

Article

How Does the “Belt and Road” Initiative Affect Debt Sustainability?

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Abstract: The Belt and Road Initiative (BRI) has opened new financing channels, promoting sustainable debt management and high-quality economic growth in China and BRI-participating countries. This paper, using sample data from 64 BRI-participating countries and 40 non-BRI countries from 2002–2021, employs the difference-in-differences (DiD) method to examine BRI impacts on government debt sustainability. Empirical results passing robustness tests reveal heterogeneous effects. Findings indicate: first, the BRI enhances government debt sustainability in participating countries; second, government spending, foreign direct investment, and international trade moderate economic development; third, the BRI exhibits heterogeneity by income, debt levels, and growth rates. The study demonstrates the BRI alleviates “debt anxiety” and injects new momentum into global economic governance system improvement and innovation, ensuring stable macroeconomic operation and high-quality economic growth.

Keywords: the Belt and Road; government debt sustainability; ways of working together; difference-in-difference method



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1. Introduction

In today’s complex global economic landscape, the issue of debt sustainability has emerged as a critical concern for many developing countries. As the world grapples with the aftermath of the 2008 global financial crisis and the ongoing challenges posed by the COVID-19 pandemic, understanding the factors that influence debt sustainability is of utmost importance. The Belt and Road Initiative (BRI), launched by China in 2013, has drawn significant attention due to its potential impact on the economic development and debt sustainability of participating countries.

The abbreviation “BRI” refers to the Belt and Road Initiative. This initiative aims to promote economic cooperation and cultural exchanges between China and participating countries. Marking its tenth anniversary, the BRI has established over 200 cooperation documents with more than 150 countries and 30 international organizations across various domains, including infrastructure, trade facilitation, financial integration, and people-to-people connectivity.

There has always been a significant debate regarding whether the impact of local government debt on the local economy is positive or negative. From the perspective of development economics theory, economic growth can help manage and reduce debt burdens over time [1–3]. The BRI has helped the countries along the line improve their transportation and energy infrastructure, which can lower production costs and increase productivity, thereby promoting economic expansion. This growth can subsequently increase government revenues and enhance the ability to service debts. For example, China has implemented landmark projects like the China–Pakistan Economic Corridor, the China–Europe Railway Express, the China–Laos Railway, and the Jakarta–Bandung High-Speed Railway. These projects form the backbone of “Six Corridors, Six Roads, Multiple Countries, and Multiple Ports”, facilitating the large-scale circulation of goods, capital, technology, and personnel among nations. However, some studies do not deny

the existence of a negative correlation between these two variables [4,5]. When local governments use local government debt to finance unproductive activities, such as funding excessive military or war efforts and crowding out private capital, it can have a negative impact on economic growth [5]. The disorderly expansion of local government debt can also inhibit economic growth. Especially when the sustainability of government debt is questioned by the public, economic growth may further accelerate its decline, which in turn leads to a loss of confidence and a debt crisis [6].

In international economics, the theory of trade and debt suggests that increased trade can improve a country's economic situation and affect its debt sustainability. The BRI promotes the expansion of international trade by enhancing connectivity and reducing trade barriers. This can lead to increased exports and imports, boosting economic activity and government revenues. In terms of trade facilitation, total import and export value between China and the co-building countries reached \$19.1 trillion, growing at an annual average rate of 6.4%, and the cumulative two-way investment exceeded \$380 billion, including over \$2400 billion in China's direct foreign investment. However, limitations exist as well. For instance, trade imbalances may arise, and some countries may face challenges in competing in the global market. Additionally, external shocks such as trade disputes or changes in global demand can affect the stability of trade and, consequently, debt sustainability.

Combined with the above research background and economic theories, this paper utilizes the difference-in-differences method (DiD) to study the impact of the BRI on the government debt sustainability of the countries along the line. The difference-in-differences method (DiD) is a commonly used approach for evaluating policy effects. It constructs a difference-in-differences statistic that reflects policy outcomes by comparing the differences between the control group and the treatment group before and after the implementation of the policy. In this research, considering data availability, the countries along the line that participate in the BRI are regarded as the treatment group, and those that do not participate in the BRI are selected as the control group. By comparing the differences in changes between the treatment group and the control group before and after the occurrence of the BRI as well as the time differences before and after the intervention, potential endogenous factors are eliminated, thereby obtaining the policy impact of the BRI. A parallel trend test was conducted before performing the difference-in-differences analysis. The methods used in the robustness test include the propensity score matching difference-in-differences method and the placebo test method. Based on the difference-in-differences method (DiD), propensity score matching (PSM) is used to eliminate the selection bias between the treatment group and the control group. The placebo test is carried out through two methods: generating pseudo-policy shock points by advancing the shock point of the BRI and randomly sampling the samples to generate pseudo-treatment groups. In the mechanism study, the moderating effect model is utilized to investigate the impacts of government purchases, foreign direct investment, and international trade on the effect of the BRI on the government debt sustainability of the countries along the line. Through extensive data collection and rigorous empirical analysis, the following research findings have been obtained:

- (1) The BRI has enhanced government debt sustainability.
- (2) Government expenditures, foreign direct investment, and international trade have played a regulatory role in economic development by increasing productivity, promoting industrial upgrading, and expanding market access.
- (3) The impact of the BRI on debt sustainability varies depending on income levels, debt levels, and growth rates. Countries with higher incomes, lower debt levels, and faster growth rates tend to benefit more from the BRI.

This research has made the following marginal contributions:

- (1) By conducting a more comprehensive and in-depth analysis of the impact of the BRI on government debt sustainability, this research enriches the existing literature

- and enables people to have a more accurate understanding of the true impact of the initiative.
- (2) By exploring the specific mechanisms and long-term effects of the BRI, this research provides valuable insights for policymakers and practitioners, helping them design more effective policies and strategies to promote sustainable debt management and economic growth.
 - (3) This research also puts forward some practical suggestions to improve the effectiveness of the BRI and promote sustainable economic development.

2. Literature Review and Research Hypotheses

2.1. Literature Review

2.1.1. Debt Sustainability

Over time, the definition of debt sustainability has been continuously evolving and enriching. Initially, Buitier [7], proposed that debt sustainability embodies a country's ability to sustain its debt, with stronger debt-repayment capabilities indicating greater sustainability. Subsequently, more interpretations have emerged from different perspectives. For instance, from the perspective of government fiscal balance, Waits [8] held that when a government's current debt can meet its current fiscal expenditures, the debt is in a sustainable state. Milesi-Ferretti [9] pointed out that the sustainability of a country's debt implies that the government will not default in the future. Buitier [7] further suggested that as long as the current borrowing can cover the previous borrowing under the premise that the credit risk is below the warning level, the debt is considered sustainable. The International Monetary Fund [10] defined that given the financing costs and in the absence of significant adjustments, if the debt meets the conditions of solvency, it is sustainable. Akyüz [11] emphasized that unless the government increases its tax revenues or reduces public service expenditures, the continuous accumulation of public debt will lead to unsustainable debt. The European Central Bank [12] also defines government debt sustainability based on solvency: The accumulated debt of the government can be promptly repaid at any time, indicating that the government has solvency and liquidity. Hakura [13] pointed out that a country's public debt is considered sustainable if it can meet all of its current and future payment obligations without the need for special fiscal assistance and without defaulting. Meanwhile, analysts also need to consider the feasibility of the policies required to stabilize the debt and whether they are consistent with maintaining growth potential or the development process.

Overall, the evolving definition of debt sustainability encompasses various factors, ranging from concerns about debt-repayment capabilities, fiscal revenue and expenditure balance, the possibility of future default, control of credit risks, and satisfaction of repayment conditions to considerations of the relationship between revenue and the present value of debt, the impact of debt accumulation as well as the timeliness and liquidity of debt repayment. It is a comprehensive and continuously improving concept aimed at measuring a government's ability to maintain its debt level while ensuring the stable operation of the economy and public finance.

