Innovation Series https://www.innoseries.com

The Impact of the Belt and Road Initiative on the Innovation Capabilities of Countries Along the Route

Yiming Ding
Business School, East China University of Political Science and Law, Shanghai 201620, China

Abstract: Over the more than ten years since the Belt and Road Initiative was proposed, the global economic and political landscape has undergone profound changes, making scientific and effective policy evaluation essential for promoting its high-quality development. Based on panel data from 103 countries covering the period 2009–2023, this study employs a multi-period difference-in-differences method to systematically assess the causal effects of Belt and Road cooperation on national innovation capacity. The findings reveal that the Belt and Road Initiative significantly promotes national innovation capacity. This conclusion remains valid after undergoing a series of robustness tests—including parallel trends tests, policy time-randomness tests, placebo tests, and subsample regressions—and after further addressing endogeneity issues using the instrumental variables method. Heterogeneity analysis indicates that this promotional effect is primarily concentrated in emerging market and developing countries.This paper not only provides new empirical evidence on the policy effects of the Belt and Road Initiative from the perspective of innovation capacity but also offers policy references for promoting its high-quality and differentiated development.

Keywords: Belt and Road Initiative; National Innovation Capacity; Multi-period Difference-in-Differences

1. Introduction

The Belt and Road Initiative (BRI), comprising the Silk Road Economic Belt and the 21st-Century Maritime Silk Road, was proposed by Chinese President Xi Jinping during his visits to Central Asia and Southeast Asia in 2013. As a vital initiative for China's high-standard opening-up and win-win international cooperation, it has garnered wide global recognition. By August 24, 2023, China had signed over 200 BRI cooperation documents with 152 countries and 32 international organizations. The BRI has boosted infrastructure development, trade, investment, agriculture, healthcare and poverty alleviation across participating nations. President Xi Jinping's report to the 20th National Congress of the Communist Party of China stressed the need to pursue high-quality BRI development, which guides China to foster a dual-circulation economic paradigm and conduct targeted policy adjustments and evaluations for the Initiative. Against this backdrop, this study adopts the multi-period difference-in-differences method to assess the BRI's impacts on national innovation capacity. Different from prior literature that mainly focuses on the BRI's effects on investment, trade and corporate upgrading, this research innovatively takes national innovation capacity as the research perspective, complementing existing policy evaluation studies on the BRI. Empirically, the results confirm that the BRI significantly improves participating countries' innovation capacity. Using rigorous econometric tools, this paper delivers solid empirical evidence to support the strategic optimization and high-quality development of the BRI.

2. Literature Review

2.1 Research on the Evaluation of the Policy Effects of the Belt and Road Initiative

Since the launch of the Belt and Road Initiative, numerous scholars have conducted extensive research on it from both normative and empirical perspectives, with empirical studies being particularly relevant to this paper. Among these empirical studies, two categories can be distinguished: one uses Belt and Road countries as research samples, essentially continuing traditional research on various national economic factors; the other focuses on evaluating the policy effects of the Belt and Road Initiative itself, which is the primary focus of this paper.

Existing literature has assessed the impact of the Belt and Road Initiative on economic growth, trade, and sustainable development in participating countries. Regarding economic growth, Dai Xiang and Wang Ruxue [1], using panel data from 116 Belt and Road countries spanning 2010–2023 and a multi-period difference-in-differences model, demonstrated that the Belt and Road Initiative not only promotes the expansion of economic scale in participating countries but also contributes to improving the quality of their economic growth. In terms of trade, the findings of Dai Xiang and Song Jie [2] indicate that the Belt and Road Initiative has significantly enhanced the position of participating countries in the global value chain and promoted a more equitable global division of labor. Liu Shanshan [3], adopting a dual perspective of sustainable development and improvements in people's well-being, utilized a difference-in-differences model based on panel data from 152 countries covering the period 2009–2018 to provide empirical evidence on how the Belt and Road Initiative promotes the building of a community with a shared future for mankind. The study found that the BRI's positive effects on sustainable development and improvements in people's well-being in participating countries can be achieved through infrastructure development, economic growth, and environmental sustainability.

Overall, joining the Belt and Road Initiative is beneficial for countries along the route, as it is guided by the fundamental principle of "consultation, cooperation, and shared benefits," thereby better aligning with the development needs of these countries.

