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Growth Mechanisms: Dissecting the Economic Determinants of Pakistan's GDP

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ABSTRACT

This study employs ARDL's short- and long-run estimation methodologies to examine the elements that have contributed to Pakistan's economic growth between the years 1991 and 2023. According to the data, the export-to-GDP ratio and consumer price index (CPI) had minimal detrimental impacts on GDP. However, at a significance level of 5%, we observed that an increase of one unit in both the total labor force (TLF) and gross fixed capital formation (GFCF) resulted in a near-term GDP increase of 0.695 units and a long-term GDP gain of 0.733 units. These findings indicate substantial and positive impacts on GDP. Despite its favorable nature, the life expectancy rate (LER) did not have any noticeable effect on GDP in the short or medium term. These findings emphasize the importance of increasing both capital expenditure and the workforce's size in driving Pakistan's economic expansion. In order to sustain and accelerate economic growth, the paper proposes a reassessment of trade and inflation policies, with a greater focus on policies that promote workforce growth and capital accumulation, as well as enhancing the overall quality of human capital.

1. INTRODUCTION

The Pakistani economy has experienced significant fluctuations in recent years. The nation's economy has demonstrated resilience in the face of adversities like political instability, environmental disasters, and security issues. Despite the impact of the COVID-19 pandemic, GDP growth rates fluctuated between 5.8% and -0.9% before rebounding to 4.7% in the 2020–21 fiscal year (Sajjad et al., 2014; WTO, 2023a). There are plans to raise the proportion of solar power in the system's electricity production to 2% by 2030 and potentially 50% by 2045. At a time when carbon-intensive resources are still king in the energy sector, this would lead to huge savings and cuts in emissions (Haq et al., 2022). From 1960 until 1990, the Pakistani economy saw consistent growth at a rate of 6% per year (Husain, 2018). The government's effective measures to mitigate the economic impact of the global pandemic resulted in a rapid recovery of growth rates (WTO, 2023b). Sohail et al. (2023) asserts that advancements in education, foreign direct investment (FDI), and infrastructure development significantly impact Pakistan's economic growth. There exists a robust and favourable association between sustainable development goals and foreign direct investment (FDI), infrastructure investment, and the transition to renewable energy sources in the short term. People tend to view education as less significant than other aspects. Education and the transition to renewable energy sources are mutually reinforcing forces that contribute to a thriving economy. Foreign direct investment (FDI) and infrastructure have a reciprocal relationship, whereby an increase in FDI can result in accelerated economic growth. Periods of uneven GDP growth have dotted Pakistan's history. Cycles of rapid national growth occurred in the 1960s, 1980s, and 2002–07, attributed to elements such as military control and outside aid (Amjad, 2014). However, recessions and economic difficulties, particularly after 2008, followed these periods, leading to a sharp decline in fixed capital formation and investment levels (Hasan, 2015). The shift to a capitalist mode of production has affected growth patterns, resulting in unequal social and economic development (Kanwal, 2015). Despite average growth rates of over 5% over the years, there have been periodic periods of rapid expansion and stagnation, frequently linked to restrictions on foreign exchange and geopolitical developments (Amjad, 2014). The persistence of gender disparities in tandem with GDP growth underscores the necessity of including inclusivity and empowerment in economic development plans (Siegmann & Majid, 2021).

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Influencing factors of GDP growth in Pakistan—To formulating effective policies, understanding different factors that influence GDP growth in Pakistan is pertinent (Ajmair et al., 2017; Nisa, 2019; Saleem et al., 2019; Zaheer et al., 2022). Remittances, GDP per capita, labor force participation, inflation, savings, capital creation, foreign direct investment, macroeconomic indicators like broad money, mineral resources, and GDP per capita all turn out to have a strong influence on economic growth in Pakistan. Because governments are now armed with this information, they can devise ways to improve conditions of economic stability, expansion of opportunities for foreign investment, increased savings rate, and ensure an enabling environment for long-term prosperity. Notably, attaining a stable working regulatory environment and reduced corruption, and the enhancement of governance factors such as citizen participation and also transparency, political stability, and government efficiency, could be a pathway toward promoting economic growth (Ahmad et al., 2020). It is against this backdrop that an in-depth look at all these issues can impart directions to the economic advancement of Pakistan toward long-term prosperity.

