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The Impact of the Belt and Road Initiative on Country Indebtedness

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Abstract: *This research investigates the impact of China's Belt and Road Initiative (BRI) on public debt levels in participating countries. Using a panel dataset covering 173 countries across various income groups and regions, we apply quantitative analysis to assess whether BRI involvement is associated with increased sovereign indebtedness. The study incorporates macroeconomic and institutional variables to capture both structural and policy-related dynamics. Our findings suggest nuanced relationships between BRI participation and debt outcomes, highlighting the importance of governance quality, economic structure, and financing terms. The results contribute to the literature on debt sustainability in the context of global infrastructure initiatives and offer evidence-based insights for policymakers considering external development financing.*

1. INTRODUCTION

The Belt and Road Initiative (BRI) is conceptualized as a strategy to stimulate economic growth by developing infrastructure, promoting trade, and enhancing economic interconnectedness. This approach corresponds with the BRI's Five Cooperation Priorities: policy coordination, infrastructure connectivity, unimpeded trade, financial integration, and people-to-people exchanges (Jenkins, 2021). The financial integration aspect implies that participating countries often depend on external funding to support large-scale infrastructure investments. As a result, the inflow of foreign loans—mainly from Chinese financial institutions—can contribute to rising public debt, posing risks to the fiscal sustainability of these nations (Zhang, 2020).

The relationship between participation in the Belt and Road Initiative (BRI) and public debt is multifaceted, involving various economic, political, and social dimensions. The BRI, launched by China, aims to enhance global trade and stimulate economic growth across Asia and beyond through extensive infrastructure investments. However, these investments often lead to significant increases in public debt for participating countries, raising concerns about debt sustainability and economic stability.

One of the primary mechanisms through which BRI participation affects public debt is the increase in infrastructure financing. As noted by Hurley et al. (2019), the BRI is associated with substantial infrastructure financing, which often involves loans to sovereign borrowers. This practice can elevate the risk of debt distress, particularly in countries that already have precarious financial situations. The

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World Bank has raised concerns about rising public and corporate debt in BRI countries, emphasizing the need to maintain debt sustainability to mitigate vulnerabilities (Zhan, 2023). Furthermore, Li et al. (2022) found that BRI participation leads to increased corporate debt due to enhanced financing sources and reduced costs for companies involved in BRI projects, which indirectly contributes to the overall public debt burden as governments often guarantee these corporate debts.

Moreover, the implications of public debt on economic growth are significant. Studies indicate that high levels of public debt can stifle economic growth and exacerbate income inequality, particularly in BRI countries where corruption may further complicate the effective utilization of borrowed funds (Mehmood et al., 2019). The relationship between public debt and economic performance is complex, as evidenced by research showing that excessive debt can lead to reduced investment and slower economic growth (Bidzo, 2018). This is particularly concerning for low-income countries participating in the BRI, where the potential for debt overload is high, and the capacity to service debt is often limited (Narins & Agnew, 2021).

The geopolitical context of the BRI also plays a crucial role in shaping the debt landscape. Countries engaging with the BRI may find themselves in a "debt trap," where the need for continued borrowing to service existing debts leads to a cycle of dependency on Chinese loans (Wong, 2020). This situation is exacerbated by the COVID-19 pandemic, which has intensified the financial pressures on BRI participants, leading to fears of a repeat of historical debt crises (Narins & Agnew, 2021). The lack of transparency and due diligence in BRI projects has raised alarms about the long-term sustainability of the debt incurred, as many projects may not yield the expected economic returns (Baltensperger & Dadush, 2019).

While the BRI presents opportunities for infrastructure development and economic growth, it also poses significant risks related to public debt. The interplay between increased borrowing for infrastructure projects and the potential for economic stagnation due to high debt levels underscores the need for careful management of debt sustainability in BRI-participating countries. Policymakers must navigate these challenges to harness the benefits of the BRI while mitigating the risks associated with rising public debt.

2. METHODOLOGY

Based on the literature reviewed and the rising popularity of China's Belt and Road Initiative (BRI), we decided to investigate whether countries experience an increase in debt after joining the Belt and Road Initiative.

We set out the following hypothesis:

- Entry into the Belt and Road Initiative leads to an increase in the gross government debt of countries.

To test the hypothesis, we conducted an R-studio analysis and used a fixed effects model. The fixed effects model (FEM) is one of the most widely used models for examining panel data. (Lukáčiková et al., 2018)

The fixed effects model allows us to examine the effects of different variables on government debt.

