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IN THIS ISSUE

We are moving from a quarterly, seasonal system to a numbered system for the *NBER Reporter,* with the eventual goal of producing six issues per year. This is the second issue of 2007 under the new numbering system: 2007 Number 2.

Monetary Economics

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The subject matter of monetary economics encompasses a large part of macroeconomics. Most obviously, monetary economics is concerned with the conduct, effects, institutions, and history of monetary policy. But it extends far beyond that. The sources of aggregate fluctuations, the channels through which changes in monetary policy and other developments are transmitted to the macroeconomy, and households' and firms' decisions about consumption, investment, prices, and other variables that are critical to aggregate fluctuations are all important subjects in monetary economics. Indeed, the unofficial working definition of "monetary economics" that is used by the NBER's Program in Monetary Economics is "anything that central bankers should be interested in." Examples of recent work in the program that is not explicitly about monetary policy but that falls squarely within the program's mandate include research by James H. Stock and Mark W. Watson on forecasting inflation (12324); research by Christopher House and Matthew D. Shapiro on the effects of temporary investment incentives (12514); research by Michael W. Elsby on downward wage rigidity (12611); research by Andrew Ang, Monika Piazzesi, and Min Wei on using interest rates to forecast GDP growth (10672); research by Francis E. Warnock and Veronica C. Warnock on the impact of purchases of U.S. government bonds by foreign central banks on U.S. interest rates (12560); and much more.

Researchers in the NBER's Program in Monetary Economics contribute to our understanding of monetary economics by conducting empirical and theoretical studies of a wide range of subjects within the

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broad field of monetary economics. These studies are issued as NBER Working Papers, and presented and discussed at regular meetings of the program and at special NBER conferences devoted to particular subjects related to monetary policy. The studies are subsequently published in NBER volumes and in academic journals.

Although the greatest long-run influence of the members of the Monetary Economics program is surely through their research, they also have a very tangible, immediate influence through an entirely different channel: former members of the program hold key positions at central banks throughout the world. Most obviously, former NBER Research Associate (and former Director of the Program in Monetary Economics) Ben S. Bernanke took office as the eighth Chair of the Board of Governors of the Federal Reserve System in February 2006. In addition, program member (on leave) Mervyn A. King is the Governor of the Bank of England; program member Stanley Fischer is the Governor of the Bank of Israel; program member (on leave) Janet Yellen serves as President of the Federal Reserve Bank of San Francisco; program member (on leave) Frederic S. Mishkin is a member of the Federal Reserve Board of Governors; program member Lars E.O. Svensson is a Deputy Governor of the Riksbank (Sweden's central bank); and program member David G. Blanchflower is a member of the Monetary Policy Committee of the Bank of England.

Program members also interact frequently with monetary policymakers. These interactions serve to keep program members abreast of developments in monetary policymaking, and to allow policymakers to convey to NBER researchers their views about what issues are currently important to them. Traditionally, one session at the program's meeting during the NBER's Summer Institute is devoted to a discussion with a policymaker. Policymakers who have met with the group in recent years include Ben Bernanke (both in 2003, when he was a member of the Board of Governors, and in 2007, was he was chair), Stanley Fischer, Donald Kohn (when he was a member of the Board of Governors; he is currently its vice-chair), N. Gregory Mankiw (when he was chair of the President's Council of Economic Advisers), and Janet Yellen.

In this report, we provide an overview of

some of the lines of research that have been pursued in the program in the past few years. As the previous discussion suggests, however, the work done in the program is so diverse that we can only discuss a small part of it.

The Zero Lower Bound on Nominal Interest Rates

When the central bank wants to stimulate the economy, its usual tool is an open-market purchase of government debt. By increasing the stock of high-powered money, the open-market purchase drives down nominal and real interest rates, and so increases consumption and investment.

