What Causes Inflation?

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Inflation is universally unpopular; everyone from ordinary consumers to top government officials bemoans the perpetual process of rising prices. Frequently, discussions of inflation have an air of resignation. Inflation is like bad weather: we can complain about it, but it seems to be a fact of life. For most people, the causes of inflation are murky. Popular writers lay the blame on a variety of scapegoats: governments that spend too much money, the OPEC cartel, skyrocketing costs of medical care. What causes inflation, and is there any way to eliminate it?

Economists have both good news and bad news about inflation. The good news is that we know a lot about its causes and how it could be ended. The bad news—and the reason that inflation has not been ended—is that doing so could be costly. This article describes what economists understand about inflation and what issues remain mysterious. There is a clear consensus about the long-run causes of inflation—the determinants of average inflation over a decade or more. The short-run

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behavior of inflation—the ups and downs from year to year—is only partly understood.

INFLATION IN THE LONG RUN

The year-to-year movements in inflation that make newspaper headlines are small compared with the differences in inflation across different eras or different countries. In the United States, inflation as measured by the gross-national-product deflator averaged 7.4 percent per year from 1970 through 1979, but only 2.4 percent from 1950 through 1959.[1] From 1930 through 1939, inflation averaged -1.7 percent per year—the price level was lower at the end of the decade than at the beginning. And these differences across periods in the United States, while substantial, are dwarfed by differences across countries. From the 1950s to the mid-1980s, inflation averaged 4.2 percent per year in the United States, only 2.7 percent in Switzerland, but 8.0 percent in Italy, 21.2 percent in Israel, and 54.4 percent in Argentina (see Ball, Mankiw, and Romer, 1988).[2] What causes these differences in inflation over long periods?

The Culprit: Too Rapid Money Growth. While economists disagree about many issues, there is near unanimity about this one: continuing inflation occurs when the rate of growth of the money supply consistently exceeds the growth rate of output. In the long run, as Milton Friedman puts it, "inflation is always and everywhere a monetary phenomenon." When the money supply grows much more quickly than output of goods and services, inflation is high; when it grows only slightly faster than output, inflation is low; and when it consistently decreases relative to output there is deflation: the price level falls. (The most recent example of deflation in the United States is the early 1930s.)

Why does too rapid growth in the money supply cause inflation? To see the answer, consider how the economy responds when the money supply rises. According to mainstream economics, firms do not immediately adjust their prices in response to an increase in the money supply. Because prices do not respond immediately, there is an increase in the real money supply—the money supply relative to the price level. The increase in the real supply of money pushes down the price of money—that is, the interest rate. Over time, lower interest rates stimulate borrowing and spending by firms and consumers, and the economy expands. The story ends when firms react to the booming economy and their strained capacity by raising prices. Prices rise until they match the increase in the money supply, pushing the real money supply back to its original level and choking off the boom. That is, the long-run effect of a 10 percent increase in the money supply relative to output is a 10 percent increase in the price level and no change in the ratio of money to prices. It follows that if the money supply increases 10 percent faster than output every year, prices must eventually rise 10 percent per year. The gap between the average rate of money growth and the average growth rate of output determines average inflation.[3]

[1]Unless otherwise noted, all inflation figures refer to the percentage change in the GNP deflator. This variable is a broad index of the level of all prices in the economy. The more famous Consumer Price Index covers only prices paid by consumers, not those paid by governments or businesses.

[2]Citations to all papers mentioned in the text are included in the "References" section at the end of this article.

[3]To be complete, inflation depends on the growth rate of the "velocity" of money—the frequency with which money is turned over—as well as on the gap between the average growth rates of money and output. For the United States, the average growth rate of velocity (for the M2 measure of money) has been zero over the past 40 years. In practice, then, money growth of 2 or 3 percent per year is consistent with stable prices. This rate of money growth matches the natural growth of output and spending.

