Empirical Analysis of the Profitability of Local Corporation Affected by High-speed Railway Opening under the Background of ESG Based on The Multi-period DID Model

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Abstract—With the development of high-speed railway, many scholars had researched about the affection of economic especially on the macroeconomic. However, only a few discuss the relationship between railway and corporation and most focus on innovation capacity and financing capacity in company. Based on the data of listed companies and high-speed railway, the relationship of company profitability and railway under ESG. Through the multi-period double-difference model, we conclude from the regression results. In general, we believe that the opening of high-speed railway has enhanced the company's profitability of the company in big cities, but this is at the cost of the obvious siphon effect of small cities. At the same time, enterprises also need to focus on the relationship between public welfare and corporate profits in this process.

Keywords- high-speed railway; ESG; the multi-period DID Model

1 INTRODUCTION

Since the first opening of Beijing-Tianjin Intercity Railway in 2008, China has constructed the largest high-speed railway network and the longest mileage in railway. In 2020, Chinese government published Report on the Work of the Government In 2020 and mentioned new infrastructure construction in the transport for the first time. The new infrastructure construction includes intercity high-speed railway. The reason why governments develop the construction of high-speed railway is mainly because high-speed railway has accelerated the flow of production factors represented by talents and capital. It also can reduce the cost and time of information circulation, and promote the development and of regional economy especially the local companies. However, there are also some scholars who conclude that the opening of high-speed rail will have a negative effect on local economic development. Moreover, in the context of

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pursuing carbon neutrality, the ESG index became a necessary factor for corporate profit growth. This paper uses empirical analysis to explain whether the opening of high-speed railway has improved the profitability of local enterprises [1].

2 REVIEW

The research on the impact of transportation facilities on the regional economy represented by high-speed rail can be traced back to Fogel [2]. He first analyzed the impact of US railroad construction on economic growth using a quantitative method. Since then, analyzing the impact of transportation facilities on economic development has become a hot topic. Some scholars analyze the impact of transportation infrastructure construction on macroeconomic development [3], and some scholars mainly focus on high-speed rail construction to reduce information asymmetry caused by geographic distance, such as expanding the investment channels of enterprises and investment investors Explain the impact of the opening of high-speed rail on the IPO pricing of Chinese companies and the impact on analysts' forecasting capabilities [4]. It explains from the side the impact of the development of high-speed rail on the profitability of enterprises, but it does not directly point out. Many scholars at home and abroad believe that railway construction is conducive to attracting talents, promoting industrial technology upgrading and innovation, and improving the quality of enterprise development [5] but they did not specify the manpower. How resources affect the company's profitability. There is also the impact of high-speed rail on the innovation ability of enterprises, but it does not explain how innovation ability affects the profitability of enterprises. These studies analyze the impact of transportation facilities represented by high-speed rail on corporate development and macroeconomics from many aspects, but they do not directly explain the correlation analysis between the opening of high-speed rail and corporate profitability.

There are many studies on corporate profitability factors, but the main aspects involved are only based on the analysis of corporate micro-accounting subjects. Many researchers use empirical methods to study the profitability factors of enterprises based on financial indicators that affect the profitability of enterprises. The indicators designed are mainly considered from the aspects of capital structure [6], capital scale, enterprise scale, and growth [7]. Some researchers analyze the profitability of a listed company based on the popular DuPont financial analysis method [8]. Some researchers analyze the profitability of enterprises from the management ability and methods of managers. These indicators are mainly based on the financial performance of listed companies. The report, combined with the financial indicators of the enterprise, makes an empirical analysis and makes recommendations for the corporate asset structure, corporate structure, etc. These analyses are relatively microscopic and do not analyze the impact of corporate profitability from a certain external environment in which the company is located. The factors are not only macro factors such as national policies, but also have a clear relationship with the level of economic development and infrastructure construction where the company is located.

