

## Ben S Bernanke: The great moderation

Remarks by Mr Ben S Bernanke, Member of the Board of Governors of the US Federal Reserve System, at the meetings of the Eastern Economic Association, Washington DC, 20 February 2004.

*The references for the speech can be found on the Board of Governors of the Federal Reserve System's website.*

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One of the most striking features of the economic landscape over the past twenty years or so has been a substantial decline in macroeconomic volatility. In a recent article, Olivier Blanchard and John Simon (2001) documented that the variability of quarterly growth in real output (as measured by its standard deviation) has declined by half since the mid-1980s, while the variability of quarterly inflation has declined by about two thirds.<sup>1</sup> Several writers on the topic have dubbed this remarkable decline in the variability of both output and inflation "the Great Moderation". Similar declines in the volatility of output and inflation occurred at about the same time in other major industrial countries, with the recent exception of Japan, a country that has faced a distinctive set of economic problems in the past decade.

Reduced macroeconomic volatility has numerous benefits. Lower volatility of inflation improves market functioning, makes economic planning easier, and reduces the resources devoted to hedging inflation risks. Lower volatility of output tends to imply more stable employment and a reduction in the extent of economic uncertainty confronting households and firms. The reduction in the volatility of output is also closely associated with the fact that recessions have become less frequent and less severe.<sup>2</sup>

Why has macroeconomic volatility declined? Three types of explanations have been suggested for this dramatic change; for brevity, I will refer to these classes of explanations as *structural change*, improved macroeconomic policies, and good luck. Explanations focusing on structural change suggest that changes in economic institutions, technology, business practices, or other structural features of the economy have improved the ability of the economy to absorb shocks. Some economists have argued, for example, that improved management of business inventories, made possible by advances in computation and communication, has reduced the amplitude of fluctuations in inventory stocks, which in earlier decades played an important role in cyclical fluctuations.<sup>3</sup> The increased depth and sophistication of financial markets, deregulation in many industries, the shift away from manufacturing toward services, and increased openness to trade and international capital flows are other examples of structural changes that may have increased macroeconomic flexibility and stability.

The second class of explanations focuses on the arguably *improved performance of macroeconomic policies*, particularly monetary policy. The historical pattern of changes in the volatilities of output growth and inflation gives some credence to the idea that better monetary policy may have been a major contributor to increased economic stability. As Blanchard and Simon (2001) show, output volatility and inflation volatility have had a strong tendency to move together, both in the United States and other industrial countries. In particular, output volatility in the United States, at a high level in the immediate postwar era, declined significantly between 1955 and 1970, a period in which inflation volatility was low. Both output volatility and inflation volatility rose significantly in the 1970s and early 1980s and, as I have noted, both fell sharply after about 1984. Economists generally agree that the 1970s, the period of highest volatility in both output and inflation, was also a period in which monetary

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<sup>1</sup> Kim and Nelson (1999) and McConnell and Perez-Quiros (2000) were among the first to note the reduction in the volatility of output. Kim, Nelson, and Piger (2003) show that the reduction in the volatility of output is quite broad based, affecting many sectors and aspects of the economy. Warnock and Warnock (2000) find a parallel decline in the volatility of employment, especially in goods-producing sectors.

<sup>2</sup> The United States has experienced only two relatively mild recessions since 1984, compared with four recessions - two of them quite deep - in the fifteen years before 1984. Indeed, according to the National Bureau of Economic Research's monthly business cycle chronology, which covers the period since the Civil War, the 120-month expansion of the 1990s was the longest recession-free period the United States has enjoyed, and the 92-month expansion of the 1980s was the third longest such period.

<sup>3</sup> McConnell and Perez-Quiros (2000) and Kahn, McConnell, and Perez-Quiros (2002) make this argument. McCarthy and Zakrajsek (2003) provide an overview and evaluation of this literature; they conclude that better inventory management has reinforced the trend toward lower volatility but is not the ultimate cause. Willis (2003) discusses structural changes that may have contributed to reduced variability of inflation.

policy performed quite poorly, relative to both earlier and later periods (Romer and Romer, 2002).<sup>4</sup> Few disagree that monetary policy has played a large part in stabilizing inflation, and so the fact that output volatility has declined in parallel with inflation volatility, both in the United States and abroad, suggests that monetary policy may have helped moderate the variability of output as well.

