

How Should Monetary Policy Respond to Shocks While Maintaining Long-Run Price Stability?—Conceptual Issues

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This paper takes as given the principle that long-run price stability should be the central goal of monetary policy. The purpose of the paper is to discuss conceptual issues pertinent to the task of maintaining price stability once achieved.

Price stability—which because of an upward bias in measuring inflation may be defined as 1 or 2 percent measured inflation—directly raises economic well-being by increasing the efficiency of the monetary system and by reducing uncertainty about the future. There are also macroeconomic benefits of price stability. Cross-country evidence shows that countries with lower rates of inflation tend to have higher long-term economic growth rates. Moreover, a low and steady inflation rate improves cyclical performance: since the high and volatile inflation was ended in the early 1980s and a more credible and systematic monetary policy was put in place, cyclical stability has improved in the United States. From 1982 to the present, there have been two historically long economic expansions separated by a relatively short national recession. Hence, it appears that price stability yields benefits both in higher economic growth and greater output and employment stability.

In order to examine the question about how price stability should be maintained in the future, the paper first reviews some of the mistakes of the past. In particular, it examines the history of the late

1960s and 1970s in the United States when price stability was not maintained.

The paper then goes on to review what macroeconomics tells us about how monetary policy should be conducted to maintain long-run price stability. It examines how monetary policy should react to shocks and other developments in the economy such as changes in the rate of growth of potential GDP.

Learning from the past

The rise of inflation in the late 1960s and 1970s in the United States—sometimes called the Great Inflation—was an unusual historical event. It was the only major peacetime abandonment of the goal of price stability in U.S. history. As this episode fades into the distant past, it is useful to review and document the events that led to the rise in inflation and to seek lessons from them.¹ The failure of monetary policy to maintain price stability in past episodes like this should provide lessons about how monetary policy should be designed to maintain price stability in the future.

Why was price stability not maintained in the United States and many other industrialized countries during this period?

Price shocks

Some macroeconomic accounts of the 1970s point to price shocks—in particular oil price shocks—as the main source of the rise in inflation. However, in a recent paper documenting this period, economic historian Brad De Long (1996) concludes that price shocks could not have been a cause of the rise in inflation during this period. To establish the case, De Long shows that the rise of inflation was well under way before 1972 when the oil price shocks began. “The baseline inflation rate was some 5 percent per year in the early 1970s *before* there were any supply shocks...Thus I would tentatively conclude that the supply shocks of the 1970s were in large part sound and fury,” De Long argues.

De Long's timing argument is convincing. It suggests that there must be other reasons for the failure to maintain price stability. Although the price shocks had temporary effects on the inflation rate—jumps in the price level—they did not have a lasting effect on the underlying inflation rate.

Time inconsistency

In another review of the Great Inflation, Michael Parkin (1993) uses the idea of "time inconsistency" to explain the rise in inflation. Without some mechanism for the central bank to establish credibility, or consistency over time, Parkin argues that the inflation rate chosen by the central bank will be too high—an inferior equilibrium in which the inflation rate exceeds what is optimal for the economy. According to the time inconsistency theory, as developed by Finn Kydland and Edward Prescott (1974), the amount by which the inflation rate exceeds the optimal rate is higher if the natural rate of unemployment is higher.

Parkin argues further that during the 1970s in the United States, there was an increase in the natural rate of unemployment and that in the 1980s and 1990s the natural rate has come down again. Hence, according to the time inconsistency theory we should have seen an increase in inflation in the 1970s and a decline in the 1980s, a rise and fall that would roughly match a rise and fall in the natural rate.

In my view, however, the time inconsistency argument is not persuasive in explaining the failure of monetary policy to maintain price stability. It would seem too easy for society to figure out the time inconsistency problem; that is, to see that the central bank's choice of the inflation rate is excessive and to fix the problem with legislation or other social arrangements. Moreover, the time inconsistency argument fails to explain why inflation rose and then fell in much of Europe during roughly the same period even though, by most estimates, the natural rate of unemployment continued to rise throughout the 1980s, rather than fall as in the United States.

