



Supply Chain Disruptions, Inflation, and the Fed

Today's inflationary snarls reflect both supply shocks and policy stimulus

BY JOHN MULLIN

Used cars became a hot commodity during the pandemic, with their prices increasing by roughly 50 percent between January 2020 and December 2021. The spike in used car prices was a prominent example of how global supply chain disruptions have contributed to U.S. inflation. It also highlighted the complexity of global supply and demand relationships.

In the early stages of the COVID-19 pandemic, many U.S. and European auto manufacturers shut down production to help stop the disease's spread. Semiconductor producers, concentrated in Asia, responded by shifting production toward chips for electronic devices such as computers and games. As the pandemic progressed, demand increased in these other markets as homebound consumers shifted their spending away from services such as restaurant meals and travel and toward consumer durables.

Later in 2020, when U.S. auto manufacturers resumed production, they faced chip supply shortages. The shortages not only reflected pandemic-related production shutdowns in Asia, they also reflected a reluctance on the part of chip manufacturers to shift production back to chips used in auto production and away from the relatively lucrative market for chips used in electronic devices.

The diminished supply of new cars in the U.S. market provided support for higher used car prices. (See chart.) Since used cars comprise roughly 4 percent of the basket that makes up the consumer price index (CPI), the 50 percent cumulative price increase for the category increased the overall CPI by a cumulative 2 percentage points. According to an analysis by Richmond Fed economist Alex Wolman, the increase in motor vehicle prices ranked as one of the "main culprits" of the U.S. inflationary increase through November 2021.

The used car example illustrates the limited ability of monetary policy to control inflation's short-run trajectory. "It's true that inflation is a monetary phenomenon, in the sense that monetary policy has the ability to control inflation over the medium to long run," says Wolman. "However, even when monetary policy is being successful at controlling inflation, unusual shocks to supply and demand for

particular goods and services move inflation around from month to month."

The U.S. economy has indeed faced a string of unusual supply and demand shocks since the pandemic's onset — most of which have tended to boost inflation. But this fact does not necessarily let the Fed off the hook.

A MIX OF SUPPLY AND DEMAND SHOCKS

Since the onset of the pandemic, the U.S. economy has been hit by a series of supply and demand shocks. The first of these, of course, was the pandemic itself. Several early analyses of the pandemic characterized it as a combined supply-demand shock. For example, an NBER working paper in February by Martin Eichenbaum of Northwestern University, Sergio Rebelo of Northwestern University's Kellogg School of Management, and Mathias Trabandt of Goethe University Frankfurt presented a model of epidemics in which COVID-19 "acts like a negative shock to the demand for consumption and the supply of labor."

The view of the pandemic as a combination of negative supply and demand shocks found support in the data. For instance, a 2020 paper by Geert Bekaert of Columbia University, Eric Engstrom of the Fed Board of Governors, and Andrey Ermolov of Fordham University employed statistical methods to "extract aggregate demand and supply shocks for the US economy" during the early stages of the pandemic. The paper estimated that negative aggregate supply and demand shocks both contributed substantially to the initial output decline in 2020.

During the initial stages of the pandemic, there was much concern among economists and policymakers that the pandemic's initial negative effect on aggregate demand could be exacerbated by job destruction and firm closures. This concern was reflected in an *American Economic Review* article by Veronica Guerrieri of the University of Chicago's Booth School of Business, Guido Lorenzoni of Northwestern University, Ludwig Straub of Harvard University, and Iván Werning of Massachusetts Institute of Technology, which presented "a theory of Keynesian supply shocks: supply

shocks that trigger changes in aggregate demand larger than the shocks themselves.” Their preferred policy responses included many of the measures implemented by U.S. policymakers, such as emergency loans, enhanced social insurance payments, and accommodative monetary policy.

It did not take long for these measures to show results. One of their initial effects was to boost the U.S. personal savings rate. Bank accounts grew rapidly during 2020 as people received stimulus payments from the Internal Revenue Service and enhanced unemployment insurance checks — some received more from these benefits than they had been earning from their former jobs — while drastically reducing their spending on dining, entertainment, and travel. Flush with cash, many consumers quickly started to buy consumer durables.

“There was a huge surge in consumer goods demand, because households were simply unable to spend their cash on going out for a meal or going to the cinema or going on holiday,” says Christopher Williamson, chief business economist at IHS Markit, a provider of data and research affiliated with S&P Global. “So, a whole lot of us spent a lot of time ordering new computers, furniture, and bicycles.”

