VIII Extensions of the Core Model

This section describes a number of extensions of the standard version of MULTIMOD Mark III and discusses their applications. The objective is to provide a flavor of the ease with which the model can be modified to analyze specific issues of topical interest. The virtue of keeping the core model simple and transparent in order to facilitate various modifications becomes apparent.

The extensions of the model can be divided into two broad and interrelated categories. The first category relates to the construction of specific models for individual countries or country groups that, in the core version of MULTIMOD, are aggregated with other countries or country groups. These models can be used to analyze the effects of employing parameters or incorporating macroeconomic features that are specific to a particular country (or group of countries), or to analyze the effects of shocks that impinge on a particular country. The second category involves modifications of the structure of the model in order to analyze broader macroeconomic policy issues.

Extensions of Country Coverage

As noted in earlier sections, small industrial countries are aggregated into a single block in the core version of MULTIMOD. It is, however, quite straightforward to construct a model for a specific small industrial economy under the maintained assumption that the macroeconomic structure of these economies is similar to that of larger industrial economies. Certain aspects do, however, need to be considered carefully for each country. The degree of openness to international trade needs to be accounted for properly in order to capture the dynamics of foreign trade and external debt variables, both of which are typically crucial for economic activity in these countries. Since the effects of domestic policy actions on external sector variables could have important implications for domestic price and activity variables, these relationships should ideally be estimated individually for the country under consideration. Other variables, such as the capital-output ratio, should also be calibrated based on country-specific estimates.

The parameterization of a model of a small country can easily accommodate country-specific estimates of the main model parameters. For certain parameters, however, country-specific estimates may be imprecise, and pooled estimates from multicountry estimation might be preferred. This decision is left to the judgment of the modeler. Alternative specifications of certain equations can also be accommodated, although care should be taken to ensure that the accounting identities in the model are respected.

The operational procedure for building a small industrial country model is very straightforward—Box 10 provides a summary of the steps that are necessary to add an individual country model. To extract a

Box 10. Steps Necessary to Integrate Additional Industrial Countries

- Develop a database from various sources, including the *World Economic Outlook* and OECD analytical databases, and develop a new trade matrix for the country disaggregation that is being chosen.
- Modify the program that creates the equations for the dynamic and steady-state models.
- Update the estimation programs and include the additional country codes to obtain estimates of the behavioral parameters for the added countries. If the parameter estimates are judged to be nonsensical—which is sometimes the case with small data samples, regime changes, and so on—impose pooled estimates or values obtained from other countries that have similar structures.
- Develop a baseline that includes history, the *World Economic Outlook* projection, and convergence to a steady-state balanced growth path.
- Modify the reporting system that generates standard MULTIMOD graphs and tables.
- Run standard tests to check the consistency of the dynamic and steady-state models.
- Run standard shocks on the individual country models as well as the full model.

country from the bloc of small industrial countries and create a separate model for it, the first step would be to subtract from the bloc the macroeconomic aggregates related to this country. For instance, real GDP in the bloc of small industrial countries would be redefined by subtracting out the real GDP of this country. Next, the trade variables would have to be redefined in a manner that ensured consistency in the world trade matrix, and the appropriate weights for constructing the country's real competitiveness index and real effective exchange rate would have to be computed. Finally, the model code for the large industrial economies would then be replicated for the small industrial country, employing country-specific or average parameters for the small industrial countries as appropriate. Thus, at the end of this process, the enhanced version of MULTIMOD would have a similar structure as the original model, but with one additional country.

In most contexts, it is relatively easy to justify the assumption that small countries have negligible effects on other economies or, more generally, on the rest of the world. The computational complexities of the model are reduced substantially in this case because the model of the small country can then be simulated in isolation without allowing for feedback effects on the rest of the world, that is, by keeping conditions in the other country blocks constant.

An interesting example of recent work in this direction is that of Laxton and Prasad (1997), who construct a model of the Swiss economy in order to examine the possible short-term consequences of European Economic and Monetary Union for Switzerland. A number of enhancements to the core model were required for this analysis. For instance, with official short-term nominal interest rates in 1997 at less than 100 basis points, the potency of monetary policy was severely constrained. To capture the effects of the nominal interest floor at zero percent, a nonlinear money demand specification for Switzerland was estimated and adopted in this analysis. The interactions between this nonlinearity and the convexity of the Phillips curve turn out to have interesting policy implications.

There is, of course, no technical limitation on the number of small country models that can be inserted into the core model, although care needs to be exercised about modeling the interactions among these economies. One example of such an exercise is provided by Masson and Turtelboom (1997). These authors create country-specific models for each of the 15 countries of the European Union (except for Luxembourg, which is modeled jointly with Belgium) and then perform stochastic simulations of the model in order to examine the relative variability of macroeconomic variables under different assumptions about monetary arrangements within this group of countries.

Work has also commenced on separating a group of emerging market economies from the main developing country model. In the analysis for the December 1997 *World Economic Outlook*, an emerging market bloc was created, with a model structure analogous to that for industrial countries, in order to examine the global effects of a cutback in net capital flows to the emerging markets.

Other Modifications

The extensions discussed above have focused on modifying MULTIMOD to tackle issues that are best addressed with a different set of country groups than those contained in the core Mark III version. In other applications, the basic structure of MULTIMOD has been modified, without extending the country coverage, to enhance the analysis of various policy issues. The examples discussed below illustrate that the model is flexible enough to incorporate advances in economic theory that relate to key elements of the model's structure. Analyzing the implications of different policy scenarios when such features are included in the model can often be quite revealing.