Fears of another Great Depression

In rejecting the price shock explanation, De Long argues that the main reason for the Great Inflation was the memory of the Great Depression of the 1930s and people's fear of a return to high unemployment. In other words, he argues, policymakers and the public were willing to let inflation rise because, having recently experienced the Great Depression, they feared that maintaining price stability would lead to much greater unemployment.

However, there is a problem with De Long's explanation. If the experience of the Great Depression conflicted with the goal of price stability, then why was the price level so nearly stable during the 1950s and early 1960s—a period nearly as long as the Great Inflation itself? We should have seen the inflation rate rise much earlier. In this case, the timing seems off in De Long's explanation. While it is possible that the Great Inflation was just an “accident waiting to happen”—about which no one can explain the timing, I think there is a better explanation which fits the timing of the events just about perfectly.

Misleading economic theories

In my view, the rise of new macroeconomic theories and their application in practice provides much of the explanation of the abandonment of price stability in the late 1960s and 1970s. The idea that there is a long-run Phillips curve tradeoff began to appear in textbooks, newspapers, and even the *Economic Report of the President*; the inflation costs of an overheated economy according to this theory was simply a higher rate of inflation, not rising inflation. There were also the estimates indicating that the full-employment unemployment rate (now usually called the natural rate of unemployment or the NAIRU) was as low as 4 percent, although there was little evidence that price stability was consistent with this number without changes in the operation of labor markets.² Today most estimates of the natural rate of unemployment in the 1960s and 1970s are much closer to 6 percent than 4 percent.

I think it is clear that the Phillips curve and the low estimate of the natural rate of unemployment helped lead to the appointment of policymakers with less concern about pursuing price stability. It also probably led to monetary decisions—such as delays in raising interest rates when faced with inflationary pressures in the late 1960s and 1970s—which were inconsistent with price stability.

At first the Friedman-Phelps accelerationist revision of the Phillips curve—which was being absorbed into thinking and models by the mid-1970s—did little to change this predilection of existing theories to higher inflation. Once the underlying inflation rate had started rising, the accelerationist model was used to demonstrate how costly it would be to reduce inflation. So the inflation continued throughout the 1970s.

It was not until macroeconomics began to incorporate more reasonable models of expectations and price adjustment—largely through the research started by Robert Lucas (1972)—that the idea that the costs of disinflation might not be so great began to take hold. As this idea began to filter through the economics profession in the late 1970s and as popular opinion polls showed the public's aversion to inflation, we began to see a change in monetary policy. The monetary disinflation of the 1980s—while certainly not costless—was, at least in retrospect, the appropriate policy as the superior cyclical performance of the economy since that time makes clear. Observe that this explanation for the monetary policy mistake gets the timing right, not only for the rise in inflation, but also for the fall in inflation.

Lessons for maintaining price stability

I think there are three key lessons to draw from this brief review of the Great Inflation and its possible causes. First, beware of economists bearing strange new theories! A simple rule of thumb: check any new theory against Adam Smith and David Hume. Second, simply reviewing the history of the Great Inflation—how economic theory influenced decisions, the change in the natural rate and estimates about it, the changes in public opinion, the costs of

the disinflation, and so forth—will go a long way to preventing another abandonment of the price stability goal in the future; this period, along with the Great Depression of the 1930s, should be part of the curriculum of any school for central bankers. Third, price shocks—from whatever future source—should not be viewed as a reason to abandon the goal of price stability. If a credible policy aimed at price stability is in place, then such price shocks might cause a jump in the price level, but they should not require a sacrifice in the long-run goal of price stability. The experience with price shocks in Japan in 1979 and in the United States in 1990 shows how little an effect such shocks have on the underlying inflation rate if monetary policy is devoted to price stability.

The macroeconomic setting: two propositions

As the above discussion makes clear, deciding on a monetary policy to maintain price stability requires some basic propositions of how the economy works (and that they be consistent with Hume and Smith!). Two propositions are key to the question of maintaining price stability.

The *first* proposition, about which there is now little disagreement, is that there is no *long-run* tradeoff between the rate of inflation and the rate of unemployment. In other words, over long periods higher rates of inflation are not associated with lower levels of unemployment, and lower levels of inflation are not associated with higher levels of unemployment. Historical experience with inflation and unemployment provides considerable evidence for this view.

