

# How Does Inflation and Recession Correlation Vary Across Countries?

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## ABSTRACT

Central banks worldwide aim to maintain a target inflation rate of 2 %, especially during recessionary periods defined by two consecutive quarters of negative economic growth. However, undesirable inflation rates emerged following significant global events such as the 2008 - 09 Global Financial Crisis and the COVID -19 recession, raising questions about the correlation between inflation and recession. This study investigates the relationship between inflation rates and recessions across countries with varying levels of GDP per capita, using data from the World Bank spanning from 1980 to 2022 to perform correlation calculations and analysis. The findings indicate that this correlation is not uniform but varies significantly depending on a country's level of economic development, suggesting that less developed economies might experience a stronger linkage between these two variables. Understanding these variations is crucial for the development of more effective macroeconomic policies that aim to stabilize inflation and foster sustainable economic growth, particularly in economically vulnerable nations.

## Introduction

Episodes of inflation rates higher or lower than the desirable 2% rate have different causes. Typical causes for high-level inflation rates are demand-pull and cost-push. The Keynesian model suggests that insufficient supply capacity to fulfill demand causes demand-pull inflation. This often happens during boom periods, which this paper will not consider. Factors such as oil price fluctuations and currency depreciations can trigger cost-push inflation, where stagflation can occur, indicating the correlation between inflation and recession.

Moreover, typical cases of low-level inflation below 2% conventionally appear in developed countries such as the United Kingdom and the United States, where high level of productivity enables competitive pricing hence lower prices which occurs due to the economic development of the country rather than the economic cycle stage the country is in. This will not be considered in this paper. However, deflation is typically triggered by deflationary spirals during low economic growth, which is closely related to inflation expectations and level of uncertainty. This paper will consider this aspect of the relationship between inflation and recession.

Furthermore, stagflation periods highlight the correlation between inflation and recession which papers from the literature have investigated and discussed the triggers of stagflation periods. This paper will further investigate whether the economic cycle period and level of economic development of a country will influence the correlation between inflation and recession by considering three variables: inflation rates, GDP growth rate, and GDP per capita. However, as there is often a combination of multiple influencing factors that contribute to an outcome of undesirable inflation rates or recession periods like unemployment, uncertainty, interest rates, and monetary policies, this paper will discuss how these other influencing factors intertwine the correlation between inflation and recession.

Dissecting the relationship and looking at inflation independently, “inflation and inflation expectations are interconnected” (Binder 2022), which means a spiral effect of expecting higher inflation rates or maintained high-level inflation rates will eventually occur due to heightened speculations. Binder discusses how inflation expectations formed the empirical relationship between expected and realised inflation with context to two examples, one following

the theory and another not. Firstly, in the 2008-09 Global Financial Crisis, in the US, inflation remained low and stable when unemployment rapidly increased, but inflation rates were low and stable. Secondly, during COVID-19, consumers often associated increasing confirmed COVID cases with speculations of higher inflation rates. It led to an increasing realised inflation rate, suggesting the interconnecting nature of inflation expectations and realised inflation rates.

Coibion (2018) suggested two reasons for the stable inflation rate in the US after the Great Recession in 2009. It was the successful inflation anchoring and long-term inflation expectations rather than short-term speculations. Inflation anchoring has been well-managed in the US, which is beneficial for inflation rates in the long term. It allowed inflation rates to stay low and stable around the desirable 2% after the crisis and throughout the recession.

Some argue that inefficient monetary and fiscal policies would trigger inflationary pressures. Dellas and Taylas (2022) suggest that expectations shape economic activities. Dellas argues that the stagflation episodes in the 1970s and the Great Depression in 1930 in the United States were consequences of ineffective monetary policies, which failed to manage inflation expectations, hence inflation anchoring. Coibion similarly points out the indication of a correlation between expectation and inflation.