The third class of explanations suggests that the Great Moderation did not result primarily from changes in the structure of the economy or improvements in policymaking but occurred because the shocks hitting the economy became smaller and more infrequent. In other words, the reduction in macroeconomic volatility we have lately enjoyed is largely the result of *good luck*, not an intrinsically more stable economy or better policies. Several prominent studies using distinct empirical approaches have provided support for the good-luck hypothesis (Ahmed, Levin, and Wilson, 2002; Stock and Watson, 2003).

Explanations of complicated phenomena are rarely clear cut and simple, and each of the three classes of explanations I have described probably contains elements of truth. Nevertheless, sorting out the relative importance of these explanations is of more than purely historical interest. Notably, if the Great Moderation was largely the result of good luck rather than a more stable economy or better policies, then we have no particular reason to expect the relatively benign economic environment of the past twenty years to continue. Indeed, if the good-luck hypothesis is true, it is entirely possible that the variability of output growth and inflation in the United States may, at some point, return to the levels of the 1970s. If instead the Great Moderation was the result of structural change or improved policymaking, then the increase in stability should be more likely to persist, assuming of course that policymakers do not forget the lessons of history.

My view is that improvements in monetary policy, though certainly not the only factor, have probably been an important source of the Great Moderation. In particular, I am not convinced that the decline in macroeconomic volatility of the past two decades was *primarily* the result of good luck, as some have argued, though I am sure good luck had its part to play as well. In the remainder of my remarks, I will provide some support for the “improved-monetary-policy” explanation for the Great Moderation. I will not spend much time on the other two classes of explanations, not because they are uninteresting or unimportant, but because my time is limited and the structural change and good-luck hypotheses have been extensively discussed elsewhere.<sup>5</sup> Before proceeding, I should note that my views are not necessarily those of my colleagues on the Board of Governors or the Federal Open Market Committee.

### **The Taylor curve and the variability tradeoff**

Let us begin by asking what economic theory has to say about the relationship of output volatility and inflation volatility. To keep matters simple, I will make the strong (but only temporary!) assumption that monetary policymakers have an accurate understanding of the economy and that they choose policies to promote the best economic performance possible, given their economic objectives. I also assume for the moment that the structure of the economy and the distribution of economic shocks are stable and unchanging. Under these baseline assumptions, macroeconomists have obtained an interesting and important result. Specifically, standard economic models imply that, in the long run, monetary policymakers can reduce the volatility of inflation *only* by allowing greater volatility in output growth, and vice versa. In other words, if monetary policies are chosen optimally and the economic structure is held constant, there exists a long-run tradeoff between volatility in output and volatility in inflation.

The ultimate source of this long-run tradeoff is the existence of shocks to aggregate supply. Consider the canonical example of an aggregate supply shock, a sharp rise in oil prices caused by disruptions to foreign sources of supply. According to conventional analysis, an increase in the price of oil raises the overall price level (a temporary burst in inflation) while depressing output and employment. Monetary policymakers are therefore faced with a difficult choice. If they choose to tighten policy (raise the short-term interest rate) in order to offset the effects of the oil price shock on the general price level, they may well succeed - but only at the cost of making the decline in output more severe. Likewise, if monetary policymakers choose to ease in order to mitigate the effects of the oil price shock

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<sup>4</sup> Using more formal econometric methods, Kim, Nelson, and Piger (2003) also found that structural breaks in the volatility and persistence of inflation occurred about the same times as the changes in output volatility.

<sup>5</sup> Stock and Watson (2003) provide a recent overview of the debate.

on output, their action will exacerbate the inflationary impact. Hence, in the standard framework, the periodic occurrence of shocks to aggregate supply (such as oil price shocks) forces policymakers to choose between stabilizing output and stabilizing inflation.<sup>6</sup> Note that shocks to aggregate demand do not create the same tradeoff, as offsetting an aggregate demand shock stabilizes both output and inflation.

