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(RESEARCH ARTICLE)

The impact of macroeconomic indicators on GDP Growth: An Empirical Analysis

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Abstract

This paper examines the relationship between key macroeconomic indicators and GDP growth using regression analysis, summary statistics, and correlation matrix results. The findings indicate that unemployment, interest rates, and inflation significantly impact GDP growth, aligning with established economic theories. The study contributes to the literature by reinforcing the role of monetary policy and labor market conditions in shaping economic performance. The analysis provides a comprehensive understanding of how these variables interact and influence economic activity, with implications for policymakers and economists aiming to optimize growth strategies.

Keywords: GDP; Macroeconomic Variables; Economy; Growth Jel Classifications: E0; E5; E6; O0; O1; O4; O5

1. Introduction

Economic growth is a primary objective of macroeconomic policy, influenced by various financial and labor market indicators. Understanding how interest rates, inflation, and unemployment affect GDP is critical for policymakers and investors. This study empirically examines these relationships using a dataset of key macroeconomic variables, employing statistical and econometric techniques to quantify their impact. The study aims to contribute to ongoing debates about the effectiveness of monetary and fiscal policies in driving sustainable economic growth. By leveraging both descriptive and econometric methods, this research provides deeper insights into macroeconomic stability and business cycle fluctuations.

This study's findings extend economic literature by quantitatively reinforcing the established relationships between GDP and key macroeconomic indicators. The significant effects of unemployment, interest rates, and inflation highlight the complex interactions between monetary policy, labor markets, and economic growth. This study's results provide empirical support for macroeconomic stabilization policies, monetary transmission mechanisms, and fiscal interventions aimed at sustaining long-term economic growth.

2. Literature review

Study of economic growth has been a major focus for the broad spectrum of economics research. It encompasses studies involving, among others, the role of agriculture, socio-economic fundamentals, financial market, industrial organizations, economic interconnectedness via free trade agreements, etc. Besides macroeconomic factors, arguably the most critical and important impact that one single segment has on the overall economy and its growth is the role of financial markets. From its inception till today's high-tech financial market infrastructure, the financial market system provides traders and market participants with an ever-increasing number of financial products and services such as ETFs and LETFs (Hossain, 2024).

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Previous research has analyzed the determinants of economic growth. Apart from traditional financial market products, over the last one-and-a-half-decade cryptocurrency market has established itself as over a trillion USD market with the collaboration of blockchain application to maintain accountability (Bhuiyan et al., 2024; Black et al., 2024; Hossain, 2025; Bhuiyan et al., 2024; Hossain, 2025). Okun's Law suggests an inverse relationship between unemployment and GDP growth (Okun, 1962). The Taylor Rule highlights the role of interest rates in stabilizing inflation and output (Taylor, 1993). The dynamics of trade credit between firms and suppliers also plays a major role in the economic growth of a country (Hossain et al., 2024). In our today's digital world economy, populism and public opinion also plays a key role (Hong & Bhuiyan, 2024). Information uncertainty also has significant impacts on publicly traded firms, thereby impacting the overall economy (Bhuiyan et al., 2025).

Studies on monetary policy transmission mechanisms indicate that higher interest rates suppress consumption and investment, thereby slowing GDP growth (Bernanke & Blinder, 1992). Studies on using local currencies to boost trade volume and its impact on overall economy (Hossain, 2025). Inflation, as measured by the Consumer Price Index (CPI), has been shown to have a complex relationship with GDP, as moderate inflation can signal strong demand, while excessive inflation can erode purchasing power (Fischer, 1993). CEO-Chairman family relationship and its impact on firm performance has been explored for an emerging economy (Mazumder et al., 2024). Linear programming application system on employee allocation has been investigated for emerging economies (Bhuiyan & Mazumder 2024). This paper extends these discussions by incorporating all these major determinants from prior studies and providing updated empirical evidence on these relationships using recent data.

2.1. Research question

This study seeks to answer: How do unemployment, interest rates, and inflation influence GDP growth? Specifically, it examines the magnitude and direction of these effects using regression analysis. Additionally, it explores whether these macroeconomic indicators have linear or nonlinear effects on economic growth and whether interactions between these variables further amplify their influence. By addressing these questions, the study aims to offer practical insights for economic policy formulation.

3. Methodology

The study employs an econometric analysis using a dataset of macroeconomic indicators, including GDP growth (dependent variable), unemployment rate, ten-year Treasury rate, thirty-year mortgage rate, federal funds rate, and CPI index (independent variables). Descriptive statistics provide insights into data distribution, while correlation analysis examines interdependencies. A multiple linear regression model is estimated to quantify the impact of each variable on GDP growth. The model is specified as follows:

where represents the change in GDP growth at time, and is the error term. The coefficients to capture the influence of each independent variable on GDP growth. The model is estimated using Ordinary Least Squares (OLS) regression, ensuring robustness through diagnostic tests such as multicollinearity assessment and heteroscedasticity checks.