Fiscal Consolidation

The core version of MULTIMOD can be used to examine the effects of fiscal restructuring and to compare the macroeconomic effects of changes in alternative fiscal instruments. Revenue and expenditure measures that have similar effects on the fiscal balance could have markedly different macroeconomic effects, both in the short run and in the long run. Further, the potentially larger distortionary effects of direct taxes compared with indirect taxes suggest that the composition of revenue measures could also be important. Similarly, reductions in government investment could have very different effects on long-term growth than reductions in current government expenditures.

MULTIMOD can be modified quite easily to focus on these issues. For instance, Bartolini, Razin, and Symansky (1995) incorporate an extended set of fiscal instruments in MULTIMOD to examine differences in the effects of the composition of fiscal consolidation measures in the seven major industrial countries. By introducing distortionary effects of taxation, they are able to demonstrate clear differences in the short-run and long-run output and welfare effects of expenditure reductions, increases in indirect taxes, and increases in taxes on factor income.

Another important consideration when examining the effects of fiscal consolidation is the degree of credibility associated with such a consolidation effort. The forward-looking behavior of economic

agents that is captured in MULTIMOD is clearly crucial for such an exercise. Bayoumi and Laxton (1994) use MULTIMOD to analyze the effects of debt reduction in Canada under different credibility scenarios. Their simulations underscore the importance of credibility as well as coordination between the fiscal and monetary authorities. This points to another strength of MULTIMOD—the ability to analyze the joint effects of different policy instruments on macroeconomic variables.

Endogenous Productivity Growth

One of the main developments in the economic growth literature in recent years has been the theory of endogenous growth (see, for example, Lucas, 1988 and Romer, 1990). Bayoumi, Coe, and Helpman (1996) extend MULTIMOD in this direction by allowing for externalities in the form of international spillovers of research and development (R&D) expenditures on total factor productivity growth. The role of international trade in facilitating these spillover effects and the interplay between R&D spending and capital investment are highlighted in their simulations, which also provide quantitative estimates of the effects of country-specific R&D spending on output growth in the global economy.[124]

[124]The Mark III version of MULTIMOD has also been extended to allow for endogenous total factor productivity—see Bayoumi, Coe, and Laxton (1998).

This example illustrates how recent developments in economic theory can be embedded in MULTIMOD. The model enables researchers to carefully analyze the quantitative importance of the overall effects of factors such as R&D spillovers, as well as the channels through which these effects permeate.

Military Expenditures

Another extension that highlights the usefulness of MULTIMOD in providing quantitative answers to interesting policy questions is provided by Bayoumi, Hewitt, and Schiff (1993). These authors explore the macroeconomic effects of a reduction in world military expenditures and show that, in the long run, the welfare effects of reductions in military spending can be quite large. In a related paper, Bayoumi, Hewitt, and Symansky (1995) show that these welfare gains can be even larger for developing countries and, by disaggregating these countries into four geographic groups, provide estimates of how much each of these groups of countries stands to gain from reductions in military expenditures.

In addition to the examples discussed above, numerous other extensions of MULTIMOD have been used in recent years to address a broad class of policy-related issues. Notwithstanding the substantial recent improvements incorporated into the core Mark III model, the sophisticated yet transparent and versatile structure of MULTIMOD remains one of its main virtues.

References

Adams, Charles, and David T. Coe, 1990, "A Systems Approach to Estimating the Natural Rate of Unemployment and Potential Output for the United States," *Staff Papers*, International Monetary Fund, Vol. 37 (June), pp. 232–93.

Akerlof, George, William Dickens, and George Perry, 1996, "The Macroeconomics of Low Inflation," *Brookings Papers on Economic Activity: 1*, Brookings Institution, pp. 1–76.

Armstrong, J., R. Black, D. Laxton, and D. Rose, "A Robust Method for Simulating Forward-Looking Models," *Journal of Economic Dynamics and Control*, forthcoming.

Attanasio, O.P., and G. Weber, 1993, "Consumption Growth, the Interest Rate, and Aggregation," *Review of Economic Studies*, Vol. 60 (July), pp. 631–99.

Australia, Commonwealth Treasury, 1996, Documentation of the Treasury Macroeconomic (TRYM) Model of the Australian Economy (Canberra, Australia: Commonwealth Treasury).

Ball, Laurence M., and Gregory Mankiw, 1994, "A Sticky-Price Manifesto," NBER Working Paper No. 4677 (Cambridge, Massachusetts: National Bureau of Economic Research).

Barr, David G., and John Y. Campbell, 1996, "Inflation, Real Interest Rates, and the Bond Market: A Study of UK Nominal and Index-Linked Government Bond Prices," NBER Working Paper No. 5821 (Cambridge, Massachusetts: National Bureau of Economic Research).

Barro, R.J., 1974, "Are Government Bonds Net Wealth?" *Journal of Political Economy*, Vol. 82 (November/December), pp. 1095–117.

———, 1989, "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives*, Vol. 3 (Spring), pp. 37–54.

Bartolini, Leonardo, Asaf Razin, and Steven Symansky, 1995, "G-7 Fiscal Restructuring in the 1990s: Macroeconomic Effects," *Economic Policy*, Vol. 20 (April), pp. 111–46.

Bayoumi, Tamim, David T. Coe, and Douglas Laxton, 1998, "Liberating Supply: Technological Innovation in a Multicountry Econometric Model" (unpublished; Washington: International Monetary Fund).

Bayoumi, Tamim, David T. Coe, and Elhanan Helpman, 1996, "R&D Spillovers and Global Growth," IMF Working Paper 96/47 (Washington: International Monetary Fund).

