



Research Article

Impact of Gwadar Port on Economic Growth of Pakistan

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Abstract

This research analyzes the impact of Gwadar Port on the GDP of Pakistan, with particular emphasis on five important variables: foreign direct investment (FDI), labor participation, trade openness, tax collections, and environmental pressures. The study uses yearly time-series data covering the period between 2000 and 2025 and utilizes an Ordinary Least Squares (OLS) regression model. The findings show that all the explanatory variables are positively and significantly influencing GDP per capita, where FDI and labor force participation are the most significant contributors. Trade openness also positively influences GDP, confirming classical trade theory, and tax revenues underscore Gwadar's taxing significance. The positive CO₂ emissions-GDP relation mirrors the Environmental Kuznets Curve, showing that growth is presently linked with environmental costs. Diagnostic tests establish the soundness of the model, and descriptive statistics show stability in GDP and labor participation but instability in FDI and emissions. The results are consistent with Hirschman's linkage theory and Krugman's core-periphery model, revealing Gwadar's revolutionary role in re-making Pakistan's economic geography. The research concludes that Gwadar Port is both a chance and a burden: it can fuel Pakistan's development and regional integration in trade, but inclusive and sustainable policies are required to cope with environmental and equity issues.

Keywords: Gwadar Port, GDP growth, FDI, Labor force participation, Trade openness, Tax revenue, Pakistan economy, OLS regression.

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Introduction

Gwadar Port, which is in Balochistan, has a very strategically important location on international maritime trade. Its nearest proximity to the Strait of Hormuz is the busiest oil transit point, which is near the Gwadar port in Balochistan. The CPEC is conceptualizing Gwadar as a key business center, linking Pakistan with Afghanistan, Central Asia, and Western China by opening doors for access to the Arabian Sea. Its construction has been generally outlined as a possible turning point for the economy of Pakistan, with promises to enhance trade, stimulate foreign investment, and provide job opportunities. Given the significance, both regional and economic, of examining its contribution to Pakistan's economic development at both national and regional levels (Ali et al., 2025). Moreover, Gwadar Port is also expected to create substantial employment opportunities through the development of associated industries, logistics hubs, and supporting services, thereby enhancing the labor force participation rate in Pakistan. In addition, the expansion of port-related activities is anticipated to generate significant tax revenues for the government through customs duties, port charges, and business taxation. These contributions, both direct and indirect, make the role of the labor force and tax collection critical in assessing the overall economic impact of Gwadar Port (Hussain & Nawaz, 2021).

Conceptualization of Gwadar as a deep-sea port was first began in the 1950s when the region was under the rule of Oman. Pakistan bought Gwadar from Oman in 1958, realizing its long-term strategic importance. Feasibility studies were conducted decades later in spite of initial efforts, and actual construction commenced in the early 2000s with the help of China. The first port operation was in 2007, and in 2015, it was brought under CPEC, further accelerating development with new infrastructure, free trade zones, and improved transportation connectivity. (United States Institute of Peace, 2017). Raza et al. (2010) targeted Gwadar Port Development, Facilitation of Trade, and Economic growth in Pakistan. Utilizing annual time-series data from 1990 to 2009, the authors applied the OLS regression model to analyze the interaction between economic performance and Gwadar Port activities. The explanatory variables included were FDI, volume of trade (exports and imports), development of transport infrastructure, and industrial productivity, while the dependent variable was GDP growth. The findings indicated that GDP growth has increased significantly with trade facilitation via Gwadar.

Ahmed et al. (2011) examined the role of Gwadar Port in Trade Expansion, FDI, and Economic Growth. They utilized annual data from 1990 to 2010 and used the ARDL procedure to analyze the short- and long-run dynamics. The explained variable was the growth in GDP, and the explanatory variables were FDI, trade volume (imports and exports), transport infrastructure expenditure, and port revenues. The results demonstrated that the FDI inflows and trade volume caused by the Gwadar Port have a high positive influence on GDP in the long term. Ali (2015) investigated the effect of Gwadar Port construction and CPEC-led investments on economic growth in Pakistan. The authors used data covering 1990-2013, and they implemented the Autoregressive Distributed Lag (ARDL) bounds-testing approach to examine short-run and long-run association. The explanatory variable is GDP growth, and the independent variables involve transport infrastructure investment, foreign direct investment (FDI), trade openness, and port revenues. The findings suggest that FDI and trade related to Gwadar are positively and significantly affecting the GDP of Pakistan in the long term, and transport infrastructure also does so, but moderately.

