Editors' Summary

THE BROOKINGS PANEL on Economic Activity held its sixty-second conference in Washington, D.C., on September 5 and 6, 1996. This issue of *Brookings Papers on Economic Activity* includes the articles and discussions presented at that conference. The first paper employs advanced statistical technique to analyze the importance of monetary policy and the mechanisms by which it affects the economy. The second demonstrates the importance of variations in the workweek of capital in the business cycle. These papers are followed by a symposium on the economies of the Pacific Rim. The first symposium paper revisits the debate on the relative importance of total factor productivity and capital accumulation in explaining rapid economic growth in East Asia. The second considers Japan's experience, both with successful growth and, ultimately, with its financial bubble and recent stagnation. The third examines China's economic development over the past two decades and its prospects for the future. Three extended comments offer observations about past and prospective growth in the region and elsewhere. Brookings is grateful to the Korea Foundation for financial support for the symposium.

THE PROFESSION is still far from a consensus on the importance of monetary policy for the behavior of prices and output. In part this reflects the plethora of theoretical models ascribing different roles to money. In the absence of clarity about the role of money and the mechanisms by which monetary events are transmitted through the economy, there is a fundamental difficulty in distinguishing the response of the economy to actions of the monetary authority from the responses of policymakers to the economy itself. One important strand of recent empirical research attempts to understand the importance of monetary policy through the use of identified vector autoregressions

(VARs), which place minimal restrictions on the ways in which monetary actions affect the economy. These models explicitly recognize the dependence of monetary actions on other economic variables through a policy reaction function and focus attention on the effects of policy shocks or innovations. As these methods have been developed to handle complex, multivariate data sets, a variety of models and approaches has emerged. Researchers have chosen different data sets, made different identifying assumptions, and tended to emphasize differences between their results, rather than commonalities. In the first paper of this issue, Eric Leeper, Christopher Sims, and Tao Zha use a single time frame and data set to test the robustness of results in this recent literature and to trace the sources of differences in conclusions. They also extend the analysis to models with a much richer array of goods and financial market variables than has previously been considered, thus providing a more complete picture of the monetary transmission mechanism.

The authors begin with an extensive discussion of the methodology underlying identified vector autoregression models, contrasting these models with traditional simultaneous equation (SE) models and the more recent generation of dynamic stochastic general equilibrium (DSGE) models. Since the authors' subsequent application of identified VARs is accessible without a full understanding of these methodologies, our discussion of this section will be brief. Each equation in a VAR system defines a relationship between current and past values of a list of time series and a contemporaneous independent disturbance. Under the usual assumptions, each of the time series can be described as the sum of mutually independent components, which are linear combinations of the independent disturbances. A distinguishing feature of the authors' approach is their insistence that a well-specified model accounts for all correlations among disturbances, so that the system can be represented in a form in which the disturbances have an identity covariance matrix. In this setup, specifying the disturbance or disturbances that correspond to monetary actions is equivalent to specifying the equation or equations that characterize monetary policy behavior—that is, a monetary reaction function or monetary policy rule. The authors argue that it is unsatisfactory to assume, for example, that monetary policy disturbances are important but are systematically offset by private sector disturbances. If the offsetting disturbances are, in fact, responses to policy, that relation should be modeled explicitly; if

they reflect the effect of private shocks on policymaking, they should be part of the model of policy behavior.

