	−0.046 (−0.78)
Age	−1.678 *** (−13.52)
State	−0.301 (−0.22)
Inshold	0.133 *** (4.43)
GDP	0.556 ** (2.30)
Constant	−26.111 *** (−2.80)
Year & Ind	Controlled
N	18,596
Adj. R <sup>2</sup>	0.173

\*\*\*, \*\* represent 1%, 5% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

#### 4.3.4. Excluding the Alternative Explanation for the Corporate Governance Mechanism

Table 8 provides the regression results of Model (5) using both the OLS method and the fixed effect method. Insignificant regression coefficients of the interaction term  $Open \times Low\_IC$  indicate that the hypothetical corporate governance mechanism is not salient, further strengthening our argument of the information transparency mechanism illustrated in hypothesis H2.

#### 4.4. Further Analyses

Table 9 provides empirical results for the mediating effect test on investor site visit activities. Based on the principles of the mediating effect analysis, both regression coefficients and the Sobel Z value prove that high-speed railway openings can increase investor site visit activities, and further improve companies' CSR performance. That is, the increased investor site visit activities caused by high-speed railway openings play a specific mediating role in explaining the positive connection between high-speed railway openings and CSR performance.

**Table 7.** Excluding observations in railway pivot cities.

Variable	Model (1)	Model (2)	
	CSR	CSR	CSR
Open	0.983 ** (2.21)	1.267 *** (3.82)	0.359 (0.66)
Low_coverage		0.090 *** (7.88)	
Open × Low_coverage		0.021 * (1.71)	
Low_disclosure			−1.750 (−1.36)
Open × Low_disclosure			5.133 *** (2.60)
Size	5.073 *** (17.98)	4.385 *** (24.47)	5.117 *** (17.99)
ROA	86.364 *** (20.69)	78.356 *** (25.46)	86.138 *** (20.67)
Cash	−1.275 (−0.89)	−1.383 (−1.35)	−1.402 (−0.98)
Lev	−7.661 *** (−5.65)	−7.337 *** (−8.19)	−7.656 *** (−5.65)
Tax	0.703 (0.67)	1.068 (1.27)	0.648 (0.62)
MB	0.585 *** (4.90)	0.453 *** (4.80)	0.594 *** (4.96)
R&D	−0.053 (−0.90)	−0.067 (−1.50)	−0.053 (−0.90)
Age	−0.043 (−1.05)	−0.021 (−0.83)	−0.038 (−0.94)
State	2.240 *** (3.64)	2.322 *** (7.16)	2.250 *** (3.66)
Inshold	0.104 *** (2.83)	0.005 (0.18)	0.097 *** (2.60)
GDP	−0.013 (−0.14)	−0.042 (−0.70)	−0.013 (−0.14)
Constant	−86.627 *** (−13.69)	−72.641 *** (−18.83)	−87.351 *** (−13.67)
Year & Ind	Controlled	Controlled	Controlled
N	13197	13197	13197
Adj. R <sup>2</sup>	0.275	0.281	0.276

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

Empirical results in Tables 4 and 7–9 altogether prove that by increasing listed companies' information transparency, high-speed railway openings cause a significant positive effect on CSR performance. Moreover, investors' corporate site visits are one specific channel through which high-speed railway openings affect companies' CSR-related activities.

Table 10 offers empirical evidence on the effects of high-speed railway openings on five separate CSR dimensions. It is obvious that annual CSR scores in the five dimensions all experience significant increases once the company's headquarter city is reachable by high-speed train. Regression coefficients indicate that the improvement effect of high-speed railway openings is largest in the supplier, customer, and consumer responsibility dimension, while it shows minimum power in the social charitable responsibility dimension.

**Table 8.** Excluding the alternative explanation for the corporate governance mechanism.

Variable	OLS CSR	FE CSR
Open	1.958 *** (2.92)	1.406 ** (2.40)
Low_IC	−1.474 *** (−2.85)	−0.688 (−1.56)
Open × Low_IC	−0.909 (−1.55)	−0.728 (−1.43)
CRH	−0.966 (−1.29)	0.000 (.)
Size	5.016 *** (23.66)	3.089 *** (7.62)
ROA	81.956 *** (20.87)	41.574 *** (10.22)
Cash	2.231 (1.63)	0.774 (0.60)
Lev	−7.627 *** (−6.26)	−0.671 (−0.45)
Tax	0.167 (0.18)	−4.446 *** (−5.07)
MB	0.593 *** (5.51)	0.648 *** (5.86)
R&D	−0.026 (−0.56)	−0.059 (−0.89)
Age	−0.045 (−1.28)	−1.828 *** (−13.54)
State	2.365 *** (4.55)	−0.590 (−0.43)
Inshold	0.088 *** (2.76)	0.094 *** (3.00)
GDP	−0.012 (−0.14)	0.550 ** (2.11)
Constant	−83.904 *** (−17.05)	−29.311 *** (−2.84)
Year & Ind	Controlled	Controlled
N	16579	16579
Adj. R2	0.305	0.183

