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Socio-Economic Inclusion and Sustainable Economic Growth: An Evidence from Pakistan

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Abstract
Over 48 years (1975-2022), this research analyzes Pakistan's socio-economic inclusion and sustainable growth using data from PBS, SBP, and WDI. It examines GDP growth alongside healthcare expenditure, capital formation, education spending, employment, and school enrollment. Employing ARDL models and tests, it explores short and long-term dynamics, emphasizing the significance of healthcare, capital investment, education, and employment. The rigorous methodology ensures reliability, offering evidence-based policy recommendations crucial for fostering inclusive and enduring economic development. Additionally, it evaluates the impact of government expenditure on education and employment dynamics, highlighting their role in shaping economic progress and gender inclusivity in education.
Keywords: GDP growth, Gross Fixed Capital Formation, Government Expenditure on Education, Current Health Expenditure, School Enrollment, Secondary

1. Introduction
Pakistan, with a population exceeding 241.5 million, faces socio-economic challenges like poverty, inequality, and unemployment (Mukherjee, 2023). Efforts such as poverty reduction programs and education reforms have shown promising results, reducing the poverty rate from 24.3% in 2015 to 4.4% in 2020 (Siddiqui, 2021). Government initiatives like the China-Pakistan Economic Corridor (CPEC) aim to boost infrastructure and trade. Despite progress, challenges like gender inequality and environmental degradation persist. Sustainable economic growth integrates societal and environmental aspects, with measures like the Benazir Income Support Program (BISP) and investments in renewable energy addressing these challenges. Yet, hurdles remain, including high poverty rates and income disparities. Ensuring effective policy implementation and reaching those most in need are ongoing challenges. Pakistan's advancement depends on socio-economic integration and sustained economic expansion, requiring comprehensive actions for inclusive development and improved living standards (Ali et al., 2022). This research delves into promoting socio-economic inclusion in Pakistan's expanding economy while ensuring sustainable growth. It examines how key socio-economic factors impact GDP growth, particularly among marginalized groups, to evaluate current policies' effectiveness in fostering inclusive growth. Identifying crucial drivers of GDP growth, the study aims to provide actionable recommendations for policymakers and stakeholders to promote equitable and sustainable economic progress, bridging the gap between economic growth and inclusive development. This study addresses the gap in Pakistan's research on economic growth and socio-economic inclusion by examining specific variables crucial for sustainable development. It focuses on healthcare investment, capital formation, government spending on education, employment patterns, and school enrollment rates. The research aims to provide deeper insights into how these variables impact inclusive and sustainable economic growth, particularly for marginalized communities. Additionally, the study draws on successful interventions from similar contexts to offer actionable strategies for policymakers and stakeholders to promote socio-economic inclusion and drive sustainable economic growth in Pakistan.

2. Literature Review
Ashraf et al. (2023) meticulously dissect the nexus between sustainable economic growth and the attainment of SDGs in low to lower-middle-income nations. Using econometric regression techniques, they employ ARDLMs to unearth long-term dynamics. Crucially, the ADF test ensures time series data stationarity, fundamental for reliable inferences. Diagnostic tests like Heteroskedasticity and Autocorrelation further fortify model integrity, while stability tests bolster reliability, enriching comprehension of sustainable development and economic growth. Mukherjee (2023) underscores the significance of accurate census data for equitable delimitation, following the 7th Population and Housing Census, 2023, in Pakistan. Concerns over census accuracy, including population count revisions, prompt critical reflections on electoral integrity.
Mouneer et al. (2023) delve into private investment's impact on sustainable economic growth in Pakistan, employing econometric tools such as the Augmented Dickey-Fuller test to assess variable stationarity. Diagnostic tests ensure model reliability, offering insights vital for policymakers and researchers. Kalim's (2023) study scrutinizes the relationship between school resources and student enrollment in various public-school categories in Pakistan. Utilizing ARDLM, the study explores long-term dynamics, underpinned by the ADFT to validate data stationarity. George (2023) examines the causes and consequences of Pakistan's economic crisis, employing econometric regression tests like the ARDLM. The ADF test ensures data stationarity, critical for reliable analysis, with diagnostic tests fortifying model robustness.
Rehman, Andleeb, and Iqbal (2023) probe gender disparities in school enrollment across Pakistan's provinces. Using ARDLM, they explore gender, enrollment, and completion rates, buttressed by the ADF test for data stationarity and diagnostic tests for model validity. Taghvaee et al. (2023) investigate the relationship between sustainable development goals, transportation, health, and public policy. Employing ARDLM, the study delves into enduring connections, with the ADFT validating data stationarity and diagnostic tests fortifying model robustness. Ul-Haq et al.'s (2023) study explores trade liberalization's impact on gender disparities in education in Pakistan. Utilizing ARDLB, the study examines the enduring relationship, complemented by the ADF test for data stationarity and diagnostic tests for model reliability. Munir and Satti (2023) analyze the extended Solow model

