Comments Presented at Federal Reserve Conference

Price Dynamics: Three Open Questions

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It is a great delight to be here at this conference. I am very familiar with the antecedent of this meeting from 1970. I did not attend it: I was in junior high school at the time and didn't get an invitation. But a few years later, while I was in college, I spent the summer of 1978 as an intern at the Congressional Budget Office, working in their macro group. My assignment was to do some econometric work looking at alternative specifications for their inflation equation. I remember poring over the conference volume in great detail, hoping it would set me in the right direction.

When the summer ended, I didn't think I had really nailed the problem. The issue of price dynamics was, I decided, too difficult to expect a college sophomore to resolve in a single summer. Little did I know at the time that I would spend the next quarter century of my life returning to the issue with such regularity.

In my comments today, I am not going to survey broadly my current views on price dynamics. I have done that in several papers over the past few years. (Mankiw 2001, Ball and Mankiw 2002, Mankiw and Reis 2002). Instead, what I would like to do

is to focus attention to three questions about price dynamics that I would like to know the answer to but don't. My hope is to generate some further research on these topics.

Which expectations?

The first question involves inflation expectations. Economists have long understood that what people expect the inflation rate to be is a key determinant of what it actually is. The focal article on inflation expectations is, of course, Milton Friedman's justly famous Presidential Address to the American Economic Association. This piece was central at focusing our attention on the role of expectations. But it was not the first time someone had pointed out that a change in expected inflation might cause the short-run Phillips curve to shift.

The 1960 article by Samuelson and Solow, which is often cited as promoting a crude Phillips curve, was in fact far more subtle in its analysis than most people remember today. They wrote,

> "We must give another caution. All of our discussion has been phrased in short-run terms, dealing with what might happen over the next few years. It would be wrong, though, to think that our Figure 2 menu [that is, the Phillips curve] that relates obtainable price and unemployment behavior will maintain its shape in the longer run…It might be that the low-pressure demand would so act upon wage and other expectations as to shift the curve downward in the longer run."

Samuelson and Solow would probably not have objected to the converse conclusion: that a high-pressure economy would raise inflation expectations and shift the curve outward, which is in fact what subsequently happened.

Today no one doubts that inflation expectations matter. The big unanswered question, as I see it, is which expectations? In particular, I want call your attention to the issue of timing.

Much of the modern literature on monetary policy is based on Calvo's version of the standard new Keynesian Phillips. In this model, current inflation depends on the *current* expectation of *future* inflation. By contrast, other models, such as the "sticky-information" model I have explored with Ricardo Reis or Stan Fischer's model of long-term labor contracts, imply a very different timing. In these models, current inflation depends on *past* expectations of *current* inflation.

This difference in the timing of expectations matters a lot for inflation dynamics. If past expectations matter for current inflation, the inflation process will have a degree of inertia. But if, as in the Calvo model, the relevant expectations are those people hold currently, then inflation will be less sluggish, because those expectations can change quickly in response to policy changes.

Several papers in this conference are useful contributions trying to sort this issue out. My own reading of the state of play is that while everyone agrees that inflation expectations matter, there is not yet consensus about which inflation expectations matter.

Let me say a word about the so-called hybrid new Keynesian Phillips curve, which augments the standard new Keynesian Phillips with a term in lagged inflation. Several studies (such as Gali and Gertler, 1999) have suggested that adding this term

helps the model fit recent data better. I don't doubt that this is true, but I am skeptical of this amendment nonetheless. Barsky (1987) has shown that during the period of the gold standard, inflation was approximately white noise. (See also Alogoskoufis and Smith, 1991.) This fact suggests that inflation inertia is not a structural aspect of the inflation process but, instead, is a function of the monetary regime. Any model that builds in inflation inertia as structural, rather than arising through expectations, will have trouble fitting data across historical regimes.

Whither the divine coincidence?

The second question I would like answered is, to what extent do central banks face a tradeoff between inflation volatility and output volatility? In some modern theories of the business cycle, a monetary policy that aimed exclusively at stabilizing the price level would achieve, as a desirable by-product, stabilization of output at its potential level. Blanchard and Gali (2005) call this fact the "divine coincidence." If the divine coincidence is actually true, it makes monetary policy a lot easier. For example, the central bank would not need to measure potential output in order to keep actual output at potential. It would only need to stabilize prices.

