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# INNOVATIONS AND ISSUES IN MONETARY POLICY: THE LAST FIFTEEN YEARS

## Risk and Uncertainty in Monetary Policy

By ALAN GREENSPAN\*

I plan to sketch the key developments of the past decade and a half of monetary policy in the United States from the perspective of someone who has been in the policy trenches. I will offer some conclusions about what I believe has been learned thus far, though I suspect, as is so often the case, the passing of time, further study, and reflection will deepen our understanding of these developments. This is a personal statement; I am not speaking for my current colleagues on the Federal Open Market Committee (FOMC) or the many others with whom I have served over these many years.<sup>1</sup>

The tightening of monetary policy by the Federal Reserve in 1979, then led by my predecessor Paul Volcker, ultimately broke the back of price acceleration in the United States, ushering in a two-decade long decline in inflation that eventually brought us to the current state of price stability.

The fall in inflation over this period has been global in scope, and arguably beyond the expectations of even the most optimistic inflation-fighters. I have little doubt that an unrelenting focus of monetary policy on achieving price stability has been the principal contributor to disinflation. Indeed, the notion, advanced by Milton Friedman more than 30 years ago, that inflation is everywhere and always a monetary phenomenon, is no longer a controversial proposition in the profession. But the size and geographic extent of the decline in inflation raises the question of whether other forces have been at work as well.

I am increasingly of the view that, at a minimum, monetary policy in the last two decades

has been operating in an environment particularly conducive to the pursuit of price stability. The principal features of this environment included (i) increased political support for stable prices, which was the consequence of, and reaction to, the unprecedented peacetime inflation in the 1970's, (ii) globalization, which unleashed powerful new forces of competition, and (iii) an acceleration of productivity, which at least for a time held down cost pressures.

I believe we at the Fed, to our credit, did gradually come to recognize the structural economic changes that we were living through and accordingly altered our understanding of the key parameters of the economic system and our policy stance. The central banks of other industrialized countries have grappled with many of the same issues.

But as we lived through it, there was much uncertainty about the evolving structure of the economy and about the influence of monetary policy. Despite those uncertainties, the trauma of the 1970's was still so vivid throughout the 1980's that preventing a return to accelerating prices was the unvarying focus of our efforts during those years.

In recognition of the lag in monetary policy's impact on economic activity, a preemptive response to the potential for building inflationary pressures was made an important feature of policy. As a consequence, this approach elevated forecasting to an even more prominent place in policy deliberations.

After an almost uninterrupted stint of easing from the summer of 1984 through the spring of 1987, the Fed again began to lean against increasing inflationary pressures, which were in part the indirect result of rapidly rising stock prices. We had recognized the risk of an adverse reaction in a stock market that had recently experienced a steep run-up—indeed, we actively engaged in contingency planning against that possibility.

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<sup>1</sup> I, nonetheless, wish to thank my colleagues David Stockton, David Wilcox, Don Kohn, Ben Bernanke, and John Taylor, for their many suggestions and reminiscences.

In the event, the crash in October 1987 was far more traumatic than any of the possible scenarios we had identified. Previous planning was only marginally useful in that episode. We operated essentially in a crisis mode, responding with an immediate and massive injection of liquidity to help stabilize highly volatile financial markets. However, most of our stabilization efforts were directed at keeping the payments system functioning and markets open. The concern over the possible fallout on economic activity from so sharp a stock price decline kept us easing into early 1988. But the economy weathered that shock reasonably well, and our easing extended perhaps longer than hindsight has indicated was necessary.

That period was followed by a preemptive tightening that brought the federal funds rate close to 10 percent by early 1989. In the summer of that year, we sensed enough softening of activity to warrant beginning a series of rate reductions. However, the weakening of demand already under way, some pullback of credit by lenders, and the spike in oil prices associated with Iraq's invasion of Kuwait were sufficient to produce a marked contraction of activity in the fall of 1990. But perhaps aided by our preemptive action, the recession was, to then, the mildest in postwar history.

