An Analysis of Gas Prices: A Comparison between the Sixty Month Period Before March 2020 and the Sixty Month Period after March 2020

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Abstract

This paper explores the economic changes in gas prices that affect American consumers by investigating the changes in average gas prices between the sixty month period before March 2020 and the sixty month period after March 2020. Utilizing data from the U.S. Bureau of Labor Statistics and conducting a hypothesis test using a t-distribution, our analysis reveals that gas prices significantly increased following March 2020, or the start of the COVID-19 pandemic. The results show a difference in means of approximately $0.82 per gallon, with a 95% confidence interval ranging from $0.62 to $1.01. These findings suggest that global events such as the COVID-19 pandemic and subsequent supply chain disruptions played a critical role in increasing fuel costs. The findings indicate that this rise in gas prices is not due to random fluctuation, but instead represents a statistically significant economic shift that has impacted consumer behavior, inflation, and broader economic planning.

Introduction

In today's complex economy, understanding the relationship between world events and everyday economic outcomes is more important than ever. Gas prices are one of the most easily accessible indicators of economic change. The prices affect household budgets, transportation costs, and even national conversations about energy and inflation. Over the years, gas prices have experienced dramatic swings, influenced by many different factors. These changes can feel unpredictable, and it's often difficult to tell whether a shift is part of a larger trend or just a temporary spike. That's why identifying statistically significant changes in gas prices is so important. It can help with identifying and comparing real economic change with everyday fluctuation.

For background context, fuel costs play a major role in shaping the behavior of consumers and their economic planning. When gas becomes more expensive, people may drive less, rethink travel plans, or reduce spending in other areas. On an even larger scale, rising gas prices can push up the cost of goods, affecting inflation rates. On the other hand, when gas prices drop, disposable income tends to increase, especially for lower- and middle-income households who spend a larger portion of their earnings on fuel. Understanding whether there has been a

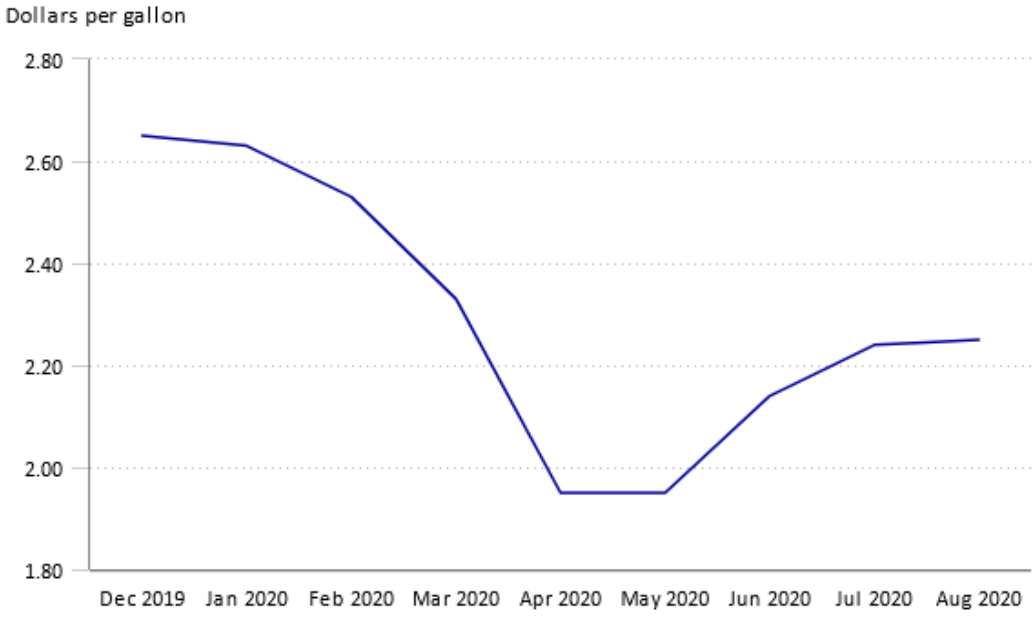
considerable change in gas prices can give us insight into the economic conditions of a given time.

In recent years, attention has been brought to gas prices, especially as the economy adjusted to the effects of COVID-19, international conflicts, and changes in energy policies. With so many factors at play, it can be easy to assume that any change in price is meaningful, but that assumption may not always be backed by the data. That's where statistical analysis becomes valuable. Instead of just relying on personal guesses or news headlines, researchers use statistical tools like hypothesis testing to see if a price change really matters or if it's just due to chance.

