Research on the Impact of the "The Belt and Road" on the Development of Open Economy in the Central and Western Regions

——Empirical Analysis Based on Differences-in-Differences

Yaxian Wang[1,a]

[1]School of Economics and Management, Nanjing University of Science and Technology, China

[a]yaxian53141@163.com

Abstract. "The Belt and Road" (B&R) has made the mid-west region the frontier of opening to the outside. Based on the sample data from 51 cities from 2005 to 2019, the paper studies the policy effects of B&R on the open economy in the mid-west region by utilizing a difference-in-differences model. Also, building upon the index of level of infrastructure development, the paper analyzes the specific mechanism of this policy effect. The research results show that: B&R has elevated the level of opening-up in the mid-west region, as reflected in a significant increase in the regions' foreign trade dependence and foreign investment reliance since the initiative was launched; further research reveals that B&R has a greater stimulating impact on promoting foreign trade in the mid-west region compared to attracting foreign investment while factors such as location and business environment have affected the policy effect of B&R to some extent. In terms of its mechanism of action, B&R has improved the transport facilitation and communication facilitation in the mid-west region, thereby promoting the development of its open economy. The research holds valuable insights for guiding China in the acceleration of the western region development through B&R, and the achievement of the high-quality opening economy development in the mid-west region.

Keywords: "The Belt and Road"; Opening to the West; Open Economy; DID; Foreign Trade Dependence; Foreign Investment Reliance.

1. Introduction

China's process of opening-up began in the eastern coastal region, extending to the mid-west region. The opening-up of the mid-west region has been lagging behind for an extended period due to the geographic disadvantage. The implementation of B&R has created new opportunities for the mid-west region to construct the open economy and driven the region to better integrate into the developmental processes of regional economic integration and economic globalization.

B&R is a crucial strategy for China to open on all fronts in response to global economic structural changes. Since the inception of the initiative, China has increased its efforts of the opening-up in the mid-west region. Additionally, border economic cooperation zones and cross-border economic cooperation zones have been established, facilitating deeper integration of the mid-west region into a more open development framework.

However, has B&R genuinely promoted the development of opening-up in the mid-west region? If so, how does B&R promote the construction of open economy in the mid-west region? Research addressing these questions will contribute to a better understanding of the effect and significance of the initiative, creating new opportunities for the development of the western region, and broadening the prospects of China's high-quality economic development.

2. Literature review

2.1 Study on the B&R

In the existing literature, scholars mostly focus on the nation countries as the research object to explore the impact of B&R on China's open economy, and there are two main research methods:

2.1.1 Descriptive analysis method

Guoli G *et al.*(2018)[1] focus on the opening-up pattern of major regions. Regions represented by Beijing-Tianjin-Hebei, have leveraged their opening-up advantages in international cooperation and industrial innovation under the leadership of B&R initiative. Wai N (2022)[2] suggests that B&R provides a new platform for China's opening-up, and the opening level has been elevated to a new height. Weihong Z and Xu Z (2022)[3] point out that B&R is the focal point of China's development, and that we should grasp the strategic opportunities, strengthen economic cooperation, and deepen the flow of factors such as commodities, technology, and talents.

2.1.2 Empirical analysis method

Wenmei K (2022)[4] quantifies the degree of trade facilitation of the six economic corridors through the GTAP model, and finds that B&R has improved the structure of China's export trade. Chunxiao Y (2020)[5] finds that B&R has improved trade facilitation level and degree of China's free trade, based on China's trade data of with B&R countries from 2001 to 2015. Boying L (2020)[6] finds that tariff levels, the connectivity of the shipping network, exchange rates and other factors affect China's trade efficiency, according to the trade data of China and B&R countries from 2007 to 2017.

2.2 Study on the opening up of the mid-west region

Scholars have mostly approached this topic from the perspective of western development. B&R forms the pattern of the mid-west region under the overall framework of "great protection, great openness and high quality" (Hailong L *et al.*, 2021)[7]. The construction of facilities in the mid-west region and Beibu Gulf has opened up the land and sea channels, creating conditions for inland and marine connection (Yi Q, 2021)[8], which is the path to improve the quality of opening-up in the mid-west region (Jianguang L, 2021)[9].

