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How the World Achieved Consensus on Monetary Policy

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In the 1970s, monetary policy was in disarray. The situation in the United States was typical: inflation peaked above 10 percent in 1974 and again in 1980. Many central bankers were pessimistic about the power of monetary policy to reduce inflation, at least at any politically acceptable cost (Burns, 1979). A survey of six then-recent empirically estimated short-run Phillips curves by Okun (1978) suggested that the Federal Reserve would need to precipitate a 10 percent contraction of employment and output in the United States for one year for each permanent percentage point reduction of inflation that it wished to achieve. In other words, it appeared that it could take a modern Great Depression—a 10 percent contraction of output and employment sustained for almost 10 years—to achieve price stability. Even then, there was no guarantee that inflation would not begin to move higher again once restrictive monetary policy was relaxed.

The arrival of Paul Volcker as chairman of the Federal Reserve in 1979 stands as a turning point. The Volcker Fed brought the inflation rate down to 4 percent by 1984, although it precipitated recessions in 1980 and 1981–82 to do so. Under Alan Greenspan, the Fed gradually worked the inflation rate down by the early 2000s below 2 percent, a range that Greenspan (2003) dubbed "effective price stability."

The improved inflationary picture in the United States was accompanied by parallel developments around the world. Average inflation worldwide declined from 14 percent in the early 1980s to 4 percent in the early 2000s (Rogoff, 2003).[1] Industrial economies achieved a reduction in inflation from 9 to 2 percent, while developing economies brought inflation down from 31 to 6 percent.

Moreover, during the quarter century or so that inflation has been stabilized, the United States experienced two of its longest economic expansions and two of its mildest recessions in 1990–91 and 2001. In comparison, the United States experienced six recessions in the 30 years from 1955 to 1985, culminating in the most severe U.S. recession since the 1930s in 1981–82. The "great moderation" of output volatility occurred worldwide. The volatility of annual output

[1] Rogoff (2003) reports that global inflation climbed in the first half of the 1990s and peaked at around 30 percent due to temporarily high inflation in the developing world, particularly, in transition economies.

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growth for OECD countries—for example, as measured by decade-long standard deviations of annual output growth—has fallen dramatically in the 1990s and 2000s relative to the 1970s (Rogoff, forthcoming). Stock and Watson (2003) attribute 20 to 30 percent of reduced GDP volatility in the United States to improved monetary policy and the rest to good luck in the form of smaller shocks to productivity and commodity prices, and unexplained declines in the volatility of residential investment, nonresidential construction, and durable goods production. Of course, better monetary policy may be responsible indirectly for what appears to be good luck, as Bernanke (2004) argues.

This article tells how the world achieved a working consensus on the core principles of monetary policy by the late 1990s. The story begins with a description of the muddled state of affairs in the 1970s and follows with three sections that ask: What happened in Federal Reserve policy to produce an understanding of the practical principles of monetary policy? How did formal institutional support for targeting low inflation abroad follow from an international acceptance of these ideas? And how did a consensus theoretical model develop in academia? The article then turns to how the modern theoretical consensus—known alternatively as the New Neoclassical Synthesis or the New Keynesian model of monetary policy—reinforces key advances: the priority for price stability; the targeting of core rather than headline inflation; the importance of credibility for low inflation; and preemptive interest rate policy supported by transparent objectives and procedures. Of course, a working consensus does not constitute complete agreement, and there is ample room for disagreement about various important issues regarding monetary policy. Accordingly, the conclusion identifies important issues that remain to be explored.

Practical and Theoretical Disarray in the 1970s

At the heart of the disarray in monetary policy practice in the 1970s was the tendency for a central bank like the Federal Reserve to pursue "go-stop" monetary policy. Go-stop policy was a consequence of a central bank's inclination to be responsive to the shifting balance of public concerns between inflation and unemployment. The central bank would stimulate employment in the "go" phase of the cycle until the public became concerned about rising inflation. Then aggressive interest rate policy initiated the "stop" phase of the policy cycle to bring inflation down, while unemployment rates moved higher with a lag. Public support for interest rate increases evaporated once the unemployment rate began to rise, so it was politically difficult to reverse a higher inflation rate.[2]

Wage and price setters learned to take advantage of tight labor and product markets in the "go" phase of the policy cycle to make increasingly inflationary demands, which neutralized the monetary stimulus. As a result, central banks became ever more expansionary in the pursuit of low unemployment. Lenders demanded ever-higher inflation premia in bond rates which moved

[2] Milton Friedman (1964) discussed the go-stop character of Federal Reserve policy. Romer and Romer (1989) documented six occasions on which the Federal Reserve tightened monetary policy decisively to fight inflation, all of which were followed by sharply rising unemployment. King (2005) discusses go-stop policy in the United Kingdom. See Batini and Nelson (2005) for a history of UK monetary policy from 1955 to 2004.

higher and fluctuated widely. By pursuing low unemployment and fighting inflation only when it became the predominant public concern, central banks then increased the volatility of both inflation and output.

Other factors contributed to the disarray in monetary policy in the 1970s. In the 1960s, the widespread belief in a long-run Phillips curve trade-off between inflation and unemployment inclined central banks to allow inflation to drift upward in the hope of achieving a permanently lower level of unemployment. Also, the productivity growth slowdown of the 1970s caused central banks like the Federal Reserve to overestimate noninflationary potential output (Orphanides, 2003). Oil price shocks that occurred in 1973 and 1979–80 worsened the inflation problem, although neither of the oil price shocks produced the 3 percentage point increase in U.S. inflation that occurred in the 18 months prior to Paul Volcker becoming Fed chairman in August 1979.

