The Impact of the Belt and Road Initiative on the Investment Efficiency of Enterprises

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Abstract. As a national-level top-level cooperation strategy, the Belt and Road Initiative's impact on the investment efficiency of enterprises is an important micro-dimension for measuring its economic effects. This paper constructs a two-dimensional empirical framework of 'holistic-heterogeneous' based on the residual model of Richardson (2006) to systematically examine the impact of the 'Belt and Road' policy on the investment efficiency of enterprises and its differentiated effects. The research results show that: First, the 'Belt and Road Initiative' policy significantly enhances the investment efficiency of enterprises; Secondly, there is obvious heterogeneity in policy effects. Based on the research conclusions, this paper provides countermeasures and suggestions for improving the investment efficiency of enterprises under the background of the 'Belt and Road Initiative' from different aspects.

Keywords: The Belt and Road Initiative; Enterprise investment efficiency; Richardson residual model; Enterprise growth cycle;

1 Introduction

In the 2014 government work report, the 'Belt and Road Initiative' was proposed and officially implemented as a national policy. The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China proposed to build a new system for a higher-level open economy and promote high-quality development of jointly building the 'Belt and Road Initiative'. The proposal of the Belt and Road Initiative represents the deepening of economic cooperation between China and the countries along the Belt and Road. At the same time, it is also an important measure to build a new type of international relations and makes significant contributions to promoting industrial upgrading and technological innovation (Li, 2020) [1]. The economic effects of the Belt and Road Initiative have drawn worldwide attention. As a national-level top-level cooperation initiative, the launch and implementation of the 'Belt and Road Initiative' undoubtedly have a profound impact on economic output. The output of micro enterprises is an important component of economic output. With the continuous development of promoting the joint construction of the 'Belt and Road Initiative', the economic effects brought about by this policy have also received extensive attention from both the theoretical and practical circles (Zhong et al., 2024) [2]. Research findings indicate

X. Pan et al. (eds.), *Proceedings of the 2026 11th International Conference on Financial Innovation and Economic Development (ICFIED 2026)*, Advances in Economics, Business and Management Research 382,
https://doi.org/10.2991/978-94-6239-642-5_21

that the Belt and Road Initiative is conducive to enhancing the level of enterprises' outbound investment, promoting enterprise upgrading, improving the innovation level of enterprises, reducing the risks of outbound investment, enhancing the information efficiency of the capital market, and increasing the capacity utilization rate of enterprises. The efficiency of enterprise investment is directly related to the enhancement of enterprise value. During the period of economic transformation in our country, listed companies generally have inefficient investment phenomena such as underinvestment and over-investment. Then, can the ‘Belt and Road Initiative’ policy also help enterprises truly improve their investment efficiency? Reduce the situations of underinvestment and investment redundancy?

2 Literature Review and Related Studies

This article is based on Liu Jintao et al. (2025) [3], ‘Green Investment Efficiency and Green Economic Development: Three documents, namely ‘Evidence from the Belt and Road Initiative’, Ma Linyan (2025) [4] ‘Research on the Risks of China's Direct Agricultural Investment in Countries along the Belt and Road Initiative’, and Zhong Yunjia (2024) "The Belt and Road Initiative, Institutional Distance and High-Quality Investment", sort out the research context from dimensions such as the direct correlation between policies and investment efficiency, and point out the current research deficiencies and future directions. Provide theoretical references for subsequent research.

Existing literature generally holds that the ‘Belt and Road Initiative’ policy has a significant positive impact on the investment efficiency of enterprises through the release of policy signals and the optimization of the institutional environment. However, the intensity of the impact varies depending on the policy stage and investment field (Zhong et al., 2024) [2]. However, due to the moderating effect of institutional distance, policies have a "corrective effect" on efficiency: The Belt and Road Initiative has reduced the uncertainty brought about by institutional distance by signing bilateral investment agreements (over 200 have been signed by 2024) and establishing dispute settlement mechanisms. Empirical evidence shows that in host countries with large institutional distances (such as Central and Eastern European countries), policies can increase the efficiency of enterprise investment by 15% to 20%. In countries with smaller institutional distances (such as Southeast Asian countries), the marginal effect of policies is weaker (Zhong et al., 2024) [2].

Of course, the existing research has certain deficiencies, such as an imbalance at the research level: most of the existing research focuses on the national/regional level (such as Liu Jintao et al., Ma Linyan), lacking empirical evidence at the micro level of enterprises, such as micro data on the investment efficiency of listed companies, making it difficult to reveal the differentiated impact of policies on different enterprises. At the same time, there is the problem of uneven coverage in various fields: there are many existing studies on green investment and agricultural investment, but insufficient research on investment efficiency in other fields such as manufacturing and services, and there is a lack of cross-field comparative analysis.

