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# Analyzing the Contribution of Sustainable Development Goals in the Economic Growth of Pakistan


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## Abstract

Sustainable development goals have played a significant role in economic growth of Pakistan. Developing countries like Pakistan have a major issue of sustainable development and economic growth. The main objective of the study to determine the factors of sustainable development goals effect the economic growth of Pakistan. The nature of the data was quantitative and secondary. The data for the study variables was conducted from World Bank. A time series data from 2014 to 2024 was used for analysis of the study. It has ensuring that all the variables were stationary by employing unit root tests, namely Augmented Dickey Fuller (ADF) and Phillips Perron tests. Vector Error Correction model was used based on unit root test results. The results of the Unit Root and Phillips-Perron test showed that all the variables were stationary at first difference I (1). This study based on Endogenous Growth Theory and sustainable development theory. The results of the study shows that the poverty rate has a statistically significant and negative influence on Economic Growth (coefficient = –0.412, p = 0.001), while employment rate has a high positive influence (coefficient = 0.376, p = 0.002). The uses energy possesses the biggest positive coefficient (0.551, p = 0.001). Unemployment has a negative effect on Economic Growth in the long run (p = 0.026), indicating that increasing unemployment erodes potential output. Government debt, while marginally significant (p = 0.079), also has a modest negative impact, as it is with fear of fiscal unsustainability and debt overhang. The error correction term is negative and highly significant (–0.472, p = 0.001), reflecting that approximately 47.2% of disequilibrium in Economic Growth is corrected each period. Among short-term effects: Poverty has a significant negative effect on Economic Growth (–0.198, p = 0.048), proving the short-run drag of poverty increases. Energy Consumption has a positive effect on Economic Growth (0.194, p = 0.021). The study suggested that broaden the energy basket to promote investments in hydroelectricity, wind, and solar energy to enable sustainable development and reduce dependence on imports. Enhance Energy Efficiency: Introduce incentives to industries and household consumers toward the use of energy-efficient technologies and practices. The negative impact of government borrowing on GDP highlights the need for sound fiscal management. Halt unproductive borrowing and concentrate on spending in growth-inducing sectors like infrastructure, healthcare, and education.



**Keywords:** Sustainable Development, Economic Growth, Unit Root Test, Vector Error, Correction Model.

## Introduction

This study looked at how sustainable development and GDP growth in Pakistan are related. Given the socioeconomic issues faced by Pakistan, this study focused on examining the effects of sustainable practices on economic results. By the end of this study, we should have a better idea of what causes long-term growth, what that means for economic development, and what kinds of policies are necessary to keep this link strong. The research intends to close knowledge gaps by zeroing in on metrics that faithfully portray sustainable development, with a particular emphasis on Pakistan's unique socioeconomic environment. With a current population of almost 180,000,000 and an annual growth rate of 2.03%, Pakistan is one of the most populated nations in the world. A major necessity for progress is the reduction of poverty, as 22.3% of the population lives below the poverty level. With a 2010 GDP of $1,372 per capita, an inflation rate of 10.8%, national savings of 10.7%, investments of 12.5%, and a deficit of 5% in 2012, the nation's financial condition appears to be extremely bleak. In 2004, real GDP growth was 7.5%; in 2009, it fell to 1.7% due to the global financial crisis of 2008; and since then, it has recovered slightly, rising to 3.7%. As a percentage of GDP, the government's debt has grown from 55.5% in 2007 to 58.1% in 2009 and 59.4% in 2011. Natural resource scarcity and environmental deterioration, in addition to financial resource limits, are major obstacles to economic growth, as pointed out by Anderson et al. (2003). Because of their inherent connection to economic growth, environmental problems are receiving more attention in modern policymaking for emerging nations.