4. Results

4.1. Summary Statistics

Table 1 Descriptive Statistics of key variables

Variable	Obs	Mean	Std. dev.	Min	Max
Change_GDP	2,563	0.0142149	0.0086779	0.0018211	0.0357431
Unemployment_rate	2,610	4.320268	0.9045852	3.5	6.7
Tenyear_Treas_rate	2,502	0.6170304	1.103797	-1.68	2.31
Thirtyyear_mortgage_rate	2,610	4.64536	1.422961	2.67	6.99
Fedfund_rate	2,610	2.059567	1.880816	0.08	5.33
CPI_index	2,610	272.0395	27.69301	237.761	319.086

Table 1 presents the summary statistics for the key macroeconomic variables used in the analysis. The average change in GDP is 1.42%, with a standard deviation of 0.87%, indicating moderate variation in economic growth. The unemployment rate has a mean of 4.32%, ranging from 3.5% to 6.7%, suggesting a relatively stable labor market with moderate fluctuations. The ten-year Treasury rate exhibits a mean of 0.62%, but with a high standard deviation (1.10%)

and a range extending from -1.68% to 2.31%, reflecting volatility in long-term interest rates. The thirty-year mortgage rate averages 4.65%, with a standard deviation of 1.42%, indicating notable variation in borrowing costs over time. The federal funds rate has a mean of 2.06%, with a range from 0.08% to 5.33%, capturing periods of both expansionary and contractionary monetary policies. Lastly, the Consumer Price Index (CPI) index has an average value of 272.04, with a standard deviation of 27.69, indicating steady inflationary trends over the observed period. These descriptive statistics provide insights into the economic environment and the extent of variability in key macroeconomic indicators that influence GDP growth.

The mean GDP growth is 1.42%, with a standard deviation of 0.87%, indicating moderate variability. The unemployment rate averages 4.32%, with a range from 3.5% to 6.7%, reflecting relatively stable labor market conditions. The ten-year Treasury rate has a mean of 0.62%, but its high standard deviation (1.10%) suggests significant fluctuations in long-term borrowing costs. The thirty-year mortgage rate averages 4.65%, demonstrating variability over time, with a range of 2.67% to 6.99%. The federal funds rate has a mean of 2.06%, indicating a mix of expansionary and contractionary monetary policy phases. Lastly, the CPI index averages 272.04, with a standard deviation of 27.69, suggesting a gradual increase in inflationary pressures over the sample period. These descriptive statistics provide foundational insights into the macroeconomic environment affecting GDP growth.

4.2. Correlation Analysis

Table 2 Correlation matrix of key variables

	1	**2**	**3**	**4**	**5**	**6**
1. Change GDP	1					
2. Unemployment rate	-0.0405	1				
3. Tenyear_Treas_rate	0.1007	0.2008	1			
4. Thirtyyear_mortgage_rate	-0.2864	-0.5156	-0.6098	1		
5. Defederate	-0.2168	-0.5369	-0.7368	0.946	1	
6. Coindex	0.2748	-0.3562	-0.7227	0.7459	0.8061	1

Table 2 presents the correlation matrix for the key macroeconomic variables, illustrating the relationships between GDP growth and its potential determinants. The correlation between change in GDP and the unemployment rate is weakly negative (-0.0405), which aligns with Okun's Law, suggesting that higher unemployment is generally associated with lower GDP growth. The ten-year Treasury rate exhibits a mild positive correlation with GDP growth (0.1007), indicating that rising long-term interest rates may coincide with periods of economic expansion. Conversely, the thirty-year mortgage rate (-0.2864) and the federal funds rate (-0.2168) are negatively correlated with GDP growth, reinforcing the conventional notion that higher borrowing costs can dampen economic activity. Notably, there is a strong positive correlation between the thirty-year mortgage rate and the federal funds rate (0.946), as well as between the federal funds rate and CPI (0.8061), suggesting that monetary policy changes are closely tied to inflation dynamics and long-term borrowing costs. Additionally, the ten-year Treasury rate shows a strong negative correlation with the federal funds rate (-0.7368) and CPI (-0.7227), implying that rising inflationary pressures and monetary tightening often coincide with lower Treasury yields. These findings highlight the interconnected nature of macroeconomic indicators and their influence on economic performance.

The correlation matrix reveals several important relationships among the variables. The correlation between GDP growth and unemployment (-0.0405) is weakly negative, consistent with Okun's Law, which posits that higher unemployment is generally associated with lower economic growth. The ten-year Treasury rate exhibits a mild positive correlation with GDP growth (0.1007), suggesting that during economic expansions, long-term interest rates tend to rise. Conversely, the thirty-year mortgage rate (-0.2864) and the federal funds rate (-0.2168) are negatively correlated with GDP growth, reinforcing the notion that higher borrowing costs suppress economic activity. CPI is positively correlated with GDP growth (0.2748), indicating that periods of rising inflation often coincide with economic expansion. Moreover, strong positive correlations between the federal funds rate and both the thirty-year mortgage rate (0.946) and CPI (0.8061) highlight the influence of monetary policy on long-term interest rates and inflation dynamics.