A *second* proposition, and there is more disagreement here, is that there is a *short-run* tradeoff between inflation and unemployment. I think that the short-run tradeoff is best described in terms of a tradeoff between the *variability* of inflation and the *variability* of unemployment;³ that is, in terms of the short-run fluctuations in these variables rather than their levels over time.

To understand this short-run tradeoff, consider a situation where the unemployment rate equals the natural rate of unemployment (or

real GDP equals potential GDP) and where inflation is equal to the central bank's target rate of inflation. Now suppose that there is an upward shock to the money supply due to an unavoidable error in measurement. The monetary shock will cause real GDP to rise above potential GDP, though with a lag of several quarters. This rise in GDP will cause the inflation rate to rise above its target. In such a situation the central bank has to decide how much should we "tighten" policy to bring inflation back down.

If monetary policy is tightened sharply with short-term interest rates rising by a large amount, the inflation rate will return to target quickly, but the economy will slow down and perhaps go into recession. Alternatively, if monetary policy does not tighten so much, the inflation rate will return to target more gradually, but there will be a smaller slowdown in real GDP. One policy reaction results in more inflation stability and less real GDP stability. The other policy reaction results in less inflation stability and more real GDP stability.

The money supply shock is just an example. Other shocks would give rise to the same decision. For example, the monetary response to an unanticipated change in velocity or in potential GDP growth would determine the size of the fluctuations of inflation versus output or employment.

Price stability and inflation targets

The first proposition implies that central banks should choose a target, or a target range, for inflation and then maintain the target. A low inflation target is to be preferred to a high inflation target because higher inflation has higher costs and there are no benefits because the unemployment rate will be no lower according to the proposition.

The first proposition also implies that the central bank should not set a long-run target for the unemployment rate (or for the deviation of real GDP from potential) because according to the proposition, neither the unemployment rate nor the GDP gap can be affected by

monetary policy in the long run; hence setting a target for these is beyond the scope of monetary policy.⁴

What time frame: months, quarters, years?

In reality, of course, the inflation rate would not equal the target exactly. The actual inflation rate would tend to fluctuate around the target, due to various shocks as the economy changed over time. Only on average would the inflation rate equal the target. But if one is monitoring the performance of monetary policy, over how long a time period should the average be taken?

The answer depends very much on the volatility of the inflation measure and is not the same in all countries. For example, requiring that the monthly consumer price index (CPI) inflation rate be within a narrow range of plus or minus 1 percent would not be a good policy. According to the second proposition above, it would lead to poor monetary performance because the central bank would constantly be taking corrective action which would affect the performance of real GDP. More generally, if the average is taken over too short a period of time, then the inflation rate will always be missing the target and policy will have to react too much. If the average is taken over too long a period, then large and persistent fluctuations in inflation will reduce the credibility of the policy.

For the United States, I find that a yearly measure works well in the sense that if a four quarter moving average of the inflation rate is above the target, then some corrective action should be taken.⁵

The inflation target should not be a maximum for inflation; deviations below the target are just as bad as deviations above the target.

Price level versus inflation rate

There is a subtle distinction between targeting a fixed price level versus targeting a zero inflation rate. For example, if the target price level is 100, and the price level jumps from 100 in year 1 to 103 in year 2 because of a price shock, then price level targeting requires

that the central bank take corrective action to reduce the price level back to 100 in year 3. But, if a zero inflation target is the policy, then the central bank will aim to keep the price level at 103 in the third year and no new corrective action is required. (Though as the inflation rate rose to 3 percent, most prescriptions for monetary policy would require some tightening.)

If there were no short-run tradeoff, then the corrective action would have no effect on the economy and price level targeting would be a better policy. However, if proposition two holds, then the corrective action taken to return the price level to 100 may reduce output stability.

For the same reasons that trying to keep the inflation rate within too narrow a band would not be good policy, in my view, targeting a fixed price level rather than maintaining a zero inflation rate would not be a good policy either. To be sure, the answer depends on empirical magnitudes of the short-run tradeoff, but historical experience suggests to me that a zero inflation target (perhaps adjusted for measurement error) would be preferred.

