

Impact of Macroeconomic and Social Factors on Gross Domestic Product: The Moderating Role of the Belt and Road Initiative

Syed Muhammad Salman¹
Iqra University, Karachi, Pakistan

Ayub Mehar
Iqra University, Karachi, Pakistan

Athar Iqbal
Iqra University, Karachi, Pakistan

Abstract

The primary purpose of this study is to investigate how the Belt & Road Initiative (BRI) affects the relationship between macroeconomic and social factors (i.e., foreign direct investment (FDI), lending rate, inflation, personal remittances, and secondary school education) and gross domestic product (GDP). We have collected the data from the World Bank from 1990 to 2019 (n=870, countries=23). The study has used statistical techniques such as regression analysis and hierarchical regression. The study found that macroeconomic and social factors (i.e., foreign direct investment (FDI), lending rates, inflation rates, personal remittance, and Secondary School Education) affect GDP. We also found that BRI moderates the association between macroeconomic and social factors with GDP. We have collected the data from the countries that have become the BRI partners by 2016. Future studies may consider using the data that have joined BRI after 2016.

Keywords: *Gross domestic product, foreign direct investment, lending rate, Belt and Road Initiative, personal remittances.*

¹Corresponding Author: Syed Muhammad Salman; Email: smsalman@iqra.edu.pk

Introduction

The endogenous growth theory suggests that infrastructure development generates economic activities, creates network externalities, and improves connectivity. Consequently, it increases FDI, personal remittances, and other macroeconomic and social indicators like lending rate, inflation, and school enrollments (Maparu, & Mazumder, 2017; Bende-Nabende, 2018). Many countries have generated economic activity by spending resources on infrastructure development (Enderwick, 2018). For example, Baghdad and the United States benefited from Baghdad Railroad (Brewster) and the railroad network during American Gilded Age (Rolland, 2015; Dosi, Roventini, & Russo, 2019).

China and Pakistan have a long and sustainable relationship. Both countries take an interest in the projects beneficial to them. The BRI is one of them (Lee et al., 2018; De-Soyres, Mulabdic, Murray, Rocha, & Ruta, 2019). During a visit to Kazakhstan, the president of China presented the idea of the BRI. Subsequently, in October 2013 in Indonesia, he presented a comprehensive plan for implementing the project. The important aspects of the project were coordination in policymaking, improving connectivity, facilitating unimpeded trade, and bridging the gap between people living in different cultures (Wang et al., 2020; Saeed, Cullinane, Gekara, & Chhetri, 2021). Feng et al. (2019) and Wang et al. (2020) assert that large-scale transport and infrastructure projects strengthen connectivity, reduces trade costs, and promotes market integration (Feng et al., 2019; Wang, Lim, Zhang, Zhao, & Lee, et al., 2020; Fu, Wu, Wang & Wang, 2020).

Although many studies have examined the association between infrastructure development, economic growth, GDP, a few have examined the impact of infrastructure development on other macroeconomic variables (Pradhan, Mallik & Bagchi, 2018; Toader, Firtescu, Roman, & Anton, 2018; Cigu, Agheorghiesei, & Toader, 2019). GDP also affects FDI, lending rate, inflation, personal remittances, and secondary school enrollment. Thus, this study examines the effect of the BRI on endogenous growth of participating countries and its spillover effect on economic growth and development. To meet the objective of the study, it will address the following research questions?

1. *What is the impact of FDI, lending rate, inflation rate, personal remittance, and secondary school education on GDP?*
2. *Does BRI moderate the association of macroeconomic and social factors with GDP?*

Literature Review and Hypotheses Development

FDI and GDP

GDP represents the goods and services produced in one country. Sarkodie and Strezov (2019) assert that GDP growth is an indicator of productivity and economic efficiency. Due to the growth of globalized international markets, diverse approaches are now available for firms to invest in other countries. FDI has a sustainable impact on different aspects of an economy (Almfraji & Almsafir, 2014). The impact of FDI can be direct or indirect. Gezdim and Zortuk (2018) and Herzer (2012) suggest that FDI creates a setup that allows a firm to operate in a foreign country, accumulate capital, transfer technology, and produce goods and services.

Extant literature suggests that the association between FDI and economic growth is inconsistent. Some studies found that both are positively associated (Kalai & Zghidi 2019; Sarkodie & Strezov, 2019). At the same time, others found a negative relationship (Nyoni, 2018; Abdouli & Hammami, 2017) between FDI and economic growth. The awareness of a sustainable environment has increased globally. Thus, the impact of FDI in a host country's environment is positive if investing firms also transfer green technology with plants and machinery (Demena & Afesorgbor, 2020). Otherwise, it will adversely affect the host country's environment in the short run (Siddique, Ansar, Naeem & Yaqoob, 2017). FDI allows capital accumulation, technology transfers, improved production efficiency, and generates economic activities.

