

Monetary Policy Analysis

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The past several years have seen very rapid development in the area of monetary policy analysis.¹ A welcome aspect is the convergence of approaches used by academic and central-bank economists. For example, examination of a notable NBER conference volume² and/or a special issue of the Journal of Monetary Economics (Vol. 43, July 1999) suggests that it would be difficult, if not impossible, to identify the author of almost any article or comment as belonging to one group or the other. A major stimulus to this convergence, I believe, was John Taylor's exposition of the now-familiar "Taylor Rule,"³ which encouraged academics to focus on policy rules expressed in terms of interest-rate instruments (thereby conforming to actual central bank practices) and encouraged central bankers to think of policy in a more rule-like fashion.

Mainstream Analysis

Much of this recent work has utilized an approach that might be described as follows: the researcher specifies a quantitative macroeconomic model that is intended to be structural (invariant to policy changes) and consistent with both theory and evidence. Then, analytically or by stochastic simulations, he determines how crucial variables such as inflation and the output gap behave on average under various hypothesized policy rules. Normally, rational expectations is assumed throughout. Evaluation of the outcomes can be accomplished by reference to an explicit objective function or left to the judgement (i.e., implicit objective function) of the policymaker. Optimal control techniques may or may not be involved.

There is also considerable agreement about the general, broad structure of the macroeconomic model to be used—though much disagreement over details. For the simplest closed-economy analysis a three-equation system is often used, involving just

(1) an optimizing “IS” type of intertemporal spending relation, (2) a price adjustment relation, and (3) an interest rate policy rule of the general Taylor type. The basic logic of the analysis is not affected if (1) and (2) are sets of equations representing “sectors” of the model, rather than single equations. A major development over the past 10-15 years is the tendency of researchers to employ versions of (1) and (2) that are based on optimizing analysis of individual agents in a dynamic, stochastic setting. Often the price adjustment relation is based on the work of Calvo and Rotemberg, although there continues to be much dispute concerning the theoretical and empirical adequacy of this specification.⁴ Development of the optimizing or “expectational” IS relationship—basically a consumption Euler equation plus some substitutions—was effected more or less simultaneously by a number of independent analysts.⁵ My own paper with Edward Nelson, was not the first in print but is arguably the only one to explore the relationship of the new expectational specification with IS specifications of the traditional type.

Extensions and Differences

More generally, my recent work has in large measure conformed to the approach just outlined. Papers with Nelson appear in both the Taylor volume and the JME issue mentioned above,⁶ with the former representing a policy-rule exploration based on an estimated model that is highly orthodox in most respects. The latter paper features an extension, however, that makes the model applicable to a small open economy. Import demand is derived as part of the optimizing behavior of consumer-producer households, with imports being modelled as intermediate goods, used in the production of consumables, rather than as consumption goods in the manner favored in most of the “new open-economy macro” literature. In a subsequent paper, Nelson and I show that

this alternative formulation is helpful in matching some features of actual exchange rate behavior.⁷

A second way in which my work represents an extension of the basic model concerns the role of capital. Much of the literature treats the stock of productive capital as fixed or exogenous.⁸ A paper written with Miguel Casares endogenizes capital investment behavior and explores several issues.⁹ Some significant findings are that capital stock adjustment costs must be included to avoid highly unrealistic behavior (especially in sticky-price models); that adjustment-cost specifications need to penalize rapid changes more sharply than with the familiar quadratic cost specification; and that models with constant capital can provide reasonable approximations for purposes of monetary policy and business-cycle analysis.

A feature of the literature under discussion is that most models include no money-demand function and no variable reflecting quantities of any monetary aggregate. The usual optimizing analysis justifies this omission, however, only if the specification of the function for transaction costs (which are reduced by holdings of real money balances) is separable in money and the spending variable. Two recent papers of mine argue that such separability is implausible and conduct investigations of the magnitude of the implied misspecification.¹⁰ My quantitative analysis, based on calibrations intended to be realistic, indicates that the effects of this misspecification are very small.¹¹ Thus the usual omission of money is perhaps acceptable, although inappropriate in principle. (The first of these papers also shows how monetary policy can be effectively expansionary via an exchange rate channel even with the usual interest rate instrument immobilized by a “liquidity trap” at its zero lower bound.)