The analysis of government debt sustainability primarily uses three methods. The first is the econometric testing approach, such as the time series variable stationarity test by Hamilton [14]. When the time series of government debt is non-stationary, it implies that the debt trend is unstable, which may lead to continuously rising debt levels without any predictable pattern, increase the ratio of debt to gross domestic product (GDP), and may disrupt fiscal planning and budgeting due to significant fluctuations in debt caused by unexpected events. Eventually, this may result in unsustainable debt, triggering inflation and economic instability. Conversely, when the time series is stationary, the debt trend is predictable. The government can borrow in a controlled and sustainable manner and plan fiscal policies and debt management strategies accordingly. It can also accurately predict future debt levels and better plan debt-servicing activities. Meanwhile, it provides confidence to creditors and investors, reduces borrowing costs, and maintains a stable and

healthy fiscal situation. Therefore, time series stationarity is an important indicator of the sustainability of government debt. Quintos [15] further explored this by using cointegration tests on government revenue and expenditure to analyze the sustainability of government debt. The second method is the composite indicator approach, which uses various indicators to approximate debt sustainability. This includes Buiter's [7] "fundamental gap" indicator, Blanchard's [16] "taxation gap" indicator, and Giammarioli's [17] "financing gap" indicator. These indicators consider the interactions of different factors within the economy. The intertemporal accounting approach, the third method, primarily examines future debt sustainability. While this method considers long-term sustainability, it may overlook interactions between uncertainties and variables like interest and growth rates.

2.1.2. Debt Issues in the Belt and Road Countries

Countries participating in the BRI face risks of excessive indebtedness and economic dependence. For instance, as pointed out by Hurley [18], large-scale infrastructure projects and other economic cooperation initiatives under the BRI might lead participating countries to assume excessive debt, which could subsequently become a heavy burden on their economies and potentially crowd out other vital public expenditures. To objectively assess this risk, a comprehensive analysis of the debt sustainability of each participating country should be carried out, encompassing an examination of factors such as their debt levels, economic growth prospects, revenue sources, and the expected returns on BRI-related investments. Moreover, certain countries like Pakistan, as analyzed by Ali [19], may develop economic dependence on China due to their involvement in the BRI. This dependence could manifest as changes in China's economic policies or investment priorities having a significant impact on the economic trajectory of these countries, and might even limit the development of their independent economic capabilities. To evaluate this risk, a detailed study of the economic structure and development patterns of the participating countries should be conducted, including an analysis of the degree of industrial diversification, the extent of local value addition in BRI projects, and the development of domestic supply chains. Although the BRI aims to promote economic growth and shared prosperity among countries along the route [20], scholars such as Yilmaz [21] have also pointed out its potential risks, such as economic dependence and debt risks. Meanwhile, as recognized in the research field, there is a lack of rigorous empirical analysis, so more research is needed to comprehensively evaluate the impact of the BRI.

In addition to these concerns, these nations may find themselves ensnared in excessive debt burdens, which could adversely impact their economic stability and hinder long-term development [18,22]. Shen [23] posits that the BRI (BRI) bears a resemblance to the Marshall Plan, as both aim to foster economic growth and shared prosperity among nations along the route. This is achieved by facilitating the free flow of economic elements, ensuring efficient resource allocation, and promoting deep market integration. Conversely, Richard [24] contends that the Marshall Plan lacked a development-oriented approach, regional specificity, and a clearly defined timeline for its implementation. This dependency could potentially undermine the government's capacity to autonomously manage its resources. Carmody [22] recognizes the positive contributions of the BRI but warns that China might inadvertently engage in "debt diplomacy". Notably, this area of research is characterized by a lack of rigorous empirical analysis.

Conversely, advocates of BRI contend that it has generated unprecedented development opportunities and economic growth momentum for the countries along the route. This is achieved through the enhancement of infrastructure development [25,26], facilitation of trade flows, and promotion of direct investment [27,28].

Yang et al. [29] highlight the significant economic benefits brought about by the initiative. Liu [30] demonstrated through spatial econometrics that transportation infrastructure enhances high-quality economic growth among Belt and Road countries. Specifically, the connectivity of facilities improves transportation and communication infrastructure [30–32], thereby reducing the costs of trade and investment and increasing economic efficiency.

Yu et al. [33] found that BRI significantly promotes trade and economic growth among the participating countries [34]. Lowering tariffs and non-tariff barriers achieves trade facilitation, enhancing trade convenience, expanding market size and trade opportunities, increasing government revenue and corporate profits, and alleviating debt pressures. Capital financing offers diversified financing channels and financial support, helping countries along the BRI address capital shortages [35–37] and thereby promote economic growth. Liu [38] notes that Confucius Institutes play a positive role in Chinese mergers and acquisitions in BRI countries.

2.1.3. The Dialectical Relationship Between Debt and Economic Growth

Concerning the link between government debt and economic growth, current research primarily highlights two key aspects: the positive impact of government debt on economic growth. The principal purposes of government borrowing encompass addressing fiscal deficits, enhancing public investment, facilitating transfer payments, responding to emergency rescue situations, as well as supporting reconstruction and recovery efforts. Additionally, these borrowings aim to improve social welfare and public services while bolstering international trade and maintaining diplomatic relations. Consequently, the overarching objective of government borrowing is to implement proactive fiscal policies that promote both economic growth and social stability. Researchers such as Tran [39] and Law [40] have calculated threshold values for the impact of government debt on economic growth in emerging economies and developing countries.

However, it is also crucial to mention the potential negative effects of public debt. Excessive debt levels can crowd out private investment, lead to higher interest rates, and increase the risk of financial instability. These factors can, in turn, negatively impact economic growth. Furthermore, if the government fails to repay its debts on time, it may damage its credit rating and limit its ability to borrow in the future, thereby exacerbating fiscal constraints. Bahal [41] analyzed the determinants of public debt in a dynamic political economy model with overlapping generations. It was pointed out that the elasticity of substitution between public debt and private consumption determines the scale of public debt and may potentially explain the differences in debt levels among various countries. Meanwhile, the article also discussed that in the absence of commitment, the scale of public debt might be either higher or lower depending on the elasticity of substitution between public consumption and private consumption. In contrast, De Soyres [31], based on the public debt data of 178 countries from 1995 to 2020, provided new empirical evidence indicating that the impact of an unanticipated increase in the public debt-to-GDP ratio on the level of real GDP is generally negative, and this impact varies with other fundamental characteristics. Specifically, for countries with higher initial debt levels or those with an upward debt trajectory in the past five years, an unanticipated increase in the public debt-to-GDP ratio would harm the level of real GDP. However, for countries with low income levels or those that have completed the Heavily Indebted Poor Countries (HIPC) Debt Relief Initiative, an unanticipated increase in public debt would promote real GDP growth.

On the other hand, this study emphasizes the positive effects of economic growth on the sustainability of government debt. Sustaining high levels of economic growth is essential for ensuring debt sustainability, as it increases government tax revenues, decreases unemployment rates, and mitigates social security burdens. Consequently, these factors collectively enhance the government's capacity to service its debt. Yakita [42] found that economic growth increases the threshold value of government debt, improving its sustainability. Nersisyan et al. [43] proposed that the level of economic growth significantly influences a country's debt sustainability. They argue that a slowdown in economic growth is one of the key factors leading to unsustainable national debt. When economic growth slows, government tax revenue decreases, and the cost of debt financing increases. If the government maintains or increases its expenditure, this will lead to a significant increase in the pressure to repay principal and interest over time. Conversely, if economic growth is rapid, it can provide more support for debt repayment. Additionally, the effective use

of new debt can further accelerate economic growth, enhancing debt sustainability and creating a positive cycle effect.

To sum up, there is a wealth of research literature on issues related to debt sustainability, and there are also abundant literature references in the quantitative analysis of debt sustainability. However, there are relatively few studies on the quantitative analysis of the debt sustainability of the countries along the Belt and Road since the BRI was proposed. Previous studies have shown that a country's debt sustainability is closely related to its economic growth, and economic growth plays a positive role in improving a country's debt sustainability. Meanwhile, the literature indicates that since the BRI was proposed, it has promoted the economic growth of the countries along the line in terms of government cooperation, international investment, and international trade. However, in the current stage of literature research, there is a lack of direct analysis of the impact of the BRI on the debt sustainability of the countries along the line and how the economic benefits brought by the initiative affect the country's debt sustainability. This paper uses the "financing gap" method to quantitatively calculate the debt sustainability of the countries along the line, and then uses the difference-in-differences method to explore the impact of the BRI on the government debt sustainability of the countries along the line and analyzes the reasons from the perspective of economic growth.

