The Role of the Opening of CHINA RAILWAY Express in Enhancing the Level of High-quality Development of Shaanxi's Foreign Trade

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Abstract. The opening of CHINA RAILWAY Express (Xi'an) is a key measure to integrate Shaanxi into the "the Belt and Road" initiative, which promotes China's "opening up to the west" and will be the key to the new pattern of “opening up to the world” during the period of China's "14th Five-Year Plan". It will be the key to the new pattern of "opening up to the outside world" during the period of "14th Five-Year Plan" of China, and promote the opening up of Shaanxi Province to the outside world with high quality. This paper selects the panel data of 31 provinces from the Wind database, covering the period from 2010 to 2022, with a total of 403 data. It measures the level of high-quality development of foreign trade of Shaanxi Province and other provinces in the control group through the comprehensive evaluation method. Synthetic Control Methods(SCM), Differences-in-Differences(DID) and Parallel Trend Test are further used to analyze the impact of the opening of the CHINA RAILWAY Express(CR Express) on the high-quality development level of foreign trade in Shaanxi Province. The results of the study show that the opening of CR Express significantly promotes the improvement of the level of high-quality development of foreign trade in Shaanxi Province, and there exists a certain influence mechanism effect, that is, the opening of CR Express helps to improve the innovation-driven ability, promote the upgrading of the industrial structure, and provide endogenous impetus for the growth of the level of high-quality development of foreign trade in Shaanxi Province. Based on the above empirical research conclusions, this paper puts forward the viewpoint that the visibility and influence of CR Express should be further improved from the aspects of operation efficiency, service quality and innovation ability, so as to promote the high-quality opening-up of Shaanxi Province with the new development concept. And in the context of continuously improving the transportation infrastructure of CR Express, the domestic industries rich in innovation advantages and facing transformation can effectively supplement the economic development gap of the countries along the route, so as to realize the win-win situation of innovation drive, industrial upgrading of Shaanxi Province and improvement of the welfare level of the countries along the route.

Keywords: CHINA RAILWAY Express, High-quality development of foreign trade, Innovation drive, Industrial upgrading

1 Introduction

In September 2013, General Secretary Xi first proposed "the Belt and Road"("B&R") Initiative during his visit to Kazakhstan. Since then, the national-level design, which is the key

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to China's economic transformation and upgrading, has been put into practice, aiming to create a new pattern of China's opening up to the outside world. In this context, CR Express has gradually become the most closely connected path between China and the countries along the "B&R". The initiative is a strategic move by China to promote economic and trade cooperation with the countries along the routes and to promote the long-term stable development of the economy, and as an intermodal railroad train between China and the countries along the Belt and Road as well as some parts of Europe, CR Express is an important carrier for their economic and trade development. In recent centuries, shipping has been the main channel of international trade. By the end of July 2022, CR Express had opened more than 57,000 lines and transported 5.3 million TEU of cargo, with a heavy container rate of 98.3% and a cumulative value of nearly 300 billion US dollars. A total of 82 railway lines have been laid, connecting 196 cities in 24 European countries.

With the operational development and gradual improvement of CR Express in recent years, its importance to the high-quality development of foreign trade(HDF) in Shaanxi Province has become more and more evident. However, there is still a lack of research in this field, based on this, this paper will combine the changes in the high-quality development of Shaanxi's foreign trade after the opening of CR Express, adopt the method of quasi-natural experiment to quantitatively analyze whether CR Express has a certain role in improving the level of high-quality development of Shaanxi's foreign trade, and explore the mechanism of its influence.

2 Literature Review and Theoretical Analysis

2.1 High-quality development of foreign trade(HDF)

There are many studies in academic circles in the field of the level of HDF. In the development concept, innovative foreign trade should change from scale growth to quality and efficiency growth, highlighting the importance of quality in the development; in the layout of foreign trade, it is necessary to coordinate the distribution of resources according to the overall situation, and to give full play to their respective geographic advantages and comparative advantages, to form a synergy of foreign trade; in the layout of foreign trade, it is necessary to coordinate the distribution of resources according to the overall situation, give full play to their respective geographic advantages and comparative advantages, and form a synergy of foreign trade; in the mode and structure of foreign trade, first of all, it is necessary to transform from the traditional form to the digital form, and in addition to open up more foreign trade markets to adapt to the needs of the international market demand[1].