It is worth mentioning that scholars study the impact of the OBOR on the opening-up of the mid-west region from the perspectives of trade costs (Xiaofan L and Lingduo J, 2020)[10], "internationalization" of the western region (Yujie Z, 2016)[11], and inland cities (Guolei D and Xiaoguang W, 2019)[12]. However, these studies do not cover heterogeneity analysis and mechanism analysis, which can identify the differential impact and analyze the specific path of the impact.

In summary, this paper complements the literature on the effects of B&R, high-quality opening-up, and the development of the mid-west region, and provides micro-level evidence. Firstly, this paper quantifies the specific policy effects by constructing an indicator system and using normative analysis. Secondly, this paper reveals the specific mechanism of B&R on the mid-west region from the perspective of infrastructure construction. Thirdly, this paper distinguishes the influence of different factors such as geographic location, China-European liner and business environment through heterogeneity test.

3. Research hypotheses

This paper focuses on the part of trade and facility connectivity. In order to expand inland border openness in China, we should seize the opportunity of global industrial reorganization and promote the coordinated development of inland trade, investment, and technological innovation. We should also innovate processing trade models, and form an institutional mechanism conducive to the development of inland industrial clusters. In summary, this paper puts forward the following hypotheses:

Hypothesis 1: B&R enhances the level of open economic development in the mid-west region, which is mainly reflected in the fact that foreign trade dependence and foreign investment reliance have increased significantly after the initiative was put forward.

Regarding the role of mechanisms, since B&R was put forward, the formation of a composite infrastructure network comprising railroads, highways, shipping, aviation, pipelines and a comprehensive spatial information network is rapidly taking shape. Infrastructure construction has strongly promoted optimal allocation of cross-regional resource elements, and the transaction costs of commodities, capital, information and technology between regions have decreased, promoting the development of open economy in the mid-west region. Therefore, this paper proposes:

Hypothesis 2: B&R promotes the development of open economy in the mid-west region by improving the level of infrastructure development.

4. Model construction

This paper adopts the difference-in-differences model (DID) model to study the impact of B&R on the mid-west region in China. This paper draws on the research methodology of Zachary (2021)[13] and constructs the following model with the purpose of the study:

$$\text{open}_{i,t} = \alpha + \beta \times \text{area}_i \times \text{year}_t + \gamma X_{i,t} + \delta_i + \eta_t + \varepsilon_{i,t}$$

The explanatory variable $open_{i,t}$ denotes the development level of open economy of city i in year t. The core explanatory variables in this paper are the interaction terms represented by $area_i \times year_t$, whose correspondence rule is: $area_i=1$ denotes the experimental group; $area_i=0$ denotes the control group; $year_t=1$ denotes years after 2013, and $year_t=0$ denotes years before 2013. The coefficient of the interaction term β reflects the policy impact of the OBOR. δ_i denotes individual fixed effects, η_t denotes year fixed effects, and $\varepsilon_{i,t}$ denotes random error term.

4.1 Data sources

B&R consists of 18 provinces, among which Inner Mongolia, Guangxi, Chongqing, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang which belong to the mid-west region. Considering the availability of data, the prefecture-level cities of 8 provinces except Tibet and Qinghai are set as the experimental group. Among non-"Belt and Road" regions, the provinces in the eastern and northeastern regions are Beijing, Tianjin, Hebei, Jiangsu, and Shandong, so the prefecture-level cities of these five provinces are set as the control group in this paper. After deleting Zhaotong, Baiyin, Tianshui and other cities with a lot of missing data, this paper uses the panel data of 51 prefecture-level cities from 2005 to 2019. The data in this paper are all from the China Urban Statistical Yearbook, as well as the statistical yearbooks and statistical bulletins of each province.

