The Effect of Interest Rate on Economic Growth

By Devin Le

Abstract

Central banks worldwide rely heavily on interest rate adjustments as the primary lever for managing economic activity; however, the empirical evidence linking interest rates to output growth remains ambiguous. This paper revisits this debate by analyzing the U.S. economy from 1961 to 2024 using a time-series regression. We find that the answer is largely no. While the interest rate carries a negative association with GDP growth; however, the effect is not statistically significant. The real gross private domestic investment growth rate emerges as a meaningful driver of growth, suggesting that how much an economy invests matters far more than what interest rates are set at. The results also point to a broader pattern in which U.S. GDP growth has gradually weakened over time, a trend that persists regardless of where interest rates stand. Altogether, these findings raise a reasonable question for policymakers: if interest rates are not reliably moving growth, should they remain the primary instrument for economic policymaking? The evidence presented in this paper suggests that a greater emphasis on fostering investment may have stronger results.

Introduction

The United States is the largest economy in the world in terms of GDP, making its economic performance highly influential both domestically and globally. Changes in US economic growth can have a significant impact on the global economy. Understanding the importance of the factors that drive GDP growth is essential.

Economic growth is the most important indicator of a country's economic performance and overall standard of living. Stable economic growth supports rising incomes, while periods of

slow growth are associated with higher unemployment and increased financial stress for households and firms. Understanding how these factors could possibly influence economic growth is a central concern for policymakers. Among these many factors, interest rates play an extremely important role, as they are a primary tool through which central banks influence economic activity.

Interest rates influence economic growth in several ways. Changes in interest rates affect borrowing costs for households and firms, which shape consumer behavior, investment, and overall economic activity. Higher interest rates generally discourage borrowing and investment, leading to slower economic growth, while lower interest rates are intended to encourage spending and support economic expansion. Higher interest rates can help reduce inflation and promote financial stability. However, in some cases, this may benefit the broader economy, but it may also increase unemployment and weaken economic growth, creating a spillover effect. This highlights the need for government involvement through monetary policy.

The relationship between GDP growth and interest rates is much more complex, since households and firms do not have complete information about future interest rate movements or the duration of policy changes, which can lead to uncertainty and delayed economic decisions. Additionally, myopic behavior may cause households and firms to focus on immediate borrowing costs rather than long-term outcomes, potentially leading to lower investment or inefficient consumption choices. Again, this reinforces the need for policy intervention.

Literature Review

Fontana (2011), drawing on both classical and modern monetary theory, finds that interest rates play a central role in influencing economic activity, particularly in the short run. The study shows that changes in monetary policy, especially through interest rate adjustments, can affect

output, employment, and economic fluctuations, indicating a real impact on economic growth. However, the paper also highlights that these effects are mainly short-term, as traditional theories suggest that monetary policy is neutral in the long run.

Hansen and Seshadri (2013), using an extended historical dataset, find in their study that the long-run correlation between real interest rates and productivity growth has a moderately negative relationship, with an estimated long-run correlation of about −0.20, although the authors note this estimate is not very precise. This suggests that periods of lower interest rates are generally associated with higher productivity growth, while periods of higher interest rates tend to coincide with weaker productivity growth.

In contrast, more recent empirical studies question whether interest rates are a strong or causal driver of growth. Bosworth (2014) finds that domestic economic growth is influenced not only by real interest rates but also by a wide range of domestic and international factors. In particular, he emphasizes that the foreign interest rates highly influence domestic interest rates because capital markets are highly integrated internationally. The author finds only a weak correlation between real interest rates and economic growth, suggesting that closed-economy models may be insufficient for analyzing interest rate behavior. Similarly, Lee and Werner (2022) run a model to see if interest and economic growth are correlated, which used complex time-series methods, including time-varying dynamic conditional correlation within a GARCH framework and tests of statistical causality. The authors find very little support for a negative relationship between interest rates and economic growth. Instead, the evidence suggests that interest rates are not a causal driver of growth. These findings challenge conventional monetary policy assumptions and raise doubts about the effectiveness of interest rate reductions as a tool for stimulating economic growth

We use “year” as the unit of analysis and collect a time-series dataset consisting of annual U.S. macroeconomic observations from 1961 to 2024.