To conduct the study, we collected data for 173 countries (i) over the period from 2012 to 2022 (t). We collected data from all countries in the world, where at the beginning of the research we

had a sample of 217 countries, but due to the unavailability of some data we had to eliminate it to a smaller number of countries. The complete list of included countries is provided in the attachments. The data used in our analysis were obtained from the World Development Indicators (WDI) database compiled by the World Bank, which provides statistical information on a wide range of development indicators for countries around the world, and from the International Monetary Fund (IMF). The table shows the independent variables as well as the dependent variable General government gross debt.

Table 1. List of indicators used

General government gross debt	log_Gen_gov_gross_debt (IMF, 2024)
GDP (constant 2015 US$)	log_GDP (WBG, 2024)
Real efective exchange rate	Log_REER (WBG, 2024)
Exports of goods and services (% of GDP)	log_Exp_GS (WBG, 2024)
BRI	BRI Sacks in Krivosudská, Kittová a Steinhauser, 2022

Source: Own processing

For our analysis, the FEM equation takes the form:

$$\log(\text{Gen_gov_gross_debt})it = \alpha i + \beta 1 \log(\text{GDP})it + \beta 2 \log(\text{Exp_GS})it + \beta 3\ \text{BRI}it + \beta 4 \log(\text{REER})it + uit \quad (1)$$

Where:

- log(Gen_gov_gross_debt)it is the logarithm of gross government debt for country i at time t.
- αi is the individual fixed effect component for country i.
- log(GDP)it is the logarithm of gross domestic product for country i at time t.
- log(Exp_GS)it is the logarithm of exports of goods and services for country i at time t.
- BRIit is the indicator variable for participation in the Belt and Road Initiative for country i at time t.
- log(REER)it j is the logarithm of the real effective exchange rate for country i at timet.
- uit is the error term for country i at time t.

General government gross debt represents the total value of all financial liabilities that the general government has to creditors. This indicator includes all levels of government, including central, regional and local government, as well as social funds. General government gross debt includes debt instruments such as government bonds, loans and other forms of public debt. This indicator is important for assessing the fiscal stability and sustainability of a country's public finances (IMF, 2024).

GDP (constant 2015 US$) represents the total value of all goods and services produced in an economy each year, adjusted for the effect of inflation. Using constant 2015 prices allows the impact of changes in the price level over time to be eliminated, providing a more accurate picture of the actual growth or decline in economic activity. This indicator is important for the analysis of economic developments as it allows for the comparison of economic performance in different periods without inflation distortions. The resulting value is expressed in US dollars, which allows international comparison between countries (WBG, 2024).

The real effective exchange rate reflects the impact of factors such as changes in exchange rates or inflation, which promote favourable conditions for a country's exports (Plchová, 2005). Darvas

(2012) adds that the most used price and cost indicators for REER include consumer prices (CPI), producer prices (PPI), GDP deflator and unit labour costs (ULC). The use of the REER improves the modelling considerably by considering the evolution of the value of the currency and the price level. However, the inclusion of the REER in the models may reduce the number of observations as many economies do not have data available for this indicator.

Exports of goods and services (% of GDP) represent the share of the total value of all goods and services exported by a country in its gross domestic product (GDP). This indicator captures how important exports are to a country's economy and allows an assessment of the extent to which an economy is dependent on international trade (WBG, 2024).

BRI The Belt and Road Initiative (BRI) variable represents China's initiative. In the case of the BRI indicator, we created an artificial variable for each cross-sectional unit. The variables take the value of 0 or 1, where 1 represents the year of entry into the BRI and we assign 0 for years when countries were not part of the initiative.

We began our analysis by creating a database to serve as a basis for further action. A good quality database is crucial because all our further results are based on it. We created the database in Excel, where the first column, labeled "i", contains a list of all the countries used in the paper. The second column, labeled "t", represents the time data, namely the years 2012 to 2022, and the remaining columns contain the dependent (y) and independent (x) variables. We uploaded the finished database to R Studio. We used the R packages dplyr, readxl, plm, and lmtest to analyze the data and create the panel data model.

These packages provided robust tools to efficiently process, analyze, and model our panel data, contributing to the reliability and accuracy of the results.

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Residuals:
   Min.        1st Qu.      Median       3rd Qu.      Max.
-1.6967898  -0.1004275  -0.0079673  0.1144587  2.0066233
Coefficients:
              Estimate    Std. Error   t-value     Pr(>|t|)
log_GDP       0.051347    0.248198     0.2069      0.836155
log_Exp_GS    -0.482716   0.149195     -3.2355     0.001263    **
BRI           0.263741    0.055396     4.7610      2.277e-06   ***
log_REER      -0.573642   0.264786     -2.1664     0.030565    *
Total Sum of Squares:       73.999
Residual Sum of Squares:    58.993
R-Squared:                  0.20279
Adj. R-Squared:             0.11928
F-statistic:  52.2098 on 4 and 821 DF   p-value:   < 2.22e-16
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Figure 1. Fixed effects model analysis in R-studio