2. EMPIRICAL LITERATURE REVIEW

A prospering economy relies on a link between gross domestic product and the number of people actively seeking employment. According to studies done in Sri Lanka, Bangladesh, India, China, Malaysia, Thailand, and Pakistan, there is a strong positive correlation between labor and capital and real GDP. This points to the fact that a rise in both labor and capital leads to a significant expansion of GDP (Khatun & Afroze, 2017; Rahman, 2018). Furthermore, studies Khatun & Afroze (2017) highlight the significance of women's labor force participation in maintaining economic growth, particularly in nations such as India and Bangladesh. In addition, research into Pakistan's GDP and the effect of the country's entire labor force (male and female) has shown a positive correlation between the two variables, even after controlling for variables such as oil prices (Qamar et al., 2015). These findings underscore the significance of optimizing labor force participation to drive economic progress and enhance GDP growth in various economies. Shamshir et al. (2019) in Pakistan have discovered a significant correlation between unemployment, foreign direct investment (FDI), workforce size, and long-term economic growth. Furthermore, studies conducted in middle-income countries underscore the modification of the U-shaped relationship between women's labor force participation and economic growth by factors like education and fertility rates (Yıldırım & Akinci, 2020). Studies conducted in Asian nations provide evidence supporting the U-shaped theory, indicating that the relationship between female labor force participation and economic development is not consistent. Instead, it shows a negative association in some nations and a positive correlation in others (Su et al., 2019). The empirical research demonstrates the crucial need to address unemployment and gender inequality in order to attain sustainable economic growth. It reveals a long-term correlation between labor force participation and GDP in Nigeria (Yakubu et al., 2020). Triha et al. (2023) presents an investigation of the correlation between the youth unemployment rate in Indonesia and the rate of participation in the country's labor force. The multivariate study in Padang City found a strong correlation between the size of the labor force and the number of micro, small, and medium enterprises (MSMEs). This underscores the crucial role of MSMEs in contributing to Indonesia's Gross Domestic Product (GDP) and employment opportunities, particularly during the COVID-19 pandemic.

The complex interaction between GDP and capital is crucial for achieving sustained economic growth and prosperity. Ding et al. (2021) suggest that human capital, with its higher output elasticities compared to physical capital, primarily drives economic growth. Human capital plays a crucial role in fostering the development of more sustainable economies. Effective capital, which encompasses both energy and physical capital, has the potential to impact carbon emissions. The utilization of renewable energy, augmented capital, and a lower population can diminish the efficiency of capital allocation in production processes (Deka et al., 2023). Furthermore, it is important to note that there is no direct correlation between economic growth and environmental quality. Instead, there is a relationship that follows an N-shaped curve between ecological footprint and financial development. The ecological footprint contributes to environmental degradation through energy consumption and the use of renewable resources, while financial development contributes through investment in human capital (Shujah-ur-Rahman et al., 2019). Furthermore, fluctuations in GDP per capita account for a significant portion of the variation in life expectancy. This suggests that income levels consistently correlate with life expectancy, irrespective of income levels, and the concept of reverse causality does not influence this association (Jetter et al., 2019). Ultimately, the decline of natural resources can result in a decrease in individual wealth, underscoring the importance of sustainable management of natural capital alongside economic expansion (Kurniawan & Managi, 2019). Examining the relationship between GDP and human capital intrigues a significant number of economists. Research indicates that human capital, encompassing education, training, and work experience, plays a crucial role in economic development (Aydın & Demiröz, 2023; Daňová & Širá, 2023). Yu (2022) indicates that educational human capital had a positive impact on real GDP growth in China's provinces, although the effect was not very significant. This implies that, in order to get higher economic returns, it is advisable to reduce our dependence on physical capital. Researchers have linked the allocation of resources towards research and development (R&D) and education to enhanced growth in the Gross Domestic Product (GDP), highlighting the crucial role of human capital in a nation's advancement (Jiménez-Yumbla et al., 2022). The relationship between human capital and GDP growth is complex, and scholars are currently working to understand its mechanics and its impact on economic development.

