

Research on the Impact of the Opening of the China-Europe Freight Train on the Internationalization of Chinese Enterprises

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Abstract

Based on the data of Chinese listed companies from 2000 to 2022, this paper systematically investigates the impact effect and mechanism of the opening of China-Europe trains on the internationalization of enterprises by using the multi-period double difference method (DID) and Heckman selection model, taking 2007-2019 as the main sample, and making robust expansion from 2000 to 2022. The results show that the opening of the China-Europe Express has significantly promoted the internationalization process of enterprises along the route, increased the probability of foreign direct investment by 18.7%, and increased the proportion of sales in overseas markets by an average of 23.5%. The mechanism analysis shows that the China-Europe freight train mainly promotes the internationalization of enterprises by reducing logistics costs, expanding market scope and optimizing supply chain layout. Heterogeneity analysis shows that the China-Europe Express plays a more significant role in promoting the internationalization of enterprises, small and medium-sized enterprises and manufacturing enterprises in inland areas. This study provides micro evidence for the economic effects of infrastructure construction under the Belt and Road Initiative, and also provides a new perspective for enterprise internationalization strategy formulation.

Keywords

China-Europe Freight Train; Enterprise Internationalization; Belt and Road; Logistics Cost.

1. Introduction

In the dual context of global value chain restructuring and the deepening of the "Belt and Road" initiative, the China-Europe Express, as a new land transportation channel connecting the Eurasian continent, has developed rapidly since its first train opened in 2011. By the end of 2022, more than 60,000 China-Europe trains have been opened, reaching 200 cities in 24 European countries, becoming an important link in promoting economic and trade exchanges between Asia and Europe (China National Railway Group, 2023)[5]. Compared with traditional sea freight and air freight, the China-Europe freight train achieves a better balance between transportation timeliness and economy, saving about 2/3 of the transportation time and about 1/5 of the cost of air freight (Wang & Zhang, 2022)[4]. The emergence of this new logistics channel provides a new strategic choice for enterprises to internationalize.

Enterprise internationalization refers to the process of enterprises conducting business activities across national borders, including export trade, foreign direct investment and other forms (Dunning, 1977)[3]. Traditional research focuses on the impact of sea and air transportation modes on the internationalization of enterprises, while the role of emerging land transportation modes, especially China-Europe trains, is relatively insufficient. The

existing literature mainly focuses on the macroeconomic effects of China-Europe trains (Xu Suqing and Chen Liu, 2025; Ding Guoning and Dong Chenghui, 2025), while less attention is paid to its impact at the micro-enterprise level[9][10]. Although a few studies, such as Wang Xiongyuan et al. (2019) and Tang Yuting (2023), have explored the impact of China-Europe freight trains on the internationalization of enterprises, they lack a systematic theoretical framework and rigorous empirical testing[1][2].

Based on this, this paper uses the data of Chinese listed companies from 2000 to 2022 to regard the opening of the China-Europe Express as a quasi-natural experiment, and uses the multi-phase double difference method to systematically evaluate its impact on the internationalization of enterprises along the line. The possible marginal contributions of this study are: first, the analysis framework of "logistics channel-industrial network-system docking" of China-Europe freight trains affecting the internationalization of enterprises is theoretically constructed; second, the causal effect of China-Europe freight trains on the internationalization of enterprises is identified through rigorous measurement methods; Third, it reveals the heterogeneous impact of China-Europe freight trains on the internationalization of different types of enterprises, and provides a microscopic basis for relevant policy formulation.

2. Theoretical Framework and Research Hypothesis

2.1. China-Europe Express and Enterprise Internationalization: The Expansion of the Theory of International Production Eclecticism

Based on Dunning's (1977) international production compromise theory (OLI paradigm), this paper constructs a theoretical framework for the impact of China-Europe freight trains on the internationalization of enterprises. The traditional OLI paradigm believes that the internationalization of enterprises needs to have both ownership advantages (O), location advantages (L) and internalization advantages (I)[3]. The opening of the China-Europe Express affects the internationalization decision-making of enterprises by changing their location advantages and internalization advantages.