Source: Own research

3. RESULTS

The analysis including the BRI, log_GDP, log_Exp_GS and log_REER variables provided important insights into the factors influencing countries' gross government debt. The results are presented based on the statistical significance and interpretation of the coefficients of each variable:

BRI (Belt and Road Initiative):

Based on the low p-value for the BRI variable, we reject the null hypothesis of insignificance of the parameter estimate. The confidence interval does not contain a value of 0, confirming the existence of a relationship between BRI membership and the dependent variable. The coefficient suggests that countries that have joined the BRI have on average 0.26 percentage points higher gross government debt, which may be due to higher use of foreign financing and investment.

Log_GDP:

The coefficient for the log_GDP variable was not statistically significant (p-value > 0.05). Although the estimate was positive, its value was close to zero, indicating that log_GDP does not have a significant effect on gross government debt in the observed model. This result may be influenced by other factors that neutralize the effect of economic performance on government debt.

Log_Exp_GS (exports of goods and services):

This coefficient was statistically significant at the 0.01 level (p-value < 0.01), and the results showed a negative relationship between the logarithm of exports of goods and services and gross government debt. An increase in exports is associated with a decrease in gross government debt, which may be the result of an improved trade balance, higher foreign exchange reserves and less need for external financing.

Log_REER (real effective exchange rate):

The log_REER variable has a statistically significant negative effect on gross government debt. This result suggests that an improvement in the real effective exchange rate is associated with a decline in gross government debt, which may be due to higher competitiveness, economic stability and growth in export earnings. For policymakers, this result underlines the importance of promoting competitiveness and exchange rate stability in reducing government debt.

Based on the results of the regression analysis, we can conclude that participation in the Belt and Road Initiative (BRI) is associated with an increase in gross government debt. These findings support concerns that projects financed under the BRI framework may contribute to significant fiscal burdens, especially in countries with weaker debt management capacities or limited economic diversification.

To illustrate how BRI-related financing can translate into sovereign debt pressures, we reference two well-known examples from the broader public discourse. Montenegro, for instance, undertook a highway construction project between the cities of Bar and Boljare, financed by a loan from the Export-Import Bank of China amounting to one billion euros. According to Martinovic and Milovic (2022), this loan represents a substantial portion of the country's public debt. The inability to generate sufficient revenue from the highway raised concerns about repayment capacity and contributed to economic strain, increasing the country's financial dependence on China.

Similarly, Sri Lanka utilized BRI funding to construct the Hambantota port, a project whose costs far exceeded anticipated revenues. As Wignaraja et al. (2020) note, Sri Lanka was ultimately unable to service its debt, leading to the transfer of port control to a Chinese company for 99 years. This case has sparked international debate about sovereignty, debt sustainability, and the long-term implications of infrastructure-linked borrowing.

These examples serve to contextualize the quantitative findings by highlighting the real-world risks of BRI-related debt accumulation. While they are not the primary focus of this study, they underscore the importance for governments to carefully assess the economic and strategic implications of large-scale infrastructure financing through external sources.

The study reveals a strong link between participation in the Belt and Road Initiative (BRI) and rising public debt levels. Supporting this, Li et al. demonstrate that BRI engagement also correlates with higher corporate debt, especially when governments back corporate loans, further intensifying public debt burdens (Li et al., 2022). Using a difference-in-differences methodology, they show that corporate indebtedness tends to surge after BRI adoption, with a possible stabilization depending on how well debt is managed.

The economic consequences of growing public debt are complex, often undermining growth and stability. Huang (2016) argues that excessive debt can limit public investment, dampening economic performance over the medium and long term. This is particularly critical for lower-income BRI countries, where limited fiscal space hampers debt servicing and increases the likelihood of default (Cao et al., 2022). Rauf et al. further stress that unsustainable debt undermines financial stability and can negatively affect broader socio-economic outcomes in BRI nations (Rauf et al., 2018).

4. FUTURE RESEARCH DIRECTIONS

The results of this study open up several interesting directions for future research. One important area could be exploring the long-term effects of projects funded by the Belt and Road Initiative (BRI) on participating countries. For example, future studies could look into how these projects contribute to better infrastructure, job creation, and economic growth in the regions involved.

Another important question is how the increased debt from BRI projects affects the financial health of these countries in the long run. Researchers could also compare the impact of the BRI in different parts of the world, like Asia, Africa, and Eastern Europe, to see how the outcomes vary depending on regional factors.

There's also room to explore alternative ways to finance big infrastructure projects that might reduce the debt burden for countries while still allowing them to grow. Since sustainability is a growing concern, it would also be worth studying how BRI projects affect the environment and local communities and whether they align with global goals for sustainable development.