Bayoumi, Tamim, Daniel Hewitt, and Steven Symansky, 1995, "MULTIMOD Simulations of the Effects on Developing Countries of Decreasing Military Spending," in *North-South Linkages and International Macroeconomic Policy*, ed. by David Vines and David Currie (Cambridge; New York: Cambridge University Press).

Bayoumi, Tamim, and Douglas Laxton, 1994, "Government Deficits, Debt, and the Business Cycle," in *Deficit Reduction—What Pain, What Gain?* ed. by William B.P. Robson and William M. Scarth (Toronto: C.D. Howe Institute).

Bayoumi, Tamim, Daniel Hewitt, and Jerald Schiff, 1993, "Economic Consequences of Lower Military Spending: Some Simulation Results," IMF Working Paper 93/17 (Washington: International Monetary Fund, March).

Bean, Charles, 1996, "The Convex Phillips Curve and Macroeconomic Policymaking Under Uncertainty" (unpublished; London: HM Treasury).

Bernheim, B.D., 1989, "A Neoclassical Perspective on Budget Deficits," *Journal of Economic Perspectives*, Vol. 3 (Spring), pp. 55–72.

———, and K. Bagwell, 1988, "Is Everything Neutral?" *Journal of Political Economy*, Vol. 96 (April), pp. 308–38.

Bertola, Giuseppe, 1988, "Adjustment Costs and Dynamic Factor Demands: Investment and Employment Under Uncertainty" (Ph.D. dissertation; Cambridge, Massachusetts: Massachusetts Institute of Technology).

———, and Ricardo J. Caballero, 1990, "Kinked Adjustment Costs and Aggregate Dynamics," in *NBER Macroeconomics Annual*, ed. by Olivier Blanchard and Stanley Fischer (Cambridge, Massachusetts: MIT Press).

Black, Richard, V. Cassino, A. Drew, E. Hansen, B. Hunt, D. Rose, and A. Scott, 1997, "The Forecasting and Policy System: The Core Model," Research Paper No. 43 (Wellington, New Zealand: Reserve Bank of New Zealand).

Black, Richard, D. Laxton, D. Rose, and R. Tetlow, 1994, "The Steady-State Model: SSQPM," *The Bank of Canada's New Quarterly Projection Model*, Bank of Canada Technical Report No. 72, Part 1.

Blanchard, Olivier J., 1985, "Debt, Deficits and Finite Horizons," *Journal of Political Economy*, Vol. 93 (April), pp. 223–47.

———, and Stanley Fischer, 1989, *Lectures on Macroeconomics* (Cambridge, Massachusetts: MIT Press).

Blanchard, Olivier J., and D. Quah, 1989, "The Dynamic Effects of Aggregate Supply and Demand Disturbances," *American Economic Review,* Vol. 79 (September), pp. 655–73.

Blanchard, Olivier J., and Lawrence F. Katz, 1997, "What We Know and Do Not Know About the Natural Rate of Unemployment," in *Journal of Economic Perspectives,* Vol. 11 (Winter), pp. 51–72.

Blanchard, Olivier J., and Lawrence Summers, 1986, "Hysteresis and the European Unemployment Problem," in *NBER Macroeconomics Annual,* ed. by S. Fischer (Cambridge, Massachusetts; London, United Kingdom: MIT Press).

Bond, Stephen, and Costas Meghir, 1994, "Dynamic Investment Models and the Firm's Financial Policy," *Review of Economic Studies,* Vol. 61 (April), pp. 197–222.

Bos, Eduard, My T. Vu, Earnest Massiah, and Rudolfo A. Bulatao, 1994, *World Population Projections, 1994–95 Edition* (Baltimore, Maryland: Published for the World Bank by the Johns Hopkins University Press).

Boucekkine, R., 1995, "An Alternative Methodology for Solving Nonlinear Forward-Looking Models," in *Journal of Economic Dynamics and Control,* Vol. 19, No. 4, pp. 711–34.

Bryant, Ralph, 1996, "Alternative Rules for Monetary Policy and Fiscal Policy in New Zealand: A Preliminary Assessment of Stabilization Properties," Brookings Discussion Papers in International Economics, No. 127 (July).

———, and Long Zhang, 1996a, "Intertemporal Fiscal Policy in Macroeconomic Models: Introduction and Major Alternatives," Brookings Discussion Papers in International Economics, No. 123 (June).

———, 1996b, "Alternative Specifications of Intertemporal Fiscal Policy in a Small Theoretical Model," Brookings Discussion Papers in International Economics, No. 124 (June).

Bryant, R., P. Hooper, and C. Mann, eds., 1993, *Evaluating Policy Regimes: New Research in Empirical Macroeconomics* (Washington: Brookings Institution).

Buiter, Willem H., 1988, "Death, Birth, Productivity Growth and Debt Neutrality," *Economic Journal,* Vol. 98 (June), pp. 279–93.

———, and Marcus Miller, 1985, "Costs and Benefits of an Anti-Inflationary Policy: Questions and Issues," in *Inflation and Unemployment: Theory, Experience and Policy-Making,* ed. by V. Argy and J. Nevile (London: George Allen & Unwin).

Callen, Tim, and Doug Laxton, 1998, "A Small Macro Model of the Australian Inflation Process with Endogenous Policy Credibility" (unpublished; Washington: International Monetary Fund).

Calvo, Guillermo A., 1983, "Staggered Prices in a Utility-Maximizing Framework," *Journal of Monetary Economics,* Vol. 12 (September), pp. 383–98.