High-quality foreign trade should be sustainable. At different times, economies guide the healthy and sustainable development of foreign trade through the introduction of appropriate trade policies[2]. Whether or not the foreign trade objectives of a particular time period have been achieved is measured not only in economic terms, but also in terms of social and ecological benefits. The sustainable development of foreign trade requires particular attention to the protection and utilization of the environment and resources, and should not be achieved at the expense of the environment or resources.

High-quality foreign trade should have strong international competitiveness. Foreign trade competitiveness is the basic component of international competitiveness. Since the reform and

opening up, China's competitive export commodities have been concentrated in labor-intensive products, which are usually only low-tech, while our technology- and capital-intensive products lack competitiveness. The international competitiveness of foreign trade in border areas is relatively low. With the continuous development of global foreign trade, new changes have occurred in foreign trade competitiveness. Compared with traditional foreign trade competitiveness, the new foreign trade competitiveness has weakened the price factor as a single important influence in competitiveness, and has paid more attention to quality, technology, services and brand names, and has taken diversification in quality and technology as an important means of competition. The new foreign trade competitiveness is based on the improvement of total factor productivity and is characterized by low pollution, low consumption and high efficiency.

2.2 The impact of CR Express on the development of foreign trade in Shaanxi province

CR Express can reduce trade costs and thus enhance the development of foreign trade in Shaanxi Province. The more generally accepted explanation of trade cost is the accumulation of all other costs to be paid in addition to the production cost of the commodity when obtaining the commodity, including but not limited to transportation costs, distribution costs, foreign trade barriers, information communication costs, etc. In the context of the continuous development of globalization, multilateral and bilateral trade agreements between countries are also improving, the level of tariffs between countries is decreasing, and policy barriers are also weakening, which also means that the importance of trade and transportation costs is more highlighted. Studies have shown that the scale and normalization of CR Express freight mode can make the enterprise's inventory management more simple and easy to accelerate the flow of funds in the case of reducing capital consumption, and ultimately reduce the enterprise inventory costs[3]. Compared to the traditional and well-established sea and air freight, CR Express, which is emerging and has a bright development prospect, is currently given a large subsidy by the government, which further reduces the price gap between CR Express and direct logistics by sea. This has attracted more companies that need to accomplish their transportation goals in a stable and safe manner and in accordance with the estimated freight time to choose to use CR Express for international trade transportation. It can be seen that the emergence of CR Express can reduce trade costs and become a competitive high value-added in Shaanxi Province. Because products with high requirements for logistics timeliness are more easily and affordably shipped to overseas markets, it also facilitates domestic imports of high-quality goods from abroad, and is able to promote the high-quality development level of foreign trade.

2.3 The mediating role of industrial upgrading in the process of increasing the level of HDF

Industrial upgrading refers to the process where, driven by technological progress, a particular industry gradually reduces its dependence on traditional resource endowments (e.g., labor, land, etc.) and increasingly relies on high-end factors (e.g., technology, capital, etc.)[4]. To this end, against the backdrop of the evolving new pattern of opening up to the outside world, the successful upgrading of an industry's structure depends not only on the optimal allocation of high-end supply-side factors like technology and capital but also on the rapid development of demand-side international trade.