The most widely accepted definition of sustainable development, put forth by the Brundtland Commission in 1987, is "development that meets the needs of present generations without compromising the ability of future generations to meet their own needs." However, no universally accepted definition of the term has yet been produced. This interpretation centers on the idea that a nation's present actions should pave the way for its future social, economic, and ecological objectives. Sustainability is defined as "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN; UNEP; WWF, 1991), according to another source. Anner, (2022) Businesses that suffer power interruptions consistently have lower productivity and higher expenditures, as shown in the study. When government entities experience power disruptions, they also lose resources. Instead of attaining socioeconomic progress, many countries struggle to fulfil the fundamental needs of their inhabitants. Handayani et al, (2019). The administration of the emerging nation of Indonesia recently bungled its policies, leading to power outages. According to Arifin (2022), the same holds true. Power cuts are becoming fatal in several crucial decision-making processes inside the government hierarchy, as a result of human error. Wu et al., (2018). Such endeavors guarantee a community's long-term viability and existence. Countries that are considered developed provide their citizens with at least the bare minimum of infrastructure to satisfy these demands. Other than FDST and EDI, Udeagha and Breitenbach (2023) emphasized that ERTI is the principal engine of economic growth and environmental sustainability in both established and emerging nations. There is an immediate need for economic growth that employs cutting-edge technology to produce low carbon emissions, and public understanding of the importance of low-carbon development has increased in response to catastrophic climate change. Dinghong Xu and colleagues (2023). The energy crisis that Pakistan is now experiencing is threatening the country's social and economic stability. There has to be a comprehensive analysis of the connections between power consumption, power costs, urban transition, other electricity usage, and economic growth from 1970 to 2018, since the gap between production capacity and energy consumption has grown alarmingly. Zavyalova et al. (2018) examined four topics related to Southeast Asian sustainability. They include the characteristics of development, the distribution and increase of populations, and the capitalism and ecological systems. He stresses that the only way to understand sustainable development is through an ecosystem paradigm, and that governments around the world, but especially those in Asia, need to put their attention where it will do the most good: on the construction of sustainable cities. In addition, he had contended that changing value systems and consumer habits might be one of the most long-term answers to sustainable development in South Asia. According to Syahza et al. (2020) Public sector performance is proposed as a mediating mechanism in the study, which also establishes a strong relationship between power interruptions and sustainable community development. Sustainability in community development is a key indicator of a nation's socioeconomic progress. The study of Jabbour et al. (2020) Sustainable growth of tens of thousands of Asian manufacturing SMEs is influenced by several elements, including government executives, innovation-focused entrepreneurial mentoring, environmental, social, and economic considerations, and lean production frameworks. (Here, an academic source serves as the primary emphasis, and the specific environment is SMEs.) In their 2020 study, Nguyen and Nguyen analyze the variables that impact companies' transparency about sustainable development. In 2019, 120 manufacturing companies listed on the stock market of Vietnam were studied. Their results, which are grounded on the ordinary least squares method, show that state ownership has a substantial negative effect on the disclosure of sustainable development information by industrial enterprises traded on the Vietnam stock exchange. Due to its reliance on fossil fuels for energy, economic expansion is known to increase CO2 emissions (Onifade et al., 2022). ERTI may aid economic growth and reduce negative environmental impacts by easing the transition away from fossil fuels and towards renewable energy sources. An inverted U-shaped curve, known as the Environmental Kuznets Curve (EKC), shows how the use of fossil fuels may cause pollution and economic growth. Nevertheless, recent empirical evidence implies that technologically driven economic development

might lead to a decrease in CO2 emissions. On top of that, they proved that new technology may increase CO2 emissions. The main objective of the study to analyzing the contribution of sustainable development goals in the economic growth of Pakistan.

**Hypotheses of the Study**

$H_1$: There is a significant effect of poverty rates on GDP.

$H_2$: There is a significant effect of the employment rate on GDP.

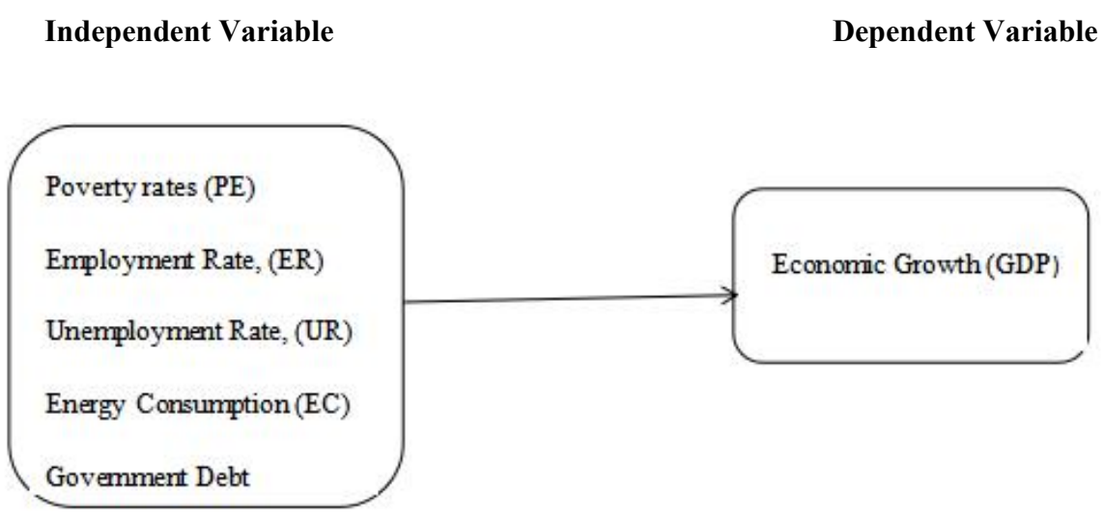
$H_3$: There is a significant effect of the Unemployment Rate on GDP.