At an abstract level the VAR model is quite similar in form to traditional simultaneous equation models, and its implementation raises many of the same issues. In order to use the VAR model for economic policy, it is necessary to impose restrictions that give its elements economic interpretation—that is, identify the model. Like traditional SE modelers, VAR modelers can use exact linear restrictions on the coefficient elements that relate the variables to one another and to the disturbances. However, because of the assumption that the disturbances are independent, a VAR model needs fewer such restrictions than a similarly sized SE model, which places no restrictions on the correlations among disturbances. The authors use two other sorts of identifying restrictions: probabilistic assertions about the elements of the coefficient matrix (this turns out to be problematic in their subsequent empirical work) and informal restrictions on the reasonableness of the impulse response functions that trace the effects of disturbances on the variables over time. Their informal criteria for plausibility are loose. For example, in response to monetary contraction, they regard as implausible either significant positive responses of prices or output, or a significant negative response of interest rates. The authors are unapologetic about using their beliefs about the forms of impulse responses to focus on particular specifications. They note that this is no different than economists' typical practice of adjusting a model until it both fits the data and gives reasonable results. They also observe that it would be computationally expensive, though possible, to impose these beliefs about the forms of the impulse responses as precise a priori mathematical restrictions.

The treatment of policy as random in identified VAR models has often been criticized. But the authors argue that policy is as random as any other aspect of economic behavior. It reflects the dynamic interaction among members of the Federal Reserve's Open Market Committee with somewhat different policy objectives and with uncertainty about both the condition of the economy and the consequences of policy actions. In such circumstances, economists are far from a deterministic explanation of policy actions.

The authors observe that DSGE models are much more strongly restricted than identified VARs, invoking many conventional but arbi-

trary restrictions on functional forms of utility, on production functions, and on the stochastic properties of disturbances. The DSGE models do provide a complete interpretation of the stochastic disturbances in the model, but such disturbances are typically far fewer in number than are the variables in the system. By contrast, the identified VAR approach starts with an unidentified model of the economy and introduces identifying information cautiously. As a result, while the effects of policy disturbances on the economy can be traced out, the precise mechanism by which they work their way through the economy may not be known. The authors suggest that each approach has its advantages and its disadvantages. The DSGE approach invites the erroneous impression that the data produce a result that actually flows almost entirely from initial assumptions. The identified VAR approach does not provide a convenient framework for the application of a priori knowledge about interactions in the economy.

Leeper, Sims, and Zha provide an historical overview of empirical work that has attempted to uncover the effects of monetary policy actions on prices and output, highlighting the many difficulties that have arisen. The timing of monetary events relative to movements in prices or output is easily observed and provides evidence that is undoubtedly persuasive to many observers. A simple graph of short rates, for example, appears to show that almost all postwar U.S. recessions have been preceded by monetary tightening, suggesting that policy was responsible for the event. However, this simple interpretation is subject to two criticisms. First, evidence from timing is notoriously sensitive to the treatment of trends; differencing the data can dramatically alter the results. The apparent lead of interest rates may be simply an artifact of the general rise of interest rates during the period. Second, money, output, and prices may all be responding to other variables, rather than to one another.

The authors elaborate on these issues. Although evidence from the timing of cyclical peaks is sensitive to differencing or other filtering of the data, more sophisticated tests of causation are not. Monetary aggregates, for example, do help to predict future output independent of data filtering. This is so even if the effects are limited to the variation in money that past output does not predict. Milton Friedman presents such evidence in his classic analysis of the importance of money. To illustrate this result, the authors provide a simple VAR in M1, the

consumer price index, and GDP that indicates that an innovation in money leads to a smooth and slow response of the price level and a quicker, but less sustained, response of output. At the same time, in this VAR innovations in output and prices have little effect on money. Although these results do not easily fit a rational expectations monetarist view, they are consistent with a more eclectic monetarist view. The results, however, are still vulnerable to the second criticism noted above. Movements in money, although purged of the influences of past and contemporaneous movements in prices and output, may be responding to other variables, not included in the analysis, that affect both current money and subsequent output and prices.

