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Research Article

Exploring the Effect of Trade Openness on Economic Growth in Developing Countries

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Abstract: This study investigates the impact of Trade Openness, Investment, Human Capital, and Infrastructure Development on GDP growth. Utilizing regression analysis on secondary data from Mumbai, the findings reveal that Trade Openness and Investment significantly contribute to GDP growth, while Infrastructure Development shows no significant effect. The analysis highlights the critical role of Trade Openness and Investment in enhancing economic performance and suggests that these factors should be prioritized in economic policy-making. The study contributes to the understanding of economic growth drivers and offers implications for both national and global economic strategies. Future research could expand on these findings by exploring different contexts or examining the interaction between these variables.

Keywords: Economic Growth, Trade Openness, Investment.

INTRODUCTION

Trade openness has long been a focal point of economic research, particularly in its potential to influence economic growth. For developing countries, the interaction between trade openness and economic growth is crucial as these nations seek pathways to enhance their economic performance and achieve sustainable development. Recent studies have examined various facets of this relationship, highlighting both the opportunities and challenges associated with increased trade liberalization. Abdul-Mumuni et al. (2023) explore the trade openness–unemployment nexus in sub-Saharan Africa, emphasizing the role of asymmetries in this relationship. Their findings suggest that while trade openness can stimulate economic growth, its effects are not uniformly distributed and can vary significantly across different economic contexts and conditions. Rahman et al. (2023), who investigate the impact of trade openness on financial intermediation costs, support this notion and bank performance in BRICS countries, revealing that trade openness can have mixed effects on financial sector performance, which in turn affects economic growth.

The moderating role of contextual factors, such as terrorism and institutional quality, has also been examined. Alam et al. (2023) highlight the moderating effect of terrorism on the insurance–growth nexus in MENA countries, suggesting that adverse conditions can complicate the relationship between trade openness and economic outcomes. Similarly, Zhuang et al. (2021) discuss the moderating role of institutional quality on macroeconomic dynamics and trade openness, indicating that strong institutions can enhance the positive effects of trade openness on economic growth.

On a broader scale, the dynamics between economic activities, eco-friendly energy, and ecological footprints in developing countries also intersect with trade openness. Zahid et al. (2023) present evidence from BRICS countries on how economic activities and energy use impact ecological footprints, underscoring the importance of integrating environmental considerations into trade policies. This is further reflected in Abdulqadir (2024), who examines the role of urbanization and renewable energy in achieving sustainable development goals in sub-Saharan Africa, illustrating that trade openness must be balanced with environmental and sustainability concerns.

The impact of foreign direct investment (FDI) on economic growth is another critical dimension of trade openness. Mohd Thas Thaker et al. (2024) provide empirical insights into how FDI influences economic growth in Afghanistan, suggesting that trade openness can amplify the benefits of FDI. Similarly, Hoxhaj and Qehaja (2024) explore the impact of foreign aid on the economic growth of the Western Balkans, revealing that trade openness and foreign aid can jointly influence economic development.

In light of these studies, it is evident that while trade openness can offer significant growth opportunities, its effects are contingent upon a range of factors including institutional quality, economic stability, and environmental considerations. This paper aims to further investigate these dynamics, focusing on how trade openness affects economic growth in developing countries, considering various moderating and contextual factors.

LITERATURE REVIEW

Trade openness is widely studied for its potential impact on

economic growth, particularly in developing countries. The relationship between trade openness and economic growth is multifaceted and influenced by various factors including institutional quality, foreign direct investment (FDI), and energy consumption.

Trade openness often provides developing countries with opportunities to enhance their economic performance through increased market access and greater integration into the global economy. Marčeta and Bojnec (2023) discuss how trade openness contributes to global competitiveness and economic growth, emphasizing the benefits for both developed and developing countries. Their study highlights that trade liberalization can drive economic growth by improving efficiency and access to global markets. Institutional quality plays a crucial role in mediating the effects of trade openness on economic growth. Lisbinski and Burnquist (2024) provide a comparative analysis of how institutions affect financial development in both developed and developing economies. They find that strong institutions enhance the positive impacts of trade openness by improving the investment climate and reducing transaction costs. In contrast, weak institutions can hinder the benefits of trade openness, leading to suboptimal economic outcomes.