2.2. Research Hypothesis

The BRI is designed to promote economies of scale, reduce transportation and transaction costs, and increase fiscal revenues and debt repayment capacity. An investment diversification strategy is intended to diversify risks and strengthen financial flows, thereby contributing to stable debt management. Technology spillover is expected to enhance productivity and technological levels, promoting industrial upgrading and economic structure optimization. Regional cooperation is intended to enhance economic linkage and risk resistance, build a community of interests and responsibilities, and lay a solid foundation for debt sustainability.

Hypothesis H1 proposes the initiative improves debt sustainability.

Under the impetus of the BRI, the growth in government purchases signifies economic prosperity and financial strength, providing a solid foundation for debt repayment. The inflow of foreign direct investment brings about capital accumulation, technological progress, and economic growth. It also raises tax revenues and export potential, strengthening the government's ability to repay debt. Moreover, the expansion of international trade deepens the debt sustainability of countries. International trade expansion deepens economic ties between countries, expands market scope, drives the development of related industries, and further enhances a country's economic strength and financial support capacity.

Hypothesis H2 postulates that augmented government acquisitions, foreign investment, and global trade along the Belt and Road route will enhance the debt sustainability of these governments.

The interplay of three factors exerts a profound influence on the impact of BRI on the debt sustainability of countries situated along the route. These factors are the countries' income level, economic growth rate, and debt level. A higher income level provides a more robust fiscal foundation, thereby enhancing the capacity to repay debt. The phenomenon of rapid economic growth has the effect of increasing fiscal revenue, which in turn serves to alleviate debt pressure and enhance the country's ability to bear debt. Conversely, an appropriate debt level facilitates the optimal distribution of capital, stimulating economic growth while circumventing undue financial risks.

Based on this, we propose Hypothesis H3: The effectiveness of the BRI in enhancing the debt sustainability of participating countries is contingent upon their income levels, economic growth rates, and existing debt burdens.

3. Empirical Research

3.1. Model and Variable Description

The research objects of this paper are the countries along the BRI. For the purposes of analyzing the availability of data and the reliability of results, 64 countries along the BRI are selected as the treatment group in this paper, and another 40 non-aligned countries around the world are chosen as the control group. To meet the requirements of conducting relevant comparisons and analyzing long-term impacts related to the BRI, the time interval is set from 2002 to 2021, with 2014 being designated as the implementation period of the policy. The data are sourced from the World Bank Database, the IMF Database, and the China Belt and Road Network.

This study employs the DiD model, and the benchmark regression equation is presented as follows:

$$debtsus_{i,t} = \alpha_0 + \alpha_1 BRI_{it} + \alpha_2 x_{i,t} + \mu_i + v_t + \epsilon_{i,t} \quad (1)$$

where, $debtsus_{i,t}$ is the explained variable, BRI_{it} is the core explanatory variable, α_0 is the constant term, $x_{i,t}$ is the control variable, μ_i is the country-fixed effect, and v_t is the time-fixed effect. The main purpose of controlling the country-fixed effect and the time-fixed effect $\epsilon_{i,t}$ is to exclude the unobservable and does not change with time and country factors on the results of the impact of the results of the random perturbation term.

(1) Explained variable: government debt sustainability ($debtsus_{i,t}$). The connotation is that as long as the present value of future government revenue and expenditure differences can offset the initial debt, a country's public debt is sustainable. This paper uses the difference between a country's (region's) long-term net fiscal revenue rate and government indebtedness ratio in a given year to measure the sustainability of a country's public debt. However, the calculation of the long-term fiscal surplus rate, which is based on periodical fiscal surplus data discounted and summed over time, makes this method less operationally viable. Therefore, the measurement of Giammarioli et al. [17] calls for a compromise algorithm. During the sample period, the long-term fiscal surplus rate for year T is defined as the sum of the discounted values of fiscal surpluses from period t to period T. The exact calculation is as follows:

$$debtsus_{it} = \frac{fiscalsur_{it}}{GDP_{it}} - debt_{it} = \left[\frac{\sum_{n=0}^{T-t} \frac{I_{i,t+n} - E_{i,t+n}}{(1+r)^n}}{\sum_{n=0}^{T-t} \frac{GDP_{i,t+n}}{(1+r)^n}} \right] - debt_{it} \quad (2)$$

In Equation (2), $Fiscalsur_{it}$ is the present value of the fiscal surplus accumulated by the country from year t to year T; GDP_{it} is the present value of the GDP accumulated by the country from t year to T year; $debt_{it}$ is the government indebtedness ratio, which is measured by the ratio of the total government debt to the GDP; $I_{i,t+n}$, $E_{i,t+n}$, and $GDP_{i,t+n}$ are the country's fiscal revenues, fiscal expenditures, and the gross national product (GNP) for the $t + n$ period, of which the data of the fiscal expenditures and the fiscal revenues are obtained from the IMF database; and the social discount rate, denoted as r , is set at 8%. This rate is consistent with the "Methods and Parameters for Economic Evaluation of Construction Projects (Third Edition)". (2) Explanatory variables: The BRI is the interaction term of two dummy variables: one for "Belt and Road" countries and one for implementation time. It's 0 before the policy (before 2014) and 1 after. Additionally, it's one for "Belt and Road" countries. "Belt and Road" countries are 1, while other countries are 0. (3) Based on the Keynesian cross model, the IS-LM model, and neoclassical investment theory, the following three moderating variables can be selected. They are government purchases as a share of GDP, foreign direct investment as a share of GDP, and total trade as a share of GDP. (4) Based on economic growth theory, Keynesian theory, population economics theory, international trade theory, and neoclassical economics theory, the following control variables can be selected. The control variables include the labor participation rate (estimated by the ILO),

the economic growth rate, the population growth rate, the unemployment rate, the export growth rate, and the education level. See Table 1 for details:

Table 1. Refinement of Variables Description.

Variable Category	Variable Name	Variable Symbol	Variable Symbol	Expected Direction
Explained Variables	Debt sustainability	debtsus _{i,t}	Debt sustainability in countries along the t-year	+
Core Explanatory Variables	Belt and Road Initiative	BRI _{it}	1 for joining BRI after 2014, and 0 for joining BRI after 2014	/
Moderating variables	Government Purchases as a Share of GDP	G _{i,t}	Government purchases as a share of GDP in country i along the route in year t	+
	Foreign Direct Investment as % of GDP	FDI _{i,t}	FDI as a percentage of GDP for countries along the route in year t.	+
	Total trade as a share of GDP	Trade _{i,t}	Total trade as a share of GDP of countries along the route i in year t	+
Control variables	Labor participation rate (ILO estimates)	Labor _{i,t}	Share of labor force population in total population in country i along the route in year t	+
	Population growth rate	Population _{i,t}	The population proportion in country i has increased over time, specifically in year t	+
	Economic growth rate	g _{i,t}	Economic growth rate of country i along the route in year t	+
	Unemployment rate	Unemployed _{i,t}	Unemployed population as a share of the labor force in country i along the route in year t	-
	Education level	education _{i,t}	Share of population aged 25 and over with post-secondary education in total population of countries along the route i in year t	+
Other variables in the robustness test	Export growth rate	export _{i,t}	The share of exports of goods and services in the GDP of countries along the route in year t	+
	Share of private sector loans	private finance _{i,t}	Private sector lending as a share of the GDP in countries along the route in year t	+
	Aging rate	oLd _{i,t}	Population aged 65 years as a share of the total population in country i along the route, year t	-

Source: Data from the World Bank database, IMF database, and China Belt and Road Network.

Descriptive statistics for the variables involved in the benchmark regression are shown in Table 2:

Table 2. Results of descriptive statistics of variables.