In future research, we will deepen at the micro level: based on the specific data of listed companies, we will empirically analyze the impact of the 'Belt and Road' policy on the investment efficiency of enterprises, with a focus on the heterogeneity of enterprise ownership, scale, and industry, such as the differences between state-owned enterprises and non-state-owned enterprises. At the same time, expand the mechanism and dynamic effect expansion. For instance, explore by different growth stages that the Belt and Road policy has improved the investment efficiency of enterprises at different growth cycles.

3 Research Hypotheses

Richardson (2006) proposed the residual measurement model, which can effectively solve the problem that investment efficiency cannot be quantitatively analyzed. This model estimates the optimal investment situation of the enterprise in the current period by analyzing the relevant financial indicators within the enterprise. The efficiency value of enterprise investment is estimated by comparing the actual investment level with the optimal investment level (Li, 2020) [1]. This paper takes the impact of the "Belt and Road Initiative" policy on the investment efficiency of enterprises as the core. Centering on four research hypotheses, it adopts the logical chain of 'construction of expected investment model→measurement of investment efficiency→panel regression test', and combines the residual measurement model and heterogeneity analysis of Richardson (2006) to systematically verify the policy effect. The impact of the "Belt and Road Initiative" policy on the investment efficiency of enterprises is verified through the regression results of four hypotheses.

Most of the existing studies on the 'Belt and Road Initiative' and enterprise investment efficiency adopt single indicators such as 'investment scale/return on investment', making it difficult to distinguish the heterogeneous impacts of 'underinvestment' and 'investment redundancy'. This paper strictly adheres to Richardson's (2006) residual model. By constructing an expected investment function, the definition of investment efficiency is transformed into "the residual between actual investment and expected investment". This not only quantifies the level of investment efficiency but also accurately identifies inefficient investment types as insufficient or redundant, making the mechanism analysis of policy effects more targeted.

This paper takes the impact of the 'Belt and Road' policy on the investment efficiency of enterprises as the core and constructs a two-dimensional research framework around 'overall effect - heterogeneous characteristics'. The explained variable of enterprise investment efficiency refers to the residual measurement model of Richardson (2006). First, the 'expected investment model' (with various financial data of the enterprise as the explanatory variables) is constructed, and then the investment efficiency is measured by the 'absolute value of the residual between actual investment and expected investment' (the smaller the residual, the higher the efficiency). Meanwhile, the absolute value of the residuals is further taken to test the two-way improvement effect of the policy on inefficient investment. The moderating variables include enterprise ownership (state-owned enterprises/non-state-owned enterprises), growth cycle (growth

stage/mature stage/decline stage), and regional differences (enterprises in the south/north), which are used to test the heterogeneity effect. Control variables cover all financial indicators of the enterprise to eliminate the interference of other factors on investment efficiency. Based on this framework, this paper systematically examines for the first time the heterogeneous effects of the 'Belt and Road Initiative' policy on enterprises of different ownerships and at different growth stages, filling the research gap in 'policy-enterprise individual differences' and making the conclusions more targeted and of practical guiding value. This article not only answers the question of whether the policy is effective, but also reveals how it is effective and for whom it is more effective, forming a complete chain of policy effect evidence and providing theoretical support and policy reference for high-quality investment along the Belt and Road Initiative.

This article forms a progressive research framework around four hypotheses:

H1 (Overall Effect): First, verify whether the policy is 'effective' on investment efficiency;

H1.a, H1.b, H1.c (Heterogeneous effects): Finally, focus on 'who is more effective' to reveal the individual differences in policy effects.

3.1 H1: the Belt and Road Initiative has Significantly Enhanced the Efficiency of Enterprise Investment

The core of this assumption is the 'overall improvement of investment efficiency', which is measured in this paper by the "absolute value of investment efficiency residuals" (the larger the absolute value of the residuals, the lower the investment efficiency). The Belt and Road Initiative has created a broader market space and more investment opportunities for enterprises by strengthening infrastructure connectivity and promoting trade and investment liberalization and facilitation. Enterprises can allocate resources more effectively, improve the efficiency of fund utilization, and thereby significantly enhance investment efficiency. For instance, some enterprises have responded to the 'Belt and Road Initiative' by making strategic layouts in co-construction countries. Through international production capacity cooperation, they have reduced production and transportation costs, shortened delivery cycles, and thereby increased their return on investment. This assumption verifies whether the Belt and Road Initiative had led to a decline in the 'overall degree' of enterprises' deviation from the optimal investment level, without distinguishing the 'deviation direction' (whether there is insufficient or redundant investment).