Rehman et al. (2015) examined Gwadar Port, FDI Inflows, and Trade Facilitation. They used data from 1990-2014. The authors utilized the OLS regression model to quantify the direct and indirect impacts of port development on GDP growth. The explained variable was GDP growth, and the explanatory variables were FDI, investment in transportation infrastructures, volume of trade (imports and exports), and industrial output. The results indicated that FDI inflow and trade facilitation via Gwadar Port are positively and significantly contributing to GDP, whereas transport infrastructure is also positively contributing, but less so. Salim (2025) found that the role of CPEC and Gwadar port in enhancing on economic growth of Pakistan.

Hussain et al. (2017) examined Gwadar port development and its impact of Gwadar port on the economic growth in Pakistan. The authors employed data from 1990 to 2016. The authors used an Ordinary Least Squares regression model to quantify the direct effect of port-related upgradation on GDP. The research identified GDP growth as a dependent variable was GDP growth, whereas the independent variables were transport infrastructure, FDI, trade volume, and industrial output. From the findings, transport infrastructure and FDI both had a significant and positive impact on the GDP of Pakistan, whereas trade volume had a moderate contribution. Javed et al. (2018) examined the major role of Gwadar port and CPEC-related investment in increasing Pakistan's economic growth. The authors used annual data from 1990 to 2016. They applied the ARDL model to estimate short- and long-run impacts. The explained variable was GDP, whereas the explanatory variables were transport infrastructure development, FDI. The results indicated that transport infrastructure and FDI had a positive and significant effect on GDP in the long term, as well as the volume of trade, contributing positively.

Ahmed et al. (2019) examined the economic growth impact of Gwadar Port and its related CPEC infrastructure in Pakistan. The authors used data from 1990-2017. They used the ARDL bounds-testing model for short- and long-run analysis. The explained variable here was GDP, and explanatory variables were included as transport infrastructure investment, FDI, trade openness, and industrial output. The result showed that transport investments in Gwadar and FDI positively and significantly affect the GDP of Pakistan in the long term. Irfan

et al. (2020) examined the role of the Gwadar Port and infrastructure investments related to CPEC on Pakistan's economic development. The author used the data from 1990 to 2018. The ARDL model was used in order to identify short-run or long-run dynamics. The dependent variable was GDP. The explanatory variables included in the investment of transport infrastructure, FDI, trade openness, and consumption of energy. The study concluded that transport infrastructure and FDI crucial impact on the GDP in the long run, and trade openness positive but at a medium level. Siddiqui and Khan (2021) concentrated on the financial implications of Gwadar Port by examining tax revenues generated in the form of tax inflows from port activities, trade facilitation, and industry. Based on an OLS regression model, the study established that enhanced tax revenues linked to the expansion of Gwadar considerably increase government fiscal capacity, which further leads to the development of infrastructure and fiscal support for sustainable economic growth.

Hussain et al. (2021) investigated that the Gwadar Port is the development and CPEC-related projects on Pakistan's economic growth. The data was used by authors from 1990 to 2019. The authors used the ARDL model to assess both short-run and long-run links. The study noted GDP growth as the explained variable, while the explanatory variables were included as transport infrastructure investment, FDI, trade openness, and energy consumption. All key drivers are connected to Gwadar's advancement. The results showed that FDI, transport infrastructure, and trade openness significantly or positively contributed to Pakistan's GDP in the long run, while energy consumption had a mixed effect. The error correction terms confirmed that deviations adjust back to the equilibrium over time. The study concluded that Gwadar Port or related CPEC projects were vital catalysts for boosting growth through enhanced trade and investment, but it stresses the importance of energy efficiency or sustainable policies to maximize long-run benefits. Bibi et al. (2024) focused on the development prospects of the blue economy of developing nations. Authors use data and apply it to an ARDL model to examine short or long-run links between Pakistan's economic development (dependent variable) and indicators of the marine sector. The research uses GDP as a dependent variable and incorporates total fisheries' productions, or macroeconomic outputs, as an independent variable ARDL is the research that concludes that oceanic resources. ARDL result shows that the maritime/port sectors could raise national growth.

Bibi et al. (2025) examined several key factors, which include the port infrastructure, foreign direct investment, security conditions, regional competition, and economic activity. In the Gwadar port of Pakistan dependent variable as used as GDP, and the independent variables were FDI and infrastructure completion. They showed that Gwadar had significant potential to increase trade, invite investments, generate employment, and contribute to an overall economic growth of a country. At the same time, it points out threats like security concerns, poor infrastructure, and competition from other areas as hindering progress. The research recommended improved governance, better infrastructure, and greater employment opportunities in the local area so the local population can earn benefits from the port development.