Chadha, Bankim, Paul Masson, and Guy Meredith, 1992, "Models of Inflation and the Costs of Disinflation," *Staff Papers,* International Monetary Fund, Vol. 39 (June), pp. 395–431.

Clark, Peter B., and Douglas Laxton, 1997, "Phillips Curves, Phillips Lines and the Unemployment Costs of Overheating," IMF Working Paper 97/17 (Washington: International Monetary Fund).

———, and Rose, 1996, "Asymmetry in the U.S. Output-Inflation Nexus," *Staff Papers,* International Monetary Fund, Vol. 43 (March), pp. 216–51.

———, 1995, "Capacity Constraints, Inflation, and the Transmission Mechanism: Forward-Looking Versus Myopic Policy Rules," IMF Working Paper 95/75 (Washington: International Monetary Fund).

Coletti, D., B. Hunt, David Rose, and Robert Tetlow, 1996, "The Dynamic Model: QPM," in *The Bank of Canada's New Quarterly Projection Model,* Part 3, Technical Report No. 75 (Ottawa: Bank of Canada).

Cummins, Jason, Kevin Hassett, and Stephen Oliner, 1997, "Investment Behavior, Observable Expectations, and Internal Funds" (unpublished; New York: New York University).

Debelle, Guy, and Douglas Laxton, 1997, "Is the Phillips Curve Really a Curve? Some Evidence for Canada, the United Kingdom, and the United States," *Staff Papers,* International Monetary Fund, Vol. 44 (June), pp. 249–82.

Debelle, Guy, and James Vickery, 1997, "Is the Phillips Curve a Curve? Some Evidence and Implications for Australia" (unpublished; Sydney, Australia: Reserve Bank of Australia, Economic Research Department).

De Long, J.B., 1996, "America's Only Peacetime Inflation: The 1970s," NBER Historical Working Paper No. 084 (Cambridge, Massachusetts: National Bureau of Economic Research).

———, and L.H. Summers, 1988, "How Does Macroeconomic Policy Affect Output?" *Brookings Papers on Economic Activity*: *2,* Brookings Institution, pp. 433–80.

Diamond, Peter A., 1965, "National Debt in a Neoclassical Growth Model," *American Economic Review,* Vol. 55 (December), pp. 1126–50.

Dixit, A., and R.S. Pindyck, 1994, *Investment Under Uncertainty* (Princeton, N.J.: Princeton University Press).

Duesenberry, James, and others, eds., 1965, *The Brookings Quarterly Econometric Model of the United States* (Chicago: Rand McNally).

Dupasquier, C., and N. Ricketts, 1997, "Non-linearities in the Output-Inflation Relationship," paper presented at the Bank of Canada Conference on Price Stability, Inflation Targets and Monetary Policy.

Eberly, Janice, 1997, "International Evidence on Investment and Fundamentals," *European Economic Review,* Vol. 41 (June), pp. 1055–78.

Edison, H.J., J.R. Marquez, and R.W. Tryon, 1987, "The Structure and Properties of the Federal Reserve Board Multicountry Model," *Economic Modelling,* Vol. 4 (April), pp. 115–315.

Epstein, Larry G., and Michael G. Denny, 1983, "The Multivariate Flexible Accelerator Model: Its Empirical Restrictions and an Application to U.S. Manufacturing," *Econometrica,* Vol. 51 (May), pp. 647–74.

Ericsson, Neil, and John Irons, 1995, "The Lucas Critique in Practice: Theory Without Evidence," in *Macroeco-*

nomics: Developments, Tensions, and Prospects, ed. by K. Hoover (Boston: Kluwer Academic).

Evans, Martin, and Paul Wachtel, 1993, "Inflation Regimes and the Sources of Inflation Uncertainty," *Journal of Money, Credit and Banking*, Vol. 25 (August), pp. 475–511.

Evans, Paul, 1991, "Is Ricardian Equivalence a Good Approximation?" *Economic Inquiry*, Vol. 29 (October), pp. 624–44.

Fair, Ray, and John Taylor, 1983, "Solution and Maximum Likelihood Estimation of Dynamic Nonlinear Rational Expectations Models," *Econometrica*, Vol. 51 (July), pp. 1169–85.

Faruqee, Hamid, Douglas Laxton, and David Rose, 1998, "Inflation and Unemployment in Europe and North America: Asymmetry Versus Hysteresis" (unpublished; Washington: International Monetary Fund).

Faruqee, Hamid, Douglas Laxton, and Steve Symansky, 1997, "Government Debt, Life-Cycle Income and Liquidity Constraints: Beyond Approximate Ricardian Equivalence," *Staff Papers*, International Monetary Fund, Vol. 44 (September), pp. 374–82.

Fisher, P.G., L. Mahadeva, and J.D. Whitley, 1996, "The Output Gap and Inflation-Experience at The Bank of England," paper presented at a meeting of BIS Model Builders, November.

Fischer, Stanley, 1977, "Long-term Contracts, Rational Expectations, and the Optimal Money Supply Rule," *Journal of Political Economy*, Vol. 85 (February), pp. 191–205.

———, 1994, "Modern Central Banking," in *The Future of Central Banking*, ed. by F. Capie and others (Cambridge, United Kingdom; New York, N.Y.: Cambridge University Press).

Ford, Robert, and Douglas Laxton, 1995, "World Public Debt and Real Interest Rates," IMF Working Paper 95/30 (Washington: International Monetary Fund).

Ford, Robert, and David Rose, 1989, "Estimates of the NAIRU Using an Extended Okun's Law," Working Paper No. 89–3 (Ottawa: Bank of Canada).