3.2 H1.a: The Belt and Road Initiative had a Stronger Effect on Improving the Investment Efficiency of State-Owned Enterprise

State-owned enterprises and non-state-owned enterprises differ in terms of enterprise nature, resource endowment, business goals, etc. The impact of the 'Belt and Road' policy on their investment efficiency may also vary. State-owned enterprises have advantages in terms of policy support and financial strength, which may be more conducive to taking advantage of the opportunities of the 'Belt and Road Initiative' for large-

scale overseas investment and infrastructure construction, thereby improving investment efficiency. Non-state-owned enterprises have more advantages in terms of market flexibility and innovation capabilities. They can adapt to the market demands of countries along the Belt and Road Initiative more quickly, find investment opportunities in some emerging industries and service sectors, and improve investment efficiency. Therefore, the 'Belt and Road Initiative' policy may significantly improve the investment efficiency of state-owned enterprises and non-state-owned enterprises, and the degree of improvement for the two may vary.

3.3 H1.b: The Belt and Road Initiative has Significantly Improved the Investment Efficiency of Mature and Growth-Stage Enterprises

Enterprises at different growth stages have different investment demands and characteristics. For enterprises in the growth stage, the market expansion opportunities and resource integration platforms brought by the 'Belt and Road' policy can help them obtain more financial and technical support, accelerate their growth and development, and improve investment efficiency. For mature enterprises, policies can prompt them to expand overseas markets, seek new profit growth points, prevent them from falling into investment rigidity, and enhance investment efficiency. For enterprises in the decline stage, the Belt and Road Initiative may offer them opportunities for industrial transfer and transformation and upgrading. By seeking new investment projects and cooperation opportunities in countries along the routes, they can achieve a second round of entrepreneurship and improve investment efficiency. Therefore, the 'Belt and Road' policy has an improving effect on the investment efficiency of enterprises at different growth stages.

3.4 H1.c: The Belt and Road Initiative had a Stronger Effect on Improving the Investment Efficiency of Enterprises in the North

The Belt and Road Initiative (BRI) demonstrates a markedly stronger effect on improving investment efficiency for northern enterprises, rooted in structural economic disparities and region-specific constraints. Northern firms, traditionally encumbered by severe overcapacity in heavy industries and saturated domestic markets, exhibit acute sensitivity to BRI-enabled market diversification. The initiative's infrastructure connectivity and trade facilitation disproportionately alleviate these region-specific bottlenecks, enabling more efficient capital allocation toward productive overseas ventures. Additionally, BRI's institutional opening—compelling adherence to international standards in governance and risk management—catalyzes endogenous productivity gains within often state-owned northern enterprises, mitigating agency inefficiencies. This exogenous shock effectively accelerates marketization reforms where domestic policies have plateaued. Empirically, BRI functions as a regional leveling mechanism: by amplifying marginal returns precisely where capital misallocation is most severe, it redistributes growth opportunities northward, thereby contributing to balanced national development while enhancing firm-level investment efficiency through competitive discipline and expanded market access.

4 Experimental Design

4.1 Positivism Model

$$Invest_{i,t}=\beta_0+\beta_1 Time*Treat_{i,t}+\gamma\times ControlVariables_{i,t}+\varepsilon_{i,t}$$

In this model, $Invest_{i,t}$ represents an enterprise i In t Indicators related to the investment efficiency of the period. β_0 is the intercept term, it reflects the basic level of enterprise investment efficiency when the related factors of the "Belt and Road Initiative" and control variables are not taken into account. β_1 is the coefficient of the core explanatory variable, it is used to measure the extent to which the "Belt and Road" policy (reflected by $Time*Treat_{i,t}$) affects the investment efficiency of enterprises. Among them, It is a virtual variable. If the time was in 2014 (the year the Belt and Road Initiative was proposed) and later, Time=1, otherwise, time=0, $Treat_{i,t}$ is also a virtual variable, if the enterprise is related to the "Belt and Road Initiative", $Treat_{i,t}$=1, otherwise, $Treat_{i,t}$=0, $Time*Treat_{i,t}$ is the interaction item, it is used to capture the specific impact of the implementation of the "Belt and Road" policy on the investment efficiency of enterprises related to the "Belt and Road". γ is the coefficient vector of the control variable and $\varepsilon_{i,t}$ is the random error term.