The disarray was further reflected in the collapse of political institutions that had served as the foundation of the international monetary system. Under the Bretton Woods system of fixed exchange rates established after World War II, countries around the world agreed to fix their exchange rates to the dollar, and the United States agreed to maintain convertibility of the dollar into gold at $35 an ounce. Increasingly inflationary go-stop policy in the United States was incompatible with the maintenance of gold convertibility. The fixed exchange rate system limped along and finally collapsed completely in 1971–1973 when the world's major currencies introduced a permanent float against the dollar and the United States severed the dollar's link to gold.[3]

With the collapse of Bretton Woods, for the first time in modern history, all the world's major currencies were de-linked from gold or any other commodity. The lack of any formal constraint on money creation contributed to the nervousness about inflation. In the United States, an attempt to provide a new legislative framework for monetary policy fell short. The U.S. Congress enacted the Humphrey–Hawkins Full Employment Law in October 1978, which set national goals of 4 percent unemployment and 3 percent inflation to be achieved by 1983 with a further reduction to zero inflation by 1988. However, the law specified that the reduction in inflation was not to impede the reduction in unemployment, and it authorized no programs to achieve its objectives. It is no coincidence that shortly thereafter, the dollar suffered a dramatic collapse on the foreign exchange market that precipitated an unprecedented rescue package on November 1, 1978.

The disarray in monetary policy practice was reflected in deep divisions within the academic world. These divisions involved two key questions. First, did a central bank have the power to control inflation? Second, could central bank credibility influence inflation expectations? And how would the interaction between the two determine the costs of disinflation?

Well into the 1970s, there was widespread skepticism that monetary policy alone could control inflation. Even the head of the Federal Reserve from 1970 to 1978, Arthur Burns, was pessimistic (Burns, 1979; Hetzel, 1998). Inflation was commonly believed to be driven primarily

[3] The forthcoming second volume of Allan Meltzer's history of the Federal Reserve tells this story in detail.

by factors other than monetary policy: fiscal deficits, commodity price shocks, inflation psychology, aggressive labor unions, or monopolistically competitive firms.

Monetarist economists led by Milton Friedman, Karl Brunner, and Allan Meltzer worked beginning in the 1960s to show that a central bank had the monetary policy tools to act decisively against inflation. They did so in three ways: First, monetarists assembled international evidence that even if short-term inflation can be affected by many factors, long-term sustained inflation is always associated with excessive money growth. Second, they developed the theory of money demand and supporting econometric evidence to show that control of money is both necessary and sufficient to control the trend rate of inflation. Third, they argued that a central bank could exercise sufficient control over money to control inflation through its monopoly on currency and bank reserves, even if fluctuations in the demand for money were hard to predict. These arguments may now seem self-evident, but they were highly controversial at the time.

Macroeconomists had long realized that inflation expectations play a central role in propagating wage and price inflation. However, they divided sharply over whether monetary policy could manage inflation expectations in practice. For example, leading Keynesian economist James Tobin (1980, p. 64) thought that "the price- and wage-setting institutions of the economy have an inflationary bias. Consequently, demand management cannot stabilize the price trend without chronic sacrifice of output and employment unless assisted, occasionally or permanently, by direct incomes policies of some kind."

On the other side, rational expectations monetary theory explored the link between "inflation psychology" and monetary policy. Robert Lucas and Thomas Sargent showed that in theory, inflation expectations could be made to conform to a central bank's desired low rate of inflation if a central bank was credibly committed to following a noninflationary money growth rule (Lucas, 1976; Lucas and Sargent, 1981). In a credible disinflation, money growth, expected inflation, and actual inflation could all slow together with little adverse effect on employment. In a noncredible disinflation, wage and price inflation would continue as before, and the public would drive interest rates and unemployment up as it competed for increasingly scarce real money balances.

The question was whether and how soon a central bank could acquire credibility for a transition to low inflation. On one side, Keynesians like Tobin (or Okun, as mentioned earlier) tended to believe that credibility would be hard to acquire, inflationary expectations would be slow to change, and the costs of disinflation would be high. Monetarists were divided over how readily a central bank could acquire credibility for low inflation. Kydland and Prescott (1977) showed that optimal monetary policy was not "time consistent," meaning that a central bank free to make policy choices on a discretionary basis had an incentive to promise to pursue low inflation, and then to run an expansionary monetary policy aimed at lower unemployment, unless that promise was backed by a credible "commitment mechanism." It appeared that central bank independence alone was not enough to overcome the commitment problem: after all, the Federal Reserve had long been an independent central bank. Kydland and Prescott's logic suggested that a central bank might be foolish to attempt a disinflation without a legislative mandate for low inflation, because it might be unable to acquire the credibility needed for the disinflation to succeed.

Most monetarists acknowledged that the short-run unemployment costs of deliberate disinflation would be substantial. But they believed that determined disinflationary monetary policy could reduce expected inflation relatively quickly, so that the costs of disinflation would be much lower than commonly believed. This academic controversy would soon be resolved by empirical evidence that Paul Volcker was to provide as leader of the Federal Reserve.

Federal Reserve Contributions to Monetary Policy Practice

When Paul Volcker became Chairman of the Federal Reserve Board in August 1979, he was determined to take aggressive action against inflation. After a severe crisis of confidence in commodity markets, on October 6, 1979, the Fed broke sharply with its tradition of saying little in public about its actions and grabbed the headlines with a dramatic, high-profile announcement that it planned to place greater emphasis on controlling money to fight inflation (Lindsey, Orphanides, and Rasche, 2005). By associating itself more closely with key monetarist ideas, the Volcker Fed implicitly took responsibility for inflation and created an expectation that the Fed was willing to let short-term interest rates rise dramatically to bring inflation down (Volcker, 1978).