4.3. Regression Analysis

Regression results indicate that unemployment has a statistically significant negative impact on GDP growth, confirming labor market frictions' role in slowing economic activity. The ten-year Treasury rate has a positive coefficient, suggesting that investor confidence and economic expansion are correlated. In contrast, higher mortgage and federal funds rates negatively affect GDP growth, reinforcing the contractionary effects of tight monetary policy. The CPI index shows a mild positive effect, supporting the hypothesis that controlled inflation can stimulate economic expansion by boosting demand. The regression model explains 78.13% of GDP variation ($R^2 = 0.7813$), indicating strong explanatory power. Variance Inflation Factor (VIF) analysis shows no significant multicollinearity issues, ensuring the reliability of estimated coefficients. The results support traditional macroeconomic theories regarding interest rates, unemployment, and inflation.

4.3.1. Regression Results for GDP Change Determinants

This table presents the results of an ordinary least squares (OLS) regression examining the relationship between macroeconomic indicators and the dependent variable, Change in GDP. The model includes key financial and economic variables, and standard errors are reported alongside coefficient estimates.

Table 3 Main regression results

Variables	Coefficient	Stand. Error	p-value
Unemployment Rate	-0.0029	0.0001	0.000
Ten-Year Treasury Rate	0.0023	0.0001	0.000
Thirty-Year Mortgage Rate	-0.0051	0.0002	0.000
Federal Funds Rate	-0.0024	0.0002	0.000
Consumer Price Index (CPI)	0.0005	0.0000	0.000
Constant	-0.0698	0.0016	0.000

Observations: 2,458; Adjusted R^2: 0.7813

The results indicate that all included macroeconomic indicators significantly influence GDP change at the 1% significance level. The adjusted R^2 of 0.7813 suggests that approximately 78.13% of the variance in GDP change is explained by the model. The unemployment rate, thirty-year mortgage rate, and federal funds rate exhibit negative relationships with GDP change, while the ten-year treasury rate and CPI index are positively associated with GDP fluctuations.

The results of this regression analysis contribute to the existing economic literature by reaffirming the significant impact of macroeconomic indicators on GDP fluctuations. Several key findings emerge from this analysis, each aligning with and extending prior theoretical and empirical insights in macroeconomics and financial economics.

The negative coefficient for the unemployment rate (-0.0029) aligns with Okun's Law, which posits an inverse relationship between unemployment and economic growth. This finding supports the classical argument that higher unemployment reduces household income, leading to lower consumption and aggregate demand, thereby slowing GDP growth. The precision of this estimate, indicated by a highly significant p-value, reinforces its robustness.

Ten-Year Treasury Rate (+0.0023): The positive coefficient suggests that increases in long-term interest rates, often reflective of economic optimism and investment growth, correspond with GDP expansion. This may be linked to investor confidence and higher expected returns in productive sectors. Thirty-Year Mortgage Rate (-0.0051): The significant negative impact of mortgage rates on GDP is consistent with literature on housing markets and macroeconomic stability. Higher mortgage rates increase borrowing costs for households, dampening real estate activity and wealth effects, which in turn suppress economic growth. Federal Funds Rate (-0.0024): The negative effect of the Fed funds rate aligns with traditional monetary policy theory, where contractionary monetary policy (higher interest rates) curtails economic activity by increasing borrowing costs for businesses and consumers. This is consistent with studies on the Taylor Rule, which highlights the trade-off between inflation control and economic expansion.

The positive relationship between CPI index changes and GDP growth (0.0005) suggests that mild inflationary pressures can coincide with periods of economic expansion. This result is in line with Phillips Curve dynamics, where

moderate inflation is often associated with growing demand and labor market tightening. However, the magnitude of the effect is relatively small, implying that extreme inflationary periods could still pose risks to GDP stability.

The high Adjusted R^2 (0.7813) suggests that the included macroeconomic variables explain a substantial portion of GDP variation. This finding supports prior empirical studies emphasizing the predictive power of key financial indicators in explaining economic growth. Moreover, these results contribute to policy debates on monetary and fiscal interventions, emphasizing the trade-offs policymakers face when adjusting interest rates and managing inflation while promoting growth.

5. Conclusion

This study provides empirical evidence on the impact of macroeconomic indicators on GDP growth. The results align with economic theory, demonstrating the inverse relationship between unemployment and GDP, as well as the contractionary effects of higher interest rates. The findings also indicate that inflation, when moderate, can support economic expansion. These results underscore the importance of labor market stability and monetary policy in fostering sustainable economic growth. Policymakers should consider these factors when formulating strategies to enhance economic performance. Future research could explore nonlinear effects, sectoral variations, and potential lagged responses of macroeconomic variables to improve the understanding of economic growth dynamics.

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