Investigating the Inflation-Economic Growth Nexus in Pakistan from 1990 to 2020

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Abstract:

Purpose: This study explores the historical nexus between inflation and economic growth in Pakistan, spanning the years from 1990 to 2020. The main aim of the present study is to investigate the nexus between inflation and economic growth in Pakistan, and to suggest recommendations for inflation and GDP growth.

Design/Methodology/Approach: Through a meticulous examination of economic variables, policy shifts, and external influences, this study uncovers the intricate dynamics shaping Pakistan's economic scenario. Drawing inspiration from a rich tapestry of scholarly endeavors, the research synthesizes insights from diverse perspectives to offer a comprehensive understanding of this nexus. Empirical findings underscore a critical gap in the comprehensive historical analysis specific to the Pakistani economic context. Descriptive statistics analysis reveals the dynamic nature of variables, showcasing mean values, variability, and distribution characteristics. Unit root tests affirm significant associations among GDP growth, inflation, and unemployment indicators, while correlation analysis unveils a negative relationship between GDP and inflation, highlighting the complex interplay between economic growth and price stability. Vector autoregression estimates and least square regression methods further validate these relationships, emphasizing the impact of inflation and unemployment on GDP growth. The ECM model introduces a temporal dimension, elucidating short-term dynamics and long-term equilibrium relationships.

Findings: The research establishes intricate links between inflation, economic growth, unemployment, and foreign direct investment, providing empirical evidence supporting the existence of a meaningful nexus. The negative correlation between inflation and GDP growth implies that policymakers should carefully consider inflationary pressures to foster sustainable economic development.

Practical Implications: Policy recommendations anchored in empirical evidence are proposed to ensure a balanced and favorable nexus between inflation and economic growth in Pakistan. These findings contribute to the broader economic discourse, offering valuable insights for policymakers, researchers, and practitioners aiming to guide Pakistan's economic trajectory with evidence-based strategies.

Originality/Value: Thoughtful state interventions and targeted strategies are recommended to maintain a favorable level of inflation conducive to positive economic growth.

Keywords: ADF, ECM, Pakistan, Economic Growth rate, FDI, Inflation, Nexus.

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1. Introduction

To investigate the inflation-economic growth nexus in Pakistan, this research undertakes a focused investigation into the context of Pakistan. The aim is to unravel the historical dynamics that have shaped the interplay nexus between inflation and economic growth in Pakistan's economy in recent years. By meticulously examining economic variables, policy shifts, and external influences, we seek to discern patterns and trends defining this nexus in Pakistan.

As an economist traversing a complex economic landscape, understanding the historical background of this relationship is paramount for informed future decision-making and policy formulation for the country. Secondly, based on empirical findings, the study endeavors to propose particular policy recommendations aimed at ensuring a balanced and favorable nexus between inflation and economic growth rate in Pakistan.

These recommendations will be positively anchored in evidence and aim to offer pragmatic insights for economic policymakers and decision-makers. This research aims to contribute not only to the understanding of the economy but also to contribute valuable knowledge to the broader discourse on economic dynamics, with actionable policy guidance for sustainable development in Pakistan.

Drawing inspiration from a rich tapestry of scholarly endeavors, the study embarks on a journey through diverse lenses, each contributing a unique and strong facet to our understanding. Mehak and Waqas, (2023) set a course, unfurling a narrative where inflation, exchange rates, and foreign direct investment play very important roles, unveiling a delicate dance that shapes the nation's growth trajectory.

Meticulous inquiry by Iqbal, Nadeem, and Akbar (2022) brought to light determinants of inflation, unraveling threads that weave it into the fabric of economic growth. (Ali, Mansoor, Iram, Khan, and Ali, 2023) provided further insights, unraveling the intricate relationship between external debt, inflation rates, and the economic pulse of Pakistan.

Ramazan, Osman, and Fatih (2020) broadened our horizon, offering a comparative perspective by exploring experiences of inflation in the area of targeting countries. Rutayisire (2015) directed our gaze to Rwanda, revealing the nuanced interplay between inflation and economic growth, underscoring the relevance of thresholds in this intricate dance.

Rousseau and Yilmazkuday (2009) expansive study, using data from 80 countries, illuminated the multifaceted interaction between inflation, financial development, and growth. In the specific context of Pakistan, (Uddin, 202; Khan, Hue, Zaman, and Mehmood, 2023) contributed by unraveling the intricacies of the GDP-inflation relationships and the impact of the Gwadar seaport on various economic indicators.

The symphony of insights crescendos with Ramzan (2021) exploration of inflation and unemployment's influence on the economic growth of Pakistan, underlining the imperative for essential policy interventions. Imran, Ali, and Kanwal (2022) meticulous investigation completes the ensemble, affirming the lasting relationship between inflation and economic growth in the Pakistani context.

