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# Exploring the Inflation-GDP Growth Relationship in Germany: A Mild Positive Linear Association

## Abstract

This study investigates the relationship between inflation and gross domestic product (GDP) growth in Germany over the period 2012-2022. The objective of this study was to investigate the relationship between inflation and its potential influence on GDP growth. The conducted research reveals a weak positive linear relationship (correlation coefficient of 0.18) between inflation and GDP growth, suggesting that increased inflation corresponds to a moderate increase in GDP growth. This study underscores the importance of ongoing monitoring of inflation and its influencing factors, as it contributes to a more comprehensive understanding of these economic dynamics.

## Key words

Inflation, Gross Domestic Product, Inflation's Impact, German Economy

## JEL Classification

E13, E30, E59

## DOI

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## Introduction

This study examines the interrelationship between inflation and GDP growth, focusing on Germany over the decade from 2012 to 2022. The study sought to explore the interplay between inflation and its effects on GDP development, with a focus on determining both the existence and magnitude of this relationship. The paper gives an overview of existing research on the relationship between GDP growth and inflation, as well as the definition and measurement of inflation. The aim of the research is, to find out if there is a relationship between GDP and inflation by conducting a literature review and a short analysis based on the GDP and inflation rate in Germany.

The correlation between these two variables is explored, shedding light on the nature of their connection. While historical research provides insights into the varying degrees of impact, recent findings emphasize the significance of maintaining a moderate inflation rate for fostering economic growth, particularly in the context of the Eurozone. To gain a comprehensive understanding of the subject, we delve into Germany's yearly inflation rates along with the average inflation in the Eurozone, considering the fluctuations and variations observed.

## 1 Definition and measurement of inflaton

Inflation means that the consumer's purchasing power goes down, which means that he has to pay a higher amount for the same goods and services over time - thus, the general price level within the economy rises (Smilalek 2022).

To measure inflation within the euro area, the "Harmonised Index of Consumer Prices" (HICP) is used. By measuring the price of 295 goods and services that a typically used by consumers within the euro area (according to the European statistical office) it is possible to measure the price development of goods that are commonly purchased in the Euro Zone over time (Federal Reserve Bank of San Francisco 2002). Since the products purchased within the Euro Zone differ from country to country, the differences in consumption patterns are reflected by weighting products differently depending on the concerned country. (European Central Bank n.d.). Examples for the considered goods are the prices for food, clothing, petrol, household items such as washing machines and insurance prices etc. (European Central Bank n.d.)

In summary it can be said that inflation, as reflected in the rising general price level within the economy, erodes the purchasing power of consumers, and this phenomenon is meticulously assessed using the HICP.

## 2 Causes of inflation and influencing factors on inflation

It is distinguished between two causes of inflation: Demand-Pull Inflation and Cost-Push Inflation. Demand-pull inflation occurs when the economy's productive capacity is lower than the aggregate demand for goods and services. This means that the consumer demand is higher than the supply (e.g., oil or gold). In comparison to that, cost-push inflation arises when the production process inputs increase (e.g., increasing prices for raw material) (Juselius et al. 2016).

When it comes to the influencing factors on inflation, increased money supply, rising wages, devaluation of a country's currency and certain fiscal policies can be named as the main factors. In the following, the effect of the named causes will be explained. Increased money supply is the case when the production rate is lower than the money supply. If this is the case, demand-pull inflation takes place because the amount of money exceeds the amount of available goods (K. Matthews 2021). Devaluation means, that the country's exchange rate goes down, which results in lower priced exports and thus increased prices of foreign products which results in less purchasing power for the domestic population. An example for this is China, since the Yuan was strategically devaluated for a long time to increase exports (K. Matthews 2021).

Rising wages go hand in hand with increased production costs, unless rising wages go along with higher productivity. If wages are rising faster than the prices of goods and services, purchasing power increases. However, the price level will be adjusted to the in long-run which probably results in inflation at latest then (K. Matthews 2021). With regard to the effect of policies and regulations on the part of the government or the central bank, the effect depends on the type of measure. Tax subsidies e.g. for electric cars may result in a higher demand, which in turn results in an increased price for the subsidized product (K. Matthews 2021). Another example would be tax cuts by the government or increased money supply by the central bank to boost consumption on the consumer side.