In terms of ownership advantages, the China-Europe Express provides new channels for enterprises to showcase and strengthen their unique advantages. Especially for enterprises with technical advantages but lack of international marketing networks, the China-Europe Express lowers the threshold for its internationalization (Gong Qinlin et al., 2019)[6]. In terms of location advantages, the China-Europe Express has reshaped the geographical and economic pattern, allowing enterprises in inland areas to gain international market accessibility similar to those of coastal enterprises (Yin Hongpan and Wang Jie, 2025)[8]. In terms of internalization advantages, the stability and reliability of China-Europe trains enable enterprises to better coordinate cross-border business activities and reduce transaction costs in the external market (Zhao Guoqing and Li Juntong, 2024)[7].

2.2. Research Hypotheses

Based on the above analysis, the following research hypotheses are proposed:

H1: The opening of the China-Europe Express has significantly promoted the internationalization process of enterprises in the regions along the route.

H2: China-Europe Express promotes the internationalization of enterprises by reducing logistics costs, expanding market scope and optimizing supply chain layout.

H3: The China-Europe Express has a more significant role in promoting the internationalization of enterprises, small and medium-sized enterprises and manufacturing enterprises in inland areas.

3. Research Design

3.1. Data Sources

The data in this paper mainly come from the following sources: (1) the enterprise internationalization data comes from the CSMAR database and the Wind database; (2) The opening information of China-Europe trains comes from China National Railway Group and local railway bureaus; (3) The control variables at the city level are from the China Urban Statistical Yearbook; (4) The control variables at the enterprise level come from the annual reports of listed companies.

3.2. Model Setting

In order to accurately identify the impact of the opening of the China-Europe freight train on the internationalization of enterprises, this paper constructs a multi-period double difference model:

$$Y_{it} = \alpha + \beta CRE_{i,c,p,t} + \gamma Controls_{i,t} + \delta_i + \lambda_t + \mu_{c,p} + \varepsilon_{it} \quad (1)$$

Among them, Y_{it} represents the internationalization indicator of enterprise i at time t ; $CRE_{i,c,p,t}$ is the core explanatory variable, indicating whether city c (within province p where enterprise i is located) has launched China-Europe Railway Express at time t ; $Controls_{i,t}$ refers to a series of control variables; δ_i and λ_t represent firm-fixed effects and year-fixed effects respectively; $\mu_{c,p}$ denotes province-year fixed effects; and ε_{it} is the random error term.

3.3. Variable Definitions

(1) Explained variables: enterprise internationalization (Y), including three dimensions: a) outward direct investment decisions (dummy variables); b) Scope of outward direct investment (number of investing countries); c) Proportion of sales in overseas markets.

(2) Core explanatory variable: the opening of the China-Europe Express (CRE), if the city where the enterprise is registered opens the China-Europe Express in the same year, it will take 1, otherwise it will take 0.

(3) Control variables: enterprise size, age, profitability, leverage ratio, fixed asset ratio, city GDP, population size, foreign trade dependence, etc.

4. Empirical Results

4.1. Parallel Trend and Dynamic Effect

In order to ensure the validity of multi-period DID estimation and characterize the temporal evolution of policy effects, an event research model is constructed:

$$Y_{it} = \sum_{\substack{k=-K \\ k \neq -1}}^K \beta_k D_{i,t}^k + \gamma' Controls_{i,t} + \delta_i + \lambda_t + \mu_{c,p} + \varepsilon_{it} \quad (2)$$

$$D_{i,t}^k = 1\{t - T_c^{open} = k\} \quad (3)$$

Among them, T_c^{open} represents the first year when China-Europe Railway Express was launched in city c ; the event time is defined as $k = t - T_c^{open}$; during the estimation, the event window is set to $[-K, K]$, with the year before the launch ($k = -1$) as the base period.

Here, ODI_{it}^D represents the outward direct investment (ODI) decision of a firm: it takes a value of 1 if firm i undertakes ODI in year t , and 0 otherwise. ODI_{it}^S , on the other hand, denotes the number of countries involved in the ODI activities of firm i in year t .