There are a few ways in which my work differs from much of the current research. One is in its emphasis on the difficulty of measuring the “output gap” variable that appears in price-adjustment and Taylor-rule equations, i.e., the percentage difference between current output and its “potential” or “natural-rate” value. Papers written with Nelson and I alone argue that ignorance of the reference value is not a matter of simple measurement error, but rather a conceptual uncertainty that is likely to be long-lasting.¹² In such circumstances, it is dangerous to respond strongly to measures of the output gap, as some analysts have recommended. Another difference is that monetary-base or exchange-rate instruments are occasionally employed, rather than the usual short-term interest rate.

A methodological paper argues strongly for the general approach to policy analysis outlined at the start of this report.¹³ It emphasizes that structural models are necessary for policy analysis and that so-called “structural VARs” do not qualify—their relationships are not designed to have the necessary policy invariance. More controversially, the paper argues that vector-autocorrelation functions, not impulse response functions, should be emphasized in model diagnostics (so as to avoid the need for highly questionable identification assumptions). A starting point for the discussion is that policy analysis needs to focus on the systematic portion of monetary policy, not policy “shocks,” since the latter account for a very small fraction of movements in interest rate instruments in actual economies.

Rational Expectations Indeterminacies

A substantial portion of my recent work has been devoted to the contention that one small but prominent strand of the recent literature is misguided. This strand features

rational expectations “indeterminacies” that occur under various conditions pertaining to policy-rule design. In several papers, I have emphasized that the aberrations in question reflect multiple (real) solutions of the “bubble” or “sunspot” type, not purely nominal indeterminacies of the sort discussed in the classic monetary writings of Lange, Gurley and Shaw, Johnson, and especially Patinkin.¹⁴ I argue that there are several reasons to believe that the multiple-solution indeterminacies represent mathematical curiosities that are of no relevance for actual policymaking. One reason featured in my most recent papers is that the solutions involving problematic results are not E-stable or (therefore) adaptively learnable, as explained in the extensive theoretical contributions of Evans and Honkapohja.¹⁵ By contrast, the unique minimum-state-variable solution (defined in several of my papers¹⁶) exists, is learnable, and is perfectly well-behaved in the analytical settings under discussion. Applications of this analysis pertain to the “fiscal theory of price level determination,” as well as warnings against monetary rules based on expected future inflation rates¹⁷ and suggestions of liquidity traps generated by global indeterminacy under Taylor rules.¹⁸ All of these warnings are, I suggest, spurious. My position on these indeterminacy issues is admittedly idiosyncratic, but could therefore be of greater value if correct.

¹ For useful reviews, see R. Clarida, J. Gali, and M. Gertler, “The Science of Monetary Policy: A New Keynesian Perspective,” *Journal of Economic Literature* 37 (December 1999), pp. 1661-1707; and M. Goodfriend and R.G. King, “The New Neoclassical Synthesis and the Role of Monetary Policy,” *NBER Macroeconomics Annual* 1997, pp. 231-283. A more historical perspective is taken in B.T. McCallum, *NBER Working Paper No. 7088*, April 1999, and *Journal of Economic Methodology* 6 (No. 2, 1999), pp. 171-198.

² J.B. Taylor, ed., *Monetary Policy Rules*, University of Chicago Press for NBER, 1999.

³ J.B. Taylor, “Discretion versus Policy Rules in Practice,” *Carnegie-Rochester Conference Series on Public Policy* 39 (December 1993), pp. 195-214.

⁴ This issue, and others involving model specification, is briefly discussed in B.T. McCallum, “Should Monetary Policy Respond Strongly to Output Gaps?” *NBER Working Paper* 8226, April 2001, and *American Economic Review* 91 (May 2001), pp. 258-262.

⁵ Notable publications include M. Woodford, “Price Level Determinacy Without Control of a Monetary Aggregate,” *Carnegie-Rochester Conference Series on Public Policy* 43 (December 1995), pp. 1-46; W.

Kerr and R. G. King, "Limits on Interest Rate Rules in the IS Model," *Federal Reserve Bank of Richmond Economic Quarterly* 82 (Spring 1996), pp. 47-75; and B.T. McCallum and E. Nelson, "An Optimizing IS-LM Specification for Monetary Policy and Business Cycle Analysis," NBER Working Paper No. 5875, January 1997, and *Journal of Money, Credit, and Banking* 31 (August 1999, pt. 2), pp. 296-316.