Variant	Obs	Mean	Sd	Min	Max
debtsus	1063	−3.63	14.78	−147.12	9.13
BRI	1063	0.33	0.47	0.00	1.00
Labor	1063	59.99	7.85	40.05	81.83
g	1063	3.12	3.73	−8.00	13.00
Unemployed	1063	7.87	5.17	1.00	24.00
education	1063	85.99	19.31	16.38	109.14
export	1063	4.35	8.49	−22.00	36.00
Population	1063	0.89	1.08	−1.00	4.00
debtsus	1063	−3.63	14.78	−147.12	9.13

3.2. Benchmark Regressions and Robustness Tests

3.2.1. Benchmark Regression

The baseline regression results in Tables 3 and 4 show a significantly positive coefficient for the core explanatory BRI. This means that the BRI makes it much easier for governments along the route to pay their debts. All control variables are significant at least at the 10% level, except for education and export growth. However, this does not imply that education and exports are not crucial elements in the context of the BRI. Education provides continuous momentum for economic development by enhancing the educational level and talent cultivation in the countries along the route. Exports, in turn, drive economic growth and employment opportunities by facilitating trade facilitation and liberalization. Nevertheless, the relationship between education and debt sustainability may be influenced by multiple factors such as economic conditions, the sustainability of fiscal policies, policy stability, and the governance environment. Moreover, in this model, to consider the economic, institutional, and cultural differences among sample countries, time-fixed effects and country-fixed effects are controlled. These fixed effects may have captured the changing trends of many other economic and social variables closely related to the educational level and exports, all of which have affected the significance of the regression results. The coefficients of the labor participation rate (labor) and the economic growth rate (g) are positive, suggesting that higher labor participation and strong economic growth contribute to government debt sustainability. The coefficients of the unemployment rate (unemployed) and population growth rate (population) are significantly negative, indicating that higher unemployment and faster population growth increase a government's debt burden and reduce debt sustainability.

Table 3. Benchmark regression results.

Variant	Debtsus
BRI	1.223 ** (1.99)
Labor	0.151 * (1.79)
g	0.098 * (1.69)
Unemployed	−0.154 ** (−2.41)
Population	−0.729 ** (−2.56)
education	0.029

Table 3. Cont.

Variant	Debtsus
Export	(1.30) −0.013 (−0.57)
Observations	1.063
Time Fixed Effects	YES
Country Fixed Effects	YES
R ²	0.930

Note: Standard deviations are in parentheses, $p < 0.05$, $p < 0.1$ is denoted by **, *.

Table 4. Results of placebo test with constructed pseudo-policy shock points.

Variant	(1) 2012	(2) 2011	(3) 2010	(4) 2009
BRI	0.9425 (1.5275)	0.9285 (1.4862)	0.9685 (1.5058)	0.8983 (1.3378)
control variable	YES	YES	YES	YES
Time Fixed Effects	YES	YES	YES	YES
Country Fixed Effects	YES	YES	YES	YES
Observations	1063	1063	1063	1063
R ²	0.9206	0.9206	0.9206	0.9206

3.2.2. Robustness Test

(1) Parallel trend test

Analyzing causality through a double difference model (DiD) necessitates the initial fulfillment of the parallel trend assumption. It is imperative that consistent pre-treatment trends exist between the treatment and control groups, specifically regarding government debt sustainability in BRI countries compared to non-BRI countries. In other words, there should be no statistically significant differences in the pre-treatment trends of government debt sustainability between BRI and non-BRI nations. Figure 1 illustrates the dynamic effects of the BRI policy over two distinct periods: the first six years following implementation and an additional five years thereafter, with the year preceding policy initiation serving as the baseline period. The findings indicate that there are no significant discrepancies in pre-treatment trends of government debt sustainability between BRI (treatment) and non-BRI (control) countries, thereby confirming adherence to the parallel trend assumption.

(2) Placebo test

This study employs two methods for baseline regression using a placebo test. The first method is to construct a pseudo-policy shock point by advancing the time of the policy from 2014, assuming the BRI was proposed in 2009, 2010, 2011, and 2012, respectively, and the control variables—year, country, and time—fixed effects of the original baseline regression remain unchanged. This study examines the effect of the BRI on government debt sustainability in countries along the routes. It aims to determine if this impact remains significant. The placebo test results, showing pseudo-policy shock points, are in Table 4.

Table 4 presents hypothetical policy shocks of the BRI in the period of 2012–2009. The regression results indicate that the core explanatory BRI becomes insignificant after the shocks, implying that the baseline regression (BRI) also becomes insignificant after the pseudo-policy shocks. This indicates that improved debt sustainability in Belt and Road countries is due to the initiative's implementation, excluding other contingent factors and intervening policies.

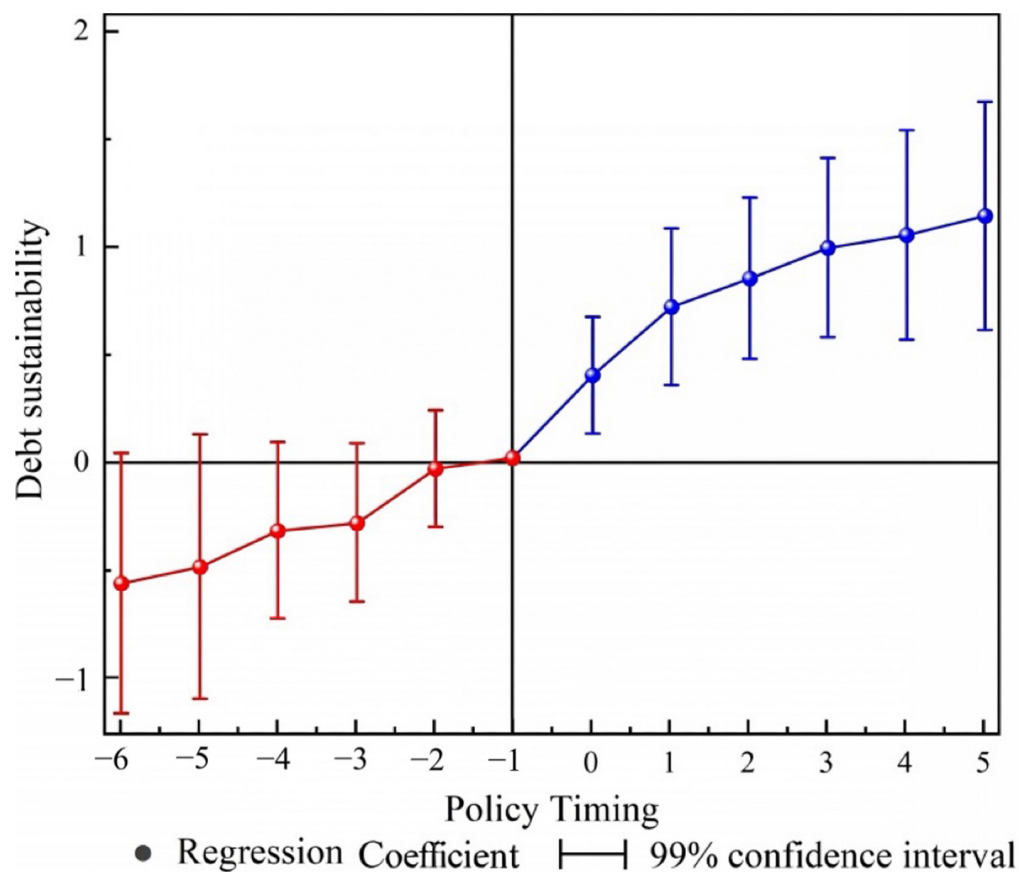


Figure 1. Parallel trend test.

Interestingly, the R-squared values remain consistent across different years, which can be mainly attributed to several factors. Firstly, all regressions adopt an exactly identical model specification, including the same dependent variables, independent variables (covering control variables), and fixed-effect terms (country-fixed effects and time-fixed effects). The consistency of this model structure ensures that the R-squared value remains stable even when the values of the independent variables (especially the pseudo-policy shock points) change over the years. Secondly, by incorporating country-fixed effects and time-fixed effects, we effectively control most of the variability in the data. These fixed effects absorb the key variability in the data. As a result, after controlling these effects, the remaining variability is relatively small, thereby making the R-squared value tend to be stable across different years. Finally, the sample size of all regression analyses remains consistent, with 1063 observations each. This means that the regressions in different years are conducted on the same dataset, only with differences in the values of the independent variables (especially the pseudo-policy shock points). This data consistency also helps maintain the stability of the R-squared value.