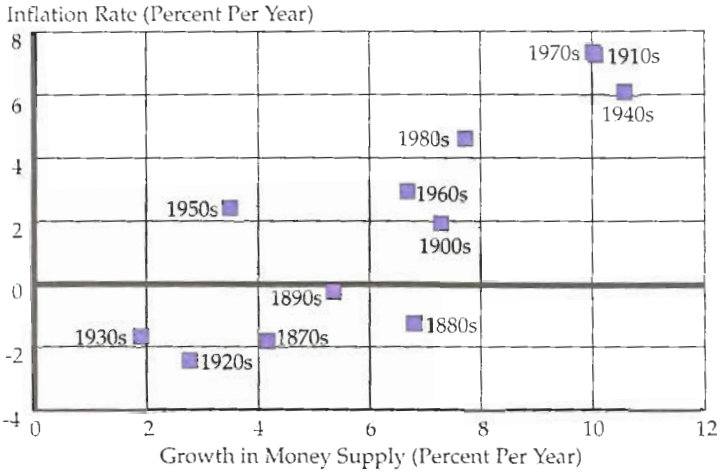
In principle, differences in inflation across countries or time periods could be explained by differences in either money growth or output growth, since the gap between the two determines inflation. In practice, however, the most important factor is money growth, which varies widely, with levels near zero in some countries and over 100 percent per year in others. Variation in output growth is smaller and thus is a secondary factor in explaining differences in the gap between money growth and output growth. As a first approximation, then, differences in inflation across time periods or countries can be explained by differences in money growth.

To provide evidence for this point, Figure 1 plots average inflation and money growth in the United States for various decades. Figure 2 presents average inflation and money growth from 1986-89 for a number of countries.[4] In Figure 1, the decades with the highest inflation, such as the 1910s and the 1970s, are those with the highest money growth. Similarly, Figure 2 shows a close relationship between inflation and money growth across countries. Countries such as Switzerland and France produce low inflation through low money growth; countries such as Turkey and Mexico produce high inflation

FIGURE 1

Money Growth and Inflation (U.S.)

(1870 - 1980)

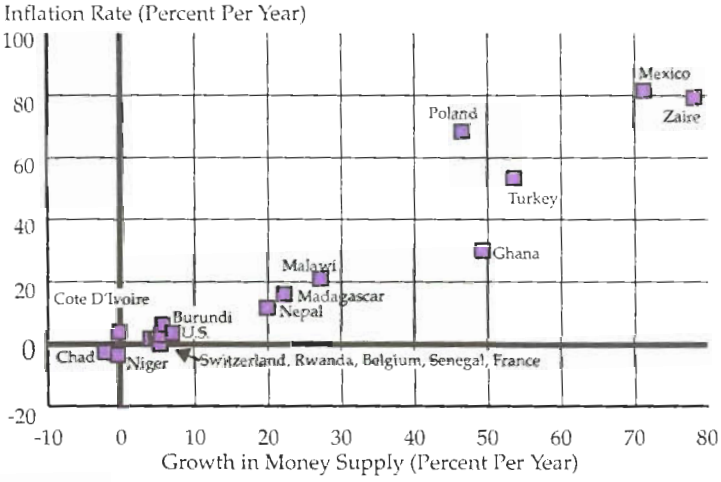


Recreated from: Milton Friedman and Anna J. Schwartz, *Monetary Trends in the United States and the United Kingdom*. Chicago: University of Chicago Press, 1982, with permission.

FIGURE 2

Money Growth and Inflation Across Countries

(1986 - 1989)



Recreated from: Andrew B. Abel and Ben S. Bernanke, *Macroeconomics*. Reading, MA: Addison-Wesley, 1992, p. 141, with permission.

[4]The data for Figures 1 and 2 are taken from Friedman and Schwartz (1982) and Abel and Bernanke (1992), respectively.

through high money growth. Along with the theoretical arguments discussed above, this evidence has convinced economists that trend or average inflation is determined by money growth.

Why Is Money Growth Excessive? The question of what causes inflation has, at one level, an easy answer: money growth. This answer, however, raises another, deeper question: why do policymakers allow the money supply to grow quickly? The Federal Reserve and corresponding monetary authorities in other countries possess effective techniques for controlling the average growth rate of the money supply.[5] Policymakers could slow average money growth enough to keep the average inflation rate at zero (although shocks to the economy would cause temporary movements above and below zero). Since both the public and the Federal Reserve dislike inflation, why isn't it eliminated?