This apparent tradeoff between output variability and inflation variability faced by policymakers gives rise to what has been dubbed the *Taylor curve*, reflecting early work by the Stanford economist and current Undersecretary of the Treasury John B. Taylor.<sup>7</sup> (Taylor also originated the eponymous Taylor rule, to which I will refer later.) Graphically, the Taylor curve depicts the menu of possible combinations of output volatility and inflation volatility from which monetary policymakers can choose in the long run. Figure 1 shows two examples of Taylor curves, marked *TC1* and *TC2*. In [Figure 1](#), volatility in output is measured on the vertical axis and volatility in inflation is measured on the horizontal axis. As shown in the figure, Taylor curves slope downward, reflecting the theoretical conclusion that an optimizing policymaker can choose less of one type of volatility in the long run only by accepting more of the other.<sup>8</sup> A direct implication of the Taylor curve framework is that a change in the preferences or objectives of the central bank alone - a decision to be tougher on inflation, for example - cannot explain the Great Moderation. Indeed, in this framework, a conscious attempt by policymakers to try to moderate the variability of inflation should lead to higher, not lower, variability of output.

How, then, can the Great Moderation be explained? Figure 1 suggests two possibilities. First, suppose it were the case, contrary to what we assumed in deriving the Taylor curve, that monetary policies during the period of high macroeconomic volatility were not optimal, perhaps because policymakers did not have an accurate understanding of the structure of the economy or of the impact of their policy actions. If monetary policies during the late 1960s and the 1970s were sufficiently far from optimal, the result could be a combination of output volatility and inflation volatility lying well above the efficient frontier defined by the Taylor curve. Graphically, suppose that the true Taylor curve is the solid curve shown in Figure 1, labeled *TC2*. Then, in principle, sufficiently well executed policies could achieve a combination of output volatility and inflation volatility such as that represented by point *B*, which lies on that curve. However, less effective policies could lead to the economic outcome represented by point *A* in Figure 1, at which both output volatility and inflation volatility are higher than at point *B*. We can see now how improvements in monetary policy might account for the Great Moderation, even in the absence of any change in the structure of the economy or in the underlying shocks. Improvements in the policy framework, in policy implementation, or in the policymakers' understanding of the economy could allow the economy to move from the inefficient point *A* to the efficient point *B*, where the volatility of both inflation and output are more moderate.

Figure 1 can also be used to depict a second possible explanation for the Great Moderation, which is that, rather than monetary policy having improved, the underlying economic environment may have become more stable. Changes in the structure of the economy that increased its resilience to shocks or reductions in the variance of the shocks themselves would improve the volatility tradeoff faced by policymakers. In Figure 1, we can imagine now that the true Taylor curve in the 1970s is given by the dashed curve, *TC1*, and the actual economic outcome chosen by policymakers is point *A*, which lies on *TC1*. Improved economic stability in the 1980s and 1990s, whether arising from structural change or good luck, can be represented by a shift of the Taylor curve from *TC1* to *TC2*, and the new economic outcome as determined by policy is point *B*. Relative to *TC1*, the Taylor curve *TC2* represents economic outcomes with lower volatility in output for any given volatility of inflation, and vice versa. According to the "shifting Taylor curve" explanation, the Great Moderation resulted not from improved practice of monetary policy (which has always been as effective as possible, given the

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<sup>6</sup> Strictly speaking, according to standard models, policymakers face a tradeoff between volatility of inflation and volatility of the output gap, the difference between potential output and actual output. If the economy's potential output grows relatively smoothly, variability in the output *gap* will be closely related to variability in actual output.

<sup>7</sup> Chatterjee (2002) provides an overview of the Taylor curve and its implications. For an exposition by Taylor himself, see Taylor (1998).

