Factors Determining Inflation in the American Economy: A Quantitative Analysis

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Abstract: *This paper aims to examine the factors that determine inflation in the United States. To accomplish the research objective, a quantitative analysis employing the linear least squares method is conducted. The authors present empirical arguments that the factors that determine inflation in the US are structural-cost ones.*

1. INTRODUCTION

In 2021, inflation in the US began to grow at unprecedented rates, reaching 6.6 percent on an annual basis in 2022. The recorded annual inflation in the US is unprecedentedly high for the US economy. Therefore, many leading experts such as Summers (2021), Blanchard (2021), Stiglitz and Regmi (2022), and others have put the question of the causes of inflation in the US at the center of academic and political debate.

Thus, clarifying the factors that determine inflation in the US becomes an important discussion issue. This paper aims to examine the drivers of inflation in the US economy in the period from 2021 until the beginning of 2023. The main thesis of the authors is that inflation in the US has a structural-expenditure nature, not a monetary nature. The monetary manifestation of inflation is a consequence, not a main cause for the inflation in the United States. Proving the author's thesis requires testing two hypotheses. One hypothesis is that the rise in US inflation is due to structural cost factors, such as rising food, electricity and gas prices, which suggests that inflation in the American economy stems from cost-structural factors that arise from supply contraction, leading to disruptions in trade chains.

The other hypothesis is that inflation in the US is due to the increase in the money supply and fiscal stimulus.

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2.   LITERATURE REVIEW

The determinants of inflation in the United States are a subject of extensive debate among researchers, with a wide range of opinions. Scholars such as Summers (2021), Blanchard (2021), Borrallo et al. (2021), Harding et al. (2023), Barnichon et al. (2021), Jordà et al. (2022), Bianchi and Fisher (2021) argue that the primary factor driving the rise in inflation is the increase in government spending and fiscal stimulus implemented by the US government to counteract the economic contraction caused by the COVID-19 pandemic. Additionally, Borrallo et al. (2021) suggest that wage dynamics and inflation expectations, along with fiscal stimulus and supply chain disruptions, play a role in determining inflation.

Stiglitz and Regmi (2022) propose that supply chain disruptions contribute to inflation by limiting the availability of goods and services. They further emphasize that other factors influencing inflation in the US economy include structural distortions in demand, a labor market transforming, and market forces that promote inflation. Stiglitz and Regmi argue that inflation in the US has become persistent due to the ongoing conflict in Ukraine. Konczal (2023) supports this view and adds that housing prices, energy costs, and food prices significantly contribute to inflation. Furthermore, Konczal (2022) identifies high corporate profit margins as another factor driving unprecedented inflation in the US. Similarly, Brainard (2022) defends a similar thesis regarding the influence of high corporate profit margins on inflation. Stiglitz, Regmi, and Konczal reject the notion that inflation in the US is primarily caused by fiscal stimulus from the government.

On the other hand, authors such as Waller (2022), Nersisyan and Wray (2022) emphasize that inflation is driven by shrinking supply and increasing demand, leading to bottlenecks in trade chains, particularly in the context of rising wages. Ball et al. (2022) argue that tightening labor markets and the transmission of past shocks to the present contribute to inflation. Bolhuis et al. (2022) specifically attribute the rise in inflation to increasing housing rental prices.

In summary, two main theses have been put forth to explain the unprecedented inflation in the American economy. One thesis attributes the primary cause to increased government spending, while the other thesis points to structural supply distortions arising from trade chain disruptions during the pandemic and fluctuations in energy and fuel prices.

3.   METHODOLOGY AND DATA

The study period spans from January 2021 to February 2023, and the data used in the analysis have been monthly and seasonally smoothed. Inflation is measured using the Consumer Price Index (CPI) and is represented as a monthly percentage change. The monthly percentage changes in food prices, gas prices, and electricity prices are also considered. The monetary aggregates M2, including both the overall money supply and the money supply in circulation, are measured as monthly percentage changes. Government spending is measured as a monthly percentage change as well. The labor market, which reflects the impact of wages, is measured by the number of unemployed individuals in one job and expressed as a percentage change monthly.

The primary data for this analysis are sourced from reputable institutions such as the US Bureau of Labor Statistics, Federal Reserve Bank of Cleveland, Federal Reserve Bank of Philadelphia, and the USA Spending website.

The measurement and determination of factors influencing inflationary dynamics are typically carried out using the method of least squares. Researchers such as Lim and Papi (1997) utilize the method to determine the factors affecting inflation. Harding et al. (2023) highlight the use of non-linear models, which assign greater significance to inflationary factors in the inflation formation process.