2.2 Research on the Belt and Road Initiative and National Innovation Capacity

Currently, there is no literature that directly examines the impact of the Belt and Road Initiative on national innovation capacity. Existing literature primarily includes evaluations of innovation capacity, analyses of the current situation, comparative studies, and research on spatial spillover effects in participating countries. Cheng Hao and Rong Yuhua [4] , after comprehensively considering data from the World Bank, the Global Innovation Index, and the World Competitiveness Yearbook, selected seven indicators—total population, GDP, R&D researchers, higher education enrollment rate, R&D expenditure, scientific journal publications, and patent applications—to conduct a quantitative evaluation of the level of scientific and technological innovation in Belt and Road countries using a second-order factor model and partial least squares estimation.Hu Jian [5] analyzed the innovation capabilities of core Belt and Road countries from the perspective of the international sociological system and explored the policy implications of national innovation capabilities for advancing the Belt and Road Initiative through comparative analysis. Feng Genyao and Feng Qianju [6], based on the

2016 Global Innovation Index, conducted a comparative analysis of the top 10 countries along the Belt and Road in terms of the Global Innovation Index. Using the world's 10 most innovative countries as a reference, they analyzed the constraints affecting the cultural innovation efficiency of Belt and Road countries and proposed policy recommendations and development strategies to promote the sustainable development of regional cultural innovation. Zhu Yongfeng et al. [7] combined geospatial analysis with spatial panel models to examine the spatial structure of innovation capacity and its spatial spillover effects among countries along the Belt and Road. Their findings indicate that the innovation capacity of these countries generally exhibits an upward trend.

2.3 Literature Review

In summary, existing literature has assessed the impact of the Belt and Road Initiative on economic growth, trade, and sustainable development in participating countries. Research related to national innovation capacity primarily focuses on analyzing the current state of innovation in these countries, with a lack of studies directly evaluating the initiative's impact on national innovation capacity. Based on this, this paper primarily discusses whether the joint construction of the Belt and Road Initiative has promoted the enhancement of innovation capacity in participating countries.

3. Theoretical Analysis

The Belt and Road Initiative was proposed against the backdrop of major adjustments in the global economic landscape and represents a significant measure to advance economic globalization. As Liu Weidong [8] noted, the Belt and Road Initiative represents an innovative form of globalization, rather than a mere continuation of previous economic globalization models. Guided by the principle of equality and mutual collaboration, the Initiative facilitates exchanges and cooperation among all participating countries. Li Yang and Zhang Xiaojing [9] further argued that this framework helps nations break the barriers imposed by developed economies and expand resource and market cooperation, laying a solid foundation for building a global growth chain of mutual benefits.

China has launched a series of trade and investment cooperation initiatives with countries participating in the Belt and Road Initiative. Guided by the fundamental principle of "consultation, cooperation, and shared benefits," these initiatives are better aligned with the development needs of countries along the route, thereby promoting economic growth across the region. As a key mechanism for realizing the concept of a "community with a shared future for mankind" [10], the Belt and Road Initiative focuses not only on China's own interests but also on those of other nations; it is driven not merely by China's development but by the progress of the world. A review of existing literature suggests that the Belt and Road Initiative may have both direct and indirect impacts on a nation's innovation capacity. On the one hand, when cooperating with countries along the Belt and Road, China enhances national innovation capacity by strengthening official and people-to-people exchanges with these nations, thereby fostering mutual understanding. On the other hand, by assisting countries along the Belt and Road in building infrastructure, promoting foreign investment, and facilitating trade, China lays the foundation for their sustainable development. This not only directly contributes to the enhancement of their national innovation capabilities but also drives their economic growth, thereby expanding the scale of effective demand and further boosting their national innovation capabilities [11].

4. Research Design

4.1 Model Specification

Most existing literature employs the difference-in-differences (DID) method to empirically evaluate policy effects. However, since different countries joined the Belt and Road Initiative at different times, this study uses a multi-period difference-in-differences method for analysis. Following the approach of Beck et al. [12] and Li et al. [13], this study employs the following multi-period DID model:

$$y_{it}=\alpha+\theta policy_{it}+\beta X_{it}+\mu_i+\lambda_t+\varepsilon_{it}$$

Where y_{it} is the dependent variable, and $policy_{it}$ indicates the presence or absence of policy effects; if country i is affected by the policy in year t, then $policy_{it}$ = 1, otherwise it is 0. Based on this, this paper specifies the following econometric model:

$$INNOVATION_{it}=\alpha+\theta BRI_{it}+\beta X_{it}+\mu_i+\lambda_t+\varepsilon_{it}$$