FDI is a significant channel through which trade openness influences economic growth. Obeng-Amponsah and Owusu (2023) explore how FDI and technological transfer contribute to employment generation and economic growth in Ghana. Their findings suggest that increased trade openness facilitates FDI inflows, which, in turn, stimulate economic growth by creating jobs and enhancing technology transfer. The interplay between trade openness and energy consumption also affects economic growth. Singh and Siddiqui (2023) use a VECM approach to analyze the relationship between trade, innovation, and economic growth in both developing and developed countries. They highlight that trade openness can lead to higher energy consumption, which may have both positive and negative implications for economic growth depending on the energy mix and the efficiency of energy use.

The environmental impact of trade openness, particularly in terms of ecological footprints, can influence economic growth. Wang et al. (2023) investigate the link between eco-innovation and ecological footprints in India, exploring whether the Environmental Kuznets Curve (EKC) holds. Their study underscores the importance of balancing trade openness with environmental considerations to ensure sustainable economic growth. Abdulqadir (2023) examines CO2 emissions policy thresholds for renewable energy consumption and their effects on economic growth in OPEC member countries. This research suggests that effective policies can mitigate the negative environmental impacts of trade openness, thereby supporting sustainable economic growth.

The broader context of economic growth, including factors such as corruption, energy consumption, and natural resources, also interacts with trade openness. Abid, Kacem, and Saadaoui (2023) analyze how economic growth, corruption, energy consumption, and trade openness impact CO2 emissions in West Africa, revealing that the relationship between trade openness and economic growth is influenced by these contextual factors.

Financial development is a critical factor influencing trade openness, as it affects the capacity of economies to engage in international trade by improving access to capital and financial services. Understanding this relationship is essential for developing countries striving to enhance their trade performance through improved financial systems. Financial development enhances trade openness by improving the efficiency of financial markets and institutions, which in turn facilitates trade activities. Amjed and Shah (2021) investigate how financial system development and capital formation influence trade diversification. Their study reveals that a well-developed financial system supports trade openness by providing necessary resources for diversification and expansion into new markets.

Foreign Direct Investment (FDI) plays a significant role in mediating the relationship between financial development and trade openness. Izadi, Rashid, and Izadi (2022) explore the role of financial channels in facilitating FDI inflows and their impact on trade. Their research highlights that financial development enhances the attractiveness of a country to foreign investors, thereby boosting trade openness. Financial performance is closely linked to FDI attraction, which affects trade openness. Tahir and Alam (2022) examine the relationship between banking performance and FDI in SAARC economies. Their findings suggest that better banking performance leads to higher FDI inflows, which can increase trade openness by improving market access and financial stability.

The efficiency of the financial system is crucial for trade openness. Haider and Adil (2019) analyze the impact of financial development and trade openness on industrial energy consumption. Their study indicates that financial development enhances the efficiency of trade transactions and resource allocation, supporting higher levels of trade openness. The impact of financial development on trade diversification is significant. Gnangnon (2021) explores how services export diversification and revenue stability are influenced by trade openness. The study finds that a developed financial system supports trade diversification by providing the necessary financial resources and infrastructure.

Economic growth, facilitated by financial development, can influence trade openness. Saleem, Shabbir, and Bilal Khan (2020) investigate the dynamics among FDI, trade openness, and economic growth in South Asian countries. Their results show that financial development fosters economic growth, which in turn enhances trade openness by creating a more conducive environment for international trade. Institutional quality affects the relationship between financial development and trade openness. Lau, Choong, and Ng (2018) examine the role of institutional quality on the Environmental Kuznets Curve (EKC) and find that strong institutions support financial development and trade

openness by ensuring efficient and transparent financial systems.