Effective management of inflation expectations by having a credible inflation anchor from the central bank enables less volatile inflation rates when external shocks or recessions occur. The strong trust from economic agents of the inflation anchor originates from believing that the central bank will implement suitable policies to prevent or resolve high inflationary pressures. The optimal method to achieve such would be a price-level targeting approach. This approach reduces the risk of zero-bound and forecasting errors. It also supplements more confidence and less uncertainty in the economy. This spirals into having more stable inflation rates and fewer speculations for volatile inflation rate movements.

Concluding from the literature, the strength of the inflation anchor determines long-term inflation expectations, in which inflation expectations strongly influence the realised real inflation rate trend line.

Negro, Giannoni, and Schorfheide (2015) state how previous papers in the literature, such as Hall (2011), claimed that models based on the New Keynesian Phillips curve can't explain the reason for the stable inflation rates post-recession in 2009. The Phillips curve traditionally uses backward-looking inflation expectations by taking the current unemployment rate to predict future inflation rates. However, Negro opposes this viewpoint by explaining that the missing prediction of the 2012 deflation period, when using models based on the New Keynesian Phillips curve, was due to the ignorance of external shocks. The reason why the models neglected or cannot forecast the impacts of external shocks originates from the traditional principle of backward-looking. Furthermore, Negro explained that if the labour share of economic activity is small, unemployment will be less relevant to future inflation rates, so more accurate predictions require a different approach. This paper uses a DSGE model, also based on the New Keynesian Phillips curve, and using the pre-crisis data successfully predicts a disinflation period with inflation remaining positive, which was the actual scenario. The reasoning behind the difference in results was that Negro viewed that inflation rate trends should base on the expected future marginal costs rather than current economic activity.

Negro argues that fundamental inflation calculations should assume people anticipate the expected future marginal costs and recalculates back to the present value rather than using the backward-looking approach. Negro explained the reason why expected future marginal costs fell but didn't trigger deflation, and the key was the monetary policy of lowering interest rates to around 0%, as well as the strong trust in the monetary policy by the economic agents that made the policy effective. Strong inflation anchoring led people to anticipate and expect the future marginal cost to increase. Concluding that Negro similarly emphasised that expectations play a huge role in realised inflation rates.

Given context to this reasoning of the effects of inflation expectations on inflation rates, (Nowzhour 2020) reflects how inflation expectations are the linkage between inflation and recession because, during recession periods, there is a tendency of expectations for lower prices or lower inflation rates which will lead to reduce economy activity such as less consumer consumption as consumers will be anticipating for price levels to fall lower, which potentially causes deflation or disinflation which then verifies the potential correlation between inflation and recession.

This paper aims to investigate the variation of the correlation between inflation rate and recession across countries. Despite extensive research on the dynamics between inflation and economic growth, the comparison of the correlation between inflation rates and recession periods across countries remains less understood. This study seeks to fill this gap by examining how different levels of economic development, as measured by GDP per capita, influence the relationship between inflation and recession. By isolating these variables, this paper aims to contribute to the existing literature by offering insights that could inform the development of more nuanced macroeconomic policies tailored to the economic realities of both developed and developing nations.

The paper is organised in this format: In the next section, I will present my data and discuss the methods I have used to calculate correlations and draw conclusions from the data. Then, in the third section, I will present my results. Finally, in the last section, I will provide some concluding remarks and areas for future research and investigation.

## Data

The inflation rate, GDP growth (1980-2022), and GDP per capita (2022) are all collected from the World Bank. The table below shows the data statistics for the variables used in this paper. The inflation rate, GDP growth, and GDP per capita are all calculated based on 170 countries with available data.