H1. FDI positively affects the GDP of a host country.

Lending Rate and GDP

Lending rates affect economic activities in a country. However, past studies found inconsistent results on the effect of lending rate and GDP. For example, Maran (2021) found a positive association between the lending rate and GDP. At the same time, others, including Huy, Loan, and Pham (2020), found an insignificant impact of lending rate on GDP. Akinwal (2018) stresses that changing lending rates may negatively or positively affect economic growth. For example, a study on a data set of 31 European countries found no causal association between public debt and growth, irrespective of debt ratio.

In contrast, Jacob et al. (2020) found no causal relationship between public debts and growth, but growth significantly affects public debt. Reducing the lending rates generates economic growth, and stringent monetary policy diminishes economic growth by maintaining relatively high lending rates in developing countries (De-Mendonça & Brito, 2021; Huy, Loan & Pham, 2020). A study in Nigeria also validated

the negative association between interest rate and investments (Maiga, 2017; Akinwale, 2018; Kummw, Taka, Guillaume, 2018).

H2: Lending rates negatively affect GDP.

Inflation and GDP

Price stability is the primary objective of central banks. It promotes a conducive investment environment and economic growth opportunities (Seleteng et al., 2013; Mishchenko, Naumenkova, Ishchenko & Ivanov, 2018). Thus policymakers can use inflation to control economic growth in an economy (Musarat, Alaloul, & Liew, 2021). Adu-Gyamfi, Nketiah, Obuobi, and Adjei (2019) suggest that slight and stable inflation generates sustainable economic growth (Vinayagathan, 2013; Thakur, 2017). Soaring inflation adversely affects the economy and increases the subsistence segment (Ndoricimpa, 2017). Economists do not have a consensus on the association between inflation and GDP. Urom et al. (2020) based on empirical evidence, concluded that once the inflation rate exceeds 10.2%, it starts affecting growth negatively. Similarly, it has been reported that when the inflation rate crosses the threshold level of 12%, it reduces the growth by 1.02% (Musarat, Alaloul, & Liew, 2021)

H3: Inflation negatively affects GDP.

Personal remittances and GDP

Cao and Kang (2020) examined the association between economic growth and personal remittances in 29 transitional economies. The study concluded that personal remittances and GDP have a significant positive relationship. Since the last 30 years, aggregate personal remittances have increased significantly (Uddin & Alam, 2021; Ceesay, Sanneh, Jawo, Jarju, & Jassey, 2019). Thus, developing countries now depend on personal remittances (Cao & Kang, 2020). Many developing countries in recent years had to face adverse balance of payment situations due to a significant reduction in personal remittances (Mekvabishvili & Atanelishvili, 2017). Countries like India give special benefits to non-resident Indians to appreciate their contribution in building and maintaining foreign exchange reserves. A developing country can only benefit with the funds remitted through documented channels (Ale, Akter, & Islam, 2018).

H4: Personal Remittances affect GDP positively and significantly.

Secondary School Enrollment and GDP

Fischer (1992) examined the association between economic instability and economic growth in sub-Saharan countries and Latin America. The study used a data set for the

period 1970-1985 and applied cross-sectional regression analysis. It found a significant association between human capital and economic growth. Based on empirical evidence, many studies concluded that secondary education, health, and education are positively associated (Arshad, Isaksen, Hansen, & Brækkan, 2017).

Ogundari & Awokuse (2018) studied economic growth and its relationship with human capital, education, and health in Sub-Saharan Africa. Many empirical studies found that an additional year of schooling increases individual income by 10%, thus enhancing the standard of living necessary for developing countries to open more schools (Resnikoff et al., 2020; Islam, Wadud, & Islam, 2007). The study used balanced panel data from 35 countries. The results reveal that human capital, health, and education have a positive and statistically significant relationship, although health is relatively more important than education. In this study, we hypothesize similarly. We have taken secondary school education as a proxy of education, reflecting the social impact of BRI. Thus, we develop the hypothesis:

H5: Secondary School enrollment affects GDP positively and significantly.