<sup>8</sup> The policy tradeoff between the variability of inflation and the variability of output implied by the Taylor curve is reminiscent of an older proposition, that policymakers could achieve a permanently higher level of output (and thus a permanently lower level of unemployment) by accepting a permanently higher *level* of inflation. However, for both theoretical and empirical reasons, this older idea of a long-run tradeoff between the levels of inflation and output has been largely discredited, and the Taylor curve tradeoff is in some sense its natural successor.

environment) but rather by favorable structural change or reduced variability of economic shocks. Of course, more complicated scenarios in which policy becomes more effective *and* the underlying economic environment becomes more stable are possible and indeed likely.

With this bit of theory as background, I will focus on two key points. First, without claiming that monetary policy during the 1950s or in the period since 1984 has been ideal by any means, I will try to support my view that the policies of the late 1960s and 1970s were particularly inefficient, for reasons that I think we now understand. Thus, as in the first scenario just discussed (represented in Figure 1 as a movement from point *A* to point *B*), improvements in the execution of monetary policy can plausibly account for a significant part of the Great Moderation. Second, more subtly, I will argue that some of the benefits of improved monetary policy may easily be confused with changes in the underlying environment (that is, improvements in policy may be incorrectly identified as shifts in the Taylor curve), increasing the risk that standard statistical methods of analyzing this question could understate the contribution of monetary policy to the Great Moderation.

### **Reaching the Taylor curve: improvements in the effectiveness of monetary policy**

Monetary policymakers face difficult challenges in their efforts to stabilize the economy. We are uncertain about many aspects of the workings of the economy, including the channels by which the effects of monetary policy are transmitted. We are even uncertain about the current economic situation as economic data are received with a lag, are typically subject to multiple revisions, and in any case can only roughly and partially depict the underlying economic reality. Thus, in practice, monetary policy will never achieve as much reduction in macroeconomic volatility as would be possible if our understanding were more complete.

Nevertheless, a number of economists have argued that monetary policy during the late 1960s and the 1970s was unusually prone to creating volatility, relative to both earlier and later periods (DeLong, 1997; Mayer, 1998; Romer and Romer, 2002). Economic historians have suggested that the relative inefficiency of policy during this period arose because monetary policymakers labored under some important misconceptions about policy and the economy. First, during this period, central bankers seemed to have been excessively optimistic about the ability of activist monetary policies to offset shocks to output and to deliver permanently low levels of unemployment. Second, monetary policymakers appeared to underestimate their own contributions to the inflationary problems of the time, believing instead that inflation was in large part the result of nonmonetary forces. One might say that, in terms of their ability to deliver good macroeconomic outcomes, policymakers suffered from excessive “output optimism” and “inflation pessimism.”

The output optimism of the late 1960s and the 1970s had several aspects. First, at least during the early part of that period, many economists and policymakers held the view that policy could exploit a permanent tradeoff between inflation and unemployment, as described by a simple Phillips curve relationship. The idea of a permanent tradeoff opened up the beguiling possibility that, in return for accepting just a bit more inflation, policymakers could deliver a *permanently* low rate of unemployment. This view is now discredited, of course, on both theoretical and empirical grounds.<sup>9</sup> Second, estimates of the rate of unemployment that could be sustained without igniting inflation were typically unrealistically low, with a long-term unemployment rate of 4 percent or less often being characterized as a modest and easily attainable objective.<sup>10</sup> Third, economists of the time may have been unduly optimistic about the ability of fiscal and monetary policymakers to eliminate short-term fluctuations in output and employment, that is, to “fine-tune” the economy.

What I have called inflation pessimism was the increasing conviction of policymakers in the 1960s and 1970s, as inflation rose and remained stubbornly high, that monetary policy was an ineffective tool for controlling inflation. As emphasized in recent work on the United States and the United Kingdom by

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<sup>9</sup> Friedman (1968) provided a major theoretical critique of the idea of a permanent tradeoff. Scholars disagree about when and to what degree U.S. monetary policymakers absorbed the lessons of Friedman’s article.