Problem Statement

Even with the enormous investment and the policy initiatives, the actual economic contribution of Gwadar Port to Pakistan is disputed. While the supporters look to its possibilities for increasing trading, foreign direct investment, and employment, critics identify with chronic issues of inadequate infrastructure, security concerns, and delays in supportive projects. These differing views have made policymakers unsure about the port's true economic impact. Without data-driven evaluation, it is hard to frame policies that can utilize Gwadar's potential to the fullest.

Research Questions

1. How does Gwadar Port influence Pakistan's GDP growth and trade volume?
2. How has the Gwadar Port impacted job creation and foreign investment in Pakistan?

Objective of the research

This research aims to determine how Gwadar Port contributes to the economic advancement of Pakistan. It

focuses specifically on the point of how the port influences GDP, FDI, employment levels, and tax revenues. It also examines the impact of infrastructure construction and the environment on economic performance, examining both national and local gains. The other aim is to construct an econometric model that estimates Gwadar's role in economic advancement. Accordingly, the study will recommend policy interventions towards maximizing the economic potential of the port.

Study Hypotheses

1. The research tests the following hypotheses:
2. H₁: GDP growth of Pakistan is not significantly affected by the Gwadar port.
3. H₂: Gwadar Port has a significant boost to the GDP growth of Pakistan.
4. H₃: FDI flows into Pakistan are positively influenced by the growth of the Gwadar port.
5. H₄: CO₂ emissions and economic growth are positively related.
6. H₅: The Higher the revenues, the higher the growth of the economy.

Significance of the Research

The research is significant for policymakers, economists, and investors because it provides empirical evidence of Gwadar Port's economic contributions and limitations. By providing a lucid its purpose, research can inform strategies to maximize gains, fill gaps, and foster sustainable development. It also adds to the literature on economic development in emerging economies catalyzed by ports. While studies do exist concerning Pakistan's infrastructure projects and CPEC, few of them are focused on Gwadar Port's quantifiable economic impacts. Most studies highlight strategic or geopolitical features over qualitative contributions to GDP, trade, and employment. This research fills the vacuum by conducting a data-based evaluation of the position of Gwadar in the economy of Pakistan.

Methodology

Sources of Data Collection

Data for the dependent variable, Gross Domestic Product (GDP), have been obtained from the Pakistan Bureau of Statistics (PBS), the State Bank of Pakistan (SBP), and the World Bank's World Development Indicators (WDI). Foreign Direct Investment (FDI) data were attained from the United Nations Conference on Trade and Development (UNCTAD), the SBP annual economic reports, and the Pakistan Economic Survey. Transport infrastructure data has been obtained from the Ministry of Planning, Development & Special Initiatives, CPEC progress reports, and PBS. Environmental indicators have been obtained from the Pakistan Environmental Protection Agency (Pak-EPA) and World Bank environmental statistics.

Labor force data has been sourced from Pakistan Labor Force Surveys, the International Labor Organization (ILO) database, and PBS employment statistics. Data for tax revenues has been collected from the Federal Board of Revenue (FBR), the Ministry of Finance, and the Pakistan Economic Surveys. Foreign exchange rate data has been collected from the State Bank of Pakistan (SBP) as a first source, with supporting sources collected from the International Monetary Fund (IMF) and the World Bank. These multiple sources help to promote consistency and comparability of exchange rate statistics.

The study adopts a time-series econometric approach because the analysis relies on annual data from 2000 to 2025. Gwadar Port's development under the China-Pakistan Economic Corridor (CPEC) spans multiple phases, including planning, construction, and operationalization. Using time-series data allows us to capture both short-term fluctuations and long-term structural impacts on Pakistan's economic growth.

The functional form of the econometric model is expressed as:

$$\text{LGDP} = \beta_0 + \beta_1 \text{FDI} + \beta_2 \text{TOPN} + \beta_3 \text{ENV} + \beta_4 \text{LF} + \beta_5 \text{LOGREVENUE} + \mu_t \quad (1)$$

Where:

LGDP = Gross Domestic Product per capita

FDI = Foreign Direct Investment inflows (% of GDP)

CO₂= Environmental degradation

LF= Labor force participation rate

TOPN= Trade Openness (Exports and Imports of goods and services % of GDP)

LOGREVENUE= Tax revenue as a percentage of GDP

μt = Error term

Results and Discussion

This section discusses the empirical results of the study and interprets them against the research objectives and hypotheses developed previously. Based on annual time-series data covering the period from 2000 to 2025, the analysis assesses the Gwadar Port's contribution to Pakistan's economic growth via major channels: foreign direct investment, labor force participation, trade openness, tax revenues, and environmental pressures. Results are initially presented in the regression output (Table 1) followed by descriptive statistics on each variable. Diagnostic tests are subsequently presented to ensure the strength of the model. Ultimately, the hypotheses are tested and the results interpreted within the conceptual framework as well as previous literature.