The answer to this question is different in different types of economies. In some countries, the answer is simple: the government prints money at a rapid rate to finance budget deficits. This explains most episodes of very high inflation—the annual inflation of several hundred percent or more that has afflicted South American countries and Israel within the past decade. These countries have had high levels of government spending and have been unable politically to match this spending with tax revenues; thus they have financed their spending by creating new money. Predictably, rapid money creation has produced high inflation. Inflation has been brought under control only when the underlying budget deficit was reduced. (In Israel, for example, such a stabilization occurred in 1985.)

[5]Specifically, the Fed manipulates the supply of money through "open market operations"—purchases and sales of government bonds. Buying bonds with money adds to the economy's money stock, and selling bonds drains money out of the economy.

Budget deficits are not, however, the basic source of inflation in the United States or in most European economies. The U.S. government has, of course, run large deficits over the past decade. But these deficits have been financed primarily by borrowing, not by printing money. That is, the government covers its deficit mostly by issuing bonds. The Federal Reserve contributes to government revenue by creating new money, but this "seignorage" is small: less than 1 percent of total revenue. In countries like the United States, policymakers would gladly eliminate inflation through lower money growth if the only cost were a small revenue loss. The deterrent to lowering inflation must arise from a different source.

The reason U.S. policymakers are reluctant to push inflation to zero is that doing so is likely to cause a recession, or at least slower economic growth. This fear is supported by both macroeconomic theory and historical experience. Slower money growth reduces inflation in the long run, but there is a lag, as discussed earlier. When money growth falls, firms initially continue to raise prices at the rate to which they are accustomed. With money growing more slowly than prices, the real money supply falls, causing a recession. Only the experience of the recession causes inflation to fall.

This theoretical story fits much of the U.S. experience. One cause of the recession that began in 1990 was, arguably, the Fed's efforts to reduce inflation in the late 1980s. More clearly, disinflation was a major cause of the recession of 1981-82—the worst recession since the 1930s. Paul Volcker, the chairman of the Federal Reserve from 1979 to 1986, moved decisively to eliminate the double-digit inflation of the late 1970s. He succeeded, but at a price: inflation fell from 10.1 percent in 1980 to 4.0 percent in 1983, but unemployment rose from 5.8 percent in 1979 to 9.5 percent in both 1982 and 1983. Research by economic historians has shown that this experience is part of a regular pattern:

when the Fed slows money growth substantially to reduce inflation, a recession occurs almost invariably.[6]

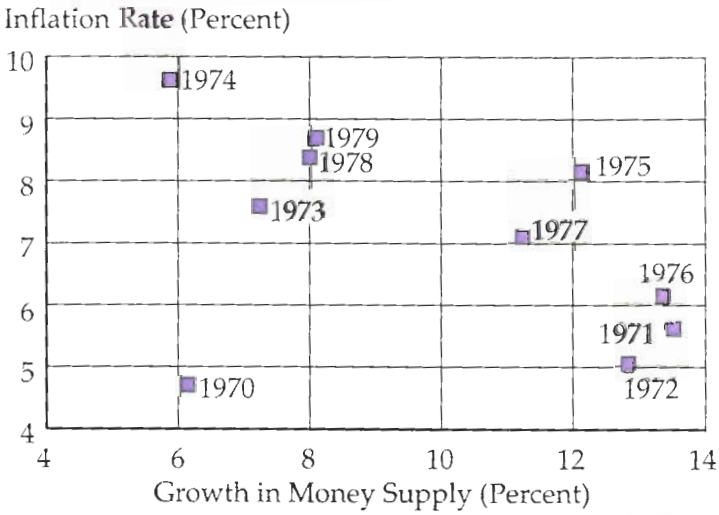
While some policymakers are willing to pay this price to reduce inflation, others are not. And the Fed's eagerness to fight inflation appears to depend on the severity of the inflation problem. Volcker was sufficiently concerned about double-digit inflation to implement the monetary tightening needed to reduce inflation. But inflation of around four percent, the level through much of the 1980s, did not create enough distress to prompt a further tightening. Thus inflation continued. (For more on this subject, the reader is referred to "What Are the Costs of Disinflation?" by Dean Croushore, in the May/June 1992 issue of this *Business Review*.)

