Are Rising Gasoline Prices the Main Determinant of the Surge in U.S. Consumer Price Inflation?[1]

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Introduction

It is widely believed that rising gasoline prices have been one of the primary determinants of the surge in U.S. consumer price inflation since 2021. In fact, one of the key policy responses of the Biden administration has been to curtail inflation by proposing gasoline tax holidays, releasing oil from the Strategic Petroleum Reserve, and exhorting U.S. oil producers to raise oil production and refiners to replenish gasoline stocks.

It is also commonly believed that fluctuations in U.S. household inflation expectations are driven almost entirely by shocks to the price of gasoline at the pump. For example, an extensively cited study by Coibion and Gorodnichenko (2015) concluded that nearly all the variability in one-year household inflation expectations is explained by variation in the level of oil and gasoline prices.

Recent research suggests that this conventional wisdom is not supported by empirical evidence. For example, the argument that gasoline price shocks explain headline consumer price inflation ultimately rests on the mistaken belief that the high inflation of the early 1970s was caused by the 1973/74 oil price shock. Yet, closer examination of the data shows that U.S. inflation was high and rising in the early 1970s, long before the oil and gasoline price shock occurred, and by no means can be attributed primarily to unexpectedly rising gasoline prices (see Barsky and Kilian, 2002).

Likewise, the view that inflation expectations are driven mainly by gasoline prices, perhaps because such prices are particularly salient to consumers, has been overturned in recent research (see Kilian and Zhou, 2022a). Once we recognize that the relationship between inflation expectations and the price of gasoline is by construction unstable over time and that modeling this relationship involves nonstandard statistical tests, earlier empirical evidence in favor of such a relationship tends to disappear.

An Alternative Modeling Framework

A more suitable class of models of the relationship between the real price of gasoline, headline inflation and household inflation expectations is a vector autoregression in which each model variable is allowed to depend on a fixed number of lags of every model variable. Vector autoregressive models have several advantages compared with traditional correlation analysis. They account for the endogeneity of the real price of gasoline with respect to domestic inflation variables, relax the dynamic restrictions implicit in

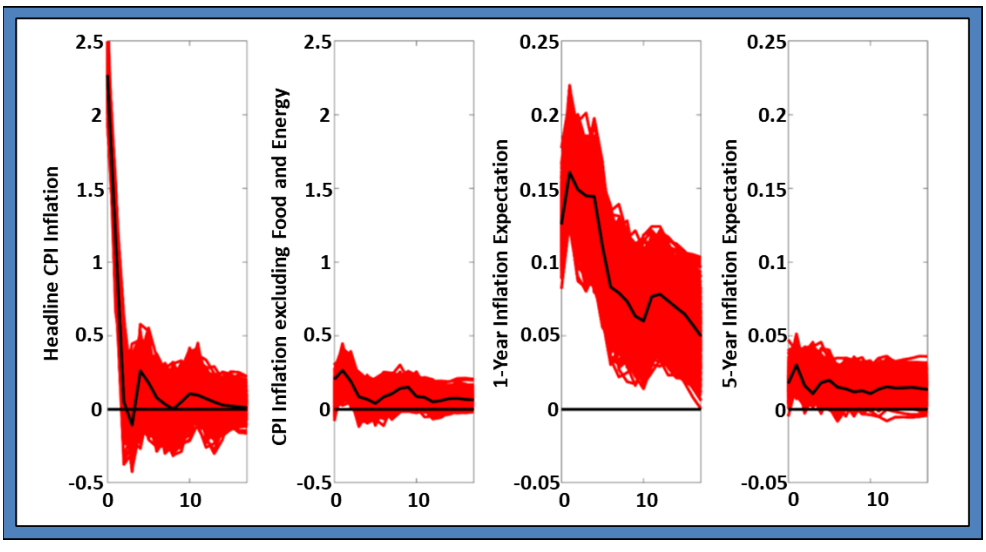
traditional correlation analysis, and allow for delayed feedback from gas price shocks to inflation expectations. Under suitable additional assumptions about the structure of the model, we can recover the responses of the model variables to a nominal gasoline price shock. Kilian and Zhou (2022a) explore several such models and show that the model estimates are remarkably robust to changes in the estimation period and in the model specification.