Let me spend a minute reviewing why the divine coincidence might be true. Consider first shocks to aggregate demand. Expansionary demand shocks tend to push prices up and output above potential; contractionary demand shocks put downward pressure on prices and depress output below potential. Because the price level and the output gap are moving in the same direction, a monetary policy that stabilizes one will automatically stabilize the other. In other words, a central bank that follows a policy of

strict inflation targeting will, as a desirable side effect, insulate output from demand shocks.

Now consider shocks to productivity. A positive shock to productivity puts downward pressure on prices and tends to increase output. A central bank committed to pure inflation targeting would respond with more expansionary policy, increasing output further. This might seem to be destabilizing. But remember that the positive productivity shock also raises potential output. In many standard models, these two effects exactly balance. That is, if the central bank keeps the price level on target, output and potential output will increase by exactly the same amount in response to a positive productivity shock. Once again, stabilizing prices automatically stabilizes output at potential.

Is this divine coincidence true in the world, or just an artifact of some oversimplified macroeconomic theories? The literature on this topic is not sufficiently developed to give a definitive answer. My guess is that it is more likely an artifact. One can certainly write down models well grounded in theory in which the divine coincidence does not arise. The key feature of such models is that supply shocks are not simply shifts in productivity but also represent shifts in how distorted the economy's production process is. For example, imagine that because of market power, prices are a markup over marginal cost. If supply shocks in part represent shifts in the size of that markup, then it turns out that the divine coincidence does not arise. In this case, monetary policymakers face a trade-off between stabilizing inflation and stabilizing the output gap.

Markup shocks are becoming a standard feature of models used to analyze monetary policy (see, for example, Clarida, Gali, and Gertler, 2002, Steinsson, 2003, and Ball, Mankiw, and Reis, 2005). Shifts in markups can be justified different ways — for

example, there can be shifts in the degree of collusion in an industry (OPEC comes to mind), or shifts in the aggressiveness of wage bargainers in models with a labor market. The mechanism generating such markup shocks may well be complex. In Ball and Mankiw (1995), for example, supply shocks arise from the interaction of menu costs and asymmetries in the distribution of shocks to desired relatives prices. The key effect of these shocks, however, is to change average markups, because firms with positive relative-price shocks respond more or less than firms with negative shocks. I would conjecture that Blanchard and Gali's proposed way to break the divine coincidence—real wages that depend on lagged real wages—can be viewed as one among many possible mechanisms for generating endogenously-varying markups.

Whether these kinds of supply shocks are an important feature of the world is, I believe, a crucial unanswered question.

Which inflation?

The third question I would like to discuss is which inflation rate should be the focus of central banks' attention. Although some inflation-targeting central banks describe their policy in terms of the overall inflation rate, the Federal Reserve tends to focus on core inflation—that is, inflation excluding the volatile food and energy sectors. Similarly, some analysts have suggested looking at the median, rather than the mean, inflation rate, on the grounds that the median is less sensitive to a few outlying sectors. (Bryan and Cecchetti 1994)

From the standpoint of practical monetary policy, the focus on core inflation seems sensible. But it is hard to square this common-sense decision with standard

monetary theory, which doesn't readily yield a variable analogous to these empirical measures. Steve Zeldes once observed that measures of core inflation are like the clues on the TV game show Jeopardy. The category is inflation. The answer is the CPI excluding food and energy. It is your job to figure out the question.

A closely related issue to whether the prices of certain goods and services should be excluded from the price index is whether some other prices should be added. For instance, should the price of financial assets such as equities be included in the price index that is the focus of monetary policy? Or should commodity prices be given greater weight in monitoring inflationary pressures than they have in consumers' basket?

Perhaps the price of labor should receive more attention from monetary policymakers. Central banks that target inflation typically choose to stabilize the price of goods and services. This means that as productivity fluctuates, nominal wages need to fluctuate as well. But maybe it would be better to maintain stability in the growth of nominal wages and to allow productivity fluctuations to be reflected in the price of goods and services. In either case, real wages would move with productivity; the key question is whether the economy is better served with a predictable price of goods and services or a predictable price of labor. The existing literature does not give a clear answer. (For one attempt at addressing the question, see Mankiw and Reis, 2003.)