In addition, with the gradual deepening of the carbon neutrality concept, ESG has also become an important measure of the sustainability of corporate development. Environment, social responsibility and corporate governance constitute the core of sustainable finance, namely the three major factors of ESG. During the construction of the highway, the external environment of the society has improved significantly, and the ESG index of the enterprise itself has changed its

relevance. The ESG index released by MSCI has a certain prediction effect for investors. The ESG rating will affect investors ' confidence in the listed companies, thus affecting the stock price, and ultimately acting on the profits of the enterprise [9].

3 THEORETICAL ANALYSIS

This article believes that the opening of high-speed rail further affects the profitability of enterprises by affecting the market and asset composition. We assume that the scope of the sales of the company is only in the form of offline entities, and does not consider the form of online sales. Assuming that the company does not have remote investment, the profitability of the company is not affected by financing such as remote investment. Assume that there is no production innovation in the enterprise in the short term so that the profitability is not affected by the innovation ability.

First, the opening of high-speed rail will affect the market. The opening of high-speed rail will increase the flow of people between cities. After the opening of high-speed rail in local cities, the consumption area of local enterprises will no longer be limited to the local area but will be expanded to cities along the line through high-speed rail. Through high-speed rail, the sales area of enterprises will expand. As a result, it will improve the profitability of the company. Similarly, the opening of high-speed rail will lead to an increase in the flow of local people, which will further promote the increase in sales of local enterprises and ultimately increase profitability. In addition, the opening of high-speed rail can significantly promote the introduction of talents. For companies, it will increase the proportion of human resources, provide companies with sufficient talent reserves, optimize the company’s asset structure, and improve the company’s internal management capabilities and efficiency. Therefore it can reduce the operating cost of the enterprise and improve the profitability of the enterprise. Similarly, on the contrary, if there is a "siphon effect" in a local city, it will hurt the above-mentioned economic benefits, leading to a shrinkage of the corporate market, a decrease in sales, the loss of talents, and ultimately a reduction in the profitability of the company.

In addition, the opening of high-speed railway is related to the strategic deployment of the government, and is bound to affect the local environment through infrastructure and transportation. Therefore, the corresponding government tax policy will also be changed, and these factors will eventually act on the development of enterprises. Assuming a simplest logical model, when the government needs to build a high-speed railway, involving land acquisition, residents compensation, engineering construction expenditure, assuming the local government can not obtain financial support from the superior government, then the local government will tend to adopt stricter tax policies to obtain the part of the income, and the direct net profit and the tax connection. When the government raises the total volume of GDP through improved transportation conditions and has more financial balances, the government tends to adopt looser tax policies to obtain a friendlier friendly business environment[10]. On this basis, if the pollution and waste caused by the main operating income of the enterprise itself is low, the sustainability ability of the enterprise will increase accordingly, although this will not significantly affect the profits in the short term, in the long term, this ESG development model can enhance the stability of the enterprise, ensure that the enterprise can continuously grow and scale, and eventually obtain greater profits.

4 EMPIRICAL ANALYSIS

4.1 Empirical Analysis and Methods

This article attempts to use the multi-period double difference model to construct the impact of high-speed rail on the profitability of local companies before and after the opening. Through the regression results, we mainly conclude: the opening of the high-speed rail helps to increase the profitability for listed companies in key cities. However, there is a negative influence on the companies in non-key cities. This result reflects the siphonic effect between enterprises at all levels of cities brought about by the opening of high-speed rail.

At the same time, ROE and ROA are used to measure the enterprise's operating capability. ROA reflects the profit rate of shareholders and creditors, ROE only reflects the profit rate of shareholders' investment. Therefore, if the enterprise has no debt, ROA and ROE are the same.

4.2 Empirical Models

Among them: i represents the company, t represents the year, ROAi, t represents the return on assets, which reflects the profitability of the company. In this article, this indicator is used as the explained variable. The advantage of ROA is that it comprehensively reflects the profitability of the enterprise. Enterprises create corporate profits through the use of shareholders' equity and the debts of creditors. Rail represents the core explanatory variable, and the high-speed rail is opened. This is a dummy variable. If the city where the company i is located opens the high-speed rail for the first time at time t, the value is 1, otherwise, it is 0. Equity represents the total capital of the listed company. The asset represents the total assets of the listed company. Income represents the operating income of a listed company. GDP indicates the proportion of tertiary industry in the city where the listed company is located in GDP. Science represents the science expenditure of the city, and the formula is science expenditure/financial expenditure. Govern represents the government's ability to intervene in the city and the formula is fiscal revenue/city total GDP.