4.2 Explained Variable: Investment Efficiency

Referring to the residual measurement model of Richardson (2006), by constructing an expected investment model, the difference between the expected investment and the actual investment of the enterprise is used to measure the investment efficiency of the enterprise. Among them, if the residual is greater than 0 ($\varepsilon_t>0$), it indicates that the enterprise has excessive investment, if ε_t is less than 0, it indicates that the enterprise has insufficient investment. The absolute value $|\varepsilon_t|$ represents the investment efficiency of the enterprise.

$$INV_{i,t}=\alpha_0+\alpha_1*Growth_{i,t-1}+\alpha_2*LEV_{i,t-1}+\alpha_3*CF_{i,t-1}+\alpha_4*ROA_{i,t-1}+\alpha_5*A_{i,t-1}+\alpha_6*FA_{i,t-1}$$
$$+\alpha_7*REV_{i,t-1}+\alpha_8*AGE_{i,t-1}+\sum Industry+\varepsilon_{i,t}$$

Among them, the calculation formula for the investment level $INV_{i,t}$ is: Investment level $INV_{i,t}$= (cash paid for constructing fixed assets, intangible assets and other long-term assets-cash recovered from disposing of fixed assets, intangible assets and other long-term assets)/Total assets at the beginning of the year.

4.3 Explanatory Variable: The Timing and Target of the "Belt and Road Initiative" Policy

'treat' is a dummy variable for "Belt and Road" participating enterprises. Listed companies in the "Belt and Road" concept section of Tonghuashun are 'Belt and Road'

participating enterprises, with a value of 1, while the rest are non-participating enterprises, with a value of 0. time is a dummy variable for time, and it is 1 for the year 2014 and subsequent years.

4.4 Main Variable Settings and Explanations

Table 1 presents the abbreviations and detailed explanations of all the variables used in this study.

Table 1. Main variable settings and explanations

Types of variables	Variable symbol	Definition
dependent variable	INV	(Cash paid for fixed assets, intangible assets and other long-term assets - Cash recovered from the disposal of fixed assets, intangible assets and other long-term assets)/ Total assets at the beginning of the year
	Invest	The absolute value of the residuals in Model 3.2 is greater than 0 indicates that the enterprise has made excessive investments; If the residual is less than 0, it indicates that the enterprise's investment is insufficient.
independent variable	Time*Treat	Listed companies in the 'Belt and Road' concept sector are 'Belt and Road' supported enterprises, with a value of 1, and the rest are set to 0. time is a dummy variable for time, and it is 1 for the year 2014 and subsequent years
Types of variables	Variable symbol	Definition
control variable	A	Logarithm of total assets
	LEV	The ratio of total liabilities to total assets
	CF	The ratio of cash flow from operating activities to total assets at the beginning of the year
	FA	The ratio of fixed assets to total assets at the beginning of the year
	ROA	Earnings before interest and taxes *2/ (Beginning of the period + Total assets at the end of the period)
	GROWTH	Year-on-year growth rate of operating income
	AGE	Corresponding date-The date of the company's listing
	REV	The total economic inflow obtained by an enterprise through conducting core business activities within an accounting period, without deducting relevant costs and expenses

5 Experiments

5.1 Data Acquisition and Sample Selection

The data in this study mainly comes from the Eastmoney Choice financial data terminal. As an authoritative financial data service platform in China, this terminal has comprehensive coverage, including data of listed companies in major global capital markets such as the Shanghai and Shenzhen A-shares, Hong Kong stocks, and the US stock market.

The sample selection period for this study was from January 1, 2010 to December 31, 2020. The sample subjects were A-share companies that were continuously listed and traded on the Shanghai Stock Exchange and the Shenzhen Stock Exchange during this period.

To avoid the interference of abnormal samples on the research conclusion, this study screened the initial samples according to the following criteria, and finally obtained valid samples that met the research requirements: excluding financial listed companies and abnormal company samples that had been treated with ST or ST* during the exclusion period.

To ensure the standardization and timeliness of industry classification, this study adopted the latest industry classification standards issued by the China Securities Regulatory Commission (as of the date of data collection for the study, the current latest standard is the 'Guidelines for Industry Classification of Listed Companies (Revised in 2012)') to classify the sample companies by industry.

Through the above data acquisition, sample scope definition, screening condition setting and industry classification, the final samples obtained in this study have the characteristics of accurate data, strong representativeness and high validity, which can provide a solid foundation for subsequent empirical analysis and research conclusions.

5.2 Descriptive Statistics

5.2.1 Residual Bar Chart.

The horizontal axis in Figure 1 represents the residuals and the vertical axis represents the frequencies. The residual distribution roughly follows a normal distribution, with the peak approaching point 0, indicating that the residuals of most enterprises are concentrated around 0. Overall, there is no significant absolute advantage difference in the number of enterprises that underinvest and those that overinvest, and the overall investment behavior is relatively balanced.

