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Federal Reserve Bank of Cleveland

Do Energy Price Spikes Cause Inflation?

by Owen F. Humpage and Eduard Pelz

The overarching goal of monetary policy is to keep money's purchasing power stable. Sometimes, however, business cycle developments or other events intervene, causing policymakers to focus for a while on more immediate, though not necessarily incompatible, objectives. The Federal Reserve, for example, dramatically cut its federal funds rate target throughout 2001 and again in November 2002, to create a buffer against a business downturn and the economic uncertainties resulting from the September 11 terrorist attacks. As the economy now moves along the path to recovery, concern about inflation eventually may acquire more weight in Federal Open Market Committee decisions.

Changing the focus of policy from counterbalancing economic weakness to preempting inflationary pressures could be particularly tricky if global recovery and continuing turmoil in the Middle East keep oil prices subject to sharp upward movements. Energy price hikes have often presented the Fed with a dilemma because they simultaneously tend to lower economic growth and raise prices. By easing monetary policy in response to a surge in energy prices, the Fed may lessen any growth consequences, but at the cost of higher inflation. By tightening monetary policy in response to an energy price hike, the Fed can prevent the inflationary consequences, but may accentuate any adverse output effects.

This *Economic Commentary* makes two points about the inflation consequences of energy price shocks: First, the repercussions of energy shortages depend critically on how the Federal Reserve reacts—or does not react—to energy price shocks. Second, because of the disinflationary stance of monetary policy over the past 20 years, the pass-through of energy price shocks to the overall level of prices, though significant, was fairly small. Relying on the past to represent the future is always problematic, but our estimates suggest that energy price hikes do not pose an overwhelming obstacle to price stability. To understand the connection between energy shortages and price movements, however, one must first appreciate the important distinction between relative price changes and inflation.

Many people mistakenly believe that a sharp rise in the price of energy is necessarily inflationary. They fail to understand that energy prices adjust to the demand and supply of energy, whereas inflation responds to the demand and supply of money. This *Economic Commentary* explains that the Federal Reserve can do nothing about relative energy prices, but it can determine how relative energy price shocks are reflected in the overall level of prices. Over the last 20 years, the inflationary consequences of energy price shocks, while significant, have been fairly subdued.

■ Different Types of Price Changes

Price changes are not all alike. Economists typically distinguish between *relative* price changes—movements in a single price or in a subset of closely related prices against all others—and *inflation*—upward movements in all prices.

Relative price changes send important signals that enable market-based economies to function properly. A rise in oil's relative price, for example, indicates that it is becoming an increasingly scarce commodity, either because its supply is falling or because demand is rising faster than supply. An increase in the relative price motivates consumers to cut back on the use of petroleum products and to seek out alternatives. At the same time, the rise in the price of oil drives producers to increase the quantities that they bring to market and to seek new sources.

Inflation, on the other hand, contains no information about the relative scarcity or abundance of particular goods and services. Instead, it indicates that the supply of money is increasing relative to the demand for money. This may occur either because the Fed is providing too many reserves to the banking system and causing the supply of money to increase rapidly, or because the demand for money is declining. In both cases, people try to dispose of their surfeit money balances largely by acquiring more goods and services; in the process, they drive up all prices, but change the relative price of none.

Through careful management of monetary policy, the Fed can, in principle, control inflation, but it can do nothing about relative price changes. If oil becomes increasingly scarce because of OPEC's actions or because oil reserves become harder to find and extract or because demand outpaces supply, the relative price of oil will go up regardless of monetary policy's stance. Moreover, this price shock will ripple through the economy, affecting the relative prices of the myriad goods that use or substitute for oil.

While monetary policy can do nothing about these relative price changes, it does affect how they influence aggregate

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price indexes. An energy shortage, for example, will cause the price of energy to rise. If the Federal Reserve responds by expanding the money stock, the aggregate price level will rise. If the Federal Reserve responds instead by shrinking the money stock, the aggregate price level will fall. If the Federal Reserve does nothing in response to the energy shortage, aggregate prices will rise if aggregate output falls, because any decline in output that accompanies energy price shocks will reduce the demand for money relative to its supply.

Any estimates of how relative energy prices affect inflation depend critically on the Federal Reserve's behavior. Consequently, the statistical methodology for making such estimates must control for monetary policy responses to energy price shocks, as well as for other key macroeconomic variables that might interact with energy.

■ An Experiment

We attempted just such an exercise, using a standard statistical technique—vector autoregression—to investigate the consequences of relative energy price shocks on core measures of inflation, while simultaneously controlling for the state of the business cycle, inflation expectations, and the Fed's monetary policy actions. We estimated separate models for each of three core measures of inflation: the Consumer Price Index less food and energy (core CPI), the Personal Consumption Expenditure deflator less food and energy (core PCE) and the Federal Reserve Bank of Cleveland's Median CPI. Because these core inflation measures exclude energy prices, we are attempting to capture the pass-through of relative energy price shocks to all other goods and services. Energy prices themselves enter directly into the overall Consumer Price Index and the overall Personal Consumption Expenditure deflator with weights of approximately $7^{1/2}$ percent and $4^{1/2}$ percent, respectively.