After letting the federal funds rate rise by 3 percentage points in the fall of 1979, the Fed paused in its tightening as evidence accumulated that the U.S. economy was moving into recession. Then, in January and February 1980, the 30-year government bond rate jumped by 2 percentage points despite a weakening economy, reflecting an unprecedented "inflation scare" in the bond market. This 2 percentage point jump in inflation expectations had a number of contributing causes: the spike in underlying inflation in connection with the ongoing oil price shock, the run-up in the dollar price of gold to $850 per ounce in January, and the Soviet invasion of Afghanistan. In addition, the Fed's hesitation to tighten monetary policy further in light of the looming recession probably contributed to the inflation scare (Goodfriend, 1993). The inflation scare forced the Fed to choose between fighting unemployment and fighting inflation; it had effectively lost "room to maneuver" between go and stop policy.

The Federal Reserve reacted aggressively—letting the federal funds rate rise by another 3 percentage points to 17 percent in March 1980 alone! Real GDP declined at an extraordinary 10 percent annual rate in the second quarter of 1980 in response to the monetary tightening, in conjunction with the unfortunate imposition of credit controls (Schreft, 1990). The recession ended quickly with the lifting of credit controls in June 1980 and an aggressive easing of monetary policy that brought the federal funds rate down to 8 percent by July. Real GDP growth bounced back in the fourth quarter of 1980.

In retrospect, 1980 was a disaster from a monetary policy point of view. The U.S. economy suffered a recession along with a destabilizing inflation scare and policy reaction, and yet at the end of the year, inflation remained above 10 percent. The events of 1980 heightened public unhappiness with inflation. Public support for inflation control and the support of the incoming Reagan administration encouraged the Volcker Fed to seize the window of opportunity that presented itself during the strong rebound in the second half of 1980 to move the federal funds rate up to 19 percent by early 1981. With a 19 percent nominal funds rate, and a historically high 9 percent real funds rate (the historical average is 1 to 2 percent), the Fed was

positioned to let the economy disinflate without having to tighten interest rates further as the unemployment rate began to rise.

Nonetheless, the bond market experienced a second inflation scare in 1981. In spite of extraordinarily tight monetary policy, the 30-year bond rate actually rose by 3 percentage points from January to October 1981 even as the economy weakened, reflecting another 3 percentage point increase in inflation expectations. However, as the U.S. economy entered another recession in July 1981, the Fed responded differently than it had in early 1980. Volcker explained why at the July 1981 Federal Open Market Committee (FOMC) meeting (Federal Open Market Committee, 1981, p. 36):

> I haven't much doubt in my mind that it's appropriate . . . to take the risk of more softness in the economy in the short run than we might ideally like in order to capitalize on the anti-inflationary momentum . . . That is much more likely to give a more satisfactory economic as well as inflationary outlook over a period of time as compared to the opposite scenario of heading off . . . sluggishness or even a downturn at the expense of rapidly getting back into the kind of situation we were in last fall where we had some retreat on inflationary psychology . . . Then we would look forward to another prolonged period of high interest rates and strain and face the same dilemmas over and over again.

The second inflation scare was pivotal because it convinced the Fed to pursue deliberate disinflation in 1981–82 rather than face costly inflation scares and associated recessions in the future by failing to bring inflation down. Thus, the Volcker Fed persisted with extraordinarily tight monetary policy even as the recession deepened.[4] The inflation break came surprisingly fast; inflation fell to 5 percent by the first quarter of 1982. But the Fed persisted with a 9 percent real federal funds rate until the interest rate on long-term bonds began to fall from its peak of 14 percent in the summer of 1982, indicating that the Fed had begun to acquire credibility for its disinflation.[5] At that point the Fed eased monetary policy sharply and the recession ended in November 1982 with the unemployment rate at 10 percent, inflation at 4 percent, and the interest rate on long-term bonds near 10 percent.

In its opening phase, the Volcker disinflation had a recent precedent. Inflation declined from over 10 percent after the first oil shock to the 5 percent range in 1976, before it rose again. Perhaps with that recent precedent in mind, the bond market suffered a third inflation scare which took the 30-year bond rate from 10 percent in mid-1983 to over 13 percent in the summer of 1984—the bond rate was then only 1 percentage point below its peak in 1981 even though actual inflation was 6 percentage points lower! Determined to protect its gains against inflation, the Volcker Fed responded to the third inflation scare with an aggressive policy tightening that took the federal funds rate to 11 percent in summer 1984. For the first time in its history, the Fed

[4] Effective M1 grew around 4.6 percentage points slower in 1981 than its average annual growth over the preceding four years, actually undershooting its target range in 1981 (Broaddus and Goodfriend, 1984).
[5] In Goodfriend and King (2005), my coauthor and I study FOMC transcripts from 1980–83 recently released to the public and find, surprisingly, that Volcker and other FOMC members regarded long-term interest rates as indicative of inflation expectations and of the credibility of their disinflationary policy. Using a modern consensus model of monetary policy, we argue that the real contractionary effects of the Volcker disinflation were mainly due to its imperfect credibility.

successfully employed interest rate policy to hold the line on inflation (at 4 percent) without creating a recession.

The bond rate subsequently fell by 6 percentage points to the 7 percent range by early 1986, indicating that the Volcker Fed had acquired credibility for 4 percent trend inflation. Remarkably, in light of its demonstrated determination to act against inflation earlier in the decade, the Volcker Fed suffered a fourth inflation scare when the 30-year bond rate rose by 2 percentage points between March and October of 1987. As discussed below, the reversal of this inflation scare under Alan Greenspan took several years.

The Volcker disinflation taught three lessons that are among the founding practical principles of the new consensus monetary policy. First, the main monetarist message was vindicated: monetary policy alone—without wage, price, or credit controls, and without supportive fiscal policy—could reduce inflation permanently at a cost to output and employment that, while substantial, was far less than in common Keynesian scenarios. Second, a determined independent central bank can acquire credibility for low inflation without an institutional mandate from the government, although this "stand alone" central bank credibility for low inflation may be fragile and periodically tested by potentially destabilizing inflation scares. Third, a well-timed aggressive interest rate tightening can reduce inflation expectations and preempt a resurgence of inflation without creating a recession.