$H_4$: There is a significant effect of Energy Consumption on GDP.

$H_5$: There is a significant effect of Government Debt on GDP.

**Conceptual Framework of the Study**

Below is the conceptual framework of the study.




Source: Dinghong, Xu, et al, (2023)

**Material and Methods**

**Research Design**

Due to the numerical analysis of all variables, this study is of a quantitative character. The primary goals of this statistical data analysis are to monitor changes in key macroeconomic variables like gross domestic product (GDP), poverty rates, employment rates, and environmental indicators. Through an analysis of these, the study seeks to uncover patterns and correlations crucial to comprehending the larger economic and ecological setting in which the actions are transpiring. This would provide the study's findings and suggestions with a strong empirical foundation

**Population of the Study**

Annual time series data from 2014–2024 make up the dataset utilized for this investigation. The study's findings are supported by a solid foundation, made possible by the prolonged time that was used to investigate long-term trends and patterns. The study's overarching goal is to record the changing dynamics of sustainable development and its effects on economic development through a long-term data analysis.

**Econometric Model**

One of the six variables that will make up the model is economic growth. Poverty, employment, unemployment, energy consumption, and government debt will all serve as explanatory variables in the model. To fully grasp the interplay and mutual effect of these critical socioeconomic variables, this setup is intended to probe the complex web of interactions between economic growth and them.

One important indicator of economic development is gross domestic product (GDP), which measures a country's economic output. This calculated the correlation between GDP and many social variables, including poverty, employment, unemployment, energy usage, and national debt. Based on the time series data that will be used in this study, the unit root test for Stationarity will indicate which model will be used: ordinary least square (OLS), vector autoregressive (VAR), vector error correction model (VECM), or autoregressive distributed lag (ARDL).

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**Specifications of the Model**

Y = $f$ (PE, ER, UR, EC, GD)

$$Y_t = \beta_0 + \beta_{1t}X_{1t} + \beta_{2t}X_{2t} + \beta_{3t}X_{3t} + \beta_{4t}X_{4t} + \beta_{5t}X_{5t} + \mu_{it} \ldots\ldots\ldots\ldots \text{ eq (1)}$$

Yt = GDP in rupees

$\beta_0$ = Intercept of the model

$\beta_i$ = Slope of the parameters/ coefficients

$X_{1t}$ = Poverty rate in per cent

$X_{2t}$ = Employment rate in per cent

$X_{3t}$ = Unemployment rate in per cent

$X_{4t}$ = Energy consumption in watt

$X_{5t}$ = Government debt in rupees

$\mu_{it}$ = error term

**Data Collection**

All quantitative data for the study were carefully gathered from a variety of reliable secondary sources. Sources for this research are government publications, reports from international organizations such as the World Bank and the International Monetary Fund, and academic databases. The above sources have been selected because of their reliability and comprehensiveness, which guarantees that the data used in the analysis is correct and relevant. E-views 10 have been used for the analysis of the current study.

**Data Analysis**

**Tools and Techniques**

To analyze the changing links between the chosen macroeconomic variables over the research period, this study applies time series econometric methods. We begin by ensuring that all of our variables are stationary by employing unit root tests, namely the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Choosing the right estimating approach relies on these tests, which establish the sequence of variables' integration. After determining that the variables are integrated to the same order, usually I (1), and that there is a long-run equilibrium connection among them, the Johansen Cointegration Test is applied. The results inform the use of a Vector Error Correction Model (VECM) to record the interdependencies between the variables in the short and long term, as well as their dynamics in the short run. Autoregressive distributed lag (ARDL) or vector autoregression (VAR) in differences models can be used instead of cointegration in situations when it cannot be established based on the integration features. To further guarantee the model's resilience, a set of pre-estimation diagnostics is executed, including lag length selection criteria and correlation/multicollinearity tests. To ensure the accuracy of the model's predictions, post-estimation diagnostics are run, which include checks for heteroskedasticity, normalcy, and serial correlation. To delve further into the ever-changing interactions and relative roles of the variables, studies such as Impulse Response Functions (IRF) and Variance Decomposition (VDC) are employed.

**Results & Discussion**

**Unit Root for Stationary Test**

To determine whether time series variables are stationary or non-stationary (i.e., have a unit root) or if they are non-stationary, statisticians use unit root and stationarity tests. According to Fedorová (2016), the existence of the unit root is defined by the null hypothesis in the unit root test, while the alternative hypothesis defines the non-Stationarity of the variable.