In the context of the Pakistani economy, the nexus between inflation and economic growth rate lacks a comprehensive historical analysis. While global existing studies on this nexus exist, a specific examination within the Pakistani context is notably absent. This gap should be filled for effective policy formulation, potentially compromising sustainable development and macroeconomic stability in the country.

Bridging this gap is crucial for policymakers, decision-makers, economists, and scholars aiming to guide Pakistan's economic trajectory with evidence-based strategies. The research question of this study is "what is the historical nexus between inflation and economic growth rate in Pakistan? What policy measures can be recommended based on empirical findings to ensure a balanced and favorable nexus between inflation and growth rate in Pakistan?"

The first objective of the research is to investigate the nexus between inflation and economic growth in Pakistan. The second objective is to suggest recommendations for inflation and GDP growth. It is needed to explore if inflation in the time-series negatively affected the growth of the economy or not. The literature review of the study provides valuable insights into the relationship between inflation and economic growth, with a focus on Pakistan.

However, despite the extensive research conducted in this area, several gaps remain to be addressed. While many studies have examined the inflation-economic growth nexus in Pakistan, they predominantly focus on specific time periods. There is a need for a comprehensive analysis covering the entire period from 1990 to 2020 to capture any evolving patterns or changes in the relationship over time.

Existing studies employ different econometric techniques, including ARDL models, OLS, panel data analysis, and threshold models. But there is a lack of consensus regarding the most appropriate methodology for analyzing the inflation-growth relationship in the Pakistani context. Addressing this gap requires a comparative evaluation of different methodologies to determine their efficacy and robustness.

While most studies investigate the impact of inflation on economic growth, there is limited exploration of other relevant variables that may influence this relationship. Policy implications: Despite the extensive empirical literature, there is limited discussion on the policy implications of the findings. A deeper analysis of the policy implications arising from the inflation-growth relationship can provide valuable guidance to policymakers in Pakistan for formulating effective monetary and fiscal policies to promote sustainable economic growth.

Addressing these research gaps will contribute to a more nuanced understanding of the inflation-economic growth nexus in Pakistan and provide valuable insights for policymakers and researchers alike

2. Literature Review

2.1 Theoretical Framework

2.1.1 Classical Economic Growth Theory: Unraveling the Foundations of Economic Expansion

Classical Economic Growth Theory: An important pillar in economic thought, has its origins in the work of founding economists such as Adam Smith, David Ricardo, and John Stuart Mill. This theory, prevalent in the late 18th and 19th centuries, explains the determinants of economic growth, with a focus on factors such as capital accumulation, technological progress, and the role of the competitive market system.

Role of Capital Accumulation: Classical economists explained the significance of saving and the accumulation of capital in fostering economic growth. The accumulation of physical capital, such as machinery and infrastructure, was seen as a precursor to increased productivity (Smith, 1776).

Comparative Advantage and Trade: David Ricardo's theory of comparative advantage emphasized international trade as a catalyst for economic growth. Specialization and trade were seen as mechanisms to enhance efficiency and resource utilization (Ricardo, 1817; Malthus, 1798).

Population Growth and Subsistence Wages: The Malthusian theory, proposed by Thomas Malthus, introduced the idea that population growth tends to outpace the growth of resources, leading to subsistence wages. This theory highlighted the role of demographic factors in shaping economic growth outcomes (Malthus, 1798).

Implications and Evolution: While the Classical Economic Growth Theory laid the groundwork for understanding economic dynamics in the economy, subsequent theories, such as Neoclassical Growth Theory and Keynesian economics, emerged to refine and expand upon these classical ideas.

2.1.2 Neoclassical Growth Theory: Unraveling Economic Dynamics

The Neoclassical Growth Theory: A fundamental and basic concept in modern economics, emerged in the mid-20th century through seminal contributions by economists Robert Solow and Trevor Swan. This theory explains the determinants of economic growth, emphasizing the interplay between capital accumulation, technological progress, and the role of diminishing returns.

Capital Accumulation and Diminishing Returns: Neoclassical economists argue that sustained economic growth results from physical capital accumulation. The theory introduces the concept of diminishing returns, suggesting that as capital increases, the marginal productivity diminishes, affecting the pace of growth (Solow, 1956).

Technological Progress as a Driver: An essential tenet of the Neoclassical Growth Theory is the role of technological progress in shaping long-term growth. Innovations and improvements in technology are considered vital factors influencing productivity and economic expansion (Romer, 1990).

Exogenous vs. Endogenous Growth: Neoclassical Growth Theory has evolved into discussions about exogenous and endogenous factors driving growth. While exogenous growth models emphasize external factors, endogenous growth models explore how internal mechanisms, such as investments in human capital and research, can fuel economic expansion (Lucas, 1988).

Policy Implications: Neoclassical Growth Theory has influenced policy discussions, emphasizing the role of state policies that encourage savings, investments, and technological advancements to sustain long-term economic growth in the economy.