Moderating Role of the Belt & Road Initiative (BRI)

In the introduction section, we have discussed that infrastructure projects, such as roads, bridges, railroads, dams, and power plants, accelerate economic growth. Huang (2016) suggests that infrastructure projects have spillover effects on economic growth. BRI projects may affect 64% of Asia, Africa, and Europe, but it is too early to predict their impact. Yan and Enderwick (2021) suggest that BRI will change World trade patterns. It would reduce traveling costs, transactions costs, enhance efficiency and provide global trade opportunities.

Huang (2016) argues that China's economic success model philosophy states, "Looking for development, building the highways first." The BRI follows China's successful model. Although Gabusi (2017) stresses that BRI is China-driven, it will benefit other participating countries. Therefore, we propose the following hypothesis:

H6a: BRI will moderate the relationship between FDI and GDP.

H6b: BRI will moderate the relationship between LR and GDP.

H6c: BRI will moderate the relationship between inflation and GDP.

H6d: BRI will moderate the relationship between personal remittances and GDP.

H6e: BRI will moderate the relationship between secondary school education and GDP.

Conceptual Model

BRI has a variety of infrastructure development projects. It provides connectivity between Asia, Europe, and Africa, affecting 40% of the world's population (Jia, 2019; Li, Jin, Qi, Shi, & Ng, 2018). Several past infrastructure development projects suggest that infrastructure development promotes economic growth. Similarly, experts believe that BRI would promote economic growth and cause social and cultural spillovers (Gabusi, 2017). Various economic theories, including endogenous growth theory, support this belief (Bleaney, Gemmell, & Kneller, 2001; Zhang, 2013; Donaldson, 2018; Maparu & Mazumder, 2017; Achour & Belloumi, 2016). Accessibility, ease of transportation, cost reduction, the flow of resources, technology transfer, foreign direct investment, and personal remittance are vital for the growth and sustainability of a country (Arbués, Baños, & Mayor, 2015; Lee et al., 2018).

Economic growth means growth in GDP due to foreign direct investment, low lending rate, low inflation rate, personal growth remittances, and educated and skilled labor force. Therefore, on the macro level, all these variables are influenced by the BRI and moderate the relationship between macroeconomic factors (i.e. FDI, lending rate, inflation, personal remittances, and secondary school enrollments as proxy of education) and GDP. The proposed conceptual model is shown in Figure 1.

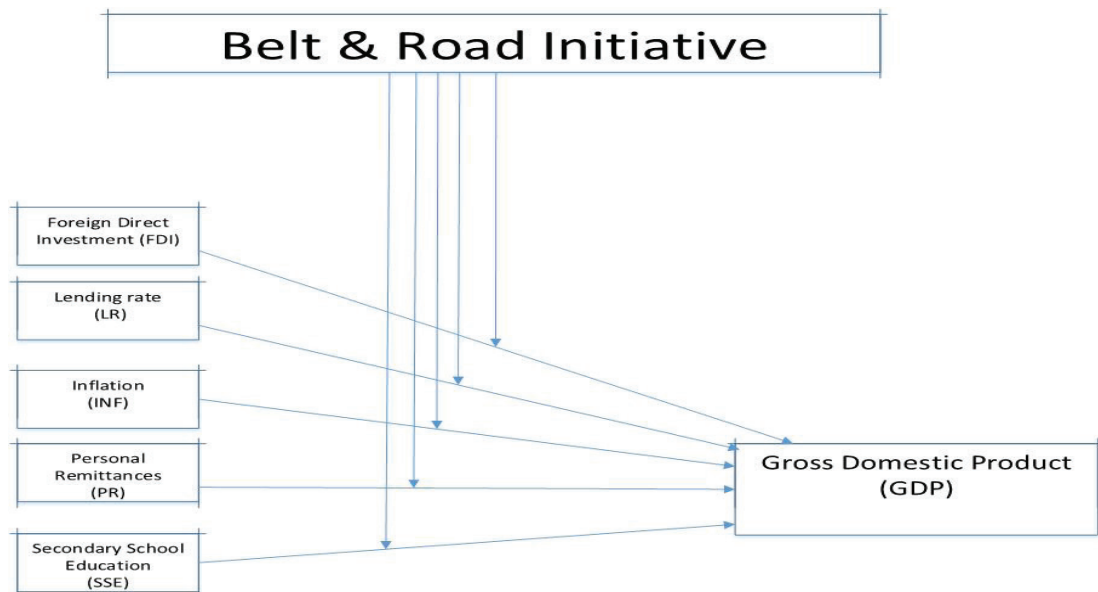


Figure 1: The Conceptual Model

Methodology

The study has used the data from 29 countries including, China, Pakistan, Malaysia, Indonesia, Thailand, Turkey, Bangladesh, Bulgaria, Chile, Costa Rica, Czech Republic, Hungary, Kenya, South Korea, Malta, Namibia, New Zealand, Nigeria, Romania, Russia, Singapore, Sri Lanka, South Africa, Poland, Kyrgyz Republic, Madagascar, Egypt, Cambodia and Magnolia which are part of the Belt & Road Initiative (BRI).