Here we focus on an extension of this modeling framework proposed in Kilian and Zhou (2022b) whose objective was to shed light on the determinants of inflation and inflation expectations since 2020. The model includes the percent change in gasoline prices, headline and core inflation as well as 1-year and 5-year household survey inflation expectations from the Michigan Survey of Consumers. We stipulate that nominal gasoline price shocks are contemporaneously unaffected by shocks to inflation and inflation expectations, consistent with evidence in Kilian and Vega (2011). The estimation period starts in early 1990, when 5-year inflation expectations first became available and ends in May 2022, several months after the invasion of Ukraine.

Impulse Response Analysis

Figure 1 shows the responses of inflation and inflation expectations to a one-time nominal gasoline price shock in the estimated model. The magnitude of the shock is immaterial here, since we are concerned with the pattern and precision of the response estimates. A priori one may have expected that a gasoline price shock would raise headline CPI inflation, since gasoline accounts for about 4% of consumer spending on average, possibly followed by further increases in other consumer prices, as the initial inflationary stimulus spreads across the economy.

Figure 1
Responses to a One-Time Gasoline Price Shock, 1990.4-2022.5



Notes: The core and headline CPI inflation rates have been annualized. The set of impulse responses shown in black is the Bayes estimator under additively separable loss. The responses in red indicate the uncertainty about this estimate.

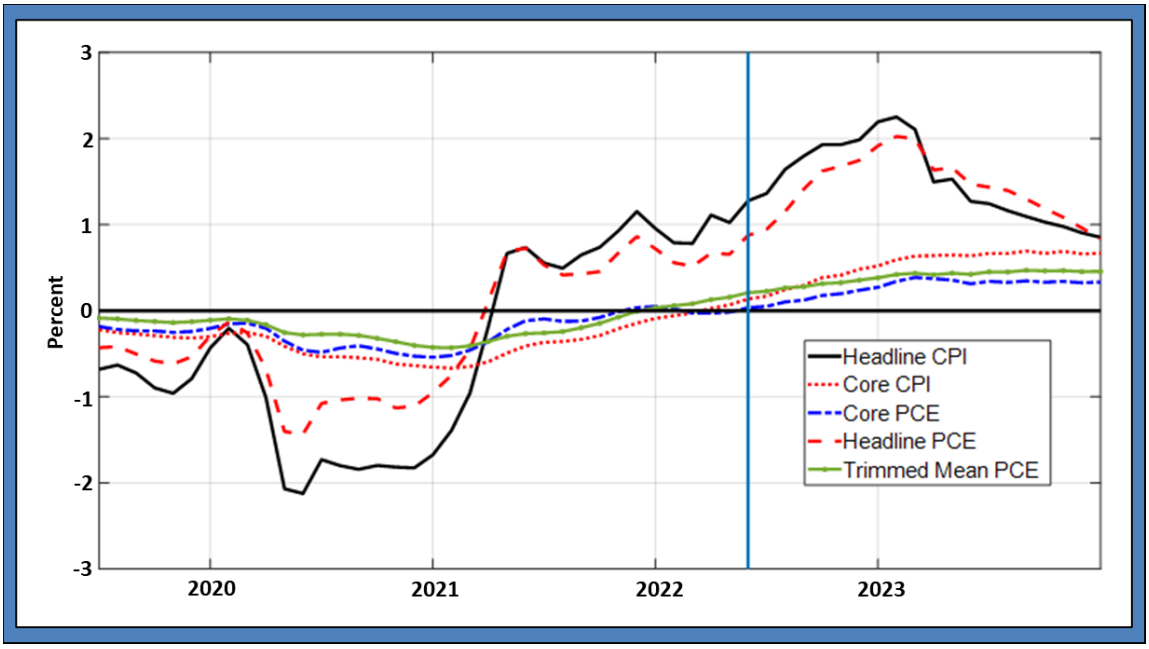
Figure 1 indeed shows an immediate sharp increase in headline CPI inflation, but that increase is short-lived and the response becomes indistinguishable from zero after two months. There is no evidence of large increases in headline CPI inflation in subsequent months. This finding is consistent with the response of core CPI inflation (defined as CPI inflation excluding food and energy). Following a modest increase on impact, the response of core inflation remains indistinguishable from zero. There is no evidence that a one-time gasoline price shock triggers subsequent waves of increases in core inflation or a large persistent increase in core inflation.

