IMF RESEARCH
BULLETIN
VOLUME 4, NUMBER 2 JUNE 2003

Editor's Note

The two leading articles address research in areas that are of key importance to the IMF's work even as they present daunting challenges in obtaining strong and conclusive results. *Early Warning Systems* (EWS) seek to predict currency crises, though there is a debate on whether this is at all possible in efficient markets. Indeed, the adage "If you are so smart, why ain't you rich?" might cast doubt on the success of these efforts. Yet, EWS seem to have some predictive power, and many investment banks now use them, presumably for a good reason. *Assessing IMF Program Effectiveness* involves major methodological difficulties. If you are sitting in your doctor's waiting room today, the people you see there are more likely to visit the doctor again next month than are those who are feeling well today. The name of the game here is finding proper counterfactuals or good instruments because economics, unlike medicine, cannot rely on controlled experiments. The results of this research are not yet clear-cut, or fully convincing, despite admirable efforts by many researchers. This *Bulletin* typically focuses on research conducted by IMF staff, but a balanced assessment in this case warrants giving equal attention to research done outside the IMF.

—Paolo Mauro

Research Summaries

Early Warning Systems

Abdul Abiad

Following the crises of the 1990s, the IMF has placed greater emphasis on strengthening its crisis prevention capabilities. One aspect of this work involves developing early warning systems that assess crisis vulnerability, which supplement in-depth country analyses and permit cross-country comparisons. Recent IMF research on the subject has focused on identifying potential indicators of vulnerability, finding the most objective way to synthesize the information from these indicators, and assessing their predictive performance.

Crisis prevention is one of the core responsibilities of the IMF. As such, detecting incipient vulnerabilities plays a central role in IMF work, and much research has been devoted to this task in recent years. (continued on page 2)

Assessing IMF Program Effectiveness

Rodney Ramcharan

Economic adjustment programs supported by the IMF provide member countries with financing and policy advice to help them resolve both short-term balance of payments difficulties and longer term structural impediments to growth. Given the importance of these adjustment programs, a voluminous literature has evolved to assess their effectiveness. This research summary selectively surveys some of the empirical approaches used to evaluate IMF program effectiveness.

IMF-supported programs are probably the institution's most visible activity and affect a wide range of countries. Over the last decade, with the decline in communism and the deepening of economic crises in many emerging market economies, some 90 countries have become involved in various IMF-supported economic adjustment programs. (continued on page 5)

In This Issue

Early Warning Systems

(continued from page 1)

This article focuses on the development of early warning systems to detect currency crises.[1]

The building blocks of an early warning system consist of a set of vulnerability indicators. Although a large number of indicators are suggested by economic theory—any variable that influences the trade-off between defending the currency or letting it float is a potential candidate—the set of variables is usually constrained by data availability; it is from this set that indicators are selected, based on their predictive ability. Following the Mexican crisis in December 1994, several studies, including Frankel and Rose (1996), Kaminsky, Lizondo, and Reinhart (1998), and Sachs, Tornell, and Velasco (1996), have sought to identify the macroeconomic variables that tend to behave "abnormally" in the run-up to a crisis.[2] The variables identified as useful have varied somewhat from study to study, owing to differences in crisis definitions, data sets, and methodologies. However, a small set of indicators—real-exchange-rate overvaluation, reserve adequacy (relative to short-term debt or broad money), domestic credit growth, current account, export growth, and reserves growth—perform well in most studies.

The Asian crisis and the ensuing interest in balance sheets and institutional factors have led researchers to look beyond the standard macroeconomic indicators for signs of vulnerability. Using firm-level data on corporate balance sheets, Mulder, Perrelli, and Rocha (2002) suggest that high leverage and short maturity structures increase both the likelihood and the depth of crises, and that shareholder rights' protection also significantly affects crisis probabilities. Bussière and Mulder (1999b) document potential interactions between economic and political factors: when reserves are low and fundamentals are weak, political instability worsens crisis severity. Rossi (1999) suggests that countries with a less open capital account, stronger bank supervision, and weaker depositor safety are less prone to currency crashes.

Several studies (Goldfajn and Valdés, 1997; Berg and others, 1999; Berg, Borensztein, and Pattillo, forthcoming) have documented the poor performance of exchange rate expectations, credit ratings, bond spreads, and interest differentials in anticipating currency crises. However, recent research has also found that less conventional measures from financial markets might eventually prove useful as early warning indicators. Examining the period preceding the Mexican devaluation of 1994, Becker, Gelos, and Richards (2000) find that despite an alleged peso overvaluation, shares of firms with high net exports outperformed the market. This pattern is consistent with forward-looking stock prices that assigned an increasing probability to a devaluation benefiting exporting firms. Gelos and Borensztein (2003) find that emerging market mutual funds withdrew their money one month prior to the onset of a crisis. Finally, Prati and Sbracia (2002) show that uncertainty regarding fundamentals—as measured by the dispersion of GDP growth forecasts—is associated with speculative attacks and the effect depends on whether the expected fundamentals are "good" or "bad."

After a set of useful indicators has been identified, the information contained in the indicators needs to be combined in an objective manner. The two workhorse models in the literature are the indicators model of Kaminsky, Lizondo, and Reinhart (1998) and Kaminsky (1999), and limited dependent variable probit/logit models. Berg and Pattillo (1999a) ask whether these models would have predicted the Asian crisis, had they been in place in late 1996. They find that the best models have real, but limited, predictive power.