4.2 Description of variables

4.2.1 Explanatory variable

Development level of open economy (*open*). Open economy has rich connotations, but considering the availability of data, this paper only considers the two components of foreign trade and foreign direct investment. This paper draws on the practice of Yi C *et al*. (2018)[14] to construct a composite indicator using both foreign trade dependence and foreign investment dependence to measure the open economy development level of the sample cities, giving a weight of 33% to foreign trade dependence and 67% to foreign capital dependence according to the importance of them. Among them, foreign capital dependence is expressed as the proportion of actual utilized foreign capital to the total fixed asset investment of the whole society, and foreign trade dependence is expressed as the proportion of total import and export to GDP.

4.2.2 Control variable

Combining the main factors affecting the development of foreign trade, this paper designs the following control variables:

(1) Gross regional product per capita (*lnpergdp*): this indicator is expressed as the logarithm of the total regional GDP divided by the population of the region at the end of the year.

(2) Fixed asset investment (*far*): this indicator is expressed as the share of regional fixed asset investment in the total GDP.

(3) Financial development level (*fin*): this indicator is expressed as the ratio of the sum of the deposits and loan balances of the urban banks in the GDP.

(4) Industrial structure (*is*): this indicator is expressed as the share of the growth value of the secondary industry in GDP.

(5) Urbanization level (*ul*): this indicator is expressed as the share of the urban population in the total population of the region.

(6) Human resources (*hr*): this indicator is expressed as the share of the number of labor force in the total population of the region.

5. Empirical analysis

5.1 Parallel trend test

The premise of using the difference-in-differences model is to satisfy the parallel trend assumption. The result shows that the 95% confidence interval of the coefficient of the interaction term crosses the 0-axis in 2010-2012, and the confidence intervals of the regression coefficients are above the 0-axis in 2015 and 2016 after the implementation of B&R, which indicates that there is no significant difference between the treatment group and the control group before the policy implementation. The result meets the criteria for the parallel trend test, indicating that the samples in this paper can be used in the regression analysis of the difference-in-differences model.
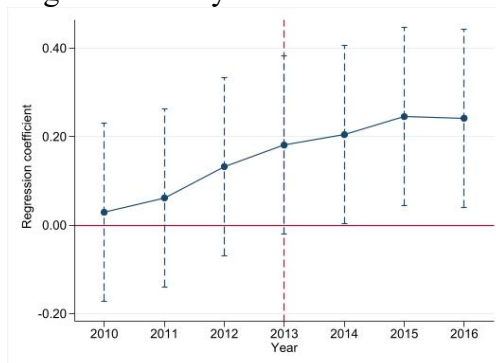

Figure 1. Parallel trend test results

5.2 Benchmark regression results

Under the premise that the samples satisfy the parallel trend assumption, this paper applies stata17 to regress the model to estimate the impact of B&R on the open economy of the mid-west region, and the regression results are shown in Table 3. In column (1), the dummy variable $area_i \times year_t$ is used to explain the changes of the open economy in the mid-west region, and its coefficient is positive at the 1% significance level, which indicates that the openness level of the mid-west region has been significantly improved after B&R. In order to further verify the validity and stability of the hypotheses, control variables are added sequentially in columns (2) to (7). The coefficients of the core explanatory variables are always significantly positive at the 1% level, hypothesis 1 is confirmed.

From the regression results of the core explanatory variable, the development of foreign trade in the mid-west region has been driven by the introduction of B&R. The mid-west region has been

facing difficulties such as inconvenient transportation and poor product competitiveness, the introduction of B&R has opened up foreign trade channels, forming a new situation of opening up in the region. The construction of transportation infrastructure network promotes the flow of resources which improves the transportation network of goods and strengthens the cooperation with the coastal regions. The mid-west region is promoting the restructuring of industrial institutions and increasing the level of facilitation through innovative modes of utilizing foreign investment and utilizing imports and exports.