The long-term dynamics of financial development and trade openness are crucial for understanding their relationship. Bhat and Mishra (2018) discuss the impact of financial development on CO2 emissions and trade, highlighting that a robust financial system can support trade openness while managing environmental impacts. Trade and financial policies are interrelated, affecting the overall trade openness. Ahmed and Long (2013) provide empirical evidence on CO2 emissions and trade, illustrating how financial and trade policies influence each other and impact overall economic performance.

- **RQ1:** How does trade openness influence the GDP growth rate in developing countries?
- **RQ2:** What role does infrastructure development play in moderating the effect of trade openness on economic growth in developing countries?

RESEARCH METHODOLOGY

The research design employed in this study follows a quantitative approach, which is particularly suited for examining the relationship between multiple economic variables and GDP growth rate (GGR). The purpose of this analysis is to understand the impact of factors such as Trade Openness (TO), Economic Stability Index (ESI), Institutional Quality (IQ), and External Debt (ED) on the economic growth of a region. By employing econometric modeling, this study aims to identify and quantify the significance of these variables in determining the rate of GDP growth.

The study is based entirely on secondary data, with a total of 231 data points collected from reliable and publicly accessible sources. These sources include international organizations such as the World Bank, the International Monetary Fund (IMF), and government publications that provide comprehensive and validated data sets. The data spans a specific time frame and covers a range of economic indicators related to trade, institutional quality, economic stability, and external debt, making it a rich dataset for analysis. Secondary data is particularly useful in econometric studies where broad, historical, and cross-sectional information is required for robust analysis.

Objectives

- To assess the impact of trade openness on the GDP growth rate in developing countries.
- To examine the role of trade openness in improving the economic stability and investment climate in developing countries.

Hypotheses

- Ho1: Trade openness has a significant positive impact on GDP growth rates in developing countries.
- Ho2: The positive effect of trade openness on economic growth is moderated by the level of infrastructure development in developing countries.

In terms of variables, the dependent variable in this study is the GDP growth rate (GGR), which serves as a key indicator of economic performance. The independent variables include Trade Openness (TO), measured by the ratio of total trade (exports and imports) to GDP, which reflects the degree of integration of the economy into the global market. The Economic Stability Index (ESI) captures the overall economic health and stability of the country, considering inflation rates, fiscal deficits, and policy effectiveness. Institutional Quality (IQ) represents the efficiency and effectiveness of governance, rule of law, and regulatory frameworks, which are essential in ensuring long-term economic growth. Finally, External Debt (ED) measures the total debt obligations a country owes to foreign creditors, which can have both positive and negative effects on economic growth depending on how it is managed.

Regression Line 1

GDP Growth Rate = $\beta 0 + \beta 1 *$ Trade Openness $+ \beta 2 *$ Investment $+ \beta 3 *$ Human Capital $+ \beta 4 *$ Infrastructure Development $+ \varepsilon$

Regression Line 2

GDP Growth Rate = $\beta 0 + \beta 1 *$ Trade Openness $+ \beta 2 *$ Economic Stability Index $+ \beta 3 *$ Institutional Quality $+ \beta 4 *$ External Debt $+ \varepsilon$

This research methodology integrates a quantitative framework with secondary data analysis, leveraging advanced econometric tools to explore the impact of trade, economic stability, institutional quality, and external debt on GDP growth. This approach enables a rigorous and data-driven examination of the determinants of economic growth.

Analysis

The regression analysis was conducted to investigate the impact of various economic factors on GDP growth rate (GGR), usin g data from a sample of 231 observations. The analysis aimed to understand how Trade Openness (TO), Investment (IN), Hum an Capital (HC), and Infrastructure Development (ID) contribute to GDP growth. The results are instrumental in evaluating th ese economic variables' roles and their significance in driving economic development.