Empirical Model

A time series linear regression model is used to estimate the relationship between economic growth and interest rates over time. In this paper, we estimate the following.

$$\textbf{GDP Growth} = \beta_0 + \beta_1 \textbf{InterestRate} + \beta_2 \textbf{R\&Dexpendituregrowthrate} + \beta_3 \textbf{RealGrossPrivateDomesticInvestmentGrowthRate} + \beta 4 \textbf{Population Growth} + \beta 5 \textbf{timetrend} + u$$

The dependent variable is GDP growth, which measures the annual percentage change in real gross domestic product and is reported in percent. The key independent variable of interest is the interest rate, measured by the effective federal funds rate, and is reported in percent, not seasonally adjusted.

R&D expenditure growth rate is another independent variable, which measures spending on research and development activities and is expressed as an annual growth rate, defined as the percentage change relative to the previous year. Real gross private domestic investment growth rate measures the total investment in the economy adjusted for inflation and is reported as an annual growth rate, defined as the percentage change relative to the previous year. The population growth variable measures the rate of change in the population and is expressed as the percent change at an annual rate, not seasonally adjusted. A time trend variable is also included in the model to control for long-run trends in the time series data.

Data

Data for this study are obtained from publicly available sources, including the Federal Reserve Economic Data database, the World Bank, and the National Center for Science and Engineering Statistics. The effective federal funds rate, real gross private domestic investment, and population growth for the United States are collected from the Federal Reserve Economic Data database maintained by the Federal Reserve Bank of St. Louis; data are available at fred.stlouisfed.org.

The GDP growth rate is obtained from the World Bank; the data is available at data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG. R&D expenditure data is collected from the National Center for Science and Engineering Statistics, and data is available at ncses.nsf.gov/data-collections/national-patterns/2023-2024#data.

GDP growth measures the percentage change in real gross domestic product over time and reflects changes in overall economic activity. Gross domestic product represents the total value of all final goods and services produced within an economy during a given period and can be measured using the expenditure, income, or production approach. The interest rate, measured by the effective federal funds rate, represents the average rate at which banks lend funds to one another overnight.

The real gross private domestic investment growth rate is expressed as the annual growth rate of total investment in the economy. This measure captures changes over time in investment activity, including components such as direct investment, portfolio investment, other investment, reserve assets, and financial derivatives. The variable is constructed as the percentage change from the previous period, calculated as: (current year − previous year) ÷ previous year.

R&D expenditure growth rate measures the annual percentage change in total spending on research and development activities relative to the previous year, calculated as (current year − previous year) ÷ previous year. R&D Expenditure statistics are based on annual surveys of multiple performers, including businesses, higher education institutions, federal agencies, federally funded research and development centers, and state governments.

Population growth measures the annual percentage change in the total population and reflects changes in the size of the labor force over time. The population growth rate is calculated as the exponential rate of growth of the midyear population from one year to the next and is expressed as a percentage. The population is defined on a de facto basis, which includes all residents regardless of legal status or citizenship, excluding refugees not permanently settled in the country of asylum. The time trend data is defined as a sequential index that increases by one for each year in the sample, beginning with a value of 1 for the first year and continuing through the final observation.

Table 1. Descriptive Statistics

Variable	Mean (st. dev)	Minimum value	Maximum value
GDP Growth (%)	3.02 (2.08)	-2.58	7.24
Interest Rate (%)	4.82 (3.60)	0.08	16.38
R&D Expenditure Growth Rate (%)	6.98 (3.59)	-0.46	14.34
Real Gross Private Domestic Investment Growth Rate (%)	4.26 (8.16)	-21.02	27.29
Population Growth(%)	0.99 (0.25)	0.16	1.66
Time Trend	32.50 (18.62)	1	64

Table 1 above shows variation across all variables used in the analysis. GDP growth ranges from a low of −2.58% to a high of 7.24%, with an average of 3.02%. The interest rate ranges from 0.08% to 16.38 %, with a mean of 4.82%.

R&D expenditure growth rate ranges from -0.46% to 14.34%, with an average of approximately 6.98%. Real gross private domestic investment growth rate ranges from -21.02% to 27.29%, with a mean of approximately 4.26%. Population growth ranges from 0.16% to

1.66%, with an average of 0.99%. Finally, the time trend variable ranges from 1 to 64, with a mean of 32.50.