Literature Review

The U.S. Bureau of Labor Statistics published a study in October 2020 highlighting the impact of COVID-19 on the prices of various petroleum products including retail gasoline and gasoline at the pump (Camp et al., 2020). For this study, prices were tracked through the Consumer Price Index (CPI), which measures the mean monthly change in the prices of foreign goods purchased by domestic consumers. Data was collected monthly from December 2019 through August 2020. Prior to the approximate start of the pandemic, the mean gasoline price in the U.S. was logarithmically decreasing from $2.65 in December 2019 to $2.33 in March 2020. After March 2020, prices remained constant between April and May, but then prices started to logarithmically increase from $1.95 in May 2020 to $2.25 in August 2020.

Figure 1.

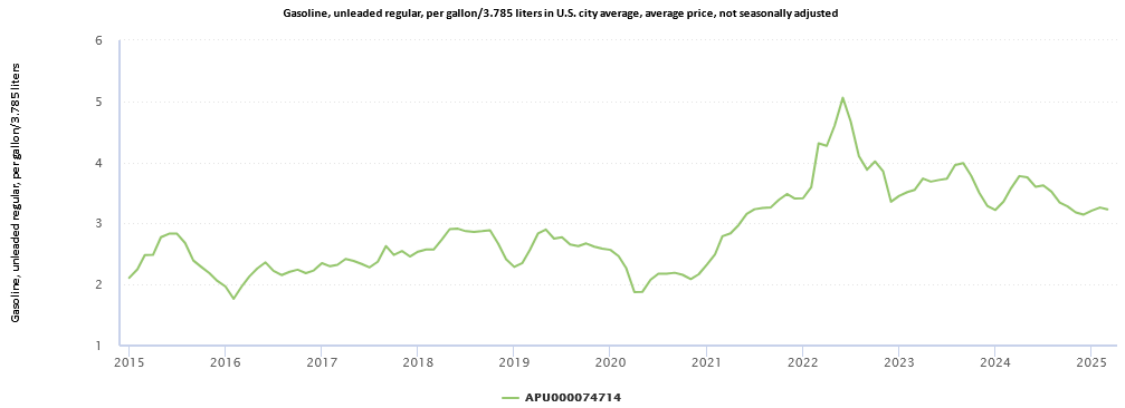


Gas prices affect almost everyone, which makes this kind of analysis very practical and relevant. It is a very accessible topic as it connects to everyday experiences while also connecting to larger economic questions. As governments look for ways to respond to inflation, support energy independence, or promote alternative fuels, understanding past trends in gas prices becomes can become very key to shaping smart decisions for the future. Digging into the data helps bring new clarity to an issue that is often driven by emotion and urgency. The data may be able to reveal patterns that may have otherwise gone unnoticed.

Methodology

To study the potential impact of COVID-19 on the prices of gasoline in the United States, we observed data collected by the U.S. Bureau of Labor Statistics through the CPI (U.S. Bureau of Labor Statistics, 2025). The CPI tracks the average price of unleaded, regular gasoline per gallon in U.S. cities monthly. The charts below reflect this data from 2015 to 2025.

Figure 2.



We observed two separate samples, one before, and one during the COVID-19 pandemic. The “before” sample includes the 60 months prior to March 2020, while the “after” sample includes the 60 months including and following March 2020. The “before” and “after” samples are reflected in the charts below, respectively.

Figure 3.