SHORT-RUN FLUCTUATIONS IN INFLATION

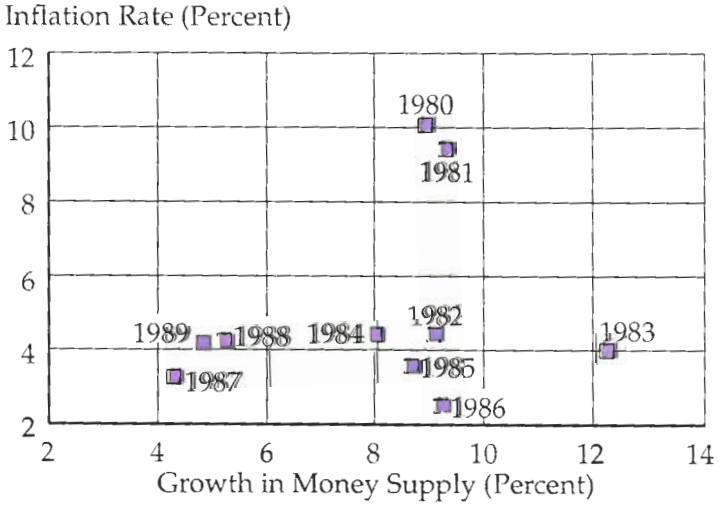
Although money growth determines average inflation in the long run, the short-run behavior of inflation is more complicated. Inflation fluctuates around its long-term trend from year to year; for example, annual inflation rates in the second half of the 1980s varied around their average of 3.6 percent, with annual rates from 1985 to 1989 of 3.6, 2.5, 3.3, 4.3, and 4.2 percent. Short-term fluctuations in inflation were larger in the 1970s: the annual rates from 1970 to 1974 were 4.7, 5.6, 5.0, 7.6, and 9.6 percent. One source of these inflation movements is temporary fluctuations in the growth of the money supply. In contrast to the long run, however, too rapid money growth is not the only, or even the primary, determinant of inflation. Figure 3 plots inflation against money growth for each year during

FIGURE 3

Money Growth and Inflation During the 1970s (U.S.)



Money Growth and Inflation During the 1980s (U.S.)



[6]Romer and Romer (1989) identify six episodes since World War II in which the Fed sharply tightened policy to reduce inflation. In each case, a recession occurred within two or three years.

the 1970s and 1980s. Clearly, annual inflation can differ considerably from money growth. What causes this short-run divergence?

Demand Shocks. One source of short-run changes in inflation is shifts in aggregate demand—in desired spending by government, businesses, and consumers. Suppose that the government spends more to finance a war or businesses become more confident about the future and invest in factories and machines. As the demand for military hardware or for factories rises, the economy expands: firms increase production and hire more workers, cutting unemployment. But again, high output and low unemployment eventually spur faster increases in wages and prices: inflation rises. Similarly, a fall in aggregate demand causes a recession, leading firms to raise prices more slowly. The economy's short-run movements between booms and recessions produce fluctuations in inflation as well.

A good example of inflation arising from a shift in aggregate demand—a shift that was not initiated by monetary policy—is the increase in inflation in the late 1960s. Annual inflation varied from 0.8 percent to 2.3 percent over the period of 1960-64, but rose to 5.3 percent in 1969. The consensus explanation for this experience is increased government spending. As the Vietnam War escalated, the Johnson administration raised military spending while also continuing the social programs of the "Great Society." As a result, the federal budget deficit grew from $1.4 billion in fiscal year 1965 to $25.2 billion in 1968, and the economy overheated: unemployment fell, but inflation rose.