Subsequent studies have developed alternative strategies in an attempt to improve predictive performance. These include embedding binary indicators, and a piecewise-linear generalization, in a probit model (Berg and Pattillo, 1999b); refining the crisis variable from a binary to a ternary variable (Mathieson and Yao, forthcoming); focusing only on successful speculative attacks (Kumar, Moorthy, and Perraudin, 2002); and addressing model uncertainty issues (Stone and Weeks, 2001). Other studies explore more sophisticated econometric techniques, such as autoregressive conditional hazard models (Zhang, 2001) and regime switching with time-varying probabilities (Abiad, 2003). Some studies depart from a regression-based setting altogether: Osband and Van Rijckeghem (2000) use classification rules to identify safety zones for fundamentals under which currency crashes are unlikely to occur, and Ghosh and Ghosh (2002) use a binary recursive tree technique to explore complex interactions among structural and economic variables. Many of the proposed approaches look promising, and most report some improvement over the

[1]Previous research summaries in the *IMF Research Bulletin* have covered banking crises (Detragiache, 2001) and contagion (Huang, 2000). Some of the models described in this article have also been applied to debt crises (Detragiache and Spilimbergo, 2001) and arrears to the IMF (Oka, 2003).

[2]Other IMF studies identifying macroeconomic indicators include Bussière and Mulder (1999a); Aziz, Caramazza, and Salgado (2000); and Milesi-Ferretti and Razin (2000).

benchmark models. Differing crisis definitions, sample coverage, and forecasting horizons make direct comparison impossible, and a true "horse race" on a single data set is still needed to help identify the strengths and weaknesses of these recent models.

In the end, however, the true test of these models lies in operationalizing them within a comprehensive framework that includes in-depth country vulnerability analyses. This has been done for the indicators and probit models, and their performance has been evaluated by Berg, Borensztein, and Pattillo (forthcoming), who emphasize the importance of out-of-sample forecasting in model evaluation. They find that the IMF's probit model and the Kaminsky, Lizondo, and Reinhart models have done reasonably well since their operational adoption about four years ago. The March 2002 issue of the IMF's *Global Financial Stability Report* (Chapter 4) also assesses the performance of early warning systems and lays out possible directions for future work in this area.

References

Abiad, Abdul, 2003, "Early Warning Systems: A Survey and a Regime-Switching Approach," IMF Working Paper 03/32.

Aziz, Jahangir, Francesco Caramazza, and Ranil Salgado, 2000, "Currency Crises: In Search of Common Elements," IMF Working Paper 00/67.

Becker, Torbjorn, Gaston Gelos, and Anthony Richards, 2000, "Devaluation Expectations and the Stock Market: A New Measure and an Application to Mexico, 1994–95," IMF Working Paper 00/28; also published in *International Journal of Finance and Economics*, 2002, Vol. 7, No. 3 (July), pp. 195–214.

Berg, Andrew, and Catherine Pattillo, 1999a, "Are Currency Crises Predictable? A Test," *IMF Staff Papers*, Vol. 46, No. 2 (June), pp. 107–38.

———, 1999b, "Predicting Currency Crises: The Indicators Approach and an Alternative," *Journal of International Money and Finance*, Vol. 18, No. 4 (August), pp. 561–86.

Berg, Andrew, Eduardo Borensztein, and Catherine Pattillo, "Assessing Early Warning Systems: How Have They Worked in Practice?" IMF Working Paper, forthcoming.

Berg, Andrew, Eduardo Borensztein, Gian Maria Milesi-Ferretti, and Catherine Pattillo, 1999, *Anticipating Balance of Payments Crises: The Role of Early Warning Systems*, IMF Occasional Paper No. 186.

Bussière, Matthieu, and Christian Mulder, 1999a, "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion," IMF Working Paper 99/88.

——, 1999b, "Political Instability and Economic Vulnerability," IMF Working Paper 99/46; also published in *International Journal of Finance and Economics*, 2000, Vol. 5, No. 4 (October), pp. 309–30.

Detragiache, Enrica, 2001, "Systemic Banking Crises: Causes, Consequences, and Policy Lessons," *IMF Research Bulletin*, Vol. 2, No. 1 (March).

———, and Antonio Spilimbergo, 2001, "Crises and Liquidity: Evidence and Interpretation," IMF Working Paper 01/2.

Frankel, Jeffrey, and Andrew Rose, 1996, "Currency Crashes in Emerging Markets: An Empirical Treatment," *Journal of International Economics*, Vol. 41 (November), pp. 351–66 .

Books from the IMF

Japan's Lost Decade: Policies for Economic Revival

Edited by Tim Callen and Jonathan D. Ostry

It has been 13 years since the bursting of the asset price bubble in Japan, yet the economy remains weighed down by excess capacity and debt, anemic growth, and entrenched deflationary pressures. If Japan's weak growth continues, this would affect not only its own people but also the world economy generally, given Japan's importance as a trading partner and supplier of capital.

Japan's Lost Decade: Policies for Economic Revival evaluates the key issues facing the Japanese economy and policymakers. The book argues that an integrated policy strategy—combining decisive bank and corporate restructuring with supportive macroeconomic policies—is needed to lift the economy from its prolonged period of lackluster performance. While welcoming the progress that the Koizumi government has made in addressing the weaknesses in the Japanese economy, the book stresses that the reform strategy is not sufficiently comprehensive and that implementation has been slower and less complete than hoped for.

The book reflects the analysis prepared by the IMF staff working on Japan. Contributors include Tim Callen, Jonathan Ostry, Taimur Baig, Giovanni Dell'Ariccia, Hamid Faruqee, Ben Hunt, Sanjay Kalra, Kenneth Kang, Douglas Laxton, Martin Muhleisen, Takashi Nagaoka, Ramana Ramaswamy, Hossein Samiei, and Warwick McKibbin.