Figure 1 also suggests a precisely estimated positive response of household inflation expectations, especially at the one-year horizon. At the five-year horizon, the response is muted and hardly distinguishable from zero. Moreover, the magnitudes in question are quite small relative to the historical level of average household inflation expectations in the Michigan Survey of Consumers.

The Cumulative Impact of Gasoline Price Shocks on 12-Month Inflation

While these results are instructive, policymakers are less interested in the effect of a one-time nominal gasoline price shock than in the cumulative impact of all gasoline price shocks to date. This question is addressed in Figure 2, which recovers this cumulative impact from the estimated vector autoregressive model for each month since June 2019.

Figure 2
12-Month Inflation Caused by Gasoline Price Shocks, 2019.6-2023.12
$110 Oil Price Scenario Starting in June 2022



Notes: The vertical line marks May 2022, the end of the historical data and the beginning of the $110/barrel oil price scenario.

We consider a range of alternative inflation measures all expressed as year-over year (or 12-month) inflation rates. Consider, for example, the black line quantifying the cumulative impact at each point in time of nominal gasoline price shocks on 12-month headline CPI inflation. Figure 2 shows a pronounced decline in headline CPI inflation associated with falling gasoline prices at the onset of the COVID-19 pandemic in 2020. The recovery started in May 2020. By May 2022, marked as a vertical blue line in the chart, the cumulative impact of gasoline price shocks on headline CPI inflation amounted to 1.2 percentage points, which is quite modest compared with the observed 12-month inflation rate of 8.6% for that month. This point is important because it shows that gasoline price shocks have been far from the primary determinant of U.S. headline CPI inflation.

May 2022 was the most recent month in this study for which actual data were available. Figure 2 also considers a hypothetical scenario under which the price of oil remains at $110 from June 2022 until December 2023. Based on the cost share of crude oil in retail gasoline prices, we map the hypothesized percent change in the oil price to the percent change in the gasoline price, which allows us to recover the sequence of nominal gasoline price shocks required to implement this scenario in the VAR model. Figure 2 shows that, under this scenario, the cumulative impact of gas price shocks on 12-month headline CPI inflation would continue to increase until early 2023, peaking near 2.2 percentage points, before declining. Similar results apply to headline PCE inflation, the preferred inflation measure of the Federal Reserve. The cumulative impact of gas price shocks on core inflation measures gradually rises in 2022, reaching about half a percentage point by the end of 2023, with some variation depending on the measure of core inflation.

The Cumulative Impact of Gasoline Price Shocks on 1-Month Inflation

Figure 2 may seem to suggest that inflationary pressures will be increasing in the remainder of 2022 under the scenario, but the observed increase in the gas-price driven headline inflation rate is an artifact of the construction of the 12-month rate as a trailing 12-month average of the annualized monthly inflation rate. As Figure 3 illustrates, when focusing on the cumulative impact of gas price shocks on the monthly headline CPI inflation rate, under the maintained scenario, the largest increases are behind us. The impact of gas price shocks on the inflation rate declines starting in June 2022, reaching half a percentage point by the end of 2023. Of course, an actual decline in oil and gas prices, as occurred after our paper was written, would accelerate this process.