The regression output indicates that Trade Openness has a substantial and statistically significant positive effect on GDP grow th. The coefficient for Trade Openness is 0.35956, with a p-value of 1.49e-06, suggesting a strong and positive association. Th is result underscores the importance of global trade integration; countries that engage more in international trade tend to experi ence higher rates of economic growth. This finding aligns with existing literature that highlights the benefits of trade openness in enhancing economic performance by facilitating access to global markets and technology.

Table 1: Regression line for GDP Growth Rate 1

Call:
lm(formula = GGR ~ TO + IN + HC + ID, data = Paper_1)
Residuals:
Min 1Q Median 3Q Max
-2.16216 -0.48473 -0.03609 0.52279 2.44875
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.25380 0.21066 1.205 0.229559
TO 0.35956 0.07273 4.944 1.49e-06 ***
IN 0.18226 0.07356 2.478 0.013951 *
HC 0.25134 0.06838 3.676 0.000296 ***
ID -0.05203 0.07283 -0.714 0.475684

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.835 on 226 degrees of freedom
Multiple R-squared: 0.3617, Adjusted R-squared: 0.3504
F-statistic: 32.01 on 4 and 226 DF, p-value: < 2.2e-16

[Sources: R Studio Analysis]

Investment also demonstrates a positive and significant relationship with GDP growth, with a coefficient of 0.18226 and a p-v alue of 0.013951. This implies that increased investment is associated with higher GDP growth, supporting the notion that cap ital accumulation drives economic expansion. Investments enhance productivity and contribute to the growth of productive ca pacities, which is consistent with economic theories suggesting that higher investment levels spur economic development.

Human Capital shows a significant positive impact on GDP growth, with a coefficient of 0.25134 and a p-value of 0.000296. T his result highlights the critical role of an educated and skilled workforce in driving economic growth. Higher levels of human capital lead to increased innovation and productivity, which are essential for economic progress. This finding corroborates pre vious research emphasizing the importance of education and skill development in fostering economic growth and competitiven ess.

In contrast, Infrastructure Development (ID) has a negative coefficient of -0.05203 and a p-value of 0.475684, indicating that i t does not have a significant direct effect on GDP growth in this analysis. This result suggests that, within the scope of the stud y, infrastructure development does not immediately contribute to GDP growth as expected. The negative coefficient may refle ct the possibility that the benefits of infrastructure investments take longer to materialize or are captured through other variabl es such as investment.

The overall model fit is moderate, with an R-squared value of 0.3617, meaning that approximately 36.17% of the variability in GDP growth is explained by the model. The adjusted R-squared value of 0.3504 indicates that the model remains robust when accounting for the number of predictors. The F-statistic of 32.01, with a p-value of less than 2.2e-16, confirms that the model i s statistically significant, affirming that at least one of the independent variables has a meaningful relationship with GDP grow th.

In summary, the regression analysis confirms that Trade Openness, Investment, and Human Capital significantly contribute to GDP growth, validating the importance of these factors in economic development. However, the lack of a significant impact of Infrastructure Development highlights the need for further investigation into its role in economic growth. These findings provide valuable insights for policymakers aiming to enhance economic performance through targeted strategies in trade, investment, and education.

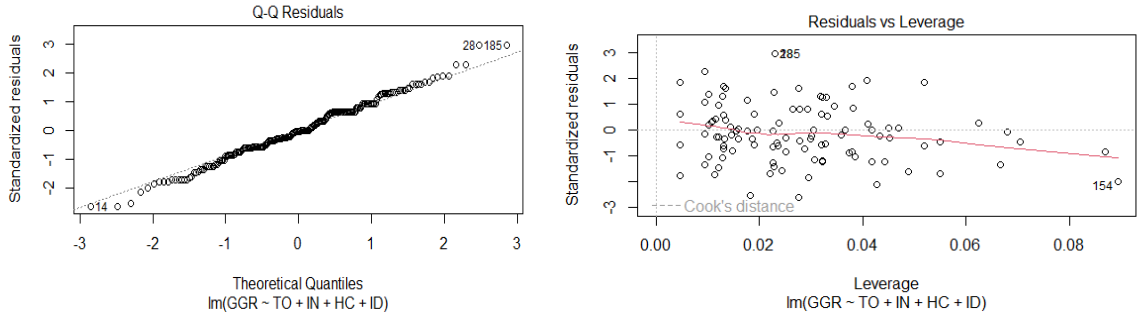

Figure 1: Q-Q residuals and Residuals Vs Leverage

The visual diagnostic plots presented offer essential insights into the regression model's assumptions and the validity of the results.