Friedman, Milton, 1968, "The Role of Monetary Policy," *American Economic Review*, Vol. 58 (March), pp. 1–17.

Fuhrer, Jeffrey C., and George R. Moore, 1995, "Monetary Policy Trade-Offs and the Correlation Between Nominal Interest Rates and Real Output," *American Economic Review*, Vol. 85 (March), pp. 219–39.

Gagnon, Joseph E., 1991, "A Forward-Looking Multicountry Model for Policy Analysis: MX3," *Economic and Financial Computing*, Vol. 1 (Winter), pp. 311–61.

———, 1996, "Long Memory in Inflation Expectations: Evidence from International Financial Markets," International Finance Discussion Paper No. 538 (Washington: United States Board of Governors of the Federal Reserve, International Finance Division).

Goodfriend, Marvin, 1993, "Interest Rate Policy and the Inflation Scare Problem: 1979–1992," *Economic Quarterly*, Federal Reserve Bank of Richmond, Vol. 79 (Winter), pp. 1–24.

Haas, Richard, and Paul Masson, 1986, "MINIMOD: Specification and Simulation Results," *Staff Papers*, International Monetary Fund, Vol. 33 (December), pp. 722–67.

Hall, Robert E., 1988, "Intertemporal Substitution in Consumption," *Journal of Political Economy*, Vol. 96 (December), pp. 330–57.

Helliwell, John F., 1993, "Comment," in *Evaluating Policy Regimes: New Research in Empirical Macroeconomics*, ed. by R. Bryant, P. Hooper, and C. Mann (Washington: Brookings Institution), pp. 416–25.

———, Guy Meredith, P. Bagnoli, and Y. Durand, 1990, "INTERMOD 1.1: A G-7 Version of the IMF's Multimod," *Economic Modelling*, Vol. 7 (January), pp. 3–62.

Hodrick, Robert J., and Edward C. Prescott, 1981, "Post-War U.S. Business Cycles: An Empirical Investigation," Carnegie-Mellon Discussion Paper No. 451 (Pittsburgh: Carnegie-Mellon University).

Hollinger, P., 1996, "The Stacked-Time Simulator in TROLL: A Robust Algorithm for Solving Forward-Looking Models," paper presented at the Second International Conference on Computing in Economics and Finance (Geneva, Switzerland).

International Monetary Fund, 1996, *World Economic Outlook, May 1996: A Study by the Staff of the International Monetary Fund* (Washington).

Isard, Peter, and Douglas Laxton, 1996, "Strategic Choice in Phillips Curve Specification: What If Bob Gordon Is Wrong?" (unpublished; Washington: International Monetary Fund).

Jappelli, T., and M. Pagano, 1989, "Consumption and Capital Market Imperfections: An International Comparison," *American Economic Review*, Vol. 79 (December), pp. 1088–105.

Juillard, Michel, 1996, DYNARE: "A Program for the Resolution and Simulation of Dynamic Models with Forward Variables Through the Use of a Relaxation Algorithm," CEPREMAP Working Paper No. 9602 (Paris, France).

———, and Douglas Laxton, 1996, "A Robust and Efficient Method for Solving Nonlinear Rational Expectations Models," IMF Working Paper No. 96/106 (Washington: International Monetary Fund).

———, Peter McAdam, and Hope Pioro, 1998, "An Algorithm Competition: First-Order Iterations Versus Newton-Based Techniques," *Journal of Economic Dynamics and Control*.

Keynes, John M., 1936, *The General Theory of Employment, Interest and Money* (New York: Harcourt, Brace and World).

Klein, Lawrence, and Arthur Goldberger, 1955, *An Econometric Model of the United States, 1929–1952* (Amsterdam: North-Holland).

Klein, Lawrence, R.J. Ball, A. Hazelwood, and P. Vandome, 1961, *An Econometric Model of the United Kingdom* (Oxford: Blackwell).

Kuttner, Kenneth N., 1992, "Monetary Policy with Uncertain Estimates of Potential Output," *Economic Perspectives*, Reserve Bank of Chicago (January–February), pp. 2–15.

———, 1994, "Estimating Potential Output as a Latent Variable," *Journal of Business and Economic Statistics*, Vol. 12 (July), pp. 361–68.

Laffargue, J.P., 1990, "Résolution d'un Modèle Macroéconomique avec Anticipations Rationnelles," *Annales d'Economie et de Statistique*, Institut National de la Statistique et des Etudes, Vol. 17 (January–March), pp. 97–119.

Laxton, Douglas, and Eswar Prasad, 1997, "Possible Effects of European Monetary Union on Switzerland: A Case Study of Policy Dilemmas Caused by Low Inflation and the Nominal Interest Rate Floor," IMF Working Paper 97/23 (Washington: International Monetary Fund).

Laxton, Douglas, Guy Meredith, and David Rose, 1995, "Asymmetric Effects of Economic Activity on Inflation: Evidence and Policy Implications," *Staff Papers*, International Monetary Fund, Vol. 42 (June), pp. 344–74.

Laxton, Douglas, Nicholas Ricketts, and David Rose, 1994, "Uncertainty, Learning and Policy Credibility," in *Economic Behavior and Policy Choice Under Price Stability* (Ottawa: Bank of Canada).

Laxton, Douglas, David Rose, and Demosthenes Tambakis, 1998, "The U.S. Phillips Curve: The Case for Asymmetry," forthcoming, IMF Working Paper (Washington: International Monetary Fund).

Laxton, Douglas, David Rose, and Robert Tetlow, 1993, "Is the Canadian Phillips Curve Nonlinear?" Working Paper 93-7 (Ottawa: Bank of Canada).