Alan Greenspan served as Chairman of the Federal Reserve Board from 1987 to 2005. Under Greenspan's leadership, the Fed demonstrated additional practical principles of monetary policy that have become part of the new consensus. The most important is that monetary policy could sustain low inflation with low unemployment on average, and with infrequent, mild recessions. The Greenspan Fed declined to announce an explicit target for inflation or a particular rule to describe its approach to monetary policy. But its monetary policy was characterized by a consistent focus on keeping inflation so low as to be negligible, which can be viewed as a form of implicit inflation targeting.

The Greenspan Fed's implicit inflation target emerged over time. Near the start of his term, Greenspan (1990, p. 6) sought to reinforce the Fed's "stand-alone" credibility for low inflation with 1989 congressional testimony in which he defined the desirable rate of inflation as one in which "the expected rate of change of the general level of prices ceases to be a factor in individual and business decision-making." By the mid-1990s, this general desire for low inflation became more specific. The Federal Open Market Committee declined to adopt a formal inflation target when it debated doing so in January 1995 and again in July 1996. Nevertheless, there was agreement within the FOMC that core inflation as measured by the personal consumption expenditure deflator remain near 2 percent over time (Federal Open Market Committee, 1995 and 1996, especially, pp. 11, 63–4, 66–7, and 72). The FOMC acknowledged a lower bound on its implicit inflation target in May 2003 when it announced that significant further disinflation below the prevailing 1 percent rate of inflation would be "unwelcome." Indeed, the Greenspan Fed maintained a 1 percent federal funds rate until the deflationary pressure passed (Broaddus and Goodfriend, 2004, p. 14, see also sections 2 and 4).

The Federal Reserve under Greenspan was patient in moving toward its implicit inflation target. In so doing, the Greenspan Fed demonstrated another practical principle of the new consensus: flexibility in moving inflation back to target after a shock. Greenspan took over as

chairman during the above-mentioned inflation scare of 1987, when long-term interest rates on bonds were rising. However, the October 1987 stock market crash prevented the Fed from fighting inflation at the time and instead caused the Fed to supply liquidity to the banking and financial system in its role as lender of last resort. As a result, inflation rose to 6 percent by 1990 and the interest rate on long-term bonds peaked around 9 percent. Tight monetary policy in conjunction with the shock of the first Gulf War brought on a mild recession in 1990–91, and the inflation rate declined gradually to 3 percent in 1992. The long-term interest rate on bonds fell below 6 percent by the end of 1993. The loss of credibility for low inflation dating from the 1987 inflation scare was reversed at some cost in unemployment—the unemployment rate peaked at 7.8 percent in June 1992 following the recession in 1990–91 before falling back to 6.5 percent in early 1994.

Having nearly achieved price stability, the Greenspan Fed moved aggressively to defend its gains on inflation when yet another inflation scare between October 1993 and November 1994 lifted the 30-year bond rate by 2.5 percentage points to 8.2 percent. The Fed responded with a 3 percentage point increase in the federal funds rate in 1994 that held inflation at 3 percent with little increase in unemployment. The 1994 tightening, like Volcker's 1984 tightening, showed once again that aggressive, countercyclical interest rate policy actions can confront an inflation scare without creating a recession. The interest rate on long-term bonds fell back to 6 percent by January 1996. Low inflation has been sustained and inflation expectations have remained anchored in the United States since then, even though the economy grew in the 4 percent range and the unemployment rate fell to 4 percent during the long boom in the late 1990s.

The 1994 tightening brought with it a revolutionary change in how the Federal Reserve communicates with the public. In February 1994, the Fed began to announce its current federal funds rate target immediately after each Federal Open Market Committee Meeting, the first in a series of steps to improve communication. The Fed had managed interest rates secretly for most of its history (Meltzer, 2003, pp. 13, 112–16; Goodfriend, 2003). In part, this was because the Fed earlier had lacked a coherent monetary policy strategy, but by 1994 it had developed a set of practical strategic and tactical monetary policy principles based on targeting low inflation. And it was increasingly difficult for the Fed to obfuscate interest rate policy because academics had begun to discuss Fed monetary policy in terms of interest rates. Expecting great scrutiny for its first tightening of monetary policy since 1989, the FOMC decided that it would be counterproductive to try to hide its current federal funds rate target from the public. In time, the public would come to see monetary policy through management of the federal funds rate as a stabilizing force for inflation, employment, and long-term interest rates.

When a recession arrived in 2001, the Greenspan Fed illustrated yet another principle of the new consensus: that credibility for low inflation strengthens the power of monetary policy to counteract recessions. The fact that inflation and inflation expectations were well-anchored enabled the Fed to cut the federal funds rate aggressively in 2001 from 6.5 to 1.75 percent to cushion the fall in aggregate demand and employment. The recession from March to November 2001 was short and mild, and might not have been denoted a recession at all in the absence of the severe contraction in economic activity caused by the September 2001 attacks.

International Aspects of the Consensus

Not long after the Federal Reserve under Paul Volcker demonstrated its power over inflation, other countries began to focus on reducing inflation. For instance, New Zealand and Canada, famously adopted "inflation targets" in 1990 and 1991, respectively, as a way of bringing inflation down from previously high levels. Sweden and the United Kingdom adopted inflation targets in autumn 1992 after being forced off the European system of fixed exchange rates (Liederman and Svensson, 1995).

Emerging market economies began to adopt inflation targeting at the end of the decade, often following the collapse of fixed exchange rates (Blejer, Ize, Leone, and Werlang, 2000). For example, Korea, Thailand, and the Philippines did so in 1998, 2000, and 2002, respectively, after the East Asian currency crisis of 1997. The International Monetary Fund accepted an inflation target as the new nominal anchor in its financial assistance program for Brazil in 1999 after that country's dollar peg collapsed. The IMF has utilized inflation targets in many of its assistance programs. Inflation targeting is employed today in over 20 emerging market and industrial countries (Batini and Laxton, 2006).