Where $INNOVATION_{it}$ represents the national innovation capacity of country i in year t; BRI_{it} is a dummy variable indicating whether country i joined the Belt and Road Initiative in year t, taking 1 if it joined and 0 otherwise; X_{it} represents the control variables. Since there are many factors influencing a country's innovation capacity—beyond the policy effects of the "Belt and Road" Initiative, which is the primary focus of this study, and the other control variables already included—there are other potential influencing factors that cannot be fully observed. Therefore, this study employs a fixed-effects panel model for estimation, where μ_i and λ_t represent the country fixed effects and the year fixed effects, respectively. ε_{it} denotes the random disturbance term.

4.2 Variable Selection and Data Sources

4.2.1 Dependent Variable

The dependent variable in this paper is national innovation capacity (INNOVATION), measured using the logarithmic form of the Global Innovation Index. The Global Innovation Index comprises over 80 indicators covering areas such as institutions, innovation drivers, knowledge creation, business innovation, technology adoption, and intellectual property. It assesses and ranks the innovation capacity and achievements of economies worldwide through surveys of global economies and by referencing data from organizations such as the World Economic Forum, the World Bank, and the United Nations. The Global Innovation Index provides a relatively comprehensive measure of a country's innovation capacity; its specific indicator scores reflect a nation's developmental strengths and weaknesses, and the evaluation methods and conclusions derived from it are recognized by the vast majority of countries worldwide. This paper draws on the Global Innovation Index Report to obtain the Global Innovation Index scores for 103 countries from 2009 to 2023.

4.2.2 Core Explanatory Variable

The explanatory variable in this study is whether a country participates in the Belt and Road Initiative. The criterion for determining a country's participation is the formal signing of a BRI cooperation document with China, which includes two forms: signing an intergovernmental memorandum of understanding on BRI cooperation with China and signing a BRI cooperation document with China. The signing dates are sourced from statistical data published on the China Belt and Road website (yidaiyilu.gov.cn,). If a country signed relevant documents with China in year t, and the signing date preceded the release date of that year's Global Innovation Index report, then the BRI value for year t and all subsequent years is set to 1; otherwise, it is set to 0. If the signing date followed the release date of that year's Global Innovation Index report, then the BRI value for year t+1 and all subsequent years is set to 1; otherwise, it is set to 0. The publication dates of the Global Innovation Index for each year are sourced from the Publications section of the World Intellectual Property Organization's official website.

4.3 Control Variables

Drawing on existing literature, the control variables selected in this study include:

I. Level of Economic Development (EDL). Generally, countries with higher levels of economic development have more developed infrastructure and a larger talent pool. These factors collectively create a favorable innovation environment that promotes scientific and technological innovation activities and enhances innovation output [14]. This study uses per capita gross domestic product (GDP) to measure the level of economic development.

II. Level of Foreign Direct Investment (FDI). Higher levels of foreign direct investment may dampen the enthusiasm for independent R&D, hinder the improvement of innovation capacity, and consequently exert a negative effect on innovation performance [15]. This study measures the level of foreign direct investment using the logarithm of the actual amount of foreign capital utilized.

III. Level of government expenditure (GOV). Government expenditure significantly incentivizes independent innovation [16], thereby enhancing a nation's innovation capacity. This study uses government final consumption expenditure to measure the level of government expenditure.

IV. Level of industrialization (INDUSTRY). The enhancement of a nation's innovation capacity is inextricably linked to its industrial economic foundation [17]. This study uses industrial value added to measure the level of industrialization.

V. Level of the service sector (SERVICE). The service sector is characterized by high employment elasticity and a high degree of knowledge intensity. It often attracts a large number of highly skilled technical professionals, providing a solid foundation and favorable environment for innovation activities, and thus exhibits higher innovation capacity.

This paper uses service sector value added to measure the level of the service sector. The data for the control variables used in this paper are all sourced from the UNCTAD statistical database. Table 1 reports the descriptive statistics for the relevant variables.

Table 1: Descriptive Statistics of Variables.