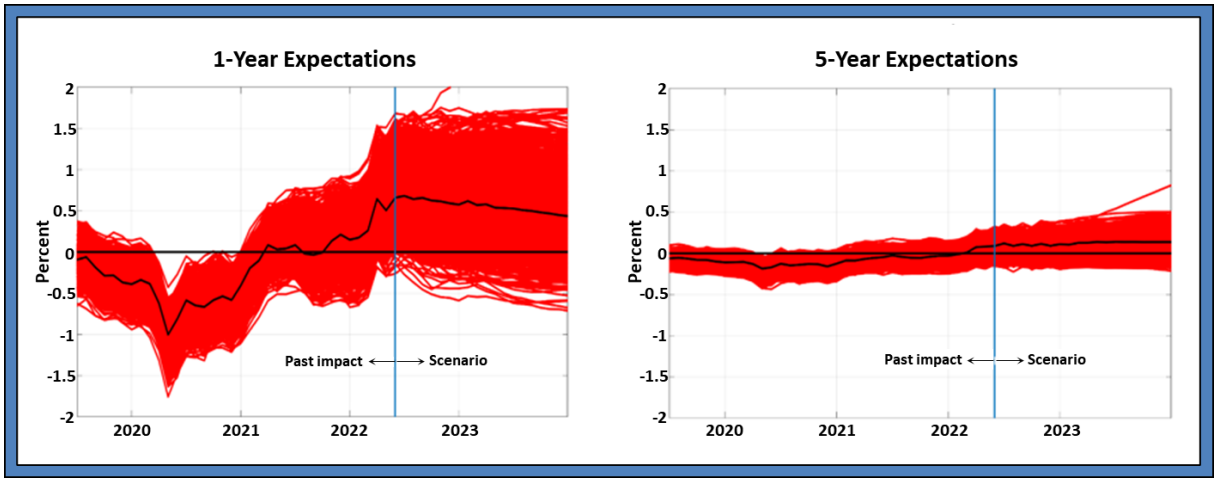
The Cumulative Impact of Gasoline Price Shocks on Household Inflation Expectations

Figure 4 shows the corresponding results for household inflation expectations. Under the $110 oil price scenario, the impact of gas price shocks on 1-year inflation expectations would peak near 0.7 percent and gradually decline going forward. The maximum impact of 0.15 percent on 5-year expectations would be negligible.

Figure 3
Monthly Headline CPI Inflation Caused by Gasoline Price Shocks, 2019.6-2023.12

Notes: The expected path is shown as the black line. The red lines capture the uncertainty about this path.

Figure 4
The Rise in Inflation Expectations Caused by Gasoline Price Shocks



Concluding Remarks

We discussed recent evidence that gasoline price shocks have not been the main determinant of U.S. inflation. This evidence runs counter to the narrative that inflation would subside if only gasoline prices could be lowered. Our analysis suggests that much of the inflationary pressure reflected in headline and

core inflation rates reflects strong demand, rising wages reflecting the growing bargaining power of workers, rising house prices, and supply chain bottlenecks.

There is no evidence that gasoline price shocks have been causing a wage-price spiral. Specifically, one might have expected that a one-time gasoline price shock would cause inflation to increase not only on impact, but again and again, as the initial gas price shock is propagated across sectors to other consumer prices. There is no indication in our estimates, however, of large secondary effects on headline or core inflation rates. Nor is there evidence that gasoline price shocks are causing long-run inflation expectations to become unanchored.

This does not mean that the dangers of a wage-price spiral should be ignored. Clearly, rising wages reflecting the growing bargaining power of workers in conjunction with persistent supply chain bottlenecks have the potential of creating a wage-price spiral with persistent inflation pressures over time becoming embedded in longer-term inflation expectations. Our point is merely that rising oil and gasoline prices are not likely to cause such a spiral.

In fact, our analysis shows that inflationary pressures in monthly data wane as soon as positive gasoline price shocks cease. This is the case even under our scenario of unchanged oil and gasoline prices in the remainder of 2022 and in 2023. To the extent that oil and gas prices have actually come down recently, contrary to the premise of our scenario, one would expect inflationary pressures from past gas price shocks to ease even more quickly. It has to be kept in mind, however, that the inflationary impact on year-over-year inflation rates looks more persistent due to temporal aggregation.

Endnotes

1 The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of Dallas or the Federal Reserve System.

Dr. Kilian presented on this topic at the JPMCC's 5th Annual International Commodities Symposium during the "Economics of Energy Markets" session on August 15, 2022. The symposium, in turn, was co-organized by Professor Jian Yang, Ph.D., CFA, the J.P. Morgan Endowed Chair and JPMCC Research Director at the University of Colorado Denver Business School and Dr. Thomas Brady, the Co-Bank Executive Director of the JPMCC.

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