Price Shocks. Until the early 1970s, most economists believed that shifts in aggregate demand were the dominant source of short-run movements in inflation. This view had to be modified, however, after the experience of the 1970s, when price shocks—a.k.a. "supply shocks"—caused large increases in inflation. These shocks were sharp increases in the prices of particular goods, namely food and energy products, arising ultimately from poor weather and the emergence of the OPEC cartel. These shocks created "stagflation": inflation rose while unemployment rose and real output fell (in contrast to the experience of demand shocks, which push inflation and unemployment in opposite directions). From 1972 to 1974, annual inflation rose from 5.0 percent to 9.6 percent as a result of a rise in food prices and the first OPEC price increase. OPEC II raised inflation from 7.1 percent in 1977 to 10.1 percent in 1980. These increases dwarfed the fluctuations in inflation arising from the demand shocks of the previous 20 years. More recently, the spike in oil prices during the gulf crisis raised inflation in the second half of 1990.

Why do rises in food and energy prices create inflation? The reader will be forgiven for thinking that the answer is obvious: food and energy are a significant fraction of the economy, and rises in prices are the *definition* of inflation. Economists, however, believe that the issue is not so simple because of the distinction between the overall price level and *relative* prices.

In classical economic theory, the price level is determined by the money supply, as described above. Changes in supply and demand for various products arising from weather conditions, cartel decisions, and so on affect not the price level but relative prices: OPEC makes oil more expensive *relative* to other goods. Theoretically, this is accomplished partly by an increase in the absolute price of oil and partly by *decreases* in all other prices. With these price adjustments, oil can become relatively more expensive while the price level remains unchanged at the equilibrium level determined by the money supply. In practice, this is not what happens: OPEC in fact raised the average price level. But it is not obvious why this is so.[7]

[7]Writing in 1975, Milton Friedman puts the point this way: "It is essential to distinguish changes in *relative* prices from changes in *absolute* prices. The special conditions that

This issue is the subject of recent research by me and Gregory Mankiw of Harvard University (Ball and Mankiw, 1992). Our explanation for the inflationary effects of price shocks rests on two ideas. First, there is some inertia in prices. Firms do not instantly adjust prices to every change in circumstances; instead, they adjust only if their desired price change is large enough to justify the costs of adjustment. For example, a mail-order company will print a new catalog to announce a 50 percent sale, but it is not worth the effort to announce a one-cent price change arising from a tiny change in costs; instead, the firm will simply keep its prices fixed. This behavior implies that large shocks have disproportionately large effects on prices: firms adjust to them quickly, while they make smaller adjustments more slowly.

The second key idea is that "price shocks" are episodes in which certain relative prices rise or fall by unusually large amounts. In the OPEC episodes, for example, some relative prices—those for oil-related products—rose 50 percent or more in response to the trebling of oil prices. By definition, other relative prices went down to balance these increases: if some prices are relatively higher, others must be relatively lower. It was not the case, however, that equilibrium prices of some nonoil products needed to fall by more than 50 percent. Instead, the relative price decreases were spread over all nonoil goods: a fraction of relative prices rose a large amount, balanced by smaller relative decreases in the majority of prices.

Combining this idea with the previous one—that large shocks have disproportionate effects—explains why OPEC was inflationary. The large relative shocks to oil-related prices triggered quick upward adjustments. For example, given the large increase in oil prices, gas stations would have suffered huge losses had they not quickly raised prices at the pump. In contrast, while prices of many other goods came under downward pressure, the required price decreases were small and hence occurred more slowly.

When consumers spent more money on oil, they had less available for toothbrushes, soft drinks, and all other nonoil goods, creating an incentive for the sellers of these products to reduce prices. But the desired decreases were only a few percentage points because OPEC did not cut heavily into toothbrush or soft drink demand. Thus firms were slow to adjust prices downward. In the short run, oil-related prices rose, and the offsetting decreases did not fully occur. Thus prices rose on average: there was inflation.

