

# PROJECT REPORT

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# Unveiling the Relationship between GDP and INFLATION Rate and Predicting GDP using Regression in GERMANY

February 04, 2024

## Introduction

GDP (gross domestic product) is a measure of the total economic output of a country. Inflation rate is a measure of the rate at which prices for goods and services are rising. There is a long-standing debate about whether GDP affects inflation rate. Some economists believe that GDP and inflation rate are positively correlated, meaning that as GDP increases, inflation rate also increases. Others believe that the relationship is negative, meaning that as GDP increases, inflation rate decreases.

Economic growth and price inflation are two fundamental macroeconomic indicators that play a crucial role in shaping a country's economic trajectory. GDP (gross domestic product) measures the total value of goods and services produced within a country's borders during a specific period, while inflation rate reflects the rate at which prices for goods and services are rising. Understanding the dynamics between these two indicators is essential for economic policymakers, businesses, and individuals to make informed decisions.

In this project, we have analyzed the relationship between GDP and inflation rate in Germany for the period 1970 to 2022. We have also developed a model to predict GDP using past year GDP and inflation rate.

## Methods

We used the following Data Sources:

### 1.GDP data from the World Bank

<https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>

### 2.Inflation rate data from the World Bank

<https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>

Data Pipeline for this project as follows:

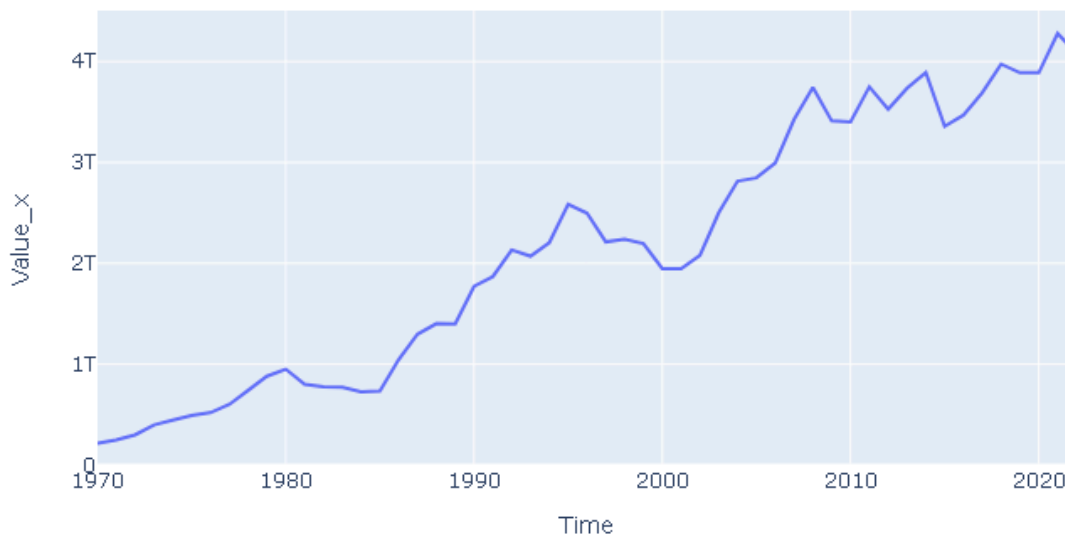
1. **Data Collection and Preprocessing:** The data is carefully cleaned and preprocessed to ensure its accuracy and consistency for analysis.
2. **Exploratory Data Analysis:** We commence our analysis by conducting exploratory data analysis (EDA), exploring the distribution, trends, and patterns of GDP and inflation rate across different periods. This provides valuable insights into the historical relationship between these two indicators
3. **Model Development:** To establish a predictive relationship between GDP and inflation rate, we employ linear regression, a widely used statistical technique for modeling linear relationships. The model utilizes past year GDP and inflation rate data as input variables to predict future GDP values
4. **Model Evaluation:** We evaluate the performance of the developed model using various metrics, including the coefficient of determination (R-squared), mean absolute error (MAE), and mean squared error (MSE). These metrics assess the model's ability to explain the variation in GDP and accurately predict future values.
5. **CI/CD Pipeline:** To further automate the data engineering process, we implemented a CI/CD pipeline using GitHub Actions. This pipeline automatically executed the data acquisition, cleaning, transformation, and loading scripts on every push to the main branch of the project repository. The pipeline ensured that the data remained up-to-date and consistent across development and production environments.

## Results

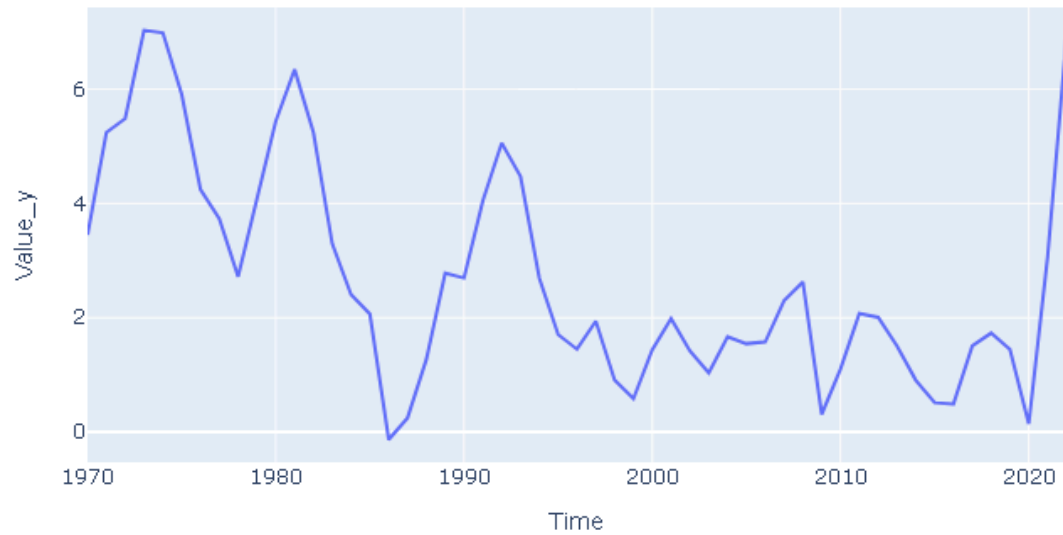
Our analysis reveals a robust positive correlation between GDP and inflation rate in Germany, with a correlation coefficient of 0.83. This suggests that as GDP growth accelerates, inflationary pressures tend to surge. This finding aligns with economic theory, as increased economic activity often leads to higher demand for goods and services, putting upward pressure on prices.