Contemporary Extensions: Contemporary economists have extended Neoclassical Growth Theory, incorporating additional factors and refining the model to better capture the complexities of modern economies.

2.1.3 New Keynesian Economic Theory: Unraveling Economic Dynamics in the Modern Context
The New Keynesian Economic Theory: It is a prominent school of thought in modern macroeconomics that incorporates Keynesian principles by incorporating microeconomic foundations. Developed in the late 20th century, the theory addresses imperfections in markets and explores how nominal rigidities, particularly in wages and prices, impact economic fluctuations (Hakim and Thalassinos, 2023).

Price and Wage Stickiness: A central tenet of New Keynesian economics is the acknowledgment of sticky prices and wages. New Keynesians posit that prices and wages do not adjust instantaneously to changes in demand and supply, creating short-run economic frictions (Mankiv, 1985; Thalassinos *et al.,* 2022).

Imperfect Competition: New Keynesian models often introduce imperfect competition in product and labor markets. This departure from perfect competition allows for a more realistic depiction of market dynamics and the impact of market power on economic outcomes (Rotemberg, 1982; Hakim and Thalassinos, 2021).

Monetary Policy and Expectations: The theory places significant emphasis on the role of monetary policy in stabilizing the economy. According to New Keynesians, central banks can influence economic outcomes through interest rate adjustments.

Expectations play a crucial role in shaping the effectiveness of monetary policy (Clarida, Gali, and Gertler, 1999).

Empirical Validation: Empirical research within the New Keynesian framework often employs dynamic stochastic general equilibrium (DSGE) models to analyze the behavior of key economic variables, providing insights into the empirical relevance of New Keynesian principles.

Policy Implications: The New Keynesian Economic Theory has influenced macroeconomic policy discussions, especially in the realm of monetary policy. Understanding the role of price and wage rigidities helps policymakers formulate strategies to address economic fluctuations.

2.2 Empirical Studies and Research Findings

Ali, Mansoor, Iram, Khan, and Ali (2023), found a relationship between external debt, inflation rate, and economic growth in Pakistan. The purpose of the study was to explore the impacts of inflation and external debt on economic growth in Pakistan, using time series data from 1981 to 2020.

The study utilized the ARDL model and ADF test. The results showed that external debt and inflation negatively and significantly affected economic growth. The variables of the agriculture sector and gross savings were found to have a significant and positive impact on the economic growth of Pakistan (Hakeem, Olatayo, and Attah, 2023). This study explored the effect of inflation and interest rate on economic growth rate in Nigeria.

The purpose of the study was to investigate this relationship in Nigeria using a descriptive research design. The data for the variables were collected from the CBN statistical bulletin and NDIC, and the OLS technique was used for analysis. The results of the study showed a significant inverse relationship between GDP and inflation, while the relationship between interest rate and GDP was positive but not significant.

Imran, Ali, and Kanwal (2022), explored the impact of inflation on economic growth in Pakistan. The aim of the research was to find a long or short-run relationship between inflation and economic growth indicators in Pakistan. The study used annual data of inflation and Pakistan. Inflation was independent, growth rate was dependent, and population growth rate was used as a control variable in this study.

ADF and Philips Perron tests of unit root test of econometric techniques were used to check the stationarity and non-stationarity of the data. The ARDL model was used to check the integration order of the variables. The results of the study showed a long-run relationship between inflation and economic growth in Pakistan.

Iqbal, Nadeem, and Akbar (2022), investigated the determinants of inflation in Pakistan and its relation to economic growth. The aim of the study was to explore the effect of money supply, gross domestic product, and exchange rate on the inflation rate in the economy. The study used the autoregressive distributed lag (ARDL) stationarity model and bound test as econometric and time series techniques.

The results of the study showed a long-term relationship among the variables. In the long run, the effect of the exchange rate on inflation was inverse, and the impact of money supply on inflation was direct and positive. GDP impact was direct on lag one and inverse on lag two. The study covered the period from 1973 to 2014, and the source of data was the World Bank Indicators WDI.

Khan, Hue, Zaman, and Mehmood (2023), investigated FDI and employment opportunities arising in Pakistan by the Gwadar seaport. The study examined the impact of gross capital formation, gross domestic income, economic growth, industrialization, and population growth from 1990 to 2019.

The study used ADF and PP unit root tests, as well as ARDL and bound tests for long- and short-run estimations. The results showed that an increase in FDI, gross capital formation, and industrialization increased employment in the long run and short run. Gross domestic income, economic growth, and population growth were negatively connected to jobs.

Mamo (2012), investigated the economic growth and inflation analysis of panel data. The objective of the study was to investigate the relationship between inflation and economic growth. The variables included real GDP growth rate, inflation, and GDP per capita. The study utilized panel data from 13 SSA countries from 1969 to 2009.