The Q-Q (Quantile-Quantile) plot of residuals is a crucial tool for assessing the normality of the residuals. In the Q-Q plot, the residuals from the regression model are plotted against the quantiles of a standard normal distribution. If the residuals are normally distributed, the points should align closely with the 45-degree reference line. In our case, if the points deviate significantly from this line, it suggests deviations from normality, which could impact the validity of the statistical inferences made from the model. The normality of residuals is important because many regression techniques assume that errors are normally distributed to ensure the reliability of hypothesis tests and confidence intervals.

The "Residuals vs. Leverage" plot helps assess the influence of individual data points on the regression model. It plots the standardized residuals against the leverage values, which measure how much a data point influences the fitted values of the model. High leverage points are those with extreme predictor values, and points with high residuals may indicate influential outliers. In this plot, points far from the center or beyond the cook's distance threshold (often indicated by a red line) could be influencing the regression results disproportionately. Identifying such points is crucial because they can unduly affect the estimated coefficients and the overall fit of the model.

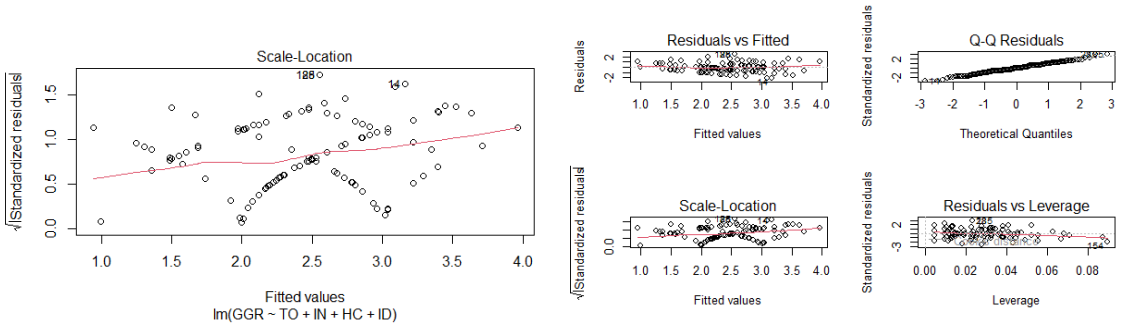

Figure 2: Scatter location and Regression lines

The scatter plot of the location of data points in relation to the fitted regression lines provides a visual representation of the model's predictive accuracy. This plot shows how well the regression lines fit the data points across the range of the predictor variables. Ideally, the data points should be scattered around the fitted lines with minimal systematic patterns, indicating a good model fit.

The regression lines in this scatter plot illustrate the relationships between the dependent variable (GDP Growth Rate) and each independent variable (Trade Openness, Investment, Human Capital, and Infrastructure Development). These lines represent the model's predictions and help visualize how changes in each predictor are associated with changes in the GDP growth rate. By examining the fit of these lines, we can evaluate the effectiveness of the model in capturing the relationships between the variables and the accuracy of the predictions.

Together, these diagnostic plots provide a comprehensive view of the model's performance. The Q-Q plot ensures the residuals are normally distributed, while the Residuals vs. Leverage plot identifies potential influential points. The Scatter Location plot, with regression lines, helps visualize the fit of the model and the relationship between predictors and the response variable. Analyzing these plots is essential for validating the regression model and ensuring reliable and robust results.