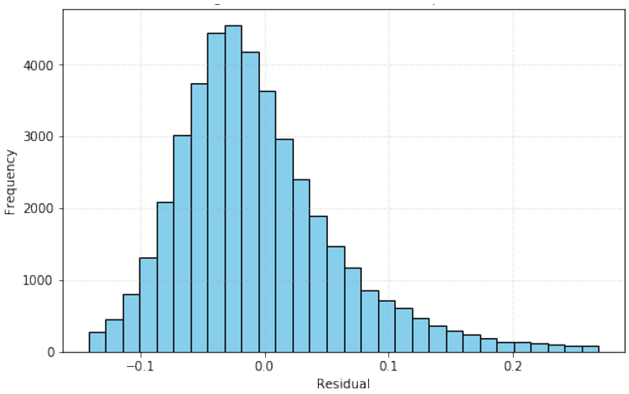

Fig. 1. Residual bar chart

5.2.2 Residual Comparison Line chart of the Belt and Road Initiative and non-Belt and Road Initiative.

As illustrated in Figure 2, before 2013, although the residual values of the two types of enterprises fluctuated, the gap was not very obvious. However, after 2013, especially in the later period, the gap in residual values between 'Belt and Road' enterprises and non- 'Belt and Road' enterprises gradually widened.

This further indicates that after the implementation of the 'Belt and Road Initiative', enterprises along the 'Belt and Road' have achieved greater improvements in investment efficiency compared to those outside the 'Belt and Road'.

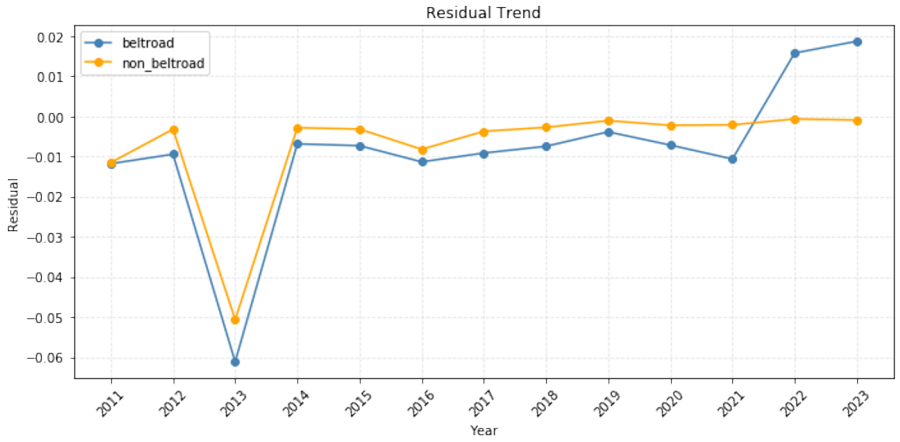

Fig. 2. Residual comparison line chart of the Belt and Road Initiative and non-Belt and Road Initiative

5.3 Correlation Test and Analysis

To ensure the rationality of the regression model setting and the validity of the estimation results, this study first conducted correlation tests on all core explanatory variables, explained variables and control variables included in the panel regression, and focused on investigating multicollinearity problems. From the results of the correlation test, it can be seen that the absolute values of the correlation coefficients among all variables are lower than 1, and the correlation coefficients among most variables are at a relatively low level, indicating that there is no significant linear correlation among the variables.

Therefore, all the variables included in the regression in this study meet the prerequisite conditions of 'no strong correlation and no multicollinearity'. There is no problem of estimation bias or significance distortion of regression coefficients due to information overlap among dependent variables. All variables can be officially included in the subsequent panel regression model for empirical analysis.

5.4 Panel Regression Results

Table 2. Panel regression results of H1 and H1.a

Variables	**(1)**	**(2)**	**(3)**
	All companies	**state-owned**	**non state-owned**
Time_Treat	-0.0152*** (-8.4846)	-0.0192*** (-6.1489)	-0.0106*** (-3.2116)
A_log	-0.0063*** (-12.594)	0.0019 (1.2130)	-0.0103*** (-9.8127)
LEV	6.469e-5*** (6.7650)	4.115e-05 (1.3710)	6.137e-05*** (4.7471)
ROA	0.0001*** (7.3698)	6.066e-05 (1.1475)	0.0002*** (4.1062)
CF	-3.835e-07** (-2.3332)	-2.42e-07 (-0.8217)	6.833e-07 (1.0101)
Variables	**(1)**	**(2)**	**(3)**
	All companies	**state-owned**	**non state-owned**
FA_log	-1.246e-05 (-0.0596)	-0.0015** (-2.3047)	0.0010* (1.6560)
Growth	8.901e-07 (1.3284)	-1.074e-06 (-0.4581)	1.128e-06 (1.2683)
REV_log	-0.0025*** (-8.9165)	-0.0071*** (-7.4083)	0.0005 (0.6855)
AGE	0.0009*** (9.5808)	0.0002 (0.8054)	0.0011*** (6.2055)
Proportion of independent directors	0.0046 (0.7970)	-9.976e-05 (-0.0098)	0.0078 (0.8786)