The research employed regression models and panel Granger causality tests. The results showed that inflation had a negative and significant relationship with economic growth based on the panel Granger causality test. Inflation had an adverse effect on economic growth, while inflation and real GDP per capita had an opposite trend.

Mehak and Waqas (2023), checked the impact of inflation, exchange rate, FDI, and growth rate. The study used time series data from 1973 to 220, sourced from World Development Indicators and SBP. The research found a favorable long-term relationship when inflation was below 2.80% but hindered growth. The effect of FDI on growth was positive when inflation was below the threshold and negative when inflation was above the threshold level.

Ramazan, Osman, and Fatih (2020), investigated the relationship between inflation and economic growth in inflation targeting countries. The objective of the study was to examine the relationship between price stability and economic growth in selected

countries applying inflation targeting. The study considered variables such as per capita GDP, growth rate, inflation, openness, and population growth rate. The study utilized panel data collected from World Development Indicators (WDI) and the International Financial Statistics (IFS) database of the IMF.

The study used a threshold dynamic panel data model to make a comparison between inflation targeting countries. The results showed that the inflation-economic growth relationship was nonlinear.

Rousseau (2002), investigated the relationship between inflation and financial development growth. The objective of the study was to find the interaction between economic growth-inflation and growth-finance relationships. The study utilized panel data from 80 countries from 1960 to 1995, sourced from the World Bank's Development WDI. The study employed cross-section regression models. The results showed that inflation inhibited economic growth both directly and indirectly through its effect on financial sector development.

Rousseau and Yilmazkuday (2009), researched inflation, financial development, and growth. The objective of the study was to find the interaction between the growth-inflation and growth-finance relationships. The study utilized panel data from 80 countries from 1960 to 1995. The results showed that inflation affected economic growth both directly and indirectly through its effect on financial sector development. Real GDP per capita, CPI, and gross fixed capital formation showed a long-run inflation directly related to economic growth in a bi-directional manner.

Rutayisire (2015), investigated threshold effects in the relationship between inflation and economic growth in Rwanda. The purpose of the study was to investigate the relationship between inflation and growth in Rwanda and determine whether there was a turning point or threshold level of inflation. The study considered variables such as real GDP growth rate, inflation rate, inflation/GDP, and openness. A quadratic regression model was applied to determine the level of the threshold.

Recent studies have uncovered that the relationship between inflation and growth may be non-linear. There was shown to be a positive relationship between low inflation and high output growth, while higher inflation was associated with a lower economic growth rate.

Valdovinos (2013), studied the relationship between inflation and economic growth in the long run. The objective of the research was to investigate whether the growth rate of the economy and the level of inflation were inversely correlated in the long run. The variables included GDP and inflation rate. The study utilized time series data analysis, with data collected from the International Monetary Fund's International Financial Statistics. The study used the approximate band-pass filter developed by Baxter and King (1995) to obtain the low-frequency components in the

time series. The results showed that the average long-run rate of inflation in a country was negatively associated with the country's long-run rate of growth.

3. Materials and Methods

Variables: Gross Domestic Product Growth (GDP), Inflation (CPI), Foreign Direct Investment (FDI), Unemployment rate (U).

The data related to this study is collected from 1990 to 2020. last 31 years data. and sources of data are from World Bank indicators and International monetary Fund.

GDP Growth Model: Dependent Variable: GDP Growth, Independent Variables: Inflation, FDI, Unemployment

Equation: $GDP = \beta 0 + \beta 1 \times Inflation + \beta 2 \times FDI + \beta 3 \times Unemployment + \epsilon$

Assess the impact of inflation, foreign direct investment (FDI), and unemployment on GDP growth.

Least square Method model: Dependent Variable: GDP Growth, Independent Variables: Inflation, FDI, Unemployment

$GDP = \beta 0 + \beta 1 \times Inflation + \beta 2 \times FDI + \beta 3 \times Unemployment + \epsilon$

The intercept ($\beta 0$) represents estimated GDP Growth Rate when all independent variables are zero.

The coefficient Inflation ($\beta 1$) indicates change in GDP Growth Rate for one-unit increase in Inflation, holding other variables constant.

The coefficient FDI ($\beta 2$) represents change in GDP Growth Rate associated with one-unit increase in FDI, while controlling for other variables.

The coefficient Unemployment ($\beta 3$) signifies impact on GDP Growth Rate for one-unit change in Unemployment, keeping other factors constant.

ECM, Error Correction Model: Dependent Variable: GDP growth rate, Independent Variables: Inflation, FDI, Unemployment, Lagged GDP, Error Correction Term

Equation: $\Delta GDP = \alpha 0 + \alpha 1 \times \Delta Infl + \alpha 2 \times \Delta FDI + \alpha 3 \times \Delta Unemplt + \beta 1 \times ECt-1 + \epsilon$

Capture short-term and long-term effects, emphasizing the importance of inflation, FDI, and unemployment dynamics.