**Table 1.** Descriptive Summary Statistics

| Variables (5 s.f.)            | Mean   | Standard Dev  | Maximum | Minimum |
|-------------------------------|--------|---------------|---------|---------|
| <b>Inflation (%)</b>          | 30.558 | <b>472.55</b> | 23773   | -17.640 |
| <b>GDP growth (%)</b>         | 3.3540 | <b>6.0841</b> | 149.97  | -64.047 |
| <b>GDP per capita (USD\$)</b> | 17422  | <b>23427</b>  | 125010  | 259.03  |

Table 1 presents descriptive summary statistics of all variables I use in my empirical analysis. I have observed that the mean inflation rate is relatively high at 30.5%. However, the standard deviation value of 472 indicated that the inflation rate varied across the sampled 170 countries. The GDP growth standard deviation value suggested that economies were integrated and interdependent. The mean GDP growth rate and the standard deviation value indicated that countries experienced a trend line of positive economic growth from 1980 to 2022. The standard deviation GDP per capita value suggested a wide gap between the income levels of the 170 countries. The maximum value of \$125010 (Luxembourg) and the minimum value of \$259 (Central African Republic) reciprocates this observation. This summary of statistics implies that as the context of the 170 countries varies in the level of economic development according to GDP per capita, which the inflation rate and GDP growth rate have also suggested. Therefore, the conclusions drawn in this paper will vary across different countries at different income levels.

## Methods

I have calculated the average correlation between the inflation rate and GDP growth rate of the 170 countries from 1980 to 2022. I categorised the countries into four income groups. High-income countries with a GDP per capita over \$40,000, mid-high-income countries with a GDP per capita between \$20,000 and \$40,000, mid-low-income countries with a GDP per capita between \$10,000 and \$20,000, and low-income countries with a GDP per capita below \$10,000. I then calculated the average, median, minimum, and maximum of the correlation values between the inflation rate and GDP growth rate, as Table 2 suggests. I have also calculated the correlation between inflation rate, GDP growth rate, and GDP per capita, as Table 3 presents. I have chosen to use correlation as the analytical tool to investigate the

relationship between inflation and recession to quantify the strength of the relationship. Inflation rates are quantified and measured by the annual percentage change, whereas recession can be defined using the annual percentage GDP growth rate. Using correlation valuations enables a more comparable analysis of the relationship between inflation and recession. However, there are several limitations, which I will discuss further in my conclusion.

## Results

**Table 2.** Based on Correlations between Correlations of Inflation Rate and GDP Growth Rate

| (X) GDP per capita (USD\$)   | Average             | Median              | Minimum      | Maximum     |
|------------------------------|---------------------|---------------------|--------------|-------------|
| All                          | <b>-0.039628578</b> | <b>-0.026791367</b> | -0.676694877 | 0.582895687 |
| <b>X&gt;40,000</b>           | 0.025596682         | -0.002215399        | -0.312005248 | 0.552126005 |
| <b>40,000&lt;X&gt;20,000</b> | 0.098499088         | 0.100965269         | -0.460297749 | 0.582895687 |
| <b>20,000&lt;X&gt;10,000</b> | <b>-0.126575191</b> | -0.174193897        | -0.609499656 | 0.505312778 |
| <b>&lt;10,000</b>            | -0.067327598        | -0.061378612        | 0.676694877  | 0.537133903 |

Table 2 presents the central tendency, maximum, and minimum values for the data set sampled from the World Bank (2022) according to the different GDP per capita groups. The average correlation of inflation rate and GDP growth rate for all the countries with available data is 0.03 which suggests no correlation. The overall median value is -0.02 implying that the correlation values are majorly tending negative and close to zero, reinforcing that there is little to no correlation between inflation and recession. Countries with GDP per capita below \$20,000 and above \$10,000 have the strongest average correlation of -0.12 out of all income groups.

**Table 3.** Correlation between Inflation Rate, GDP Growth Rate, and GDP per capita in groups

| (X) GDP per capita (USD\$)   | Correlation |
|------------------------------|-------------|
| <b>X&lt;40,000</b>           | 0.17200273  |
| <b>X&gt;40,000</b>           | -0.0328845  |
| <b>40,000&lt;X&gt;20,000</b> | 0.1222913   |
| <b>20,000&lt;X&gt;10,000</b> | 0.17922271  |
| <b>&lt;10,000</b>            | -0.0341185  |