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and foreign aid in Pakistan's economy, using ARDL and ADF tests to assess long-term relationships and data stationarity, respectively. Diagnostic tests ensure model reliability, providing insights into economic dynamics.

Ali & Bibi (2017), Ali (2023) investigates poverty, capital formation, and education's role in accelerating economic growth in Pakistan. Employing econometric regression techniques, the study validates data stationarity with the ADF test, ensuring reliable analysis. Ali, Jamil, and Economist (2023) explore infrastructure development's impact on female labor force participation in Pakistan. Using ARDLB and ADFT, they examine long-term associations and data stationarity, with diagnostic tests fortifying model integrity. Kamal, Rauf, and Fatima (2023), and Mustafa et al (2021) delve into sustainable employment and economic growth in Pakistan, employing ARDLB and ADF tests to scrutinize enduring relationships and data stationarity, respectively. Diagnostic tests ensure model reliability, enriching our understanding. Raihan (2023) explores the interplay between information technology adoption and economic growth in India, utilizing ARDLB and ADFT to investigate long-term correlations and data stationarity, respectively. Diagnostic tests fortify model integrity, providing new perspectives.

Surahio, Gu, Mahesar, and Soomro (2022) scrutinize the China-Pakistan Economic Corridor (CPEC) in SAGE Open, assessing its macro-environmental factors, security challenges, and strategies for success amid complexities. Abdul Kareem, Jimoh, and Shasi (2022) delve into Nigeria's socioeconomic landscape, employing econometric tests like ADF and ARDLB, bolstered by diagnostic checks, to provide nuanced insights into development and poverty reduction. Sohail et al. (2022); and Hussain, Maitlo, Mustafa, & Mujahid, (2022). analyze Pakistan's economic growth response to macroeconomic variables in "Response of Pakistan's economic growth to macroeconomic variables: an asymmetric analysis." Using econometric techniques like ADFT and ARDLB, they explore enduring relationships and data stationarity, ensuring credibility with diagnostic tests, stability assessments, and normality tests.

Khan et al. (2022) investigate FDI's nexus with economic growth, industrialization, and employment opportunities in Pakistan. Econometric regression tests, including ADFT and ARDLB, analyze these relationships, with diagnostic checks ensuring result robustness. Stability tests assess relationship endurance, while Normality tests validate data distribution. Khan et al.'s study offers empirical evidence on complex interactions within Pakistan's economy. Khan et al. (2022) investigate the impact of financial inclusion on economic factors across G20 nations, employing ADF and ARDLB tests for stability and assessing enduring relationships. ASER Pakistan's literature review on education in Pakistan examines various educational aspects. Although specific econometric tests are not detailed, methodologies like ADF, ARDLB, and diagnostic tests are commonly used. Stability and Normality tests ensure robust findings, enhancing credibility in educational analyses.

Özyılmaz et al. (2022) probe the healthcare spending-economic growth nexus in EU countries, employing the Panel Fourier Toda–Yamamoto Causality Test and regression models. Diagnostic tests ensure data reliability, while Stability and Normality tests validate findings. Batool (2020) examines the impact of government spending on education and health sectors on Pakistan's economic growth, employing ADF and ARDLB tests for stationarity and cointegration, with diagnostic tests ensuring accuracy. Manzoor et al. (2019) study sustainable tourism's impact on Pakistan's economy and employment using ADFT, ARDLB, diagnostics, stability, and Normality tests. Sarwar, Alsaggaf, and Ting-Qiu (2019) investigate economic, education, healthcare, and environmental sustainability links via econometric regression, validated by diagnostics, stability assessments, and Normality tests.