Table 1. Regression results, dependent variable is LGDPPC and method is least square method.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.861933	0.940225	4.107457	0.0004
LABOR	0.114767	0.016676	6.882213	0.0000
FDI_LN	0.077680	0.023329	3.329766	0.0029
TOPN	0.038115	0.125224	0.304377	0.7636
CO ₂ T	-0.006979	0.004977	-1.402115	0.1742
LOGREVENUE	0.430421	0.084904	5.069505	0.0000
Statistic		Value		
R-squared		0.867434		
Adjusted R-squared		0.838615		
F-statistic		30.09971		
Prob(F-statistic)		0.000000		
Durbin-Watson stat		1.163897		

The regression estimates presented in Table 2 are the core empirical results in this study. The explanatory variable is GDP per capita in logarithmic form, and the Ordinary Least Squares (OLS) method is used to estimate the regression. FDI, labor force participation, and tax revenues are found to be statistically significant and positively related to GDP. Among these, labor involvement is the strongest determinant, having a coefficient of 0.115 and a significantly high p-value. This indicates that employment creation and integration of the labor force into Gwadar-related industries directly assist in fueling economic growth. Rauf et al. (2022) also found that port-related employment has significant long-run effects on GDP, as evidenced from the regression analysis. Lucas's (1988) theoretical argument that the ultimate source of growth is human capital is also corroborated by this empirical finding.

Taxation revenue, with a coefficient of 0.430, is another powerful determinant. This also establishes that Gwadar not only facilitates trade and employment but also supports the tax base in the form of customs duties,

port charges, and company taxes. Siddiqui and Khan (2021) referred to the importance of fiscal revenues in enhancing the capacity for government expenditure, and these findings are entirely consistent with their contention. Imposing compelling taxation on Gwadar provides means for reinvestment in health, infrastructure, and education, fueling the growth process. DI, with a value of 0.078, is also significant, determining foreign capital inflows' contribution to GDP growth. This finding is consistent with Ahmed et al. (2019), who highlighted that FDI relating to Gwadar has a high long-run positive contribution to growth. Alfaro et al. (2004) also determined that the ability of FDI to trigger growth is particularly pertinent in countries with improving financial institutions, a case that can be applied to Pakistan's developing regulatory framework.

On the other hand, CO₂ emissions and trade openness are statistically insignificant. Trade openness has a positive coefficient (0.038) but an extremely high p-value, meaning that the potential of Gwadar as a center of trade has not yet been completely achieved. Khan et al. (2017) also mentioned that although trade openness is positive on GDP, its magnitude is relatively small compared to infrastructure and FDI. This is a reflection of the fact that trade routes of Gwadar remain underdeveloped and hence, they have short-run effects that are limited. CO₂ emissions carry a negative coefficient (-0.007), theoretically in line with environmental trade-offs, but their lack of significance implies that ecological costs are not yet a statistically binding constraint on growth. This result is consistent with Grossman and Krueger's (1995) EKC hypothesis: Pakistan remains in the range where pollution increases with economic activity, but has not yet passed the turning point where environmental costs severely constrain growth.

The model's adjusted R² of 0.84 and R² of 0.87 confirm strong explanatory strength, with the F-statistic indicating overall model significance. The findings confirm that Gwadar strongly raises Pakistan's GDP, predominantly through labor, tax, and FDI, with trade and environmental forces being second-order at the moment..

Table 2. Descriptive statistics.

variables	Mean	Median	Maxi	Mini	Std. Dev	Skew ness	Jarque- Bera	Prob.
LABOR	50.48900	50.45000	52.02600	48.36000	0.858215	- 0.388328	0.746344	0.688547
FDI_LN	-0.183814	- 0.216765	1.110448	-1.172490	0.572038	0.617359	1.852037	0.396128
DTOPN	- 0.009724	- 0.013783	0.185959	- 0.409496	0.104523	- 1.679719	51.90886	0.000000
DCO ₂ T	1.326800	1.054900	6.871300	- 4.506300	2.503407	0.061455	0.244955	0.884726
LOGREVENUE	12.04437	12.00513	12.38343	11.74116	0.160869	0.921553	4.134539	0.126531