Most countries moved to target low inflation in an explicit, formal way. Inflation targeting regimes, such as those mentioned above, differ in important respects but most involve the following characteristics: 1) the announcement of an explicit numerical inflation target by the central bank, 2) patience in reversing an inflationary shock to minimize adverse effects on employment, 3) transparency of central bank concerns and intentions about the economy and interest rate policy, and 4) formal governance mechanisms designed to hold a central bank accountable for inflation outcomes (Bernanke and Mishkin, 1997; King, 2005 ; Svensson, forthcoming).

Perhaps the most prominent and economically important example of a central bank that relies on explicit, institutional support to sustain low inflation is the Eurosystem, which includes both the European Central Bank and the national central banks of the countries that have adopted the euro. It was launched in January 1999 to manage monetary policy in the euro area, originally composed of 11 European countries. The Eurosystem does not consider its policy regime as pure inflation targeting, in part because it also monitors money growth rates in the implementation of monetary policy. Yet, the Eurosystem operates under the guidance of the Maastricht Treaty of 1992, which mandates that "the primary objective of the European System of Central Banks shall be to maintain price stability." The Eurosystem defines price stability as a rate of inflation below 2 percent but aims to maintain inflation close to 2 percent over the medium term (Issing, Gaspar, Angeloni, and Tristani, 2001). The Eurosystem inherited its priority for price stability and an operational role for money in part from the German Bundesbank, which had sustained relatively low inflation consistently with the help of monetary targets after the collapse of the Bretton Woods fixed exchange rate system in the early 1970s. In fact, the Bank of Japan, the Bundesbank, and the Swiss National Bank all utilized monetary targets successfully against inflation in the 1970s, helping to encourage the Volcker Fed to do so a few years later (Rich, 1997; Suzuki, 1985; von Hagen, 1999).

Institutional support is designed to anchor inflation expectations at the inflation target to secure the credibility of a central bank's commitment to low inflation (Gurkaynak, Levin, and

Swanson, 2006). Credibility is widely regarded around the world as the key to effective monetary policy because it guards against inflation scares and improves the flexibility for monetary policy to stabilize employment over the business cycle. The spread of explicit or implicit inflation targeting has demonstrated its virtues. The new working consensus on monetary policy has helped to reduce the volatility of both inflation and output. In any case, there is little alternative to inflation targeting: gold and monetary targets have lost favor as nominal anchors for monetary policy. Obstfeld and Rogoff (1995) emphasize that a fixed exchange rate is no longer a viable nominal anchor in an era of increasingly mobile international capital.

Yet the shift to inflation targeting has not been free of challenges. A central bank could follow mechanically the rules of the gold standard or a money growth rule with relatively little knowledge of the economy. Under a fixed exchange rate, a central bank simply follows the interest rate policy of a trading partner. In contrast, for inflation targeting to work well, countries must build credible domestic institutions. Moreover, central banks must pursue an activist interest rate policy to sustain low inflation. Structural monetary models based on the modern theoretical consensus discussed below play an increasingly important role in this.[6] In fact, a robust international exchange of ideas, practices, and experiences has grown up to disseminate the required knowledge.

Academic Advances Contributing to the Consensus

Academic advances supported the evolving consensus in monetary policy in two ways. Early academic work from the 1970s helped to encourage the Volcker Fed to act against inflation. Then, academic economists built on earlier work in the light of evidence generated by the Volcker disinflation to forge the components of what would become the consensus theoretical framework for monetary policy analysis in the 1990s. The story is one of mutually reinforcing advances in theory and practice.

The monetarist and rational expectations economists of the 1970s were influential not because they directly convinced Fed officials and others, but rather because they offered a way out of the inflationary chaos of the 1970s by building a plausible case that inflation could be tamed by monetary policy alone. As a variety of nonmonetary options for controlling inflation failed—including wage and price controls, credit controls, and fiscal policy—the monetarist option looked increasingly attractive. Thus, when the crisis came, the Volcker Fed implemented monetarist advice by targeting money growth more tightly in October 1979 and especially in 1981 to deliberately disinflate the economy when it judged continuing inflationary policy to involve higher long-term costs.

The drama and ultimate success of the Volcker era at the Federal Reserve stimulated ground-breaking academic advances in the analysis of money and business cycles. There were important advances in rational expectations econometrics, the analysis of real business cycles, the modeling of interest rate policy, and the modeling of the dynamic relationship between inflation and unemployment. Much of this progress was made possible by the increasing use of

[6] The Federal Reserve Board's FRB/US model is an example. Dynamic stochastic general equilibrium monetary models are employed widely for policy analysis at central banks around the world.

computers in dynamic-stochastic macroeconomic analysis. Although many of these advances had little practical impact at the time, they subsequently became the building blocks of the consensus model that emerged in the mid to late 1990s.

The foundations of the current consensus theory of monetary policy already reflected a degree of convergence in 1980. As reviewed by Tobin (1980), these foundations included the ideas that prices are marked up over costs (mainly wages); that price trends depend on expectations; that there is a natural rate of unemployment (where output equals its potential) at which wage and price setters perpetuate the going rate of inflation; that inflation accelerates when output is expected to exceed potential; and that inflation decelerates when output is expected to fall short of potential. Nevertheless, the unresolved problems were crucial ones involving how to model 1) the price and wage-setting process, 2) expectations, 3) the transmission of monetary policy, and 4) real factors influencing business cycles, all in a dynamic way suitable for analyzing monetary stabilization policy. These problems were addressed one by one.

In the late 1970s and early 1980s, Stanley Fischer, John Taylor, and Guillermo Calvo pioneered models of dynamic forward-looking wage and price setting. The model of staggered sticky price setting most widely used in today's consensus models of monetary policy is a direct descendant of the one presented in Calvo (1983).[7]

In his influential paper, Lucas (1976) persuaded monetary economists that it is critically important in modeling monetary policy to let expectations rationally reflect the way that monetary policy is imagined to be conducted. One key question was how to incorporate rational expectations so as to estimate and simulate a macroeconomic model suitable for policy evaluation and optimization. Taylor (1979) showed the way. In so doing, he quantified econometrically the inefficiency of go-stop monetary policy in terms of the excess volatility of output and inflation relative to his estimated efficient policy frontier.