Empirical Result

Table 2 reports the results of the time series regression estimating the relationship between interest rates, R&D expenditure growth rate, real gross private domestic investment growth rate, population growth, and GDP growth, while controlling for a time trend. The overall model is statistically significant at the 1% level, indicating that the explanatory variables are jointly significant in explaining GDP growth. The R-squared indicates that approximately 77.38% of the variation in GDP growth is explained by the model.

The coefficient on the interest rate indicates that a one percentage point increase in the interest rate is associated with a decrease of approximately 0.059969 percentage points in GDP growth, holding other factors constant. However, this effect is not statistically significant ($p > 0.1$). The coefficient on R&D expenditure growth rate indicates that a one percentage point increase in R&D growth is associated with an increase of approximately 0.0770986 percentage points in GDP growth, holding other factors constant, and is not statistically significant ($p > 0.1$).

The coefficient on real gross private domestic investment growth rate indicates that a one percentage point increase in investment growth rate is associated with an increase of approximately 0.2019702 percentage points in GDP growth, holding other factors constant, and is statistically significant at 1% ($p < 0.01$). The coefficient on population growth indicates that a one percentage point increase in population growth is associated with an increase of approximately 0.1114089 percentage points in GDP growth, holding other factors constant. However, this effect is not statistically significant ($p > 0.1$).

The coefficient on the time trend variable indicates that a one-unit increase in the time trend is associated with a decrease of approximately 0.0277451 percentage points in GDP growth, holding other factors constant, and is statistically significant at the 5% level ($p < 0.05$).

Table 2. Regression Results

```
. regress gdpgrowth interestrate rdexpendituregrowthrate realgrossprivatedomesticinvestme populationgrowth timetrend
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Source	SS	df	MS		
Model	211.719633	5	42.3439267	Number of obs	= 64
Residual	61.9071268	58	1.06736425	F(5, 58)	= 39.67
				Prob > F	= 0.0000
				R-squared	= 0.7738
				Adj R-squared	= 0.7542
Total	273.62676	63	4.34328191	Root MSE	= 1.0331

gdpgrowth	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
interestrate	-.059969	.0511054	-1.17	0.245	-.1622676	.0423296
rdexpendituregrowthrate	.0770986	.0469157	1.64	0.106	-.0168134	.1710107
realgrossprivatedomesticinvestme	.2019702	.0167466	12.06	0.000	.1684483	.2354922
populationgrowth	.1114089	.7381287	0.15	0.881	-1.366116	1.588934
timetrend	-.0277451	.0110817	-2.50	0.015	-.0499276	-.0055626
_cons	2.697458	1.157979	2.33	0.023	.3795112	5.015404

Additional Diagnostic Tests

Prior to drawing conclusions from the regression results, a series of diagnostic tests were conducted to ensure the reliability of the model. These tests include the Heteroskedasticity test, Multicollinearity test, Normality test, Ramsey test, and Autocorrelation test, each of which examines a specific assumption underlying the regression model.

Table 3. Heteroskedasticity Test (White test)

```
. regress s1s gdpgrowthf gdpgrowthf2
```

Source	SS	df	MS		
Model	.568088148	2	.284044074	Number of obs	= 64
Residual	133.654452	61	2.19105659	F(2, 61)	= 0.13
				Prob > F	= 0.8787
				R-squared	= 0.0042
				Adj R-squared	= -0.0284
Total	134.22254	63	2.13051651	Root MSE	= 1.4802

s1s	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
gdpgrowthf	-.0179727	.2063669	-0.09	0.931	-.4306288	.3946835
gdpgrowthf2	-.0055727	.0324871	-0.17	0.864	-.0705346	.0593893
_cons	1.090619	.3841257	2.84	0.006	.3225119	1.858726

According to the White test, the F-value is 0.8787, which is greater than the 10% significance level; therefore, we fail to reject the null hypothesis of homoskedasticity. This confirms that the model does not suffer from heteroskedasticity, and the error variances are constant across all observations.

Table 4. Multicollinearity Test

```
. vif
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Variable	VIF	1/VIF
timetrend	2.51	0.397965
population~h	2.07	0.482155
interestrate	1.99	0.501853
rdexpendit~e	1.67	0.597636
realgrossp~e	1.10	0.907135
Mean VIF	1.87	

The VIF test is used to detect the presence of multicollinearity among the explanatory variables in the model. With a mean VIF of 1.87, the result falls substantially below the critical threshold of 10, indicating that multicollinearity does not pose a concern in this model. Therefore, it can be concluded that there is no multicollinearity between the variables in the model that could potentially cause a problem for the regression results.