Nominal interest rates, however, cannot be negative: since high-powered money has a nominal return of zero (that is, since the nominal value of a dollar next year will be a dollar), investors will never hold bonds with negative yields. Thus when the nominal interest rate on government debt reaches zero, one critical channel through which monetary policy can stimulate the economy is no longer present. Moreover, when the nominal interest rate is zero, government debt and high-powered money are perfect substitutes: both are non-interest-bearing assets issued by the government. In this situation, an open-market purchase is just an exchange of two assets that are perfect substitutes. Thus, there is reason to fear it will have no effects.

Until recently, the possibility of an economy finding itself in such a "liquidity trap" seemed to be only a historical and theoretical curiosity. Two developments, however, changed that perception. First, in Japan, short-term nominal interest rates were virtually zero for most of the period from 1999 until quite recently. Second, in the United States, the combination of very low inflation and a weak recovery caused the Federal Reserve to push the federal funds rate down to one percent in the summer of 2003 and raised the possibility that it might want to lower the funds rate further.

These developments led to a flurry of research by members of the Monetary Economics program. This work, led by Lars E. O. Svensson and Michael Woodford and their co-authors (10195, 9968), has established that monetary policy can continue to influence the economy when the nominal interest rate is at its zero lower bound. The key mechanism by which it can do so is by influencing expectations of *future* money supplies. Once the nominal interest rate is positive again, the money supply will certainly be able to affect output and inflation. Thus expectations today of higher money supplies once nominal interest rates are no longer zero will raise expected inflation, and so lower real interest rates and stimulate the economy. This research formalizes these insights, analyzes optimal policy in this setting, and addresses the critical issue of how the central bank can affect expectations.

Federal Reserve policy during the period of very low interest rates followed these prescriptions to a significant extent. In the summer of 2003, the Federal Reserve began for the first time to include explicit indications of its intentions about future policy in its policy statements. Starting in August, it stated that it expected that low interest rates could be "maintained for a considerable period." When it finally began to raise its target for the funds rate in June 2004, it said that it expected to do so "at a pace that is likely to be measured."

Research in the Monetary Economics program has studied many other aspects of the zero lower bound on nominal interest rates. The topics considered include means of managing expectations (for example, 10679, 11056); possibilities for using fiscal policy in this situation (for example, 9623, 10290, 10840, 11374); open economy considerations (for example, 12703); historical evidence about episodes of falling prices and very low nominal interest rates (for example, 3829, 9520, 10268, 10329, 10833); and detailed studies of Japan's experience (for example, 10818, 10878, 11151).

Optimal Monetary Policy

A half century ago, monetary policy was conducted almost completely in a "seat of the pants" manner. Policymakers had only a partially articulated view of their objectives and nothing close to an explicit statement of the weights they attached to the different objectives. They responded to developments on an ad hoc basis, moving from one episode to the next with a general sense of what they wanted to accomplish and of how they might achieve it, but without an explicit framework or anything approaching a rule for conducting policy.

Obviously, this is not how one would most like policy to be made. The ideal would be to have a central bank objective function that was based on the underlying objectives of the households in the economy, and to have a rule for monetary policy that was derived from this objective function and an accurate description of the structure of the economy.

Not surprisingly, our understanding remains well short of this objective. Nonetheless, there have been significant advances. Much of the work in this effort is technical and incremental, but it is making steady progress. To give just one example, many initial analyses of optimal policy in models built up from microeconomic foundations required the highly unrealistic assumption that the long-run equilibrium of the economy was close to the first best. Recent research by Monetary Economics program members Pierpaolo Benigno and Michael Woodford has relaxed this assumption, thus bringing the analysis one important step closer to reality (10838, 10839).

This general line of research has now progressed to the point where researchers in the program are actively exploring complete micro-founded models of optimal monetary policy. The models allow for substantive discussions of such issues as the welfare implications of different targeting rules, whether simple interest rate rules for monetary policy deliver desirable outcomes, and the importance

of forward-looking behavior by the central bank (see, for example, 9491, 9929, 11523, 11896, 12158, 12898).