However, the recovery also was more modest than usual, in large measure because of the notable financial "headwinds" that confronted businesses. Those headwinds were primarily generated by the constriction of credit in response to major losses at banks, associated with real-estate and foreign lending, coupled with a crisis in the savings and loan industry that had its origins in a serious maturity mismatch as interest rates rose. With their access to managed funds threatened and the quality of their loan portfolio (and hence their capital) uncertain, these depositories were most reluctant to lend.

Policy eased gradually but persistently to counter the effects of these developments, with the funds rate falling to 3 percent by September 1992, its lowest level since the early 1960's. The uptilt to the term structure of interest rates in a generally low-interest-rate environment restored bank profitability and, eventually, bank capital. The credit crunch slowly lifted.

By early 1994, as the headwinds of financial restraint abated, it became clear that underlying price pressures were again building. If we had

left those pressures unchecked, we would have put at risk some of the hard-won gains that had been achieved over the preceding decade and a half. So, starting from a real federal funds rate that was close to zero, a preemptive tightening was initiated. The resulting rise in the funds rate of 300 basis points over 12 months apparently defused those nascent inflationary pressures.

Though economic activity hesitated in early 1995, it soon steadied, confirming the achievement of a historically elusive soft landing. The success of that period set up two powerful expectations that were to influence developments over the subsequent decade. One was the expectation that inflation could be controlled over the business cycle and that price stability was an achievable objective. The second expectation, in part a consequence of more stable inflation, was that overall economic volatility had been reduced and would likely remain lower than it had previously.

Of course, these new developments brought new challenges. In particular, the prospect that a necessary cyclical adjustment was now behind us fostered increasing levels of optimism, which were manifested in a fall in bond risk spreads and a rise in stock prices. The associated decline in the cost of equity capital further spurred already developing increases in capital investment and productivity growth, both of which broadened impressively in the latter part of the 1990's.

The rise in structural productivity growth was not obvious in the official data on gross product per hour worked until later in the decade, but precursors had emerged earlier. The pickup in new bookings and order backlogs for high-tech capital goods in 1993 seemed incongruous given the sluggish economic environment at the time. Plant managers apparently were reacting to what they perceived to be elevated prospective rates of return on the newer technologies, a judgment that was confirmed as orders and profits continued to increase through 1994 and 1995. Moreover, even though hourly labor compensation and profit margins were rising, prices were being contained, implying increasing growth in output per hour.<sup>2</sup>

<sup>2</sup> That growth was showing through in gross income per hour. An increasingly negative statistical discrepancy was masking the rise in productivity as measured by the official

As a consequence of the improving trend in structural productivity growth that was apparent from 1995 forward, we at the Fed were able to be much more accommodative to the rise in economic growth than our past experiences would have deemed prudent. We were motivated, in part, by the view that the evident structural economic changes rendered suspect, at best, the prevailing notion in the early 1990's of an elevated and reasonably stable NAIRU (non-accelerating inflation rate of unemployment). Those views were reinforced as inflation continued to fall in the context of a declining unemployment rate that by 2000 had dipped below 4 percent in the United States for the first time in three decades.

Notions that prevailed for a time in the 1970's and early 1980's that even high single-digit inflation did not measurably impede economic growth were gradually abandoned as the evidence of significant benefits of low inflation became increasingly persuasive. Moreover, the variance of GDP growth markedly lessened as inflation tumbled from its double-digit high in the early 1980's. To preserve these benefits, we engaged in our most recent preemptive tightening in early 1999 that brought the funds rate to 6½ percent by May 2000.

Our goal of price stability was achieved by most analysts' definition by mid-2003. Unstinting and largely preemptive efforts over two decades had finally paid off. Throughout the period, a key objective has been to ensure that our response to incipient changes in inflation was forceful enough. As John Taylor has emphasized, in the face of an incipient increase in inflation, nominal interest rates must move up more than one-for-one.<sup>3</sup>

Perhaps the greatest irony of the past decade is that the gradually unfolding success against inflation may well have contributed to the stock

price bubble of the latter part of the 1990's.<sup>4</sup> Looking back on those years, it is evident that technology-driven increases in productivity growth imparted significant upward momentum to expectations of earnings growth and, accordingly, to stock prices.<sup>5</sup> At the same time, an environment of increasing macroeconomic stability reduced perceptions of risk. In any event, Fed policymakers were confronted with forces that none of us had previously encountered. Aside from the then-recent experience of Japan, only remote historical episodes gave us clues to the appropriate stance for policy under such conditions. The sharp rise in stock prices and their subsequent fall were, thus, an especial challenge to the Federal Reserve.