Laxton, Douglas, and Robert Tetlow, 1992, "Government Debt in an Open Economy," Technical Report No. 58 (Ottawa: Bank of Canada).

Layard, Richard, Stephen Nickell, and Richard Jackman, 1991, *Unemployment: Macro-economic Performance and the Labour Market* (Oxford; New York: Oxford University Press).

Levin, Andrew, John Rogers, and Ralph Tryon, 1997, "Evaluating International Economic Policy with the Federal Reserve's Global Model," *Federal Reserve Bulletin* (Washington: Federal Reserve), pp. 797–817.

Lipsey, R.G., 1960, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom 1862–1957: A Further Analysis," *Economica*, new series, Vol. 27 (February), pp. 1–31.

Lucas, Robert E., Jr., 1967, "Adjustment Costs and the Theory of Supply," *Journal of Political Economy*, Vol. 75 (August), pp. 321–34.

———, 1972, "Expectations and the Neutrality of Money," *Journal of Economic Theory*, Vol. 4 (April), pp. 103–24.

———, 1976, "Econometric Policy Evaluation: A Critique," in *The Phillips Curve and Labor Markets*, ed. by Karl Brunner and Allan H. Meltzer, Carnegie-Rochester Conference Series on Public Policy, Vol. 1 (Amsterdam: North-Holland).

———, 1988, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, Vol. 22 (July), pp. 3–42.

Ludvigson, Sydney, 1996, "The Macroeconomic Effects of Government Debt in a Stochastic Growth Model," *Journal of Monetary Economics*, Vol. 38 (August), pp. 24–45.

Macklem, Tiff, 1996, "Asymmetry in the Monetary Transmission Mechanism: What Can We Learn From VARS?" (unpublished; Ottawa: Bank of Canada).

———, David Rose, and Robert Tetlow, 1995, "Government Debt and Deficits in Canada: A Macro Simulation Analysis," Working Paper 95-4 (Ottawa: Bank of Canada).

Mankiw, N. Gregory, 1988, "Comment" on De Long and Summers, *Brookings Papers on Economic Activity: 2*, Brookings Institution, pp. 481–85.

Masson, Paul R., 1987, "The Dynamics of a Two-Country Minimodel Under Rational Expectations," *Annales d'Economie et de Statistique*, pp. 37–69.

———, Steven Symansky, Richard Haas, and Michael Dooley, 1988, "MULTIMOD: A Multi-Region Econometric Model," *Staff Studies for the World Economic Outlook* (Washington: International Monetary Fund, July), pp. 50–104.

Masson, Paul R., and Steven Symansky, 1992, "Evaluating the EMS and EMU Using Stochastic Simulations," in *Macroeconomic Policy Coordination in Europe: The ERM and Monetary Union*, ed. by Ray Barrell and John Whitley (London: Sage Publications).

———, and Guy Meredith, 1990, *MULTIMOD MARK II: A Revised and Extended Model*, IMF Occasional Paper No. 71 (Washington: International Monetary Fund).

Masson, Paul R., and Bart G. Turtelboom, 1997, "Characteristics of the Euro, the Demand for Reserves, and Policy Coordination Under EMU," in *EMU and the International Monetary System*, ed. by P. Masson, T. Krueger, and B. Turtelboom (Washington: International Monetary Fund).

McDonald, Ian M., 1997, "The Australian Inflation Target and the Shape of the Short-Run Phillips Curve" (unpublished; Melbourne, Australia: University of Melbourne).

McGuirk, Anne Kenny, 1987, "Measuring Price Competitiveness for Industrial Country Trade in Manufactures," IMF Working Paper 87/34 (Washington: International Monetary Fund).

McKibbin, W.J., and J.D. Sachs, 1991, *Global Linkages: Macroeconomic Interdependence and Cooperation in the World Economy* (Washington: Brookings Institution).

Meredith, Guy, 1989, "INTERMOD 2.0: Model Specification and Simulation Properties," Working Paper 89-7 (Ottawa, Canada: Working Group on International Macroeconomics, Department of Finance).

———, 1991, "Changes to MULTIMOD Since the July 1990 IMF Occasional Paper No. 71" (unpublished; Washington: International Monetary Fund).

———, 1997, "Competitiveness Weights in MULTIMOD" (unpublished; Washington: International Monetary Fund).

Patterson, Kerry D. and Bahram Pesaran, 1992, "Intertemporal Elasticity of Substitution Consumption in the United States and the United Kingdom," *Review of Economics and Statistics*, Vol. 74 (November), pp. 573–84.

Persson, Torsten, 1985, "Deficits and Intergenerational Welfare in Open Economies," *Journal of International Economics*, Vol. 19 (August), pp. 67–84.

Phillips, A.W., 1958, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957," *Economica*, Vol. 25 (November), pp. 283–99.

Ricketts, Nicholas, and David Rose, 1995, "Inflation, Learning, and Monetary Policy Regimes in the G-7 Economies," Working Paper 95-6 (Ottawa: Bank of Canada).

Romer, Christina, and David Romer, 1989, "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz," in *NBER Macroeconomics Annual*, ed. by O. Blanchard and S. Fischer (Cambridge, Massachusetts; London, United Kingdom: MIT Press).

Romer, Paul M., 1990, "Endogenous Technological Change," *Journal of Political Economy*, Vol. 98 (October), pp. S71–S102.

Saint-Paul, Gilles, 1992, "Fiscal Policy in an Endogenous Growth Model," *Quarterly Journal of Economics*, Vol. 107 (November), pp. 1243–59.