IMF Staff Papers

Volume 50, Number 2

Gelos, Gaston, and Eduardo Borensztein, 2000, "A Panic-Prone Pack? The Behavior of Emerging Market Mutual Funds," IMF Working Paper 00/198; also forthcoming in *IMF Staff Papers*.

Ghosh, Swati, and Atish Ghosh, 2002, "Structural Vulnerability and Currency Crises," IMF Working Paper 02/9; also forthcoming in *IMF Staff Papers*.

Goldfajn, Ilan, and Rodrigo Valdés, 1997, "Are Currency Crises Predictable?" IMF Working Paper 97/159; also published in *European Economic Review*, 1998, Vol. 42, Nos. 3–5 (May), pp. 873–85.

Huang, Haizhou, 2000, "Financial Contagion: ABC Channels," *IMF Research Bulletin*, Vol. 1, No. 2 (September).

Kaminsky, Graciela, 1999, "Currency and Banking Crises: The Early Warnings of Distress," IMF Working Paper 99/178.

———, Saul Lizondo, and Carmen Reinhart, 1998, "Leading Indicators of Currency Crises," *IMF Staff Papers*, Vol. 45, No. 1 (March), pp. 1–48.

Kumar, Manmohan, Uma Moorthy, and William Perraudin, 2002, "Predicting Emerging Market Currency Crashes," IMF Working Paper 02/7.

Mathieson, Don, and James Yao, "Toward a New Early Warning System for Currency Crises: An Ordered Logit Approach," IMF Working Paper, forthcoming.

Milesi-Ferretti, Gian Maria, and Assaf Razin, 1998, "Current Account Reversals and Currency Crisis: Empirical Regularities," IMF Working Paper 98/130; also in *Currency Crises*, ed. by Paul Krugman (Chicago: University of Chicago Press, 2000).

Mulder, Christian, Roberto Perrelli, and Manuel Rocha, 2002, "The Role of Corporate, Legal and Macroeconomic Balance Sheet Indicators in Crisis Detection and Prevention," IMF Working Paper 02/59.

Oka, Chikako, 2003, "Anticipating Arrears to the IMF: Early Warning Systems," IMF Working Paper 03/18.

Osband, Kent, and Caroline Van Rijckeghem, 2000, "Safety from Currency Crashes," *IMF Staff Papers*, Vol. 47, No. 2 (December), pp. 238–58.

Prati, Alessandro, and Massimo Sbracia, 2002, "Currency Crises and Uncertainty About Fundamentals," IMF Working Paper 02/3.

Rossi, Marco, 1999, "Financial Fragility and Economic Performance in Developing Economies: Do Capital Controls, Prudential Regulation and Supervision Matter?" IMF Working Paper 99/66.

Sachs, Jeffrey, Aaron Tornell, and Andrés Velasco, 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity: 1*, Brookings Institution.

Stone, Mark, and Melvyn Weeks, 2001, "Systemic Financial Crises, Balance Sheets and Model Uncertainty," IMF Working Paper 01/162.

Zhang, Zhiwei, 2001, "Speculative Attacks in the Asian Crisis," IMF Working Paper 01/189.

Visit the Research at the IMF website at *www.imf.org/research*

Assessing IMF Program Effectiveness

(continued from page 1)

However, despite the prevalence of these programs, their effectiveness is still being debated in a number of respects. Why does the performance of many countries that have participated in a series of IMF-supported programs remain relatively weak?[1] How do we know the extent to which these programs work? Can patterns that emerge from past experience help improve program effectiveness in the future?

A large body of empirical research conducted within and outside the IMF has sought to assess IMF program effectiveness (Haque and Khan, 1998), but this research agenda faces three major methodological hurdles. First, IMF programs tend to be remarkably varied across countries, making meaningful cross-country comparisons difficult (Mussa and Savastano, 2000). Second, IMF programs are inherently complex constructs with multiple economic objectives spread over varying time horizons. As a result, the appropriate definition of IMF program effectiveness is not entirely clear. That said, much of the empirical literature has focused on the impact of IMF programs on macroeconomic aggregates such as growth and inflation. Third, neither a country's decision to seek an IMF program nor the IMF's decision to agree to a program is random; thus, selection bias is a challenge to accurate estimation. Hence, because of these methodological difficulties, most of the results are tentative. On the whole, the evidence suggests that IMF programs lower inflation and improve the balance of payments; their impact on growth is less clear.

Issues of selection bias arise because countries "demand" IMF programs in times of economic difficulties. Bird (1996) notes that adopting an IMF-supported program is generally linked to a low level of reserves, increased debt, and an overvalued exchange rate. Hence, comparisons between countries that do not enter into IMF-supported programs and those that do are difficult (Krueger, 1998). An appropriate measure of program effectiveness would compare outcomes under an IMF program with those that would have occurred in the absence of the program—the counterfactual. However, by definition, the counterfactual policy stance, and the resulting macroeconomic outcome, are never observed.

Consequently, researchers have focused on the creation of artificial policy counterfactuals. The generalized evaluation estimator (GEE), pioneered by Goldstein and Montiel (1986) and Khan (1990), is a popular method of constructing these counterfactuals. This approach constructs counterfactual policy stances by using nonprogram data to link annual changes in macroeconomic policies to deviations in lagged macroeconomic outcomes from their target values. The counterfactual policy stance is included among the set of regressors in the main regression. In this way, the impact of an IMF-supported arrangement can be measured, after controlling for the set of policies that would have been observed in the absence of such an arrangement.