It is far from obvious that bubbles, even if identified early, can be preempted at lower cost than a substantial economic contraction and possible financial destabilization—the very outcomes we would be seeking to avoid. In fact, our experience over the past two decades suggests that a moderate monetary tightening that deflates stock prices without substantial effect on economic activity has often been associated with subsequent *increases* in the level of stock prices.<sup>6</sup> Arguably, markets that pass that type of

<sup>4</sup> It is notable, that in the United States, surges in price-earnings ratios, a presumed essential characteristic of an equity price bubble, are not observed with elevated inflation expectations.

<sup>5</sup> But, as the Federal Reserve indicated in congressional testimony in July 1999, "... productivity acceleration does not ensure that equity prices are not overextended. There can be little doubt that if the nation's productivity growth has stepped up, the level of profits and their future potential would be elevated. That prospect has supported higher stock prices. The danger is that, in these circumstances, an unwarranted, perhaps euphoric, extension of recent developments can drive equity prices to levels that are unsupported even if risks in the future become relatively small. Such straying above fundamentals could create problems for our economy when the inevitable adjustment occurs" (Greenspan, testimony before the Committee on Banking and Financial Services, U.S. House of Representatives, 22 July 1999).

<sup>6</sup> For example, stock prices rose following the completion of the more than 300-basis-point rise in the federal funds rate in the 12 months ending in February 1989. And during the year beginning in February 1994, when the Federal Reserve again raised the federal funds target 300 basis points, stock prices initially flattened. But as soon as that round of tightening was completed, prices resumed their marked upward advance. From mid-1999 through May 2000, the federal funds rate was raised 150 basis points. However, equity price increases were largely undeterred

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data that relied on gross product per hour. As I indicated in the fall of 1994, "we are observing ... [an] opening up of margins ... . But unit labor costs apparently have been so well contained by productivity gains at this stage that cost pressures have not flowed into final goods prices" (FOMC transcripts, 27 September 1994, p. 37).

<sup>3</sup> See, for example, "A Half-Century of Changes in Monetary Policy," John B. Taylor's remarks delivered at the conference in honor of Milton Friedman, 8 November 2002 (unpublished manuscript, U.S. Department of the Treasury, pp. 9–10).

stress test are presumed particularly resilient. The notion that a well-timed incremental tightening could have been calibrated to prevent the late-1990's bubble while preserving economic stability is almost surely an illusion.<sup>7</sup>

Instead of trying to contain a putative bubble by drastic actions with largely unpredictable consequences, we chose, as we noted in our mid-1999 congressional testimony, to focus on policies "to mitigate the fallout when it occurs and, hopefully, ease the transition to the next expansion."<sup>8</sup>

During 2001, in the aftermath of the bursting of the bubble and the acts of terrorism in September 2001, the federal funds rate was lowered 4¾ percentage points. Subsequently, another 75 basis points were pared, bringing the rate by

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during that period despite what now, in retrospect, was the exhausted tail of a bull market. Stock prices peaked in March 2000, but the market basically moved sideways until September of that year.

Such data suggest that nothing short of a sharp increase in short-term rates that engenders a significant economic retrenchment with all its attendant risks is sufficient to check a nascent bubble. Certainly, 300 basis points proved inadequate to even dent stock prices in 1994.

<sup>7</sup> Some have asserted that the Federal Reserve can deflate a stock price bubble, rather painlessly, by boosting margin requirements. The evidence suggests otherwise. First, the amount of margin debt is small, having never amounted to more than about 1¾ percent of the market value of equities; moreover, even this figure overstates the amount of margin debt used to purchase stock, as such debt also finances short sales of equity and transactions in non-equity securities. Second, investors need not rely on margin debt to take a leveraged position in equities. They can borrow from other sources to buy stock. Or, they can purchase options, which will affect stock prices given the linkages across markets.