Javid (2019) examines the impact of public and private infrastructure investments on Pakistan's economic growth. Utilizing econometric techniques such as ADF and Autoregressive Distributed Bound tests, the study ensures robustness and comprehensiveness. Diagnostic tests and stability assessments further validate findings, with Normality tests assessing data distribution. Saleem Rahpota et al. (2018) analyze the socio-economic effects of the Benazir Income Support Programme in Pakistan, focusing on empirical evidence with potential employment of ARDLB tests and diagnostic checks. Kieny (2017) reviews healthcare system strengthening for universal health coverage and sustainable development goals, highlighting challenges and suggesting the use of econometric tools in future research. Haider et al. (2012) examine infrastructure's impact on Pakistan's economic growth using econometric regression, ADF, and ARDLB tests, ensuring validity and stability through diagnostics.

Gupta (n.d.) assesses government spending's impact on education and healthcare in developing nations, using ADF and ARDLB tests for stationarity and long-term relationships, with diagnostic and stability checks for reliability.Tabar (n.d.) investigates the impact of government spending on education and economic growth in Iran. Employing the ARDLB test, the study explores long-term effects, while the ADF test ensures stationarity. Diagnostic and stability tests enhance validity, with Normality tests validating statistical assumptions. Armeanu, Vintilă, and Gherghina (2017) investigate sustainable growth drivers in the EU-28, employing econometric regression, ADFT, and ARDLB tests with diagnostic, stability, and Normality assessments. Afzal and Yusuf (2013) provide a comprehensive overview of the health landscape in Pakistan. While specific econometric tests are not mentioned, diagnostic tools like the ADF test might be utilized for stationarity assessment. Stability and Normality tests could ensure robust analysis.

Seke et al. (2013) examine sustainable development and public health in European countries using econometric regression tests like the ADF and ARDLB. Diagnostic checks validate results, stability tests assess consistency, and Normality tests validate assumptions. Ali, L., Saeed, D., & Ahmed, A. (2016); and Mansha, Yang, Mustafa, & Nasim, (2022) study human capital formation determinants in Pakistan, employing ADFT and ARDLB tests with diagnostic, stability, and Normality assessments. Khan and Toor (2003) analyze changes in returns to education in Pakistan using econometric techniques like the ADF and ARDLB tests. Diagnostic and stability tests enhance validity, while Normality tests validate data distribution. Self and Grabowski (2004) explore the causal relationship between education and economic growth in India using econometric regression tests like the ARDLB and ADF. Diagnostic checks ensure reliability, stability assessments evaluate persistence, and Normality tests validate distributional assumptions. Pesaran et al. (2001) introduce innovative econometric tests like the ARDLB test for level relationships. Their approach utilizes the ADF test for stationarity, diagnostic tests for validity, stability assessments for consistency, and Normality tests for data distribution validation.

3. Methodology

Time series data from World Development Indicators, State Bank of Pakistan, and Pakistan Statistical Bureau were collected to analyze the impacts of various factors on GDP growth in Pakistan. The study focuses on variables like employment (EMP), government expenditure on education (GEE), gross fixed capital formation (GFCF), health expenditure (HE), secondary school enrollment (SENR), and gender parity index. The analysis spans from 1975 to 2022, employing multiple linear regression to explore the relationship between these independent variables and GDP growth. The research framework guides data collection, analysis, and interpretation, aiming to provide insights into socio-economic inclusion and sustainable economic growth in Pakistan.

The general form of the equation is:

$$GDPGt = \beta 0 + \beta 1\ EMPt + \beta 2GEEt + \beta 3GFCFt + \beta 4\ HEt + \beta 5\ SENRt + \varepsilon t \text{-(1)}$$

Here,

- *GDPG t* is the dependent variable (Gross Domestic Product Growth) at time (t).
- $\beta 0$ is the intercept.
- $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$ are the coefficients for the independent variables EMP, GEE, GFCF, HE, and SENR, respectively.
- EMPt, GEEt, GFCFt, HEt, SENRt are the values of the independent variables at time (t).
- εt represents the error term, which captures unobserved factors affecting GDPG that are not included in the model.