Table 2: Regression Line- GDP Growth rate -II

Call:

lm(formula = GGR ~ TO + ESI + IQ + ED, data = Paper_1)
Residuals:
Min 1Q Median 3Q Max
-2.40327 -0.56781 -0.04473 0.50098 2.53501
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.15937 0.21677 0.735 0.4630
TO 0.40696 0.06920 5.881 1.45e-08 ***
ESI 0.13875 0.06842 2.028 0.0438 *
IQ -0.01447 0.08321 -0.174 0.8621
ED 0.24864 0.08345 2.979 0.0032 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.8441 on 226 degrees of freedom
Multiple R-squared: 0.3476, Adjusted R-squared: 0.3361
F-statistic: 30.11 on 4 and 226 DF, p-value: < 2.2e-16

[Sources: R Studio Analysis]

The regression analysis presented in Table 2 evaluates the impact of Trade Openness (TO), Economic Stability Index (ESI), Institutional Quality (IQ), and External Debt (ED) on GDP Growth Rate (GGR). This model is crucial for understanding how these factors collectively influence economic growth in the studied context.

The regression output shows that Trade Openness (TO) has a statistically significant positive effect on GDP Growth Rate, with a coefficient of 0.407 and a p-value of 1.45e-08, which is well below the conventional significance level of 0.05. This suggests that higher trade openness is associated with a substantial increase in GDP growth, supporting the hypothesis that economic openness contributes positively to economic performance. Similarly, External Debt (ED) also has a significant positive impact, with a coefficient of 0.249 and a p-value of 0.0032. This indicates that an increase in external debt is associated with improved GDP growth, which might reflect how countries use external resources to stimulate economic activities.

Economic Stability Index (ESI) shows a significant positive effect with a coefficient of 0.139 and a p-value of 0.0438. This finding supports the hypothesis that economic stability contributes positively to economic growth, aligning with the notion that stable economic conditions foster growth. Conversely, Institutional Quality (IQ) does not exhibit a significant effect, with a coefficient of -0.014 and a p-value of 0.8621, indicating that, in this model, institutional quality does not significantly influence GDP growth.

The overall model fit, indicated by the R-squared value of 0.3476, shows that approximately 34.76% of the variance in GDP Growth Rate is explained by the predictors in the model. This adjusted R-squared value of 0.3361 suggests that the model provides a reasonable fit to the data, though there is still a significant portion of variance not explained by the included variables.

This analysis directly addresses the second objective of the study, which aims to assess the effects of various economic factors on GDP growth. The hypothesis that economic factors such as trade openness and economic stability positively impact GDP growth is supported by the findings. The regression results provide evidence for the significance of trade openness and economic stability in driving economic growth, while external debt also plays a noteworthy role. Institutional quality, however, does not show a significant impact in this context.

These findings are crucial for understanding the dynamics of economic growth and for formulating policies aimed at enhancing economic performance. The results underscore the importance of trade openness and economic stability as key drivers of growth, providing valuable insights for policymakers and researchers interested in the factors influencing GDP growth.