The second placebo test method is to randomly generate a pseudo-treatment group. We randomly select 64 countries from the total sample as the “Belt and Road” treatment group, and the remaining countries serve as the control group. Next, we construct a dummy variable BRI for the placebo test and conduct regression after controlling for country- and time-fixed effects through 1000 replications of random sampling. The regression coefficients of the sampled datasets should be mostly indistinguishable from zero, indicating no direct relationship between the treatment group and the “One Belt, One Road” Initiative. Figure 2 displays the results, with the black line representing the probability distribution of the regression coefficients and the black dots representing the kernel density estimate distribution. The right-side dotted line indicates the actual estimated regression coefficient of 1.223. The regression coefficients of the randomly chosen datasets are mostly close to

zero. There is a big difference between the sampled coefficients and the actual estimate. This means that random factors don't have as much of an effect on the baseline regression results, and the results are strong.

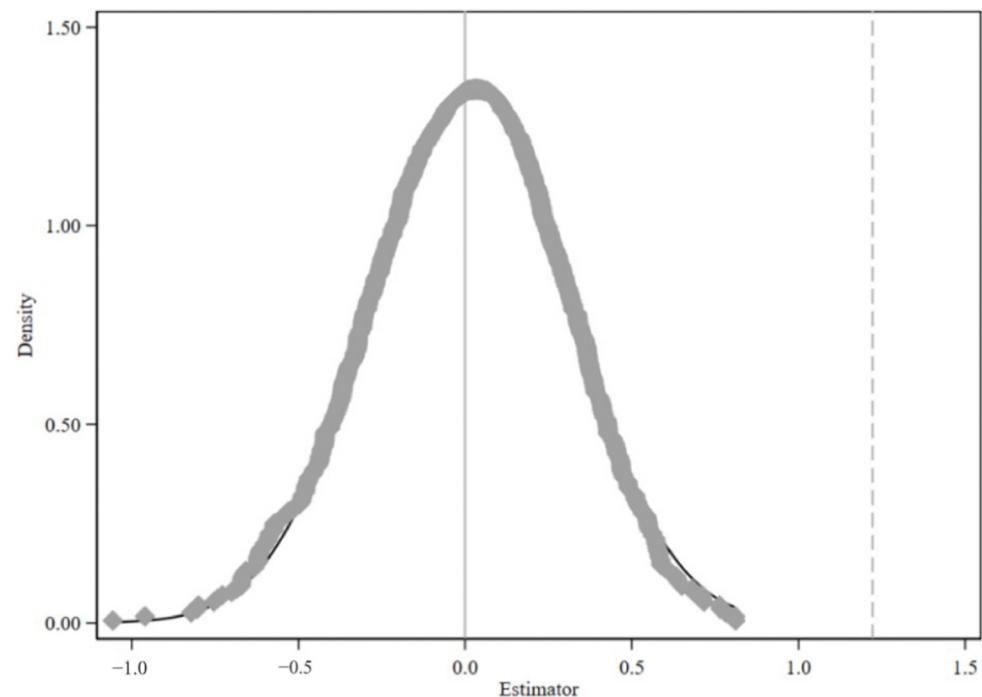


Figure 2. Placebo test for randomly generated pseudo-treatment groups.

(3) Adding control variables

To make the regression results less skewed because important explanatory variables were left out, this paper tests the original benchmark model's robustness by adding two more control variables: private financial loans and aging rate (old). This makes the model better overall and the prediction more accurate. Table 5 shows that after controlling for variables, the BRI regression results become more significant, with the coefficient increasing from 1.223 to 1.479, proving the robustness of the basic regression model results.

Table 5. Robustness test with the addition of control variables.

Variant	Debtsus
BRI	1.4791 ** (2.2580)
Observations	965
Time Fixed Effects	YES
Country Fixed Effects	YES
R ²	0.9047

Note: Standard deviations are in parentheses, $p < 0.05$ is denoted by **.

(4) Propensity Score Matching Double Difference (PSM-DiD)

Kernel matching is used for propensity score matching in this study to make sure that the covariate distributions of the treatment and control groups were equal before the BRI intervention and to lower the selection bias in the data that was collected. Table 6 displays the balance test results for the matched data, showing that all variable biases are less than 5% and all variable p -values are not significant. This suggests that the covariate differences between the matched treatment and control groups are not significant. This effectively accounts for selection bias within the sample.

Table 6. Balance test results.

Variant	Mean Value of Treatment Group	Control Group Mean Value	Deviation %	t	p
Labor	60.42	60.41	−0.01	0.02	0.99
g	4.48	4.13	−0.34	1.19	0.23
Unemployed	7.99	8.50	0.51	1.20	0.23
education	78.44	75.31	−3.13	1.62	0.11
export	5.63	6.38	0.75	1.04	0.30
Population	1.22	1.24	0.02	0.20	0.84

Afterward, the treatment and control groups were matched and subjected to difference-in-differences (DiD) regression analysis. Table 7 presents a comparison between our regression results and the benchmark regression findings. The comparison of estimation results using unweighted and weighted samples indicates consistency and statistical significance at the 5% level for both the core explanatory variable (BRI) and each control variable, regardless of sample weighting. This finding indicates that the DiD results from the benchmark regression are robust.

Table 7. Comparison of benchmark regression and PSM-DiD results.

Variables	(1) Benchmark Regression	(2) Weights Are Not Null	(3) Satisfy the Common Support Assumption
BRI	1.2229 ** (1.9857)	1.2223 ** (1.9837)	1.2049 * (1.7956)
Labor	0.1506 * (1.7906)	0.1506 * (1.7903)	0.1072 (1.1367)
g	0.0985 * (1.6923)	0.0982 * (1.6872)	0.1259 * (1.8518)
Unemployed	−0.1545 ** (−2.4063)	−0.1543 ** (−2.4029)	−0.1455 * (−1.9461)
education	0.0285 (1.3004)	0.0286 (1.3030)	0.0368 (1.3808)
export	−0.0134 (−0.5710)	−0.0135 (−0.5767)	−0.0147 (−0.5429)
Population	−0.7292 ** (−2.5589)	−0.7300 ** (−2.5598)	−0.9238 *** (−2.6679)
Time Fixed Effects	YES	YES	YES
Country Fixed Effects	YES	YES	YES
Observations	1063	1061	907
R ²	0.9208	0.9207	0.9221

Note: Standard deviations are in parentheses, $p < 0.01$ is denoted by ***, $p < 0.05$, $p < 0.1$ is denoted by **, *, same table below.

To date, hypothesis H1 posits that the BRI can enhance the debt sustainability of countries along its route. This hypothesis has been established.

4. Mechanism Analysis and Heterogeneity Analysis

The preceding benchmark regression demonstrates that the BRI has the potential to enhance debt sustainability for countries along its route. Building upon this foundation, this paper will further examine the mechanisms and heterogeneity of the initiative's impact on debt sustainability in Belt and Road countries.

4.1. Mechanism Analysis

Table 8 shows the results of three regression models. The main explanatory variable in regression (1) is the share of government purchases in economic development (BRI*G). The coefficient of this variable is positive and significant at the 1% level, indicating that a larger

share indicates better debt management for BRI participant governments. The coefficient of the main explanatory variable, the share of FDI in GDP (BRI*FDI), is positive and significant at the 10% level, as shown in Regression (2). This means that the bigger this share, the better the BRI is at helping governments in the countries along the route handle their debt. Regression (3) shows that the coefficient of BRI*Trade is positive and significant at the 10% level, indicating that the larger the share of international trade in a country's GDP, the stronger the BRI is in improving the debt sustainability of that country's government.

Table 8. Results of the analysis of impact mechanisms.

Variant	(1) G	(2) FDI	(3) Trade
BRI*G	0.0640 *** (3.6028)		
BRI*FDI		0.0634 * (1.7465)	
BRI*Trade			0.0052 * (1.7717)
control variable	YES	YES	YES
Time Fixed Effects	YES	YES	YES
Country Fixed Effects	YES	YES	YES
Observations	1063	1045	1060
R ²	0.9457	0.9452	0.9451

Note: Standard deviations are in parentheses, $p < 0.01$ is denoted by ***, $p < 0.1$ is denoted by *.

This paper concludes, through theoretical analysis and the regression results presented in Table 8, that foreign investment inflows serve as a crucial mechanism for fostering economic growth in the host country. Specifically, overseas Economic and Trade Zones (ETZs) have the potential to enhance the influx of foreign investment into the host country, thereby facilitating economic development.