Theoretically, the opening of CR Express can create a new path for industrial upgrading from both supply and demand sides. Firstly, from the supply side, the "transportation cost effect" of new economic geography believes that transportation infrastructure realizes the optimal allocation of factors by reducing transportation costs, thus creating conditions for industrial upgrading. However, from the connotation of industrial upgrading, the effect of high-end factors (capital, technology, etc.) is much higher than that of general factors. The opening of CR Express can promote industrial upgrading by optimizing the allocation of high-end factors. On one hand, CR Express catalyzes the flow of innovative elements such as technology, enhancing the innovation level in the regions it serves and providing necessary momentum for industrial upgrading. On the other hand, CR Express boosts the efficiency of capital allocation by driving financial development, supporting industrial upgrading from the perspective of capital allocation. From the demand side, the "trade growth effect" of new economic geography provides theoretical support for CR Express in promoting trade growth in the regions it serves. The opening of the train service not only drives demand-oriented industrial upgrading through trade structure reconstruction but also cooperates with advanced fields in developed countries in a "reverse gradient" manner. This achieves a "common sharing" of capital and R&D factors, further optimizing the allocation of high-end factors at the origin of the train service and promoting high-quality development of international trade in Shaanxi Province.

2.4 The mediating role of innovation-driven in raising the level of HDF

CR Express is an international transport service spanning the Eurasian continent, initially constructed to address the challenges of exporting goods from Shaanxi Province to Europe. For Shaanxi's products to enter the European market, they must meet the stringent product standards and high consumer demands of developed countries, which in turn "forces" the industrial development in Shaanxi. Studies show that direct connections established with Western developed economies through CR Express can make the exchange of innovation factors and R&D resources more convenient. And through the "reverse transfer" pathway, it brings a new momentum for technological advancement in the regions where the goods originate[5]. This effective connection with Europe can also bring advanced management experience and technology to the opening area at a very low price. The enhancement of regional innovation can directly improve the international competitiveness of local products, significantly increasing exports and generating substantial profits for local businesses. This will attract international investors, whose direct investment will once again strengthen the competitiveness of enterprises. And it will make these enterprises have a strong demand for intermediate goods, raw materials, equipment, patented technology, etc. from other developed countries, and the increment of OFDI will be promoted, and all of this will greatly enhance the level of regional foreign trade development. promoting the increase in outward foreign direct investment (OFDI), all of which significantly enhance the level of regional international trade development. To summarize, the opening of CR Express can promote the high-quality development level of foreign trade in Shaanxi Province by enhancing regional innovation.

3 Empirical Analysis

3.1 Econometric modeling

Differences-in-Differences (DID) is an important model in empirical research, which has been widely used in policy evaluation research. In the process of evaluating the effect of the opening of CR Express on the improvement of the level of high-quality development of Shaanxi's foreign trade, it is necessary to introduce the changes in the results of the control group of provinces before and after the opening of the CR Express, in order to eliminate the time effect within the treatment group. However, Shaanxi, as a province in the western part of China, should have a control group corresponding to other provinces in the country, so it may be more consistent with the real situation to use the Synthetic Control Methods to construct the counterfactual "Synthetic Shaanxi". In this paper, based on the data of each province and city, we refer to the Synthetic Control Methods proposed by Abadie & Gardeazabal (2003), and assign weights to each province that has not opened the CR Express to form a control group - "synthetic CR Express (Shaanxi) provinces" (hereinafter referred to as "synthetic Shaanxi" for the sake of convenience)[6]. This paper will simulate the economic conditions of the regions where CR Express(Shaanxi) is located before its opening by weighted synthesis of the provinces that have not yet opened CR Express(Shaanxi), so as to achieve comparison. The mode settings are as follows:

$$HDF_{c,t} = \beta_0 + \beta_1 treat_{c,t} + \beta_2 X_{c,t} + \gamma_c + v_t + \varepsilon_{c,t}$$

Where, the explained variable $HDF_{c,t}$ is the natural logarithm of the high quality development level of foreign trade of the province c in year t. $treat_{c,t}$ is the policy dummy variable, and this value is 1 for the province in the treatment group and 0 for the province in the control group. $X_{c,t}$ is a series of control variables, γ_c and v_t are the fixed effects of province and year respectively, and $\varepsilon_{c,t}$ is the random disturbance term of the model. The benchmark regression part focuses on the symbolic direction and significance of β_1. If β_1 is significantly positive, it indicates that the opening of CR Express has an enhancing effect on the level of HDF in Shaanxi Province.The sample size is 403, and the data are from the china statistical Yearbook, the china city statistical Yearbook, andthe Wind database.