\*\*\*, \*\* represent 1%, 5% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

**Table 9.** Influential mechanism analysis.

Variable	Model (1) CSR	Model (5) Visit	Model (6) CSR
Open	1.334 * (1.95)	1.465 *** (3.09)	1.104 (1.28)
Visit			0.157 *** (3.79)
Size	4.169 *** (13.96)	2.629 *** (4.25)	3.757 *** (10.23)
ROA	80.495 *** (16.35)	13.317 *** (3.03)	78.406 *** (13.95)
Cash	10.581 *** (5.99)	0.263 (0.18)	10.539 *** (4.97)
Lev	−4.760 *** (−3.58)	−1.213 (−1.08)	−4.570 *** (−2.72)
Tax	−1.627 (−1.18)	−1.606 ** (−2.35)	−1.375 (−0.95)



Table 9. Cont.

Variable	Model (1) CSR	Model (5) Visit	Model (6) CSR
MB	0.095 (0.68)	0.177 (1.19)	0.068 (0.46)
R&D	0.058 (0.88)	0.261 *** (4.51)	0.017 (0.20)
Age	−0.054 (−1.53)	−0.147 *** (−4.20)	−0.031 (−0.67)
State	2.701 *** (5.14)	−0.415 (−0.78)	2.766 *** (4.00)
Inshold	0.004 (0.10)	0.136 *** (3.57)	−0.018 (−0.38)
GDP	0.190 ** (2.40)	0.285 *** (3.09)	0.145 (1.42)
Constant	−73.561 *** (−10.97)	−55.600 *** (−4.23)	−64.840 *** (−7.81)
Year & Ind	Controlled	Controlled	Controlled
Sobel Test		z = 2.3972 **	
N	4322	4322	4322
Adj. R2	0.262	0.181	0.268

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

Table 10. Effects of high-speed railway openings on different CSR dimensions.

Variable	CSR <sub>sha</sub>	CSR <sub>emp</sub>	CSR <sub>sup</sub>	CSR <sub>env</sub>	CSR <sub>soc</sub>
Open	0.320 ** (2.52)	0.332 *** (2.80)	0.391 ** (2.22)	0.336 * (1.70)	0.227 ** (2.06)
CRH	−0.231 (−1.37)	−0.246 * (−1.65)	−0.152 (−0.70)	−0.206 (−0.81)	−0.183 (−1.25)
Size	1.000 *** (15.84)	0.991 *** (20.31)	1.244 *** (18.75)	1.442 *** (19.34)	0.299 *** (5.76)
ROA	64.940 *** (53.61)	3.687 *** (4.93)	5.795 *** (5.12)	3.463 *** (3.00)	8.148 *** (8.90)
Cash	2.919 *** (8.77)	−0.767 *** (−2.94)	−2.047 *** (−5.31)	−2.307 *** (−5.60)	1.407 *** (4.78)
Lev	−3.372 *** (−10.01)	−0.566 ** (−2.29)	−1.318 *** (−3.61)	−1.216 *** (−3.17)	−0.264 (−0.84)
Tax	−1.578 *** (−5.07)	−0.668 *** (−3.73)	−0.506 ** (−2.03)	−0.644 ** (−2.29)	3.591 *** (11.16)
MB	−0.122 *** (−3.76)	0.185 *** (8.90)	0.245 *** (8.13)	0.267 *** (8.65)	0.037 (1.40)
R&D	−0.013 (−0.88)	0.051 *** (4.78)	−0.005 (−0.38)	0.002 (0.17)	−0.082 *** (−6.48)
Age	−0.095 *** (−9.88)	0.013 * (1.75)	0.006 (0.59)	−0.014 (−1.32)	0.034 *** (3.88)
State	0.585 *** (4.50)	0.746 *** (6.64)	0.531 *** (3.22)	0.867 *** (5.09)	0.016 (0.13)
Inshold	0.048 *** (5.50)	0.003 (0.44)	0.027 ** (2.54)	−0.000 (−0.01)	0.022 *** (3.12)
GDP	0.038 (1.50)	0.028 (1.63)	−0.024 (−0.99)	−0.014 (−0.53)	−0.023 (−1.08)
Constant	−11.969 *** (−8.45)	−18.402 *** (−16.91)	−23.015 *** (−14.83)	−27.374 *** (−16.49)	−3.970 *** (−3.54)
Year & Ind	Controlled	Controlled	Controlled	Controlled	Controlled
N	18,596	18,596	18,596	18,596	18,596
Adj. R2	0.422	0.230	0.193	0.204	0.247