Under the promotion of the BRI, China and the countries along the route have made remarkable achievements in governmental cooperation, foreign investment trade, etc. As a logistics artery, the China–Europe liner has grown from 815 trains in 2015 to 16,562 trains in 2022, promoting trade between China and Europe and the countries along the route. Additionally, economic and trade cooperation zones like the Green Shengshi Industrial Park, the Djibouti International Free Trade Zone, and the Huizhou Industrial Park have not only boosted local economic development but also enhanced the debt sustainability of the cooperating countries through the green, low-carbon, and recycling model of sustainable development. The successful implementation of these projects not only deepens the economic ties between countries but also lays a solid foundation for regional economic prosperity and sustainable development.

Therefore, hypothesis H2 predicts that an increase in government purchases, foreign direct investment, and international trade in BRI member countries will enhance the initiative's ability to improve these governments' debt sustainability. The hypothesis is valid.

4.2. Heterogeneity Analysis

4.2.1. Heterogeneity Analysis by Economic Development Level

World Bank data divides the sample into upper-middle and higher-income countries versus lower-middle and lower-income countries. Table 9 (1) presents the impact of the BRI on government debt sustainability in high- and middle-income countries along the route. The coefficient of the core explanatory BRI is 1.8769 and significant at the 1% level, indicating that the BRI significantly improves government debt sustainability in high- and middle-income countries along the route. In contrast, the coefficient of the core explanatory BRI is negative and insignificant, suggesting that it does not help improve government debt sustainability in low-income countries along the route. On one hand, the "One Belt, One

Road” initiative’s investment in countries along the route mainly focuses on transportation, communication, and other infrastructure construction, which is mainly the government’s main cooperation party for low-income countries. While the infrastructure construction cycle is long and the construction of infrastructure has a certain lag in promoting the economy, in the short term, it may not be helpful for the improvement of the sustainability of the government’s debt. On the other hand, the governmental and financial systems of lower-income countries are less developed, affecting the efficiency of fund utilization and thus weakening the impact of the BRI’s financial support to countries along the route on government debt sustainability.

Table 9. Heterogeneity analysis based on level of economic development.

Variant	(1) Upper Middle Income and Above	(2) Lower Middle Income and Below
BRI	1.8769 *** (2.7272)	−0.4888 (−0.2967)
control variable	YES	YES
Time Fixed Effects	YES	YES
Country Fixed Effects	YES	YES
Observations	835	228
R ²	0.8498	0.9705

Note: Standard deviations are in parentheses, $p < 0.01$ is denoted by ***.

Analyzing the trend of government debt sustainability in countries along the BRI, the majority are upper-middle-income or higher, while fewer are lower-middle-income; government debt ratios are higher in higher-income countries than lower-income countries. Compared to low-income countries, high-income BRI countries have higher government debt ratios. Regression results indicate the BRI significantly improves debt sustainability in higher-income countries along the route, does not significantly weaken sustainability in lower-income countries, and engages in all-around cooperation with low-income countries like Africa and ASEAN. At the opening ceremony of the Beijing Summit of the Forum on China–Africa Cooperation in September 2018, President Xi Jinping proposed that China–Africa cooperation would focus on the “Eight Actions”: industrial promotion, facility connectivity, trade facilitation, green development, capacity building, health and hygiene, cultural exchange, and peace and security. This proposal would effectively promote African economic and social development. Since the introduction of the BRI, China has maintained close exchanges with ASEAN, achieving outstanding results in facility construction, international trade, and policy exchanges. China has built a number of ASEAN facility construction projects, including Indonesia’s Yavan High-Speed Railway, the China–Laos Railway, the China–Thailand Railway, and the Kuantan Port, among others, and has provided financial and technological support for ASEAN infrastructure upgrades. In terms of trade, ASEAN became our largest trading partner in 2020. The BRI’s impact on the economic development of Africa and low-income ASEAN countries will progressively strengthen with the successive completion of infrastructure construction, improved public services, the mitigation of the “New Crown” epidemic, and the gradual stabilization of the world economy. The BRI will gradually bolster the economic development of low-income countries such as Africa and ASEAN, while also gradually enhancing the sustainability of government debt.

4.2.2. Heterogeneity Analysis Based on Debt Level

Based on the inter-national debt warning line of 60% and 100%, we categorize the sample into debt-normal countries (below 60%), high-debt countries (60–100%), and ultra-high-debt countries (above 100%).

Table 10 shows that the BRI has a significant impact on the government debt ratio of countries along its route, with a positive and significant effect at the 10% level. This suggests

that the BRI enhances the debt sustainability of heavily indebted countries along the route, potentially because these countries primarily reside in the European region. European countries are important BRI partners, and the “China–Europe liner” is a key initiative for China–Europe facility interconnection, significantly expanding trade scale, promoting industrial upgrading, and injecting vitality into the economic development of countries along the route. Relatively, it improves debt sustainability for ultra-high-debt countries. However, the results show that the BRI does not significantly weaken the sustainability of government debt in high-debt countries. Together, these results suggest that the post-epidemic BRI should focus on strengthening project debt risk supervision and expanding cooperation modes. Results show the BRI significantly enhances debt sustainability for normal debt countries.

Table 10. Heterogeneity analysis based on debt level.

	(1) Ultra-High Debt	(2) High Debt	(3) Normal Debt
BRI	0.7701 * (1.9848)	−0.2841 (−0.8899)	2.4363 *** (2.5991)
control variable	YES	YES	YES
Time Fixed Effects	YES	YES	YES
Country Fixed Effects	YES	YES	YES
Observations	75	204	768
R ²	0.9549	0.9694	0.9205

Note: Standard deviations are in parentheses, $p < 0.01$ is denoted by ***, $p < 0.1$ is denoted by *.

4.2.3. Heterogeneity Analysis Concerning Economic Growth Rate

Heterogeneity analysis of the sample based on the GDP growth rate uses the average value of the sample GDP growth rate from the World Monetary Fund (IMF) WEO database. Countries above the average are high-growth economies, while those below the average are low-growth economies. We used the analyzed data to estimate a benchmark regression model, and Table 11 presents the results.

Table 11. Results of heterogeneity analysis based on economic growth rates.

Variant	(1) High Economic Growth Rate	(2) Low Economic Growth Rate
BRI	2.3182 ** (2.0606)	1.5533 * (1.8615)
control variable	YES	YES
Time Fixed Effects	YES	YES
Country Fixed Effects	YES	YES
Observations	476	561
R ²	0.9530	0.8643

Note: Standard deviations are in parentheses, $p < 0.05$, $p < 0.1$ is denoted by **, *.

Table 11, columns (1) and (2), indicate that the core explanatory variable of the BRI is significantly positive. Specifically, it reaches significance at the 5% level for countries exhibiting high economic growth rates and at the 10% level for those with lower growth rates. This finding suggests that the BRI enhances government debt sustainability irrespective of a country’s economic growth rate. Moreover, the impact of the BRI appears to be more substantial and significant in nations with higher growth rates, indicating a stronger effect on improving debt sustainability in economies experiencing rapid expansion. Enhanced economic growth generates increased tax revenues and employment opportunities, thereby bolstering governments’ capacity to service their debts and secure financing. Consequently, robust economic performance facilitates easier debt servicing for governments while providing additional resources dedicated to managing their debt obligations.

Although the BRI's impact on debt sustainability in these countries is relatively minor, there are other challenges that need in-depth exploration. For example, the Hambantota Port project in Sri Lanka faced risks of over-indebtedness due to improper project planning and financial management. Issues such as miscalculated future revenue streams, overlooked long-term operation and maintenance costs, and overly optimistic views of the port's potential contributed to this. Additionally, external economic shocks, like the global financial crisis, and domestic economic structure problems in Sri Lanka further exacerbated the situation. During implementation, overlooked risks like unclear contract management terms and lack of proper supervision mechanisms could have increased financial burdens and costs.

Moreover, economic dependence is another concern, as seen in the highway project in Montenegro. The local economy became overly reliant on this single large-scale infrastructure project funded by external sources, leading to a narrow industrial structure and making the economy vulnerable to disruptions. The large-scale investment in the project increased the country's debt burden, and any setbacks directly affected the government's ability to service the debt. The lack of alternative revenue sources meant that the government had to seek additional borrowing or face potential default, exacerbating the debt situation. Therefore, future research and project implementation should focus on these potential risks and develop risk-mitigation strategies to ensure the healthy and sustainable development of the BRI in various economic contexts.