[1]See, for example, the recent report by the Independent Evaluation Office (IEO) on the prolonged use of IMF resources (available at *www.imf.org/External/NP/ieo/2002/pu/index.htm*).

Visiting Scholars at the IMF, January–March 2003

Michael Bordo; Rutgers University

Roberto Chang; Rutgers University

Vittorio Corbo; Pontificia Universidad Católica de Chile, Chile

Javier Gómez; Banco de la República, Colombia

David Hummels; Purdue University

Jean Imbs; London Business School, United Kingdom

Bernadette Kamgnia; University of Yaoundé, Cameroon

Graciela Kaminsky; The George Washington University

Yevgeniya Kornienko; National Bank of Ukraine, Ukraine

Peter Maina; University of Nairobi, Kenya

Nephil Maskay; Nepal Rastra (Central) Bank, Nepal

Benjamin Ndong; Université Gaston Berger de Saint Louis, Senegal

Marco Pagano; Universitá di Salerno, Italy

Ila Patnaik; Indian Council for Research in International Economic Relations, India

Mark Taylor; Warwick University, United Kingdom

Carlos Végh; University of California at Los Angeles

Rafael Wouters; National Bank of Belgium, Belgium

With differing degrees of significance, the point estimates from the GEE and the other approaches that attempt to control for the counterfactual suggest that IMF programs improve the current account balance and lower inflation (Khan, 1990; Conway, 1994; Killick, Malik, and Manuel, 1995). Some of these studies also suggest a positive impact of IMF programs on economic growth (Bagci and Perraudin, 1997; Knight and Santaella, 1997), but there is no consensus on the precise timing of this growth effect. Bulír and Moon (2003) use a similar approach to study the impact of IMF programs on fiscal adjustment, finding little significant impact on the fiscal balance. Mody and Saravia (2003) examine whether IMF programs help to catalyze capital flows. The authors report evidence of a catalytic effect when a country is in an intermediate, vulnerable zone before plunging irretrievably into a crisis; at the other extreme, programs in "tranquil" periods can also send unfavorable signals to markets, hurting rather than helping countries. In addition to differing sample periods, a key source of the disagreement across these studies is their specification of the policy counterfactual as there is little theoretical basis to guide the selection of the variables used to determine policymakers' reaction functions.

Instead of relying on counterfactuals, another strand of empirical research uses instrumental variables methods or Heckman two-step estimation procedures to address sample selection issues. Barro and Lee (2002) and Easterly (2002) find mixed results on economic growth and poverty reduction while making the heroic assumption that political or institutional variables, such as a country's alignment with major shareholders at the IMF, are only related to economic growth through their influence on the IMF's lending decision. Przeworski and Vreeland (2000) find that program participation lowers growth while countries remain under a program. Chen and Thomas (2003) explore differences between programs that were successfully completed and those that ended prematurely: they find that completed programs are marginally associated with a higher subsequent growth rate, whereas programs that end prematurely are associated with a lower growth rate.

The implications of the current empirical approaches for IMF program design remain limited. For instance, the finding that IMF programs improve the balance of payments says little about whether this impact is optimal; given the trade-offs between aggregate demand and the external position, could the average improvement in the external position have been achieved with a smaller reduction in aggregate demand? Such questions are at the center of program design and are a vital area of future research. Recent work by Baqir, Ramcharan, and Sahay (2003) begins to analyze the nature of trade-offs among the program objectives. Preliminary results suggest that narrowing the gap between the current account target and its actual value reduces economic growth relative to its projected value.

References

Bagci, Pioneer, and William Perraudin, 1997, "Do IMF Programs Work?" Global Economic Institutions Working Paper No. 24.

Baqir, Reza, Rodney Ramcharan, and Ratna Sahay, 2003, "IMF Programs and Economic Growth: Is There a Link?" IMF Working Paper, forthcoming.

Barro, Robert, and Jong-Wha Lee, 2002, "IMF Programs: Who Is Chosen and What Are the Effects?" NBER Working Paper No. 8951.

Bird, Graham, 1996, "Borrowing from the IMF: The Policy Implications of Recent Empirical Research," *World Development*, Vol. 24, No. 11, pp. 1753–60.

Bulír, Aleš, and Soojin Moon, 2003, "Do IMF-Supported Programs Help Make Fiscal Adjustment More Durable?" IMF Working Paper 03/38.

Chen, Chuling, and Thomas, Alun, 2003, "An Evaluation of Fund Programs in the 1990s: The Importance of Taking Explicit Account of Stoppages," IMF Working Paper, forthcoming.

Conway, Patrick, 1994, "IMF Lending Programs: Participation and Impact," *Journal of Development Economics*, Vol. 45 (December), pp. 365–91.

Easterly, William, 2002, "What Did the Structural Adjustment Adjust? The Association of Policies and Growth with Repeated IMF and World Bank Adjustment Loans," Center for Global Development Working Paper No. 11.

Goldstein, Morris, and Peter Montiel, 1986, "Evaluating Fund Stabilization Programs with Multicountry Data: Some Methodological Pitfalls," *IMF Staff Papers*, Vol. 33 (June), pp. 304–44.

Haque, Ul Nadeem, and Mohsin S. Khan, 1998, "Do IMF-Supported Programs Work? A Survey of Cross Country Empirical Evidence," IMF Working Paper 98/169.