3.2 Variable measure and description

3.2.1 Explained variable: level of high-quality development of foreign trade (HDF).

Regarding the measurement of HDF, the Entropy Method, Principal Component Analysis and other measurement methods are commonly used in the current academic circles. Considering the measurability of the index system and the accessibility of data, this paper constructs the evaluation index system of China's high-quality development level of foreign trade, which contains 14 specific evaluation indexes in five dimensions: optimization of foreign trade structure, performance level of foreign trade, competitiveness of foreign trade, scale status of foreign trade, and sustainability of foreign trade (Table 1). And the results of empowerment measurement are displayed in the fourth column of Table 1.

Table 1: Evaluation index system for the level of HDF

	First-level	Index weight
Evaluation index for HDF	Structural optimization degree of foreign trade	0.233
	Performance level of foreign trade	0.210
	Scale of foreign trade	0.321
	Sustainability of foreign trade	0.246

3.2.2 Explanatory and Control Variables.

Explanatory variable (treat):The explanatory variable, treat, is a policy dummy variable to indicate the opening of CR Express, and the sample period for this study is 2010-2022. The value is taken as 1 for provinces in the treatment group and 0 for provinces in the control group.

Control variables (X): (1) Human capital level (Hum): this paper uses the number of students enrolled in higher education per 10,000 people to measure the level of urban human capital. (2) Urbanization level (Ul) : This paper uses the proportion of urban permanent resident population to all permanent resident population to measure urbanization level. (3) Government influence Degree (Gov) : This paper uses the ratio of fiscal expenditure to fiscal revenue to indicate the degree of local government's involvement in the economy. (4)Infrastructure level (Infra&Road): In this paper, we refer to the study of Li et al. (2022), which measures the level of information infrastructure by the proportion of Internet access users (Infra), and the level of transportation infrastructure by the per capita road area in the city (Road) [7].

3.3 Empirical results

3.3.1 Synthetic control method

According to the synthetic control method, the opening of CR Express (Shaanxi) can be regarded as a quasi-natural experiment with exogenous shocks. It is based on the panel data of twenty-one control provinces weighted to form a "Synthetic Shaanxi", and by observing the performance of foreign trade development between Shaanxi and the "synthetic Shaanxi", it is possible to infer the impact of the opening of CR Express (Shaanxi) on Shaanxi. Table 2 shows the mean values of the variables related to "Synthetic Shaanxi" and Shaanxi before the opening of CR Express (Shaanxi) (called "pre-intervention"), which shows that the deviation of the two is very small, and the mean squared prediction error (MSPE) before the intervention is very small, only 0.0491, all of which are very important for the development of Shaanxi's foreign trade. All these indicate that the fit is very good and that "Synthetic Shaanxi" is a suitable control group for Shaanxi.

Table 2: Comparison of means of variables related to Shaanxi and "Synthetic Shaanxi"

Explanatory and Control Variables	Shaanxi	Synthetic Shaanxi
Hdf	0.7843	0.7644
Hum	0.0122	0.0141
Ul	0.5631	0.6081
Gov	0.1230	0.1257
Infra	0.6501	0.5924
Road	0.4233	0.4102

3.3.2 Differences-in-Differences

In order to study the impact in a more in-depth manner, this paper takes Shaanxi and "Synthetic Shaanxi" as the experimental group and the control group, and utilizes the DID model to conduct the investigation. Table 3 shows the results based on the empirical model.

Table 3: Benchmark regression of the impact of the opening of CR Express on the level of HDF in Shaanxi Province

	(1)	(2)	(3)	(4)	(5)	(6)
treat	1.113***(2.905)	1.257***(2.948)	1.205***(2.866)	1.159***(2.912)	1.431***(3.009)	1.482***(2.948)
Hum		0.881**(2.412)	1.063**(2.921)	0.933**(2.302)	0.913**(2.202)	0.934***(2.036)
Ul			1.635**(2.422)	1.211**(2.431)	1.432**(2.805)	1.115**(2.828)
Gov				0.047**(1.172)	0.047(1.104)	0.061(1.099)
Infra					0.092*(0.312)	0.087(0.231)
Road						0.007(1.055)
coef	14.321***(24.878)	14.321*(2.905)	9.832*(0.080)	11.201(0.806)	12.098(0.960)	15.111(2.211)
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R^2	0.654	0.654	0.674	0.710	0.686	0.692