The experiment proceeded in two steps. First, we estimated the models, obtaining statistical profiles that described the average interactions among the variables over the sample period, 1980 to 2000. This included a characterization of monetary policy over the past 20 years. Then, we imposed artificial energy price shocks on the models—separate price increases and decreases—and traced how they passed through to the core price measures as they interacted with the other variables. The positive and negative energy price shocks equaled 20 percentage points, approximately three times the average month-to-month, positive or negative energy price change during the last 20 years. Because these are one-month shocks to the change in energy prices, they imply a permanent adjustment to their levels.

We found that these one-time energy price shocks had little effect on core prices. Their influence, however, was clearly asymmetric; positive price shocks raised prices, but negative price shocks did not lower prices. Positive price shocks increased the core CPI inflation rate by 0.4 percentage point after a lag of 12 months, the Median CPI inflation rate by 0.2 percentage point after 15 months, and the core PCE inflation rate by 0.6 percentage point after 16 months. These were all one-month spurts in the inflation rate. Core CPI inflation, for example, averaged 3.4 percent per year over our sample period. The one-time energy shock produced a jump to 3.8 percent 12 months later. Immediately thereafter, core CPI inflation reverted to 3.4 percent. This result implies that the trend inflation rate was not changed, but that the average level of core prices remained permanently higher. The average annual rates of core PCE and Median CPI inflation were 3.1 percent and 3.5 percent, respectively, in our sample. Consequently, the above results suggest a delayed, one-time jump in each of these inflation measures to 3.7 percent. The inflationary blips to each of the core measures were well within the range of the typical month-to-month variation (one standard deviation) in the inflation rate. In addition, we found that positive energy price shocks did not raise inflation expectations, while negative energy price shocks seemed to lower inflation expectations. Despite methodological differences, these results are consistent with the finding of economist Mark Hooker, who discovered that energy prices did not have a significant pass-through effect to core prices after 1980.

■ Are Energy Price Shocks Passé?

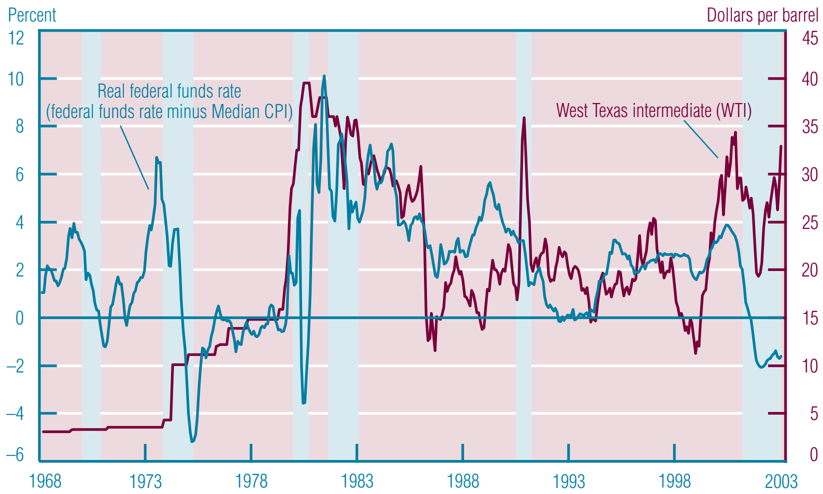
Our model suggests that the impact of energy price shocks on the U.S. economy—both on prices and output—has not been very dramatic over the past 20 years. Prior to the early 1980s, energy prices apparently had a profound effect on business cycle activity. In 1983, for example, economist James Hamilton noted that energy price spikes preceded nearly every U.S. recession since World War II, and he verified this relationship statistically. More recently, however, the connection between energy price spikes and business cycle patterns has seemed less certain. By 1996, Mark Hooker could find little evidence of a relationship. Although energy price spikes preceded the two recent recessions, the downturns were conspicuously mild (see figure 1).

Increased energy efficiency may be the most obvious reason that energy price spikes have less of a macroeconomic impact. According to Energy Department estimates, we now consume only half as many Btu of energy per unit of GDP as we did in early 1970s (see figure 2). Conservation should dampen both the business cycle consequences and the inflation impact of energy price hikes. (We did attempt to control for energy efficiency in our model.)

Some economists, however, contend that the reduced role of oil price shocks after the early 1980s reflects something more fundamental than energy efficiency. Douglas Bohi and others after him argue that oil price shocks have always been too small relative to total output to account for the observed macroeconomic consequences. They maintain that accompanying Federal Reserve policies—not the energy price shocks alone—largely accounted for the corresponding business cycle patterns. Hikes in the real federal funds rate have also preceded nearly every U.S. recession (see figure 1). In the early 1970s, an oil price hike occurred shortly after the Federal Reserve tightened monetary policy, and, in 1979 and 1980, the Fed tightened shortly after the oil price shock occurred. In both instances, however, the Fed reversed course as economic activity weakened. Inflation soared, and people began to believe that the Fed lacked the wherewithal to fight inflation when energy prices rose. A seesaw monetary policy response to oil price shocks had accentuated their impact on both output and inflation.