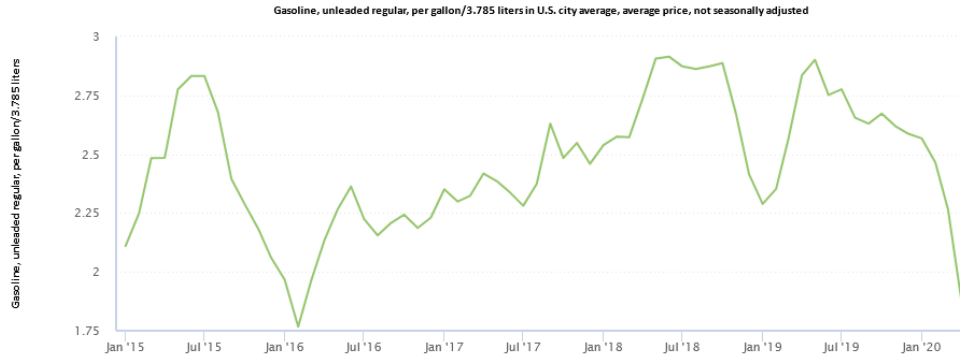
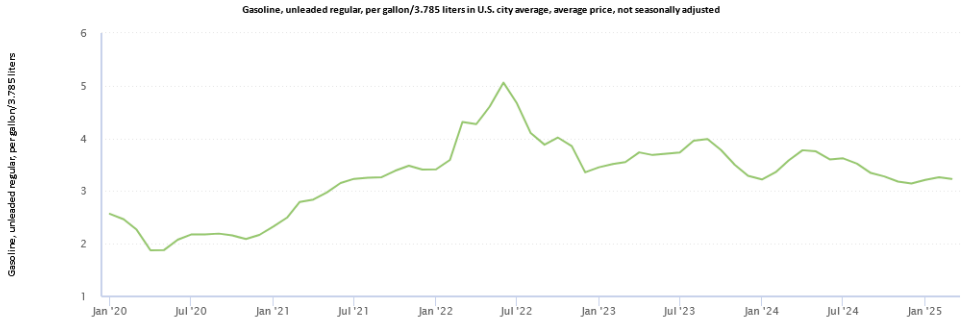
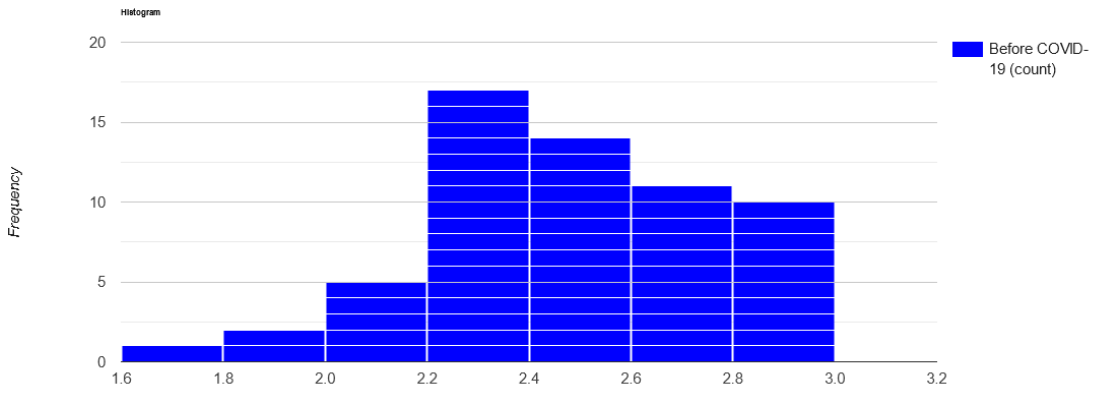


Figure 4.



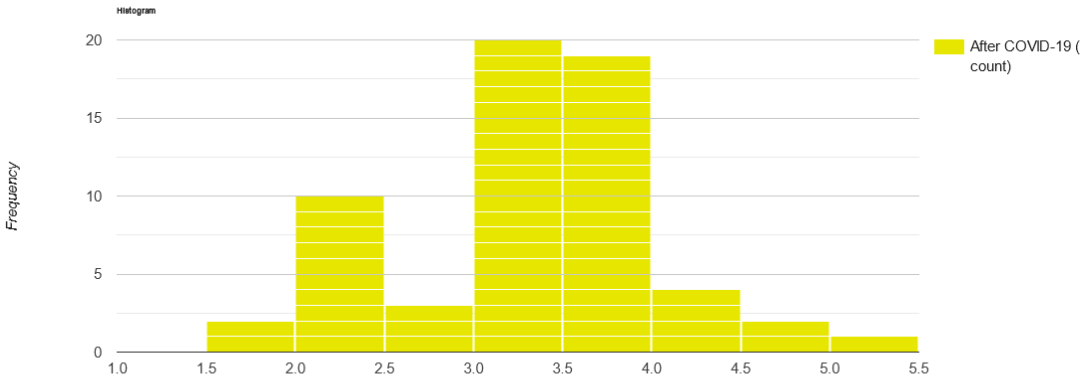
We performed a descriptive study to identify a correlation between the rise of the COVID-19 pandemic and gasoline prices in the United States. We analyzed existing studies to form null and alternate hypotheses that we tested. Additionally, we calculated a confidence interval for our parameter.

Figure 5.