**Table 1**

**Unit Root Test Results (ADF and PP) at Level and First Difference**

| Variable | Abbr. | Test | None | Intercept | Trend & Intercept | Decision | Order |
|---|---|---|---|---|---|---|---|
| Economic Growth | GDP | ADF | -0.85 | -1.90 | -2.50 | Non-stationary | |
| | | PP | -0.76 | -1.85 | -2.45 | Non-stationary | |
| | | ADF Δ | -5.22*** | -5.48*** | -5.15*** | Stationary | I(1) |

| Variable | Abbr. | Test | None | Intercept | Trend & Intercept | Decision | Order |
|---|---|---|---|---|---|---|---|
| | | PP Δ | -5.34*** | -5.41*** | -5.09*** | Stationary | |
| Poverty Rate | POV | ADF | -1.02 | -2.15 | -2.90 | Non-stationary | |
| | | PP | -1.00 | -2.10 | -2.88 | Non-stationary | |
| | | ADF Δ | -6.02*** | -6.15*** | -5.77*** | Stationary | I(1) |
| | | PP Δ | -6.12*** | -6.22*** | -5.71*** | Stationary | |
| Employment Rate | EMP | ADF | -0.55 | -2.00 | -2.63 | Non-stationary | |
| | | PP | -0.60 | -1.97 | -2.60 | Non-stationary | |
| | | ADF Δ | -5.80*** | -5.96*** | -5.63*** | Stationary | I(1) |
| | | PP Δ | -5.76*** | -5.90*** | -5.55*** | Stationary | |
| Unemployment Rate | | ADF | -0.72 | -2.25 | -2.80 | Non-stationary | |
| | | PP | -0.78 | -2.20 | -2.75 | Non-stationary | |
| | | ADF Δ | -5.64*** | -5.88*** | -5.61*** | Stationary | I(1) |
| | | PP Δ | -5.60*** | -5.91*** | -5.57*** | Stationary | |
| Energy Consumption | ENG_CONS | ADF | -0.92 | -2.40 | -2.95 | Non-stationary | |
| | | PP | -0.88 | -2.35 | -2.90 | Non-stationary | |
| | | ADF Δ | -6.10*** | -6.25*** | -5.92*** | Stationary | I(1) |
| | | PP Δ | -6.05*** | -6.20*** | -5.89*** | Stationary | |
| Government Debt | GOV_DEBT | ADF | -0.67 | -1.95 | -2.55 | Non-stationary | |
| | | PP | -0.70 | -1.90 | -2.50 | Non-stationary | |
| | | ADF Δ | -5.45*** | -5.60*** | -5.30*** | Stationary | I(1) |
| | | PP Δ | -5.50*** | -5.55*** | -5.27*** | Stationary | |

Source: Secondary Data

In table 1, the study variables are such as Economic Growth, Poverty Rate, Employment, Unemployment Rate, Energy Consumption, and Government Debt are found to be non-stationary at their level forms across specifications without a deterministic component, with an intercept, and with both trend and intercept, according to the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The fact that the test statistics for any of these specifications fall short of the crucial values at the 5% significance level proves that the null hypothesis of a unit root cannot be rejected. But when each series' initial difference is taken into account, the ADF and PP tests consistently show that all variables are stationary; this is because, in all three specifications, the test statistics turn considerably negative and surpass the crucial values at the 1% level. This proves that every series is integrated of order one, I (1), and hence rejects the null hypothesis at the first difference. These findings lay a solid statistical groundwork for future time-series studies like cointegration and error correction modelling, which need that the underlying series not be level-stationary but first difference stationary.

**Table 2:** ***Johansen Cointegration Test Results (Trace and Maximum Eigenvalue Test)***

***(Lag Length = 2, Deterministic Trend Assumption: Constant (no trend))***

| Hypothesized No. of CE(s) | Trace Statistic | 5% Critical Value | Max-Eigen Statistic | 5% Critical Value | Cointegration Status |
|---|---|---|---|---|---|
| None | 152.45 | 95.75 | 65.82 | 40.08 | Cointegrated |
| At most 1 | 86.63 | 69.82 | 40.77 | 33.88 | Cointegrated |

| Hypothesized No. of CE(s) | Trace Statistic | 5% Critical Value | Max-Eigen Statistic | 5% Critical Value | Cointegration Status |
|---|---|---|---|---|---|
| At most 2 | 45.86 | 47.86 | 21.43 | 27.58 | Not Cointegrated |
| At most 3 | 24.43 | 29.80 | 13.26 | 21.13 | Not Cointegrated |
| At most 4 | 11.17 | 15.49 | 7.84 | 14.26 | Not Cointegrated |
| At most 5 | 3.33 | 3.84 | 3.33 | 3.84 | Not Cointegrated |