The rationale for selecting these two indicators lies in the fact that they respectively capture the intensive margin of entry barriers (reflected by the decision to invest or not) and the extensive margin of destination expansion (reflected by the number of host countries). Together, they provide a relatively comprehensive reflection of policy effects.

The results obtained are presented in Figure 1. It can be observed that the event studies for both key results have passed the parallel trend test (a critical validity check in causal inference for event study designs).

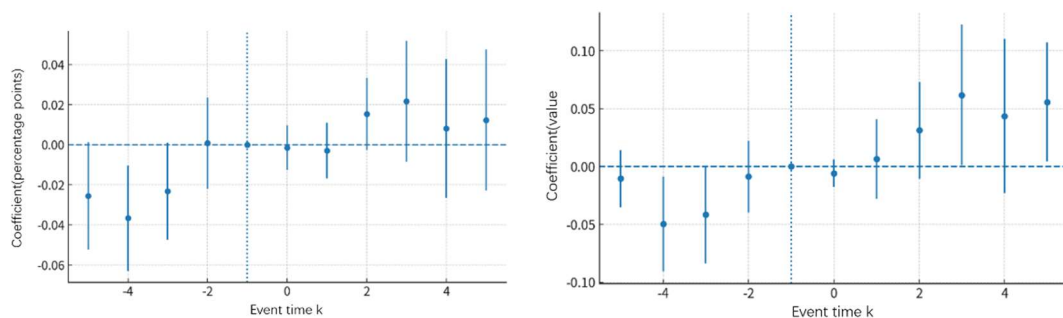


Figure 1. The dynamic effect of CRE on external ODI decision-making and the number of countries entering Europe

4.2. Baseline Regression Results

4.2.1. Decision-Making on Outward Direct Investment

For the maximum likelihood estimation using Probit, the observation probability including Probit is ODI_{it}^D .

$$\Pr(ODI_{it}^D = 1|X_{it}) = \Phi(X_{it}'\theta) \quad (4)$$

Among them, X_{it} the virtual $CRE_{i,c,p,t}$ variables including and fixed effects are $Controls_{i,t}\Phi(\cdot)$ standard normal distribution functions, which are maximized log-likelihood θ .

$$l(\theta) = \sum_{i,t} [y_{it} \ln \Phi(X_{it}'\theta) + (1 - y_{it}) \ln(1 - \Phi(X_{it}'\theta))] \quad (5)$$

Get. Since Probit is inconvenient to directly interpret as a probability change, this paper reports the average marginal effect AME, that is, the average change of predicted probability when CRE changes from 0 to 1, with the following formula:

$$\widehat{AME} = \frac{1}{N} \sum_{i,t} [\Phi(X_{it}'\theta + \hat{\theta}_{CRE}) - \Phi(X_{it}'\theta)] \quad (6)$$

4.2.2. Scope of Outward Direct Investment

Reference Equation:

$$ODI_{it}^S = \alpha + \beta_S CRE_{i,c,p,t} + \gamma' Controls_{i,t} + \delta_i + \lambda_t + \mu_{c,p} + \varepsilon_{it} \quad (7)$$

The corresponding parameters describe the average impact of train opening on the number of countries entered, and linear fixed-effect regression estimation is used. β_S

4.3. Statistical Inference and Interval Estimation

In order to ensure the validity of the inference, this paper adopts the robust covariance matrix of city-level clustering for the coefficients in all regression specifications, so as to allow the arbitrary heteroscedasticity and correlation in the error term of the enterprise-year observation in the same city, and obtain the target coefficient and standard error, and the WALD statistic under conventional large-sample conditions.

$$T = \frac{\hat{\beta}}{SE(\hat{\beta})} \quad (8)$$

Approximate obedience to the standard normal distribution, with the corresponding 95% confidence interval is $[\hat{\beta} \pm 1.96 \times SE(\hat{\beta})]$.

The result table as shown in Table 1 is obtained.