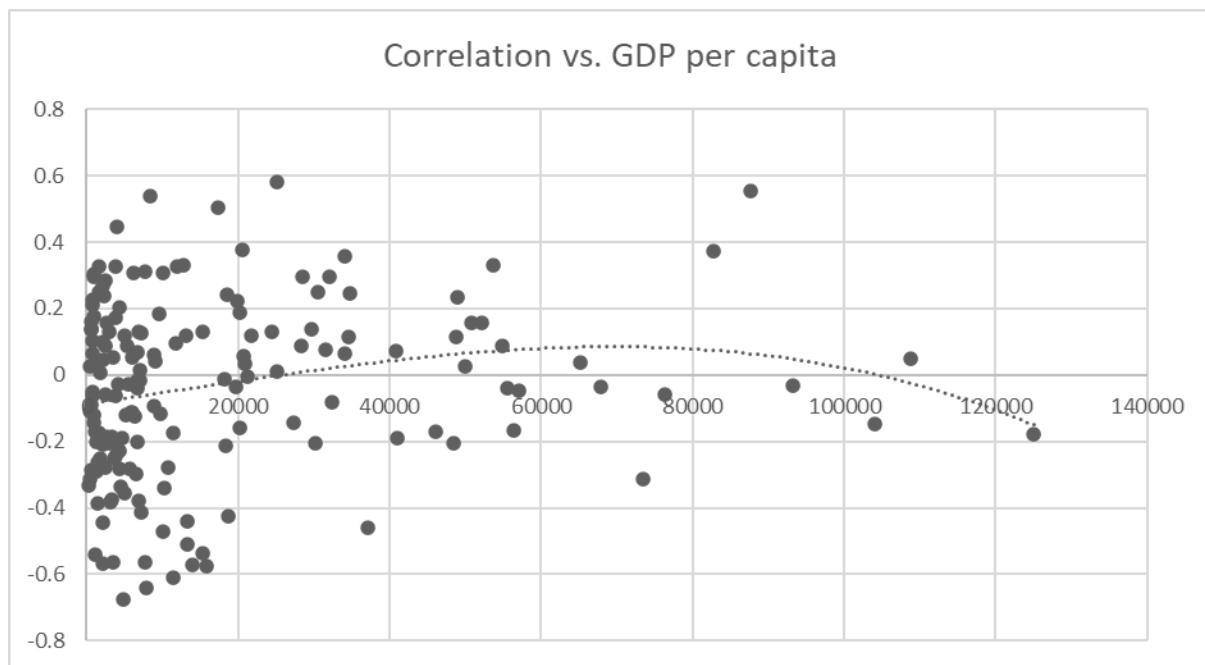
Table 3 presents the correlation values of the inflation rate, GDP growth rate, and GDP per capita. According to Table 3, there is a stronger correlation in countries with a GDP per capita below \$40,000 (0.172), and particularly countries with a GDP per capita between \$10,000 and \$20,000 (0.179). There is a weaker correlation in countries with GDP per capita above \$40,000 and below \$10,000. However, all correlation values are considered low and suggesting little relation between inflation rates, GDP growth rates, and GDP per capita.

**Table 4.** Countries with strong Correlation between Inflation and GDP Growth

| Country      | Correlation (inflation rate %/<br>GDP growth rate %) | GDP per capita (USD\$) |
|--------------|--|------------------------|
| <b>Qatar</b> | 0.55212600   | 87661.45015            |
| <b>Oman</b>  | 0.582895687  | 25056.79486            |

|                           |             |             |
|---------------------------|-------------|-------------|
| <b>Panama</b>             | 0.50531277  | 17357.62863 |
| <b>Dominica</b>           | 0.53713390  | 8351.193213 |
| <b>Romania</b>            | -0.57327413 | 15786.80174 |
| <b>Russian Federation</b> | -0.53537116 | 15270.70605 |
| <b>Bulgaria</b>           | -0.57234366 | 13974.44925 |
| <b>Costa Rica</b>         | -0.50959797 | 13365.3564  |
| <b>Kazakhstan</b>         | -0.60949965 | 11492.03194 |
| <b>Belarus</b>            | -0.63935832 | 7888.263711 |
| <b>Azerbaijan</b>         | -0.56526141 | 7762.073829 |
| <b>Indonesia</b>          | -0.67669487 | 4787.999308 |
| <b>Philippines</b>        | -0.56199851 | 3498.509806 |
| <b>Ghana</b>              | -0.56744997 | 2203.558935 |
| <b>Tanzania</b>           | -0.53867752 | 1192.766479 |