⁶ B.T. McCallum and E. Nelson, "Performance of Operational Policy Rules in an Estimated Semi-Classical Structural Model," NBER Working Paper No. 6599, June 1998, and J.B. Taylor, ed., *Monetary Policy Rules*, op. cit.; and B.T. McCallum and E. Nelson, "Nominal Income Targeting in an Open-Economy Optimizing Model," NBER Working Paper No. 6675, August 1998, and *Journal of Monetary Economics* 43 (June 1999), pp. 553-578.

⁷ B.T. McCallum and E. Nelson, "Monetary Policy for an Open Economy: An Alternative Framework with Optimizing Agents and Sticky Prices," NBER Working Paper 8175, March 2001, and *Oxford Review of Economic Policy* 16 (Winter 2000), pp. 74-91.

⁸ This practice is not universal, of course. Notable exceptions include R.G. King and A. Wolman, "Inflation Targeting in a St. Louis Model of the 21st Century," *Federal Reserve Bank of St. Louis Review* 78 (May/June 1996), pp. 83-107, (1996); and T. Yun, "Nominal Price Rigidity, Money Supply Endogeneity, and Business Cycles," *Journal of Monetary Economics* 37 (April 1996), pp. 345-370.

⁹ M. Casares and B.T. McCallum, "An Optimizing IS-LM Framework with Endogenous Investment," NBER Working Paper No. 7908, September 2000.

¹⁰ B.T. McCallum, "Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates," NBER Working Paper No. 7677, April 2000, and *Journal of Money, Credit, and Banking* 32 (November 2000, pt. 2), pp. 870-904; and B.T. McCallum, "Monetary Policy Analysis in Models Without Money," NBER Working Paper No. 8174, March 2001, and *Federal Reserve Bank of St. Louis Review* 83 (July/August 2001), pp. 145-160.

¹¹ This finding is consistent with the econometric analysis of P.N. Ireland, "Money's Role in the Monetary Business Cycle," NBER Working Paper No. 8115, February 2001.

¹² B.T. McCallum and E. Nelson, "Timeless Perspective vs. Discretionary Monetary Policy in Forward-Looking Models," NBER Working Paper No. 7915, September 2000; and B.T. McCallum, "Should Monetary Policy Respond Strongly to Output Gaps?" op. cit. Also relevant in this regard is A. Orphanides, "The Quest for Prosperity without Inflation," ECB Working Paper Series 2000-15, March 2000.

¹³ B.T. McCallum, "Analysis of the Monetary Transmission Mechanism," NBER Working Paper No. 7395, October 1999, and Deutsche Bundesbank, eds., *The Monetary Transmission Process: Recent Developments and Lessons for Europe*, Palgrave Publishers, 2001.

¹⁴ B.T. McCallum, "Issues in the Design of Monetary Policy Rules," NBER Working Paper No. 6016, April 1997, and J.B. Taylor and M. Woodford, eds., *Handbook of Macroeconomics*, North Holland 1999; B.T. McCallum, "Indeterminacy, Bubbles, and the Fiscal Theory of Price Level Determination," NBER Working Paper No. 6456, March 1998, and *Journal of Monetary Economics* 47 (February 2001), pp. 19-30; B.T. McCallum, "Monetary Policy Analysis in Models Without Money," op. cit.; and B.T. McCallum, "Inflation Targeting and the Liquidity Trap," NBER Working Paper No. 8225, April 2001. For references and a summary of the earlier literature see H.G. Johnson, "Monetary Theory and Policy," *American Economic Review* 52 (June 1962), pp. 325-384.

¹⁵ Most notable of many publications is G.W. Evans and S. Honkapohja, *Learning and Expectations in Macroeconomics*, Princeton University Press, 2001. Also see J. Bullard and K. Mitra, "Learning About Monetary Policy Rules," *Journal of Monetary Economics*, forthcoming.

¹⁶ B.T. McCallum, "Role of the Minimal State Variable Criterion in Rational Expectations Models," NBER Working Paper No. 7087, April 1999, and *International Tax and Public Finance* 6 (November 1999), pp. 621-639.

¹⁷ First noted by M. Woodford, "Nonstandard Indicators for Monetary Policy: Can Their Usefulness Be Judged from Forecasting Regressions?" N.G. Mankiw, ed., *Monetary Policy*, University of Chicago Press for NBER, 1994.

¹⁸ E.g., J. Benhabib, S. Schmitt-Grohe, and M. Uribe, "The Perils of Taylor Rules," *Journal of Economic Theory* 96 (January 2001), pp. 40-69.