The transmission of monetary policy was controversial in the late 1970s. Taylor's (1979) model assumed that a central bank used a monetary aggregate as its policy instrument, which was plausible given the Volcker Fed's focus on the monetary aggregates. Yet ordinarily, central banks implemented monetary policy with an adjustable short-term interest rate—the federal funds rate in the Federal Reserve's case. Many observers, monetarists prominent among them, believed that the use of interest rate policy in practice was in large part responsible for rising and volatile inflation and inflation expectations. Sargent and Wallace (1975) argued that the price level was indeterminate within a rational expectations macro model if the central bank employed a short-term interest rate as its policy instrument.

Bennett McCallum (1981) opened the door to the modern analysis of interest rate rules by showing that a short-term interest rate could be used as the monetary policy instrument if it is part of a rule which provides a nominal anchor, so that the price level is determinate. McCallum's paper would lead eventually to the discussion and analysis of practical monetary policy in terms of interest rates in papers like Goodfriend (1991, 1993) and Taylor (1993). In my

[7] Walsh (1998, pp. 218-20) provides an accessible derivation of the discrete-time "inflation equation" implied by Calvo's model that relates current inflation to expectations of future inflation and current output.

1991 paper, I presented some stylized facts about interest rate policy-that the Federal Reserve ordinarily prefers a "continuity of the short rate" and that federal funds rate target changes are ordinarily "highly persistent and seldom quickly reversed" to exert maximum leverage over longer-term rates (Woodford, 2003b). My 1993 paper documented aggressive federal funds rate actions in response to what I identified as inflation scares. The famous Taylor Rule described how the Federal Reserve moved the real short-term interest rate in response to the output gap and the gap between actual and targeted inflation. The Taylor Rule became the most common way to model monetary policy (Orphanides, 2007).[8] One reason the Federal Reserve began to talk openly about interest rate policy in 1994 was that academic economists had begun to do so. Indeed, thinking about monetary policy as interest rate policy is one of the hallmarks of the new consensus that has made possible increasingly fruitful interaction between academics and central bankers.

The monetary chaos of the 1970s persuaded academic macroeconomists led by Kydland and Prescott (1982) and King, Plosser, and Rebelo (1988) to ignore money and monetary policy altogether in order to focus on purely real factors influencing business cycles such as productivity shocks, fiscal policy shocks, and international terms-of-trade shocks. These papers initiated a huge, highly productive literature that revolutionized the way that academics do macroeconomics and demonstrated, among other findings, that productivity shocks born of the process of economic growth cause "real business cycles" in models with no role for money (Prescott, 2006). Not only were such fluctuations in output and employment to be expected, but they were also efficient responses to fluctuations in productivity growth.

Real business cycles were studied initially in models with perfectly competitive, flexible prices and wages. Blanchard and Kiyotaki (1987) provided an important bridge from earlier work to the modern monetary policy consensus by analyzing what can be interpreted as an imperfectly competitive real business cycle model with sticky nominal prices and wages. Rotemberg and Woodford (1991, 1992) extended the bridge by exploring endogenous countercyclical markups for real business cycles in a fully dynamic context.

Much of the disarray reflected earlier in disputes between monetarist and Keynesian economists has been resolved in the consensus benchmark model of monetary policy referred to as the New Neoclassical Synthesis or New Keynesian model, the two names reflecting the two directions from which the convergence came. The consensus model incorporates classical features such as intertemporal optimization, rational expectations, and a real business cycle core, together with Keynesian features such as monopolistically competitive firms, staggered sticky nominal price setting, and a central role for monetary stabilization policy. The consensus model and its implications for monetary policy were presented initially in Goodfriend and King (1997) and in Clarida, Galí, and Gertler (1999).[9] Woodford (2003a) provides an extensive theoretical treatment, and my 2002 paper provides an introductory exposition of the consensus model.

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[8] Previously, several writers including McCallum (1988) had discussed the merits of operational activist policy rules using the monetary base as the policy instrument.

[9] Rotemberg and Woodford (1999) provide evidence consistent with the consensus model. Brayton, Levin, and Williams (1997), King and Wolman (1996), and Rotemberg and Woodford (1997) contain early examples of the consensus model. Christiano, Eichenbaum, and Evans (2005) and Smets and Wouters (2007) are recent examples of work that embodies elements of the new consensus.

In an intellectual irony, real business cycle models that were originally developed to study aggregate fluctuations independently of money and monetary policy have become the benchmark against which to judge optimal monetary policy in models with sticky prices. The idea is that optimal monetary policy should make the New Neoclassical Synthesis model perform as if prices were perfectly flexible, which is to say that optimal monetary policy should make the economy perform like its imperfectly competitive real business cycle core (Goodfriend and King, 1997, 2001). Below, we will see how this important theoretical principle reinforces the priority given to price stability in practice.

Academic thinking also played a role in the transition from central bank secrecy to transparency during the past quarter century. From the perspective of monetary economics, a central bank had little need to communicate with the public under a gold standard, as long as it faithfully maintained a fixed currency price of gold. Central banks remained secretive after the gold standard collapsed, in part out of habit and in part because they lacked a coherent monetary policy strategy within which they could communicate productively. Today, central banks have an incentive to utilize transparency and communications to facilitate an understanding of their interest rate policy actions to strengthen the credibility of their commitment to low inflation.

