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Structural Change and Monetary Policy

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This Economic Letter *summarizes the papers presented at the conference "Structural Change and Monetary Policy" held in San Francisco on March 3-4, 2000, under the joint sponsorship of the Federal Reserve Bank of San Francisco and Stanford University's Stanford Institute for Economic Policy Research.*

Pronouncements about the "new economy" in the U.S. are made with such frequency that they may soon become tiresome and trite. From an economist's perspective, however, the discussion about recent changes in the structure of the economy is just starting to get interesting, as enough data finally are becoming available to begin a reasoned debate about what is happening and why. Indeed, from an economist's point of view, almost all of the heavy lifting in terms of analysis and explanation regarding the new economy remains to be done.

The six papers presented at this conference provide some first steps in defining the recent changes in the U.S. economy and in describing the appropriate behavior of monetary policy in the face of such changes. The papers are listed at the end and are available–along with comments by discussants and the keynote speech by Federal Reserve Board Governor Laurence Meyer–at /economic-research/events/2000/march/structural-change-monetary-policy/

Two papers focus on documenting recent changes in the structure of the U.S. economy. One paper examines the apparent moderation in business cycles since the early 1980s. The authors find a distinct decline in the volatility of real output growth and provide some evidence to suggest that this change

reflects a behavioral adjustment on the part of durable goods producers to keep better control of their inventories. The other paper focuses on what is the most acclaimed attribute of the new economy: the remarkable rise in productivity growth since 1995. The authors show that both the growing use of information technology in businesses and the gains in the efficiency of producing computers and semiconductors have made substantial contributions to the recent surge in productivity growth. A separate panel discussion by Chad Jones and John Taylor, both of Stanford University, and Mark Watson, of Princeton University, also considers some of the recent changes in trend and cycle.

Three of the conference papers explore how monetary policy should operate during periods of structural change–particularly when the degree of this change is unknown. Thus, the key question investigated is how monetary policymakers should take into account uncertainty about potential output or the level of the natural rate of unemployment. One of these papers provides an interesting episodic analysis that is calibrated to the mid-1970s productivity slowdown and to the mid-1990s productivity speedup. The other papers provide a general theoretical analysis of optimal policy under data uncertainty. Governor Meyer's keynote speech focuses on how such research can be applied to the conduct of monetary policy on a practical level.

Finally, one paper examines the implications of structural change for the behavior of agents in the economy. It tries to elucidate how businesses and consumers may change their behavior in response to shifts in the policy regime.

Output fluctuations in the United States: what has changed since the early 1980s?

The McConnell and Perez Quiros paper analyzes quarterly movements in real output and its broad components since the early 1950s. The paper identifies a large and statistically significant decline in the volatility of U.S. real GDP growth that took place in the early 1980s. Indeed, the standard deviation of output fluctuations during the earlier period (1953-1983) is about twice as large as during the more recent one (1984-1999).

Of particular interest is the source of this decline in volatility. It may reflect good luck in the latter period (for example, fewer oil price shocks and other disturbances), or improved monetary policymaking (as suggested in Judd and Rudebusch 1998 and the conference panel discussion by John Taylor), or a structural change in the economy (say, a shift to a more stable service-oriented economy). Of course, a combination of these factors also may be at work. To shed some light on this issue, the authors disaggregate output into nondurable goods, durable goods, services, and structures, and find that shifts in the shares of these components–and particularly the growth in the importance of the service sector–do not appear able to explain the decline in volatility. Instead, the authors note that much of the decline in overall volatility can be attributed to smoother durable goods production. Furthermore, there is evidence of a change in the behavior of durable goods inventories but not durable goods sales. Thus, the authors suggest that a change in the management of durable goods inventories, perhaps including the just-in-time techniques and tight control made possible by computers, may have played an important role in the reduction in overall output volatility.

The resurgence of growth in the late 1990s: is information technology the story?

Since 1995, rapid growth in real output has been accompanied by an average annual increase in nonfarm business productivity of about 2-3/4 percent, which is nearly double the average pace over the preceding 25 years. The Oliner and Sichel paper adopts the standard neoclassical growth accounting framework to determine the source of this pickup in growth. In their version of this framework, the annual growth in output is attributed to increases in labor, information technology capital (including computer hardware, software, and communication equipment), other capital, and a residual component that measures general technological change.

Their results indicate that the contribution to productivity growth from the *use* of information technology

capital jumped in the second half of the 1990s, as U.S. firms invested heavily in the "high-tech" revolution. In addition, technological advances in the *production* of computers and semiconductors also appear to have made an important contribution. Overall, the authors estimate that these two factors accounted for about two-thirds of the recent jump in productivity growth.

Learning about a shift in trend output: implications for monetary policy and inflation

The Lansing paper considers the consequences of a shift in trend output for a monetary policy that is based at least in part on the difference between actual and trend output–the "output gap" which is used in the popular Taylor rule (Judd and Rudebusch 1998). Under such a policy, the productivity slowdown of the early 1970s may have contributed to the substantial rise in inflation in the latter part of that decade. This may have happened if monetary policymakers only gradually perceived the slowdown in productivity and trend output; thus, actual output appeared lower relative to trend than it actually was. Consequently, monetary policy might have been inappropriately loose, which would foster inflation.

The Lansing paper formalizes this intuition in a small forward-looking macroeconomic model where the Federal Reserve's regression-based perceived gap between actual and trend output is used as an input to the monetary policy rule in real time, while the true gap influences aggregate demand and inflation. The author calibrates two experiments to match the structural breaks in trend output in the 1970s and the 1990s. He finds that in this framework, errors in estimating potential output can account for some, but by no means all, of the historical long-term movements in U.S. inflation.