To ensure the appropriateness of the stochastic dynamics within the aggregate statistical sample, the data must conform to a Gaussian normal distribution. Dickey and Fuller (1981) describe this distribution using the following logic:

$$Y_t = \alpha + \rho Y_{t-1} + e; (t = 1, 2, \dots n) \tag{1}$$

Where: Y_t – dynamic order; e – noise; α and ρ are parameters that indicate whether Y_t fits a Gaussian normal distribution. The dynamic range must be such that the data adequately fits a $(\alpha, \rho) \leq 0{,}1$ Gaussian normal distribution over time.

The least squares method can be expressed using the following equation:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \tag{2}$$

Where Y_i is the result of the impact of a given factor; X_i is a factor; α and β are parameters; ε_i is a term of the equation.

4.   RESULTS AND DISCUSSION

The scientific discussion examining the factors influencing inflation in the United States suggests that inflation (CPI) is primarily driven by excessive government spending (spending gov). Consequently, we can represent the first equation in the following form:

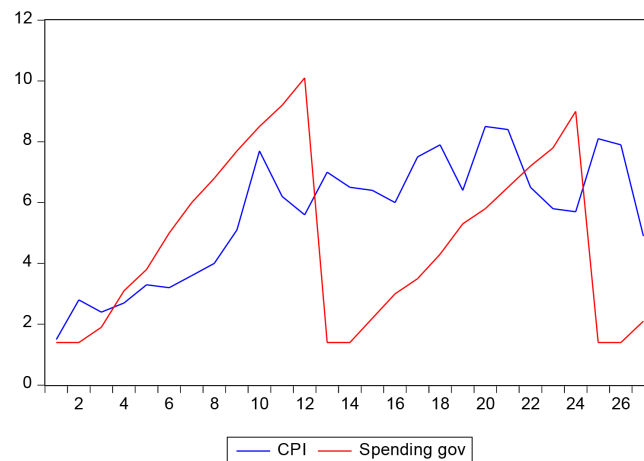$$CPI = \alpha + \beta_{Spending\_gov} + \varepsilon \tag{3}$$

Figure 1. Stationarity test - CPI and Spending gov.
Source: Federal Reserve Bank of Cleveland; USA Shipping gov.; author's calculations

The stationarity test indicates that mathematical transformations are necessary to fulfill the requirement of a Gaussian normal distribution over time (Figure 1). Following these transformations, the variables exhibit a response that aligns with a Gaussian normal distribution (Figure 2).
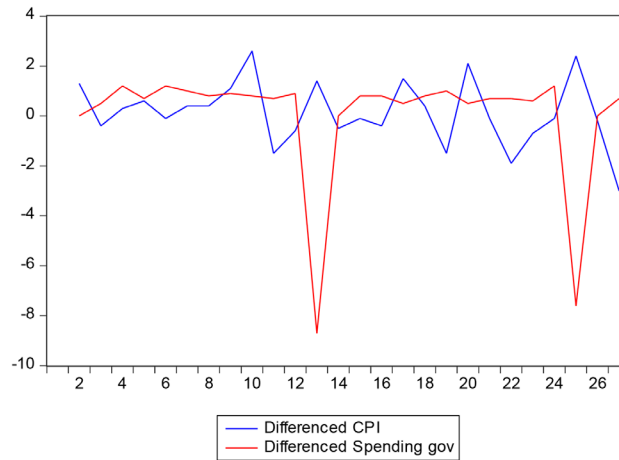
Figure 2. Stationarity test - CPI and Spending gov.

Source: Federal Reserve Bank of Cleveland; USA Shipping gov.; author's calculations
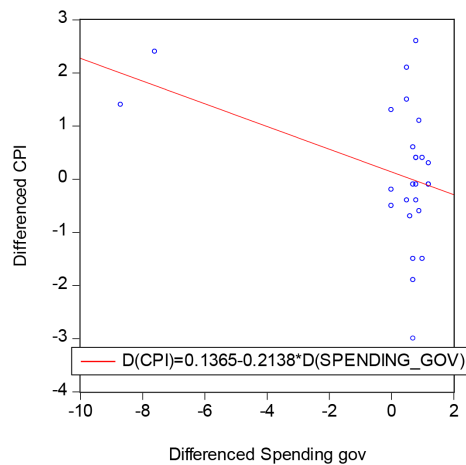

Figure 3. The effect of government spending (Spending gov.) on inflation (CPI)

Source: Author's calculations

A unit increase in government spending reduces US inflation by 0.21 percent (Figure 3). Although this effect of government spending on inflation is statistically significant, it only explains 0.15 of the overall inflation dynamics in the US economy. Notably, the crucial empirical finding is that an increase in government spending does not result in inflationary pressures.