Combining the results of the three heterogeneity analyses so far supports the third hypothesis of this paper, H3. The income level, economic growth rate, and debt level of the countries along the route influence the BRI's ability to improve debt sustainability. This hypothesis is valid.

5. Further Discussion

5.1. Differences and Similarities Between the BRI and the World Bank in Related Aspects

The BRI's and the World Bank's relevant projects are both dedicated to promoting global economic development and cooperation in terms of goals. The World Bank focuses on poverty reduction. It offers financial support and technical assistance to assist developing countries in improving infrastructure and meeting the basic living requirements of residents, thus creating conditions for poverty alleviation. In contrast, the BRI is more diverse. In addition to infrastructure construction, it emphasizes the "Five Connectivities" goals such as unobstructed trade, financial integration, and people-to-people and cultural exchanges. It aims to achieve regional and even global economic prosperity and development and simultaneously enhance mutual understanding and trust among the people of the countries along the line.

In terms of implementation methods, both involve multi-party participation and resource integration. The World Bank unites the governments of member countries, professional teams, etc., and conducts comprehensive supervision from project screening to implementation based on project evaluation standards and processes. The BRI adheres to the principles of extensive consultation, joint contribution, and shared benefits. It encourages extensive participation of various entities such as the governments and enterprises of the countries along the line. They jointly discuss the planning and construction contents of projects and integrate resources such as inter-governmental assistance, policy-based loans, cooperation with international financial institutions, and enterprise investments to jointly promote the implementation of projects. However, the World Bank has a stronger leading role in project implementation. Its funds mainly come from its own sources, and it relies on international professional teams for technical guidance and management. In contrast, the BRI emphasizes the principal position of the countries along the line more. The sources of funds are diversified, and enterprise investments account for an important proportion, enabling them to fully exert their market vitality and innovation capabilities.

Both the World Bank and the BRI have had positive impacts on infrastructure development and economic growth in recipient or along-route countries. However, World

Bank projects focus more on poverty alleviation and basic condition improvements, while the BRI drives economic growth and enhances regional competitiveness through trade liberalization, investment cooperation, and fostering division of labor and cooperation. Regarding debt sustainability, the World Bank considers recipient countries' debt repayment capacity, while the BRI supports debt sustainability through economic growth and enhanced government debt repayment capacity.

5.2. Potential Long-Term Impacts of the BRI

5.2.1. Potential Impact on Debt Sustainability: Degree of Corruption, Institutional Efficiency, and Debt Risk

Based on the theory of economic growth and fiscal revenue, the improvement of infrastructure construction and economic growth form a virtuous interaction, which has a profound impact on the debt sustainability of countries along the Belt and Road. In this process, the degree of corruption and institutional efficiency are the key factors.

On the one hand, the gradual improvement of infrastructure and the continuous promotion of economic growth can significantly increase the fiscal revenue of countries along the line, providing solid support for the government's debt repayment. However, the breeding of corruption may erode this positive result. In some countries, corrupt practices may lead to the misappropriation or waste of project funds, thereby affecting the economic benefits of the project and the growth of fiscal revenue. According to relevant research by the World Bank, in infrastructure projects in some developing countries, cost overruns caused by corruption can average 20–30% of the initial project budget. Taking the China–Laos Railway as an example, its completion has greatly improved the transportation infrastructure in Laos. After its opening, the logistics cost has been reduced by about 30%, making it more convenient for Laos to export agricultural products, minerals, and other resources, attracting a large amount of external investment into trade, processing, and other industries, stimulating the local economy, and significantly increasing government tax revenue. The goods transportation tax has increased by about 40% year-on-year, and the corporate income tax has increased by about 35%. However, if there are corrupt practices during the project implementation, it may lead to cost overruns, construction period delays, and other problems, thereby affecting debt sustainability. For example, if high-priced and low-quality materials are purchased due to corruption in the railway construction material procurement process, the cost may increase by an additional 10–15%. Therefore, attention must be paid to the construction of project transparency and supervision mechanisms to ensure the rational use of funds and the smooth progress of the project.

On the other hand, debt-risk management is also the key to ensuring debt sustainability. When promoting relevant projects under the BRI, attention should be paid to the reasonable arrangement of debt maturity structure and the expansion of diversified financing channels. At the same time, project management should be strengthened to improve the efficiency of capital use and avoid single-source financing dependence and excessive borrowing. In this process, the improvement of institutional efficiency is also crucial. By improving laws and regulations, strengthening supervision and law enforcement, etc., the standardization and transparency of project management can be improved, thereby reducing debt risks. According to a report by the International Monetary Fund, countries with higher institutional efficiency have a debt default probability in infrastructure project debt management that is approximately 30% lower than that of countries with lower institutional efficiency.

5.2.2. Potential Impact on Economic Growth: Interest Rates, Exchange Rates, and Trade and Investment

The infrastructure-first theory in development economics indicates that complete infrastructure is the key cornerstone of economic development. Under the BRI, countries along the line have created favorable conditions for economic growth by strengthening infrastructure construction. However, fluctuations in interest rates and exchange rates may also have an important impact on economic growth.

On the one hand, the improvement of infrastructure has reduced production costs and improved production efficiency, laying a solid foundation for the economic growth of countries along the line. The normalized operation of the China–Europe Railway Express and the construction of energy infrastructure have further promoted trade and investment activities in countries along the line. Taking a certain country in Central Asia as an example, after the passage of the China–Europe Railway Express, the local logistics cost has been reduced by about 25%, and the trade volume has increased by about 30%. However, changes in interest rates may affect the financing costs and investment willingness of enterprises. When interest rates rise, the financing costs of enterprises increase, which may lead to reduced investment and slower economic growth. According to the economic data analysis of some countries along the line, during the period when interest rates rose by 2%, the fixed-asset investment of enterprises decreased by an average of about 15%, and the growth rate of gross domestic product (GDP) slowed down by about 0.5–1 percentage points. Therefore, when promoting the BRI, attention should be paid to changes in interest rates and corresponding policy measures should be taken to stabilize interest rate levels.

On the other hand, fluctuations in exchange rates may also have an impact on the economic growth of countries along the line. The appreciation or depreciation of the exchange rate will affect the competitiveness of export products and the cost of imports, thereby affecting the trade balance and economic growth. Under the BRI, trade among countries along the line is becoming more and more frequent, and fluctuations in exchange rates may have an important impact on trade relations. For example, during a certain period, the currency of a certain country in Eastern Europe appreciated by about 10% against the currencies of its major trading partners. The price competitiveness of its export products declined, and the export volume decreased by about 12% in the short term. While the import cost was reduced, the import volume increased by about 8%, and the trade surplus narrowed, which had a certain negative impact on economic growth.

5.2.3. Potential Impact on International Cooperation: Political Stability and Regional Integration

During the long-term progress of the BRI, it has had a profound impact on international cooperation. This impact is not only reflected in the deepening of the cooperative relationship among countries along the line but also in the expansion of the scope and depth of international cooperation. In this process, political stability has become a key factor.

On the one hand, the BRI has deepened the cooperative relationship among countries along the line by strengthening connectivity, trade and investment cooperation, and people-to-people exchanges, forming a closer regional economic community. However, political instability may undermine this positive result. In some countries, political turmoil may lead to an increase in policy discontinuity and uncertainty, thereby affecting the smooth progress of cooperation projects and the stable development of the regional economy. Taking a certain country in ASEAN as an example, during the period of domestic political unrest, an infrastructure project planned to be jointly constructed with China was forced to be suspended. The project involved an investment of about 500 million US dollars and was expected to create 2000 local jobs. The project delay led to a short-term increase in the local unemployment rate by about 2%, and the development of surrounding related industries was also impacted, with an estimated economic loss of 100 million US dollars. Therefore, strengthening the construction of political stability is an important guarantee for the smooth progress of the BRI. Taking the cooperation between ASEAN and China under the BRI as an example, remarkable achievements have been made in infrastructure connectivity and trade and investment between the two sides. However, if there are political instability factors among countries along the line, it may lead to the interruption or delay of cooperation projects, thereby affecting the economic interests of both sides. Therefore, when promoting the BRI, attention should be paid to the assessment and maintenance of political stability, and political risks should be reduced by strengthening political dialogue and cooperation mechanism construction.