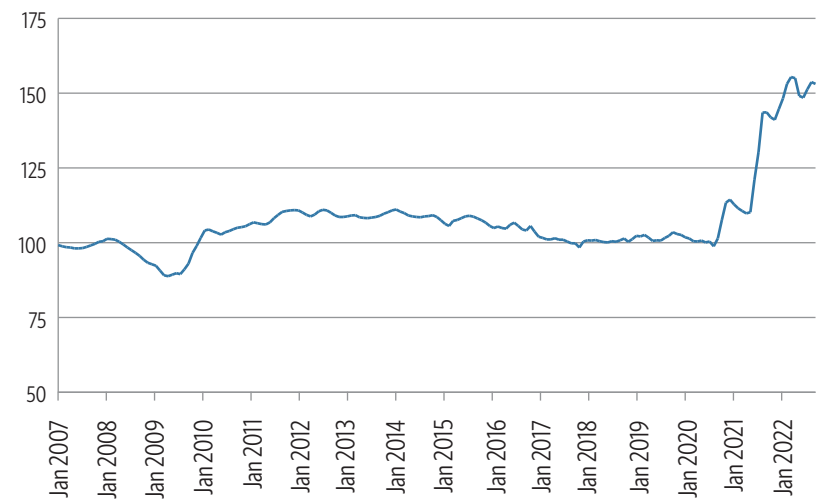
In retrospect, there is a broad consensus among economists and policymakers that the combination of increased fiscal spending and an aggressively accommodative monetary policy ultimately overshoot the mark by providing excessive economic stimulus. To the extent that they did, the policies arguably constituted a second major shock to the U.S. economy. The Russian invasion of Ukraine in February of this year imposed a third major shock by restricting global oil and grain supplies, causing spikes in the two commodities’ prices, which had been already increasing since mid-2020. The combination of the three shocks — the pandemic, the expansionary policy overshoot, and war — left analysts with a hard-to-identify stew in which pandemic-related foreign plant closures, heightened consumer durables demand, and increased global commodity prices have put tremendous strains on global supply networks.

SUPPLY CHAIN DISRUPTIONS

There is no precedent in recent history for the supply chain disruptions that currently afflict the global economy. The scope of the problem is seen, among other places, in

Used Cars Become Hot Commodities

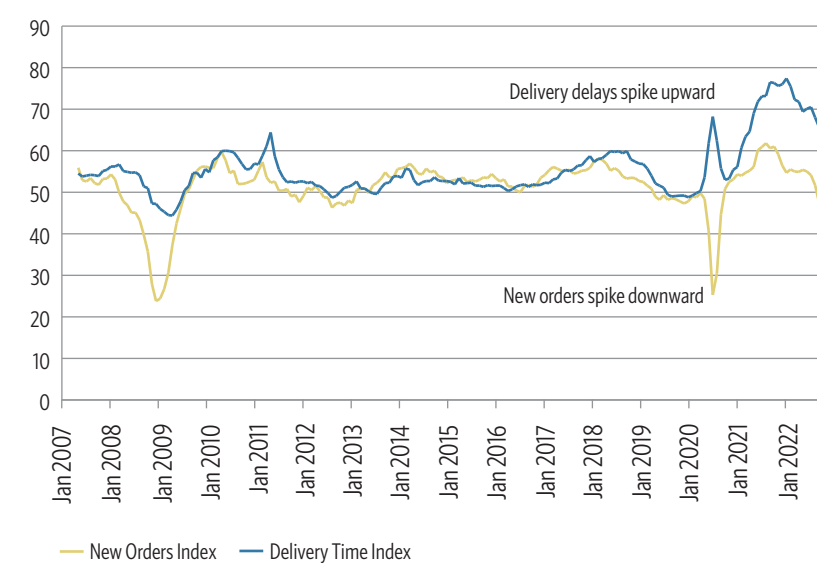
Consumer Price Index for Used Cars and Trucks (Rebased, December 2006 = 100)



SOURCE: Bureau of Labor Statistics via FRED

Unprecedented Delivery Delays

JPMorgan Purchasing Managers Indices: Delivery Time Index and New Orders Index



SOURCE: S&P Global

the recent behavior of the JPMorgan Global Purchasing Managers Indices (PMI) delivery time index, which provides a measure of delivery delays around the globe. Ordinarily, the delivery index tends to closely track the JPMorgan PMI new orders index. For example, when the new orders index declined during the 2008-2009 recession, the delivery index declined as well; and when the new orders index subsequently recovered, the delivery index followed suit. This positive correlation is just what one would expect for economic cycles that are driven primarily by fluctuations in aggregate demand: Weak demand means shorter waiting times; strong demand means longer waiting times. (See chart.)