Variable	Observation	Mean	Standard Deviation	Minimum	Median	Maximum
INNOVATION	1133	3.66	0.29	2.94	3.64	4.32
BRI	1,133	0.16	0.37	0.00	0.00	1.00
EDL (in $10,000)	1,133	1.81	2.09	0.05	0.91	10.85
FDI	1,133	10.87	1.78	5.87	10.83	16.05
GOV (trillion)	1,133	0.12	0.33	0.0006	0.02	2.77
INDUSTRY (trillion dollars)	1,133	0.18	0.56	0.0012	0.04	5.66
SERVICE (trillion)	1,133	0.44	1.55	0.0025	0.07	16.11

Data sources: Global Innovation Index (GII) Report, China Belt and Road Network, UNCTAD database

5. Analysis of Empirical Results

5.1 Basic Regression

The results of the multi-period difference-in-differences regression are shown in Table 2. Column 1 of Table 2 presents a simplified regression without control variables, while Column 2 presents the basic regression with control variables included. Based on the results in Table 2, the BRI coefficient in the simplified regression is positive but does not pass the significance test, whereas the BRI coefficient in the basic regression is positive and passes the significance test. Therefore, it can be preliminarily concluded that the Belt and Road Initiative significantly promotes the improvement of innovation capacity in countries along the route. The coefficients of the remaining control variables are all consistent with the expectations of this paper and are significant.

Table 2: Results of the Basic Regression.

Variables	(1) Simplified Regression	(2) Regression with Control Variables
BRI	0.009	0.019**
	(0.746)	(2.001)
EDL		0.104***
		(4.514)
FDI		-0.054***
		(-3.017)
GOV		0.463**
		(2.554)
INDUSTRY		-0.224*
		(-1.774)
SERVICE		0.086***
		(2.658)
_cons	3.663***	4.006***
	(1922.535)	(20.885)
N	1133	1133
Country fixed effects	YES	YES
Year Fixed Effects	YES	YES
Within R^2	0.001	0.114

Note: The numbers in parentheses are t-values; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The same applies below.

5.2 Parallel Trends Test

An important prerequisite for using the difference-in-differences method is the fulfillment of the parallel trends assumption, which posits that the "Belt and Road" initiative has no policy impact and that the treatment group and control group exhibit identical trends. Therefore, this study first conducts a parallel trends test for the model. Following the approach of Dai Xiang and Wang Ruxue

(2022), this study examines trend changes from the five years prior to the policy's implementation to the four years following its implementation.As shown in Figure (1), the confidence intervals for the regression coefficients (-5, -4, -3, -2, -1) covering the five years prior to the policy's implementation all include zero, indicating that the estimates are not significant. This suggests that the treatment group and the control group exhibited consistent trends prior to the implementation of the Belt and Road policy, thereby satisfying the parallel trends assumption.

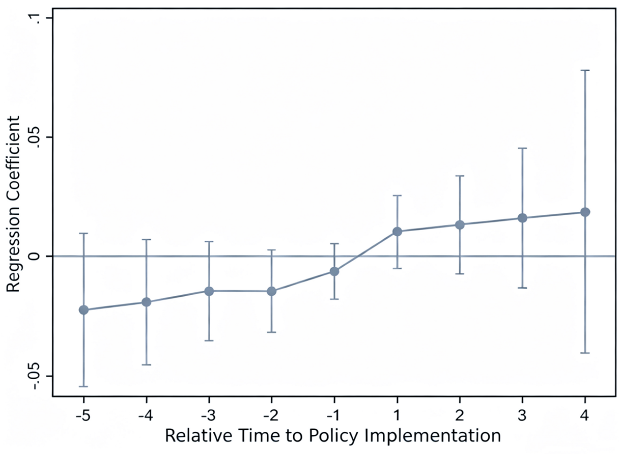

Figure 1: Parallel Trends Test.

5.3 Robustness Tests

This paper employs three robustness tests—the policy time randomness test, the placebo test based on randomly selected experimental groups, and subsample regression—to enhance the reliability of the empirical results.

5.3.1 Test for Policy Timing Randomness

In addition to the Belt and Road Initiative, other policies or random factors may also influence a country's innovation capacity. Such influences, unrelated to the Belt and Road Initiative, could ultimately invalidate the conclusions presented earlier. To eliminate the influence of such factors, following the approach of Liu Ruiming and Zhao Renjie [18], this study uniformly shifts the year each country joined the Belt and Road Initiative forward by 2 to 5 years to conduct the policy-timing randomness test. If the coefficient of the difference term remains significantly positive at this point, it indicates that the improvement in a country's innovation capacity likely stems from other policy changes or random factors, rather than the Belt and Road Initiative. If the coefficients of the difference-in-differences terms are not significantly positive, this indicates that the improvement in a country's innovation capacity stems from the Belt and Road Initiative. As shown in Table 3, the coefficients of the difference-in-differences terms in all columns are not significant, indicating that the improvement in a country's innovation capacity stems from the Belt and Road Initiative.