Thus, not surprisingly, the preponderance of research suggests that changes in margins are not an effective tool for reducing stock-market volatility. It is possible that margin requirements inhibit very small investors whose access to other forms of credit is limited. If so, the only effect of increasing margin requirements is to price out of the market the very small investor without addressing the broader issue of stock price bubbles.

If a change in margin requirements were taken by investors as a signal that the central bank would soon tighten monetary policy enough to burst a bubble, then there might be the appearance of a causal effect. But it is the prospect of monetary policy action, not the margin increase, that should be viewed as the trigger. In a similar manner, history tells us that "jawboning" asset markets will be ineffective unless backed by action.

<sup>8</sup> Quoted from testimony before the Committee on Banking and Financial Services, U.S. House of Representatives, 22 July 1999.

June 2003 to its current 1 percent, the lowest level in 45 years. We were able to be unusually aggressive in the initial stages of the recession of 2001 because both inflation and inflation expectations were low and stable. We thought we needed to be, and could be, forceful in 2002 and 2003 as well because, with demand weak, inflation risks had become two-sided for the first time in 40 years.

There appears to be enough evidence, at least tentatively, to conclude that our strategy of addressing the bubble's consequences rather than the bubble itself has been successful. Despite the stock-market plunge, terrorist attacks, corporate scandals, and wars in Afghanistan and Iraq, we experienced an exceptionally mild recession—even milder than that of a decade earlier. As I discuss later, much of the ability of the U.S. economy to absorb these sequences of shocks resulted from notably improved structural flexibility. But highly aggressive monetary ease was doubtless also a significant contributor to stability.<sup>9</sup>

The Federal Reserve's experiences over the past two decades make it clear that uncertainty is not just a pervasive feature of the monetary policy landscape; it is the defining characteristic of that landscape. The term "uncertainty" is meant here to encompass both "Knightian uncertainty," in which the probability distribution of outcomes is unknown, and "risk," in which uncertainty of outcomes is delimited by a known probability distribution. In practice, one is never quite sure what type of uncertainty one is dealing with in real time, and it may be best

<sup>9</sup> Some have argued that, as a consequence of the 1995–2000 speculative episode, long-term imbalances remain, having been only partly addressed since early 2001, the peak of the post-bubble business cycle. For example, large residues of household and external debt are perceived as barriers to future growth. But in the past, imbalances that led to business contractions were rarely fully reversed before the subsequent economic upturn began. Presumably they were fully reversed in later periods, or they continued to fester, but not by enough to halt economic growth.

Even if imbalances persist in our current environment, the business decline that began in March 2001 came to an end in November of that year, according to the National Bureau of Economic Research. We experienced tepid recovery until the second half of last year, when GDP accelerated considerably. Hence, when the next recession arrives, as it inevitably will, it will be a stretch to attribute it to speculative imbalances of many years earlier.

to think of a continuum ranging from well-defined risks to the truly unknown.

As a consequence, the conduct of monetary policy in the United States has come to involve, at its core, crucial elements of risk management. This conceptual framework emphasizes understanding as much as possible the many sources of risk and uncertainty that policymakers face, quantifying those risks when possible, and assessing the costs associated with each of the risks. In essence, the risk-management approach to monetary policymaking is an application of Bayesian decision-making.

This framework also entails devising, in light of those risks, a strategy for policy directed at maximizing the probabilities of achieving over time our goals of price stability and the maximum sustainable economic growth that we associate with it. In designing strategies to meet our policy objectives, we have drawn on the work of analysts, both inside and outside the Fed, who over the past half century have devoted much effort to improving our understanding of the economy and its monetary transmission mechanism. A critical result has been the identification of a relatively small set of key relationships that, taken together, provide a useful approximation of our economy's dynamics. Such an approximation underlies the statistical models that we at the Federal Reserve employ to assess the likely influence of our policy decisions.