This theoretical story explains a large number of the rises and falls in inflation in the United States. The oil and food price episodes in the 1970s are examples. Another example is the large *decrease* in oil prices in 1985-86. Our theory predicts that inflation should fall in this episode because the decreases in oil prices occur more quickly than the smaller increases in other prices. And, indeed, inflation fell from 4.4 percent in 1984 to 2.5 percent in 1986.

Our theory also explains episodes before the famous supply shocks of the 1970s. For example, inflation rose above 10 percent in 1951, largely due to a demand shock: the Korean War. Inflation then plummeted to near zero in 1952, and the cause appears to be a price shock. Specifically, the prices of meat, rubber, vegetable oil, and several other products fell steeply. More generally, my research with Mankiw suggests that a combination of demand and price shocks explains most of the year-to-year fluctuations in U.S. inflation since 1950.

Although some relative price increases are inflationary according to our theory, others are

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drove up the prices of oil and food required purchasers to spend more on them, leaving them less to spend on other items. Did that not force other prices to go down or to rise less rapidly than otherwise? Why should the *average* level of prices be affected significantly by changes in the price of some things relative to others?"

not. One example is the steady increase in the cost of medical care. These price increases probably have little to do with inflation, despite frequent claims to the contrary in popular discussions. A relative price increase affects inflation only if there is an unusually large shock during a particular year, so that the upward price adjustment occurs more quickly than the offsetting downward adjustments. Medical costs have risen faster than the overall price level for several decades, but the rise has been steady; there are no cases of 50 percent or 100 percent increases within a year, as in the case of oil. This smooth adjustment of relative prices could occur without inflation. If the Federal Reserve pursued noninflationary monetary policy, the average price level would remain steady, with rises in the price of medical care offset by price decreases in other industries.

FROM THE SHORT RUN TO THE LONG RUN

According to the analysis so far, the average rate of inflation over a long period is determined by the amount that average growth of the money supply exceeds average output growth. Inflation fluctuates around its trend from year to year in response to various demand and price shocks. We have seen that these ideas explain much of the U.S. inflation experience, but they do not capture one aspect: the link between the short run and the long run.

Suppose that inflation is proceeding at the level determined by trend money and output growth and that oil prices rise sharply. The theories reviewed so far suggest that this price shock should raise inflation in the short run but that inflation should then return to its long-run trend if trend money growth is unchanged. In fact, shifts in inflation arising from demand or price shocks appear quite persistent. When government spending raised inflation in the late 1960s, and when OPEC raised inflation in the 1970s, there was little sign that inflation would naturally return to its previous level. Instead, inflation continued until the Federal Reserve became sufficiently concerned to tighten policy, producing a recession. (Such policy tightenings occurred in 1970 in response to the high inflation of the late 1960s and in 1974 and 1978-79 after the OPEC shocks. See Romer and Romer, 1989.) Absent a policy tightening and recession, inflation arising from price or demand shocks seems to continue indefinitely: short-run shifts in inflation have long-run effects on trend inflation. How can this evidence be squared with our earlier theories?

Recall the crucial fact that trend inflation is ultimately caused by faster growth in the money supply than in output. Logically, if shocks such as OPEC shift trend inflation, they must induce the Federal Reserve to raise trend money growth (until the point when policymakers decide that inflation is too high and accept the cost of disinflation). Why does a short-run spurt in inflation lead the Fed to raise the average level of money growth?

The usual answer to this question focuses on the behavior of inflationary expectations. In past experience, individuals have seen that increases or decreases in inflation usually persist for a substantial period. Thus, when they see a new rise in inflation (because of an OPEC shock, for example), they expect inflation to stay high. Crucially, this expectation is self-fulfilling: the expectation that inflation will stay high causes it to stay high. The reason expectations affect actual inflation is that they affect decisions about wage- and price-setting. If everyone expects a 10 percent rate of inflation to continue, workers will demand 10 percent wage increases to keep up. Firms will raise prices 10 percent to match the higher wages they pay and also the 10 percent increases they expect from their competitors. Thus inflation will continue at 10 percent, fulfilling expectations.