Indicator variables for monetary policy

A general guideline that economic analysis gives to policymakers is the principle of certainty equivalence, which states that optimal policy requires the same response when there is only partial information about the state of the economy as when there is full information (Walsh 2000). However, under partial information, the policymaker doesn't react in the same given fashion to the known value of, say, the output gap, but to the *best estimate of the unknown output gap*. Consequently, there is a separation between the selection of the optimal policy (the optimization problem) and the estimation of the current state of the economy (the signal extraction problem). Once the policymaker has obtained the best guess of the state of the economy, he or she can then set policy as if there were no uncertainty. In this case, more uncertainty does not lead to more cautious policy actions.

The Svensson-Woodford paper extends this result to the much more complicated case when some of the variables that the central bank reacts to depend on private-sector expectations of future developments in the economy. Examples of such forward-looking variables include exchange rates, bond rates, and inflation expectations. However, these forward-looking variables depend on an estimate of the current state of the economy, which in turn depends on an observation of the forward-looking variables. This circularity in the presence of forward-looking behavior greatly complicates both the optimization and signal extraction problems. However, this paper overcomes these problems and shows that the certainty-equivalence principle continues to hold in the case of a linear forward-looking model (with a standard loss function). Thus, even in a forward-looking setting, the authors note that the proper weight to be placed on an efficient estimate of the output gap is unaffected by the degree of uncertainty in that measure.

On signal extraction and non-certainty equivalence in optimal monetary policy rules

The Swanson paper explores some exceptions to the principle of certainty equivalence. One exception noted by Smets (1998) is that certainty equivalence fails to hold when policymakers can respond only to some of the important determining variables in the system. For example, the coefficients of the optimal Taylor rule–which responds only to the output gap and inflation–would depend on the amount of uncertainty about these variables. Another exception, explored by Rudebusch (1999, 2000) and the

Lansing paper cited above, relies on the fact that the real-time estimate of the output gap may not be a completely efficient estimate of the actual output gap. In this case, the optimal coefficient, say, on the output gap, also would depend on the amount of noise in the real-time output gap estimate. The Swanson paper generalizes this result and places it in an arguably more realistic setting. Namely, if the output gap is taken to be one of many indicators of a more general state of "inflationary pressures," then the weight to be placed on the output gap is also dependent on the accuracy of its measurement. In this case, more uncertainty calls for more timid policy actions.

Near-rationality and inflation in two monetary regimes

The Ball paper focuses on the very different behavior of U.S. inflation during two periods: 1879-1914 and 1960-1997. During the early period, when the U.S. had a gold standard before the founding of the Fed, inflation fluctuated around a constant level throughout the sample. In contrast, during the postwar period with discretionary monetary policy, the rate of inflation has shown large and persistent deviations from its average. This evidence suggests that the stochastic process generating inflation cannot always be viewed as independent of monetary policy, as is often assumed in economic modeling. The Ball paper proposes a near-rational model of expectations, in which agents make optimal *univariate* forecasts, in order to explain both episodes. In this model, the structural change embodied in the evolution of the monetary system is reflected in the behavior of the agents.

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Conference papers

Ball, Laurence. "Near-Rationality and Inflation in Two Monetary Regimes." Johns Hopkins University.

Lansing, Kevin. "Learning about a Shift in Trend Output: Implications for Monetary Policy and Inflation." Federal Reserve Bank of San Francisco.

McConnell, Margaret, and Gabriel Perez Quiros. "Output Fluctuations in the United States: What Has Changed since the Early 1980s?" Federal Reserve Bank of New York.

Oliner, Stephen, and Daniel Sichel. "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" Board of Governors of the Federal Reserve.

Svensson, Lars, and Michael Woodford. "Indicator Variables for Monetary Policy." Princeton University.

Swanson, Eric. "On Signal Extraction and Non-Certainty Equivalence in Optimal Monetary Policy Rules." Board of Governors of the Federal Reserve.

References

Judd, John P., and Glenn D. Rudebusch. 1998. "Taylor's Rule and the Fed: 1970-1997." Federal Reserve Bank of San Francisco *Economic Review* 3, pp. 3-16. http://www.sf.frb.org/economic-research/econrev/98-3/3-16.pdf

Rudebusch, Glenn D. 1999. "Is the Fed Too Timid? Monetary Policy in an Uncertain World." Federal Reserve Bank of San Francisco Working Paper 99-05. http://www.sf.frb.org/economic-research/workingp/wp99-05.pdf

Rudebusch, Glenn D. 2000. "Assessing Nominal Income Rules for Monetary Policy with Model and Data Uncertainty." Federal Reserve Bank of San Francisco Working Paper 2000-03. http://www.sf.frb.org/economic-research/workingp/2000/wpgr00-02.pdf

Smets, Frank. 1998. “Output Gap Uncertainty: Does It Matter for the Taylor Rule?” In *Monetary Policy under Uncertainty*, eds. B. Hunt and A. Orr, pp. 10-29. Wellington: Reserve Bank of New Zealand. http://www.rbnz.govt.nz/research/workshops/monpolsmet.pdf.

Walsh, Carl. 2000. “Uncertainty and Monetary Policy.” *FRBSF Economic Letter* 2000-08 (March 17). http://www.sf.frb.org/economic-research/wklyltr/2000/el2000-08.html.

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