4. Results and Discussion

4.1 Descriptive Statistics Analysis

According to descriptive statistics, the average GDP is 4.17%, with a maximum of 8.00% and a minimum of -0.90% observed. The average GDP growth shows an overall moderate economic expansion, but the average rate of inflation at 8.25% indicates a dangerous level of price pressure in the economy. This pattern suggests a potential connection between inflation and GDP. Higher inflation coincides with periods of lower GDP growth, as indicated by the skewness value (Table 1).

Table 1. *Descriptive Statistics Analysis*

| Statistics / Variable	GDP Growth (Percent)	Inflation (CPI) Percent	Unemployment rate Percent	YEARS
Mean	4.167742	8.254194	6.106452	2005
Median	4.100000	7.900000	5.900000	2005
Maximum	8.000000	19.60000	8.300000	2020
Minimum	-0.900000	2.900000	3.100000	1990
Std. Dev	1.922565	3.973677	1.122478	
Skewness	-0.130343	0.636102	0.112329	
Kurtosis	3.512582	3.201925	3.617234	
Jarque-Bera	0.427151	2.143234	0.557288	
Probability	0.807691	0.342454	0.756809	
Sum	129.2000	255.8800	189.3000	
Sum Sq. Dev	110.8877	473.7034	37.79871	
Observations	31	31	31	

Source: *Author own Estimation through EViews.*

4.2 Graphical Trends of Indicators

Figure 1 shows key economic indicators such as inflation (CPI), unemployment, GDP growth, and foreign direct investment (FDI) for the years 1990 to 2020. In terms of inflation, there are fluctuations over the years, with notable spikes in 2009 (19.6%) and in 2020 (10.7%).

The GDP growth rate varies annually, with mostly positive growth in most years. The most significant negative growth occurred in 2020 (-0.9%). Unemployment rates generally hover around 5-6%, with spikes in 2009 (5.5%) and in 2020 (6.6%). FDI values vary, indicating fluctuations in foreign investment. Notable peaks are observed in 2006 (2.6397) and 2005 (1.5157).

Figure 1. *CPI inflation, unemployment, GDP growth rate and FDI.*
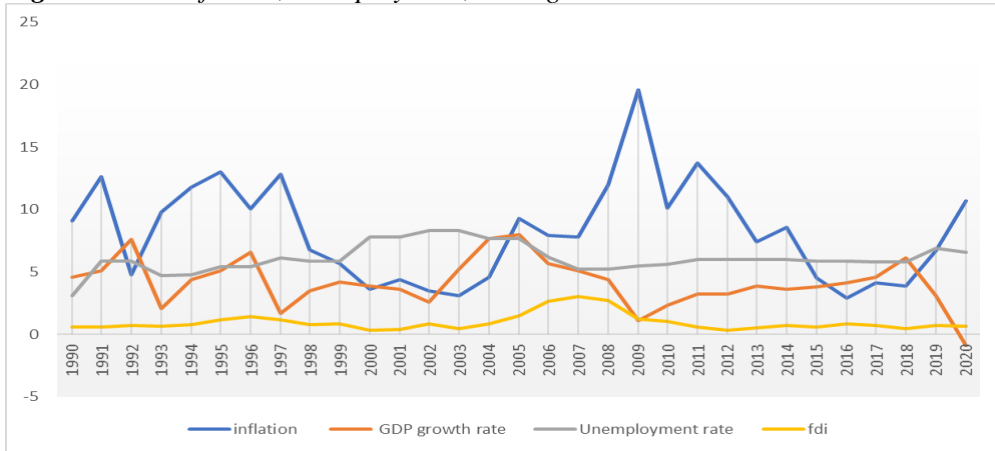
Source: Author Own Estimation through Excel 2016.

Overall, the data reflects the economic volatility influenced by events such as the global financial crisis of 2008 and the economic impact of the COVID-19 pandemic in 2020 on the economy of Pakistan.

4.3 Unit Root Test

Augmented Dickey-Fuller (ADF) Unit Root Test is applied to time series variables, which can indicate non-stationarity of the variables. Here is the interpretation of the results: At the level with an intercept, the T-statistic is -3.09, which is less than the critical value (-3.670170) at a 5% significance level. This rejects the null hypothesis of a unit root and shows that the GDP growth rate is stationary, indicating a stable economic growth process (Table 2).