In contrast, the two indexes moved in dramatically divergent directions at the onset of the pandemic. The new orders index plunged, signaling a collapse in aggregate demand, but the delivery time index spiked upward. This negative correlation is just what one would expect for an economic cycle driven by a combination of negative supply and demand shocks.

Supply disruptions (as reflected in the delivery time index) became even more pronounced as aggregate demand (as reflected in the new orders index) recovered. The new orders index peaked in mid-2021, and subsequently declined. Nevertheless, the delivery time index has remained near its historical peak, signaling continued supply problems.

Global companies reported reduced production due to staff shortages that peaked during each of the pandemic's various waves, according to data from S&P Global. Each wave of staff shortages gave rise to a follow-on wave of materials shortages.

Transportation snarls exacerbated the problems caused by plant closures, further disrupting global supply chains. "There were a lot of port closures — notably in China," says Williamson. "With restrictions heavily in place, the ports just couldn't function as efficiently as they could before. And it's not just ships going into ports, but trucks bringing containers in and out of the ports. A lot of containers ended up in the wrong places. It produced unprecedented congestion."

By late 2021, shipping a container through U.S. ports took more than three times longer than it normally did. The congestion at Chinese ports only worsened recently due to COVID-19 lockdowns in Shanghai and other ports. Shipping costs have remained elevated, and port congestion has had numerous effects that may have been hard to predict. California farmers, for instance, have been having a difficult time finding container capacity to export tree nuts, produce, and dairy products.

Of all the supply problems that have arisen during the pandemic, semiconductor shortages have had some of the most widespread effects. In many cases, semiconductors account for only a small part of a product's total cost. Yet they often have no close substitutes, making them indispensable to the production process. Because of this, semiconductor shortages can have an outsized effect on final-product supply shortages and the inflationary pressures they create. Recent research by economists at the St. Louis Fed indicated that the problem extended far beyond the auto industry to a broad range of other U.S. manufacturing industries. Comparing 56 industries that use semiconductors as a direct input with 170 industries that do not, they found substantially higher price changes in the semiconductor-dependent industries during 2021.

Additional research from the St. Louis Fed shows that price pressures tended to be greatest in U.S. industries with heightened exposure to foreign countries experiencing particularly severe supply bottlenecks, as measured by indexes of work backlogs and supplier delivery times. Some of the largest exposures were in the U.S. motor vehicles, petroleum, basic metals, and electrical equipment industries.

HOW MUCH INFLATION CAME FROM WHERE?

A natural question is the extent to which increased inflation is due to overly accommodative macroeconomic policies versus the supply-side shocks caused by the COVID-19 pandemic and, more recently, the war in Ukraine. The multiplicity of shocks and their staggered arrival times make this a difficult question to answer definitively.

Researchers have responded to the challenge by taking a variety of approaches. One such effort was undertaken by the Richmond Fed's Alex Wolman in a recent working paper, "Relative Price Shocks and Inflation," which he co-authored with Francisco Ruge-Murcia of McGill University. Within the context of a more general analysis of the relationship between relative price shocks and inflation, the researchers presented a model that they used to break down the behavior of U.S. inflation from March 2021 through November 2021 into contributions from supply-side shocks versus overly accommodative monetary policy.

In the model, the monetary authorities do not attempt to stabilize the prices of individual goods and services, nor do they attempt to constrain overall inflation to an extremely narrow range in the short run. "If the relative price of used cars needs to go sky high because of supply disruptions, the way that's going to happen at first is for the prices of used cars to go sky high," says Wolman. "It's not going to happen by having the prices of all of the other goods in the economy decline all at once." Thus, sector-specific supply shocks can affect the economy-wide rate of inflation on a month-by-month basis, even under a monetary regime marked by low inflation and policy stability.

Over the model's long-term horizon, however, monetary policy does stabilize inflation. Although the central bank allows unusually large relative price shocks to pass through to inflation, those shocks are — by definition — unusual, so inflation tends to remain close to the Fed's target.

Wolman and Ruge-Murcia found that the inflationary increase during the period between March 2020 and November 2021 was roughly four-fifths due to supply-side shocks, with the single largest supply-side shock coming from the vehicle sector. Overly accommodative monetary policy explained the remaining one-fifth of the inflation overshoot. Although the model does not explicitly incorporate fiscal policy, Wolman believes that, in practice, their calculation of monetary policy's contribution to inflation most likely captures the combined inflationary contributions of both monetary *and* fiscal policy. "My view is that there was a big expansionary fiscal shock, and that if the Fed had followed its usual policy rule, it would have chosen a much higher interest rate than it actually did," says Wolman. "To the extent that the Fed did not raise rates in response to the fiscal stimulus, it's going to show up in our model as a monetary policy shock."