Table 1. Benchmark regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$area_i×year_t$	0.3596***	0.3110***	0.3360***	0.3386***	0.3422***	0.3625***	0.3725***
	(0.0896)	(0.0833)	(0.0852)	(0.0835)	(0.0837)	(0.0829)	(0.0818)
$lnpergdp$		0.2765***	0.2553***	0.2412***	0.2366***	0.2256***	0.1714***
		(0.4215)	(0.0400)	(0.0424)	(0.0422)	(0.0576)	(0.0600)
far			-0.3016***	-0.2812***	-0.2705***	-0.2573***	-0.1838***
			(0.0251)	(0.0671)	(0.0661)	(0.0717)	(0.0590)
fin				0.0426***	0.0502***	0.0368***	0.0062
				(0.0115)	(0.0117)	(0.0143)	(0.0199)
is					1.0539***	1.0954***	1.1087***
					(0.3116)	(0.3091)	(0.3584)
ul						0.1379	0.0582
						(0.1343)	(0.1480)
hr							1.0722**
							(0.6115)
Constant	0.7422***	-2.1747***	-1.7800***	-1.7305 ***	-1.777***	-1.6975***	-1.2164**
	(0.0806)	(0.4215)	(0.3787)	(0.3750)	(0.3791)	(0.5141)	(0.5398)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	765	765	765	765	765	757	756
R^2	0.1574	0.2128	0.2216	0.2266	0.2312	0.2327	0.2380

Notes: The brackets indicate robust standard error, while***, **, and * respectively indicate significant at the 1%, 5%, and 10% levels.

From the regression results of control variables: the regional economic development level, financial development level and regional industrial structure have a relatively significant positive effect; the level of urbanization and human resources also present a positive effect, but it is not significant. The regression coefficient of fixed asset investment is negative at 1% significance level, indicating that it has a significant negative effect. It is mainly due to the lack of growth of fixed assets, which cannot provide endogenous impetus for the development of open economy in the central and western regions. B&R has compensated for this disadvantage, helping the mid-west region to build a new development pattern, and promoting sustainable and coordinated regional development. The healthy flow of resources between the international and domestic markets has also provided strong support for foreign trade in the mid-west region.

5.3 Placebo test

There are many factors that may affect the open economy level of a region, considering the influence of random factors, endogenous factors and other related factors, this paper randomly

selects experimental groups to conduct a placebo test. The sample of this paper contains 51 prefecture-level cities, of which 24 are cities along B&R. Therefore, 24 pseudo-experimental groups are randomly selected from the 51 samples 500 regressions is plotted.
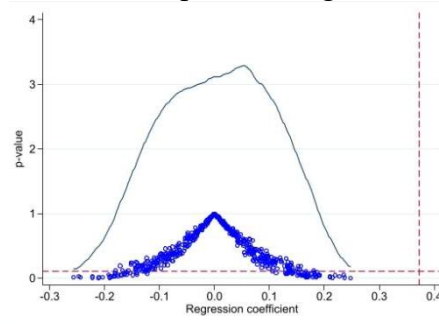

Figure 2. Placebo test results

The curves shown in Figure 2 are the kernel density distributions of the estimated coefficients after 500 regressions. The dots are the corresponding p-values of the estimated coefficients, the vertical dashed line is the true estimate of the double difference model 0.3725, and the horizontal dashed line is the significance level 0.1. From the results plot, it can be observed that the majority of the estimated coefficients are clustered around the 0-points and the corresponding p-value is insignificant at the 10% level, which suggests that the estimation results are not influenced by other policy influence and no important correlates are missed.

6. Further analysis

6.1 Heterogeneity test

6.1.1 Exponential differentiation

This paper adopts the economic indicators of foreign trade dependence and foreign investment reliance to measure the impact of B&R on the development of the open economy in the mid-west region. In order to measure the utility of these two measures separately, this section conducts regressions on the two indexes. In the regression result in columns (1) and (2) of Table 2, the coefficients of the interaction terms of foreign trade dependence and foreign capital dependence are both significantly positive. However, numerically, the regression coefficient of foreign trade dependence is much higher than that of foreign investment dependence, which indicates that the development of foreign trade in the mid-west region is better than that of foreign investment. The reasons can be analyzed from the following two aspects:

Table 2. Heterogeneity Test Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Foreign investment dependence	Foreign trade dependence	Coastal cities	Inland cities	Better business environment	Poorer business environment
$area_i \times year_t$	0.0220***	1.0894***	0.7755***	0.4184***	0.5818***	0.1058***
	(0.0042)	(0.2438)	(0.1297)	(0.1235)	(0.1363)	(0.0399)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	754	755	180	576	375	381
R^2	0.3995	0.2279	0.6280	0.2803	0.2858	0.2382

Notes: The brackets indicate robust standard error, while***, **, and * respectively indicate significant at the 1%, 5%, and 10% levels.