Table 2. *ADF Unit Root Test at Level Data / Same Order*

Intercept			Trend and Intercept		
Variables	T-statistics	Critical value	Probability	T-statistics	Critical value	Probability
GDP Growth rate	-3.090050	-3670170	0.0381	-3.157220	-4.309824	0.1127
INFLATION	-2.861259	-3.670170	0.0620	-4.064248	-4.394309	0.0201
Unemployment	-3.263570	-3.670170	0.0259	-3.054517	-4.296729	0.1351

Source: Author own Estimation through EViews

When considering trend and intercept, the T-statistic is -3.16, again lower than the critical value (-4.309824) at a 5% significance level, confirming the stationary nature of the GDP growth rate. Regarding inflation: At the level with an intercept, the T-

statistic is -2.86, which is below the critical value (-3.670170) at a 5% significance level. However, it does not clearly reject the null hypothesis, as the p-value (0.0620) indicates minor stationarity issues. On trend and intercept, the T-statistic becomes -4.06, which is lower than the critical value (-4.394309) at a 5% significance level.

Here, the null hypothesis is rejected, indicating that inflation is stationary with a trend and intercept. For unemployment, it is stationary without a trend but with an intercept. With trend and intercept, the T-statistic is -3.05, which is below the critical value (-4.296729) at a 5% significance level. This indicates stationarity without a clear rejection. These findings are crucial for time-series analysis and modeling, ensuring that all variables are suitable for econometric analysis.

4.3. Phillip-Perron Unit Root Test at Level Data / Same Order

Phillip-Perron Unit Root Test at the level of data, with the same order, in Table 3 shows that the GDP growth rate has a T-statistic of -2.92 with an intercept, and -3.01 with trend and intercept, indicating non-stationarity. The inflation rate has a T-statistic of -2.94 with an intercept, and -2.90 with trend and intercept, both of which are close to the critical values, suggesting non-stationarity. In the case of unemployment, the T-statistic is -3.31 with an intercept, and -3.13 without intercept, indicating stationarity. These findings provide insights into the stability of these economic variables and are essential for robust time-series analysis and modeling.

Table 3. *Phillip-Perron Unit test*

	Intercept			Trend and Intercept		
Variables	T-statistics	Critical value	Probability	T-statistics	Critical value	Probability
GDP Growth rate	-2.919641	-3.670170	0.0549	-3.006177	-4.296729	0.1471
INFLATION	-2.940955	-3.670170	0.0525	-2.900373	-4.296729	0.1765
Unemployment	-3.307483	-3.670170	0.0235	-3.128780	-4.296729	0.1181

Source: *Author own Estimation through EViews.*

4.4 Correlation Analysis

The correlation analysis (Table 4) results between GDP and inflation in Pakistan show a correlation coefficient of approximately -0.35. This indicates a moderate negative association between the two variables. On average, periods of higher economic growth tend to be associated with lower inflation, and vice versa. The negative correlation aligns with economic intuition, as rapid economic growth may lead to increased production and decreased unemployment, which could contribute to lower inflationary pressures.

However, it's important to note that correlation alone does not establish causation, and other factors may influence the observed relationship. Therefore, it is essential to consider the complex dynamics and nexus of inflation and economic growth.

Table 4. *Correlation analysis*

Variables	GDP	INFLATION
GDP	1.000000	
INFLATION	-0.349291	1.000000

Source: *Author own Estimation through EViews.*

4.5 Vector Autoregression Estimates

VAR (Vector Autoregression) estimates provide insights into the relationship between GDP growth and its lagged values, the impact of inflation and unemployment in the context of Pakistan. The coefficient for GDP (-1) is 0.4721, indicating that a one-unit increase in the previous period's GDP is associated with a 0.4721 unit increase in the current period. The t-statistic of 2.1719 suggests statistical significance. The coefficient for GDP (-2) is 0.0013, implying a smaller impact from GDP two periods ago, although it is statistically insignificant (Table 5).

Table 5. VAR estimates (Standard errors in ( ) and t-statistics in [ ])

VARIABLES	GDP (Dependent)	R-squared	0.170808
GDP (-1)	0.472111 (0.21738 [2.17186]	Adj. r-squared	0.71305
GDP (-2)	0.001305 (0.2129) [0.00621]	SE. equation	1.908071
UNEMPLOYMENT	-0.10515 (0.08287) [-1.2698]	F-statistics	1.716610
		Log likelihood	-57.7338

Source: *Author own Estimation through EViews.*

The coefficient for inflation is -0.1052, suggesting that a one-unit increase in inflation is associated with a 0.1052 unit decrease in GDP growth. The t-statistic of -1.2698 indicates statistical significance.

This negative coefficient shows that higher inflation inversely affects economic growth. The overall model fit, as indicated by the R-squared value of 0.171, suggests that the autoregressive model explains approximately 17.1% of the variance in GDP growth.

4.6 Least Squares Method Estimates

According to the least squares regression results of the growth rate and the independent variables (inflation, FDI, and unemployment), the coefficient is 5.731107, which is equivalent to 5.73%. The t-statistic is 2.2677, and it is

statistically significant at the 0.05 level, indicating that it is different from zero. A one-unit increase in inflation is associated with a decrease of 0.2193 units in GDP growth rate.