Despite this remarkable progress, the models are still missing important elements. For example, their explanation of why inflation is undesirable bears little resemblance to the concerns expressed by policymakers, businesspeople, and the public, and the models often use assumptions about price-setting that have unrealistic implications for the dynamics of inflation. Thus, although the models provide valuable insights, they remain far from the point where one would want to use them as the basis of actual policymaking.

While the effort to construct reliable fully-founded analyses of optimal monetary policy continues, in the meantime many analyses of policy take shortcuts. For example, in the absence of a believable central bank objective function derived from first principles, an appealing alternative is to directly specify an objective function in terms of the behavior of aggregate variables. Similarly, it is often helpful to restrict one's attention to a specific class of possible rules for monetary policy (such as ones that make the interest rate a linear function of a small number of variables) rather than considering all possible monetary policies. Another powerful shortcut is to specify some relations among aggregate variables directly instead of attempting to derive them from microeconomic foundations. Program member Lars E. O. Svensson, for example, has used this type of shortcut-based approach to address the issues of how policymakers' subjective judgments can be incorporated into policymaking (9421, 11167). He shows that the fact that policymakers' usually have more information than can be explicitly incorporated into a rule for setting interest rates favors "targeting rules" over "instrument rules." That is, it favors specifying policy in terms of policymakers' expectations of the variables of ultimate interest, such as output and inflation, rather than in terms of an immediate instrument of monetary policy, such as a short-term interest rate. Similarly, this sort of non-fully-grounded approach is well suited to addressing such complicated issues as how the existence of low probability but extreme events should affect policymaking (10196), and the role of uncertainty about the true model in policymaking (9566, 10025, 11733).

The Effects of Monetary Policy

A classic question — perhaps *the* classic question — in monetary economics is how changes in monetary policy affect the economy. Recent research in the Monetary Economics program has extended work on this issue in several directions.

Research by Gary Richardson and William Troost (12591) provides striking new evidence about an old and hotly debated question within this general area: could Federal Reserve intervention have prevented bank failures during the Great Depression? There is general agreement that the massive fall in the money supply played a crucial role in the Depression, and that bank failures played an important role in that fall. In earlier work, Charles Calomiris and Joseph Mason argued, however, that the banks that failed did so not because they were the victims of panics that left them without liquidity, but rather because they were genuinely insolvent (4934, 7919). If so, then while general monetary expansion presumably would have mitigated the Depression, efforts by the Federal Reserve merely to provide short-run liquidity to distressed banks would have done little good.

Richardson and Troost's insight is that the different regional Federal Reserve banks had very different policies during this period. In particular, the Federal Reserve Bank of Atlanta acted aggressively to help banks facing panics, while the Federal Reserve Bank of St. Louis did little. In addition, largely by historical accident, one half of Mississippi is in the Atlanta Federal Reserve district and the other half is in the St. Louis district; and the two parts of the state (especially in the area near the border between the two districts) are very similar in other ways. Thus, comparing the performance of the banks in the two halves of the state provides an almost ideal experiment for determining the effects of Federal Reserve intervention on banks facing panics. Richardson and Troost find that in the critical early years of the Depression, there were dramatically fewer bank failures in the part of Mississippi in the Atlanta district than in the part in the St. Louis district. Thus, it appears that even in conditions as severe as those of the Depression, central bank intervention can greatly reduce the effects of banking panics.

A central problem in determining the effects of monetary policy on output and inflation is that monetary policymakers base their actions on an enormous amount of information. The Federal Reserve, for example, devotes vast resources to monitoring economic conditions and forecasting likely economic developments. If the Federal Reserve uses this information to successfully stabilize the economy, then an economist studying monetary policy would observe output and prices growing steadily in the face of frequent changes in monetary policy, and so might falsely conclude that policy actions have little effect. And because policymakers consider so much information, the straightforward strategy of simply controlling for the variables considered by policymakers is not even remotely possible.