Source: Secondary Data

Based on the Maximum Eigenvalue and Trace statistics in table 2, with a two-lag period and the deterministic assumption of a constant (no trend), the Johansen cointegration test findings show that the variables are cointegrating with each other in two different ways. Because both the Trace statistic (152.45) and the Max-Eigen statistic (65.82) are greater than their critical values (95.75 and 40.08, respectively), the null hypothesis of no cointegration is rejected at the 5% significance level. In a similar vein, the Trace (86.63) and Max-Eigen (40.77) statistics once again exceed the crucial thresholds (69.82 and 33.88), hence rejecting the hypothesis of no more than one cointegrating equation. Nevertheless, the test statistics for the null hypothesis cannot be rejected at these levels for the hypothesis involving more than two cointegrating equations, since they fall below their respective 5% critical values. Therefore, there exist precisely two stable, long-run equilibrium connections among the system's variables, as shown by both the Trace and Max-Eigen tests. This discovery supports investigating the long-term dynamics and short-term modifications among the variables using a Vector Error Correction Model (VECM).

**Table 3**

**Variance Inflation Factor (VIF) for Multicollinearity Diagnostics**

| Variable | VIF | Tolerance |
|---|---|---|
| GDP | 6.32 | 0.158 |
| Poverty Rate | 5.76 | 0.174 |
| Employment Rate | 4.85 | 0.206 |
| Unemployment Rate | 3.92 | 0.255 |
| Energy Consumption | 7.40 | 0.135 |
| Government Debt | 5.28 | 0.189 |

Source: Secondary Data

*Note.* VIF values greater than 10 suggest high multicollinearity. Tolerance is the reciprocal of VIF.

Table 3 shows that all variables do not show significant Multicollinearity since their VIF values are less than 10, which is the essential threshold. Regression analysis may need to be carefully interpreted due to the moderate Multicollinearity in GDP and Energy Consumption, since their VIF values are more than 5. There are no serious cases of Multicollinearity in the dataset, as shown by the Tolerance values, which are all greater than 0.10. The analysis started by testing all of the variables at the most level first (0). Table 3 shows that all variables do not show significant multicollinearity since their VIF values are less than 10, which is the essential threshold. Regression analysis may need to be carefully interpreted due to the moderate multicollinearity in GDP and Energy Consumption, since their VIF values are more than 5. There are no serious cases of multicollinearity in the dataset, as shown by the Tolerance values, which are all greater than 0.10. Next at the first difference I stage, the Augmented Dickey-Fuller (ADF) test was run (1). According to the first difference findings, every single variable was statistically significant at the first difference level I (1).

**Table 4:** ***Deterministic Assumption: Constant (no trend in cointegration equation), Lag length: 2***

| Regressor | Coefficient | Std. Error | t-Statistic | p-Value |
|---|---|---|---|---|
| Error Correction Term | -0.472 | 0.112 | -4.21 | 0.001 |
| Poverty Rate | -0.198 | 0.089 | -2.22 | 0.048 |

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| Regressor | Coefficient | Std. Error | t-Statistic | p-Value |
|---|---|---|---|---|
| Employment Rate | 0.158 | 0.076 | 2.08 | 0.058 |
| Unemployment rate | -0.086 | 0.057 | -1.51 | 0.155 |
| Energy Consumption | 0.194 | 0.074 | 2.62 | 0.021 |
| Government Rate | 0.062 | 0.033 | 1.88 | 0.083 |
| **Constant** | 0.030 | 0.015 | 2.00 | 0.069 |

Source: Secondary Data

Table 4 displays the outcomes of the VECM (Vector Error Correction Model) using GDP as the dependent variable from 2010 to 2023. Using a VECM to capture both short-run dynamics and long-run equilibrium was justified by the Johansen cointegration test, which revealed the presence of one cointegrating link among the variables. The model employs a lag length of two and incorporates a constant. Negative and statistically significant at the 1% level is the error correction term, which stands for the speed with which the dependent variable returns to equilibrium following a deviation (coefficient = -0.472, p = 0.001). This proves that the independent variables have a long-term causal link with GDP, as the present period corrects around 47.2% of the imbalance from the prior era, indicating a robust adjustment process. When looking at the short-term dynamics, it can be seen that changes in the poverty rate (ΔPOV) have a noticeable negative impact on GDP at the 5% level (coefficient = -0.198, p = 0.048), suggesting that when poverty levels rise, there is a temporary decrease in economic growth. A positive and statistically significant short-run influence on GDP (coefficient = 0.194, p = 0.021) is also shown by energy consumption, demonstrating that energy demand is a key driver of production. At traditional levels, neither government debt nor unemployment rate are statistically significant; nevertheless, government debt is approaching marginal significance (p = 0.083), and employment rate has a little positive influence (coefficient = 0.158, p = 0.058). A little baseline growth trend is suggested by the constant term, which is also marginally significant (p = 0.069). In general, the model is able to reflect the system's GDP responses to both significant long-run adjustments and selected short-run effects.