The t-statistic for this relationship is -2.3305, and it is statistically significant at 0.05, showing a significant negative relationship between inflation and economic growth. On the other hand, the coefficient for FDI is 0.876015, which means that a one-unit increase in FDI is associated with an increase of 0.8760 units in GDP growth rate (Table 5).

Table 5. *Least Squares estimates: Dependent variable: GGR (GDP Growth Rate)*

Variables	Coefficient	Std. Error	t-statistics	Probab.	R-square	0.2168
C	5.731107	2.527	2.2677	0.0316	Adj. r. s	0.1298
INFLATION	-0.219308	0.094	-2.3305	0.0275	f-statistic	2.4926
FDI	0.876015	0.5027	1.7425	0.0928		
UNEMPLOYMENT	-0.098079	0.3293	-0.2977	0.7682		

Source: *Author own Estimation through EViews.*

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The t-statistic for this relationship is -2.3305, and it is statistically significant at 0.05, showing a significant negative relationship between inflation and economic growth. On the other hand, the coefficient for FDI is 0.876015, which means that a one-unit increase in FDI is associated with an increase of 0.8760 units in GDP growth rate. However, the t-statistic for this relationship is 1.7425, and it is not statistically significant at conventional levels (Probability is 0.0928).

For unemployment, the coefficient is -0.098079, indicating that a one-unit increase in unemployment is associated with a decrease of 0.0981 units in GDP growth rate. The t-statistic for this relationship is -0.2977, and it is also not statistically significant (Probability is 0.7682). The R-squared value is 0.2168, which means that approximately 21.68% of the variability in GDP growth rate is explained by the independent variables.

The F-statistic is 2.4926, and it tests the overall significance of the regression model. In summary, the results show a statistically significant negative relationship between inflation and GDP growth rate. However, the effects of FDI and unemployment are not statistically significant in this model.

4.7 Error Correction Model: Dependent Variable GDP

The Error Correction Model (ECM) results are going to show insights into the short-term dynamics and long-term equilibrium relationship between GDP and its determinants (inflation, FDI, and unemployment) in Pakistan (Table 6).

Table 6. *Error Correction Model Estimates*

Variables	Coefficient	Std. error	t-statistic	Prob.
C	-0.1281	0.3146	-0.4072	0.6873
D(INF)	-0.2463	0.0839	-2.9338	0.0071
D (FDI)	1.5272	0.8615	1.7726	0.0885
D (UNEMP)	0.4263	0.4144	1.0286	0.3135
ECT (-1)	-0.6759	0.2403	-2.8126	0.0094

Source: *Author own Estimation through EViews.*

The Intercept Coefficient (-0.1281) represents the immediate impact on GDP when all variables are zero. The coefficient is not statistically significant (Probability is 0.6873), showing that the immediate effect of the intercept is not robustly supported. D(inflation): Coefficient (-0.2463): a one-unit increase in the first difference of inflation is associated with a decrease of 0.2463 units in GDP.

The t-statistic (-2.9338) is significant at the 0.01 level, indicating a statistically significant short-term negative relationship between changes in inflation and changes in GDP. D(FDI): Coefficient (1.5272): a one-unit increase in the first difference of FDI is associated with an increase of 1.5272 units in GDP. The t-statistic (1.7726) is not statistically significant at conventional levels (Probability is 0.0885), showing that the short-term impact of changes is not supported. D(unemployment): Coefficient (0.4263): a one-unit increase in the first difference of unemployment is associated with an increase of 0.4263 units in GDP.

The Error Correction Term (ECT -1): Coefficient (-0.6759): the error correction term measures the speed at which the model adjusts to long-term equilibrium after a shock. A one-unit deviation from the long-term equilibrium in the previous period is associated with a decrease of 0.6759 units in GDP in the current period. The t-statistic (-2.8126) is significant at the 0.01 level, suggesting a statistically significant adjustment towards long-term equilibrium after a shock.

In short, the ECM results indicate a significant short-term negative relationship between changes in inflation and GDP, suggesting that adjustments in inflation have an impact on short-term economic growth in Pakistan. The significance of the error correction term suggests that the model exhibits a mechanism for adjusting towards long-term equilibrium aftershocks, emphasizing the importance of considering both short-term dynamics and long-term equilibrium in the inflation and economic growth nexus.

5. Discussion

The analysis presented in this study offers valuable insights into the nexus of inflation and economic growth in Pakistan from 1990 to 2020. The empirical results include descriptive statistics, graphical trends, unit root tests, correlation analysis, vector autoregression estimates, the least squares method, and an error correction model.

The descriptive statistics reveal important characteristics of the data used. The average GDP growth rate over the period is 4.17%, with a maximum of 8.00% and a minimum of -0.90%. On the other hand, the average inflation rate is 8.25%, with fluctuations observed over the years, including spikes in 2009 and 2020. These statistics provide a foundational understanding of the economic dynamics in Pakistan during the selected study period.