[a] Standard errors adjusted for clustering are in parentheses; ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

This paper conducts a quasi-natural experiment test with the opening of CR Express in Xi'an and Baoji cities in Shaanxi Province, and applies DID to examine the role of this policy shock in enhancing the level of HDF in Shaanxi Province. The results of the benchmark regression are shown in the table 3, where the core explanatory variables and each control variable are added one by one in columns (1)-(6). Year and province fixed effects are also controlled for, and the regression standard errors are clustered to the province level. The results show that the estimated coefficients of the core explanatory variable treat are always significantly positive at the 1% level, indicating that the opening of CR Express significantly promotes the level of HDF in Shaanxi Province.

3.3.3 Parallel trend test

The application of DID needs to satisfy the assumption of parallel trend, i.e., there is no significant difference in the HDF levels of the experimental group and the control group in terms of the time-varying trend before the year of the policy shock. In this paper, we use the "graphical method" to test the results of the DID model estimation of the impact of the opening of CR Express on the level of HDF in Shaanxi Province. We visualize whether there is any difference between the two groups of data before the opening. If there is no obvious difference in the visual judgment, it means that the "parallel trend hypothesis" is satisfied, and vice versa, it is not satisfied. The results of the test are shown in Figure 1.

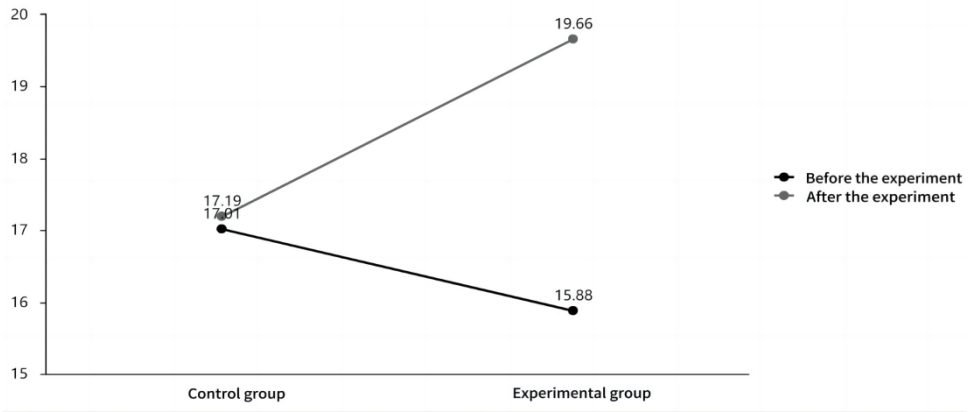

Figure 1: HDF trends in experimental and control groups.

As can be seen from the figure, the HDF levels of the two groups are basically identical at the time before the experiment, indicating that the parallel trend assumption is satisfied. This proves that the results of this experiment are robust and that the opening has brought a positive impact on the level of HDF in Shaanxi Province.

3.3.4 Impact mechanism test

Based on the theoretical analysis in the previous section and drawing on the research of Wen et al. (2004) [8], this paper establishes a mediator model, and the specific model is set as follows:

$$IM_{c,t} = \beta_0 + \beta_1 treat_{c,t} + \beta_2 X_{c,t} + \gamma_c + v_t + \varepsilon_{c,t}$$

$$HDF_{c,t} = \beta_0 + \beta_1 treat_{c,t} + IM_{c,t} + \beta_2 X_{c,t} + \gamma_c + v_t + \varepsilon_{c,t}$$

In the model, IM is the mechanism variable, and other variables are set the same as the benchmark regression model. First, referring to the study of Bian et al. (2019), this paper measures the innovation level by the number of patents granted after logarithmization[9]. Column 3 shows that the coefficient of the policy dummy variable is significantly positive, indicating that the opening can boost the growth of the level of HDF in Shaanxi Province by improving the level of innovation.