\*\*\*, \*\*, \* represent 1%, 5%, and 10% levels of significance, respectively. T-values are presented beneath the coefficient estimates in parentheses.

Table 11 presents the standardized regression results using the OLS method. As presented, when explaining the dependent variable CSR, the explanatory power of the independent variable Open is around 4.43%, which is greater than firms' fundamental variables such as Cash, Tax, R&D, Age, and Inshold. Firm size and return on assets account for the largest and the second largest weights in explaining Chinese public firms' CSR performance, respectively.

**Table 11.** Standardized regression results of Model (1) using the OLS method.

Variable	Coeff	t-Value	%Weight
Open	0.0450	2.97	4.42
CRH	−0.0224	−1.49	2.20
Size	0.3700	24.31	36.36
ROA	0.2662	24.43	26.16
Cash	−0.0083	−0.77	0.82
Lev	−0.0842	−5.83	8.27
Tax	0.0023	0.29	0.23
MB	0.0703	6.54	6.91
R&D	−0.0109	−1.06	1.07
Age	−0.0248	−1.85	2.44
State	0.0792	5.41	7.78
Inshold	0.0337	3.39	3.31
GDP	−0.0003	−0.03	0.03

## 5. Discussion

In this article, we provide coherent, balanced, and compelling empirical evidence on the positive effect of high-speed railway openings on Chinese public companies' CSR performance. The main findings in this article are solid under several robustness test methods. Our results suggest that participants in the Chinese capital market commonly consider CSR activities to be a valuable way to increase both the shareholder value and the stakeholder value of the company, while investors in the U.S. capital market usually regard CSR as activities for managers to maximize their personal benefits at the expense of shareholders' wealth [9]. The positive connection between a company's information transparency and the firm's CSR activities is consistent with what Zhang et al. [8] discovered in the Chinese capital market, but from a totally different perspective. Besides, from the view of CSR activities, our results also provide a practical application for the argument that the increased information sharing and face-to-face interactions brought by high-speed trains will cause significant influences on regional entrepreneurial activities [28].

Using the standardized regression method, we further provide empirical evidence on the relative explanatory power of high-speed railway openings for listed companies' CSR performance in Table 11. However, it should be noticed that regression coefficients are highly dependent on regression model design and variable selection. Thus, the weight of 4.43% can only be an approximately estimated number. For example, if we choose the original value of a firm's total asset rather than the natural logarithm of firm size and rerun Model (1) using the standardized regression method, then the explanatory power of high-speed railway openings will rise to 6.02%, while the numbers for firm size and return on asset will change from 36.36% and 26.16% to 7.43% and 41.00%, respectively.

A limitation of our study is that from the empirical results, we can only obtain the conclusion that high-speed railway openings do improve public companies' CSR performance through increasing firm-level information transparency. However, because of lacking direct measurement of firm-specific information flows in current studies, we are not able to offer precise data on how much firm-specific information transparency is improved by high-speed railway openings. Using empirical methods, this article sheds lights on a potential direction in evaluating social impacts of high-speed railway openings.

From a broader view, our results imply that in promoting companies' engagement in CSR activities, regulators should put more effort into improving companies' information

disclosure quality and let investors access more firm-specific information more easily. Although useful, high-speed railway opening is still a relatively expensive way to improve information flows of public companies in the Chinese capital market. Thus, regulators can create innovative regulatory systems, such as mandatory CSR information disclosure requirement and CSR-oriented investment education, to achieve their goals.