Khan, Mohsin S., 1990, "The Macroeconomic Effects of Fund-Supported Adjusted Programs," *IMF Staff Papers*, Vol. 37, No. 2 (June), pp. 195–231.

Killick, Tony, Moazzam Malik, and Marcus Manuel, 1995, "What Can We Know About the Effects of IMF Programmes?" *World Economy*, Vol. 15 (September), pp. 575–97.

Knight, Malcolm, and Julio Santaella, 1997, "Economic Determinants of IMF Programs," *Journal of Development Economics*, Vol. 54, pp. 405–36.

Krueger, Anne O., 1998, "Whither the World Bank and the IMF?" *Journal of Economic Literature*, Vol. 36 (December), pp. 1983–2000.

Mody, Ashoka, and Diego Saravia, 2003, "Catalyzing Capital Flows: Do IMF Programs Work as Commitment Devices?" IMF Working Paper, forthcoming.

Mussa, Michael, and Miguel Savastano, 2000, "The IMF Approach to Economic Stabilization," in *NBER Macroeconomics Annual 1999*, Vol. 14 (Cambridge, Massachusetts: MIT Press), pp. 79–122.

Przeworski, Adam, and James Raymond Vreeland, 2000, "The Effect of IMF Programs on Economic Growth," *Journal of Development Economics*, Vol. 62, pp. 385–421.

IMF Research Bulletin

Coming in September 2003

- Sovereign Bonds and Public Debt Management
- Trade
- Country Study: Sweden

New IMF Study on Globalization

The Effects of Financial Globalization on Developing Countries: Some Empirical Evidence

Eswar Prasad, Kenneth Rogoff, Shang-Jin Wei, and M. Ayhan Kose

A new IMF study on the effects of financial globalization on developing countries provides a candid, systematic, and critical review of recent evidence on this complex subject. The following main findings are based on a review of the literature and new empirical evidence.

- In spite of an apparently strong theoretical presumption, it is difficult to detect a strong and robust causal relationship between financial integration and economic growth.
- Contrary to theoretical predictions, in many developing countries, financial integration appears to be associated with *increases* in consumption volatility—both in absolute terms and relative to income volatility.
- There appear to be threshold effects in the relationships between financial integration and growth as well as between financial integration and volatility. A sufficient level of absorptive capacity seems to be required for economies to derive the benefits of financial integration in terms of higher growth and lower volatility. Recent evidence suggests that sound macroeconomic frameworks and institutions—in particular, good governance—have important quantitative and qualitative effects on developing countries' experiences with financial globalization.

This study is forthcoming as IMF Occasional Paper No. 220. It is currently available in full-text format at *www.imf.org/research*.

Country Study

Thailand

Reza Baqir

Thailand has gradually ascended to the front lines of high-growth Asia in the last few years. The authorities have successfully introduced a new monetary framework based on inflation targeting, maintained exchange rate flexibility, strengthened the external position, and recently embarked on fiscal consolidation. At the same time, accelerating corporate and financial sector reforms has proved challenging and investment growth has remained modest. This article summarizes recent research by IMF staff on postcrisis Thailand.

In the last four years, growth in Thailand averaged about 4 percent—half the average of the 15 years preceding the 1997 crisis. A key question for policymakers and academics alike is whether Thailand can regenerate the economic momentum of the precrisis years. Griffiths (2000) highlights the role of an investment boom, especially in nontradable sectors, in driving the growth acceleration of the mid-1990s and sowing some of the seeds of the subsequent instability. As the crisis developed, private investment collapsed—in 1998 it was a third of its 1996 level. Using a growth accounting framework, Jonsson (2001) found that capital accumulation, more than total factor productivity growth, accounted for the high precrisis growth rates. With capital accumulation expected to remain modest in the medium term, he argued that economic growth will need to be driven primarily by higher total factor productivity growth.

Some of the decline in investment and its subsequent sluggish recovery in the postcrisis period reflects the excess capacity from the investment boom of the early 1990s. However, some researchers attributed the decline to a "credit crunch" in the aftermath of the crisis. Greene (2002) finds a strong correlation in the precrisis years between net private capital inflows, bank credit to the private sector, and real private investment and suggests that the sudden reversal of net capital flows during the crisis choked credit and investment. However, using a disequilibrium econometric framework to study the determinants of international capital flows, Mody and Taylor (2002) find that an "international capital crunch" likely lasted only until mid-1998 in Thailand. Schwartz (2000) notes that a slowdown in credit growth is not, by itself, evidence of a credit crunch: it is difficult to make a definitive statement regarding the existence or extent of a credit crunch, as both supply- and demand-side effects were at play. As it turned out, credit continued to languish, even as the economy began to grow. Baqir and Zanello (2003) examine the causes of "growth without credit" and compare Thailand's experience to that of other postcrisis countries.

One of the lessons learned from the Asian crisis is that exchange-rate pegs and open capital accounts do not mix well. After the July 2, 1997, devaluation of the baht, Thailand has maintained flexibility in its exchange rate and its regime is currently classified by the IMF as "managed floating with no preannounced path for the exchange rate." Nevertheless, some observers of the crisis-hit Asian economies have pointed to an apparent lack of exchange rate flexibility after the crisis. Hernandez and Montiel (2001) and Baig (2001) consider the volatility of the exchange rate, reserves, and interest rates before and after the crisis and conclude that Thailand is now floating to a greater extent than it did before, though less than "real floaters."

With the move to a more flexible exchange rate regime, the Thai authorities have adopted inflation targeting as their monetary policy framework. In an effort to better understand the channels of monetary policy transmission, Baqir (2002) uses vector autoregressions and finds that while changes in the Bank of Thailand's policy rate are associated with changes in real output with a lag of four to six quarters, the bank-lending channel appears weak. He also finds suggestive evidence of an asset price channel.

