

The Relationship Between GDP, Unemployment, Inflation, and Economic Growth: A Global Economic Analysis (2010-2025)

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1. Introduction

Economic indicators such as GDP, unemployment, inflation, and economic growth play critical roles in understanding the health and dynamics of economies worldwide. This project investigates how these variables interact across multiple countries from 2010 to 2025. Using the Economic Indicators & Inflation Dataset (Worldwide) from Kaggle, we aim to analyze the relationships between GDP, unemployment rate, inflation rate, and economic growth for a selection of major global economies. By applying statistical techniques, we will identify key trends and correlations in the data, contributing valuable insights into the ongoing economic conditions and forecasting future trends for 2024 and 2025.

The dataset spans from 2010 to 2025, providing a comprehensive picture of economic conditions for countries including the United States, China, India, Japan, and others. This analysis will help policymakers and economists better understand how these variables interact over time, and how such interactions might influence global economic stability.

2. Literature Review

The relationship between inflation, unemployment, and economic growth has been widely studied in economics. The Phillips Curve suggests an inverse link between inflation and unemployment, while moderate inflation typically accompanies GDP growth. Friedman (1968) argued that while inflation may rise with low unemployment, long-term growth needs stable inflation. Recent studies, like those by Blanchard (2016),

show that inflation and unemployment are closely tied to GDP growth, with recessions negatively impacting both employment and price stability. This project builds on these findings by analyzing the Economic Indicators & Inflation Dataset, covering 20+ countries over 15 years. It also includes projections for 2024-2025 to offer deeper insights into global economic trends.

3. Research Question

How do GDP, unemployment, inflation, and economic growth interact with each other, and what global trends can be observed?

4. Data Source & Methods

Data Source & Selection

The dataset used for this analysis is the Economic Indicators & Inflation Dataset (Worldwide) from Kaggle. Includes data from 2010 to 2025 for multiple countries, covering key indicators:

- GDP (in billion USD) – Represents the total economic output of a country.
- Inflation Rate (%) – Measures the annual percentage increase in the general price level.
- Unemployment Rate (%) – Indicates the percentage of the labor force that is unemployed but actively seeking work.
- Economic Growth (%) – Represents the annual percentage change in GDP.

Analysis Strategy

- Correlation Analysis – Measuring relationships between GDP, inflation, unemployment, and economic growth across countries.
- Regression Analysis – Examining the impact of GDP, inflation, and unemployment on economic growth using multiple regression models.

- Time Series Analysis – Identifying trends over time through line plots and forecasting methods to evaluate economic patterns.

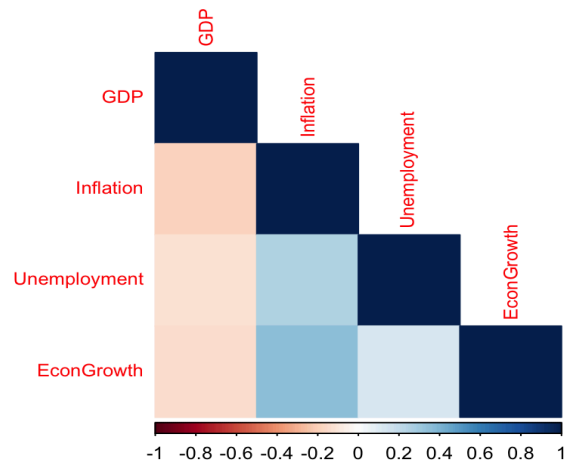
5. Exploratory Data Analysis (EDA)

Correlation Matrix:

```
##                GDP  Inflation Unemployment EconGrowth
## GDP           1.0000000 -0.1807651   -0.1241291 -0.1353753
## Inflation     -0.1807651  1.0000000    0.2559102  0.3660374
## Unemployment -0.1241291  0.2559102    1.0000000  0.1314685
## EconGrowth   -0.1353753  0.3660374    0.1314685  1.0000000
```

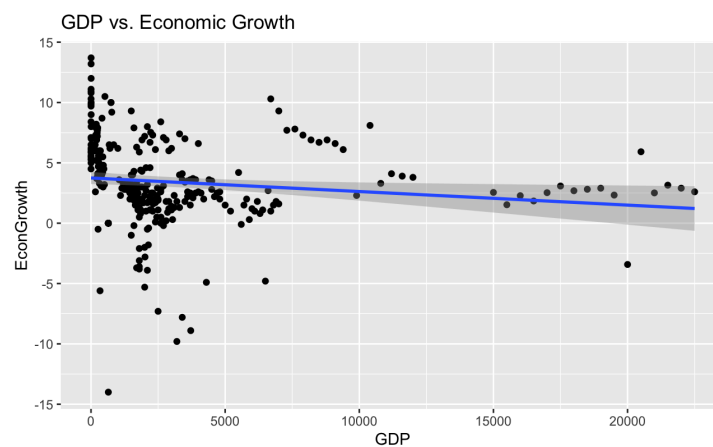
- GDP shows weak negative correlations with inflation, unemployment, and economic growth, suggesting a marginal inverse relationship with these indicators.
- Inflation has a moderate positive correlation with economic growth (0.37) and a weak positive correlation with unemployment (0.26), which differs from the expected inverse relationship in the Phillips Curve.
- Unemployment and economic growth exhibit a weak positive correlation (0.13), indicating minimal direct association.