Proportion of the top ten shareholders	4.701e-05* (1.7722)	-3.106e-05 (-0.4233)	5.905e-05 (1.1995)
Pb	-2.022e-06 (-0.2663)	2.041e-05 (1.4656)	-2.744e-05** (-2.5434)
constant	0.1947*** (19.299)	0.0979*** (3.3399)	0.2353*** 11.382

5.4.1 For H1.

In the assumption that 'the Belt and Road Initiative significantly enhances the investment efficiency of enterprises', the panel regression results shown in Table 2 are as follows: After taking the absolute value of the residual, the larger the value, the worse the investment efficiency; the closer it is to 0, the higher the efficiency. That is, the stronger the influence of policies, the smaller the absolute value of the residual. In terms of significance and correlation, the coefficient of the Time_Treat variable is -0.0152 and the p value is 0.0000. A negative coefficient sign indicates that the "Belt and Road" policy has a positive impact on the investment efficiency of Belt and Road enterprises: after the policy was proposed, the investment efficiency of these enterprises has significantly improved (the absolute value of the residual has decreased). The magnitude of the coefficient: It quantifies the extent of this improvement. The larger the absolute value, the stronger the policy's effect on enhancing investment efficiency (that is, the greater the reduction in the degree of deviation from the optimal investment level).

5.4.2 For H1.a.

For state-owned enterprises, the panel regression result coefficient is -0.0192 and the p value is 0.0000, indicating that the Belt and Road policy has a significant positive impact on their investment efficiency. For non-state-owned enterprises, the panel regression result coefficient is -0.0106 and the p value is 0.0013. After the implementation of the policy, the investment efficiency of non-state-owned enterprises has also improved. When comparing the two, the possible reasons for this difference are as follows: Firstly, from the perspective of enterprise management: State-owned enterprises usually have relatively complete decision-making processes and strict approval systems, which give them a unique advantage in the investment of 'Belt and Road' projects. Facing the complex political, economic and social environment of the countries along the route, state-owned enterprises can make more stable investment decisions through rigorous feasibility studies, risk assessments and other procedures, reducing the probability of investment mistakes. Secondly, from the perspective of the identity of state-owned enterprises: As important executors of national strategies, state-owned enterprises have received strong support from the government in the 'Belt and Road' policy. The government will offer certain policy preferences to state-owned enterprises in terms of project approval, capital financing and tax benefits, which will help them reduce investment costs and improve investment efficiency.

Table 3. Panel regression results of H1.b and H1.c

Variables	(3)			(4)	
	growth period	mature period	degenerating period	Southern Enterprises	Northern enterprises
Time_Treat	-0.0141* (-2.6684)	-0.0164*** (-4.9834)	-0.0129*** (-3.2356)	-0.0137*** (-4.3754)	-0.0168*** (-5.1802)
A_log	-0.0086*** (-5.3637)	-0.0017 (-1.2693)	-0.0093*** (-5.6984)	-0.0072*** (-6.8737)	-0.0039** (-2.4560)
LEV	0.0001 (3.1998)	6.637e-05** (2.1176)	4.417e-05*** (2.5791)	7.241e-05*** (4.1756)	5.557e-05*** (4.2369)
ROA	0.0001** (2.4125)	0.0003*** (4.1768)	0.0001** (2.1914)	0.0002*** (3.6874)	0.0001* (1.8794)
CF	-3.749e-06 (-1.2556)	6e-08 (0.2262)	-5.449e-07** (-2.0770)	-6.194e-07* (-1.8100)	-2.309e-07 (-0.7308)
FA_log	0.0008 (1.1727)	-0.0014** (-2.4194)	0.0018* (1.9121)	0.0007* (1.7493)	-0.0013 (-1.4416)
Growth	-9.647e-07 (-1.6379)	2.118e-06** (3.1462)	-1.022e-06 (-0.8037)	1.241e-06 (1.4581)	-4.051e-06 (-1.1483)
REV_log	-0.0022* (-1.9521)	-0.0049*** (-6.2449)	0.0010 (0.8942)	-0.0025*** (-3.7335)	-0.0028 (-2.6005)
AGE	0.0010*** (3.5359)	0.0008*** (4.3435)	0.0006*** (2.6985)	0.0011*** (7.3215)	0.0005** (1.9620)
Proportion of independent directors	-0.0012 (-0.0857)	-0.0024 (-0.2323)	0.0196 (1.4316)	0.0051 (0.6027)	0.0024 (0.2136)
Proportion of the top ten shareholders	-2.44e-05 (-0.3303)	2.733e-05 (0.4436)	3.144e-05 (0.4845)	9.709e-05** (2.0453)	-6.851e-05 (-1.0722)
Pb	-2.861e-06 (-0.1506)	1.255e-05 (0.4889)	2.436e-06 (0.0845)	4.196e-06 (0.2537)	-3.929e-05 (-1.1085)
constant	0.2410*** (7.8833)	0.1324*** (4.8821)	0.2118*** (7.3594)	0.2051*** (10.084)	0.1653*** (5.5600)