The export-to-GDP ratio is a widely used measure of trade openness, which has a complex and multifaceted connection with GDP. Empirical research has provided compelling evidence that trade openness has a positive impact on economic growth (Atiq-ur-Rehman et al., 2021; Jošić, 2023; Yadav, 2021). Factors such as the country's size, proximity to trading partners, commodity prices, currency rates, and investment levels all influence the trade-GDP ratio, as well as the long-term effects of trade policy on economic indices (Bleaney & Tian, 2023). Studies have shown that trade openness positively influences GDP development due to increased producer competitiveness, technological transfer, and export promotion initiatives (Atiq-ur-Rehman et al., 2021). However, there are variations in the relationship between trade openness and GDP growth at different levels, indicating that the impact of trade

openness differs among quantiles (Jošić, 2023). People often associate trade openness with economic growth. Nevertheless, other factors exert an influence on this connection, and comprehending its particular dynamics and intricacies necessitates meticulous investigation. Multiple studies have demonstrated the existence of various facets in the complex relationship between GDP and CPI/inflation. Research conducted in both India and China indicates that the relationship between GDP and inflation exhibits positive short-term dynamics in India while displaying negative long-term relationships in China (Keerti, 2023). The vector autoregression model in the US demonstrates evident causal connections between GDP, inflation, and the unemployment rate, indicating the potential for predicting these macroeconomic variables based on each other (Zhu, 2023). Furthermore, a study across ten nations reveals a significant correlation between inflation and long-term economic growth. Over time, the Error Correction Model rectifies disparities between the two variables, indicating a positive correlation in certain countries and a negative correlation in others (Ahmmed et al., 2020). These results highlight the importance of understanding the intricate correlation between GDP and inflation for effective economic management and policymaking. During the period from 1988 to 2020, another study (Jošić, 2023) supports the premise that trade openness favorably aids economic growth in OECD nations. Ravikumar et al. (2024), there is no discernible causal relationship between trade openness and the other factors that make up GDP and FDI inflows. This implies that trade openness might not have a significant impact on FDI or GDP in Brazil. The GDP per capita has a positive and statistically significant impact on trade openness, according to the findings of another study. This implies that trade openness tends to expand together with an increase in GDP per capita (KUÇLU & Yenilmez, 2024). Sugözü & Ünver (2024) found a causal link between financial development and economic growth. Results validate a reciprocal association between GDP and financial development. Additionally, it is discovered that there is a bidirectional relationship between both variables and gross fixed capital formation (GFCF), which is a control variable included in the model. According to Shi & Wang (2024), human capital contributes 15.2%± 2.1% to GDP growth during the high-speed growth phase and increases to 23.8%± 3.4% during the industrial structure adjustment period. At different phases, labor market conditions, capital investment, and technological advancement all have a major impact on economic growth. Ungureanu (2024) explores how human capital affected the OECD countries' economic growth from 1990 to 2022. The results demonstrate that population growth, life expectancy, and tertiary enrollment all favorably impact human capital performance in connection to economic growth. Adeleke & Moses (2023) focuses on how Nigeria's economic growth between 1999 and 2022 is impacted by the development of human capital. The results show that government spending on health care and education has a positive and statistically significant effect on RGDP. Furthermore, life expectancy has a favorable and statistically negligible effect on RGDP. The influence of total school enrollments (SER) on RGDP is positive and statistically insignificant. In conclusion, this analysis reveals that there is a statistically significant correlation between the development of human capital and economic growth in Nigeria, both in the short and long term. Bharti Kapur (2023) examines the trends in India's GDP and Consumer Price Index across time, with a focus on how they interact. The Granger causality test, which was used to investigate the link between GDP and CPI, revealed that none is a cause of the other. According to data from France, Germany, and Italy, real interest rates have a negative influence on real GDP while having a favorable impact on CPI and unemployment rates in the short run in EU countries (Yang, 2024).

3. RESEARCH METHODOLOGY

To foster Pakistan's economic progress, we can utilize crucial macroeconomic indicators that have a substantial impact on growth. Secondary data is collected from WDI (World Bank) website from 1991 to 2023 for the purposes of analysis. We can simply adjust the widely used Cobb-Douglas production function to suit this particular case.

$$\mathrm{GDP_t} = \mathrm{A_t} + \mathrm{K_t^{\alpha}} + \mathrm{L_t^{\beta}} + \mathrm{HC_t^{\gamma}} + \mathrm{TR_t^{\delta}} + \mathrm{IF_t^{\theta}} + \varepsilon_t \quad (1)$$