Table 4: Sub-sample Regression Results.

Variable	(1) 2 years in advance	(2) 3 years in advance	(3) 4 years in advance	(4) 5 years in advance

fakeBRI2	0.011			
	(1.218)			
fakeBRI3		0.010		
		(1.026)		
fakeBRI4			0.008	
			(0.724)	
fakeBRI5				0.003
				(0.241)
EDL	0.102***	0.101***	0.101***	0.100***
	(4.554)	(4.556)	(4.482)	(4.363)
FDI	-0.054***	-0.054***	-0.055***	-0.055***
	(-3.015)	(-3.034)	(-3.057)	(-3.001)
GOV	0.448**	0.436**	0.419**	0.401**
	(2.483)	(2.479)	(2.423)	(2.378)
INDUSTRY	-0.207	-0.197	-0.182	-0.167
	(-1.653)	(-1.623)	(-1.530)	(-1.449)
SERVICE	0.082**	0.080**	0.076**	0.070**
	(2.527)	(2.550)	(2.464)	(2.391)
_cons	4.014***	4.019***	4.027***	4.029***
	(20.762)	(20.707)	(20.792)	(20.674)
N	1133	1133	1133	1133
Country Fixed Effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Within R^2	0.111	0.110	0.110	0.110

5.3.2 Placebo Test Based on Randomly Selected Experimental Groups

To further rule out the potential impact of omitted variables on the validity of the empirical results, this paper adopts the methodology of Ferrara et al. [19] to randomly select countries as the experimental group for further placebo tests. The experimental group described earlier comprises 73 countries that signed documents related to the Belt and Road Initiative before 2019, while the control group consists of 30 countries that signed such documents in 2019 or later and those that have not joined the Belt and Road Initiative. This paper randomly selected 73 countries from the total sample of 103 to form the experimental group, with the remaining 30 countries serving as the control group. A dummy difference-in-differences term was constructed and estimated according to Model (2) to obtain the coefficients of the dummy difference-in-differences term. This process was repeated 500 times to obtain kernel density estimates of the coefficients (as shown in Figure 2), where the vertical line represents the true difference-in-differences coefficient. As shown in Figure 2, the estimation results from the randomized grouping are concentrated around zero and follow a near-normal distribution, with a mean close to 0. Most p-values are greater than 0.1 (as shown in Figure 3), indicating that the Belt and Road Initiative has no significant positive effect on the randomly selected experimental group. Furthermore, the true coefficient of the difference-of-squares term (the vertical dashed line) lies somewhat outside the main distribution range, suggesting that the probability that the previously observed enhancement of national innovation capacity through the Belt and Road Initiative is merely a random result is relatively low.

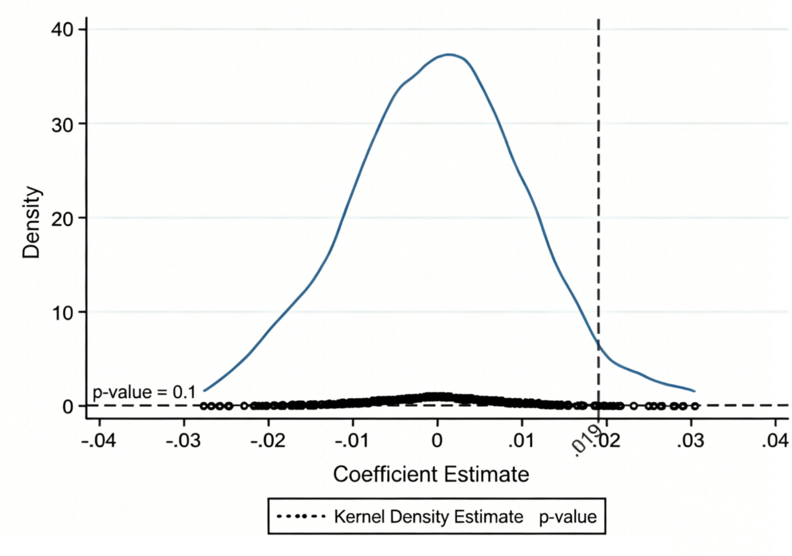

Figure 2: Placebo Test Results.