A large academic literature has explored the welfare effects of central bank information policy and generally found that transparency dominates secrecy, especially when a central bank operates under a credible commitment to pursue low inflation (Goodfriend, 1986). Blinder (1996) emphasized that in a democracy, a central bank should be fully accountable for the policies it pursues and that transparency is necessary for accountability. For these and related reasons, Svensson (forthcoming) and Woodford (2005) emphasize that a high degree of transparency is central to the effective functioning of formal "inflation targeting" regimes widely employed around the world today.

How Consensus Theory Supports Monetary Policy Practice

The consensus model of monetary policy reinforces four main advances in monetary policy arrived at in practice: the priority for price stability; the targeting of core rather than headline inflation; the importance of credibility for low inflation; and preemptive interest rate policy supported by transparent objectives and procedures. The theoretical support for these four features of monetary policy practice is explained below.

The Priority for Low Inflation

The consensus theory of monetary policy has at its core monopolistically competitive firms that set product prices at a markup over the marginal cost of production (which depends on productivity and the cost of labor and materials). Because price adjustment is costly, firms consider changing their product prices only if demand and cost conditions threaten to compress or elevate actual markups significantly and persistently relative to flexible-price profit-maximizing levels. An excessively high markup yields too much market share to competitors, and a markup that is too low fails to exploit market power enough to maximize profits.

Firms consider raising product prices if marginal cost moves above trend because labor productivity (output per hour) falls below its trend, or if strong aggregate demand increases the intensity of resource utilization and thereby causes wage or materials costs to rise relative to trend. Conversely, firms consider cutting product prices if labor productivity rises relative to trend, or if weak aggregate demand relaxes resource utilization and thereby causes wage or materials costs to fall relative to trend. To sustain low inflation, monetary policy must manage aggregate demand taking aggregate productivity into account, so that marginal cost rises at the targeted rate of inflation—then firms will raise product prices at the targeted rate of inflation because they are confident that doing so will keep actual markups at flexible-price profit-maximizing markups.

According to this "inflation targeting principle," monetary policy that targets inflation makes the best contribution to the stabilization of output. The reasoning is this: 1) an economy with stable inflation is one in which firms maintain their profit-maximizing markups on average; 2) an economy in which monetary policy sustains profit-maximizing markups operates as if firms sustained profit-maximizing markups themselves by adjusting their own product prices flexibly and continuously; 3) targeting inflation thus makes actual output conform to potential output, where potential output is defined as the fluctuating level of aggregate output that would be determined by supply factors in the flexible-price, imperfectly competitive real business cycle core of the economy.

This line of argument implies that inflation targeting yields the best cyclical behavior of employment and output that monetary policy alone can deliver. Thus, and here is a revolutionary point delivered by the modern theoretical consensus—even those who care mainly about stabilization of the real economy can support a low-inflation objective for monetary policy. This point has two corollaries. First, monetary policy should not try to counteract fluctuations in employment and output due to real business cycles. Second, as an operational matter, a central bank can make the economy conform to its underlying real business cycle core by stabilizing inflation. The above reasoning suggests that if nominal wages were sufficiently flexible, there would be little if any short-run trade-off between inflation and unemployment because monetary policy could stabilize marginal cost fully by acting on wages through its influence on aggregate demand for goods and labor. On the other hand, monetary policy might face a trade-off in the presence of temporary wage rigidity, especially if a large negative productivity shock required an outright fall in wages (as opposed to slower wage growth) to bring marginal cost back down.[10] That said, ordinarily the targeted rate of inflation should be sustainable with positive wage growth since nominal wages grow on average at the sum of inflation and productivity growth.

The above argument says nothing about why *low* inflation should be targeted, as opposed to *steady* inflation, but other features of the monetary economy bear on this point. First, inflation is inefficient because it is a tax on the use of money that causes the socially inefficient substitution of "shopping time" and "costly credit" for money balances in managing transactions. Second, given that price changes are not "indexed" to trend inflation when it is low, zero

[10] In the context of a long-term employment relationship, a firm has the scope and incentive to utilize its workers efficiently, irrespective of the infrequent adjustment of nominal wages. To the extent that this is the case, an economy with temporarily rigid nominal wages would behave as if nominal wages were fully flexible (Goodfriend and King, 2001, pp. 88–91).

inflation is called for to minimize relative price distortions that misallocate output across goods due to staggered price adjustment among firms. Third, the nonindexation of the tax system causes inflation to produce additional distortions (Feldstein, 1997). Fourth, on the other hand, the fact that nominal interest rates cannot fall below zero has the potential to create problems for monetary policy that call for a little inflation to put a small inflation expectations premium in nominal interest rates. Taken together, these considerations argue for an inflation objective in the 1 to 2 percent range found in practice.

Targeting Core Rather than Headline Inflation

Central banks such as the Federal Reserve choose implicitly or explicitly to target a core index of inflation that excludes volatile prices of such goods as food and oil. Consensus theory explains why targeting core rather than headline inflation makes sense.

Imagine that the economy experienced an inflationary shock to highly flexible prices like food or oil. If the goal was to stabilize a headline (overall) index of inflation that included these prices, then monetary policy would depress aggregate demand in the sticky-price sector and relax resource utilization there to depress wages and other costs, elevate markups, and induce monopolistically competitive firms to cut their prices. According to the consensus theory, that would be unnecessarily inefficient. As much as possible, monetary policy should make the economy operate as if all prices were fully flexible. That principle is achieved best by targeting core rather than headline inflation and letting the economy adjust to changes in the relative prices of goods like food and oil, while core inflation and employment are both stabilized. Moreover, core inflation would be a more stable nominal anchor than overall inflation, and it would serve as a better anchor for inflation expectations.

The Importance of Credibility for Low Inflation

The consensus theory of monetary policy confirms in a number of ways the importance that central bankers attach to credibility for low inflation. First, costly price-setting implies that firms care about expected future wage and materials costs in setting current prices. When an inflation-targeting regime is fully credible, firms are confident that inevitable departures of actual markups from flexible-price profit-maximizing markups will be temporary because monetary policy is expected to make them so. In effect, credibility for low core inflation makes beliefs of future costs in the sticky-price sector invariant to current shocks so that beliefs themselves anchor current pricing decisions to the targeted core rate of inflation.