Recent research in the ME program has proposed two novel ways of addressing this problem. Ben Bernanke, Jean Boivin, and Piotr Eliasz use factor analysis, a statistical procedure for identifying common movements in a large number of series. They summarize the information available to the Federal Reserve by considering a large number of time series and then using factor analysis to identify a small number of types of co-movement in the series. They find that this approach yields much more plausible estimates of the macroeconomic effects of changes in monetary policy than estimates that attempt to summarize the information available to the Federal Reserve by considering only a few series.

In our own research, we exploit the fact that the Federal Reserve staff summarizes its assessment of the implications of all the data it examines by constructing a macroeconomic forecast (9866). We therefore examine the behavior of output and inflation following changes in the Federal Reserve's target for the federal funds rate that differ from its normal response to its forecasts of output and inflation. Even more than Bernanke, Boivin, and Eliasz, we find that accounting for the information that goes into policy decisions has a large effect on estimates of the effects of changes in monetary policy, and leads to estimated effects that are faster and larger than previous estimates.

A related strand of research in the program investigates the effects of an important recent development in monetary policy. One major change in monetary policy over the past two decades has been the adoption of inflation targeting by many central banks. An obvious question is therefore whether inflation targeting has important effects on macroeconomic outcomes. This issue is being actively investigated (and debated) in the program. Research by Laurence M. Ball and Niamh Sheridan concludes that the main difference between inflation targeters and non-targeters is that the non-targeters started from worse situations, and that this difference (and not the adoption of targeting) accounts for the greater improvement in macroeconomic performance in these countries (9577). However, research by Antonio Fatás, Ilian Mihov, and Andrew K. Rose and by Frederic S. Mishkin and Klaus Schmidt-Hebbel, using somewhat different samples and approaches, finds a beneficial effect of inflation targeting (10846, 12876). Research on this issue continues.

Some other recent research on the effects of monetary policy exploits the fact that central banks usually make changes in monetary policy through discrete, readily observable actions. For example, the Federal Reserve typically keeps its target for the federal funds rate fixed for extended periods; when it changes the target, it announces the change. This feature of policy allows researchers to estimate the impact of unexpected monetary policy actions on interest rates, stock prices, and other financial market variables with considerable precision. NBER researchers have used this idea to address a variety of issues. For example, Linda S. Goldberg and Michael W. Klein show that over the first six years the European Central Bank was in operation, the response of interest rates and exchange rates to policy actions changed in a way that suggests that market participants were becoming increasingly convinced of the ECB's commitment to keeping inflation stable (11792).

To give another example, in research presented at a meeting of the Monetary Economics program, Refet Gürkaynak, Andrew Levin, and Eric Swanson use the response of financial market variables to discrete monetary policy actions and to other discrete macroeconomic developments (notably data releases) to provide evidence about whether explicit inflation targeting keeps long-term inflation expectations stable.[1] Specifically, they focus on the forecasts of inflation at long horizons implicit in nominal and inflation-indexed bonds of different maturities. They find that the implied inflation forecasts are responsive to news in economies without explicit inflation targets, such as the United States and the United Kingdom before 1997. In economies with inflation targeting, however, the implied forecasts are virtually impervious to news. Thus, their evidence suggests that an explicit inflation target helps anchor expectations of inflation in the long run.

Program researchers have investigated numerous other questions about the effects of monetary policy. Examples include differences in the effects of monetary policy in the United States over time (9459); the importance of credibility to the effects of monetary policy (11562); differences in the effects of monetary policy between the United States and Europe (9984, 9985); and the effects of changes in the Federal Reserve's implicit target rate of inflation (12492).

The Great Moderation

One striking feature of modern macroeconomies is that the business cycle has been dramatically tamed. In the United States, for example, there have been only two recessions — both of them mild — over the past 25 years; over the previous 35 years, in contrast, there were eight.

This "great moderation" of the economy has attracted considerable attention from researchers in monetary economics. Margaret McConnell and Gabriel Perez-Quiros carefully document the change in business cycle volatility for the United States, establish that it is almost certainly not a random statistical fluctuation, and show that the break occurred in the early 1980s.[2] James H. Stock and Mark W. Watson show that most — though not all — major industrialized countries have experienced similar changes (9859).