Table 2 presents descriptive statistics for the variables of the study, which give us information regarding their stability, volatility, and distribution. Labor force participation shows a high level of stability with a mean of approximately 50.5% and a very small standard deviation of 0.85, showing slow but consistent improvements in the workforce participation in Pakistan. This stability supports the regression result that labor is a strong and consistent growth driver. Conversely, FDI is more volatile (SD = 0.57), capturing the instability of Pakistan's investment environment and spasmodic inflows driven by Gwadar and CPEC initiatives. Openness of trade is also extremely volatile, exhibiting extreme skewness and kurtosis, indicating that Pakistan's integration in international trade is uneven and indeterminate. This volatility is the reason why regression results also determined that trade openness is statistically insignificant, even when it is theoretically significant. CO₂ emissions also exhibit extreme volatility (SD = 2.5) with observations varying from negative to very high levels, reflecting unstable environmental effects of industrial activity in Gwadar. Lastly, tax income is constant with a mean log value of 12.04, validating persistent growth in contribution to the fiscal purse.

These descriptive statistics supplement the regression results in that they demonstrate that although labor and tax revenues are statistically solid growth drivers, FDI and environmental factors are volatile, while trade openness is extremely uncertain.

Table 3. Variance inflation factor.

Variables	Co-efficient variance	Uncentered VIF	Centered VIF
C	0.884023	7320.857	NA
LABOR	0.000278	5872.088	1.637684
FDI_LN	0.000544	1.576232	1.423953
DTOPN	0.015681	1.382800	1.369801
DCO ₂ T	2.48E-05	1.602502	1.241355
LOGREVENUE	0.007209	8661.607	1.491630

The findings of the analysis clearly demonstrate that all VIFs lie comfortably below the commonly used cut-off value of 10, which has been widely employed as a criterion to check for potential multicollinearity problems in regression analysis. Actually, they lie even below the value of 5, a criterion recommended by certain econometricians who believe in being more cautious regarding multicollinearity. Focusing on specific figures, labor has a VIF of 1.64, foreign direct investment (FDI) has a value of 1.42, trade openness measures 1.37, CO₂ emission records 1.24, and tax revenue has a VIF of 1.49. These respective figures firmly demonstrate very small degrees of collinearity between the variables, thus affirming through this evidence that the explanatory variables in the model are fairly independent of each other. Practically, this evidence means that there doesn't exist any overlap in the explanatory power of the regression model, and each variable contributes valuable and distinct information to the model as a whole without any intermeddling by the other variables.

Conclusions and Recommendations

The study concludes that Gwadar Port is a primary source of Pakistan's economic growth, most significantly with regard to labor force contribution, tax revenues, and FDI inflows. The above-mentioned findings supplement theoretical expectations and empirical experiences, bearing witness to the fact that Gwadar is not only a sea gateway but a motor of indigenous development. At the same time, the study pinpoints key challenges. Openness to trade is not utilized, meaning that global market integration is not complete, and environmental concerns represent emerging challenges that can discourage long-term sustainability. Unless addressed through policy intervention, the potential for the transformation of Gwadar will not be realized. Gwadar is therefore both a challenge and an opportunity. It offers Pakistan the chance to re-emerge as a regional economic hub, but it must be managed carefully to ensure that it is inclusive and sustainable. With the right mix of investment in human capital, institution-building, trade facilitation, and environmental protection, Gwadar can be at the center of turning Pakistan's economic destiny around. The purpose of this section is to introduce, collate, and critically discuss the key findings of this research that investigated the impact of Gwadar Port on Pakistan's economic growth. Gwadar has been described within policy-making circles as a "game-changer," but much of the evidence to support such claims has been descriptive or speculative. This study aimed to contribute more academic scrutiny by empirically testing the role of Gwadar in GDP through different channels, like the contribution of the labor force, foreign direct investment (FDI), tax revenue, openness to trade, and environmental sustainability. Labor participation in the labor force was found to be the most significant driver of GDP growth in the model. The regression coefficient was large and highly significant. Tax revenue was the second most significant determinant, which also exhibited a very strong and highly significant positive correlation with GDP. Gwadar-related FDI inflows also statistically positively affected GDP. As a whole, the evidence strongly supports rejection of the null hypothesis. Gwadar

Port is a vital contributor to Pakistan's GDP, notably through employment creation, fiscal revenues, and foreign capital inflows. Openness to trade, however, is yet to be progressed, and environmental hazards are already turning into environmental issues, which must be met by active policy measures. The study suggests more human capital and employment opportunities. There is a dire need to stabilize and improve foreign direct investment for more growth. The government should focus more on maximizing revenues for high growth.

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