However, despite extensive efforts to capture and quantify what we perceive as the key macroeconomic relationships, our knowledge about many of the important linkages is far from complete and, in all likelihood, will always remain so. Every model, no matter how detailed or how well designed, conceptually and empirically, is a vastly simplified representation of the world that we experience with all its intricacies on a day-to-day basis.

Given our inevitably incomplete knowledge about key structural aspects of an ever-changing economy and the sometimes asymmetric costs or benefits of particular outcomes, a central bank needs to consider not only the most likely future path for the economy, but also the distribution of possible outcomes about that path. The decision-makers then need to reach a judgment about the probabilities, costs, and benefits of the various possible outcomes under alternative choices for policy.

A policy action that is calculated to be optimal based on a simulation of one particular model may not, in fact, be optimal once the full extent of the risks surrounding the most likely path is taken into account. In general, different policies will exhibit different degrees of robustness with respect to the true underlying structure of the economy.

For example, policy A might be judged as best advancing the policymakers' objectives, conditional on a particular model of the economy, but might also be seen as having relatively severe adverse consequences if the true structure of the economy turns out to be other than the one assumed. On the other hand, policy B might be somewhat less effective in advancing the policy objectives under the assumed baseline model but might be relatively benign in the event that the structure of the economy turns out to differ from the baseline. A year ago, these considerations inclined Federal Reserve policymakers toward an easier stance of policy aimed at limiting the risk of deflation even though baseline forecasts from most conventional models at that time did not project deflation; that is, we chose a policy that, in a world of perfect certainty, would have been judged to be too loose.

As this episode illustrates, policy practitioners operating under a risk-management paradigm may, at times, be led to undertake actions intended to provide insurance against especially adverse outcomes. Following the Russian debt default in the autumn of 1998, for example, the FOMC eased policy despite our perception that the economy was expanding at a satisfactory pace and that, even without a policy initiative, it was likely to continue doing so.<sup>10</sup> We eased policy because we were concerned about the low-probability risk that the default might trigger events that would severely disrupt domestic and international financial markets, with outsized adverse feedback to the performance of the U.S. economy.

The product of a low-probability event and a potentially severe outcome was judged a more serious threat to economic performance than the higher inflation that might ensue in the more probable scenario. That possibility of higher

<sup>10</sup> See minutes of the FOMC meeting of 29 September 1998.

inflation caused us little concern at the time, largely because increased productivity growth was resulting in only limited increases in unit labor costs and heightened competition, driven by globalization, was thwarting employers' ability to pass through those limited cost increases into prices. Given the potential consequences of the Russian default, the benefits of the unusual policy action were judged to outweigh its costs.

Such a cost-benefit analysis is an ongoing part of monetary-policy decision-making and causes us to tip more toward monetary ease when a contractionary event, such as the Russian default, seems especially likely or the costs associated with it seem especially high.

The 1998 liquidity crisis and the crises associated with the stock-market crash of 1987 and the terrorism of September 2001 prompted the type of massive ease that has been the historic mandate of a central bank. Such crises are precipitated by the efforts of market participants to convert illiquid assets into cash. When confronted with uncertainty, especially Knightian uncertainty, human beings invariably attempt to disengage from medium- to long-term commitments in favor of safety and liquidity. Because economies, of necessity, are net long (that is, have net real assets) attempts to flee these assets cause prices of equity assets to fall, in some cases dramatically. In the crisis that emerged in the autumn of 1998, pressures extended beyond equity markets. Credit-risk spreads widened materially, and investors put a particularly high value on liquidity, as evidenced by the extraordinarily wide yield gaps that emerged between on-the-run and off-the-run U.S. Treasuries.

The immediate response on the part of the central bank to such financial impositions must be to inject large quantities of liquidity—or, as Walter Bagehot (1873 p. 85) put it, describing such policies of the Bank of England more than a century ago, in a panic the Bank should lend at very high rates of interest “to all that bring good securities quickly, freely, and readily.” This was perhaps an early articulation of a crisis risk-management policy for a central bank.