Where $\mathrm{GDP_t}$ = Gross domestic product at time 't, $\mathrm{A_t}$ = Total factor productivity at time 't', $\mathrm{K_t}$ = Capital stock at time 't' (Gross fixed capital formation), $\mathrm{L_t}$ = Labore force at time 't'(Total labor force), $\mathrm{HC_t}$ = Human capital at time 't' (Proxied by education levels or health expenditures), $\mathrm{TR_t}$ = Trade openness at time 't' (Export-to-GDP), and $\mathrm{IF_t}$ = Inflation rate at time 't' (CPI or GDP deflator). While α, β, γ, δ, and θ are elasticities of respective variables. By taking natural log (ln) both sides, we get

$$\ln(\mathrm{GDP_t}) = \phi + \alpha(\ln K) + \beta(\ln L) + \gamma(\ln HC) + \delta(\ln TR) + \theta(\ln IF) + \varepsilon_t \quad (2)$$

Here, ϕ represent intercept or constant, $\alpha, \beta, \gamma, \delta,$ and θ are the coefficients of variables respectively.

The ARDL model incorporates the lagged values of both the dependent variable (GDP) and the independent variables. For the sake of simplicity, we will analyze a generic ARDL (p, q1, q2, q3, q4, q5) model. For this model, the number of latencies for the dependent variable GDP is denoted by p, while the number of lags for each independent variable is denoted by qi.

$$GDP_t = \phi_0 + \sum_{i=1}^{p} \alpha_i \left(GDP_{t-i}\right) + \sum_{j=0}^{q1} \beta_j \left(K_{t-j}\right) + \sum_{k=0}^{q2} \gamma_k \left(L_{t-k}\right) + \sum_{m=o}^{q3} \delta_m \left(HC_{t-m}\right) + \sum_{n=0}^{q4} \theta_n \left(TR_{t-n}\right) + \sum_{O=0}^{q5} \varphi_0 \left(IF_{t-o}\right) + \varepsilon_t \quad (3)$$

Using the ARDL bounds testing method, estimate both short-term and long-term relationships. When the variables integrate in distinct orders (I(0) and I(1)) or I(0) or I(1), this method proves especially beneficial.

4. RESULTS AND DISCUSSIONS

The results of the Augmented Dickey-Fuller (ADF) unit-root test in Table 1 below suggest that all variables exhibit stationarity at the first difference (I). The findings necessitate the use of econometric techniques, such as ARDL and/or co-integration.

Table 1. Unit-Root Test Results

Variable	ADF		Remarks
	I(0)	I(1)	
CPI	0.5210	0.0001	Stationary at I(1)
GFCF	0.6046	0.0001	Stationary at I(1)
TLF	0.5475	0.0116	Stationary at I(1)
HC	0.5828	0.0039	Stationary at I(1)
Tade Openness	0.3190	0.0001	Stationary at I(1)
GDP	0.3437	0.0002	Stationary at I(1)

Table 2. Lag-Length Criterion Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	409.3	NA	2.01	-26.0	-25.7	-25.9
1	570.0	248*	6.7*	-34.0*	-32.1*	-33.4*
2	605.3	41.0	9.37e	-34.0	-30.4	-32.84

According to the above table 2, the outcomes of lag-length criteria outcomes confirm that all methods are revelling lag-length 1 for this model.

4.1 Johansen Co-integration Test Results

Our results from the Johansen co-integration analysis test show that there is one co-integration equation with a significance level of 5%. This is supported by both the trace test and the max-eigenvalue test. The results confirm the presence of a long-term association between the variables in our model.

Table 3. Error Correction Model Results

Variable	Coefficient	SE	t-Statistic	Prob.
D (GFCF))	0.69	0.03	18.94	0.00
CointEq(-1)*	-0.56	0.08	-6.77	0.00
R^2	0.918	Durbin-Watson stat		1.79
Adj. R^2	0.915			
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.24	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
* p-value incompatible with t-Bounds distribution.				