On the one hand, the substantial growth in foreign trade has benefited from a more coordinated overall foreign trade layout. The B&R has deeply tapped the markets of developing countries and

emerging economies, and the diversified international market has provided more opportunities for the foreign trade of the mid-west region, and the trade structure has also been optimized. High-level opening platforms that have emerged under B&R. In addition, B&R has accelerated the gradient transfer of the domestic manufacturing industry, with a large number of processing and manufacturing foreign trade production enterprises gradually transferring their production capacity to the inland provinces, which objectively promotes the rapid development of foreign trade in the mid-west region.

On the other hand, the development of the mid-west region has created conditions for the inflow of foreign capital, but the lack of location advantages has also created obstacles to the further expansion of foreign investment. With B&R really come into effect, it boosts the central region to become a new region to attract foreign investment. But these factors cannot effectively compensate for the lack of location advantages. For a long time, the tax incentives in the mid-west region has not been adjusted according to the changes in the domestic and international situations, and the scope of the national encouragement catalog previously formulated is obviously narrow, and the threshold of the tax incentives and other policies are high, the tax incentives for attracting foreign investment in the mid-west region no longer have a competitive advantage, which to a certain extent restricts the competitiveness of the mid-west region in attracting foreign investment.

6.1.2 Geographical differentiation

Columns (3) and (4) of Table 2 show the effects of B&R on the level of open economic development in coastal and inland cities, and it can be seen that both of them can be significantly promoted, the response of coastal cities to B&R is more obvious.

There are two possible explanations for this phenomenon. Firstly, the infrastructure of coastal areas is more complete. Under the influence of B&R, coastal areas have more frequent trade exchanges with countries along the routes through well-developed and unimpeded transportation channels. Although inland cities have formed a large-scale transportation system under the promotion of B&R, the degree of convenience is still far less than coastal cities. Secondly, the quality of economic development in inland cities is not high, which limits the opening-up process. Low population density and backward level of technological development makes island cities difficult to form a competitive advantage. However, the coastal cities have attracted a large number of talents, labor force and foreign capital by virtue of their high-quality economic development level, which adds impetus to their opening-up process.

6.1.3 Business environment differentiation

According to *the Report on Business Environment in 296 Chinese Cities in 2020*, 51 cities can be regressed into better business environment and poorer business environment. From the regression results in columns (5) and (6) of Table 2, the policy effects on cities with better business environment are significantly higher than those on cities with poorer business environment. B&R can stimulate the vitality of all kinds of market players, and a good business environment is conducive to attracting and gathering development factors, promoting the upgrading of the regional industrial structure and enhancing the international competitiveness of the region through the creation of advanced productive forces and perfecting the allocation of the factor market.

6.2 Mechanism of action test

Based on the logic of the previous paper, this paper examines the relevant factors through the mediation effect, and examines the potential impact of infrastructure construction. This paper uses the logarithm of road freight traffic (*lntraffic*) and the logarithm of the number of cell phone subscribers (*lntel*) in the proportion of 50% of each to jointly constitute an indicator: infrastructure construction (*ic*). The data is from the China Urban Statistical Yearbook.

Table 3 shows the regression results. In column (1), the coefficient is significantly positive, which indicates that the proposal of B&R effectively improves the level of infrastructure facilitation in the mid-west region. In column (2), the coefficient is also significantly positive, which indicates

that the improvement of infrastructure construction has a positive impact on the expansion of the level of open economy. The coefficient of the interaction term 0.3345 in column (2) in this table is smaller than the coefficient of the interaction term 0.3725 in column (7) in Table 1, which proves that infrastructure construction plays a partly positive mediating role in the promotion of the open economy of the mid-west region and the mediating role is 6.73%. The hypothesis 2 is confirmed.

