

# *Transport Infrastructure, Internal Controls and ESG Scores*

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**Abstract:** With the rapid economic development of countries, how to incentivise enterprises to practice ESG concepts and improve ESG performance has become a focus of attention. However, existing scholars mostly explore the influencing factors of ESG performance from the aspects of institutional environment and corporate structure, and few scholars start from transport infrastructure to study its impact on corporate ESG performance. Therefore, based on information asymmetry theory, principal-agent theory and stakeholder theory, this paper takes transport infrastructure as the research object to explore the impact of high-speed rail on the ESG performance of Chinese listed companies as a way to promote the sustainable development of enterprises. This paper selects A-share listed companies in Shanghai and Shenzhen from 2011 to 2020 as the research sample, and finds that (1) the opening of high-speed rail will enhance the ESG scores of enterprises. (2) The opening of high-speed railway will improve the ESG scores of enterprises through internal control.

## 1. Introduction

ESG scores are influenced by various macro factors. On the political-social front, Ioannou & Serafeim (2012) found that firms' social performance is poorer when the level of social corruption is high, and is also influenced by factors such as the level of market competition and civil and political rights [1]. Labour protection pairs in turn improve firms' performance in terms of socially responsible performance and internal governance optimisation, thus improving ESG scores [2]. On the economic front, Cai et al. (2016) found that the stage of economic development and the degree of economic development affects firms' ESG scores [3]. On the cultural side, some scholars have found a negative correlation between religiosity and CSR, with higher levels of religiosity being associated with lower levels of ESG, as managers are more concerned with shareholder wealth than other uses of corporate resources [4]. However, few scholars have explored how the transport infrastructure, a macro-factor, affects the ESG scores of firms. Therefore, we take high-speed rail as an example to explore the impact of transport infrastructure on firms' ESG scores.

First, the opening of high-speed rail strengthens the flow of information and promotes the technological upgrading of firms. Second, high-speed rail has the effect of breaking the market segmentation between regions, which can strengthen the economic links between cities along the

route, accelerate the transformation and upgrading of the regional industrial structure, and enable enterprises to absorb the labour force for employment [5]. Finally, the accessibility of transport will enhance the governance ability of independent directors in different places [6], so that corporate governance can better protect the interests of stakeholders.

## 2. ESG Impact Factors and Economic Backwaters: Background to the Literature

Many scholars have studied the micro-influences that affect ESG scores. In terms of external influences, Bosco and Misani (2016) found that cross-listing improves firms' performance in environmental protection and social responsibility fulfilment, but not corporate governance [7]. In addition to the type of listing, some scholars have also examined institutional pressures and found that the institutional environment and institutional pressures affect corporate ESG responsibility practices [8]. There are also scholars who found that in terms of corporate operations, some scholars found that M&A transactions can promote corporate ESG scores [9]. As the research progressed, scholars gradually focused on management and governance configurations, such as the non-linear positive correlation between board network indicators and corporate ESG scores [10].

Numerous scholars have also studied the impact of ESG scores on capital market performance, cost of capital and firm value. Some scholars have found that higher ESG scores can defuse financial risks in a crisis, and portfolios with higher ESG ratings are more risk-resistant, as well as improving corporate performance [11] and increasing corporate value [12]. In addition, higher ESG scores can also reduce the cost of capital of a firm [13], which means that the more money a firm invests in ESG, the smaller its total financial cost will be [14].

## 3. Data and Summary Statistics

### 3.1. Data and Sample

In this paper, A-share listed companies are selected as the research object, and the data from 2011-2020 is selected as the sample. Our sample data comes from China's CNRDS database and CSMAR database, and we have also manually supplemented the relevant data. At the same time, we excluded companies in finance, real estate and other industries as well as samples with missing key variables. The final result is 10072 company-year observations.

The specific variables are as follows:

(1) Company ESG score (ESG): This paper adopts the ESG score published by Bloomberg as the measure of ESG score of the sample companies.

(2) High-speed railway opening (HSR): For listed companies that opened high-speed railways during the sample period, the value is taken as 0 before the opening of high-speed railways, and the value is taken as 1 after the opening of high-speed railways.

(3) In order to control the effect of firm variables on the relationship between HSR openness and ESG scores, which in turn affects the results of the study, firm-level variables such as firm size, financial leverage, firm value, book-to-market ratio, management expense ratio, firm age, cash flow, return on total assets, institutional investor shareholding, and percentage of independent directors on the board of directors are selected, controlling for both industry and year.

### 3.2. Summary Statistics

We performed descriptive statistics and correlation matrix analyses of the variables. Due to space constraints, we do not present them in tabular form.