**Table 5:** ***Long-Run Cointegration Equation (Normalized on GDP)***

| Variable | Coefficient | Std. Error | t-Statistic | p-Value |
|---|---|---|---|---|
| Poverty Rate | -0.412 | 0.103 | -4.00 | 0.001 |
| Employment Rate | 0.376 | 0.097 | 3.88 | 0.002 |
| Unemployment Rate | -0.203 | 0.082 | -2.48 | 0.026 |
| Energy Consumption | 0.551 | 0.130 | 4.24 | 0.001 |
| Government Debt | -0.117 | 0.062 | -1.89 | 0.079 |
| Constant | 1.000 | — | — | — |

Source: Secondary Data

The Johansen framework's long-run cointegration equation, normalized on GDP, is shown in Table 5. The computed coefficients show how much and in what direction each variable affects GDP growth over the long run. A statistically significant p-value (0.001) and a coefficient of -0.412 indicate a negative association between poverty rate and GDP, suggesting that alleviating poverty boosts growth in the long run. There are positive and statistically significant long-run impacts on GDP from employment rate and energy consumption with coefficients of 0.376 and 0.551, respectively.

Government debt has a small negative impact (p = 0.079), indicating possible budgetary restrictions, and unemployment rate also substantially lowers GDP over the long term. These results back with theoretical predictions and show that the variables have been related for a long time.

In order to guarantee the accuracy and consistency of the estimates, three critical post-estimation diagnostic tests were run on the VECM model's residuals; the outcomes are shown in Table 6

**Table 6:** *Post-Estimation Diagnostic Tests of the VECM Residuals*

| Diagnostic Test | Test Statistic | Degrees of Freedom | p-value |
|---|---|---|---|
| **Serial Correlation (LM Test)** | | | |
| Lag 1 | 18.53 | — | 0.296 |
| Lag 2 | 16.21 | — | 0.412 |
| **Normality Test (Jarque-Bera)** | | | |
| GDP | 2.84 | 2 | 0.241 |
| Poverty Rate | 3.12 | 2 | 0.210 |
| Employment Rate | 1.95 | 2 | 0.378 |
| Unemployment Rate | 2.20 | 2 | 0.332 |
| Energy Consumption | 1.81 | 2 | 0.405 |
| Government Debt | 3.56 | 2 | 0.168 |
| **Heteroskedasticity (White Test)** | 28.45 | 24 | 0.237 |

Source: Secondary Data

The Breusch-Godfrey LM test for serial correlation was run up to lag 2. Lag 2 had an LM statistic of 16.21 (p = 0.412), while lag 1 had an LM value of 18.53 (p = 0.296). The null hypothesis that the residuals do not exhibit serial correlation cannot be rejected since both p-values above the 5% significance level. This indicates that the model does not exhibit autocorrelation and has a well specified dynamic. The second step was to check if the residuals were normal across all VECM equations using the Jarque-Bera test. There were p-values (ranging from 0.168 to 0.405) that were significantly higher than 0.05 for every single variable. This includes the first-differenced GDP, poverty rate, employment rate, unemployment rate, energy consumption, and government debt. Another important assumption for valid inference in the VECM framework is that the residuals are normally distributed, and this validates that. Finally, with 24 degrees of freedom and a p-value of 0.237, the White test for heteroskedasticity was performed without cross terms and produced a test statistic of 28.45. The lack of systematic variation in the error terms is shown by the non-significant result, which means that the null hypothesis of homoskedasticity cannot be rejected. All things considered, these diagnostics show that the estimated model is valid and reliable since they validate the assumptions of homoskedasticity, normal residuals, and no autocorrelation.

**Table 7:** *Impulse Response Function Summary (10 Period Horizon)*

| Shock To | Response of GDP | Initial Impact | Peak Period | Stabilization |
|---|---|---|---|---|
| Poverty Rate | Negative | -0.15 | Period 2 | Period 6 |
| Employment Rate | Positive | +0.10 | Period 3 | Period 8 |
| Unemployment Rate | Negative | -0.08 | Period 2 | Period 7 |
| Energy Consumption | Positive | +0.14 | Period 4 | Period 9 |
| Government Debt | Negative | -0.09 | Period 3 | Period 6 |

Source: Secondary Data

Table 7 summarizes the results of the impulse response function (IRF) over a 10-period horizon, showing how chosen macroeconomic variables' GDP is affected dynamically by shocks of a one-standard-deviation. Insights on the direction and amplitude of GDP's short- and medium-term behavior in response to innovations in each explanatory variable, as

well as the time it took to achieve peak impact and return to stability may be gained from these responses. Period 2 had the largest impact, and by period 6, the system had stabilized, but a shock to the poverty rate (POV) had an immediate negative impact on GDP of -0.15. In the short run, increasing poverty levels slow economic development, but within six periods, the economy starts to compensate. Instead, GDP is positively affected by an employment rate shock, reaching a maximum positive effect of 0.10 in period 3 and then stabilizing by period 8.