The study has collected data from the World Bank from 1990 to 2019. GDP is the dependent variable. At the same time, independent variables in the study are FDI, lending rate, inflation, personal remittances, and secondary school enrollment. The BRI was moderating variable in the study. The study has used regression and hierarchical regression for testing the direct and moderating hypotheses. Thus, the study will test the following regression equations:

$$GDP_{it} = \alpha + \beta_1 FDI_{it} + \beta_2 LR_{it} + \beta_3 INF_{it} + \beta_4 PR_{it} + \beta_5 SSE_{it} + \beta_6 BRI_{it} + \varepsilon_{it} \dots\dots\dots (1)$$

$$GDP_{it} = \alpha + \beta_1 FDI_{it} + \beta_2 LR_{it} + \beta_3 INF_{it} + \beta_4 PR_{it} + \beta_5 SSE_{it} + \beta_6 BRI_{it} + \beta_7 (FDI * BRI)_{it} + \beta_8 (LR * BRI)_{it} + \beta_9 (INF * BRI)_{it} + \beta_{10} (PR * BRI)_{it} + \beta_{11} (SSE * BRI)_{it} + \varepsilon_{it} \dots\dots\dots (2)$$

Table: 1 Measurement of Variables

Variables	Abbreviation	Measurements
Dependent Variable		
Gross domestic product	GDP	GDP (current US\$). Data is collected from the world bank database.
Independent Variables		
Foreign Direct Investment	FDI	Foreign Direct Investment (current US\$). Data is collected from the world bank database.
Lending rate the world bank database.	LR	Lending interest rate (%). Data is collected from
Inflation World Bank database	INF	Yearly inflation rate. Data is collected from
Personal Remittances	PR	Personal remittances as a percentage to GDP. Data is collected from World Bank database
Secondary School Enrollment	SSE	Gross enrollment in secondary school enrollment. Data is collected from World Bank database.

Moderator		
Belt & Road Initiative		
	BRI	1-Belt & Road Initiative period, 0- Non-Belt & Road Initiative period
Interactions		
FDI * BRI		
		Interaction of Foreign direct investment with Belt & Road Initiative
LR * BRI		
		Interaction of lending rate with Belt & Road Initiative.
INF * BRI		
		Interaction of Inflation with Belt & Road Initiative.
PR * BRI		
		Interaction of Personal remittances with Belt & Road Initiative.
SSE * BRI		
		Interaction of Secondary School Education with Belt & Road Initiative.

Results

Panel Regression Analysis

The study has used panel regression analysis. We estimated the pooled, fixed-effect, and random effect models. The Hausman test suggests that the random effect model is appropriate. The covariance between FDI and Tinflation, personal remittances and inflation; secondary school education and inflation, and secondary school education and personal remittances are insignificant.

Table 2: Panel Regression Results

	Pooled OLS		Fixed effects		Random effects	
	GDP	GDP	GDP	GDP	GDP	GDP
	(1)	(2)	(1)	(2)	(1)	(2)
Constant	-2265.3*** (0.004)	-2401.8*** (0.00015)	-4103.7*** (0.0034)	-5404.6*** (0.000)	-3558.5** (0.0108)	-4554.8*** (0.0006)
FDI	30.49303*** (0.000)	25.689*** (0.0000)	26.602*** (0.000)	20.473*** (0.000)	27.212*** (0.0000)	21.116*** (0.0000)
LR	15.41674 (0.302)	15.712 (0.3300)	19.826 (0.2031)	15.918 (0.3284)	18.557 (0.2252)	15.487 (0.3353)