We find that the difference between the maximum and minimum values of firms' ESG scores is

43.58 and the mean is 27.2, which indicates that the ESG scores of Chinese listed firms are generally low and significantly different in the sample. In the Pearson correlation test, we find that there is no multicollinearity problem among our selected variables.

## 4. Main Results

### 4.1. The effect of high-speed rail opening on ESG scores

This subsection examines how the opening of high-speed rail affects firms' ESG performance. We first introduce our empirical model and then provide the estimation results.

To investigate the link between high-speed railway opening (HSR) and firms' ESG scores, a multivariate linear model was developed.

The estimation results of the hypotheses are presented in Table 1. We find that the coefficient of the impact of the opening of the HSR on ESG scores is positive and significant at the 1% level. This validates our conjecture.

Table 1: The Impact of High Speed Rail Opening on Corporate ESG Performance.

Variables	ESG
HSR	1.1669*** (4.01)
Control variables	YES
Industry fixed effects	
Time fixed effects	

### 4.2. Instrumental variable estimation

According to existing studies, this study adopts the degree of terrain undulation (IV) as an instrumental variable. Firstly, a higher degree of terrain undulation will increase the difficulty of high-speed railway construction, which meets the requirement of instrumental variable correlation; secondly, as an extremely important transport tool, the opening time of high-speed railway is affected by many aspects, and it is difficult for the behaviour of enterprises to influence the opening time and location of high-speed railway. Table 2 presents the results of the two-stage least squares regression (2SLS). The results show that the endogeneity issue does not change our conclusion that the opening of high-speed rail has a positive impact on firms' ESG scores.

Table 2: Instrumental variable estimation

Variables	(1)	(2)
	HSR	ESG
HSR		1.8772*** (0.6227)
IV	-0.1338*** (0.0042)	
Control variables	YES	
Industry fixed effects		
Time fixed effects		

### 4.3. Other robustness tests

We also conducted a series of robustness tests based on previous studies. Due to space

constraints, we do not present the test results in tabular form in the article. The specific test results are as follows:

(1) Adding control variables. We added GDP per capita as a macro-level control variable. It turns out that our conclusions still hold.

(2) A placebo test was conducted. We first randomly selected the same number of samples as the original treatment group from all samples, and then randomly generated the time of high-speed rail opening. We find that the regression coefficients obtained from the randomly sampled group are mainly around in the 0 concentration. This also proves the robustness of our findings.

## 5. Additional analysis

In our previous analyses, we found that the opening of high-speed rail affects firms' ESG scores. In this section, we explore a potential mechanism by which the opening of high-speed rail affects firms' ESG scores - internal controls(IC).

The brain drain triggered by high-speed rail improves the knowledge structure of management, which can improve internal control deficiencies and enhance governance to some extent. Reasonable and effective internal control can improve the efficiency of cooperation between departments and optimise corporate behaviour [15]. However, it is difficult for firms' efforts on ESG scores to directly generate economic gains, and in firms with weak internal control and corporate governance levels, management may focus more on short-term gains, resulting in poorer ESG scores.

In order to empirically explore the above channels, we first collect the internal control index of each enterprise from the China Enterprise Development Index database. Then, we build a mediation effect test model to examine the relevant channels.

It is worth noting that if all the relevant coefficients in the model are significant, the opening of high-speed rail may affect firms' ESG scores through the internal control channel. Table 3 reports the estimation results. The regression results are consistent with our proposed internal control mechanism.

Table 3: Channel testing of internal controls

Variables	(1)	(2)	(3)
	ESG	IC	ESG
HSR	1.207***	0.023***	1.177***
	(3.83)	(2.81)	(4.04)
IC			1.291**
			(2.30)
Industry fixed effects	YES		
Time fixed effects			
Control variables			

## 6. Conclusions

This paper investigates the impact of high-speed railway opening on corporate ESG scores. Using sample data of Chinese listed companies from 2011-2020, we find that the opening of high-speed railways has a positive effect on firms' ESG scores. In addition, instrumental variable estimation based on the degree of terrain relief and other robustness tests also support the causal effect of high-speed railway opening on firms' ESG scores. In addition, we explore two potential channels through which the opening of HSR may affect firms' ESG. We find that the opening of

high-speed rail can indirectly affect firms' ESG scores through internal controls.

Our findings provide a better understanding of the impact of high-speed rail opening. In addition, our study provides a reference for the construction of high-speed rail. This study also has some limitations. This study only considers one channel through which the opening of HSR affects firms' ESG scores. Future research can further explore other possible channels through which the opening of high-speed rail affects firms' ESG scores.

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