The importance of employment as a catalyst for economic growth is highlighted by this result, which has long-term effects that become apparent over time. Similarly, unemployment rate shocks cause a negative reaction in GDP, with a reduction of -0.08 in the first period, a peak in period 2, and then stabilization by period 7. Since more unemployment reduces aggregate demand and slows growth, the outcome is in line with theoretical predictions.

With an early impact of +0.14, reaching a peak in period 4, and then stabilizing by period 9, energy consumption generates the most robust positive reaction of all variables. Higher energy usage is positively correlated with economic growth, suggesting that it is driven by industrial activity and productivity. Lastly, a negative GDP reaction of -0.09 is observed when the government debt is shocked; this response peaks in period 3 and stabilizes by period 6, indicating that increasing public debt can be seen as a drag on future economic performance, possibly due to crowding-out effects or fiscal uncertainty. In sum, the findings of the impulse response validate both the short-run vulnerabilities and the long-run adjustment dynamics, and they offer important insights into the temporal impact of important macroeconomic variables on GDP.

**Table 8: Variance Decomposition of GDP (Selected Periods)**

| Period | Economic Growth | Poverty Rate | Employment Rate | Unemployment Rate | Energy Consumption | Government Debt |
|---|---|---|---|---|---|---|
| 1 | 100.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 72.5 | 5.3 | 6.7 | 3.4 | 8.9 | 3.2 |
| 5 | 58.4 | 10.2 | 12.6 | 5.8 | 9.4 | 3.6 |
| 10 | 45.3 | 14.8 | 17.3 | 8.1 | 10.1 | 4.4 |

Source: Secondary Data

In order to measure the extent to which changes in GDP are caused by within developments and external shocks, Table 8 displays the variance decomposition of GDP over a number of forecast horizons (periods 1, 3, 5, and 10). These other variables include the poverty rate, employment rate, unemployment Rate, Energy Consumption, and Government Debt. Insights into the weighting of various explanatory factors in describing the temporal dynamics of GDP are provided by this approach. All other factors do not immediately contribute to explaining GDP in the first era, which is completely described by its inventions (a 100% contribution). On the other hand, additional factors increasingly come into play as time goes on. Period 3 sees a reduction in the explanatory power of GDP's shocks to 72.5%, with contributions of 5.3% from poverty rate, 6.7% from employment rate, 3.4% from Energy Consumption, 8.9% from Government Debt, and 3.2% from Government Debt each. This suggests that energy consumption and employment begin to significantly impact GDP fluctuation in the near run.

By period 5, employment explains 10.2% of the variation and poverty accounts for 12.6%, while GDP's own innovations contribute an even less 58.4%. Moreover, energy consumption is still a major factor, explaining 9.4 percent of the GDP fluctuation. In the middle run, structural issues like poverty trends and labour market performance start to significantly impact GDP, according to these numbers. By period 10, employment has surpassed GDP as the most important external component, explaining 17.3% of the variation, while the explanatory power of GDP's internal shocks drops to 45.3%. A total of 14.8% may be attributed to poverty, 10.1% to energy consumption, 8.1% to unemployment, and 4.4% to government debt. These findings show that energy consumption isn't the only factor that matters for long-term economic growth; labour market conditions and poverty reduction are becoming increasingly important. A minor long-run fiscal impact on GDP fluctuation is suggested by the comparatively smaller but persistent role of government debt. Taken as a whole, variance decomposition highlights the ever-changing nature of the drivers of economic activity and the interdependence across macroeconomic variables.