<sup>10</sup> Orphanides (2003) has emphasized the importance of poor estimates of potential output and the closely associated concept of the natural rate of unemployment for explaining the inflationary policies of the 1970s. He notes the difficulty that policymakers of the time faced in distinguishing the productivity slowdown of the period from a cyclical decline in output. Analytical support for the view that confusion between the cyclical and secular aspects of the 1970s’ slowdown had inflationary consequences is provided by Lansing (2002) and Bullard and Eusepi (2003).

Edward Nelson (2004), during this period policymakers became more and more inclined to blame inflation on so-called cost-push shocks rather than on monetary forces. Cost-push shocks, in the paradigm of the time, included diverse factors such as union wage pressures, price increases by oligopolistic firms, and increases in the prices of commodities such as oil and beef brought about by adverse changes in supply conditions. For the purpose of understanding the upward trend in inflation, however, the most salient attribute of cost-push shocks was that they were putatively out of the control of the monetary policymakers.

The combination of output optimism and inflation pessimism during the latter part of the 1960s and the 1970s was a recipe for high volatility in output and inflation - that is, a set of outcomes well away from the efficient frontier represented by the economy's Taylor curve. Notably, the belief in a long-run tradeoff between output and inflation, together with an unrealistically low assessment of the sustainable rate of unemployment, resulted in high inflation but did not deliver the expected payoff in terms of higher output and employment. Moreover, the Fed's periodic attempts to rein in surging inflation led to a pattern of "go-stop" policies, in which swings in policy from ease to tightness contributed to a highly volatile real economy as well as a highly variable inflation rate. Wage-price controls, invoked in the belief that monetary policy was ineffective against cost-push forces, also ultimately proved destabilizing.

Monetary policymakers bemoaned the high rate of inflation in the 1970s but did not fully appreciate their own role in its creation. Ironically, their errors in estimating the natural rate and in ascribing inflation to nonmonetary forces were mutually reinforcing. On the one hand, because unemployment remained well above their over-optimistic estimates of the sustainable rate, they were inclined to attribute inflation to outside forces (such as the actions of firms and unions) rather than to an overheated economy (Romer and Romer, 2002; Nelson, 2004). On the other hand, the view of policymakers that exogenous forces largely drove inflation made it more difficult for them to recognize that their estimate of the sustainable rate of unemployment was too low. Several years passed before policymakers were finally persuaded by the evidence that sustained anti-inflationary monetary policies would actually work (Primiceri, 2003). As you know, these policies were implemented successfully after 1979, beginning under Fed Chairman Volcker.

Better known than even the Taylor curve is John Taylor's famous Taylor rule, a simple equation that has proved remarkably useful as a rule-of-thumb description of monetary policy (Taylor, 1993). In its basic form, the Taylor rule relates the Federal Reserve's policy instrument, the overnight federal funds interest rate, to the deviations of inflation and output from the central bank's desired levels for those variables. Estimates of the Taylor rule for the late 1960s and the 1970s reflect the output optimism and inflation pessimism of the period, in that researchers tend to find a weaker response of the policy rate to inflation and (in some studies) a relatively stronger response to the output gap than in more recent periods.<sup>11</sup> As I will shortly discuss further, an insufficiently strong response to inflation let inflation and inflation expectations get out of control and thus added volatility to the economy. At the same time, strong responses to what we understand in retrospect to have been over-optimistic estimates of the output gap created additional instability. As output optimism and inflation pessimism both waned under the force of the data, policy responses became more appropriate and the economy more stable. In this sense, improvements in policymakers' understanding of the economy and the role of monetary policy allowed the economy to move closer to the Taylor curve (or, in terms of Figure 1, to move from point *A* to point *B*).