Several theories of this striking change have been proposed. One possibility is that it reflects structural changes in modern economies. McConnell and Perez-Quiros, for example, find that the moderation in overall output volatility is largely associated with changes in the behavior of inventory investment. They therefore argue that changes in inventory management technology are a likely candidate cause of the great moderation.

This conclusion is challenged, however, by a careful analysis of the U.S. automobile industry by Valerie A. Ramey and Daniel Vine (10384). They show that the automobile sector has experienced similar changes in volatility and in the behavior of inventory investment as the economy as a whole. They also find that in autos, where we have higher-quality and higher-frequency sales data than for the economy as a whole, there has been an important decline in the persistence of changes in sales. They then demonstrate that such a change in persistence would be likely to lead endogenously to a sharp change in the behavior of inventory investment of the type we have observed even without *any* changes in

inventory management technology. Intuitively, consider an auto manufacturer faced with a decline in sales. If the manufacturer expects the fall to be permanent, it will want to reduce its inventories to prevent its inventory-sales ratio from rising permanently. But if it expects the fall to be highly transitory, it is likely to want to temporarily increase its inventories to avoid the costs associated with quickly reducing production and then increasing it again. Thus, Ramey and Vine's analysis strongly suggests that changes in inventory management technology are not the underlying source of the moderation.

Another possibility is that the moderation is simply the result of good luck. The 1970s, for example, saw major, unprecedented disruptions of world oil markets. Stock and Watson are the most prominent advocates of the hypothesis that the great moderation stems largely from a decline in the size of the exogenous shocks impinging on the economy (9127, 9859). Estimating a variety of reduced-form and simple structural models, they find that the variance of shocks of all types has been smaller in recent decades, and that this decline is the main proximate source of the reduction in business cycle volatility.

This view, too, has been challenged. In research recently presented to the Monetary Economics program, Luca Benati and Paolo Surico construct an artificial economy in which a change in the way monetary policy is conducted manifests itself to a researcher as an apparent decline in the size of the non-policy shocks hitting the economy.[3] The importance of Benati and Surico's finding is not clear, however: one issue that was raised in the discussion of the paper when it was presented was the extent to which their result depends on special features of their example and to what extent it is generalizable.

A final possibility is that the stabilization is the result of improved policy. This hypothesis has obvious appeal. In our own work, we have found that monetary policymakers have been guided by a better understanding of the economy in recent decades and have largely avoided episodes where they first pursued expansionary policies that caused inflation to rise and then pursued extremely tight policies to bring inflation back down (6948, 9274). Unfortunately, researchers have had only limited success in finding persuasive ways of constructing formal statistical estimates of the contribution of improved policy to the great moderation. Active research on these issues is continuing, however (for example, 10973, 11147, 11777, 11946, 12022).

Concluding Remarks

In our view, what emerges from this discussion is a sense of the breadth and vibrancy of monetary economics. Researchers are addressing an extremely broad range of issues using a very wide range of approaches. This diversity is one of the great strengths of the Monetary Economics program. If it were possible to determine in advance which lines of research would bear fruit and which would prove unproductive, a narrowly focused research agenda would make sense. But since it is not possible, pursuing a multitude of different approaches is the best way to ensure that our understanding of monetary economics continues to advance.

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1 *R.Gürkaynak, A. Levin, and E. Swanson, "Does Inflation Targeting Anchor Long-Run Inflation Expectations? Evidence from Long-Term Bond Yields in the U.S., U.K., and Sweden," unpublished paper, Federal Reserve Board, October 2006. Presented at the Monetary Economics Program Meeting, November 4, 2005.*

2 *M. McConnell and G. Perez-Quiros, "Output Fluctuations in the United States: What Has Changed since the Early 1980s?"* American Economic Review *90 (December 2000), pp. 1464–76.*

3 *L. Benati and P. Surico, "VAR Analysis and the Great Moderation," unpublished paper, Bank of England, 2007. Presented at the Monetary Economics Summer Institute, July 9, 2007.*