The economic world in which we function is best described by a structure whose parameters are continuously changing. The channels of monetary policy, consequently, are changing in tandem. An ongoing challenge for the Federal Reserve—indeed, for any central bank—is to

operate in a way that does not depend on a fixed economic structure based on historically average coefficients. We often fit simple models only because we cannot estimate a continuously changing set of parameters without vastly more observations than are currently available to us. Moreover, we recognize that the simple linear functions underlying most of our econometric structures may not hold outside the range in which adequate economic observations exist. For example, it is difficult to have much confidence in the ability of models fit to the data of the moderate inflations of the postwar period to accurately predict what the behavior of the economy would be in an environment of aggregate price deflation.

In pursuing a risk-management approach to policy, we must confront the fact that only a limited number of risks can be quantified with any confidence. And even these risks are generally quantifiable only if we accept the assumption that the future will, at least in some important respects, resemble the past. Policymakers often have to act, or choose not to act, even though we may not fully understand the full range of possible outcomes, let alone each possible outcome's likelihood. As a result, risk management often involves significant judgment as we evaluate the risks of different events and the probability that our actions will alter those risks.

For such judgment, policymakers have needed to reach beyond models to broader, though less mathematically precise, hypotheses about how the world works. For example, inferences about how market participants and, hence, the economy might respond to a monetary policy initiative may need to be drawn from evidence about past behavior during a period only roughly comparable to the current situation.

Some critics have argued that such an approach to policy is too undisciplined—judgmental, seemingly discretionary, and difficult to explain. The Federal Reserve, they conclude, should attempt to be more formal in its operations by tying its actions solely, or in the weaker paradigm, largely, to the prescriptions of a simple policy rule. Indeed, rules that relate the setting of the federal funds rate to the deviations of output and inflation from their respective targets, in some configurations, do seem to capture the broad contours of what we

did over the past decade and a half. And the prescriptions of formal rules can, in fact, serve as helpful adjuncts to policy, as many of the proponents of these rules have suggested. But at crucial points, like those in our recent policy history (the stock market crash of 1987, the crises of 1997–1998, and the events that followed September 2001), simple rules will be inadequate as either descriptions or prescriptions for policy. Moreover, such rules suffer from much of the same fixed-coefficient difficulties we have with our large-scale models.

To be sure, sensible policy-making can be accomplished only with the aid of a rigorous analytic structure. A rule does provide a benchmark against which to assess emerging developments. However, any rule capable of encompassing every possible contingency would lose a key aspect of its attractiveness: simplicity. On the other hand, no *simple* rule could possibly describe the policy action to be taken in every contingency and thus provide a satisfactory substitute for an approach based on the principles of risk management.

As I indicated earlier, policy has worked off a risk-management paradigm in which the risk and cost–benefit analyses depend on forecasts of probabilities developed from large macro-models, numerous submodels, and judgments based on less mathematically precise regimens. Such judgments, by their nature, are based on bits and pieces of history that cannot formally be associated with an analysis of variance.

Yet, there is information in those bits and pieces. For example, while we have been unable to readily construct a variable that captures the apparent increased degree of flexibility in the United States or the global economy, there has been too much circumstantial evidence of this critically important trend to ignore its existence. Increased flexibility is a likely source of changing structural coefficients.

Our problem is not, as is sometimes alleged, the complexity of our policy-making process, but the far greater complexity of a world economy whose underlying linkages appear to be continuously evolving. Our response to that continuous evolution has been disciplined by the Bayesian type of decision-making in which we have engaged.

While all, no doubt, would prefer that it were otherwise, there is no way to dismiss what has to be obvious to every monetary policymaker.

The success of monetary policy depends importantly on the quality of forecasting. The ability to gauge risks implies some judgment about how current economic imbalances will ultimately play out.

Thus, both econometric and qualitative models need to be continually tested. The first signs that a relationship may have changed is usually the emergence of events that seem inconsistent with our hypotheses of the way the economic world is supposed to behave. The anomalous rise in high-tech capital-goods orders in 1993, to which I alluded earlier, is one such example. The credit crunch of the early 1990's is another.