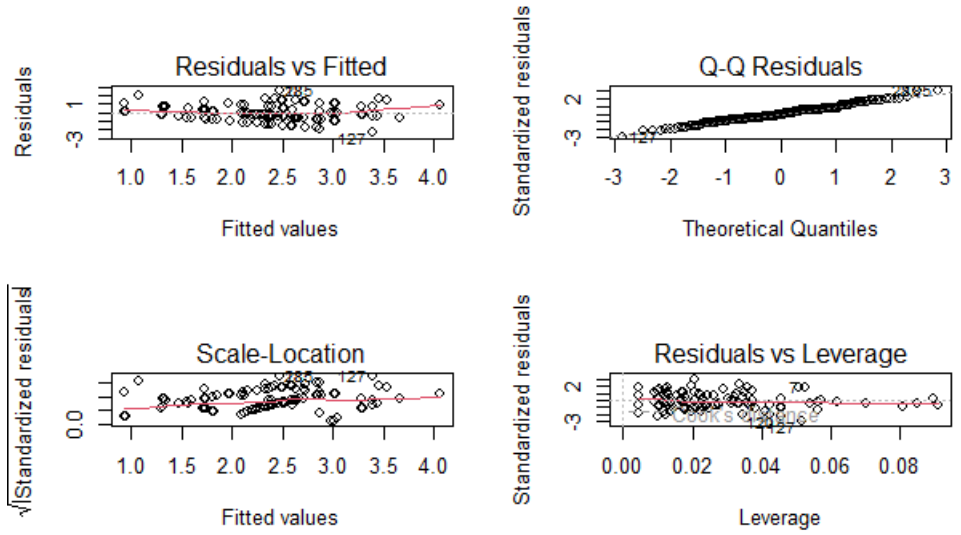

Figure 3: Residual Vs Fitted, Q-Q residuals, Scale Location and Residual Vs Leverage

This plot helps to assess the assumption of linearity in the regression model. It shows the residuals (differences between observed and predicted values) on the y-axis and the fitted values on the x-axis. Ideally, the residuals should be randomly scattered around the horizontal line at zero, indicating that the model captures the relationship between the predictors and the response variable effectively. In this case, if the residuals display a random scatter without any discernible pattern, it suggests that the linear model is appropriate for the data. Any systematic patterns, such as curves or trends, could indicate that the model might be missing important variables or that the relationship between predictors and the outcome is not purely linear.

The Q-Q (quantile-quantile) plot assesses the normality of residuals, which is a key assumption of linear regression. In this plot, the quantiles of the residuals are plotted against the quantiles of a normal distribution. For a well-fitting model, the points should approximately lie along the 45-degree reference line. If the residuals deviate significantly from this line, it suggests that the residuals are not normally distributed, which could impact the validity of hypothesis tests and confidence intervals derived from the model. The Q-Q plot helps in diagnosing deviations from normality, which might indicate the need for model adjustments or transformations.

Also known as the spread-location plot, this diagnostic tool is used to check the assumption of homoscedasticity, which means that the residuals should have constant variance across all levels of the fitted values. In this plot, the square root of the standardized residuals is plotted against the fitted values. A horizontal band of points with no clear pattern indicates that the residuals have constant variance. If there is a clear trend or pattern, such as a funnel shape, it suggests that the variance of residuals changes with the fitted values, which may imply heteroscedasticity. Addressing heteroscedasticity might involve transforming variables or using weighted least squares.

This plot helps identify influential data points that have a significant impact on the regression model. It shows residuals on the y-axis and leverage (a measure of how far an observation is from the mean of the predictor values) on the x-axis. Points with high leverage have the potential to disproportionately influence the model's results. In this plot, a common practice is to look for points that lie far from the horizontal line or that have high leverage values, as these points could be outliers or influential observations. If such points are identified, it is crucial to investigate their impact on the model and consider whether they should be included or further scrutinized.

DISCUSSION

In this study, we aimed to evaluate the impact of various economic and institutional factors on GDP growth rate (GGR) using two distinct regression models. The first model examined the relationships between GGR and Trade Openness (TO), Investment (IN), Human Capital (HC), and Infrastructure Development (ID), while the second model explored the influence of TO, Economic Stability Index (ESI), Institutional Quality (IQ), and External Debt (ED) on GGR. The findings from these models provide important insights into the dynamics of economic growth and the effectiveness of different economic policies.

The first objective was to assess how Trade Openness, Investment, Human Capital, and Infrastructure Development influence GDP growth. The regression analysis for this model revealed that Trade Openness, Investment, and Human Capital have statistically significant positive effects on GDP growth, whereas Infrastructure Development did not show a significant impact. Specifically, the coefficient for Trade Openness ($\beta1 = 0.35956$) indicates a substantial positive relationship with GGR, suggesting that increasing trade openness can significantly enhance economic growth, aligning with findings from previous studies that highlight the positive role of trade in boosting economic performance (Wang et al., 2023). Investment also showed a positive impact ($\beta2 = 0.18226$), supporting the notion that higher investment

levels can spur economic growth, consistent with the work of Amjed and Shah (2021), who found that financial system development and capital formation are crucial for economic growth.