5.4.3 For H1.b.

The growth cycle of an enterprise is a dynamic and evolving process. According to the formula "enterprise growth stage = Net operating cash flow/net profit", the growth stage of an enterprise can be defined as the growth stage (0< ratio <1), the maturity stage (ratio >1 and stable), and the decline stage (ratio decline or turn negative) based on the magnitude of this ratio. Each of these stages has its own characteristics and development patterns, driven not only by technological, market and management factors, but also influenced by the external environment and policy support (Mi, 2025) [5]. Through the classification of these three types of enterprises and panel regression, the results obtained are: The Belt and Road policy has improved the investment efficiency

of all three, but to different degrees The coefficient in the mature stage, as shown in Table 3, is -0.0164, which shows the strongest improvement. After the policy, the 'absolute value of the residual of investment deviation from the optimal level' of mature enterprises decreased by an average of 0.0164, making it the group with the largest reduction in deviation degree among the three cycles and the most significant improvement in investment efficiency. The coefficient in the growth stage is -0.0141. Its improvement is moderate. After the policy, the absolute value of the residual of enterprises in the growth stage decreased by an average of 0.0141. The decline in the degree of deviation was smaller than that in the mature stage but greater than that in the decline stage. The improvement in investment efficiency was at an intermediate level. The coefficient in the recession period is -0.0129, and its improvement is the weakest. After the policy, the absolute value of the residual of enterprises in the recession period decreased by an average of 0.0129, which is the group with the least degree of deviation among the three cycles. Although the investment efficiency has improved, the improvement is relatively limited.

The "Belt and Road" policy improves investment efficiency most visibly for mature firms: their strong cash flows and high credit ratings let them absorb and deploy the newly available capital quickly, while stable market shares and deep industry knowledge keep their projects close to the optimal scale. Growth-stage companies, though offered the same financing windows, still face binding internal liquidity shortages and managerial immaturity; consequently, their expansion plans remain capital-rationed and error-prone, muting the policy's impact. Decline-stage firms, pressured by shrinking product markets, technological obsolescence and talent flight, find even preferential funding insufficient to offset structural downturns, so the initiative's marginal gain in investment efficiency is weakest for them.

5.4.4 For H4.

For the regression results of the investment efficiency of enterprises in the north and south, the result for enterprises in the south is: significant, with a coefficient of -0.0137. The result of the northern enterprise is: significant, with a coefficient of -0.0168. According to the previous analysis, it can be known that a negative coefficient and a larger absolute value indicate that the policy has a stronger effect on improving investment efficiency. Meanwhile, to rule out the possible reason for the significant improvement in investment efficiency in the north due to its lower starting point, this section takes the average of the investment efficiency of enterprises in the north and south before 2013 and finds that the difference is negligible. Therefore, this interfering factor is excluded (as shown in the Figure 3). Therefore, from the coefficients of the regression results, it can be known that the Belt and Road policy has improved the investment efficiency of northern enterprises more than that of southern enterprises. This might be because: Firstly, in terms of geographical location and transportation, with the advancement of the 'Belt and Road Initiative', land transportation, due to its low cost and convenience, has gradually become the core link connecting various regions. The northern railway transfer centers led by Shenyang, Beijing and Shijiazhuang have played a key role. Secondly, in terms of industrial structure characteristics, as China's economy tran-

sitions from a high-speed growth stage to a high-quality development stage, the industrial structure in the northern region has gradually solidified (Zhao, 2023) [6]. Traditional heavy industry and basic manufacturing still account for a relatively large proportion in the industrial structure. These industries have strong adaptability in the infrastructure construction of the countries along the Belt and Road. Ultimately, it might be due to the policy support intensity and focus being more on the northern regions. During the policy implementation process, the support intensity and focus for the northern regions might have been somewhat inclined. As a result, although the northern manufacturing industry has a comparable understanding of industrial design to that of the southern manufacturing industry, most enterprises in the north have been exposed to certain aspects such as industrial design much earlier than those in the south. It has brought certain inherent advantages to enterprises in the north (Jia, 2006) [7].