The sluggish transmission of monetary policy through the banking sector is symptomatic of the ongoing structural problems in the financial and corporate sectors. Haksar (2000, 2001) provides an in-depth look at the restructuring of the financial system in the aftermath of the crisis, subsequent progress, and prospects for further reform. He concludes that while Thai banks have made substantial progress in reducing their vulnerability, balance sheet fragilities remain. Kim and Stone (1999) present a theoretical framework to illustrate how highly leveraged firms can halt investment to avoid bankruptcy when facing a capital inflow cutoff. They provide supporting evidence from Thailand and other Asian countries. In assessing the early progress with resolving corporate sector problems, Endo and Griffiths (2000) note that, compared to other countries, Thailand's initial approach was private sector

led, market based, and voluntary. Giorgianni (2001) provides detailed information on the design and implementation of the Thai Asset Management Company, which was subsequently set up by the government to accelerate the debt restructuring process, and benchmarks its key design features against international experience. Haksar and Kongsamut (2002) analyze firm-level data for listed companies and find that although debt levels have fallen from their precrisis peaks, particularly for smaller firms, they remain high by international standards, and interest coverage ratios continue to hover just above the break-even point.

Besides the decline in living standards, the crisis has left the Thai taxpayer with a large stock of public debt. Fiscal policy has faced the trade-off of countering the effects of the crisis while containing public debt. Barnett (2000a) finds that the fiscal impulse was mildly expansionary in the precrisis period and turned contractionary in 1997/98 before turning expansionary in 1998/99. In related papers, Barnett (2000b) and Barnett and Haksar (2001) examine public debt dynamics, taking into account the costs of financial sector restructuring, and find key sensitivities to interest rate and GDP growth shocks. Giorgianni (2002) assesses Thailand's fiscal vulnerability, building in estimated contingent liabilities of the government arising from financial sector restructuring. This yields estimates of gross public debt considerably higher than the headline figures.

References

Baig, Taimur, 2001, "Characterizing Exchange Rate Regimes in Post-Crisis East Asia," IMF Working Paper 01/152.

Baqir, Reza, 2002, "The Channels of Monetary Policy Transmission in Thailand," in *Thailand: Selected Issues*, IMF Staff Country Report No. 02/195.

———, and Alessandro Zanello, 2003, "Growth Without Credit," in *Thailand: Selected Issues*, IMF Staff Country Report, forthcoming.

Barnett, Steven, 2000a, "Measuring Fiscal Stimulus in Thailand," in *Thailand: Selected Issues*, IMF Country Report No. 00/21.

———, 2000b, "Public Debt Dynamics in the Aftermath of the Crisis," in *Thailand: Selected Issues*, IMF Country Report No. 00/21 (Washington: International Monetary Fund).

———, and Vikram Haksar, 2001, "Medium Term Debt Outlook," in *Thailand: Selected Issues*, IMF Staff Country Report No. 01/147.

Endo, Toshihide, and Mark Griffiths, 2000, "Resolving the Corporate Debt Problem," in *Thailand: Selected Issues*, IMF Country Report No. 00/21.

Giorgianni, Lorenzo, 2001, "Design and Implementation of the Thai Asset Management Corporation," in *Thailand: Selected Issues*, IMF Staff Country Report No. 01/147.

———, 2002, "An Assessment of Thailand's Fiscal Vulnerability," in *Thailand: Selected Issues*, IMF Staff Country Report No. 02/195.

Greene, Joshua E., 2002, "The Output Decline in Asian Crisis Countries: Investment Aspects," IMF Working Paper 02/25.

Griffiths, Mark, 2000, "From Recession to Recovery: A Real Sector Perspective," in *Thailand: Selected Issues*, IMF Country Report No. 00/21.

Haksar, Vikram, 2000, "Financial Sector Restructuring," in *Thailand: Selected Issues*, IMF Country Report No. 00/21.

———, 2001, "Financial Sector Developments and Prospects," in *Thailand: Selected Issues*, IMF Staff Country Report No. 01/147.

———, and Piyabha Kongsamut, 2002, "Corporate Performance in Thailand," in *Thailand: Selected Issues*, IMF Staff Country Report No. 02/195.

Hernandez, Leonardo, and Peter Montiel, 2001, "Post-Crisis Exchange Rate Policy in Five Asian Countries: Filling in the 'Hollow Middle'?" IMF Working Paper 01/170.

Jonsson, Gunnar, 2001, "Growth Accounting and the Medium Term Outlook in Thailand," in *Thailand: Selected Issues*, IMF Staff Country Report No. 01/147.

Kim, Se-Jik, and Mark R. Stone, 1999, "Corporate Leverage, Bankruptcy, and Output Adjustment in Post-Crisis East Asia," IMF Working Paper 99/143.

Mody, Ashoka, and Mark P. Taylor, 2002, "International Capital Crunches: The Time-Varying Role of International Asymmetries," IMF Working Paper 02/43.

Schwartz, Stephen B., 2000, "Credit Growth Before and After the Crisis," in *Thailand: Selected Issues*, IMF Country Report No. 00/21.

IMF Country Reports are available at *www.imf.org*. *Selected Issues* consist of self-contained analytical chapters addressing specific topics in depth. They are of interest to both policymakers and researchers.