4. Description of Variables

4.1. GDPG

Annual percentage growth rate of Pakistan's Gross Domestic Product, reflecting the country's economic performance. Positive values indicate growth, while negative values signal contraction.

4.2. EMP

Reflects the employment rate among individuals aged 15 and above, indicating labor force participation. Higher values signify greater employment relative to the working-age population.

4.3. GEE

Represents the portion of Pakistan's GDP directed towards education. Higher values suggest a greater focus on education within national budget allocations.

4.4. GFCF

GDP share invested in tangible assets such as structures and equipment, signaling a focus on capital accumulation and long-term economic growth.

4.5. HE

Percentage of Pakistan's GDP spent on healthcare, indicating priority given to the health sector. Higher values may reflect commitment to improving healthcare infrastructure and services.

4.6. SENR

Total enrollment in secondary education, with the Gender Parity Index measuring relative access for males and females.

Table 1

Variables	Description	Sources
Dependent Variable(s)		
1. Economic Growth Rate	GDP growth (annual %)	PSB/WDI/SBP
Independent Variables		
1. Education Level	1. School enrollment, secondary (gross), gender parity index (GPI)	PSB/WDI/SBP
2. Socio-economic variable	1. Current health expenditure (% of GDP) 2. Government expenditure on education, total (% of GDP)	PSB/WDI/SBP
3. Labor Market Indicators	1. Employment to population ratio, 15+, total (%) (national estimate)	PSB/WDI/SBP
4. Investment and Capital Formation	1. Gross fixed capital formation (% of GDP)	PSB/WDI/SBP

5. Result and Discussion

The research presents descriptive statistics for six economic variables: GDPG, EMP, GEE, GFCF, HE, and SENR. Each variable is observed 48 times. Table 2 summarizes mean, standard deviation, minimum, and maximum values for each variable. For example, the mean GDPG value of 4.81 indicates an average annual growth rate of 4.81%, with a standard deviation of 2.15.

The results section features the BGSCLM Test, assessing variable interconnections and temporal trends. Serial correlation analysis detects autocorrelation issues in time series data. Comparing F-statistic and R-squared values with critical values from a chi-square distribution suggests no significant serial correlation, indicating a well-specified model. Positive correlations are observed between GDPG (-1), EMP, GEE (-1), and GFCF with RESID. A 1% increase in GDPG (-1) leads to a 0.094-unit change in RESID, while EMP, GEE (-1), and GFCF show similar associations.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDPG	48	4.8051	2.1471	-1.2741	10.2157
EMP	48	49.976	2.6165	41.8	55.16
GEE	48	2.3436	0.3646	1.7675	3.2816
GFCF	48	16.035	1.7379	12.52	19.112
HE	48	0.8091	0.2205	0.44	1.3535
SENR	48	0.57705	0.18855	0.32147	0.88433

Source: Author's estimation

Table 3: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.26998	Prob. F (2, 20)	5%	0.7661
Obs.*R-squared	1.15667	Prob. Chi-Square (2)	5%	0.5608

Source: Author's estimation

5.1. The Augmented Dickey-Fuller Test

The Augmented Dickey Fuller (ADF) Test is pivotal in assessing data stationarity, crucial for reliable outcomes in this study's analysis.

The general form of the ADFT equation is:

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta y_{t-2} + \ldots + \delta_p \Delta y_{t-p} + \varepsilon_t$$

In this equation:

Δ represents the first difference, calculated as the gap between the current and preceding values of the variable.

yt is the level of the time series at time t.

α is the constant term.

β is the coefficient on the trend term (t).

γ is the coefficient on the lagged level term (y_{t-1}).

1, 2,… $\delta 1$, $\delta 2$…, δp are coefficients on the lagged first difference terms (Δ−1, Δ−2…, Δ−Δyt−1, Δyt−2…, Δyt−p).

εt is the residual term or the error term.

ADF's alternative hypothesis (H1) suggests data lacks unit root, while the null hypothesis (H0) posits its presence.