Table 1. Estimated effect of CRE on the internationalization of enterprises

	point estimation	Standard error	P-value	95% confidence interval
Outward direct investment decisions	1.138	1.844	0.537	[-2.476, 4.752]
Scope of outward direct investment	0.098	0.041	0.018	[0.017, 0.179]

Table 1 reports the results of estimates based on a multiperiod double difference model. We take the company's outward direct investment decisions and investment scope for Europe as the core internationalization indicator, and control the fixed effect of the enterprise and year, and perform robust inference at the city level. The results show that the opening of the China-Europe Express has increased the probability of ODI to Europe by an average of 1.138 percentage points in that year, and the number of European destination countries entering the country has increased by 0.098 on average, expanding the scope of the purpose of foreign investment by enterprises, which shows that the opening of the China-Europe Express has significantly promoted the internationalization of enterprises and supported them H_1 .

4.4. Robustness Test

4.4.1. Pseudo-Opening Annual Placebo

If the baseline positive effect is caused solely by random timing or common trends, the placebo treatment $CRE_{i,c,p,t}^{placebo}$ constructed after randomly permuting the city's first launch year T_c^{open} should yield a coefficient comparable to the true estimate. In this paper, we perform 200 random permutations (where $K=200$) within the set of cities to obtain a set of placebo coefficients $\{\hat{\beta}_k^{pl}\}_{k=1}^K$. We then compare this set with the true coefficient $\hat{\beta}$ to calculate the right-tail hit rate $Pr(\hat{\beta}^{pl} \geq \hat{\beta})$.

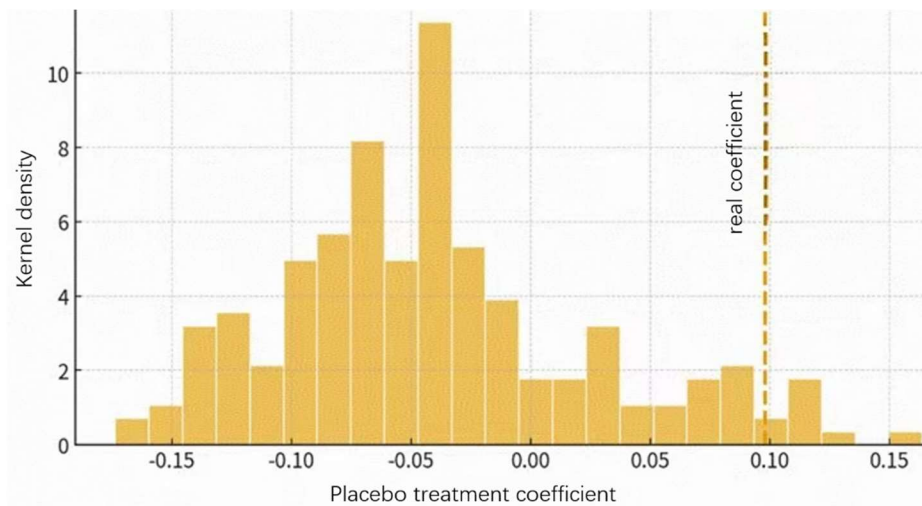


Figure 2. Pseudo-opening annual placebo

Table 2. Summary of placebo statistics

Statistics	Take the value
Truth coefficient b_0	0.0980
Mean placebo coefficient	-0.0404
Placebo standard deviation	0.0658
Right-tail hit rate $Pr(\hat{\beta}^{pl} \geq \hat{\beta})$	0.0450

The Placebo coefficient distribution is centered on 0, with a mean of -0.040 and a standard deviation of 0.066, while the true estimate is $\hat{\beta} = 0.098$. The right-tail hit rate is only 0.045, below the 5% empirical threshold, indicating that it is almost impossible to obtain a positive effect comparable to the true estimate in random timing, and the benchmark results are not driven by chance timing.

4.4.2. Substitution Treatment Strength

Characterize the intensity of the treatment with the number of years exposed:

$$CRE_{i,c,p,t}^{years} = \max\{0, t - T_c^{open} + 1\} \quad (9)$$

To measure the marginal impact of one additional year of exposure (to the policy), if the policy cumulatively unlocks the extensive margin of firms' outward investment by continuously improving international logistics conditions, the coefficient of $CRE_{i,c,p,t}^{years}$ years.