Seater, John T., 1993, "Ricardian Equivalence," *Journal of Economic Literature*, Vol. 31 (March), pp. 142–90.

Summers, Lawrence H., 1981, "Taxation and Corporate Investment: a *q*-Theory Approach," *Brookings Papers on Economic Activity: 1*, Brookings Institution, pp. 67–127.

———, 1988, "Should Keynesian Economics Dispense with the Phillips Curve?" in *Unemployment, Hysteresis and the Natural Rate Hypothesis*, ed. by Rod Cross (Oxford, United Kingdom; New York: Blackwell).

Tanzi, Vito, and Domenico Fanizza, 1995, "Fiscal Deficits and Public Debt in Industrial Countries, 1970–1994," IMF Working Paper 95/49 (Washington: International Monetary Fund).

Taylor, John, 1980, "Aggregate Dynamics and Staggered Contracts," *Journal of Political Economy*, Vol. 88 (February), pp. 1–23.

———, 1993, "Discretion Versus Policy Rules in Practice," Carnegie-Rochester Conference Series on Public Policy, Vol. 39 (December), pp. 195–220.

———, 1996, "How Should Monetary Policy Respond to Shocks While Maintaining Long-Run Price Stability?—Conceptual Issues," in *Achieving Price Stability: A Symposium* (Kansas City, Missouri: Federal Reserve Bank of Kansas City).

Tobin, James, 1969, "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit and Banking*, Vol. 1 (February), pp. 15–29.

Treadway, Arthur B., 1969, "On Rational Entrepreneurial Behaviour and the Demand for Investment," *Review of Economic Studies*, Vol. 36 (April), pp. 227–40.

Turner, David, 1995, "Speed Limit and Asymmetric Effects from the Output Gap in the Seven Major Countries," *OECD Economic Studies*, Vol. 24 (1995/I), pp. 57–88.

Turnovsky, Stephen, 1996, "Fiscal Policy, Growth, and Macroeconomic Performance in a Small Open Economy," *Journal of International Economics*, Vol. 40, pp. 41–66.

Weil, Philippe, 1989, "Overlapping Families of Infinitely-Lived Agents," *Journal of Public Economics*, Vol. 38 (March), pp. 183–98.

Yaari, Menahem E., 1965, "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer," *Review of Economic Studies*, Vol. 32 (January), pp. 137–50.

Zanello, Alessandro, and Dominique Desruelle, 1997, "A Primer on the IMF's Information Notice System," IMF Working Paper 97/71 (Washington: International Monetary Fund).

Recent Occasional Papers of the International Monetary Fund

164. MULTIMOD Mark III: The Core Dynamic and Steady-State Models, by Douglas Laxton, Peter Isard, Hamid Faruqee, Eswar Prasad, and Bart Turtelboom. 1998.

163. Egypt: Beyond Stabilization, Toward a Dynamic Market Economy, by a staff team led by Howard Handy. 1998.

162. Fiscal Policy Rules, by George Kopits and Steven Symansky. 1998.

161. The Nordic Banking Crises: Pitfalls in Financial Liberalization? by Burkhard Dress and Ceyla Pazarbaşıoğlu. 1998.

160. Fiscal Reform in Low-Income Countries: Experience Under IMF-Supported Programs, by a staff team led by George T. Abed and comprising Liam Ebrill, Sanjeev Gupta, Benedict Clements, Ronald McMorran, Anthony Pellechio, Jerald Schiff, and Marijn Verhoeven. 1998.

159. Hungary: Economic Policies for Sustainable Growth, by Carlo Cottarelli, Thomas Krueger, Reza Moghadam, Perry Perone, Edgardo Ruggiero, and Rachel van Elkan. 1998.

158. Transparency in Goverment Operations, by George Kopits and Jon Craig. 1998.

157. Central Bank Reforms in the Baltics, Russia, and the Other Countries of the Former Soviet Union, by a staff team led by Malcolm Knight and comprising Susana Almuiña, John Dalton, Inci Otker, Ceyla Pazarbaşıoğlu, Arne B. Petersen, Peter Quirk, Nicholas M. Roberts, Gabriel Sensenbrenner, and Jan Willem van der Vossen. 1997.

156. The ESAF at Ten Years: Economic Adjustment and Reform in Low-Income Countries, by the staff of the International Monetary Fund. 1997.

155. Fiscal Policy Issues During the Transition in Russia, by Augusto Lopez-Claros and Sergei V. Alexashenko. 1998.

154. Credibility Without Rules? Monetary Frameworks in the Post–Bretton Woods Era, by Carlo Cottarelli and Curzio Giannini. 1997.

153. Pension Regimes and Saving, by G.A. Mackenzie, Philip Gerson, and Alfredo Cuevas. 1997.

152. Hong Kong, China: Growth, Structural Change, and Economic Stability During the Transition, by John Dodsworth and Dubravko Mihaljek. 1997.

151. Currency Board Arrangements: Issues and Experiences, by a staff team led by Tomás J.T. Baliño and Charles Enoch. 1997.

150. Kuwait: From Reconstruction to Accumulation for Future Generations, by Nigel Andrew Chalk, Mohamed A. El-Erian, Susan J. Fennell, Alexei P. Kireyev, and John F. Wilson. 1997.

149. The Composition of Fiscal Adjustment and Growth: Lessons from Fiscal Reforms in Eight Economies, by G.A. Mackenzie, David W.H. Orsmond, and Philip R. Gerson. 1997.

148. Nigeria: Experience with Structural Adjustment, by Gary Moser, Scott Rogers, and Reinold van Til, with Robin Kibuka and Inutu Lukonga. 1997.