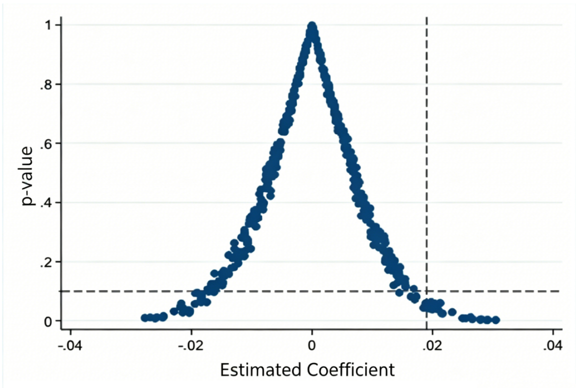

Figure 3: Details of Placebo Test Results.

5.3.3 Sub-sample Regression

Since the Global Innovation Index is a dynamic evaluation system, it has been continuously improved and refined in line with global innovation trends since its inception in 2007, with its conceptual framework not finalized until 2012. To ensure that differences in the measurement of national innovation capacity do not affect the empirical results, this study excluded data prior to 2012 from the sample and performed a regression on Model (2); the results are presented in the first column of Table 4.Furthermore, the experimental group in this study comprises 17 developed countries and 56 other countries, while the control group consists of 18 developed countries and 12 other countries; there is significant imbalance between the experimental and control groups in terms of economic characteristics. To mitigate the potential impact of this imbalance on the empirical results, this study manually excluded 11 developed countries from the control group based on the average Global Innovation Index of the experimental group and the proportion of developed versus other countries, and then performed a regression of Model (2). The results are presented in Column 2 of

Table 4. Taking both of the above factors into account, we conducted a regression of Model (2) using data from 2012 to 2019 that excluded the 11 developed countries from the control group, with the results presented in the third column of Table 4. As shown in Table 4, the coefficients for BRI in each column are significantly positive, and the differences in coefficient values are small, indicating that the conclusions of this paper are highly robust.

Table 4: Sub-sample Regression Results.

Variables	(1)	(2)	(3)
BRI	0.015*	0.020**	0.016*
	(1.861)	(2.079)	(1.927)
EDL	0.059**	0.139***	0.107***
	(2.305)	(5.663)	(5.107)
FDI	0.003	-0.060***	0.006
	(0.152)	(-3.101)	(0.294)
GOV	0.488**	0.694	0.105
	(2.082)	(1.075)	(0.192)
INDUSTRY	-0.166	-0.183	-0.208
	(-1.046)	(-1.445)	(-0.732)
SERVICE	0.050	-0.013	0.184
	(1.636)	(-0.075)	(0.726)
_cons	3.436***	4.027***	3.321***
	(16.198)	(19.518)	(14.584)
N	824	1012	736
Country fixed effects	YES	YES	YES
Year Fixed Effects	YES	YES	YES
Within R^2	0.095	0.121	0.110

4. Heterogeneity Analysis

Given the significant differences in economic development levels among the sample countries, this study conducts a heterogeneity analysis based on whether a country is a developed nation. As shown in Table 5, the coefficient for BRI in Column 1 is insignificantly negative, whereas in Column 2, the coefficient for BRI is significantly positive and significantly larger than that in the baseline regression. This indicates that the impact of the Belt and Road Initiative on national innovation capacity is primarily concentrated in emerging market and developing countries.

Table 5: Results of Heterogeneity Tests.

Variable	(1) Developed Countries	(2) Other Countries
BRI	-0.008	0.033***
	(-0.897)	(2.956)
EDL	-0.033***	0.154***
	(-2.955)	(4.449)

FDI	0.078***	-0.036
	(5.062)	(-1.555)
GOV	0.160	1.129
	(1.141)	(1.656)
INDUSTRY	-0.053	-0.233
	(-0.441)	(-1.607)
SERVICE	-0.005	-0.111
	(-0.166)	(-0.603)
_cons	3.136***	3.743***
	(17.989)	(15.904)
N	385	748
Country fixed effects	YES	YES
Year fixed effects	YES	YES
Within R^2	0.107	0.116

5. Endogeneity Issues

From the perspective of empirical methods and procedures, although this paper employs a fixed-effects model and a series of robustness tests to control for some endogeneity issues, it will also utilize the instrumental variables method for further analysis to address potential endogeneity problems in the core explanatory variables. Following the approach of Jin Gang and Shen Kunrong [20] , we select the geographical distance between China and countries along the Belt and Road as the instrumental variable for the Belt and Road Initiative. Since geographical distance does not vary over time, to introduce a dynamic dimension, this study adopts the method of Acemoglu et al. [21] by multiplying it by a time dummy variable to construct an interaction term for testing endogeneity.