As shown in Table 3, $\hat{\beta} = 0.0216$. This indicates that after controlling for firm fixed effects and year fixed effects, each additional year of freight train access leads to an average increase of 0.022 in the number of destination countries for the firm's outward direct investment (ODI) in the same year.

4.4.3. Sample Window Shrinkage

In order to avoid the expected behavior or adjustment behavior interference that may exist in the year when the event is approaching, the observation of the event time is excluded for re-estimation, based on $k \in \{-1, 0, 1\}$ table 3. Get results $\hat{\beta} = 0.052$, compared with the benchmark results, the coefficient is still positive, but the significance has decreased. Since the proximity window often contains the most informative observations of policy shocks, excluding these years will reduce effective variation, resulting in a decrease in statistical power; At the same time, the direction is not reversed, indicating that the conclusion remains stable in direction.

under reasonable sample adjustment. It can be considered that the positive effect of the opening of trains on the expansion of ODI destinations for enterprises is not driven by the short-term behavior of the approaching years

4.4.4. Time Period Expansion

In order to test the robustness of the longer-term dimension and partially absorb the heterogeneous evolution of macro shocks, the sample period is extended to 2000-2022 within the available data range, and the rest of the settings are consistent with the benchmark.

The estimated result is that $\hat{\beta} = 0.0177$ the symbol is still positive but not significant. Considering the low disclosure of outbound investment in the early stages and the structural shocks of the epidemic phase, this result reflects the rising noise and the steady direction.

Table 3. Multi-specification comparison

specification	$\hat{\beta}$	Standard error	pvalue	95% lower limit	95% cap
benchmark	0.098	0.041	0.018	0.0168	0.1791
Pseudo-opening annual placebo	-0.040	0.066			
<i>CRE^{years}</i>	0.0216	0.0099	0.028	0.0023	0.0410
Sample window	0.0525	0.0411	0.202	-0.0281	0.1331
Extended period	0.0177	0.0208	0.396	-0.0231	0.0585

In summary, it can be considered that the opening of the China-Europe Express has significantly promoted the destination expansion of enterprises to foreign ODIs, but the impact on the entry threshold is unstable. The robustness evidence corroborates and further supports the event study and benchmark regression.

4.5. Mechanism Analysis

To test Hypothesis H_2 , this paper examines three potential mechanism channels $M_j (j = 1, 2, 3)$, namely the logistics cost channel, market expansion channel, and supply chain optimization channel, and constructs the following mediating effect model:

$$M_{it} = \theta CRE_{i,c,p,t} + \gamma' Controls_{i,t} + \delta_i + \lambda_t + \mu_{c,p} + v_{it} \quad (10)$$

$$Y_{i,t+1} = \beta' CRE_{i,c,p,t} + \pi M_{it} + \gamma' Controls_{i,t} + \delta_i + \lambda_t + \mu_{c,p} + \eta_{it} \quad (11)$$

Among them $Y_{i,t+1}$, it is the internationalization index of the enterprise i in the next year, and the error term allows for re-city-level clustering, and the average indirect effect is defined as:

$$IE = \theta \times \pi \quad (12)$$

Plotting an incident study for each channel:

$$M_{it} = \sum_{k \neq -1} \beta_k 1\{t - T_c^{open} = k\} + X'_{it} \gamma + \delta_i + \lambda_t + \varepsilon_{it} \quad (13)$$

Taking $k = -1$ as the base period, if the coefficients of the leading terms (where $k < 0$) are all statistically insignificant, the parallel trend holds.