4.3 Data Sources

The data of corporate financial statements comes from the data of Chinese listed companies in the Wind database (excluding ST companies). The opening time of the high-speed rail comes from the China Transport Yearbook over the years. The city data comes from the China City Yearbook over the years.

4.4 Descriptive Statistics

As shown in Table 1, the number of variables is 16,652, and the data time is from 2004 to 2016. The average value of ROA is 5.388%, and the average value of Rail is 0.4953, indicating that nearly 49.53% of the observations are affected by the opening value of high-speed rail.

TABLE 1. DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	16,652	5.387835	111.5372	-108.5536	14096.36

Year	16,652	2009.983	3.735235	2004	2016
Rail	16,652	0.43178	0.495339	0	1
Equity	16,652	4.00E+09	1.90E+10	-1.70E+10	6.32E+11
Asset	16,652	5.22E+10	5.56E+11	7056828	2.32E+13
Income	16,652	1.01E+10	5.52E+10	-6.86E+08	1.59E+12
GDP	16,652	0.44931	0.1182229	-0.403768	0.8023
Science	16,652	0.03674	0.042283	0	0.368055
Govern	16,652	0.100146	0.0561816	0.0015063	0.6543

5 EMPIRICAL RESULTS

5.1 Regression Model

TABLE 2. REGRESSION MODEL

Explained Variable：Return on Assets（ROA）			
Explaining variable	**Comprehensive level**	**The level of key cities**	**The level of non-key cities**
Rail	1.60907	11.0299***	-2.695353***
	-1.968076	4.269332	-0.8427419
Asset	-10.40867***	-12.51174***	-8.574494***
	-0.9424682	1.467583	-0.4295806
Equity	4.090997***	4.269073***	6.519789***
	-0.6855935	0.9754975	-0.5236733
Income	5.275353***	7.251872***	2.775645***
	-1.018626	1.704727	-0.3923772
Govern	35.37334***	30.22752	-16.50421
	-18.67975	26.59112	-14.60726
Science	-15.44527	-53.20741	-11.82958*
	-21.92817	41.58406	-6.866949
GDP	16.29134***	18.09385	-2.120269
	-7.907629	11.84405	-3.368979
Year	-.1710733***	-1.717141***	——
	-0.2628871	0.5975082	
Cons	372.2184	3477.787***	0.4611459
	-527.0656	1196.094	-6.169193
n	16,115	10194	5,908
R^2	0.0084	0.0081	0.0681
Adj R^2	0.0079	0.0073	0.0669

Table 2 shows the regression data of listed companies in cities at all levels. We found that the core variable in the regression results-the opening of high-speed rail is not significant. We believe that this is because the profits of listed companies in different levels of cities reflect the different results of the opening of high-speed rail. Perhaps companies in some cities have a positive impact on the opening of high-speed rail, while others have a negative impact.

Key cities in this article refer to municipalities directly under the central government, provincial

capital cities, and sub-provincial cities separately listed in the plan (full name: cities separately listed in the national social and economic development plan, including Shenzhen, Dalian, Qingdao, Ningbo, Xiamen), return to the focus city listed company data The results are shown in Table 2. It can be seen that the opening of the high-speed rail has a positive impact on the ROA of listed companies. With other conditions unchanged, after the opening of the high-speed rail in the city where the listed company is located, the return on assets of the listed company increased by 11.03% year-on-year.

Non-key cities refer to prefecture-level cities other than key cities in China. The regression results are shown in Table 2. It can be seen that the opening of high-speed rail has a negative impact on the profitability of non-key cities. Under the premise that other conditions remain unchanged, after the opening of the high-speed rail, the return on assets of local enterprises has become -2.695%, reflecting the siphoning effect between cities, that is, the transfer of resources from non-key cities to key cities.