How should monetary policy react to shocks?

A long-run target, or a target range, for inflation does not imply any particular policy to achieve that target. There are a whole range of policies which will give the same average target rate of inflation. The long-run average rate of inflation is determined by the long-run average rate of money growth, but there are two broad classes of policies—those that focus on monetary aggregates and those that focus on short term interest rates—that will lead to a particular long-run path for money growth.

Money growth policies

One simple money growth policy is the constant growth rate rule for the money supply put forth by Milton Friedman. According to the quantity theory of money (not a new idea), the average long-run rate of inflation will equal the average money growth rate minus the

long-run growth rate of real GDP plus the velocity growth rate. Hence, as long as one knows the trend growth of velocity, one can use money growth policies to maintain any long-run rate of inflation—and price stability in particular.

There are extensions of Friedman's constant growth rate rule to allow for contingencies. For example, an alternative money growth policy would have money growth responding to real GDP or to inflation. Money growth would average the Friedman k -percent rate, but would be increased when real GDP dropped below potential GDP and decreased when real GDP rose above potential GDP. And McCallum (1988) and Meltzer (1987) have examined money growth policies which automatically adjust to shifts in velocity.

How do money growth policies react to *shocks*? One might argue that there is no reaction, but constant money growth rules imply an important automatic adjustment of interest rates to shocks as described below. First, consider a money supply policy which calls for constant growth rate of the money supply. In its most simple form, the demand for money is a demand for real money balances—the money supply divided by the price level—which is a function of real GDP and the short-term interest rate. If money growth is fixed, then there must be a relationship between the price level or its percentage change (the inflation rate), real GDP and the short-term interest rate.

In other words, the interest rate depends on the inflation rate and on real GDP. For a fixed money growth policy, a higher level of real GDP raises the interest rate as does a higher level of inflation. Thus, constant money growth policies entail an automatic adjustment of interest rates to shocks in a generally stabilizing direction: when there is an upward shock to inflation, the interest rate rises which tends to reduce spending and bring back down the inflation rate.

Interest rate policies

Interest rate policies have received much more attention than money supply policies in recent years. But there is a similarity

between how money supply policies and many interest rate policies respond to shocks. The interest rate policy I have proposed, for example, (see Taylor, 1993, and discussion in the next section) has the same properties as the money growth policy discussed above: a rise of real GDP has the central bank raising the interest rate as does an increase in the inflation rate.

I think this close connection between how money growth policies and interest rate policies respond to shocks is useful for maintaining price stability. The similarity in how they react to shocks suggests that both have a role as a consistency check on the other when deciding how monetary policies should respond to shocks in order to maintain price stability. They give two reinforcing recommendations for monetary policy. And if interest rate policies become unreliable—perhaps because inflation gets very high or very low—then money supply policies can be brought into play.

Responding to real GDP

This relationship between money growth policies and interest rate policies also helps answer an important question about how monetary policy should respond to changes in real GDP. Proposition one above implies that it is not wise for a central bank to have a long-run target for real output or unemployment as it should for an inflation rate. But should real output be a factor in interest rate decisions? In general, non-target variables can play an important role in policy reactions. We know that real GDP plays a role in moving interest rates when the central bank keeps money growth fixed; this is one of the attractive features of money supply rules, because the interest rate changes help moderate booms and slumps in real GDP and thereby help stabilize both inflation and real GDP.

For the same reason, real GDP should appear in interest rate policies: the increase in the interest rate in response to a rise in GDP helps moderate the boom and stabilize inflation.

Supply-side changes in potential GDP growth

How should monetary policy respond to a change in the growth of potential GDP, perhaps due to an increase in the trend growth of productivity after a change in tax or regulation policy?

To answer this question I will focus on interest rate policies and use a little algebra. (For a money growth policy, an increase in the growth rate of potential GDP will lead to a lower inflation rate according to the quantity theory of money equation, unless the money growth rate is increased by the amount that potential GDP growth rises. When choosing the k in the k -percent money growth policy, one needs to have an estimate of the long-run growth rate of the economy. Mistakes in the estimate of potential growth are translated into mistakes on inflation).