Much of the empirical work following the VAR approach can be regarded as an effort to examine this possibility. Leeper, Sims, and Zha reestimate the models of several authors, using a standard data set and time period, to illuminate the many issues that arise and distill whatever conclusions are robust. As Sims has pointed out in earlier work, although little of the variation in monetary aggregates is predictable from data on past prices and output, a considerable amount is predictable when information on past interest rates is included. Leeper, Sims, and Zha confirm this in a simple VAR system in which money innovations have little predictive power for output once the federal funds rate is included. However, the model reveals other problems that are common in VAR investigations. One is the "liquidity puzzle." Expansionary innovations in monetary aggregates, rather than reducing interest rates in accordance with common sense and most theories, appear to increase rates. Although interest rate innovations do not exhibit the reverse phenomenon—positive rate innovations are followed by monetary contraction—they display the "price puzzle." Prices rise steadily following a positive rate innovation; if the rate innovation is interpreted as a monetary contraction, the results have the disconcerting implication that monetary contractions produce inflation.

The authors use the four-variable system with output, prices, M1, and the federal funds rate to illustrate how restrictions on some of the VAR relations can alter the results and eliminate these puzzles. They impose the restraints that policymakers do not respond within the month to innovations in prices and output and that prices and output are unresponsive to within-month changes in interest rates and money. In the resulting system, a tightening of policy leads to an initial rise in the

federal funds rate and a decline in M1. Over the next year, the funds rate gradually returns to its initial level, while M1 remains well below its initial level. Although output declines persistently in response to the monetary contraction, not much of its overall variance is attributed to the policy disturbance. Prices move in the expected direction, but only slightly and statistically insignificantly. The system has other attractive features. Every private sector shock that implies inflation generates a contractionary response in the interest rate. Indeed, most of the movement in interest rates is accounted for by these endogenous responses, rather than by policy shocks. The authors observe that most of the variation in output and prices is accounted for by innovations that look like supply shocks, which move prices and output in opposite directions. While the restrictions provide a more satisfactory model of policy shocks, some puzzles remain. It is hard to understand, for example, why M1 responds so strongly and persistently when the effects of policy on prices and output are so small and the effects on interest rates are so temporary.

In other attempts to pin down the role of policy, researchers have introduced additional variables that may contain information about the future course of prices and output and that could influence current policy actions. To ignore such variables risks relegating their effects to the disturbance term and attributing to policy shocks events that in fact determine policy. Researchers have also explored the possibility of replacing monetary aggregates with variables such as total or unborrowed reserves, which the Fed controls more directly. Such variables, for example, may not show the exaggerated response of M1 revealed in the four-variable model above. The authors discuss three recent studies by Steve Strongin; Lawrence Christano, Martin Eichenbaum, and Charles Evans; and Ben Bernanke and Ilian Mihov, all of which introduce some details of the banking system and focus on the reserves market, omitting monetary aggregates from the analysis. These studies follow the general strategy illustrated in the four-variable model, although they are not always clear about the restrictions on the nonpolicy equations necessary to justify the interpretations given to the results. Leeper, Sims, and Zha conclude that they either suffer from anomalous results or require implausible restrictions.

The inadequacies of the relatively small models in the existing literature lead the authors to construct and analyze two much larger sys-

tems, in which they distinguish between two aspects of Fed behavior: macroeconomic policy and bank regulation. In their view, the Federal Reserve is concerned with reserve and deposit flows in the short run primarily because of their potential impact on the funds rate, for which the Fed sets its objectives in the light of broader macroeconomic conditions. The smaller of the authors' two models contains thirteen variables, including both M1 and total reserves. In addition to GDP, the authors include three of its components—consumption and residential and nonresidential investment—as well as unemployment, allowing them to assess in some detail the plausibility of responses to policy disturbances. These variables, together with the general price level and M1, are assumed to be sluggish—not responding to financial signals within the month. In addition to the commodity prices included in the simpler models, the authors include three informational variables: the Standard and Poor's 500 stock price index, the ten-year Treasury bond rate, and an index of the value of the dollar. Each is allowed to respond within the period to all other variables. As in the simpler models, the system includes only one short interest rate in the policy block, since, with more than one short rate, it is hard to disentangle arbitrage relationships from Fed behavior.