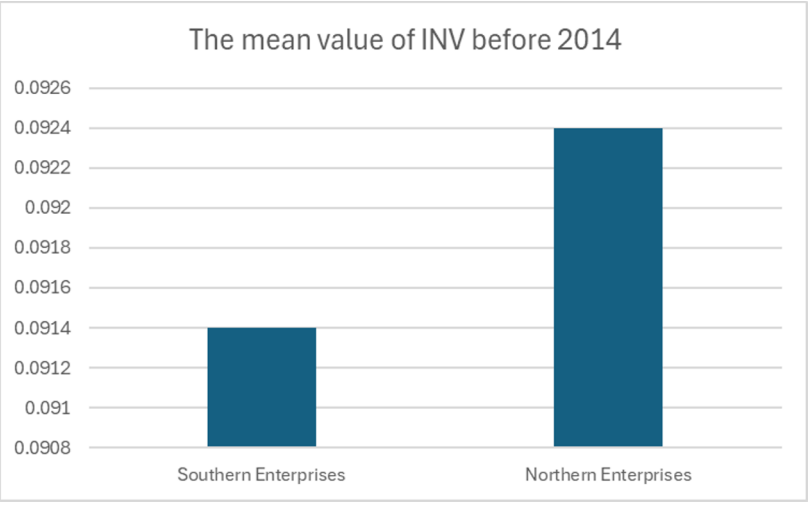

Fig. 3. A comparison of the average investment efficiency of enterprises in the North and South before 2014

6 Summary and Suggestions

6.1 Suggestions based on the Differences in Investment Efficiency Improvement Between State-Owned Enterprises and Non-State-Owned Enterprises

To close the SOE–non-SOE efficiency gap, (i) upgrade the "going-global" portal: add country-level industry maps, white-lists, risk alerts and an expert-training forum, plus overseas physical desks that match projects and settle disputes for private firms. (ii) Light the "credit lamp" [8]: create a private-sector internationalisation fund, low-interest loans, export-credit insurance, dedicated bank quotas at preferential rates, and include private cross-border ABS in Bond Connect to widen funding sources. (iii) Institutional redesign [9]: publish detailed BRI tax-relief rules and streamlined approval

guides for non-SOEs, cut administrative hurdles and raise outbound-investment convenience.

6.2 Improvement in Investment Efficiency based on Different Growth Cycles

As an enterprise grows, its financing needs and options are constantly changing. Therefore, targeted and differentiated policies should be formulated according to the different growth cycles of enterprises (Mai, 2005) [10]. Firstly, for growth-stage enterprises, they already have their own technologies and products. At this point, they are faced with the task of market expansion. At this time, enterprises need a large amount of funds (Fan, 2015) [11]. The government can introduce more targeted financing support policies and precisely match the sources of funds (Mi, 2025). For instance, special industrial funds can be established and preferential loans provided to alleviate their financial constraints. At the same time, training in enterprise management and decision-making capabilities should be strengthened to help them better seize policy opportunities and improve investment efficiency. For enterprises in the decline stage, in addition to providing financial support, it is also necessary to focus on guiding them to carry out industrial transformation and upgrading. Through policy guidance, encourage enterprises to cooperate with other enterprises or undergo mergers and acquisitions and reorganizations. Utilize the 'Belt and Road' policy to expand new business areas and enhance the competitiveness and investment efficiency of enterprises. Secondly, enhance policy promotion and interpretation: Strengthen the promotion and interpretation of the 'Belt and Road Initiative' policies to help enterprises at different growth stages better understand the policy content and implementation details, improve their awareness and grasp of the policies, and enable them to make more effective use of policy resources and enhance investment efficiency. At the same time, a policy effect evaluation and adjustment mechanism should be established to regularly assess the impact of the 'Belt and Road' policies on the investment efficiency of enterprises at different growth stages. Based on the assessment results, the policy direction and intensity should be adjusted in a timely manner. In light of the characteristics and demands of enterprises at different stages, policy measures should be optimized to better leverage the role of policies in enhancing the investment efficiency of enterprises.

6.3 Suggestions based on the Differences in the Improvement of Investment Efficiency Between Enterprises in the South and the North

First of all, we should enhance the land transportation connection between the southern regions and the countries along the Belt and Road Initiative, increase investment in the construction of land transportation infrastructure such as railways and highways in the southern regions, and improve the land transportation capacity between the southern regions and the countries along the Belt and Road Initiative. Secondly, due to the 'inherent advantages of the north' mentioned earlier, the government needs to guide southern enterprises to adjust their industrial structure in accordance with the demands of the 'Belt and Road Initiative', and encourage high-tech industries, services and other sectors in the south to innovate cooperation models in line with the actual needs of the

countries along the ‘Belt and Road’. Furthermore, the shift from a situation where the south is strong and the north is weak to a balanced regional development is an inevitable trend. Therefore, it requires national-level planning and proactive policy planning, as well as proactive efforts and wise promotion (Wang, 2023) [12]. It is also necessary to enhance regional cooperation and coordinated development, and promote cooperation and coordination between the southern and northern regions in the construction of the ‘Belt and Road Initiative’. Realize complementary advantages and coordinated development.

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