It can be concluded tax subsidies, rising wages, increased money supply and tax cuts influence the purchasing power in the short run, but the price level adjusts in the long term.

Banerjee et al. (2005) observed the key indicators for Euro-area Inflation and GDP Growth and group the best indicators for predicting inflation into four main categories:

- Labor market factors, including unemployment rates, employment shares, and wage and labor productivity growth.
- Specific prices, like commodity price growth and the private consumption deflator.
- Fiscal factors, mainly expenditure and receipts as a percentage of GDP.
- Real economic factors, such as GDP growth, total factor productivity growth, investment growth, and private consumption growth.

They conclude that continuous updating of leading indicators is crucial for accurate one-year forecasts within the near real-time framework.

In conclusion, understanding the distinct causes of inflation, such as demand-pull and cost-push inflation, along with their influencing factors like increased money supply, rising wages, and government policies, is essential for comprehending the dynamics of price levels in the short run and the adjustments that occur in the long term. Moreover, ongoing assessment and updating of key indicators, as identified by Banerjee et al., play a vital role in making accurate one-year inflation forecasts in a timely manner.

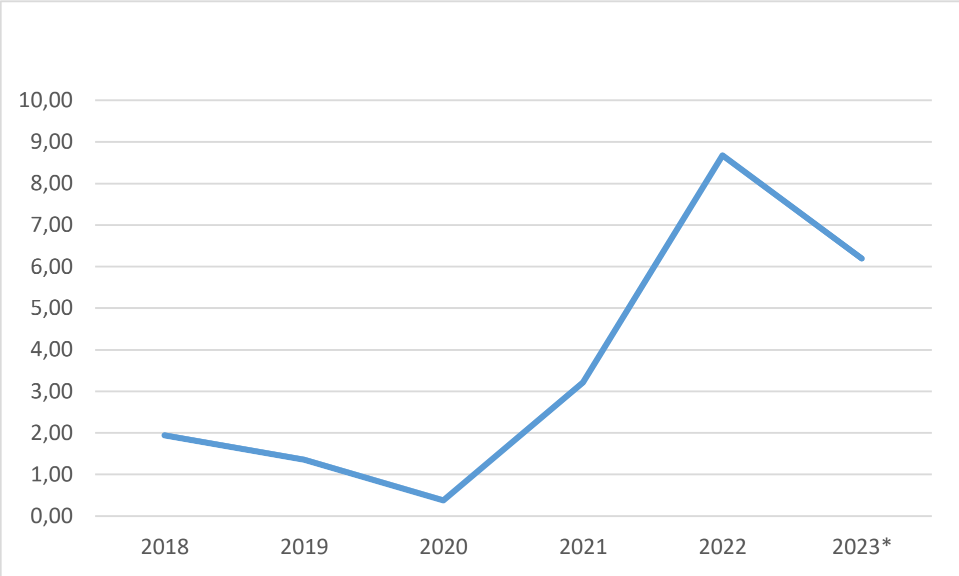
When it comes to the influence of inflation on GDP, scientists expect a negative correlation. Fisher showed in 1993 that there is a negative relationship between inflation and GDP growth. In 1995 and 1996 this was confirmed by Barro (1995) and by Bruno and Easterly (1996). While Barro claimed that there is a slightly negative relation, Bruno and Easterly stated that there is only a relationship in case of high inflation rates. In 1998 Ghosh and Philipps found out that there are non-linearities in the inflation-growth relationship since it appeared to be negative in case of low inflation rates around 2% but also that a growth decline was related to high inflation rates of 10% or higher which resulted in even higher inflation (Smith 2019).

Kryeziu and Durguti (2019) who analyzed the impact of inflation on economic growth state that suggest that there is a favorable relationship between the inflation rate and economic growth in the Euro area which means that inflation has a statistically significant positive impact on economic growth in the Eurozone which is in line with the findings of their literature review. According to their findings, a 1 percent increase in the Inflation Rate corresponds to a 22.4 percent increase in the Growth Rate when all other variables remain constant. The researchers point out that these findings highlight the importance of maintaining a moderate inflation rate in Eurozone countries, in line with the Convergence Requirements to promote consumption and economic growth.