The Error Correction Model (ECM) is a useful econometric technique for modeling the relationship between non-stationary time series variables that are cointegrated. Although individual time series may not exhibit stationarity, their linear combination results in stationarity when they are cointegrated, indicating a long-term equilibrium relationship. ECMs efficiently capture both the immediate fluctuations and the gradual adaptations towards a stable state between variables. This demonstrates that Pakistan's economy is heading towards equilibrium, as the estimated findings show a negative and statistically significant error correction coefficient (-0.569460) (< 5% or < 0.005). The R-square value of 0.918563 (91.85%) indicates that the CPI, GFCF, life expectancy rate, export-to-GDP ratio, and TLF account for 91.85% of the total variation in Pakistan's GDP in this model. The Durbin-Watson value also confirms that the model does not have an auto-correlation issue. Lastly, the F-statistics value also confirms that our model is fit and that a long-term relationship exists between our selected variables.

4.2 ARDL Long-run and Short-run Results

Table 4. ARDL Short and Long Run Results

Variables	Short-run Coefficients	Long-run Coefficients
C	-2.66**	-4.67*
CPI	-0.004	-0.008
Trade Openness	-0.147	-0.259
GFCF	0.695*	0.545*
HC	0.150	0.264
TLF	0.733*	1.288*
"*" and "**" represent 5% and 10% level of significance		

According to the ARDL short-run and long-run estimations, Pakistan's consumer price index (CPI) and export-to-gross domestic product ratio were consistently negative and statistically insignificant from 1991 to 2023. According to the data, a one-unit increase in gross fixed capital creation (GFCF) and total labor force (TLF) has a remarkable and statistically significant impact on Pakistan's economy, both in the short and long term. This effect was observed this effect from 1991 to 2023. gross domestic product (GDP) of Pakistan might increase by 0.695 units in the short term and by 0.733 units in the long term if both the gross fixed capital formation (GFCF) and the total labor force (TLF) increase by one unit. This is based on a statistical significance level of 5%. The life expectancy rate (LER) has a positive but statistically negligible influence on Pakistan's gross domestic product (GDP), both in the short term and in the long run. Therefore, we will make use of the following approximation equation for multiple regression:

$$\ln(\mathrm{GDP}_t) = \phi + \alpha(\ln \mathrm{K}) + \beta(\ln \mathrm{L}) + \gamma(\ln \mathrm{HC}) + \delta(\ln \mathrm{TR}) + \theta(\ln \mathrm{IF}) + \varepsilon_t \quad (4)$$

The equation above can be expressed as:

$$\mathrm{GDP} = -4.67 + 0.545(\mathrm{K}) + 1.288(\mathrm{L}) + 0.264(\mathrm{HC}) - 0.259(\mathrm{TR}) - 0.008(\mathrm{IF}) + \varepsilon_t \quad (5)$$

4.3 Diagnostic Tests Results

Table 5. Diagnostic Results

Test	Methods	F-Statistic	P-values
Serial Correlation	Breusch-Godfrey Serial Correlation LM Test	0.227148	0.7986
Heteroskedasticity	Breusch-Pagan-Godfrey	2.118145	0.0807
Normality	Jarque-Bera	2.450	0.7479

According to the above table results, there is absence of heteroskedasticity and serial correlation problems while data also confirm the condition of normality.

The CUSUM chart graphically displays the total amount that each sample value deviates from the target value. No matter how little the process means drifts, the cumulative deviation values will always rise (or fall) because the CUSUM chart is cumulative.

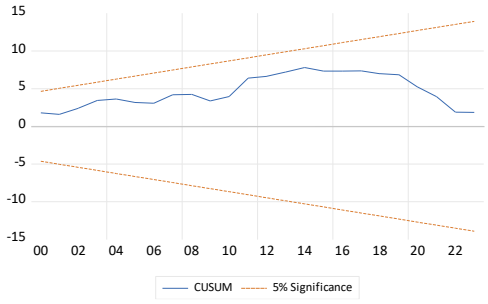

Fig. 1. CUSUM Test

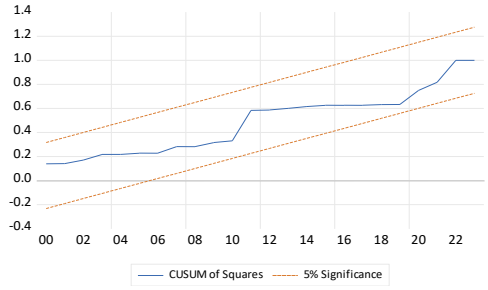

Fig. 2. CUSUM Square Test

5. CONCLUSION AND RECOMMENDATIONS

This study focuses on the complex relationships between significant economic variables and how those relationships affect Pakistan's GDP between 1991 and 2023. The ARDL error-correction regression model is employed in the study to give a comprehensive understanding of how different factors interact and shape Pakistan's overall economic environment.