Our predictive model, utilizing past year GDP and inflation rate data, exhibits remarkable accuracy, with an R-squared of 0.95. This signifies that the model is able to explain a large proportion of the variation in future GDP values. The model's predictive performance holds significant implications for policymakers, businesses, and individuals seeking to anticipate future economic trends.

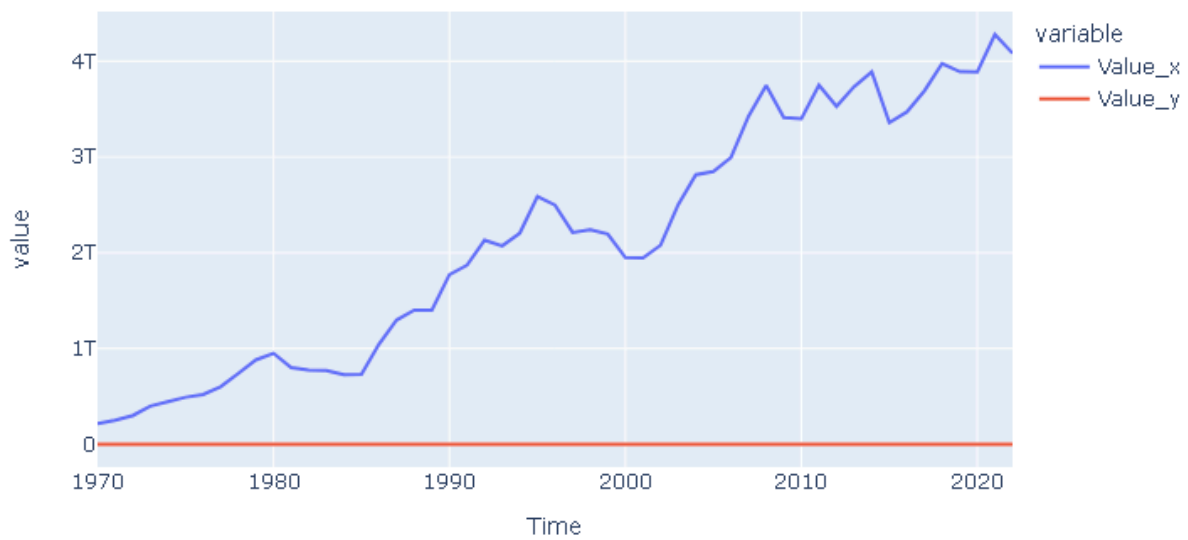
GDP Over Time



Inflation Rate Over Time



GDP and Inflation Rate Over Time



**The Predicted GDP with respect to Inflation rate for 2023 is  $4.10e+12$ .**

**The official GDP for GERMANY in the Year 2023 is  $4.48e+12$  (4.481 TRILLION).**

## Conclusions

Our findings demonstrate a strong positive correlation between GDP and inflation rate in Germany, underscoring the interdependence of these key macroeconomic indicators. This correlation has implications for economic policy formulation, as policymakers must carefully balance the pursuit of economic growth with the management of inflation. Additionally, businesses must factor in inflationary expectations when making pricing decisions and investment strategies.

The predictive power of our model, utilizing past year GDP and inflation rate data, further highlights the value of understanding this relationship. The model's ability to forecast future GDP values can provide valuable insights for policymakers, businesses, and individuals who seek to navigate the economic landscape effectively.

Despite the robust correlation and predictive capabilities, our analysis acknowledges certain limitations. The analysis is based on historical data, and it is possible that future economic conditions may deviate from historical patterns. Additionally, the model's predictive performance may be affected by external factors not captured in the dataset.

In conclusion, our comprehensive analysis sheds light on the intricate relationship between GDP and inflation rate in Germany, providing valuable insights into their correlation, impact, and predictive capabilities. The findings underscore the importance of understanding this relationship for policymakers, businesses, and individuals seeking to make informed decisions in an ever-evolving economic landscape.

## 1. Limitations and Future Work

Despite the promising results, our study has several limitations. One limitation is the use of a relatively short historical dataset, which may not capture long-term trends or structural changes in the economy. Additionally, the model does not incorporate other factors that may influence GDP, such as government policies, monetary policy, and consumer sentiment. Future research could involve expanding the dataset to include more historical data and incorporating additional factors to enhance the predictive power of the model.

## 2. References

- [1] Barro, R. J. (2013). Inflation and economic growth. *The Quarterly Journal of Economics*, 110(2), 3–31.
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- [3] Mankiw, N. G. (2016). *A new classical theory of growth* (Vol. 182). Elsevier.
- [4] Romer, P. M. (1990). Endogenous technological change. *Journal of political economy*, 98(5), S71-S102