### **Improved monetary policy or a shifting Taylor curve?**

Improvements in monetary policy that moved the economy closer to the efficient frontier described by the Taylor curve can account for part of the Great Moderation. However, several empirical studies have questioned the quantitative importance of this effect and emphasized instead shifts in the Taylor curve, brought about by structural change or good luck. For example, in a paper presented at the

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<sup>11</sup> See, for example, Judd and Rudebusch (1998), Taylor (1999), Clarida, Gali, and Gertler (2000), Cogley and Sargent (2002), and Mehra (2002). Orphanides (2003) argues that, if one takes account of policymakers' mis-estimates of the output gap in the 1970s, the same Taylor rule that describes policy after 1979 applies to the 1970s as well. The debate is an important one, but it may bear more on what policymakers actually thought they were doing - and thus on the history of ideas - than on the question of whether monetary policy was in fact inefficient or even destabilizing during the period. There seems to be little doubt that it was.

Federal Reserve Bank of Kansas City's annual Jackson Hole conference, James Stock and Mark Watson (2003) use several alternative macroeconomic models to simulate how the economy would have performed after 1984 if monetary policy had followed its pre-1979 pattern. Although inflation performance after 1984 would clearly have been worse if pre-1979 monetary policies had been used, Stock and Watson find that output volatility would have been little different. They conclude that improved monetary policy does not account for much of the reduction in output volatility since the mid-1980s. Instead, noting that the variance of the economic shocks implied by their models for the 1970s was much higher than the variance of shocks in the more recent period, they embrace the good-luck explanation of the Great Moderation. Interesting research by Timothy Cogley and Thomas Sargent (2002) and by Shaghil Ahmed, Andrew Levin, and Beth Anne Wilson (2002) likewise find a substantial reduction in the size and frequency of shocks in the more recent period, supporting the good-luck hypothesis.

Both the structural change and good-luck explanations of the Great Moderation are intriguing and (to reiterate) both are no doubt part of the story. However, an unsatisfying aspect of both explanations is the difficulty of identifying changes in the economic environment large enough and persistent enough to explain the Great Moderation, both in the United States and abroad. In particular, it is not obvious that economic shocks have become significantly smaller or more infrequent, as required by the good-luck hypothesis. Tensions in the Middle East, often blamed for the oil price shocks of the 1970s, have hardly declined in recent years, and important developments in technology and productivity have continued to buffet the economy (albeit in a more positive direction than in the 1970s). Nor has the international economic environment become obviously more placid, as a series of financial crises struck various regions of the world during the 1990s and the powerful forces of globalization have proceeded apace. In contrast, following the adverse experience of the 1970s, changes in the practice of monetary policy occurred around the world in similar ways and during approximately the same period.

Certainly, stability-enhancing changes in the economic environment have occurred in the past two decades. However, an intriguing possibility is that some of these changes, rather than being truly exogenous, may have been induced by improved monetary policies. That is, better monetary policies may have resulted in what appear to be (but only appear to be) favorable shifts in the economy's Taylor curve. Here are some examples of what I have in mind.

First, monetary policies that brought down and stabilized inflation may have led to stabilizing changes in the structure of the economy as well, in line with the prediction of the famous Lucas (1976) critique that economic structure depends on the policy regime. High and unstable inflation increases the variability of relative prices and real interest rates, for example, distorting decisions regarding consumption, capital investment, and inventory investment, among others. Likewise, the high level, variability, and unpredictability of inflation profoundly affected decisions regarding financial investments and money holdings. Theories of "rational inattention" (Sims, 2003), according to which people vary the frequency with which they re-examine economic decisions according to the underlying economic environment, imply that the dynamic behavior of the economy would change - probably in the direction of greater stability and persistence - in a more stable pricing environment, in which people reconsider their economic decisions less frequently.

Second, changes in monetary policy could conceivably affect the size and frequency of shocks hitting the economy, at least as an econometrician would measure those shocks. This assertion seems odd at first, as we are used to thinking of shocks as exogenous events, arising from "outside the model," so to speak. However, econometricians typically do not measure shocks directly but instead infer them from movements in macroeconomic variables that they cannot otherwise explain. Shocks in this sense may certainly reflect the monetary regime. For example, consider the cost-push shocks that played such an important role in 1970s' thinking about inflation. Seemingly unexplained or autonomous movements in wages and prices during this period, which analysts would have interpreted as shocks to wage and price equations, may in fact have been the result of earlier monetary policy actions, or (more subtly) of monetary policy actions expected by wage- and price-setters to take place in the future. In an influential paper, Robert Barsky and Lutz Kilian (2001) analyze the oil price shocks of the 1970s in this spirit. Barsky and Kilian provide evidence that the extraordinary increases in nominal oil prices during the 1970s were made feasible primarily by earlier expansionary monetary policies rather than by truly exogenous political or economic events.