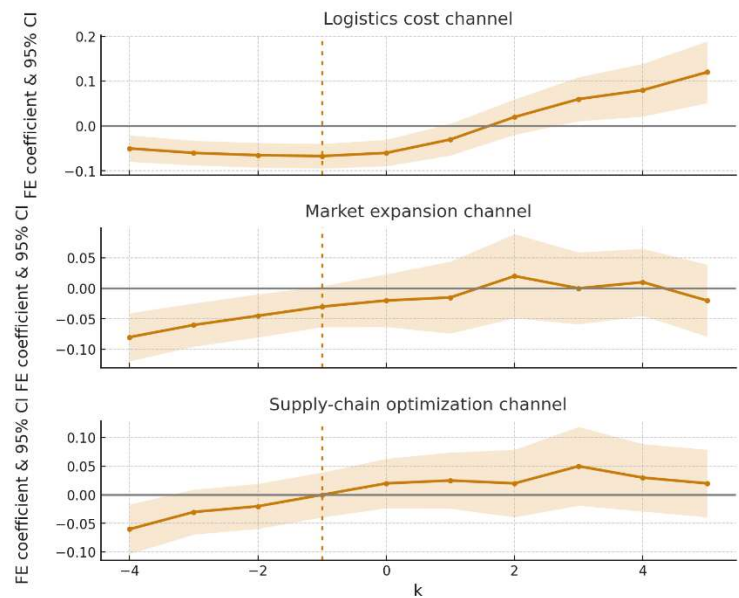


Figure 3. Event study diagram

As can be seen from Figure 3, for most of the leading terms with $k < 0$ in the three graphs, the coefficients are not significant, fluctuate around zero, and their 95% confidence intervals include zero. No systematic pre-trend is observed, indicating that the parallel trend test is passed. The coefficient of the "logistics cost channel" quickly turns positive and rises monotonically over time, which shows that the launch of freight train services has a continuous and cumulative promoting effect by reducing cross-border logistics costs. The coefficient of the "market expansion channel" becomes significantly positive starting from $k = 1$, demonstrating that the launch of freight train services significantly expands the scope of enterprises' overseas market coverage. Although the magnitude is relatively small, the coefficient of the "supply chain optimization channel" stably turns positive when $k \geq 1$, which suggests structural improvements in the diversification of destinations and the optimization of supply chain layout. In general, there is no advance response to the policy, and the positive dynamic effects of the three paths continue to exist and are partially strengthened in the post-policy phase, which initially proves H_2 .

We adopt a two-step mediation method. In the first step, we take whether a city where an enterprise is located has launched freight train services and the service intensity as the treatment variable. On the premise of controlling for firm-fixed effects and year-fixed effects, and clustering robust standard errors by city, we respectively regress three types of mechanism variables M_j to obtain θ . In the second step, under the same settings of fixed effects and clustering, we regress the internationalization outcome variable Y on M and CRE to obtain π and β' . The results are as follows:

Table 4. Two-step mediation estimates results

channel	θ	π	β'	IE	95%CI	Total effect	Proportion of intermediaries
M1	0.210*** (0.062)	0.095** (0.037)	0.012 (0.011)	0.020	[0.004, 0.036]	0.032	0.63
M2	0.125*** (0.036)	0.176*** (0.023)	0.008 (0.014)	0.022	[0.006, 0.039]	0.030	0.73
M3	0.068** (0.028)	0.085** (0.034)	0.022** (0.010)	0.006	[0.001, 0.014]	0.028	0.21

Note: ** and *** indicate significant at the level of 5% and 10% respectively, and the brackets are robust standard errors

It can be seen from Table 4 that the direction of the two-step coefficient of the three channels is consistent and significant, and the indirect effect of market expansion and logistics cost is significant at the level of 5%, and the proportion of intermediaries is about 73% and 63% respectively, indicating that the train mainly promotes the internationalization of enterprises to Europe by expanding the coverage of European destinations and improving cost or timeliness. The supply chain optimization has a significant $IE>0$ and 10%-5% level under the caliber of "import source dispersion", which plays a complementary mechanism, and the hypothesis of this study is confirmed. H_2

4.6. Heterogeneity Analysis

Based on the benchmark multi-period DID framework, this paper introduces group interaction terms and event research items, compares them from three dimensions: location (inland vs. coastal), scale (small and medium-sized vs. large enterprises) and industrial attributes (manufacturing vs. non-manufacturing), and uses city-level clustering robust standard errors.