Since the early 1980s, however, the Fed has credibly committed to long-term price stability. The annual inflation rate has dropped from double-digit rates to around 2 percent to 3 percent, and the connection between inflation expecta-

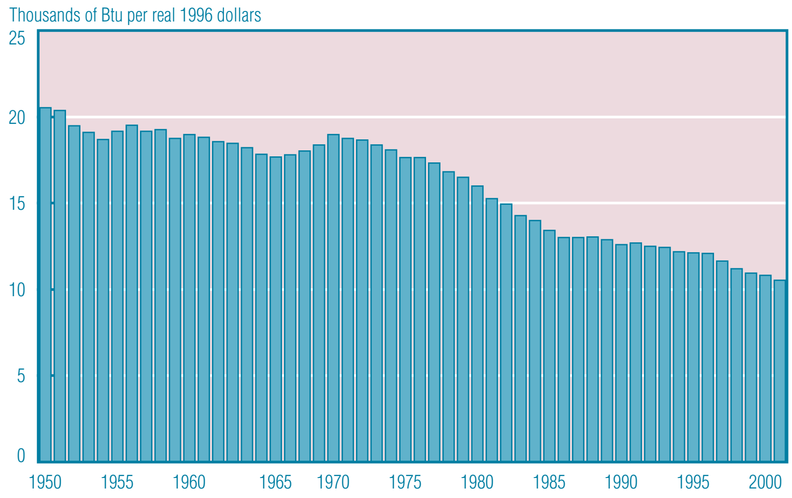
FIGURE 1 ENERGY, MONETARY POLICY, AND THE BUSINESS CYCLE[a]



a. Shaded areas indicate recessions.

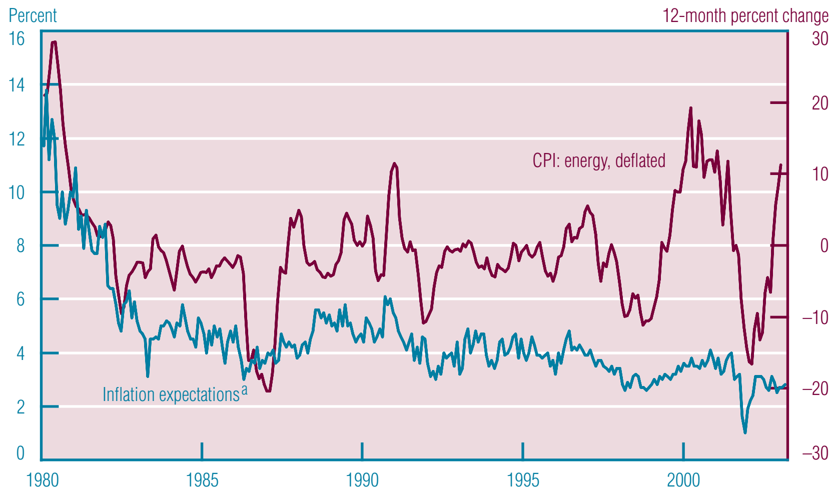
SOURCES: Board of Governors of the Federal Reserve System; Federal Reserve Bank of Cleveland; and *The Wall Street Journal*.

FIGURE 2 ENERGY USAGE RELATIVE TO OUTPUT



SOURCE: U.S. Department of Energy, Energy Information Administration.

FIGURE 3 ENERGY CPI AND INFLATION EXPECTATIONS



a. Mean expected change in consumer prices a year ahead as measured by the University of Michigan's *Survey of Consumers*.

SOURCES: U.S. Department of Labor, Bureau of Statistics; and University of Michigan.

tions and energy price movements has weakened (see figure 3).

■ The Past as Prologue

Using a statistical profile of past economic interrelationships to portray the future is always a perilous task. For one thing, energy prices over the next five or 10 years need not behave as they did over the last 20 years. They may rise higher and demonstrate more volatility, which could fundamentally alter their economic impact relative to how our models depicted it. Nevertheless, as a first approximation, the results are instructive: Over the past 20 years, energy shortages have altered relative energy prices, but they have had little pass-through effects to core measures of inflation. This result owes much to the Fed's ability to lower the rate of inflation over this period and to convince the public that it is willing and able to continue such a policy over the long term.

■ Recommended Reading

On oil prices and business cycles:
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Michael Dotsey and Max Reid, “Oil Shocks, Monetary Policy, and Economic Activity,” Federal Reserve Bank of Richmond, *Economic Review*, July/August, 1992, pp. 14–27.

On the Median CPI:
Michael F. Bryan and Stephan G. Cecchetti, “The Consumer Price Index as a Measure of Inflation,” Federal Reserve Bank of Cleveland, *Economic Review*, Quarter 4, 1993, pp. 15–24.

On oil prices and core price measures:
Mark A. Hooker, “Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regimes,” Board of Governors of the Federal Reserve System, 1999, unpublished manuscript.

Owen F. Humpage and Eduard Pelz, “Do Energy Price Shocks Affect Core Price Measures?” Federal Reserve Bank of Cleveland, Working Paper no. 02-15, November 2002.

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