IMF Working Papers

Working Paper No. 02/231
Leading Indicators of Growth and Inflation in Turkey
Leigh, Daniel; Rossi, Marco

Working Paper No. 02/232
Measuring Liquidity in Financial Markets
Sarr, Abdourahmane; Lybek, Tony

Working Paper No. 02/233
Market Predictability of ECB Monetary Policy Decisions: A Comparative Examination
Ross, Kevin

Working Paper No. 02/234
"Original Sin," Balance Sheet Crises and the Roles of International Lending
Zettelmeyer, Jeromin; Jeanne, Olivier D.

Working Paper No. 02/235
Imperfect Competition and the Design of VAT Regimes: The Case of Energy Trade Between Russia and Ukraine
Shiells, Clinton R.

Working Paper No. 02/236
Tax Revenue Forecasts in IMF-Supported Programs
Golosov, Mikhail; King, John R.

Working Paper No. 02/237
Firm Investment, Corporate Finance, and Taxation
Palomba, Geremia

Working Paper No. 02/238
Stock Market Developments and Private Consumer Spending in Emerging Markets
Funke, Norbert

Working Paper No. 02/239
Macroeconomic News and Stock Returns in the United States and Germany
Funke, Norbert; Matsuda, Akimi

Working Paper No. 02/240
Performance Budgeting—Is Accrual Accounting Required?
Diamond, Jack

Working Paper No. 03/1
Testing the Informational Efficiency of OTC Options on Emerging Market Currencies
Chan-Lau, Jorge; Morales, Armando

Working Paper No. 03/2
A Comparison Between Two Public Expenditure Management Systems in Africa
Lienert, Ian C.

Working Paper No. 03/3
How Much Leverage Is Too Much, or Does Corporate Risk Determine the Severity of a Recession?
Ivaschenko, Iryna V.

Working Paper No. 03/4
What Determines the Reservation Wages of Unemployed Workers? New Evidence from German Micro Data
Prasad, Eswar S.

Working Paper No. 03/5
Optimal Monetary Policy in a Small Open Economy with Habit Formation and Nominal Rigidities
Choi, Woon Gyu; Jung, Yongseung

Working Paper No. 03/6
Small African Stock Markets—The Case of the Lusaka Stock Exchange
Marone, Heloisa

Working Paper No. 03/7
Currency Demand, the Underground Economy, and Tax Evasion: The Case of Guyana
Faal, Ebrima A.

Working Paper No. 03/8
What Determines the Implementation of IMF-Supported Programs?
Ivanova, Anna; Mayer, Wolfgang; Mourmouras, Alexandros T.; Anayiotos, George C.

Working Paper No. 03/9
Inflation Targeting Regimes
Carare, Alina; Stone, Mark R.

Working Paper No. 03/10
FDI to Africa: The Role of Price Stability and Currency Instability
Rogoff, Kenneth; Reinhart, Carmen

Working Paper No. 03/11
Dollarization of Liabilities: Beyond the Usual Suspects
Barajas Estrada, Adolfo; Morales, Armando

Working Paper No. 03/12
Inflation Targeting Lite
Stone, Mark R.

Working Paper No. 03/13
Toward a Statutory Approach to Sovereign Debt Restructuring: Lessons from Corporate Bankruptcy Practice Around the World
Bolton, Patrick

Working Paper No. 03/14
Income Inequality and Redistributive Government Spending
De Mello Jr., Luiz R.; Tiongson, Erwin H.

Working Paper No. 03/15
Information Technology and Productivity Growth in Asia
Lee, Il Houng; Khatri, Yougesh

Working Paper No. 03/16
Political Economy of Oil-Revenue Sharing in a Developing Country: Illustrations from Nigeria
Ahmad, Ehtisham; Singh, Raju J.

Working Paper No. 03/17
What Happens After Supervisory Intervention? Considering Bank Closure Options
Andrews, Michael; Josefsson, Mats A.

Working Paper 03/18
Anticipating Arrears to the IMF: Early Warning Systems
Oka, Chikako

Working Paper 03/19
Fiscal Sustainability and Resource Mobilization in the Dominican Republic
Melhado Orellana, Oscar E.

Working Paper No. 03/20
Portfolio Flows into India: Do Domestic Fundamentals Matter?
Gordon, James P.; Gupta, Poonam

Working Paper No. 03/21
Medium-Term Exchange Rate Forecasting: What Can We Expect?
Meredith, Guy M.

Working Paper No. 03/22
Productivity Trends in India's Manufacturing Sectors in the Last Two Decades
Unel, Bulent

Working Paper No. 03/23
An Analysis of the Underground Economy and Its Macroeconomic Consequences
Dabla-Norris, Era; Feltenstein, Andrew

Working Paper No. 03/24
Financial Infrastructure, Group Interests, and Capital Accumulation: Theory, Evidence, and Policy
Bossone, Biagio; Mahajan, Sandeep; Zahir, Farah

Working Paper No. 03/25
Some Implications for Monetary Policy of Uncertain Exchange Rate Pass-Through
Hunt, Benjamin L.; Isard, Peter

Working Paper No. 03/26
Exchange Rate Regime Considerations in an Oil Economy: The Case of the Islamic Republic of Iran
Celasun, Oya

Working Paper No. 03/27
How Does Globalization Affect the Synchronization of Business Cycles?
Kose, Ayhan; Prasad, Eswar S.; Terrones Silva, Marco E.

Working Paper No. 03/28
The Equilibrium Real Exchange Rate of the Malagasy Franc: Estimation and Assessment
Cady, John

Working Paper No. 03/29
Economic Implications of China's Demographics in the 21st Century
Cheng, Kevin C.