Correlation Heatmap:

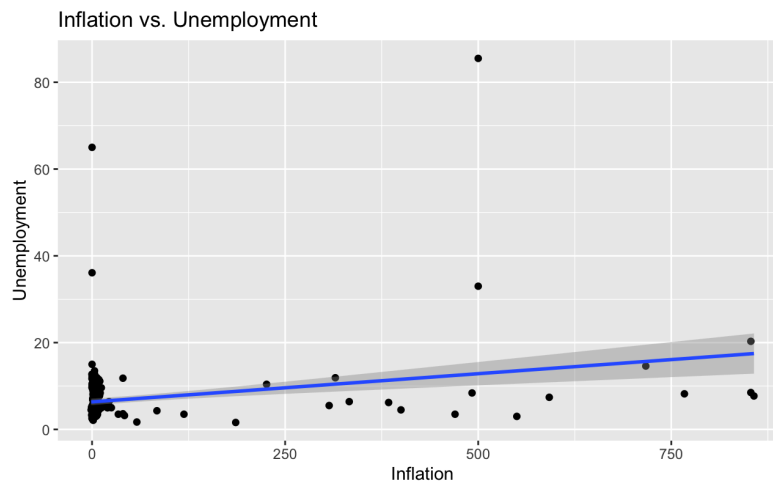


The heatmap shows that Economic Growth and Inflation have the highest moderate correlation (+0.37), indicating that higher inflation tends to coincide with higher economic growth. Additionally, Unemployment and Inflation are moderately positively correlated (+0.26), suggesting that as inflation rises, unemployment also tends to increase slightly.

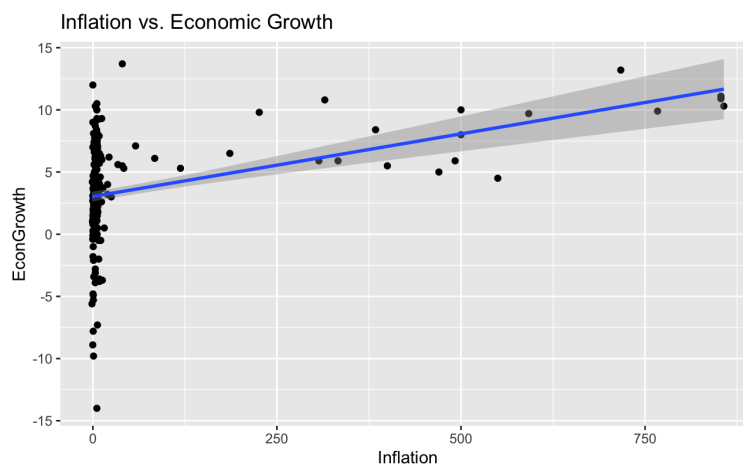
Scatterplots for Key Relationships:



GDP vs. Economic Growth: The scatterplot shows a weak and slightly downward trend, indicating that changes in GDP are not strongly associated with changes in economic growth. This suggests that GDP alone may not be a strong predictor of economic growth.



Inflation vs. Unemployment: The scatter plot reveals a slight upward trend, suggesting a weak positive correlation, where higher inflation is modestly associated with higher unemployment. This aligns with some economic theories but is not a strong relationship in this dataset.



Inflation vs. Economic Growth: The scatterplot shows a positive trend, indicating that as inflation increases, economic growth also tends to rise. This suggests a mild but positive relationship between inflation and economic growth.

6. Modeling & Analysis

Correlation Analysis:

Already completed within the EDA process. The correlation analysis reveals that GDP has weak negative correlations with inflation (**-0.18**), unemployment (**-0.12**), and economic growth (**-0.14**), suggesting minimal inverse relationships. Inflation and unemployment show a weak positive correlation (**+0.26**), indicating they tend to rise together. Inflation and economic growth have a moderate positive correlation (**+0.37**), implying that higher inflation is associated with higher economic growth. Unemployment and economic growth have a very weak positive correlation (**+0.13**), showing a minimal relationship. These findings highlight the interconnectedness of GDP, inflation, unemployment, and economic growth, with inflation and economic growth exhibiting the strongest positive correlation.