a. **Inflation (CPI) and GDP Growth -** The absence of a positive correlation between Pakistan's GDP growth and the Consumer Price Index (CPI), a gauge of inflation, is one of the study's key conclusions. This result supports the idea that inflation can impede economic progress, especially when it is erratic. Excessive inflation frequently reduces purchasing power, breeds economic uncertainty, and deters investment and consumer expenditure. Economic authorities should prioritize managing inflation as, in the case of Pakistan, the ongoing inflationary pressures seen over the study period seem to have a negative impact on GDP growth.

b. **Trade Openness and GDP Growth -** The export-to-GDP ratio, which is a measure of trade openness, did not significantly correlate positively with GDP growth in Pakistan, according to the study. This finding contradicts the widely held belief that greater trade openness generally boosts economic growth by enticing innovation, increasing markets, and increasing efficiency. The absence of a beneficial effect in Pakistan's situation could be due to many things, including trade imbalances, structural inefficiencies, or the type of exported items, which might not be valuable or diverse enough to substantially boost GDP development. This research emphasizes the need for a more sophisticated approach to trade policy that emphasizes improving the value and quality of exports in addition to volume increases in trade.

c. **Capital Formation (GFCF) and GDP Growth -** According to the findings, gross fixed capital formation (GFCF) has a considerable influence on Pakistan's GDP growth. One of the primary drivers of economic growth is capital formation, which includes investments in machinery, infrastructure, and other long-term assets. Economic theory predicts that more capital investment leads to higher productivity and economic growth, which supports this conclusion. Given that capital formation boosts GDP growth, measures encouraging investment in physical infrastructure and industrial capacity could be particularly effective in fostering long-term economic growth in Pakistan.

d. **Total Labor Force and GDP Growth -** Another important finding is that, both in the short and long term, the labor force has a positive, albeit small, impact on GDP growth. Although having more workers can accelerate economic growth, Pakistan's experience seems limited. Numerous factors, such as the calibre of the work force, underemployment, or an imbalance between labor skills and market demands, could be to blame for this. The results show that increasing the labor force is important, but to maximize its contribution to economic growth, it must be paired with initiatives to raise worker productivity through training, skill development, and better job matching.

e. **Life Expectancy Rate (LER) and Human Capital -** The analysis also briefly discusses the importance of human capital, as evidenced by the life expectancy rate (LER). The emphasis was on improving the quality of human capital rather than on the direct relationship between LER and GDP growth and on the critical role that human capital plays in long-term economic development. Improving living and healthcare conditions can increase life expectancy, resulting in a more productive workforce and longer-term economic growth.

5.1 Recommendations

Different policy recommendations could be made to support Pakistan's economic growth considering the empirical findings:

a. Focus on Capital Formation: Policymakers should prioritize initiatives that boost investment in infrastructure and industrial capacity. Given the substantial impact of gross fixed capital formation on GDP, efforts to attract both domestic and international investment in capital-intensive projects will be significant.

b. Labor Force Development: While increasing labor force participation is important, increasing worker productivity should also be the primary priority. This can be achieved by implementing targeted education and skill development programs that guarantee the labor force is prepared to meet the demands of the current economic environment.

c. Inflation Management: Better inflation management is required, as evidenced by the lack of a positive link between inflation and GDP growth. It is recommended that policies be put in place to stabilize prices, lessen the

unpredictability of inflation, and safeguard consumers' purchasing power.

d. Reevaluate Trade Policies: The insignificant impact of trade openness on GDP growth prompts a revision of trade regulations. Efforts should be undertaken to increase the value of exported commodities, diversify them, and address trade sector inefficiencies.
e. Invest in Human Capital: Enhancing human capital quality must be a long-term strategic goal. Improved living circumstances, healthcare, and education policies will increase workers' productivity, resulting in long-term economic growth.

In summary, this research offers an insightful analysis of Pakistan's economic dynamics as well as practical policy recommendations. Pakistan can build a stronger and more resilient economy that is more appropriate to achieve sustained growth by concentrating on capital formation, labor force development, inflation management, and human capital improvement.

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