Another factor cited as a cause of inflation is the labor market.

$$CPI = \alpha + \beta_{Labor\_market} + \varepsilon \tag{4}$$

Both variables, namely the increase in newly created jobs and the preservation of jobs during the pandemic, satisfy the requirement for a Gaussian normal distribution (Figure 4). The analysis reveals that these labor market dynamics lead to a significant decrease in inflation in the American economy (Figure 5).

The analysis reveals that job growth in the U.S. economy explains a substantial portion, specifically 74 percent, of the variation in U.S. inflation. This finding indicates that the expansion of employment and the increased production of goods and services have a significant influence on restraining the growth of inflation.
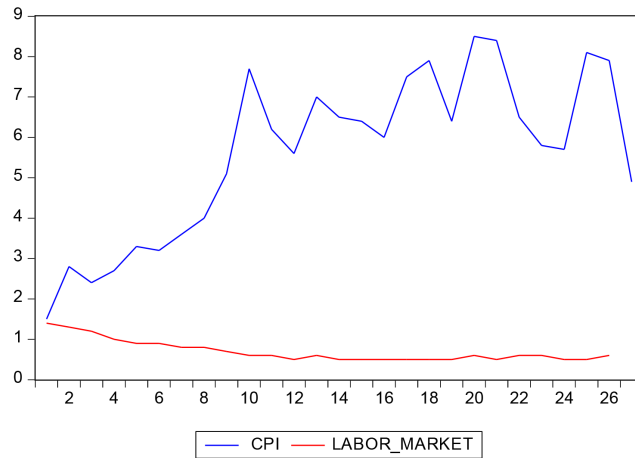
Figure 4. Stationarity test - CPI and Labor_market

Source: Federal Reserve Bank of Cleveland; US Bureau of Labor Statistics; author's calculations
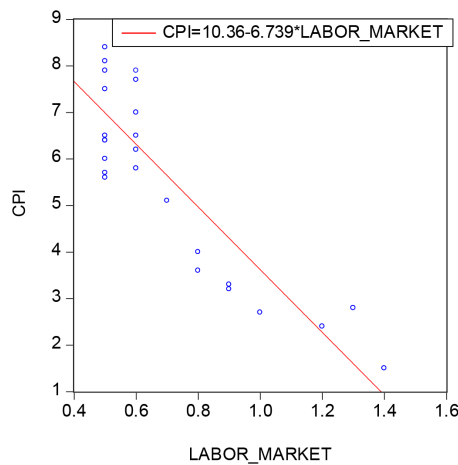

Figure 5. The effect of the labor market (Labor_market.) on inflation (CPI)

Source: Author's calculations

The money supply is an important determinant of inflation.

$$CPI = \alpha + \beta_{M2} + \varepsilon \qquad (5)$$

The two variables correspond to a Gaussian normal distribution (Figure 6).
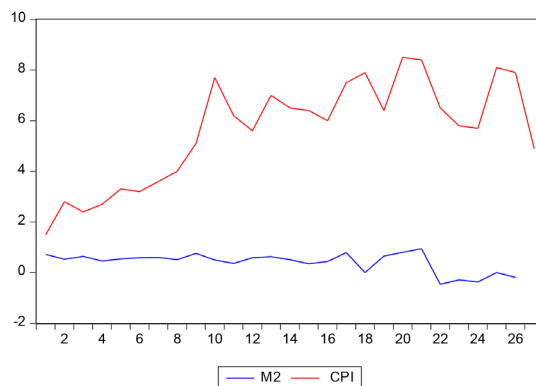

Figure 6. Stationarity test - CPI and monetary aggregates M2

Source: Federal Reserve Bank of Cleveland; Federal Reserve Bank of St. Louis; author's calculations
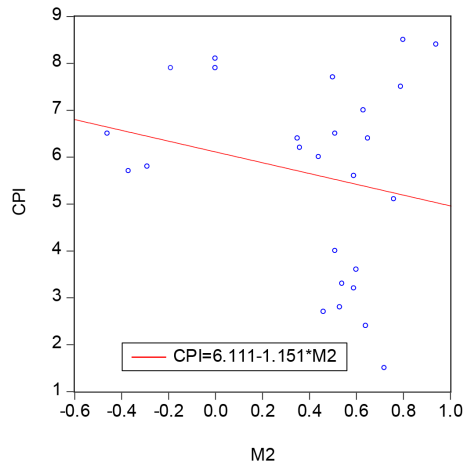
Figure 7. The effect of money supply (M2) on inflation (CPI)
Source: Author's calculations