$GDPGt = \beta 0 + \beta 1\ EMPt + \beta 2 GEEt + \beta 3 GFCFt + \beta 4\ HEt + \beta 5\ SENRt + \varepsilon t$ ------(2)

The Augmented Dickey-Fuller Test (ADF Test) results reveal varied stationarity among economic variables in their original form. While GDPG and EMP show likely stationarity, others like GEE, GFCF, HE, and SENR do not. However, after the first difference transformation, all variables exhibit stationarity, with highly significant test statistics and low probabilities. This transformation effectively addresses non-stationarity issues, ensuring stability in the time series data and facilitating reliable econometric modeling. In essence, while some variables may be stationary at their original level, all become stationary after differencing, emphasizing the effectiveness of this technique in rendering series stationary and enhancing the robustness of subsequent analysis.

Table 4: Descriptive Statistics Unit Root Test

At Level						
	GDPG	EMP	GEE	GFCF	HE	SENR
t-Stats	-4.90	-3.57	-2.82	-1.75	-0.86	-0.06
Prob	0.0002	0.0101	0.062	0.3961	0.7915	0.9473
1st Difference						
		D(EMP)	D(GEE)	D(GFCF)	D(HE)	D(SENR)
t-Stats		-11.84	-6.43	-6.22	-5.50	-7.44
Prob		0.0000	0.0000	0.0000	0.0000	0.0000

Source: Author's estimation

5.2. Autoregressive Distribution Lag Model (ARDL)

In this study, we utilized the ARDL methodology to gauge a specific variable's impact on Pakistan's economic growth, offering simplicity and robustness compared to prior methods. Employing the ARDL Long Run Form and Bounds Test, we examined co-integration, revealing a lasting relationship between variables crucial for economic analysis and policy formulation. With an F-statistic of 13.22117, compared against critical values, we confirmed co-integration, highlighting the variable's contribution to or hindrance of the nation's economic development. This approach provides comprehensive insights into long-term dynamics and sustained associations among variables over time.

Table 5: ARDL Bound Test for Correlation among the Variables.

Test critical values		Sig. level	I (0)	I (1)
			Asymptotic: n=1000	
F-stats	13.22117	10%	2.08	3
K	5	5%	2.39	3.38
		1%	3.06	4.15
Actual Sample Size	45		Finite sample: n=40	
		10%	2.26	3.29
		5%	2.69	3.82
		1%	3.67	5.01

Source: Author's estimation

Table 6: Long Run Coefficients: Conditional Error Correction Regression

Variable	Coefficients	S. Error	t-Stats	Sig.val.
EMP	-0.265006	0.154025	-1.720547	0.0994
GEE	-5.162889	0.154025	-4.318478	0.0003
GFCF	-1.444162	0.471711	-3.061537	0.0057
HE	3.361561	1.484956	2.263744	0.0338
SENR	-11.90063	2.905883	-4.095357	0.0005
C	58.01825	16.13220	3.596426	0.0016

Source: Author's estimation

Table 7: Short Run Coefficients: Level Equation

Variable	Coefficients	S. Error	t-Stats	Sig. val.
D(EMP)	-0.263026	-0.263026	-1.867187	0.0753
D(GEE)	0.462764	1.175301	0.393741	0.6976
D(GFCF)	0.205230	0.337921	0.607331	0.5498
D(HE)	-0.478030	2.734935	-0.174787	0.8628
D(SENR)	-14.30055	9.746540	-1.467244	0.1565
CointEq(-1)	-0.992525	0.091451	-10.85305	0.0000
R-squared	0.884192	Mean dependent var	-0.042239	
Adjusted R-squared	0.822152	S.D. dependent var	2.568196	