Lastly, adding more economic factors, like inflation, interest rates, or how open a country is to trade, could help create a fuller picture of what drives public debt and how initiatives like the BRI fit into that. By diving into these areas, future research could provide useful insights for countries looking to balance the benefits and risks of participating in global development projects like the BRI.

5 CONCLUSION

Our research confirmed the existence of a relationship between participation in the Belt and Road Initiative (BRI) and the increase in gross government debt of participating countries. We conclude that BRI membership is associated with a 0.26 percentage point rise in public debt. This result highlights the financial risks tied to BRI-financed projects, particularly in nations that rely heavily on foreign funding for infrastructure development.

We explain this increase in debt as a consequence of the high upfront costs and repayment obligations of large-scale infrastructure projects funded under the BRI. While these projects often promise economic benefits, such as improved connectivity and trade potential, the associated financial risks can outweigh these benefits in the absence of strong fiscal safeguards. At the same time, our analysis shows that higher export earnings and stable real effective exchange rates help reduce public debt, suggesting that a focus on boosting export capacity and maintaining currency stability can mitigate these risks.

However, it is important to point out the limitations of this research. The analysis did not account for the long-term economic benefits of BRI projects, such as increased productivity or regional integration, which may balance or even offset the short-term debt increase. Additionally, our findings are limited by the availability and quality of data, particularly for countries with incomplete economic indicators.

We therefore recommend that future research examines the broader economic, social, and environmental implications of BRI projects over a longer time horizon. Researchers should also explore alternative financing mechanisms to balance infrastructure development with fiscal sustainability. These insights can help policymakers adopt strategies that maximise the benefits of BRI projects while managing their associated risks effectively.

The relationship between BRI participation and public debt underscores the need for careful planning and robust financial frameworks. By addressing these challenges, participating countries can enhance the long-term benefits of the initiative while minimising its potential drawbacks.

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Appendix

Table 2. List of countries

Afghanistan	Djibouti	Lebanon	Samoa
Albania	Dominican Republic	Lesotho	Sao Tome and Principe
Algeria	Ecuador	Liberia	Saudi Arabia
Angola	Egypt	Lithuania	Senegal
Argentina	El Salvador	Luxembourg	Serbia
Armenia	Equatorial Guinea	Macao SAR, China	Sierra Leone
Australia	Estonia	Madagascar	Singapore
Austria	Eswatini	Malawi	Slovak Republic
Azerbaijan	Ethiopia	Malaysia	Slovenia
Bahamas, The	Fiji	Maldives	Solomon Islands
Bahrain	Finland	Mali	South Africa
Bangladesh	France	Malta	Spain
Barbados	Gabon	Mauritania	Sri Lanka
Belarus	Gambia, The	Mauritius	St. Lucia
Belgium	Georgia	Mexico	St. Vincent and the Grenadines
Belize	Germany	Moldova	Sudan
Benin	Ghana	Mongolia	Suriname
Bhutan	Greece	Montenegro	Sweden
Bolivia	Guatemala	Morocco	Switzerland
Bosnia and Herzegovina	Guinea	Mozambique	Tajikistan
Botswana	Guinea-Bissau	Myanmar	Tanzania
Brazil	Guyana	Namibia	Thailand
Brunei Darussalam	Haiti	Nepal	Timor_Leste
Bulgaria	Honduras	Netherlands	Togo
Burkina Faso	Hong Kong SAR, China	New Zealand	Tonga
Burundi	Hungary	Nicaragua	Trinidad and Tobago
Cabo Verde	Iceland	Niger	Tunisia
Cambodia	India	Nigeria	Turkey
Cameroon	Indonesia	North Macedonia	Turkmenistan
Canada	Iran, Islamic Rep.	Norway	Uganda
Central African Republic	Iraq	Oman	Ukraine
Chad	Ireland	Pakistan	United Arab Emirates
Chile	Israel	Panama	United Kingdom
China	Italy	Papua New Guinea	United States
Colombia	Jamaica	Paraguay	Uruguay
Comoros	Japan	Peru	Uzbekistan
Congo, Dem. Rep.	Jordan	Philippines	Vanuatu
Congo, Rep.	Kazakhstan	Poland	Vietnam
Costa Rica	Kenya	Portugal	West Bank and Gaza
Cote d'Ivoire	Korea, Rep.	Puerto Rico	Zambia
Croatia	Kuwait	Qatar	Zimbabwe
Cyprus	Kyrgyz Republic	Romania	
Czechia	Lao PDR	Russian Federation	
Denmark	Latvia	Rwanda	

Source: Own processing