The analysis reveals a surprising finding that the money supply has a statistically insignificant effect on inflation (Figure 7). This result suggests that changes in the money supply do not have a significant impact on inflation in the U.S. economy. Consequently, this empirical evidence allows for the argument that inflation in the U.S. is not primarily caused by an excessive money supply.

On the other hand, the analysis highlights that food prices play an important role in driving the increase in inflation.

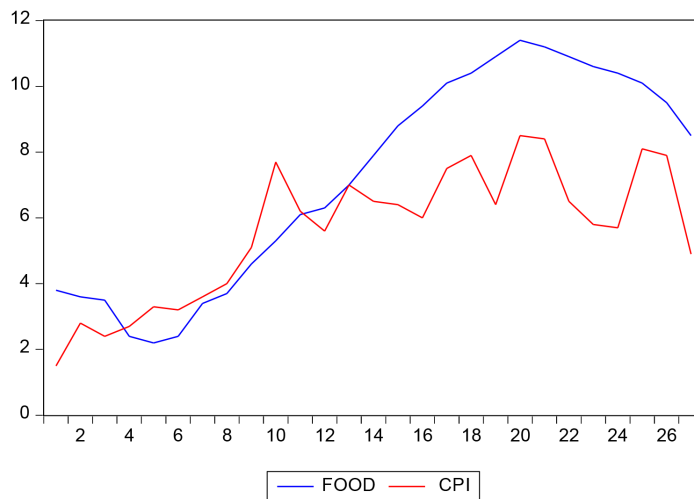$$CPI = \alpha + \beta_{Food} + \varepsilon \tag{6}$$

Figure 8. Stationarity test - CPI and Food
Source: Federal Reserve Bank of Cleveland; author's calculations

The analysis indicates that both variables, namely food prices and inflation, exhibit stationarity (Figure 8). Furthermore, the study reveals that an increase in food prices leads to an increase in inflation (Figure 9). This finding suggests that changes in food prices have a significant impact on overall inflation levels in the studied context. Additionally, it is noted that food prices contribute significantly to the deviation of inflation growth, meaning that fluctuations in food prices have a substantial effect on the variation in inflation rates.

However, it is observed that the variables representing the price of gas and the price of electricity do not satisfy the requirement for a Gaussian distribution (Figure 10). As a result, these variables transform (Figure 11).
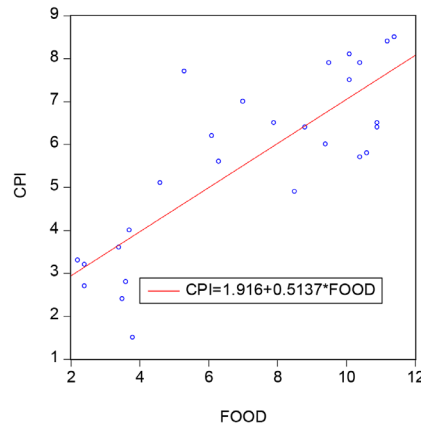

Figure 9. The effect of food prices on inflation (CPI)
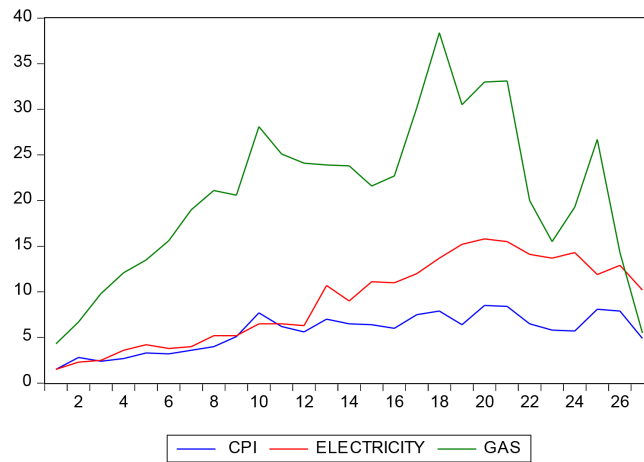**Source:** Author's calculations