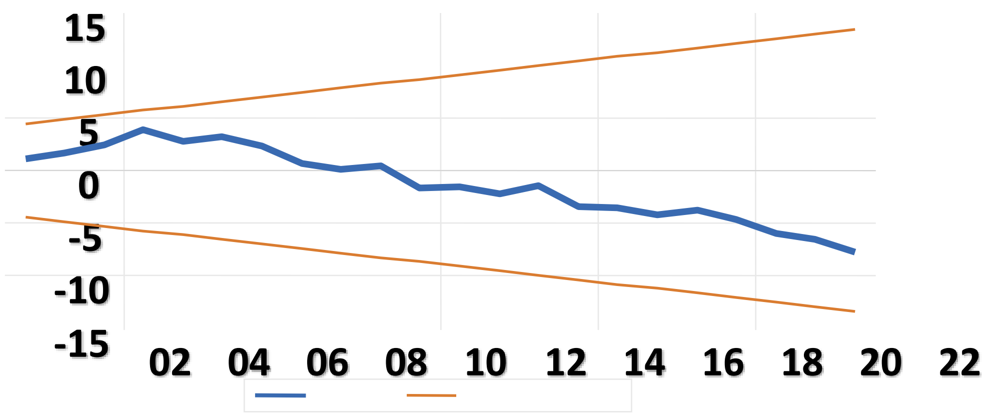
Source: Author's estimation

5.3. Stability Tests: CUSUM and CUSUM Squares

Utilize Cusum and Cusum squares tests to evaluate parameter stability over time, identifying structural changes in variable relationships.

5.3.1. CUSUM Chart

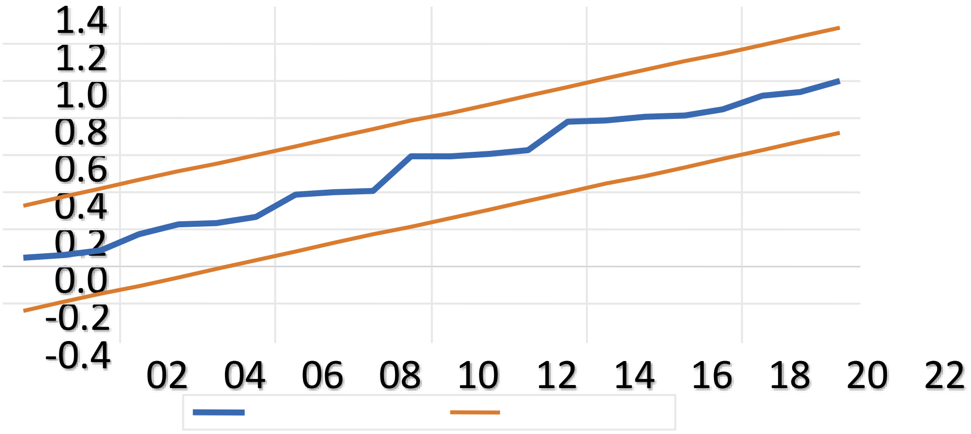
The CUSUM chart tracks deviations of observations from a target value over time. The blue line represents cumulative deviations, while dotted lines indicate significance levels. Crossing these lines signals significant changes in process average or variability, as confirmed by statistical analysis. The chart shows control until point 10, then a persistent decrease suggests a shift below the target or increased variance.



Graph 1: CUSUM chart

5.3.2. CUSUM of Squares

Graph 2 depicts the CUSUM of Squares method, a tool for detecting changes in process mean or variance. The increasing CUSUM of Squares line signals growing deviations from the expected value, implying a potential shift in mean or increased variability. Crossing the Significance line indicates statistically significant changes, warranting investigation into process quality or stability.