Table 3 Mechanism of Action Test Results

	(1)	(2)
	ic	*open*
$area_i \times year_t$	0.2149***	0.3345***
	(0.1137)	(0.0872)
ic		0.1167***
		(0.0211)
Time effect	Yes	Yes
Individual effect	Yes	Yes
Observations	765	765
R^2	0.2025	0.2721

Notes: The brackets indicate robust standard error, while***, **, and * respectively indicate significant at the 1%, 5%, and 10% levels.

7. Conclusion

This paper takes the mid-west region along B&R as the main research object, based on the panel data of 51 prefecture-level cities from 2005 to 2019, and adopts the difference-in-differences model to study the impact and specific mechanism of B&R on the development of the open economy in the mid-west. The results show that: (1) B&R significantly promotes the development of open economy in the mid-west, and passes the parallel trend test and the robustness test, which confirms the robustness of the conclusions; (2) B&R has a significant impact on foreign trade and foreign investment, coastal cities and inland cities, and different business environments; (3) the mediation effect test finds that B&R enhances the level of infrastructure construction in the mid-west region, which ultimately promotes the open economic development of the mid-west region.

It should be noted that due to the limited availability of data, this paper does not include service trade data in the study. However, the three indicators of trade in goods, foreign investment and trade in services together measure the changes in the level of the open economy of the mid-west region. Considering all three together can truly and more accurately reflect the whole picture of the opening-up of the mid-west region by B&R, which will be the direction of in-depth research in the future.

References

[1] Guoli G,Zhangxue H,Yan Z.Promote the Docking between the "One Belt One Road" and the Three Regional Development Strategies[J].Macroeconomic Management,2018(08):15-18.

[2] Wai N.Building an Open Economic System for the New Era[J].Shanghai Economic Research, 2022(05):24-29.

[3] Weihong Z,Xu Z.The Era Background, Historical Logic, and Practical Foundation of China's Institutional Openness in Shanghai Economic Research[J].Economist,2022(04):17-27.

[4] Wenmei K.Research on the Impact of Trade Facilitation on International Economy and Trade - Based on the Empirical Analysis of the Six Economic Corridors of the "One Belt One Road"[J].Prices Monthly,2022(03):48-54.

[5] Chunxiao Y.An Empirical Analysis of the Factors Influencing China's Export to Countries along the "the Belt and Road" -- Based on the Gravity Model[J].Hubei Social Sciences,2020(12):90-96.

[6] Boying L.Building a New Development Pattern to Achieve Sustainable High-quality Economic and Social Development: an Empirical Study Based on Economic and Trade Cooperation between China

and Countries along the "One Belt One Road"[J].Journal of Northwest University (Philosophy and Social Sciences Edition),2020,50(06):115-126.

[7] Hailong L,Debu G,Yulan X.Research on the Thinking of Constructing a New Pattern of Western Development with "Great Protection, Great Opening, and High Quality"[J]. Macroeconomic Research,2021(06):80-92.

[8] Yi Q.New Ideas for the Construction of the Western Land Sea Corridor and the Opening up and Development of Southwest China[J].Economic System Reform,2021(02):50-55.

[9] Jiguang L.A Study on the Opening up Path of Border Areas under the New Development Pattern[J].Guizhou Social Sciences,2021(05):120-127.

[10] Xiaofan L,Lingduo J."One Belt One Road" construction, central and western opening-up and regional economic development[J].World Economy,2020,43(10):3-27.

[11] Yujie Z.Boosting the Social and Economic Development of the Central and Western Regions with the "New Type of Openness"[J].Jinyang Academic Journal,2016(05):132-138.

[12] Guolei D,Xiaoguang W."One Belt One Road" Construction and the Economic Opening of Inland Cities in Central and Western China[J].Urban Studies,2019,26(03):10-14+20.

[13] Zachary B. Affirmative Action, Mismatch, and Economic Mobility after California's Proposition [J]. The Quarterly Journal of Economics,2021,137(1):115-160.

[14] Yi C,Hui L,Tao S,Haimeng L,Zhipeng T,Dongsheng Z.The Spatiotemporal Pattern and Driving Factors of Open Economic Development in southwestern China[J].World Regional Studies,2018,27(04):77-89.