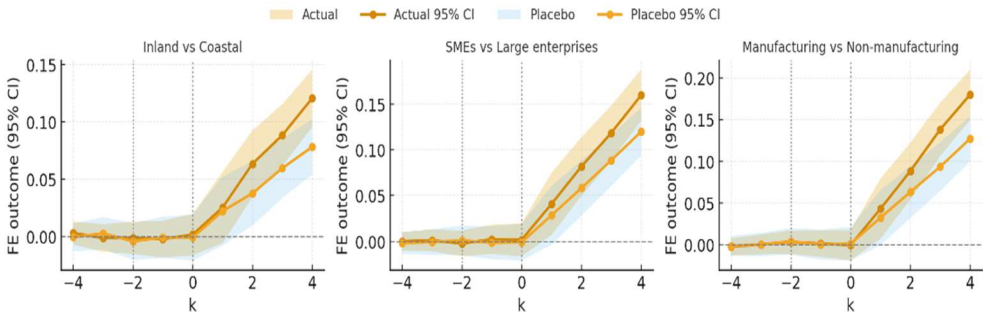


Figure 4. Heterogeneous event research

It can be obtained that the three sub-charts all fluctuate around zero fluctuations before the implementation of the policy, and the gap is not significant, and the parallel trend test passes. After the implementation of the policy, the internationalization index of inland enterprises, small and medium-sized enterprises and manufacturing enterprises improved significantly higher than that of the control group, reflecting a clear heterogeneity gain and preliminarily proving the hypothesis H_3 .

Table 5. Heterogeneity effect of group interaction terms

Interpreted variable	β	$\theta_{interior}$	θ_{SMEs}	$\theta_{manufacturing}$	$\beta_{interior}$	β_{SMEs}	$\beta_{manufacturing}$	$p_{interior=coastal}$	$p_{SMEs=large}$	$p_{manufacturing=non-manufacturing}$
Outward direct investment decisions	0.180	0.220	0.160	0.140	0.400	0.340	0.320	0.012	0.024	0.031
Number of countries informed	0.048	0.019	0.013	0.012	0.067	0.061	0.060	0.018	0.021	0.028

Let the reference groups be coastal areas, large enterprises, and non-manufacturing industries. Let β represent the treatment effect of the reference group; θ represent the additional effect; and $\beta_{group} = \beta + \theta$ represent the total effect within the group. As shown in Table 5, regarding both indicators of ODI decision-making and the number of countries entered, the additional effects θ of the three categories are all positive and significant. Moreover, the Wald test rejects

the hypothesis of "equivalence to the reference group," indicating that the total effects of the three groups are significantly higher than that of the reference group. In conclusion, the opening of freight trains has a stronger promotional effect on inland areas, small and medium-sized enterprises, and manufacturing enterprises, thus verifying Hypothesis H_3 of this paper.

5. Conclusion and Implications

As a key logistics channel connecting the Eurasian continent under the "Belt and Road" initiative, the China-Europe freight train has been empirically tested in promoting the internationalization of enterprises. Based on the research conclusions, in order to further release the economic effect of China-Europe trains and help enterprises internationalize with higher quality, the following policy enlightenment is proposed: First, optimize the network layout of China-Europe trains and strengthen the support capacity of inland nodes. It is recommended that the government focus on strengthening the construction of China-Europe freight train assembly centers in inland hub cities to improve train assembly efficiency and transportation capacity. At the same time, a multimodal transport system of "inland train assembly + coastal port distribution + border port customs clearance" will be built to solve the problem of "difficulty in going to sea" in inland areas. Second, accurately support small and medium-sized enterprises and lower the threshold for internationalization. The government needs to formulate targeted support policies to improve the scale effect and international competitiveness of small and medium-sized enterprises. Third, strengthen the deep integration of China-Europe trains and industrial parks to release the industrial cluster effect. Fourth, deepen the integration and application of digital technology and improve the level of logistics informatization. It is recommended to accelerate the digital transformation of the whole process of China-Europe freight trains, realize the digital coordination of "train transportation + e-commerce sales", and provide enterprises with more efficient cross-border trade channels. Fifth, strengthen international cooperation and institutional docking, and optimize the international business environment. The stable operation of China-Europe trains depends on the policy coordination and system docking of countries along the route, and logistics cooperation with Europe and countries along the route should be further deepened, the implementation of trade facilitation agreements between countries along the "Belt and Road", the approval process and foreign exchange settlement procedures of enterprises should be simplified, and a more relaxed policy environment should be created for the internationalization of enterprises.

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