Regression Analysis:

Console output:

```
lm(formula = EconGrowth ~ GDP + Inflation + Unemployment, data = data)
```

Residuals:

	Min	1Q	Median	3Q	Max
	-17.3194	-1.4614	-0.2222	2.0014	9.9912

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	3.107e+00	3.245e-01	9.577	< 2e-16 ***
GDP	-5.711e-05	4.537e-05	-1.259	0.209
Inflation	9.488e-03	1.543e-03	6.149	2.49e-09 ***
Unemployment	1.882e-02	3.013e-02	0.625	0.533

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

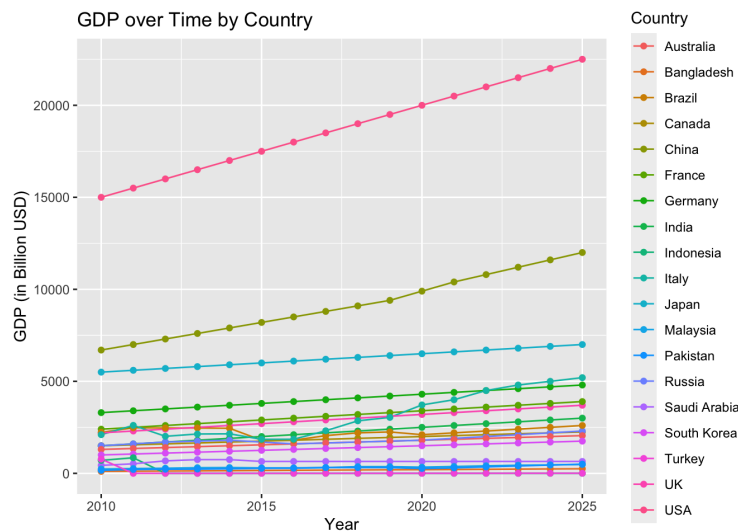
Residual standard error: 3.38 on 300 degrees of freedom

Multiple R-squared: 0.1401, Adjusted R-squared: 0.1315

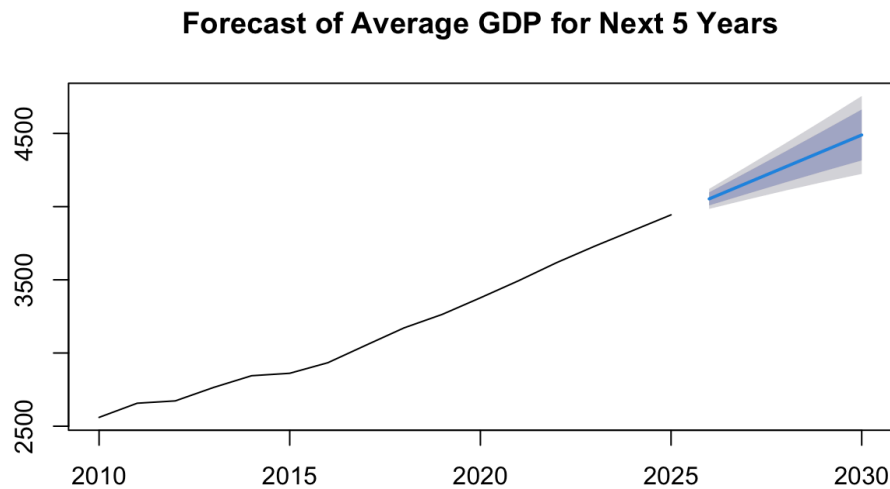
F-statistic: 16.29 on 3 and 300 DF, p-value: 7.834e-10

The regression model shows that economic growth is about 3.11 when all predictors are zero. GDP has a negative relationship with economic growth, but it's not statistically significant. Inflation has a positive and significant impact on economic growth, meaning higher inflation is linked to higher growth. Unemployment has a positive relationship with economic growth, but this is not significant. The model explains only 14% of the variation in economic growth, meaning other factors also influence growth. However, the overall model is statistically significant, thus the predictors together have a meaningful impact on economic growth.

Time Series Analysis:



This plot shows slight upward trends in GDP for most countries, indicating steady but modest economic growth over time. The small increases in GDP may suggest stable economies, especially in developed countries. Variations in growth rates could be influenced by things like government policies, infrastructure, or global conditions. Overall, we see a common gradual increase throughout the countries.



Upward Trend in GDP: The forecasted increase in average global GDP supports the expectation of global economic growth in the coming years. This is consistent with outside trends of recovery post-pandemic and ongoing economic development in many markets.

Inflation's Role: We found that inflation tends to rise with economic growth, meaning countries are growing, but also dealing with higher prices as demand for goods and services increases.

7. Limitations

- Assumes linear relationships
- External factors such as political changes are excluded

8. Conclusion

This analysis explored how GDP, inflation, unemployment, and economic growth interact globally from 2010 to 2025. Our findings reveal that inflation is positively correlated with economic growth, suggesting that higher inflation may drive higher economic growth. However, GDP and unemployment have weaker relationships with

economic growth, with only inflation showing a significant and strong link. The forecast indicates an overall increase in GDP globally, signaling positive economic trends in the coming years. However, the model explains only 14% of the variation in economic growth, suggesting that other external factors, such as political changes and global events, play a significant role in shaping economic outcomes.

These findings show that inflation might help drive growth, but they also highlight how complicated the economy is. More research is needed to understand other factors that influence these trends.