Before conducting the regression using the instrumental variable, we first test for endogeneity of the explanatory variable. As shown in Table 6, the P-value of the Hausman test is 0.003, indicating that the explanatory variable exhibits strong endogeneity. Under the assumption of a spheric disturbance term, two-stage least squares regression is the most effective method. However, as shown in Table 6, the disturbance term exhibits heteroscedasticity and autocorrelation, failing to satisfy the spheric disturbance assumption. Therefore, this paper employs a two-stage generalized moment estimation method to address the endogeneity issue.

Table 6: Results of Tests for Endogeneity, Heteroscedasticity, and Autocorrelation.

Endogeneity Test	Test Method	Hausman test
	Statistic (χ^2)	19.690
	p-value	0.003
Test for heteroscedasticity	Test Method	Likelihood-ratio test
	Statistic (χ^2)	443.160
	p-value	0.000
Autocorrelation test	Test Method	Wooldridge test
	Statistical value (F)	78.952

p-value	0.000

As shown in Table 7, regarding the results of the instrumental variable validity tests, the p-value of the LM statistic in the non-identifiability test is 0, which significantly rejects the null hypothesis of insufficient identification; the F-statistic in the weak instrumental variable test exceeds the critical value of 10 proposed by Staiger and Stock [22] , thus rejecting the weak instrumental variable hypothesis; However, the p-value for the Hansen J-statistic in the over-identification test is 0.001, indicating that the instrumental variables may exhibit some endogeneity; nevertheless, overall, the selected instrumental variables are effective. As shown by the regression results in Table 4, the coefficient for BRI is significantly positive. This implies that even after accounting for endogeneity, the Belt and Road Initiative still plays a significant role in promoting national innovation capacity.

Table 7: Instrumental Variables Regression Results.

Variables	(1)
BRI	0.269***
	(6.021)
EDL	0.083***
	(18.731)
FDI	0.052***
	(13.874)
GOV	0.602***
	(5.831)
INDUSTRY	-0.127***
	(-4.187)
SERVICE	-0.082***
	(-5.896)
_cons	3.124***
	(86.605)
N	1133
Underidentification test	72.662
(LM statistic)	[0.000]
Weak identification test (F statistic)	14.962
Overidentification test	30.180
(Hansen J statistic)	[0.001]
R^2	0.706

Note: Values in parentheses are t-values; values in square brackets are p-values; ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

6. Conclusions and Recommendations

6.1 Conclusions

Using sample data from 103 countries covering the period from 2009 to 2023, this study employs a multi-period difference-in-differences method to evaluate the policy impact of the Belt and Road Initiative. The results indicate that the Belt and Road Initiative has significantly boosted national innovation capacity. This conclusion holds even after conducting various robustness tests—including policy time randomization, random assignment of treatment groups, and regression on a selected subsample—and accounting for endogeneity issues. A differentiated analysis by country type reveals that the impact of the Belt and Road Initiative on national innovation capacity is primarily concentrated in emerging market economies and developing countries.

6.2 Recommendations

To advance high-quality development of the Belt and Road Initiative (BRI) amid evolving domestic and global circumstances, we should follow the principles of extensive consultation, joint contribution and shared benefits, and improve relevant institutional and policy frameworks. First, we need to optimize opening mechanisms for inland and border areas, foster coordinated development between coastal, inland and border regions, and build a sound industrial system to elevate overall opening-up levels. Second, we will expand trade ties with BRI partners by restructuring import and export patterns, shifting from volume-driven trade to a model prioritizing quality, efficiency and diversified trade forms including goods, services, technology and capital. Third, we will refine policies and services for outbound investment, deepen international production capacity cooperation, and advance related institutional reforms. Fourth, we will align domestic and international rules via free trade zones, optimize the business environment through market-oriented reforms, strengthen intellectual and property rights protection, and cut enterprises' institutional transaction costs. Furthermore, China will actively engage in global economic governance, stand against protectionism, and work with all parties to tackle transnational challenges and build a community with a shared future for mankind.

References

[1] Dai Xiang, Wang Ruxue. The Economic Growth Effects of China's "Belt and Road" Initiative on Countries Along the Route: Quality or Quantity [J]. International Trade Issues, 2022(05):21-37.