Table 5 presents all 15 countries with a strong negative correlation between inflation and GDP growth rate, with 13 of 15 countries having a GDP per capita below \$20,000.



**Figure 1.** Correlations of Inflation Rate and GDP Growth Rate vs GDP per capita

Figure 1 presents a scatter diagram of the correlation values between the average correlation and GDP per capita for all 170 countries with data available from the World Bank (2022). Excluding countries with a GDP per capita over \$40,000, Figure 1 shows a trend line of positive correlation between the inflation rate, GDP growth rate, and GDP per capita. I have observed that there are more range of correlation coefficients for countries with GDP per capita below \$10,000 and countries with GDP per capita between \$10,000 and \$20,000. As Figure 1 suggests, countries with a GDP per capita above \$20,000 have a smaller spread of correlation values with a higher coefficient.

## Discussion

Table 2 presents the average correlation as -0.03, showing little indication of a relation between inflation and recession, which implies that for most countries, inflation and recession do not relate. Countries with GDP per capita above \$10,000 and below \$20,000 have the strongest average correlation at -0.12 out of all income groups. However, the correlation is considered weak. Supporting this finding, as Table 3 suggests, countries with GDP per capita above \$10,000 and below \$20,000 have the strongest correlation of 0.17 between the inflation recession average correlation and GDP per capita. The correlation is considered weak but the strongest out of all. Supplementing this, countries with a correlation coefficient above 0.5 have been shown in Table 4 and Table 5. With a total of 15 countries, there are six countries with a GDP above \$10,000 and below \$20,000 and 7 countries with a GDP below \$10,000. Figure 1 also suggests that countries with a GDP below \$10,000 and countries with a GDP above \$10,000 and below \$20,000 have more number of larger coefficient correlation values compared to countries with a GDP per capita above \$20,000.

These calculation results indicate that countries with a GDP below \$20,000 have a relatively higher correlation between inflation and recession, whereas countries with a GDP per capita above \$20,000 have a relatively lower correlation between inflation and recession. However, there is only a minority proportion of countries with high correlation, where majorly the correlation coefficient is below 0.5, which is considered weak.

From the conclusions drawn from the literature, one can identify that inflation rates are closely related to inflation expectations and that business and consumer confidence in the government's ability to manage the inflation anchor influences inflation expectations. Therefore, when there is little trust that the government can secure the inflation anchor, there will be spirals of inflation speculations for inflation rate movement. Speculations will reciprocate into real inflation rates, meaning inflation expectations shape future inflation movements. This reasoning connects closely with the results calculated in this paper.

Table 2 shows that countries with a GDP per capita between \$10,000 and 20,000 have stronger correlations between inflation and recession. A potential explanation for this result would be that the government and central bank of a country with a lower GDP per capita provide less consumer and business confidence and a higher level of uncertainty for future inflation rates. Such implies that countries with lower GDP per capita are more prone to triggering higher or lower inflation. Binder reciprocates this viewpoint by suggesting that in recession periods in the US, the inflation rate was low and stable due to the success of inflation anchoring and successful management of inflation expectations.

Unsuccessful inflation anchoring can trigger speculations for movement in the inflation rates where past papers have justified this relationship. The stagflation period in Brazil showcases the correlation between inflation and recession. However, the correlation calculations from this paper suggest that inflation and recession have little relationship. Brazil experienced a stagflation period in 2015 which Sicsu has investigated. Sicsu explained that the high cost-push inflation rate was an unintended consequence of the fiscal contractionary policies imposed. However, ineffective management of inflation expectations was the key cause of the recession. The uncertainty increased the marginal prospect of saving, which meant a fall in consumer consumption and aggregate demand, ultimately causing a recession. Sicsu recognised that inflation expectations spiralled and caused the realised inflation rates to accelerate as soon as the rise in production costs led to inflationary pressures on consumer goods.