The graphical analysis illustrates the trends of the economic indicators used, including CPI inflation, the unemployment rate, the GDP growth rate, and foreign direct investment (FDI). Fluctuations in these indicators reflect the economic volatility experienced by Pakistan, influenced by events such as the global financial crisis of 2008 and the COVID-19 global pandemic in 2020.

The unit root tests, including the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests, assess the stationarity of the time series variables. The results indicate that the GDP growth rate and inflation exhibit stationary behavior, particularly when considering both the intercept and the trend. These findings are essential for ensuring the suitability of variables for time-series analysis and modeling.

The correlation analysis reveals a moderate negative association between GDP and inflation, with a correlation coefficient of approximately -0.35. This suggests that periods of higher economic growth tend to coincide with lower inflation, and vice versa. While correlation does not imply causation, it provides valuable insights into the relationship between these variables.

The vector autoregression estimates offer further insights into the relationship between GDP growth and its lagged values, as well as the impact of inflation and unemployment. The results indicate a statistically significant negative relationship between inflation and GDP growth, highlighting the adverse effects of inflation on the economic growth rate and economic expansion.

The OLS (ordinary least squares) regression model results provide additional evidence of the negative relationship between inflation and GDP growth. While inflation exhibits a statistically significant negative coefficient, the effects of FDI and unemployment are not statistically significant in this model.

The error correction model sheds light on the short-term dynamics and long-term equilibrium relationship between GDP and its determinants. The significant short-term negative relationship between changes in inflation and GDP suggests that adjustments in inflation have an impact on short-term economic growth in Pakistan. Additionally, the significance of the error correction term underscores the importance of considering both short-term dynamics and long-term equilibrium in the inflation and economic growth nexus.

In conclusion, the findings of this study contribute to a better understanding of the inflation-economic growth nexus in Pakistan. The evidence presented in this study highlights the importance of managing inflationary pressures to foster sustainable economic growth in the country.

6. Conclusion

This research is an investigation to find the historical nexus between inflation and the economic growth rate in the economy of Pakistan over the past few decades, with a particular focus on its impact on GDP growth rate. The second purpose is to find policy measures that can be recommended based on empirical findings to ensure a balanced and favorable relationship between inflation and economic growth rate in Pakistan.

In essence, the investigation into the inflation-economic growth nexus spanning from 1990 to 2020, 31 years of data on independent variables such as inflation, unemployment rate, population growth rate, foreign direct investment, and the dependent variable GDP growth rate in Pakistan has underscored a critical gap in the comprehensive historical analysis specific to the Pakistani economic context. A comprehensive analysis was conducted on the inflation-economic growth nexus in Pakistan from 1990 to 2020.

The descriptive statistics analysis revealed the dynamic nature of GDP growth, inflation rate, and unemployment, showcasing mean values, variability, and other distribution characteristics. Unit root tests ADF and Phillips Perron methods showed a significant association among GDP growth, inflation, and unemployment indicators. Correlation analysis revealed a negative relationship between GDP and inflation, showing a complex interplay between economic growth and price stability in the economy.

The vector autoregression estimates and least square regression method further highlighted the validity of these relationships, emphasizing the impact of inflation and unemployment on GDP growth. The least square method showed that a one unit increase in inflation is associated with a decrease of 0.2193 units in the growth rate. The ECM (Error Correction Model) introduced a temporal dimension, highlighting the short-term dynamics and long-term equilibrium relationships.

The coefficients indicate that changes in inflation, FDI (Foreign Direct Investment), and unemployment contribute to adjustments in GDP, as a one unit increase in inflation is associated with a decrease of 0.2436 units in GDP. These results emphasize the existence of a dynamic equilibrium.

The research not only establishes intricate links between inflation, economic growth, unemployment, and foreign direct investment but also provides empirical evidence supporting the existence of a meaningful nexus. The negative correlation between inflation and GDP growth implies that policymakers should carefully consider inflationary pressures to foster sustainable economic development.

These findings contribute to the broader economic discourse, offering valuable insights for policymakers, researchers, and practitioners. These stakeholders are requested to adopt meticulously targeted strategies to uphold a balanced and favorable nexus between inflation and economic growth. Understanding specific causes of inflation, such as agricultural productivity, external monetary influences, and supply chain disruptions, is imperative for the effective implementation of policies aimed at curbing inflation.

Thoughtful state interventions in wage and price structures and the establishment of price control agencies should be adopted to maintain a favorable level of inflation to promote positive economic growth in the economy.

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Abbreviations and References:

INF:	Inflation	LS:	Least square
GDP:	Gross Domestic product	FDI:	Foreign Direct Investment
Pop:	Population	WBI:	World Bank indicators
CPI:	Consumer price index	SBP:	State Bank of Pakistan
UN:	Unemployment	IMF:	International Monetary Fund

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