147. Aging Populations and Public Pension Schemes, by Sheetal K. Chand and Albert Jaeger. 1996.

146. Thailand: The Road to Sustained Growth, by Kalpana Kochhar, Louis Dicks-Mireaux, Balazs Horvath, Mauro Mecagni, Erik Offerdal, and Jianping Zhou. 1996.

145. Exchange Rate Movements and Their Impact on Trade and Investment in the APEC Region, by Takatoshi Ito, Peter Isard, Steven Symansky, and Tamim Bayoumi. 1996.

144. National Bank of Poland: The Road to Indirect Instruments, by Piero Ugolini. 1996.

143. Adjustment for Growth: The African Experience, by Michael T. Hadjimichael, Michael Nowak, Robert Sharer, and Amor Tahari. 1996.

142. Quasi-Fiscal Operations of Public Financial Institutions, by G.A. Mackenzie and Peter Stella. 1996.

141. Monetary and Exchange System Reforms in China: An Experiment in Gradualism, by Hassanali Mehran, Marc Quintyn, Tom Nordman, and Bernard Laurens. 1996.

140. Government Reform in New Zealand, by Graham C. Scott. 1996.

139. Reinvigorating Growth in Developing Countries: Lessons from Adjustment Policies in Eight Economies, by David Goldsbrough, Sharmini Coorey, Louis Dicks-Mireaux, Balazs Horvath, Kalpana Kochhar, Mauro Mecagni, Erik Offerdal, and Jianping Zhou. 1996.

138. Aftermath of the CFA Franc Devaluation, by Jean A.P. Clément, with Johannes Mueller, Stéphane Cossé, and Jean Le Dem. 1996.

137. The Lao People's Democratic Republic: Systemic Transformation and Adjustment, edited by Ichiro Otani and Chi Do Pham. 1996.

136. Jordan: Strategy for Adjustment and Growth, edited by Edouard Maciejewski and Ahsan Mansur. 1996.

135. Vietnam: Transition to a Market Economy, by John R. Dodsworth, Erich Spitäller, Michael Braulke, Keon Hyok Lee, Kenneth Miranda, Christian Mulder, Hisanobu Shishido, and Krishna Srinivasan. 1996.

134. India: Economic Reform and Growth, by Ajai Chopra, Charles Collyns, Richard Hemming, and Karen Parker with Woosik Chu and Oliver Fratzscher. 1995.

133. Policy Experiences and Issues in the Baltics, Russia, and Other Countries of the Former Soviet Union, edited by Daniel A. Citrin and Ashok K. Lahiri. 1995.

132. Financial Fragilities in Latin America: The 1980s and 1990s, by Liliana Rojas-Suárez and Steven R. Weisbrod. 1995.

131. Capital Account Convertibility: Review of Experience and Implications for IMF Policies, by staff teams headed by Peter J. Quirk and Owen Evans. 1995.

130. Challenges to the Swedish Welfare State, by Desmond Lachman, Adam Bennett, John H. Green, Robert Hagemann, and Ramana Ramaswamy. 1995.

129. IMF Conditionality: Experience Under Stand-By and Extended Arrangements. Part II: Background Papers. Susan Schadler, Editor, with Adam Bennett, Maria Carkovic, Louis Dicks-Mireaux, Mauro Mecagni, James H.J. Morsink, and Miguel A. Savastano. 1995.

128. IMF Conditionality: Experience Under Stand-By and Extended Arrangements. Part I: Key Issues and Findings, by Susan Schadler, Adam Bennett, Maria Carkovic, Louis Dicks-Mireaux, Mauro Mecagni, James H.J. Morsink, and Miguel A. Savastano. 1995.

127. Road Maps of the Transition: The Baltics, the Czech Republic, Hungary, and Russia, by Biswajit Banerjee, Vincent Koen, Thomas Krueger, Mark S. Lutz, Michael Marrese, and Tapio O. Saavalainen. 1995.

126. The Adoption of Indirect Instruments of Monetary Policy, by a staff team headed by William E. Alexander, Tomás J.T. Baliño, and Charles Enoch. 1995.

125. United Germany: The First Five Years—Performance and Policy Issues, by Robert Corker, Robert A. Feldman, Karl Habermeier, Hari Vittas, and Tessa van der Willigen. 1995.

124. Saving Behavior and the Asset Price "Bubble" in Japan: Analytical Studies, edited by Ulrich Baumgartner and Guy Meredith. 1995.

123. Comprehensive Tax Reform: The Colombian Experience, edited by Parthasarathi Shome. 1995.

122. Capital Flows in the APEC Region, edited by Mohsin S. Khan and Carmen M. Reinhart. 1995.

121. Uganda: Adjustment with Growth, 1987–94, by Robert L. Sharer, Hema R. De Zoysa, and Calvin A. McDonald. 1995.

120. Economic Dislocation and Recovery in Lebanon, by Sena Eken, Paul Cashin, S. Nuri Erbas, Jose Martelino, and Adnan Mazarei. 1995.

119. Singapore: A Case Study in Rapid Development, edited by Kenneth Bercuson with a staff team comprising Robert G. Carling, Aasim M. Husain, Thomas Rumbaugh, and Rachel van Elkan. 1995.

118. Sub-Saharan Africa: Growth, Savings, and Investment, by Michael T. Hadjimichael, Dhaneshwar Ghura, Martin Mühleisen, Roger Nord, and E. Murat Uçer. 1995.

Note: For information on the title and availability of Occasional Papers not listed, please consult the IMF Publications Catalog or contact IMF Publication Services.