On the other hand, the BRI has strong attraction and radiation effects, attracting more countries and international organizations to pay attention and participate. With the progress of the initiative, its successful experience has provided a valuable reference for other regional cooperation projects, promoting global economic cooperation to develop in a more diversified and balanced direction. In this process, political stability also plays an important role. By strengthening international cooperation and coordination mechanism construction, the cooperation and exchanges among countries along the line in political, economic, and security fields can be promoted, further promoting the development of the regional integration process.

5.3. Future Research Directions

Based on the above analysis, there are two significant research directions worthy of attention in the future. First, optimize the debt sustainability assessment model and conduct an in-depth exploration of how to incorporate more factors influencing the debt sustainability of the Belt and Road projects. Some simple analytical models or frameworks can be attempted to better illustrate the relationships among various factors. For example, in the part of debt sustainability, construct a model that includes factors such as the degree of corruption, institutional efficiency, and debt risk to demonstrate how they interact to affect debt sustainability. In the part of economic growth, construct a model of the correlation among interest rates, exchange rates, and economic growth. In the part of international cooperation, construct a framework reflecting the relationship between political stability and regional integration. Meanwhile, combine big data and artificial intelligence technology to enhance the model's predictive ability and accuracy for complex situations, thereby providing a more scientific basis for project decision making.

Second, study the international cooperation governance model under the BRI, including multilateral coordination mechanisms, dispute settlement mechanisms, and benefit distribution mechanisms. Analyze how to ensure the fairness of the interests of all parties, effectively achieve the sustainable development of international cooperation when more countries and international organizations are involved, and how to combine international prevailing rules and standards with the characteristics of the BRI to construct a more complete international cooperation governance system.

6. Conclusions

The “Belt and Road” initiative, proposed in 2013, has become one of China's major strategies. After top-level planning was completed in 2015, full implementation began in 2016. Over the past decade, it has progressed gradually, adhering to the principles of consultation, joint construction, and shared benefits, establishing an open and inclusive framework for regional economic cooperation. The initiative aims to achieve the “Five Connectivities” goals and has been recognized by countries along the route. This paper analyzes how the initiative enhances the sustainability of government debt in countries along the route, by examining achievements in government cooperation, foreign investment, and trade.

Economic growth has a positive impact on debt sustainability. The BRI can enhance debt sustainability among countries along the route, despite having varying economic growth rates. From 2008 to 2012, the GDP of BRI countries totaled \$101 trillion, increasing by 39.6% to \$141 trillion in the five years following the initiative. Economic growth can reduce the relative proportion of debt, increase tax revenues, create jobs, and improve employment conditions, thereby strengthening the sustainability of government debt.

Chinese investment helps countries along the Belt and Road with financing. The BRI has improved debt sustainability in both low and high-debt countries. Countries with low debt levels have low economic development and weak financing capabilities, while high-debt countries face high financing costs and difficulties. Analysis shows that increases in foreign direct investment and government purchase expenditures have a positive impact on the initiative. Despite the 2020 pandemic, China's direct investment

in countries along the route still reached \$186.1 billion, an increase of 0.3% year-on-year, accounting for approximately 14% of China's total foreign direct investment during the same period. Infrastructure investment has promoted economic growth and industrial upgrading, driving GDP growth by 1.28 to 2.8 percentage points with investment areas continuously expanding. This is thanks to the "Five Connectivity" cooperation model of the BRI. The improvement in government debt sustainability in countries along the route due to Chinese investment is reflected in increased employment, reduced social welfare expenditures; improved investment and trade environment, increased economic vitality and tax revenue; expanded financing channels for infrastructure construction, alleviating government financing pressures; enhanced international competitiveness, attracting foreign investment, and strengthening government financing capabilities.

Trade growth promotes economic development and debt sustainability in Belt and Road countries. The initiative has strengthened bilateral trade between China and these countries, as well as their economic and trade cooperation with other partners. In 2023, trade growth between China and Belt and Road co-building countries reached 6.4%, far exceeding the global average, with a total trade volume of \$19.1 trillion. The trade volume doubled from 2013 to 2022 and now accounts for a growing share of global trade. These achievements are due to the innovative infrastructure connectivity cooperation model.

Over the past decade, the rapid development of the China–Europe Railway Express has connected multiple countries, transported substantial goods value, and served as a model of regional infrastructure connectivity and economic cooperation. The launch of this service has promoted trade [44], industrial collaboration, upgrading [45], and economic growth. The increase in trade has augmented trade taxes and fiscal revenues and improved debt conditions along the route. The upgrading of industries has enhanced economic vitality, stimulated growth, stabilized fiscal activities, and expanded the operational space for government debt. Moreover, China has jointly established over 80 economic and trade cooperation zones with countries along the route, attracting investment, and generating tax revenues and employment opportunities. These zones have strengthened the ability of countries to attract foreign investment, facilitated international trade, improved employment environments, alleviated social security pressures, and increased tax revenues, thereby improving the sustainability of government debt. Under the BRI, improvements in infrastructure connectivity among countries have enhanced financing, trade, and investment environments along the route. The development of trade and investment facilitation, along with financing channels provided by the Asian Infrastructure Investment Bank and the Silk Road Fund, have collectively promoted economic and social development. This has alleviated government financing pressures, boosted economic development momentum, increased fiscal revenues and employment opportunities, and reduced social security expenditures. Consequently, the growth in government purchases, foreign investment, and international trade along the route has enhanced the ability of the BRI to improve the sustainability of government debt.

However, this research also has the following limitations:

- (1) The practical suggestions proposed in this research for enhancing the effectiveness of the BRI and promoting sustainable economic development may encounter various challenges during the implementation process in different countries and regions. For example, due to the differences in policy environments, economic structures, and development needs among various countries, adjustments, and optimizations may be required according to specific circumstances.
- (2) The research results are mainly based on macro-level analysis, with insufficient attention paid to the impacts on enterprises and individuals at the micro level. In practice, the BRI may have significant impacts on enterprises' investment decisions, trade patterns, and individuals' employment and income, but this research does not conduct an in-depth analysis of these aspects. Future research can further explore the micro level and its long-term impact, and develop targeted policy measures to

provide inspiration for policy formulation and shape a new pattern of international economic cooperation.

7. Policy Recommendations

Policymakers should focus on debt sustainability, domestic institutional construction, and the improvement of the international cooperation governance model when promoting the BRI. First of all, it is necessary to optimize the debt sustainability assessment model, comprehensively consider more influencing factors, and ensure the rational formulation of debt scale and financing strategies. Secondly, strengthen domestic institutional construction, improve the standardization and transparency of project management, prevent corrupt practices, and ensure debt sustainability. In addition, formulate targeted policies according to the different situations of various countries to balance the short-term benefits of projects and long-term debt repayment capabilities. Finally, strengthen the research on the international cooperation governance model, and improve multilateral coordination, dispute settlement, and benefit distribution mechanisms to promote the sustainable development of international cooperation.

When enterprises participate in Belt and Road projects, they should fully evaluate interest rate and exchange rate risks, strengthen the research on the political stability of the host countries of the projects, and attach importance to project cost management and quality control. Enterprises should closely monitor local interest-rate and exchange-rate fluctuations, adopt financial derivative instruments to lock in financing costs, and reduce the impact of exchange-rate fluctuations on profits. At the same time, conduct an in-depth assessment of the political environment of the host countries of the projects, establish a risk early-warning mechanism, and flexibly adjust investment strategies. During the project implementation process, strictly control costs, ensure project quality, and enhance the reputation and competitiveness of enterprises in the international market.

International organizations play an important role in promoting international cooperation and coordination of the BRI. First, they should promote the integration of international rules and the characteristics of the BRI, integrate sustainable development goals into project planning, and ensure that projects take into account economic, environmental, and social objectives. Second, strengthen support for the capacity-building of participating countries, provide technical assistance and training, and enhance the capabilities of countries in project management, debt management, etc. Finally, establish an international cooperation information-sharing platform, integrate information such as national policies and project progress, promote information exchange and resource sharing, improve the efficiency and quality of international cooperation, and avoid redundant construction and cut-throat competition.

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