Consider the following policy for setting the interest rate:

$$(1) \quad i = \pi + gy + h(\pi - \pi^*) + r^f$$

where y is real GDP measured as a percentage deviation from potential GDP, i is the short-term nominal interest rate measured in percentage points, and π is the inflation rate measured in percentage points. The parameters π^* , r^f , g , and h are all positive. Thus the interest rate responds to deviations of inflation from a target π^* and to the deviations of real GDP from potential GDP. When inflation rises, the nominal interest rate rises by more than the inflation rate. When real GDP rises relative to potential GDP, the interest rate also rises. The intercept term r^f in this relationship is the implicit real interest rate in the central bank's reaction function.

Suppose first that the long-run average value of the real GDP deviation y is 0 and let the long-run real interest rate be r^* so that in the long run $i - \pi = r^*$.

Suppose now that there is an increase in the growth rate of potential GDP; that is, rather than averaging the constant 0, the

central bank's perceived gap variable is actually growing so that $y = a + bt$ in the long run. Plugging these values into the policy rule and solving for the equilibrium inflation rate yields

$$(2) \quad \pi = \pi^* + (r^* - r^f)/h - g(a + bt)/h.$$

This equation implies that if the central bank chooses a monetary policy with wrong estimates of the parameters that the steady state inflation rate π will not equal the target inflation rate π^* .

If potential GDP growth rises and the Fed does not take this into account, then the Fed's error would eventually show up in less price stability (inflation below the target). Eventually the Fed would adjust so that any negative effects on real GDP would be temporary. For the same reasons that there is no long-run tradeoff between inflation and unemployment, a policy of underestimating potential GDP growth on the part of the monetary authorities would have short-term effects on growth but not long-term effects.

But a much better policy response to an increase in potential GDP growth would be to adjust the estimate of potential GDP in monetary policy decisionmaking. This would prevent the inflation rate from deviating from its target—and thus be a policy of maintaining price stability. To the extent that there is a short-run tradeoff (proposition two), this policy would prevent a shortfall of the economy below the now higher potential GDP growth path.

Conclusion: the choice of policy rules

I have tried to discuss the appropriate monetary policies for maintaining price stability in general terms without taking a position on whether these policies should be formulated with policy rules or guidelines. But I think that the discussion makes clear that most of the issues of how policy should react to shocks are really questions about alternative policy rules which describe how policymakers should react to different contingencies.

I think that there are several reasons to use policy rules to recommend how policy instruments should respond to shocks. First, and the most commonly cited academic reason, is the time inconsistency problem discussed earlier. Second, if people are forward-looking, one needs to stipulate future as well as current policy actions in order to evaluate the effects of policy. Third, policy rules can reduce uncertainty about policy actions. Fourth, policy rules can be useful as a way to instruct policymakers about actions to take to achieve their goals. Fifth, policy rules can make it easier to teach students and educate the public about monetary policies. Sixth, policy rules provide a way to increase the accountability of policymakers.

I recognize that some events may require that the central bank depart from the rule, and that some discretion is still necessary in working with a rule. But with a policy rule, the analysis of policy—including showing that a deviation from the rule is needed—will emphasize discretion less and the rule more.

Endnotes

¹Papers in the volume, *Price Stabilization in the 1990s*, Kumiharu Shigehara, ed., 1993, provide a useful review of the inflation episodes in the United States, Canada, Europe, East Asia, and Latin America during the 1970s.

²It was not until 1976 that the outgoing Ford Administration's Council of Economic Advisers, chaired by Alan Greenspan, raised the estimate to 4.9 percent and they were criticized for doing so.

³Or the fluctuations in the deviations of real GDP from potential GDP, because these are highly correlated with deviations of the unemployment rate from the natural rate.

⁴Recall that a higher inflation rate can lower the growth rate of potential GDP, so that price stability is the best monetary policy for potential GDP growth.

⁵Using a forecast of inflation rather than the actual inflation rate is another form of averaging, because most forecasts are close to weighted averages of past variables.

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