INF	2.687357 (0.538)	-36.513 (0.1274)	0.8307 (0.8376)	-37.830* (0.0699)	1.1006 (0.7846)	-38.291* (0.0656)
PR	58.01751*** (0.000)	40.852*** (0.0000)	63.980*** (0.000)	39.086*** (0.0000)	63.740*** (0.0000)	40.420*** (0.0000)
SSE	16.73175* (0.057)	24.144*** (0.0033)	42.661** (0.0184)	71.763*** (0.0000)	34.992** (0.0236)	59.239*** (0.0000)
BRI	452.3494* (0.061)	-1403.6** (0.0356)	324.48 (0.1473)	-1311.0** (0.0226)	348.51 (0.1156)	-1316.9** (0.0216)
Interactions						
FDI × BRI		1161.4*** (0.0000)		1510.1*** (0.0000)		1469.4*** (0.0000)
LR × BRI		742.01* (0.0987)		435.29 (0.2635)		471.44 (0.2241)
INF × BRI		-5462.8* (0.0917)		-5068.16* (0.0702)		-5182.4* (0.0633)
PR × BRI		1144.4*** (0.0000)		882.59*** (0.0000)		903.03*** (0.0000)
SSE × BRI		939.31*** (0.0002)		578.76*** (0.0070)		620.47*** (0.0037)
F-statistics	385.10*** (0.000)	266.40*** (0.000)	101.26*** (0.000)	122.90*** (0.0000)	249.11*** (0.000)	197.67*** (0.0000)
R-squared	0.729	0.774951	0.80614	0.853461	0.63583	0.718717
Adj. R-squared	0.727789	0.772042	0.79818	0.846517	0.63330	0.715081

Hierarchical Regression

To test our proposed hypotheses, we applied hierarchical moderated regression analysis. First, we converted all independent variables and the moderating variable into standardized values to reduce multi-collinearity. Hypothesis 1 suggests that foreign direct investment (FDI) positively affects GDP. The results presented in Table 2 supports the hypothesis ($p < 0.05$). Hypothesis 2 predicts that the lending rates affect the GDP. The results presented in Table 2 do not support this hypothesis ($p > 0.05$). Hypothesis 3 postulates that inflation has a significant effect on GDP. The results suggest an insignificant effect ($p > 0.05$). Hypothesis 4 predicts that personal remittance positively affects GDP, which our results support (refer to Table 2) ($p < 0.05$). Hypothesis 5 suggests that secondary school enrollment affects GDP positively. The results support the hypothesis ($p < 0.10$).

Table 3 reports the results of hierarchical regression analysis. We found that the Belt Road Initiative (BRI) moderates FDI and GDP. The results support hypothesis 6a. Hypothesis 6b suggests that Belt Road Initiative (BRI) moderates lending rates and gross GDP, which our

results partially support. Moreover, hypothesis 6c suggests that the Belt Road Initiative (BRI) moderates inflation and GDP, which our results support. Hypothesis 6d suggests that Belt Road Initiative (BRI) moderates personal remittances and GDP, which our results support. Finally, hypothesis 6e suggests that Belt Road Initiative (BRI) moderates secondary school education and GDP.

Table 4: Hierarchal Regression

	GDP (1)	GDP (2)
Constant	-2265.393 (0.004)	-2401.825 (0.002)
FDI	30.493 (0.000)	25.690 (0.000)
LR	15.417 (.302)	15.712 (0.330)
INF	2.687 (0.538)	-36.514 (0.127)
PR	58.018 (0.000)	40.853 (0.000)
SSE	16.732 (0.058)	24.145 (0.003)
BRI	452.349 (0.062)	-1403.607 (0.036)
Interactions		
FDI × BRI		1161.487 (0.000)
LR × BRI		742.015 (0.099)
INF × BRI		-5462.822 (0.092)
PR × BRI		1144.411 (0.000)
SSE × BRI		939.316 (0.000)
	R Squared	R Squared change
Model 1	.730	.730
Model 2	.775	0.45
		F statistic
Model 1		385.110***
Model 2		34.235***

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Moreover, p-values are in parentheses.

Discussion and Conclusion

The main objective of this study is to investigate the moderating effect of the Belt & Road Initiative (BRI) on the relationship between macroeconomic and social factors and GDP. We analyzed the data using the panel and hierarchical regression analyses. The study found that macroeconomic and social factors, i.e., lending rates, inflation rates, personal remittance, and Secondary School Education, affect GDP. We also found that the Belt Road Initiative (BRI) moderates the relationship between macroeconomics and social factors and gross domestic product (GDP). The results corroborate earlier studies (Kalai & Zghidi, 2019; Sokhanvar, 2019; Sarkodie & Strezov, 2019).

Limitations and Future Research

This study has several limitations. We have collected the data from the countries that have become the BRI partners by 2016. Future studies may consider using the data that have joined the forum after 2016. This study has examined the effect of social and macroeconomic factors on GDP and the moderating role of the BRI. Future studies may take a holistic approach using more moderating, independent, and dependent variables. BRI may have spillover effects on non-member countries, which future studies may explore.

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