5.2 Robustness Test

In order to test that the benchmark regression results are not affected by accidental factors, especially for the explained variables, we try to replace other corporate profit indicators. We replace ROA with ROE, comprehensively consider corporate profitability, and perform regression analysis again in Table 3.

TABLE 3. ROBUSTNESS TEST

Explained Variable：Return on Equity（ROE）			
Explaining variable	**Comprehensive level**	**The level of key cities**	**The level of non-key cities**
Rail	-1.897092***	1.927329***	-3.206523***
	0.27397	0.494403	0.504433
Asset	-1.462203***	-1.460056***	-3.162302***
	0.136014	0.169951	0.257131
Equity	1.17392***	1.542219***	3.719302***
	0.098247	0.112966	0.313451
Income	1.307601***	.9015147***	1.471724***
	0.14701	0.197413	0.234862
Govern	20.52216***	20.32891***	-43.49236***
	2.60465	3.079341	8.743353
Science	6.249092**	-17.48951**	1.481447
	3.119385	4.815574	4.110296
GDP	9.216317***	10.59399***	-1.22636
	1.141296	1.371581	2.016543
Year	-.1710733***	-.7188173***	——
	-0.26289	0.069194	
Cons	-16.02745***	1429.273***	-28.3384
	1.972131	138.5117	3.692645
n	16,115	10194	5,908
R^2	0.0269	0.037	0.0593
Adj R^2	0.0265	0.0362	0.0582

At the comprehensive level, we changed the return on assets to the return on net assets, and the regression result changed from a positive effect to a negative effect. This shows that on the whole, after the opening of the high-speed rail, most of the resources are transferred to A small number of key cities have led to a decline in the overall profitability of listed companies in non-key cities, thus showing a negative effect on the whole.

For key cities, the impact of high-speed rail on corporate profitability is consistent with the benchmark regression results. The opening of high-speed railway has a positive impact on the profitability of enterprises in key cities. After the opening of the high-speed rail, it is a stimulus for listed companies, and other conditions remain unchanged. Under the circumstances, the return on net assets of listed companies rose by 1.927%.

For non-key cities, the results are also consistent with the benchmark regression results, still, a negative effect, reflecting the loss of resources in non-key cities caused by the opening of high-speed rail, and further reflecting the siphoning effect between cities. Under the premise that other conditions remain unchanged, after the opening of the high-speed rail, the return on net assets of listed companies in non-key cities has dropped by 3.207%.

6 CONCLUSION AND ADVICE

Through the multi-period double-difference model, we conclude from the regression results that the opening of high-speed rail has a positive impact on listed companies in key cities. The opening of high-speed rail can effectively promote the profitability of locally listed companies. However, for companies listed in non-key cities, this is a negative impact. The opening of high-speed rail will reduce the profitability of local enterprises. We believe that this observation reflects the siphonic effect between cities at different levels in China. To be specific, the opening of high-speed rail causes the transfer of resources from non-key cities to key cities, which is reflected in the profitability of listed companies. We believe that the resources transferred through the opening of the high-speed rail are mainly human resources represented by talents. The main purpose of the opening of the high-speed rail is to reduce travel costs and time between cities. The most important manifestation is population mobility. The flow of talents has taken away a lot of resources in second and third-tier cities and also provided resources for listed companies in key cities. Therefore, local governments should fully consider the impact of the opening of high-speed rail on the profitability of local enterprises.

At the same time, enterprises should also actively consider their own level of ESG, combined with the relevant government policies around the opening of high-speed railway, actively carry out enterprise upgrading and transformation, seize environmental opportunities, integrate human resources, standardize the corporate governance system, especially for listed enterprises, the influence of ESG index on the stock price is gradually deepening. In the context of ESG, enterprises should fully consider environmental and social factors, so that the growth of enterprise profitability is sustainable in the long term.

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