Second, the absence of credibility exposes the economy to "inflation scares" by subjecting expectations of future marginal cost to shocks and beliefs beyond a central bank's control. Inflation scares create a dilemma for monetary policy. To prevent firms from passing higher inflation expectations through to actual inflation, a central bank must engineer an offsetting deflationary force by contracting demand relative to potential output, to weaken labor markets, depress wages, and elevate markups. Thus, we see why go-stop policy increased the volatility of both unemployment and inflation and why it is critical for monetary policy to preempt rising inflation. In the "go" phase of the policy cycle, the central bank was reluctant to act against inflation until rising inflation became the predominant public concern. But by then,

pricing decisions embodied higher inflation expectations, which could only be reversed with contractionary interest rate policy.

Third, credibility must anchor inflation expectations so that a central bank can manipulate real interest rates reliably with a nominal interest rate policy instrument to manage aggregate demand. Furthermore, real interest rates govern only the price of current relative to future spending. Expected future income prospects must be anchored independently of monetary policy to give interest rate policy the leverage to manage current spending. Credibility does this by anchoring expected future markups to flexible-price profit-maximizing markups, thereby anchoring expected future income prospects to productivity growth and other real business cycle factors independent of monetary policy. For all these reasons, credibility for targeted inflation is absolutely essential for effective interest rate policy. That is why it is a good idea for central banks to have strong institutional support to reinforce the credibility of their commitment to low inflation.

Preemptive Interest Rate Policy Supported by Transparent Objectives and Procedures

Consensus theory says that to stabilize inflation, interest rate policy must shadow the fluctuating "real natural rate of interest" that keeps actual markups at flexible-price profit-maximizing markups and makes aggregate demand support real business cycles. One reason why inflation targeting is technically demanding is that the natural rate of interest is not directly observable in markets and must be tracked with the help of a structural theoretical monetary model. Saying that interest rate policy should track the fluctuating natural rate of interest is to support the idea arrived at in practice that interest rate policy should preempt rising inflation, which it can do without increasing unemployment. From this perspective, we can understand the positive correlation observed in the go-stop period between higher interest rates and higher unemployment as an artifact of the misunderstood and mismanaged interest rate policy of the time, rather than as a structural feature of monetary policy.

Short-term interest rate policy, like moving the federal funds rate, must exert its leverage over current aggregate demand through its leverage over longer-term interest rates. According to the expectations theory of the term structure, longer-term interest rates move with an average of expected future short rates. Thus, to predict accurately the effect of an interest rate policy action on longer-term interest rates and aggregate demand, a central bank must create an understanding in markets as to what a given short-term interest rate action implies for future short rates. For this task, communication is central to effective interest rate policy. Rational expectations reasoning teaches that ad hoc announcements can reinforce but not substitute for a genuine mutual understanding between markets and the central bank created on the basis of an explicit, credible low-inflation objective supported by a policy rule—a systematic articulation of how a central bank intends to move its short-term interest rate instrument in response to macroeconomic news to achieve that objective. Hence, the consensus model of monetary policy supports the worldwide drive to improve transparency in monetary policy practice.

Conclusion

The working consensus on monetary policy still leaves plenty of unfinished business and scope for controversy. For instance, there is little consensus agreement about the nature of Japan's deflationary monetary policy problems in the 1990s. The potential for deflation and the capacity of monetary policy to act against deflation—given that nominal interest rates cannot fall below zero—are important matters still in dispute (Svensson, 2003). A closely related matter is that the benchmark consensus model of interest rate policy has no role for "money and banking" and only a single interest rate. There is much to learn about how monetary policy is transmitted from the interbank interest rate policy instrument through the banking sector to various other interest rates and rates of return in the economy and on to employment and output (Goodfriend and McCallum, 2007). Another controversial matter involves extreme price fluctuations in markets for credit, equity, foreign exchange, and other assets. The benchmark consensus model says that asset prices should be allowed to adjust flexibly relative to targeted inflation. Yet the nature of extreme asset price fluctuations and the scope for monetary policy to deal with them are of great interest to monetary policy theorists and policymakers alike (Hunter, Kaufman, and Pomerleano, 2003).

The quantitative significance of sticky nominal price and wage adjustments for monetary policy are hotly debated. Extensive international evidence on sticky prices and wages is surveyed in this journal in Dhyne et al. (2006) and in Dickens et al. (2007). On one side, Golosov and Lucas (2007) argue that since monetary policy shocks cannot induce large or persistent real responses in their calibrated model of costly price adjustment, sticky prices are relatively unimportant. On the other side, Blanchard and Galí (2007) argue that the rigidity of *real* wages in the real business cycle core of the economy implies a quantitatively significant short-run trade-off between unemployment and inflation.

Among other things, no fully satisfactory theory exists to explain the loss or acquisition of credibility for low inflation or, similarly, how inflation scares occur, and the sensitivity of such phenomena to fiscal policy concerns. Models typically assume that a central bank follows a fully credible policy rule or that policy is purely discretionary, although models with learning are a prominent exception (Orphanides and Williams, 2005). There is plenty of opportunity to improve the statistical indicators that must guide monetary policy, especially real-time estimates and indicators of the "natural rate of interest." Finally, there is plenty of room for debate about the design of institutional mechanisms to support credibility for targeted inflation.

The worldwide progress in monetary policy is a great achievement that, especially when viewed from the perspective of 30 years ago, is a remarkable success story. Today, academics, central bank economists, and policymakers around the world work together on monetary policy as never before (McCallum, 2002). The worldwide working consensus provides a foundation for future work because it was forged out of hard practical lessons from diverse national experiences over decades, and because it provides common ground upon which academics and central bankers can work to improve monetary policy in the future.

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