Working Paper No. 03/30
Trade, Growth, and Poverty: A Selective Survey
Berg, Andrew; Krueger, Anne O.

Working Paper No. 03/31
Some Simulation Properties of the Major Euro Area Economies in MULTIMOD
Hunt, Benjamin L.; Laxton, Douglas M.

Working Paper No. 03/32
Early Warning Systems: A Survey and a Regime-Switching Approach
Abiad, Abdul

Working Paper No. 03/33
Performance Budgeting: Managing the Reform Process
Diamond, Jack

Working Paper No. 03/34
Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization
Kaminsky, Graciela; Schmukler, Sergio

Working Paper No. 03/35
A Currency Union for the Caribbean
Worrell, DeLisle

Working Paper No. 03/36
Fiscal Adjustment in Transition Countries: Evidence from the 1990s
Purfield, Catriona M.

Working Papers, Policy Discussion Papers, and many other IMF publications can be downloaded in full-text format from *http://www.imf.org/external/pubind.htm*.

IMF Research Bulletin

Paolo Mauro
Editor

Archana Kumar
Assistant Editor

Kellett Hannah
Systems Consultant

Julio R. Prego
Compositor

Phil Torsani
Graphic Designer

Dawn Heaney
Editorial Assistant

The *IMF Research Bulletin* (ISSN: 1020-8313) is a quarterly publication in English and is available free of charge. Material from the *Bulletin* may be reprinted with proper attribution. Editorial correspondence may be addressed to The Editor, IMF Research Bulletin, IMF, Room 9-612, Washington, DC 20431 USA or e-mailed to *resbulletin@imf.org*.

For Electronic Notification: Sign up at *www.imf.org* (e-mail notification) to receive notification of new issues of the *IMF Research Bulletin* and a variety of other IMF publications. Individual issues of the *Bulletin* are available at *http://www.imf.org/external/pubs/ft/irb/archive.htm*.

For Print Subscriptions: Address requests to Publication Services, Box X2001, IMF, Washington, DC 20431 USA; e-mail: *publications@imf.org*.

The Global Economy Model (GEM): Q & A

By Douglas Laxton

What is the GEM and where did it originate from?

The Global Economy Model (GEM) is a new multicountry simulation model. When Kenneth Rogoff took over as the director of the Research Department, one of his key priorities was to develop a new macro model for both research and policy analysis, bridging the gap between recent developments in academia and models used by policymaking institutions. The GEM builds on the new open-economy macro (NOEM) literature pioneered by Obstfeld and Rogoff (1995, 1996; see also other references at *www.imf.org/external/np/res/mmod/biblio/ multimod.cfm*). The IMF invited Paolo Pesenti of the New York Fed and National Bureau of Economic Research to lead the project by developing the theoretical structure for the GEM. Last year Paolo Pesenti and I developed the first working version of the GEM and presented it at the Carnegie-Rochester Conference on Public Policy (Laxton and Pesenti, 2003).

What are the main strengths of NOEM models such as the GEM?

These structural models have strong theoretical foundations based on microeconomic theory. Unlike reduced-form models, they are not as prone to the Lucas critique and can therefore be used more reliably for policy analysis. In practice, they are relatively easy to use when addressing issues that interest policymakers. The GEM incorporates nominal rigidities and monopolistic competition in both product and labor markets. This helps distinguish between the relative roles of market inefficiencies and monetary policy in generating inflation persistence. It is thus possible to conduct well-defined experiments to show how changes in structural policies, which influence the degree of competition in markets, may change the degree of inflation persistence, and to trace the implications for the business cycle and the optimal formulation of monetary policy. Bayoumi, Laxton, and Pesenti (2003) show that increases in the degree of competition in labor markets and product markets can significantly reduce inflation persistence, thus making it easier to successfully implement monetary policy.

What other GEM-related research and applications are in the works?

Building on research conducted at the Fed Board, Hunt and Rebucci (2003) have developed a version of the GEM to explore the role of U.S. productivity growth in the 1990s in explaining the deterioration in the U.S. trade balance. They show that multisector models such as the GEM can help us better understand the implications of productivity growth when it is concentrated in the tradables sector. Also, the current versions of the GEM have been calibrated: following work done by Frank Smets of the European Central Bank and Raf Wouters of the National Bank of Belgium, we are now trying to estimate the model using Bayesian methods.

What about documentation and code?

The model is still at an early stage and additional refinements are being introduced. That said, an IMF working paper by Paolo Pesenti will document the theoretical structure of the model. We are also planning to release an IMF occasional paper later in the year that will include applications, solution techniques, and estimation methodology. Ultimately, we plan to make some versions of the model and sample programs available to the public.

References

Bayoumi, Tamim, Douglas Laxton, and Paolo Pesenti, 2003, "When Leaner Isn't Meaner: Measuring Benefits and Spillovers of Greater Competition in Europe," IMF Working Paper, forthcoming.

Hunt, Benjamin, and Alessandro Rebucci, 2003, "The U.S. Dollar and Trade Deficit: What Accounts for the Late 1990s?" IMF Working Paper, forthcoming.

Laxton, Douglas, and Paolo Pesenti, 2003, "Monetary Policy Rules for Small, Open, Emerging Economies," *Journal of Monetary Economics*, forthcoming.

Obstfeld, Maurice, and Kenneth Rogoff, 1995, "Exchange Rate Dynamics Redux," *Journal of Political Economy*, Vol. 103, pp. 624–60.

———, 1996, *Foundations of International Macroeconomics* (Cambridge, Massachusetts: MIT Press).