Concluding to Sicsu's explanation, the fiscal policy triggered inflation rates to occur, where the spiralled inflation speculations for higher inflation rates led to a recession. This evaluation indicates the correlation between inflation expectations and recession rather than inflation and recession. However, the movement of inflation rates is majorly influenced by inflation expectations, so it is safe to correlate inflation and recession using inflation expectations as a trilateral relationship. Brazil also has a relatively low GDP per capita of \$8918 in 2022 (World Bank), which aligns with this paper's previous findings about countries with lower GDP per capita being more prone to inflation speculations.

## Conclusion

This paper concludes that inflation rates and recession have a weak correlation for most sampled countries. There is a relatively weaker correlation for countries with a GDP per capita above \$20,000, whereas countries with a GDP per capita below \$20,000 have a relatively stronger correlation. This result reiterates previous studies about the importance of the central bank's inflation anchoring ability, where countries with lower GDP per capita have a strong correlation between inflation rates and recession.

Concluding from the findings of this paper, developing economies will benefit from enhancing their ability to manage the inflation anchor. This can be achieved by increasing transparency in policy-making, and investing in better economic forecasting tools can improve the central banks' credibility. Furthermore, consistent monetary and fiscal policies are crucial during recessions and high inflationary periods. The consistency will provide a better vision and enable businesses and consumers to project their expectations about future inflation rates and economic growth movements. Additionally, the international community, including organisations like the IMF and World Bank, should consider these findings when advising on macroeconomic stabilisation programs in lower-income countries.

Future research should also explore the potential moderating effects of other macroeconomic variables, such as unemployment rates, exchange rate volatility, and fiscal policy effectiveness, on the relationship between inflation and recession. Additionally, incorporating more sophisticated econometric models, such as vector autoregression (VAR) or structural equation modelling (SEM), could provide deeper insights into the causal mechanisms underlying this relationship. Understanding these dynamics can enable more effective policy interventions that foster stable economic growth across diverse economic contexts.

## Limitations

One limitation of the calculations in this paper is the use of correlation as an analytical tool to investigate the relationship. Correlation effectively evaluates a relationship between two variables and provides comparable results. However, inflation and recession are complicated concepts, with qualitative factors such as inflation expectations, which are hard to measure but influential to the relationship. Therefore, more sophisticated models that could better quantify qualitative factors are needed to investigate and understand the relationship and causes of inflation and recession periods.

Furthermore, this paper evaluated inflation rates and recession periods as independent variables, keeping other influencing factors constant. It is an unrealistic approach as economic factors are influential in multi-dimensions. Therefore, including other influential factors such as the unemployment rates when investigating the relationship will provide a better understanding in a more detailed manner for future studies. The correlation values presented in this paper do not suggest whether the size of the recession or inflation rate would be an influencing factor, which limited the interpretations concluded from the calculations. For example, whether a recession with a larger negative coefficient of the GDP growth rate percentage might be more prone to trigger a relatively higher or lower undesirable inflation rate is unable to be interpreted. The stronger correlation between inflation and recession in these nations suggests a need for more proactive and adaptive monetary policies.

There have been many changes and shifts within the timeframe used in this paper's calculations. From 1980-2022, the economic structure, consumer and investor behaviour, and monetary and fiscal policy philosophies transformed vastly. Therefore, using this time frame for the calculations in this paper reduces the relevance of the results. For example, the rise in the technology industry in the recent decade has shifted the economic structure and priorities of consumers and investors. The birth of quantitative easing as a monetary measure after the Global Financial Crisis has also reshaped the policy philosophy. Therefore, concluding the relationship between inflation rates and recession in this broad time frame disregards the differences in context and neglects the accuracy to some extent.

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