Third, monetary policy can also affect the distribution of measured shocks by changing the sensitivity of pricing and other economic decisions to exogenous outside events. For example, significant movements in the price of oil and other commodities continued to occur after 1984. However, in a

low-inflation environment, with stable inflation expectations and a general perception that firms do not have pricing power, commodity price shocks are not passed into final goods prices to nearly the same degree as in a looser monetary environment. As a result, a change in commodity prices of a given size shows up as a smaller shock to output and consumer prices today than it would have in the earlier period. Likewise, there is evidence that fluctuations in exchange rates have smaller effects on domestic prices and economic activity when inflation is less volatile and inflation expectations are stabilized (Gagnon and Ihrig, 2002; Devereux, Engel, and Storgaard, 2003).

Fourth, changes in inflation expectations, which are ultimately the product of the monetary policy regime, can also be confused with truly exogenous shocks in conventional econometric analyses. Marvin Goodfriend (1993) has suggested, for example, that insufficiently anchored inflation expectations have led to periodic “inflation scares”, in which inflation expectations have risen in an apparently autonomous manner. Increases in inflation expectations have the flavor of adverse aggregate supply shocks in that they tend to increase the volatility of both inflation and output, in a combination that depends on how strongly the monetary policymakers act to offset these changes in expectations.

Theoretical and empirical support for the idea that inflation expectations may become an independent source of instability has grown in recent years.<sup>12</sup> As I mentioned earlier, a number of researchers have found that the reaction of monetary policymakers to inflation has strengthened, in that the estimated coefficient on inflation in the Taylor rule has risen from something less than 1 before 1979 to a value significantly greater than 1 in the more recent period. If the policy interest rate responds to increases in inflation by less than one-for-one (so that the real policy rate does not rise in the face of higher inflation), economic theory tells us that inflation expectations and the economy in general can become unstable. The problem arises from the fact that, if policymakers do not react sufficiently aggressively to increases in inflation, spontaneously arising expectations of increased inflation can ultimately be self-confirming and even self-reinforcing. Incidentally, the stability requirement that the policy rate respond to inflation by more than one-for-one is called the Taylor principle (Taylor, 1993, 1999) - the third concept named after John Taylor that has played a role in this talk. The finding that monetary policymakers violated the Taylor principle during the 1970s but satisfied the principle in the past two decades would be consistent with a reduced incidence of destabilizing expectational shocks.<sup>13</sup>

Support for the view that inflation expectations can be an independent source of economic volatility has also emerged from the extensive recent literature on learning and macroeconomics (Evans and Honkapohja, 2001). For example, Athanasios Orphanides and John C. Williams (2003a, 2003b) have studied models in which the public must learn the central bank’s underlying preferences regarding inflation by observing the actual inflation process.<sup>14</sup> With learning, inflation expectations take on a more adaptive character; in particular, high and unstable inflation will beget similar characteristics in the pattern of inflation expectations. As Orphanides and Williams show, when inflation expectations are poorly anchored, so that the public is highly uncertain about the long-run rate of inflation that the central bank hopes to achieve, they can become an additional source of volatility in the economy. An analysis that did not properly control for the expectational effects of changes in monetary policy might incorrectly conclude that the Taylor curve had shifted in an adverse direction.

## Conclusion

The Great Moderation, the substantial decline in macroeconomic volatility over the past twenty years, is a striking economic development. Whether the dominant cause of the Great Moderation is structural change, improved monetary policy, or simply good luck is an important question about which no consensus has yet formed. I have argued today that improved monetary policy has likely made an important contribution not only to the reduced volatility of inflation (which is not particularly controversial) but to the reduced volatility of output as well. Moreover, because a change in the monetary policy regime has pervasive effects, I have suggested that some of the effects of improved

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<sup>12</sup> See Bernanke (2003, 2004) for more extensive discussions.