[2] Dai Xiang, Song Jie. "The Global Value Chain Optimization Effects of the Belt and Road Initiative: A Perspective on the Enhanced Position of Participating Countries in the Global Value Chain Division of Labor" [J]. China Industrial Economics, 2021(06): 99-117.

[3] Liu Shanshan. The Impact of the "Belt and Road" Initiative on Sustainable Development in Participating Countries: An Empirical Test Using a Difference-in-Differences Model [J]. East China Journal of Economics and Management, 2022, 36(01): 42-52.

[4] Cheng Hao, Rong Yuhua. Evaluation of the Level of Scientific and Technological Innovation in Countries Along the "Belt and Road" [J]. Statistics and Decision Making, 2022, 38(07): 171-174.

[5] Hu Jian. "The Foundation of Cooperation within the 'Belt and Road' Framework: An Analysis Based on the Current State of Innovation Capacity in Core Countries Along the Route" [J]. Journal of Social Sciences, Hunan Normal University, 2017, 46(02): 92-102.

[6] Feng Genyao, Feng Qianju. International Comparative Study and Implications of Cultural Innovation Capacity in Countries Along the "Belt and Road" [J]. International Business Research, 2018, 39(03): 51-62.

[7] Zhu Yongfeng, Wang Zilong, Zhang Zhiwen, Zhu Lingling. "Spatial Spillover Effects of Innovation Capabilities in Countries Along the Belt and Road" [J]. China Science and Technology Forum, 2019(05):171-180.

[8] Liu Weidong. "The Scientific Implications and Issues of the 'Belt and Road' Initiative" [J]. Advances in Geography, 2015, 34(05): 538-544.

[9] Li Yang, Zhang Xiaojing. “The New Normal”: The Logic and Prospects of Economic Development [J]. Economic Research Journal, 2015, 50(05): 4-19.

[10] Liu Wei, Wang Wen. “A Community with a Shared Future for Mankind” from the Perspective of Political Economy in the New Era of Chinese Socialism [J]. Management World, 2019, 35(03): 1-16.

[11] Fan Hongzhong. The Effective Demand Scale Hypothesis, R&D Investment, and National Independent Innovation Capacity [J]. Economic Research Journal, 2007(03):33-44.

[12] Beck T., Levine R., Levkov A. Big Bad Banks: The Winners and Losers from Bank Deregulation in the United States [J]. The Journal of Finance, 2010, 65(5): 1637–1667.

[13] Li P, Lu Y, Wang J. Does Flattening Government Improve Economic Performance? Evidence from China [J]. Journal of Development Economics, 2016, 123: 18–37.

[14] Lin Shouf, Dong Xiaoqing. Impact and Transmission Mechanisms of Comprehensive Innovation Reform Pilots on Regional Innovation Capacity [J]. Science and Technology Progress and Policy, 2022, 39(02): 91–100.

[15] Zeng Jingjing, Zhou Danping. Regional Characteristics, Industrial Structure, and Urban Innovation Performance: A Quasi-Natural Experiment Based on Innovative City Pilot Programs [J]. Public Administration Review, 2019, 1(03): 66–97.

[16] Liu Qiongzhi. Incentivizing Independent Innovation: Public Expenditure Effects and Optimal Scale [J]. Research on Quantitative and Technical Economics, 2007(03): 81-90+101.

[17] Liu Jianping, Lu Hongyan. Digital Trade in Services and National Innovation Capacity: A Study on the Mediating Effects of Income Disparities [J]. Technology and Economy, 2022, 41(10): 1-11.

[18] Liu Ruiming, Zhao Renjie. Do National High-Tech Zones Promote Regional Economic Development?—A Verification Using the Difference-in-Differences Method [J]. Management World, 2015(08):30-38.

[19] La Ferrara, E., A. Chong, and S. Duryea. “Soap Operas and Fertility: Evidence from Brazil” [J]. American Economic Journal: Applied Economics, 2012, 4(4): 1-31

[20] Jin Gang, Shen Kunrong. The Effects of Chinese Enterprises’ Transportation Investments in Countries Along the “Belt and Road”: Developmental Benefits or Debt Traps? [J]. China Industrial Economics, 2019(09):79-97.

[21] Acemoglu, D., Johnson, S., & Robinson, J. A. The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth [J]. American Economic Review, 2005, 95(3): 546–579.

[22] Staiger D, Stock J H. Instrumental Variable Regression with Weak Instruments [J]. Econometrica, 1997, 65(3):557–586.