In the CSR aspect, future research may explore the evaluation of other types of infrastructure investments, such as newly built airports, highways, and subways, as one possible direction, and may also focus on finding new internal channels to explain the socioeconomic impacts brought about by certain kinds of infrastructure. Another possible direction is to further discuss the diversified motivations for CSR activities in different dimensions and to find detailed influential factors in promoting certain kinds of CSR activities.

## 6. Conclusions

In the recent macro-economic environment full of uncertainties, infrastructure plays an important role in promoting China's economic development and forming future social norms, providing plenty of research opportunities in both academic and practical areas. Focusing on Chinese high-speed railway openings and Chinese public firms' annual CSR performance, this paper extends the current literature concerning the micro-level economic consequences brought about by transportation infrastructure investments. Empirical results illustrate that: First, high-speed railway openings have a significantly positive influence on firms' CSR activities. Second, the positive effect is more salient in companies with a poor information environment, indicating that high-speed railway openings can improve information flows and companies' information transparency, further leading to better CSR performance. Third, the results of the mediating effect analysis prove that the increased investor site visit activities brought about by high-speed railway openings is one specific internal channel. The improvement effect of high-speed railway openings is unbalanced among the five CSR dimensions, with the largest effect in the supplier, customer, and consumer responsibility dimension and the smallest effect in the social charitable responsibility dimension.

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## Appendix A

In this section, we provide supplementary information on how Hexun's annual CSR score is constructed. Detailed factors in developing Hexun's CSR score and the calculation weights of each influential factor are presented in Table A1 below. According to Hexun's CSR ranking system, all data required to calculate the CSR score are collected from the public company's annual report and separate CSR report. Original data are further processed and ranked by Hexun's research team before the annual CSR score is released to the market.

**Table A1.** Factors in developing Hexun's CSR score and the calculation weights.

Dimension	Aspect	Factor
Shareholder responsibility (30%)	Profit (10%)	Return on equity (2%)
		Return on asset (2%)
		Operating margin (2%)
		Ratio of profits to cost (2%)
		Earnings per share (1%)
		Undistributed profits per share (1%)
	Debt payment (3%)	Quick ratio (0.5%)
		Current ratio (0.5%)
		Cash ratio (0.5%)
		Debt-to-equity ratio (0.5%)
		Asset-liability ratio (1%)
	Return (8%)	Dividend-to-financing ratio (2%)
		Dividend yield (3%)
		Dividend payout ratio (3%)
	Information disclosure (5%)	Number of penalties imposed by the exchange on the company and related persons taking responsibility (5%)
Innovation (4%)	Product development expenditures (1%)	
	Technology innovation concepts (1%)	
	Number of technological innovation projects (2%)	
Employee responsibility (15%) (The ratio in the consumer industry is 10%)	Performance (5%) (4%)	Per capita income of employees (4%) (3%)
		Employee training (1%) (1%)
	Security (5%) (3%)	Security check (2%) (1%)
		Security training (3%) (2%)
	Caring for employees (5%) (3%)	Consciousness of condolences (1%) (1%)
		Condolences (2%) (1%)
		Consolation expenditure (2%) (1%)

Table A1. Cont.

Dimension	Aspect	Factor
Supplier, customer, and consumer responsibility (15%) (The ratio in the consumer industry is 20%)	Product quality (7%) (9%)	Quality management awareness (3%) (5%)
		Quality management system certificates (4%) (4%)
	After-sales service (3%) (4%)	Customer satisfaction survey activities (3%) (4%)
	Integrity and mutual benefit (5%) (7%)	Fair competitions between suppliers (3%) (4%)
Anti-commercial bribery trainings (2%) (3%)		
Environmental responsibility (20%) (The ratio in the manufacturing industry is 30%) (The ratio in the service industry is 10%)	Environmental governance (20%) (30%) (10%)	Environmental protection awareness (2%) (4%) (2%)
		Environmental management system certifications (3%) (5%) (2%)
		Environmental protection investment amount (5%) (7%) (2%)
		Number of sewage types (5%) (7%) (2%)
		Number of energy saving types (5%) (7%) (2%)
Social charitable responsibility (20%) (The ratio in the manufacturing industry is 10%) (The ratio in the service industry is 30%)	Social value contribution (20%) (10%) (30%)	Income tax to total profit ratio (10%) (5%) (15%)
		Charity donation amount (10%) (5%) (15%)

Data source: [www.hexun.com](http://www.hexun.com), accessed on 28 November 2019.

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