Figure 10. Stationarity test - CPI, gas, petrol, and electricity
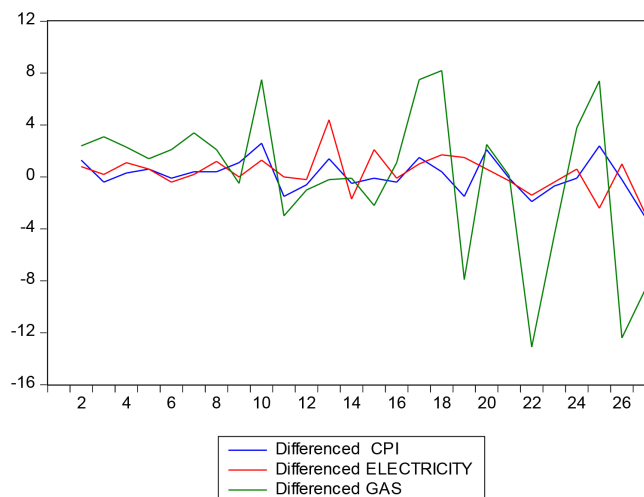**Source:** Federal Reserve Bank of Cleveland; author's calculations

Figure 11. Stationarity test - CPI, gas, petrol, and electricity
Source: Federal Reserve Bank of Cleveland; author's calculations

To analyze the functional linear relationship between electricity prices and inflation, the following equation is considered:

$$CPI = \alpha + \beta_{Electricity} + \varepsilon \qquad (7)$$

It implies that there is a relationship between the two variables, and the equation is used to explore and quantify the nature and extent of this relationship. The price of electricity leads to an increase in inflation (Figure 12).
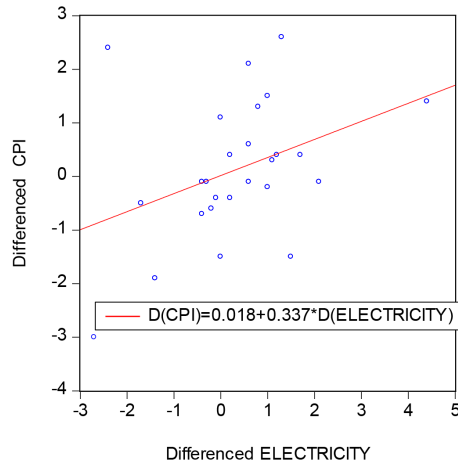

Figure 12. The effect of electricity prices on inflation (CPI)
Source: Author's calculations

Gas prices are identified as a crucial component of inflation, as indicated by the following equation:

$$CPI = \alpha + \beta_{Gas} + \varepsilon \qquad (8)$$

Equation (8) signifies the significance of gas prices in influencing inflation. It suggests that changes in gas prices have a notable impact on the overall inflation levels. Moreover, the analysis reveals that almost half of the deviation in inflation growth can be attributed to gas prices (Figure 13).
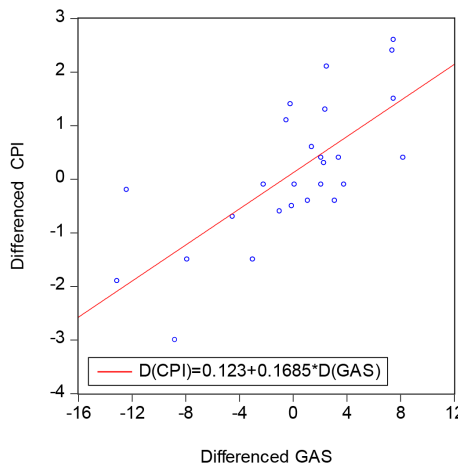

Figure 13. The effect of gas prices on inflation (CPI)
Source: Author's calculations

5. CONCLUSION

The analysis of factors influencing inflation in the US reveals that the increase in gas prices, electricity prices, and food prices play significant roles. These factors point to the existence of structural cost inflation within the US economy. However, the empirical results provide evidence to reject the hypothesis that government fiscal stimulus is the primary driver of inflationary growth in the US.

Instead, the findings support the thesis that inflation in the USA is a consequence of structural disruptions in trade chains. These disruptions lead to a structural change in demand and are accompanied by supply contractions and increases in energy prices. This whole process is deepened by the war in Ukraine.

These insights suggest that a combination of structural factors related to trade disruptions, changes in demand, and energy price increases are key drivers of inflation in the US. It highlights the complex interplay of various factors contributing to the inflationary dynamics observed in the economy.

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