The emergence of inflation-targeting in recent years is an interesting development in this regard. As practiced, it emphasizes forecasts, but within a more rule-like structure that skews monetary policy toward inflation containment as the primary goal. Indeed, its early applications were in high-inflation countries where discretionary monetary policy fell into disrepute.

Inflation-targeting often originated as a fairly simple structure concentrating solely on inflation outcomes, but it has evolved into more-discretionary forms requiring complex judgments for implementation. Indeed, this evolution has gone so far that the actual practice of monetary policy by inflation-targeting central banks now closely resembles the practice of those central banks, such as the European Central Bank, the Bank of Japan, and the Federal Reserve, that have not chosen to adopt that paradigm.

In practice, most central banks, at least those not bound by an exchange-rate peg, behave in roughly the same way. They seek price stability as their long-term goal and, accounting for the lag in monetary policy, calibrate the setting of the policy rate accordingly. Central banks generally appear to have embraced a common model of the channels through which monetary policy functions, although the specifics and emphasis given to those channels vary according to our particular circumstances. All banks ease when economic conditions ease and tighten when economic conditions tighten, even if in differing degrees, regardless of whether they are guided by formal or informal inflation targets.

As yet unresolved is whether the mere announcement that a central bank intends to engage in inflation-targeting increases the credibility of the central bank's inclination to



maintain price stability and, hence, assists in the anchoring of inflation expectations. The Bank of England's recent experiences may be encouraging in this regard. But, presumably, we will not know for sure the significance of formal inflation-targeting as a tool until the world economy is subjected to shocks of sufficient magnitude to assess the differential performance of those who do not employ formally announced inflation targets. To date, inflation has fallen for formal targeters, but it has fallen for others as well.

Under the rubric of risk management are a number of specific issues that we at the Fed had to address over the past decade and a half and that will likely resurface to confront future monetary policymakers. Most prominent is the appropriate role of asset prices in policy. In addition to the narrower issue of product price stability, asset prices will remain high on the research agenda of central banks for years to come. As the ratios of gross liabilities and gross assets to GDP continue to rise, owing to expanding domestic and international financial intermediation, the visibility of asset prices relative to product prices will itself rise. There is little dispute that the prices of stocks, bonds, homes, real estate, and exchange rates affect GDP. But most central banks have chosen, at least to date, to view asset prices not as targets of policy, but as economic variables to be considered through the prism of the policy's ultimate objective.

As the transcripts of FOMC meetings attest, making monetary policy is an especially humbling activity. In hindsight, the paths of inflation, real output, stock prices, and exchange rates may have seemed preordained, but no such insight existed as we experienced it at the time. In fact, uncertainty characterized virtually every meeting, and as the transcripts show, our ability to anticipate was limited. From time to time the FOMC made decisions, some to move and some not to move, that we came to regret.

Yet, during the last quarter century, policy-makers managed to defuse dangerous inflationary forces and dealt with the consequences of a stock-market crash, a large asset price bubble, and a series of liquidity crises. These events did not distract us from the pursuit and eventual achievement of price stability and the greater economic stability that goes with it.

As we confront the many unspecifiable dangers that lie ahead, the marked improvement in the degree of flexibility and resilience exhibited by our economy in recent years should afford us considerable comfort.<sup>11</sup> Assuming that it will persist, the trend toward increased flexibility implies that an ever-greater part of the resolution of economic imbalances will occur through the actions of business firms and households. Less will be required from the risk-laden initiatives of monetary policymakers.

Each generation of policymakers has had to grapple with a changing portfolio of problems. So while we eagerly draw on the experiences of our predecessors, we can be assured that we will confront different problems in the future. The innovative technologies that have helped us reap enormous efficiencies will doubtless present us with challenges that we cannot currently anticipate.

We were fortunate, as I pointed out in my opening remarks, to have worked in a particularly favorable structural and political environment. But we trust that monetary policy has meaningfully contributed to the impressive performance of our economy in recent decades.

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<sup>11</sup> See my testimony before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate, 11 February 2003.