For the “before” sample, the distribution graph is left skewed. The mean price of gasoline was $2.49 with a standard deviation of 0.270.

Figure 6.



After COVID-19, the mean price of gasoline was $3.31 with a standard deviation of 0.713.

The null hypothesis states that the calculated population mean gas price before COVID-19 subtracted from the calculated population mean gas price after COVID-19 is zero. Equivalently, we can say that the two calculated population means are equal.

H_0: $\mu_{after} - \mu_{before} = 0$

The alternate hypothesis states that the calculated population mean gas price before COVID-19 is less than the calculated population mean gas price after COVID-19.

H_1: $\mu_{after} - \mu_{before} > 0$

Because we are not dealing with STEM data, we define:

$\alpha = 0.05$

Although our sample sizes are greater than 30, we cannot use a normal distribution to calculate a confidence interval because the COVID-19 pandemic is so recent and there is not enough preliminary data, so we must use a t-distribution.

$\bar{x}_1 \approx \$2.49$

$s_1 \approx 0.270$

$n_1 = 60$

$Df_1 = 59$

$\bar{x}_2 \approx \$3.31$

$s_2 \approx 0.713$

$n_2 = 60$

$Df_2 = 59$

$$Sp \approx \sqrt{\frac{(Df2)(s2)^2+(Df1)(s1)^2}{n2+n1-2}} = \sqrt{\frac{(3.31)(0.713)^2+(2.49)(0.270)^2}{60+60+2}} = 0.539$$

$$SE \approx Sp\sqrt{\frac{1}{n2}+\frac{1}{n2}} = 0.539(\sqrt{\frac{1}{60}+\frac{1}{60}}) = 0.098$$

$tc(\alpha = 0.05,\ Df = 118) \approx 1.984$ [FROM T-TABLE]

$$|E| \approx tc * SE = 1.984 * 0.098 = 0.194$$

$$C.I. \approx (\bar{x}2 - x1) - E < \mu2 - \mu1 < (\bar{x}2 - \bar{x}1) + E$$

$$\approx (3.31 - 2.49) - 0.194 < \mu2 - \mu1 < (3.31 - 2.49) + 0.194$$

$$\approx 0.620 < \mu2 - \mu1 < 1.014$$

∴ We are 95% confident that the difference between our true population mean gas prices lies between \$0.62 and \$1.02.

$$tc \approx \frac{(xduring - xbefore) - (\mu during - \mu before)}{SE} = \frac{(3.31 - 2.49) - (0)}{0.098} = 8.357$$

$p(8.357) \approx 0$

As t-score increases, the corresponding p-value decreases. Our calculated t-score is so large that its corresponding p-value value is statistically indistinguishable from 0, and is therefore negligible. Because $0 <= 0.05$ ($p <= \alpha$), we reject the null hypothesis (H_0).

Based on these calculations we can conclude that our P-values are much lower than our alpha, which means that we can reject the null hypothesis. This means that between the sixty month period before covid and the sixty month period after covid, there was a statistically significant increase in gas prices during the latter sixty month period.

Conclusion

In conclusion, in order to complete this study we used data from the United States Bureau of Statistics for prices of gas during all 120 months. We then used that information to compare the sixty month period before March 2020 and the sixty month period following March 2020 to find out if there was an increase in gas prices between the two periods. Our findings revealed that there was a statistically significant increase in the later sixty months. Although gas prices have always fluctuated due to market conditions, seasonal shifts, and geopolitical tensions, our statistical analysis shows that the sixty month period following March 2020 marked a statistically significant change. By comparing the mean gas prices before and after the start of the COVID-19 pandemic, we found strong evidence of a statistically significant increase. This confirms that the pandemic had a measurable impact on everyday economic conditions.

References

Camp, K. M., Mead, D., Reed, S. B., Sitter, C., & Wasilewsky, D. (2020, October). *From the barrel to the pump: the impact of the COVID-19 pandemic on prices for petroleum products*. Bureau of Labor Statistics. Retrieved May 6, 2025, from https://www.bls.gov/opub/mlr/2020/article/from-the-barrel-to-the-pump.htm

U.S. Bureau of Labor Statistics. (2025, March). *Gasoline, unleaded regular, per gallon/3.785 liters in U.S. city average, average price, not seasonally adjusted*. U.S. Bureau of Labor Statistics. Retrieved May 6, 2025, from https://data.bls.gov/dataViewer/view/timeseries/APU000074714