Recent research by economists at the New York Fed broadly concurs with Wolman's finding that the inflationary increase seen during 2021 owed much to supply-side factors



such as production and shipping bottlenecks and higher input prices. They also agreed in the assessment that loose monetary policy played a secondary role, concluding that the global nature of recent supply shocks suggests that “domestic monetary policy actions would have only a limited effect on these sources of inflationary pressures.”

But these two studies come with an important caveat: They only cover the period through late 2021, when U.S. inflation was still behaving much like it had during 1995–2019 — a period of low and stable inflation in which relatively high monthly inflation readings were mostly accounted for by large price increases in a small share of goods and services. More recent data have deviated from this pattern. “Not only has inflation continued to be high,” says Wolman, “it has also been associated with a larger share of goods with large price increases.” To Wolman, this increased inflationary breadth raises concern that inflation may be becoming more of a monetary phenomenon and less a supply-side phenomenon.

Ana Maria Santacreu of the St. Louis Fed has taken a variety of approaches to understanding the recent increase in inflation. “We’ve done a lot of things from different angles,” she says. “There’s no one method that can tell us, ‘how much is demand, and how much is supply?’” While some of her research has pointed to the importance of supply-side factors, she has also found evidence suggesting that expansionary fiscal policies have played an important role. She recently co-authored a working paper that examined recent increases in inflation across a sample of advanced and emerging economies. The researchers found that expansionary fiscal policies tended to increase consumption but had only a limited impact on the supply of goods as measured by industrial production indexes. “We take the results as evidence that fiscal policies contributed to inflationary mismatches between demand and supply,” says Santacreu.

A MONETARY POLICY CONUNDRUM

Pinning down the precise sources of current inflationary pressure has important implications for policy. To the extent that increased inflation reflects overly stimulative policy, the antidote is apparent: Reverse course and revert to policies more consistent with past periods in which inflation was stabilized. To the extent that increased inflation reflects supply-side shocks, however, the usual tools of aggregate demand management are likely to offer little help.

READINGS

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In the wake of the global oil price shocks of the 1970s, economists devoted much effort to understanding the optimal monetary policy response to supply shocks. Unfortunately, however, the consensus conclusion was that the standard tools of monetary and fiscal policy are not well designed to address supply shocks. Edward Gramlich of the University of Michigan provided a summary of this viewpoint in a 1979 article that appeared in *Brookings Papers on Economic Activity*. He concluded that supply shocks are very costly, no matter what the policy response: “If their unemployment impact is minimized by accommodating policies, the shock-induced inflation can linger for several years. If their inflationary impact is minimized by an immediate recession, the cost in terms of high unemployment is sizable.”

As a practical matter, economists have often advocated some degree of accommodation in response to aggregate supply shocks. But the prescription for accommodation typically rests on the assumption of an economy initially at equilibrium — that is, one with stable inflation and full employment. While that was likely the case at the onset of the pandemic, it certainly was not the case when global energy and grain supplies were disrupted at the onset of the war in Ukraine. Indeed, year-over-year U.S. inflation had already hit a nearly 40-year record before that point.

While monetary policy is generally not an effective avenue for alleviating supply shocks, companies and governments are likely to take measures designed to soften such blows in the future. Undoubtedly, changing perceptions of risk will cause some firms to reassess their supply chains, just as Japanese automakers did after their supply networks were heavily disrupted by the 2011 Tōhoku earthquake. Indeed, even before the pandemic, many companies had been already reassessing their reliance on foreign value chains, due to, among other things, increased labor costs in China and the growing importance of “speed-to-market” as a competitive factor.

Calls for government policies to decrease dependency on global supply chains have come from many circles in the United States, Europe, and Japan. Treasury Secretary Janet Yellen, for example, has raised the prospect of “friend-shoring” policies. Similarly, officials from France and Germany have spoken of “reshoring projects” and “minimizing one-sided dependencies.” Within the United States, the costs and benefits of such policies will continue to be debated among researchers and politicians, while Fed officials focus on the appropriate extent of monetary tightening or accommodation. **EF**

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de Soyres, François, Ana Maria Santacreu, and Henry Yong. “Demand-Supply Imbalance During the COVID-19 Pandemic: The Role of Fiscal Policy.” Working Paper, June 2022.