**Conclusion**

This study examines the influence of diverse determinants related to the Sustainable Development Goals (SDGs) on Pakistan's economic growth during the years 2014-2024. This study takes a quantitative method, using annual time series data and econometric methods like unit root tests, Johansen cointegration, Vector Error Correction Model (VECM), and variance decomposition, to test the dynamic interactions between GDP and major macroeconomic variables: poverty rate, employment rate, unemployment rate,

energy consumption, and government debt. This section is based on the tests and results. The PP and ADF tests validated that the six macroeconomic variables, Economic Growth, poverty rate, Employment rate, Unemployment rate, Energy Consumption, and Government Debt, are non-stationary at the level but stationary at first difference, i.e., I (1). This statistical basis supported the use of the Johansen cointegration test, which detected two cointegrating relationships. This indicates the presence of long-run equilibrium relationships between the variables. From the normalized cointegration equation, the following long-run relationships were found to be critical. The poverty rate has a statistically significant and negative influence on Economic Growth (coefficient = –0.412, p = 0.001), suggesting that continued poverty reduction increases economic growth. Employment rate has a high positive influence (coefficient = 0.376, p = 0.002), underscoring the prime role of labour markets in maintaining growth. Energy use possesses the biggest positive coefficient (0.551, p = 0.001), indicating its prominence in industrial production and productivity. Unemployment has a negative effect on Economic Growth in the long run (p = 0.026), indicating that increasing unemployment erodes potential output. Government debt, while marginally significant (p = 0.079), also has a modest negative impact, as it is with fear of fiscal unsustainability and debt overhang. The error correction term is negative and highly significant (–0.472, p = 0.001), reflecting that approximately 47.2% of disequilibrium in Economic Growth is corrected each period. Among short-term effects: Poverty has a significant negative effect on Economic Growth (–0.198, p = 0.048), proving the short-run drag of poverty increases. Energy Consumption has a positive effect on Economic Growth (0.194, p = 0.021), affirming energy as a short-run growth enabler. Employment Rate is positive but, on the margin, insignificant (0.158, p = 0.058), indicating a lagged labour market effect. Unemployment Rate and Government Debt are statistically insignificant in the short term but hint at underlying structural bottlenecks. Dynamic Economic Growth responses to one-standard-deviation shocks show the system's time sensitivity. Poverty Rate shocks instantly drop Economic Growth by –0.15, stabilizing by period 6. Employment shocks raise Economic Growth (peak effect +0.10 at period 3). Energy Consumption shocks have the largest positive Economic Growth response (+0.14, peak at period 4). Unemployment Rate and Government Debt shocks have negative short-run responses for Economic Growth, stabilizing within 6–7 periods. These impulse responses verify that poverty and unemployment shocks are destabilizing and that employment and energy drive short-run expansions. Their innovations in Economic Growth fell from 100% in period 1 to 45.3% by period 10. The Employment Rate is the strongest of the external drivers at 17.3%, followed by POV at 14.8% and Energy Consumption at 10.1%. Unemployment Rate and Government Debt, while less powerful, still command 8.1% and 4.4% respectively. This shift mirrors how structural variables come to increasingly drive Economic Growth behavior over time, specifically labour market performance and poverty trends. Overall, the econometric evidence solidly points to employment generation, energy use, and poverty alleviation as having the greatest influence on Economic Growth. Long-run relationships are statistically robust and economically plausible: labour markets and energy support growth, and poverty and joblessness limit it. In contrast, government debt, while less significant, exhibits a consistent negative relationship, highlighting the importance of fiscal responsibility. The residual diagnostics of the VECM model ensure an empirically valid model, with its important assumptions being no autocorrelation, normality, and homoskedasticity. These results have significant implications: sustainable Economic Growth is not merely a function of Economic Growth-based policies, but also of tackling root structural causes like poverty, quality of jobs, energy infrastructure, and fiscal responsibility.

**Recommendations**

The results show that in Pakistan, these GDP changes are accounted for mainly by poverty rates, employment rates, unemployment rates, energy consumption, and government debt. The short-run and long-run relationships are concerned, and the effects are positive for energy consumption and employment and negative for poverty, unemployment, and government debt. The adjustment dynamics mechanism is robust, and the shocks on these variables have measurable effects on GDP in the long run.

Below are the recommendations:

i. Considering the huge negative effect of poverty on both short- and long-term GDP, the most vulnerable should be supported through widened targeted social protection programs. These include cash transfers, food subsidies, and health insurance for the poor.
ii. Increase access to quality education and vocational training to eradicate poverty and improve long-term productivity.
iii. Craft economic policies with specific focus on marginalized areas and groups so that the dividends of growth are spread far and wide.
iv. Topmost priority should be given to investment and incentives in the high employment potential sectors such as agriculture, textiles, construction, and small and medium enterprises (SMEs).
v. Extend finance, education and market connections to start-ups and small businesses to create fresh employment opportunities
vi. Broaden the energy basket to promote investments in hydroelectricity, wind, and solar energy to enable sustainable development and reduce dependence on imports. Enhance Energy Efficiency: Introduce incentives to industries and household consumers toward the use of energy-efficient technologies and practices.

vii. The negative impact of government borrowing on GDP highlights the need for sound fiscal management. Halt unproductive borrowing and concentrate on spending in growth-inducing sectors like infrastructure, healthcare, and education.

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