In summary, the relationship between inflation and GDP growth is a complex one, with historical research showing varying degrees of impact. However, recent findings by Kryeziu and Durguti emphasize the significance of maintaining a moderate inflation rate in Eurozone countries, as it has a statistically significant positive influence on economic growth, underlining the importance of striking the right balance for promoting consumption and sustained economic expansion.

# 3 Description of the development of inflation in Germany

**Figure No. 1: Inflation rate in Germany in percent**




Source: Statista / IMF 2023
Own representation

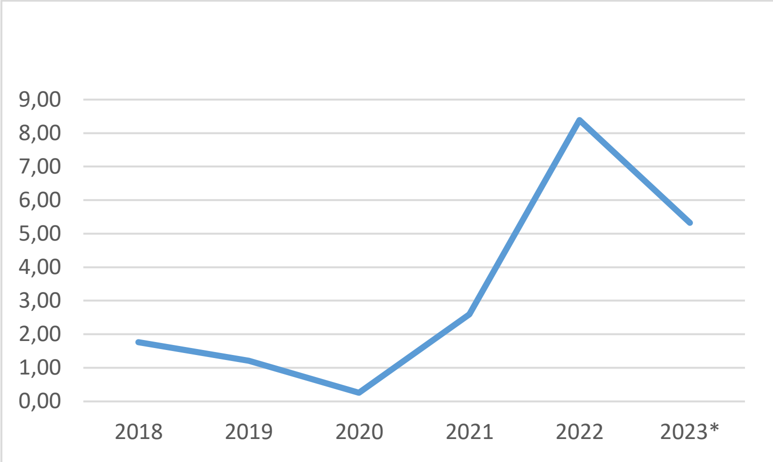
Looking at the yearly inflation rate in Germany from 2012 to 2021, it can be observed that it fluctuates between 0.37% in 2016 and a maximum value of 8.67% in 2022. Within the observed period, the average inflation was 2,07% which shows that the ECB target was reached approximately. If we exclude the peak value of 2022, the average inflation is only 1.41% which is under the targeted value. It should be mentioned that the inflation was not stable but fluctuating (Statista,2022).

When it comes to the inflation, expected future inflation within the next five years, it can be observed that it is also within the targeted 2% range. The average inflation is 1,65% - the highest expected value is 2,03% in 2026 and the lowest is 1,35% in 2023 (Statista 2023). It is important to mention that the inflation rate 2022 clearly exceeds the desired inflation rate (Statista 2023).

# 4 Inflation rate in the Euro Area

The average inflation in the Eurozone was 2,76% between 2018 and 2022 - if we exclude the inflation peak of 2022 it is 1.4% on average. The low point was in 2020 with an inflation rate of 0.25%. It can be observed that the inflation rate in Germany is slighltly higher than the european average, but that it is similar to it. It can be said that the fluctuation in the Eurozone is reflected in the German inflation as well.