<sup>13</sup> In a similar spirit, Stefania Albanesi, V.V. Chari, and Lawrence Christiano (2003) have shown that when the central bank’s commitment to fighting inflation is perceived to be weak, as may have been the case during the 1970s, self-confirming increases in expected inflation are possible and will tend to destabilize the economy.

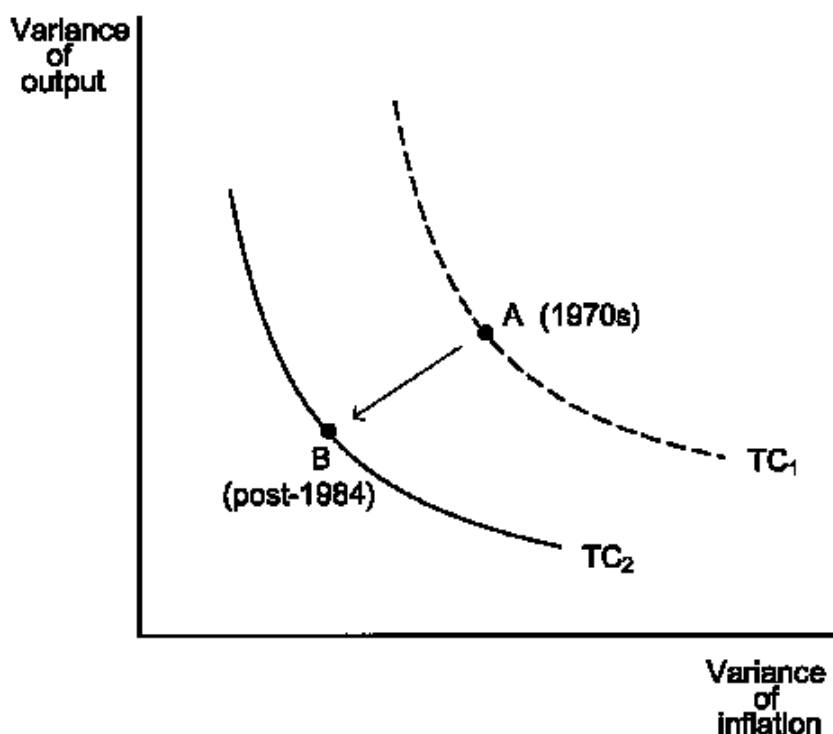
<sup>14</sup> See Bernanke (2004) for additional discussion.

monetary policies may have been misidentified as exogenous changes in economic structure or in the distribution of economic shocks. This conclusion on my part makes me optimistic for the future, because I am confident that monetary policymakers will not forget the lessons of the 1970s.

I have put my case for better monetary policy rather forcefully today, because I think it likely that the policy explanation for the Great Moderation deserves more credit than it has received in the literature. However, let me close by emphasizing that the debate remains very much open. Although I have focused on its strengths, the monetary policy hypothesis has potential deficiencies as well. For example, although I pointed out the difficulty that the structural change and good-luck explanations have in accounting for the rather sharp decline in volatility after 1984, one might also question whether the change in monetary policy regime was sufficiently sharp to have had the effects I have attributed to it.<sup>15</sup> The consistency of the monetary policy explanation with the experience of the 1950s, a period of stable inflation during which output volatility declined but was high in absolute terms, deserves further investigation. Moreover, several of the channels by which monetary policy may have affected volatility that I have mentioned today remain largely theoretical possibilities and have not received much in the way of rigorous empirical testing. One of my goals today was to stimulate further research on this question. Clearly, the sources of the Great Moderation will continue to be an area for fruitful analysis and debate.

Figure 1

### Monetary policy and the variability of output and inflation



<sup>15</sup> Stock and Watson (2003) make this point. Supporting their argument, in Bernanke (2004) I present evidence that even today inflation expectations may not be anchored as well as we would like.