My guess is that this question regarding the best measure of inflation is closely related to the question regarding the divine coincidence. Both are related to the issue of how we model supply shocks. The common approach of modeling supply shocks as shifts in the economy-wide production function is almost surely too simple. Supply

shocks tend to originate the specific sectors, such as energy—a fact that we macroeconomists may ignore too often.

How Far We Have Come

These are just three of the many questions that, I believe, we still need to address to understand price determination and optimal monetary policy. There are, of course, many others, some of which are spelled out in the fascinating papers at this conference.

When I look back at the literature on monetary economics since that famous Fed conference on price determination in 1970, I see a tremendous amount of change in our profession. At the time of that conference, the rational expectations revolution was only in its infancy; now the axiom of rational expectations is part of the macroeconomist's catechism. We also now have more rigorous models of short-run price adjustment that can explain why rational economic actors may make decisions that lead to short-run monetary non-neutrality. The young Turks of that era are the old fogies today (and I am all too quickly making that transition myself). Now, the hot topic in economics is the intersection with psychology, with its suggestion that maybe people aren't so rational after all. This shift in direction gives us reason to hope that the next three decades of research on monetary economics will prove as creative and fruitful as the past three.

References

Alogoskoufis, George, and Ron Smith. (1991). "The Phillips Curve, the Persistence of Inflation and the Lucas Critique: Evidence from Exchange Rate Regimes." *American Economic Review* 81:5, 1254-1275.

Ball, Laurence, and N. Gregory Mankiw (1995). "Relative-Price Changes as Aggregate Supply Shocks." *Quarterly Journal of Economics* 110:1, 161-193.

Ball, Laurence, and N. Gregory Mankiw. (2002). "The NAIRU in Theory and Practice." *Journal of Economic Perspectives* 16 (Fall), 115-136.

Ball, Laurence, N. Gregory Mankiw, and Ricardo Reis. (2005). "Monetary Policy for Inattentive Economies." *Journal of Monetary Economics* 52 (May), 703-725.

Barsky, Robert. (1987). "The Fisher hypothesis and the forecastability and persistence of inflation" *Journal of Monetary Economics* 19, 3-24.

Blanchard, Olivier, and Jordi Gali. (2005). "Real Wage Rigidities and the New Keynesian Model." Working paper, September.

Bryan, Michael F., and Steven G. Cecchetti. (1994). "Measuring Core Inflation." In *Monetary Policy*, edited by N. Gregory Mankiw, 195-215. Chicago: University of Chicago Press.

Calvo, Guillermo A. (1983). "Staggered Prices in a Utility Maximizing Framework." *Journal of Monetary Economics* 12, 383-398.

Clarida, Richard, Jordi Gali and Mark Gertler. (2002). "A Simple Framework for International Monetary Policy Analysis." *Journal of Monetary Economics* 49:5, 879-904.

Fischer, Stanley. (1977). "Long-term Contracts, Rational Expectations, and the Optimal Money Supply Rule." *Journal of Political Economy* 85:1, 191-205.

Friedman, Milton. (1968). "The Role of Monetary Policy." *American Economic Review* 58:1, 1-17.

Gali, Jordi and Mark Gertler. (1999). "Inflation Dynamics: A Structural Econometric Model." *Journal of Monetary Economy* 44:2, 195-222.

Mankiw, N. Gregory. (2001). "The Inexorable and Mysterious Tradeoff between Inflation and Unemployment." *Economic Journal* 111 (May), C45-C61.

Mankiw, N. Gregory, and Ricardo Reis. (2002). "Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve." *Quarterly Journal of Economics* 117, 1295-1328.

Mankiw, N. Gregory, and Ricardo Reis. (2003). "What Measure of Inflation Should a Central Bank Target?" *Journal of the European Economic Association* 1 (September), 1058-1086.

Samuelson, Paul A., and Robert M. Solow. (1960). "Analytical Aspects of Anti-Inflation Policy." *American Economic Review* 50:2 (May), 177-194.

Steinsson, Jon. (2003). "Optimal Monetary Policy in an Economy with Inflation Persistence." *Journal of Monetary Economics* 50 (October), 1425-1456.

Zeldes, Stephen P. (1994). Comment on "Measuring Core Inflation.". In *Monetary Policy*, edited by N. Gregory Mankiw, 216-219. Chicago: University of Chicago Press.