Table 5. Normality Test

```
. sktest gdpgrowth

Skewness and kurtosis tests for normality
                                                    ------ Joint test ------
    Variable |        Obs   Pr(skewness)   Pr(kurtosis)   Adj chi2(2)  Prob>chi2
-------------+---------------------------------------------------------------
   gdpgrowth |         64         0.0646         0.3487          4.39     0.1116
```

For this test to pass, the dependent variable should be normally distributed. The Skewness/Kurtosis test for normality was conducted on GDP growth across 64 observations. The Chi2-value is 0.1116, which is greater than the 10% significance level; therefore, we fail to reject the null hypothesis. This proves that the dependent variable GDP growth is normally distributed and passes the normality test.

Table 6. Ramsey Test

```
. ovtest

Ramsey RESET test for omitted variables
Omitted: Powers of fitted values of gdpgrowth

H0: Model has no omitted variables

F(3, 55) =   1.35
Prob > F = 0.2668
```

The Ramsey test examines whether the model suffers from omitted variable bias. The null hypothesis states that the model has no omitted variables, and for it to be retained, the F-value must be greater than the 10% significance level. In this model, the F-value is 0.2668, which is well above the 10% significance level; therefore, we fail to reject the null hypothesis. This confirms that the empirical model is correctly specified and is free from omitted variable bias.

Table 7. Autocorrelation Test

```
. estat durbinalt

Durbin's alternative test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	**1.027**	**1**	**0.3109**

H0: no serial correlation

For this test to pass, the Prob > chi2 value should be greater than 10%, meaning we fail to reject the null hypothesis of no serial correlation. In this model, the Prob > chi2 value from Durbin's alternative test is 0.3109, which is considerably greater than the 10% significance level. Therefore, we can conclude that there is no autocorrelation present in the model, and the residuals are not serially correlated.

Conclusion

The empirical results show that the real gross private domestic investment growth rate and the time trend variable are statistically significant in explaining GDP growth, while the interest rate, population growth, and R&D expenditure growth rate are not statistically significant. More specifically, real gross private domestic investment is positively related to GDP growth and statistically significant, while the time trend variable is negatively related and also statistically significant. In contrast, the interest rate has a negative coefficient, but the effect is not statistically significant.

From a policy perspective, the results suggest that investment may play a more important role in economic growth than interest rates alone. Since the real gross private domestic investment growth rate is positively related to GDP growth and statistically significant, policies that support investment could have a stronger impact on growth. At the same time, the insignificant result for the interest rate suggests that changes in interest rates alone may not be enough to influence GDP growth. This means policymakers should not rely only on interest rate adjustments, but also consider other factors that affect investment and overall economic activity.

These findings are generally consistent with previous studies that question the strength of the relationship between interest rates and economic growth. For example, Bosworth (2014) finds only a weak relationship between interest rates and growth, while Lee and Werner (2022)

find little evidence that interest rates directly cause changes in economic growth. Hansen and Seshadri (2013) also find only a moderate relationship. Although Fontana (2011) suggests that interest rates can influence economic activity, especially in the short run, the results in this paper show limited evidence of a strong relationship over time.

Limitations

This study has several limitations. First, the model uses a simple time series regression, which may not fully capture how variables affect each other over time. For example, changes in interest rates or R&D spending may affect economic growth with a delay, and not including lagged variables may limit the model's ability to capture the full relationship. Second, since the analysis only uses U.S. data, the results may not apply to other countries with different economic conditions and policies. Third, despite controlling for several important variables, the model may still omit other relevant determinants of GDP growth, such as human capital and physical capital, the exclusion of which may affect the precision of the estimates.

Reference

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