The Federal Reserve is not helpless in the face of this self-fulfilling inflationary spiral. The spiral can continue only as long as it is

"accommodated" by the Fed—as long as the Fed raises money growth as much as inflation has risen. However, a price shock such as that caused by OPEC is not only inflationary for the U.S., it also is contractionary. Because the higher price of imported oil leaves Americans with less of their incomes to spend on domestic goods and services, it causes output and employment to fall, at least temporarily. The Federal Reserve could bring inflation back down by slowing money growth. The result will be to reduce output further, causing a recession that eventually forces inflation down. Over substantial periods, however, such as the 1970s, the Fed has been unwilling to impose this cost on the economy. Thus, once a shock such as OPEC raises inflation, it can stay high for a long period before a Paul Volcker takes charge and disinflates. The price shock creates a vicious circle in which persistence in inflation creates the expectation of persistence, which in turn creates persistence.

While this story is widely accepted, it is not airtight. At an empirical level, it appears true that changes in inflation are expected to persist. Surveys of the expectations of forecasters and of ordinary citizens show that a rise in current inflation leads to higher forecasts of future inflation. At a deeper level, however, it is not clear *why* expectations behave that way. Since the expectation of persistence is self-fulfilling, it proves itself correct. But there are other expectations that would also be self-fulfilling. Suppose that a price shock raised inflation in one year, but everyone expected that inflation would return to its original level in the next year. With the expectation of moderate inflation, workers would moderate their wage demands, and firms would moderate their price increases. Thus the expectation of low inflation would also prove itself correct. Since expectations of either persistent or nonpersistent inflation are self-fulfilling, it appears that either expectation would be rational. The U.S. economy has settled into a situation in which people expect inflation to persist, perhaps only because it has in the past.

CONCLUSIONS

The behavior of inflation is one of the better-understood areas of macroeconomics. There is a wide consensus about the long-run determinants of inflation and, arguably, a consensus about much of its short-run behavior. The average inflation rate over long periods is determined by the extent to which the average rate of money growth (which, in the United States, is chosen by the Federal Reserve) exceeds the average growth rate of real output. Short-run inflation fluctuates around its long-run average because of demand shocks, such as large increases in government spending, and supply shocks, such as sharp rises in the prices of food and energy.

Some countries have persistently high inflation because they continuously create new money to finance large, ongoing budget deficits. Such countries are unable to reduce money growth enough to halt inflation because their governments have been unable to eliminate budget deficits and because they do not have effective alternatives for financing those deficits. In the United States, however, the government budget deficit is financed almost entirely with Treasury debt, not money creation. The United States had low average inflation in the 1980s because money growth, on average, only slightly exceeded output growth.

Finally, the distinction between short-run and long-run determinants of inflation is blurred by the fact that short-run changes often influence the long-run trend. When a demand or price shock raises short-run inflation in the United States, expectations of future inflation rise. Historically, the Fed often accommodated these expectations by allowing money growth to rise, so expectations were fulfilled. Not allowing money growth to rise would have slowed output growth and perhaps caused a recession.

These conclusions—a summary of the thinking of mainstream economists—partly fit ideas that are popular among journalists and the public and partly contradict such ideas. It is common, for example, to blame inflation on excessive deficit spending by the government. This view is on target for the case of Argentina, but not for the United States. Little of the U.S. deficit is financed by printing money. Thus it was possible for U.S. inflation to fall between the 1970s and the 1980s even though the U.S. budget deficit rose substantially. On the other hand, the view that government spending fuels U.S. inflation has a grain of truth. There are periods, notably the Vietnam era, when too much spending overheats the economy, producing inflation that persists as long as monetary policy is accommodative.

Perhaps the most common scapegoats for inflation are the particular prices that the public observes to rise most rapidly. In some eras, these are oil or food prices; a current favorite is medical care. When journalists and citizens blame individual prices for inflation, they confuse average and relative prices. Particular prices could rise just as much in relative terms even if the overall price level were constant. Again, however, there is a grain of truth in conventional thinking. Particularly sharp increases in prices, such as OPEC shocks, are inflationary.

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