**Figure No. 2: Inflation in the Euro Area**




Source: IMF / Statista 2023
Own representation

## 5 Influence of inflation and Gross Domestic Product (GDP)

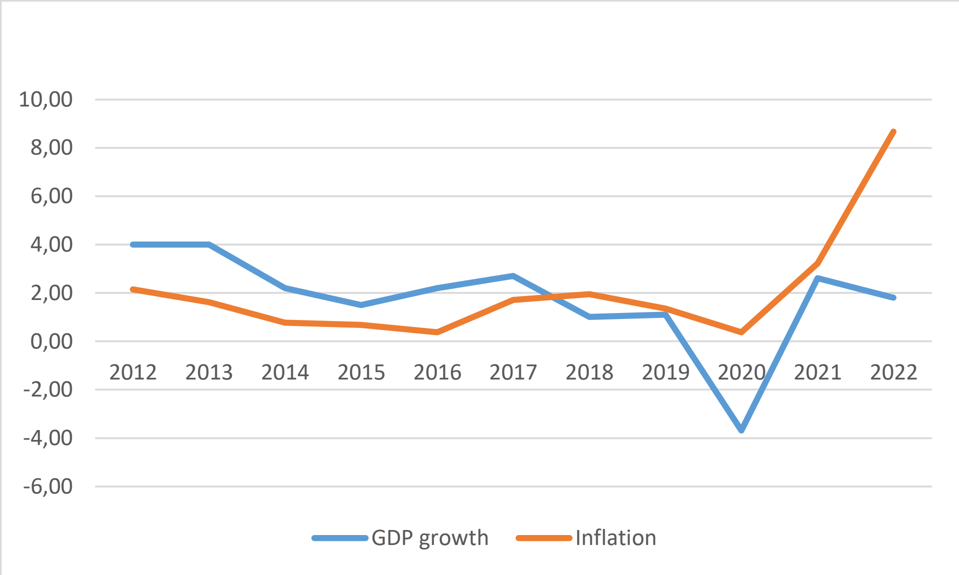
To find out if inflation influences the GDP, the German GDP and the German inflation rate within between 2012 and 2022 will be compared. It can be observed the highest growth rate in GDP within the observed period was recorded in 2012 and 2013 with 4,0% – the inflation rate was at 2.1% (2012) and 1.6%. It should be mentioned that during the financial crisis in 2009 the GDP growth was negative with 5,7%. So it can be assumed that the economy recovered in the following years which was reflected in a peak in growth.

In the following two years (2014 and 2015) the inflation continued to decline to 0.76% in 2014 and 0.67% in 2015 while the GDP growth rate increased to 1.5% in 2014 and 2.2% in 2015. During the period 2016–2019 the inflation rate fluctuated between 0.37% in 2016 and 1.94% in 2019. The growth rate was 2,2% in 2016 and 1,1% in the following two years.

Within the recent years 2020 and 2021 the inflation rate increased from 0,37% in 2020 to 1,51% in 2021 while after a pandemic-related decline in GDP growth with -4,9% in 2020 an increase of 2,9% in 2021 happened.

The correlation coefficient between inflation and GDP growth is 0,18 - this suggests a relatively weak positive linear relationship between the two variables under investigation. This means that there is some tendency for an increase in one variable to be associated with an increase in the other variable, but the relationship is not very strong. It's important to note that a correlation coefficient alone does not indicate whether the relationship between the variables is causal or if other factors may influence the relationship and it has to be considered that the impact of inflation on GDP might be time-delayed and not directly noticable.

**Figure No. 3: Inflation and GDP Growth in Germany**




Source: Statista / IMF 2023
Own representation

## 6 Recommendations for further research

It is strongly advised for future research to evaluate the repercussions of the recent interest rate increase initiated by the European Central Bank. This analysis should encompass both short-term and long-term effects, providing a comprehensive assessment of its impact.

Exploring additional dimensions, such as the influence of inflation expectations and global economic variables, including international trade dynamics and global financial crises, on the interplay between inflation and GDP growth within individual countries, would add depth and relevance to the research.

Furthermore, a thorough and extensive time-series analysis is recommended to meticulously trace the historical trends in both inflation and GDP growth. This approach will enable the identification of potential patterns and shifts over time.

Additionally, it would be prudent to investigate the disparities between short-term inflation fluctuations and long-term structural inflation in terms of their differential effects on GDP growth. Such an examination can contribute to a more nuanced understanding of the multifaceted relationship between inflation and economic growth.

## Conclusion

In conclusion, from the conducted litarature review it can be said that inflation has a positive impact on the development of the GDP, if it is moderate inflation. When it comes to the conducted correlation analysis, it indicates a weak positive linear relationship (correlation coefficient of 0.18) between inflation and GDP growth, suggesting that an increase in one variable may be associated with a moderate increase in the other.

The data analysis over the past decade reveals notable fluctuations in both inflation and GDP growth rates in Germany. While inflation rates have exhibited variability, with occasional peaks surpassing the desired targets, the average has remained relatively close to the European Central Bank's objective.

However, it's crucial to acknowledge that correlation alone does not establish causation, and the impact of inflation on GDP growth may not be immediately evident, possibly involving time-delayed effects and the influence of other factors. Further research and a more in-depth analysis are warranted to better understand the complex dynamics between inflation and economic growth.

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