Graph 2: CUSUM Squares

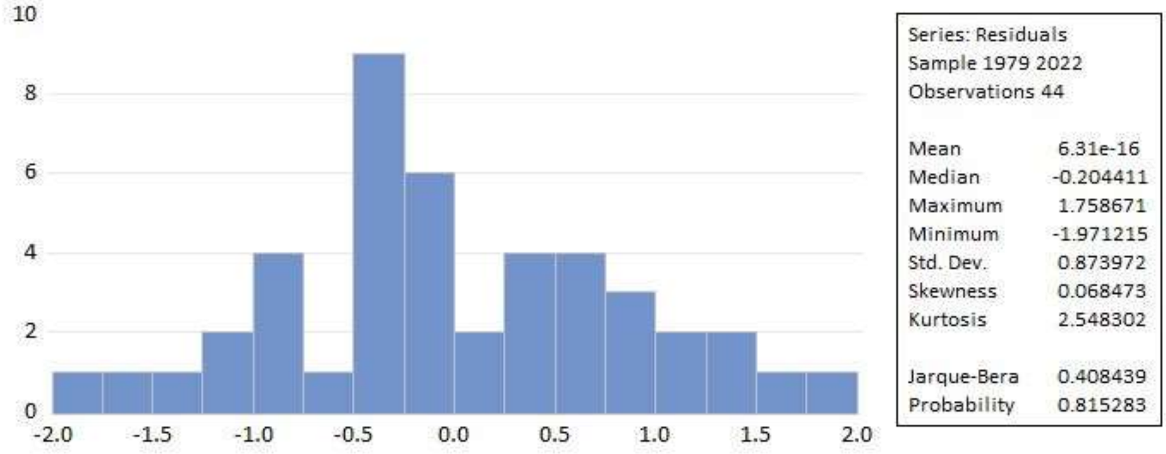
5.4. Heteroskedasticity Test

Heteroskedasticity occurs when error variability in a regression model varies unevenly across explanatory variables. Detecting and addressing it is vital for robust and accurate regression analysis. Table 6's F-statistic and p-value help determine if heteroskedasticity exists. A low p-value rejects the homoskedasticity assumption, indicating significant heteroskedasticity. Conversely, a high p-value suggests no significant variability in errors.

The p-value of 0.975007 suggests no evidence of heteroskedasticity, ensuring reliable coefficient standard errors, a favorable outcome for the model.

5.5. Normality Test: Histogram

The histogram of residuals in graph 3 reveals the distribution and characteristics of errors. With a mean close to zero and standard deviation of 0.878972, predictions exhibit variability. A prominent peak at -0.5 indicates underpredicted observations. The Jarque-Bera test, yielding a probability of 0.815283, suggests no significant deviation from normality.



Graph 3: Histogram Test of Normality (Jarque - Bera Test)

5.6. Regression Specification Error Test

Ramsey RESET test evaluates model fit by detecting omitted variables. In Table 8, high p-values (0.98) for t-Stats and F-Stats imply no specification error. Test SSR indicates negligible contribution of additional variables to explaining variation in the dependent variable.

The Ramsey RESET test shows no significant evidence of specification error, indicating the current model is adequately specified. It's important to consider these results alongside other diagnostics and the research context.

Table 8: Diagnostics Tests Results

Diagnostic Tests	F-statistic	Prob. F (5%)	Results
Serial Correlation LM Test:	0.26998	0.7661	Test confirms well-specified model (p > 0.05)
Heteroscedasticity Test:	0.417728	0.9750	Finds no evidence of varying error variance
Ramsey RESET Test:	0.00037	0.98	High p-values suggest the model is well-specified.

5.7. Summary of Findings

The research provides extensive insights into Pakistan's economy, employing diverse statistical analyses and modeling techniques. Key findings include:

1. The BGSCLM Test identifies temporal patterns, affirming observation independence.
2. URT reveals stationarity variations among economic variables.
3. ARDLM unveils factors impacting Pakistan's economic growth.
4. ARDLB confirms enduring variable relationships over time.
5. Stability tests detect shifts in process mean or variance.
6. Absence of heteroskedasticity ensures reliable model coefficients.
7. Histogram and normality tests validate model adequacy.
8. Ramsey RESET test supports overall model fit, indicating minimal specification errors.

These analyses deepen our understanding of Pakistan's economic dynamics, offering insights into growth determinants.

6. Conclusion & Recommendation

In conclusion, this study delves into the intricate relationship between socio-economic inclusion and sustainable economic growth in Pakistan, drawing from a comprehensive dataset spanning 48 years. Utilizing data from reputable institutions such as the PBS, SBP, and WDI, the research employs robust methodologies including ARDLM, ARDLB Test, and other statistical tests to uncover nuanced insights into Pakistan's economic trajectory. The analysis highlights the significance of healthcare investment, infrastructure development, and education in driving economic progress.

The findings underscore the importance of prioritizing healthcare investment, infrastructure development, and education expenditure for sustainable economic growth. Policymakers are urged to address employment challenges, promote gender inclusivity in education, and adopt long-term economic planning strategies. Continuous monitoring and evaluation, coupled with attention to stationarity issues in education and healthcare variables, are deemed essential for effective policy implementation.

These evidence-based recommendations offer a roadmap for fostering inclusive and enduring economic development in Pakistan, ensuring resilience and sustainability amidst evolving socio-economic dynamics. The study's implications are invaluable for policymakers and researchers, providing evidence-based insights for informed decision-making and targeted interventions aimed at promoting inclusive and sustainable economic development in Pakistan.

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