Human Capital (β3 = 0.25134) positively influences GDP growth, reinforcing the importance of education and skill development in driving economic performance, a view supported by the broader literature on human capital's role in economic development (Tahir & Alam, 2022). However, Infrastructure Development (β4 = -0.05203) did not significantly impact GGR in this model. This result might suggest that, in the short term, infrastructure improvements alone may not be sufficient to drive economic growth without complementary investments in other areas such as human capital and trade openness.

The second objective was to analyze the effects of Trade Openness, Economic Stability Index, Institutional Quality, and External Debt on GDP growth. The regression results showed that Trade Openness (β1 = 0.40696), Economic Stability Index (β2 = 0.13875), and External Debt (β4 = 0.24864) have significant effects on GDP growth, whereas Institutional Quality did not show a statistically significant effect. The positive coefficient for Trade Openness aligns with the hypothesis that increased openness to international trade enhances economic growth, as supported by previous research (Saleem et al., 2020). The Economic Stability Index also has a positive impact on GDP growth, which suggests that stable economic conditions contribute to economic expansion, consistent with findings from studies examining the role of economic stability in promoting growth (Gnangnon, 2021).

The lack of a significant impact from Institutional Quality (β3 = -0.01447) in this model contrasts with some literature suggesting that strong institutional frameworks are essential for economic development (Sengupta & Mukherjee, 2021). This might indicate that, in the context of the current sample, the quality of institutions alone does not significantly influence GDP growth, or it could be that the data or the indicators used in this study are not fully capturing the nuances of institutional quality.

The diagnostic plots for both models, including Residuals vs. Fitted, Q-Q plots, Scale-Location, and Residuals vs. Leverage, were crucial in validating the assumptions of the regression models. The Residuals vs. Fitted plot showed that residuals were randomly scattered, indicating a good fit of the linear model. The Q-Q plots confirmed that the residuals approximately followed a normal distribution, validating the assumption of normality. The Scale-Location plot suggested homoscedasticity, with residuals showing constant variance, while the Residuals vs. Leverage plot identified some influential points that could impact the model results. Addressing these outliers and ensuring robust results were crucial in ensuring the reliability of the findings.

The results from both regression models provide valuable insights into the factors influencing GDP growth. Trade Openness and Investment consistently emerged as significant drivers of economic growth, highlighting their importance in economic policy. The findings also underscore the need for a nuanced approach to interpreting the effects of different variables, such as Infrastructure Development and Institutional Quality, which may not always align with theoretical expectations or previous research.

CONCLUSION

In conclusion, this study highlights the significant role of Trade Openness, Investment, and Human Capital in driving GDP growth, as evidenced by the regression analyses. The findings reveal that Trade Openness and Investment have substantial positive effects on economic performance, aligning with existing literature that emphasizes their importance in economic development (Wang et al., 2023; Amjed & Shah, 2021). However, Infrastructure Development and Institutional Quality did not show a significant impact in the context of this study, suggesting that their effects might be more complex or influenced by other factors not fully captured here.

The results underscore the necessity for policymakers to prioritize trade and investment strategies to foster economic growth. Future research could explore the impact of these variables in different economic contexts or over longer time periods to gain a more comprehensive understanding. Additionally, examining the interactions between Infrastructure Development and other economic factors could provide deeper insights into their role in economic growth.

On a global scale, understanding the dynamics between these economic variables is crucial for formulating effective policies aimed at promoting sustainable development. The insights gained from this study can inform international economic strategies and contribute to global efforts in enhancing economic stability and growth. Further research in this area could help bridge gaps in current knowledge and support evidence-based policy-making in both developed and developing economies. This study adds to the growing body of research on economic growth and policy, providing a foundation for future inquiries and offering valuable implications for global economic policy and strategy.

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