The opening provides a new opportunity for regional industrial upgrading. Referring to the study of Sheng et al. (2005), this paper takes the proportion of added value of tertiary industry to GDP as a proxy variable for regional industrial upgrading[10]. The results in columns 4 and 5 of Table 4 show that the opening significantly promotes regional industrial upgrading, and it can be seen that CR Express, as a bridge linking the foreign trade of China, Europe and the countries it serves, promotes the exchange of products and technologies between Shaanxi and foreign markets, and creates more opportunities and conditions for industrial upgrading.

Table 4: Impact mechanism test of the opening of CR Express on the HDF in Shaanxi province

Variables	Innovation-driven		Industrial upgrading	
	Patent(1)	Hdf(2)	Update(3)	Hdf(4)

Treat	0.4773***(0.1230)	0.3611***(0.0685)	0.0688***(0.0073)	0.1345***(0.0542)
Patent		0.0713***(0.0090)		
Update				0.8075***(0.1134)
X	YES	YES	YES	YES
Coef	4.5266***(4.878)	2.8973*(2.905)	5.5531*(0.080)	7.0440(0.812)
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
R^2	0.3411	0.1601	0.1207	0.287

[a] Standard errors adjusted for clustering are in parentheses; ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

4 Conclusions and policy recommendations

Taking the opening of CR Express as an entry point, this paper selected the panel data of 31 provinces from the Wind database, covering the period from 2010 to 2022, with a total of 403 data.The level of HDF development is then measured annually through 13 indicators by constructing a composite level measurement indicator. It further adopted the DID to test the enhancement effect of the opening on the HDF level.It is found that the opening significantly promotes the level of HDF in Shaanxi Province compared with the non-opening area, and this conclusion still holds after a series of processes such as the introduction of control variables and Parallel Trend Test. And this boosting effect is mainly realized through the dimensions of innovation driving and industrial structure upgrading. Based on the above empirical results, this paper puts forward the following policy implications:

On the one hand, the 19th National Congress of the Communist Party of China proposed to focus on the construction of the "Belt and Road" and form a situation of linkage between land and sea and mutual assistance between east and west. The opening of CR Express contributes to the formation of this opening pattern. Therefore, Shaanxi Province should increase its railway frequency and lines to radiate a wider range of enterprises, continuously optimize the transportation organization, and promote the intensive and efficient use of transportation resources. In addition, it should effectively strengthen product management, further enhance the visibility and influence of CR Express from the aspects of operation efficiency, service quality, innovation ability, etc., in order to promote the high-quality opening up of Shaanxi Province.

On the other hand, Shaanxi Province should continue to deepen the opening up, adhere to the "going out" strategy, and strengthen the cooperation consensus with countries along the "Belt and Road". Under the background of continuous improvement of transportation infrastructure such as CR Express, domestic industries with innovative advantages and facing transformation will fill the economic development gap of countries along the line. Finally, the "win-win" situation of innovation-driven Shaanxi Province, industrial upgrading and the improvement of the welfare level of countries along the route will be realized.

Finally, since the outbreak of COVID-19, in the case of the sudden increase in the cost and time uncertainty of other logistics channels, the logistics cost of CR Express is basically not affected, and it can still maintain a timely and stable operation. Its advantages are obvious, and it has become the preferred logistics method for many foreign trade enterprises to resume work and production. Shaanxi Province should build the CR Express (Xi'an) consolidation

center to accelerate the building of the Asia-Europe land and sea trade channel with it as the hub connecting Eurasia and facing East, South and West Asia. This can deepen economic and trade cooperation with countries along the route and promote the integration and development of transportation, logistics, commerce, industry, finance, humanities and other factors. Shaanxi's acceleration of the construction of an inland reform and opening-up highland can serve the country's opening up to the west and provide an important impetus for the formation of a new development pattern that is dominated by the domestic general cycle and mutually reinforcing by the domestic and international double cycle.

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