In view of the large number of variables and potential pitfalls, the results of estimating this model are remarkably sensible. Shocks to the Fed's macroeconomic policy equation produce plausible effects. In response to a monetary contraction by the Fed, short and long interest rates rise, reserves and M1 fall smoothly, output and its components fall, unemployment rises, commodity prices drop smoothly, and the dollar appreciates. The impulse responses are not only qualitatively sensible, they are also rather sharply estimated. Several other results stand out. Reserve movements appear to reflect the Fed's accommodation of shifts in demand for reserves that are unrelated to movements in M1, indicating that it is inappropriate to use reserves as a single monetary aggregate variable. A private sector shock appears to be the single most important source of variation in both M1 and total reserves, showing why it is unsatisfactory to use monetary aggregates as one-dimensional policy indicators. A large fraction of the variance of interest rates is attributed to systematic policy responses to inflation, not to erratic fluctuations in policy.

The authors also present a still larger model with eighteen variables,

replacing the short Treasury rate with the Federal Reserve's discount rate and the federal funds rate, and adding four other variables related to the banking sector. The results from this model are quite similar to those from the thirteen-variable version. They not only demonstrate the feasibility of a more elaborate description of the monetary process, but also provide insights not available from the smaller model. For example, movements in the discount rate and in the federal funds rate are not equivalent. A federal funds rate change "ratified" by a change in the discount rate has larger and more permanent effects than a movement in the funds rate alone.

The authors are encouraged by their success with a large modeling framework that gives a clearer understanding of identification issues and is able to trace out the effects of policy actions across a wide range of variables. This success increases their confidence about their identifying assumptions. A major lesson of the authors' analysis is that it is inappropriate to regard movements in monetary variables mainly as responses to policy disturbances; rather, most movements in monetary variables are responses to the state of the economy, not random deviations of the monetary authorities from their usual behavior. They conclude that their methodology both allows the policy response process to be identified empirically, and sharpens economists' understanding of how monetary policy, in turn, affects the economy.

THE PROCYCLICAL behavior of both labor and total factor productivity (TFP) is a salient feature of the business cycle. This characteristic poses a problem for the simplest models of production that assume constant returns to scale and in which variations of output come from variations in the amount of labor that is applied to a fixed stock of capital. In such models labor productivity should be countercyclical, reflecting the diminished returns to labor associated with higher employment and more hours. A variety of explanations have been provided for why productivity is not countercyclical, ranging from positing short-run increasing returns to scale to simply assuming that technological shocks are cyclical. A traditional explanation, more in keeping with the neoclassical view of technology, is that over the cycle, the delivery of capital services from a fixed capital stock varies directly with labor input. It has long been clear that variation in capital services can help to explain cyclical productivity qualitatively, but there has been little

direct evidence on its quantitative importance. In the second paper of this issue, Matthew Shapiro provides quantitative evidence on the importance of variation of the workweek of capital, both for aggregate manufacturing and for individual industries.

The essential assumption in Shapiro's analysis is that the delivery of capital services from a given stock of capital depends on the number of hours for which the capital is utilized. Shapiro considers three different margins that affect this workweek—the number of shifts that capital operates, the number of hours in each shift, and the number of days per week that the plant operates—and examines three different sources of information about these margins. The Census Bureau's Survey of Plant Capacity (SPC) provides a direct measure, asking how many hours per day and days per week establishments operate. The SPC data are available for only the fourth quarter and over a short sample period, and they record only total employment, not employment per shift. Shapiro makes use of an unpublished series constructed by Joseph Beaulieu and Joe Mattey that aggregates the SPC data to the industry level, making necessary assumptions about the ratio of capital to labor across shifts. His two other sources of information are surveys of workers conducted by the Bureau of Labor Statistics—the Area Wage Survey (AWS) and the Current Population Survey (CPS)—from which he infers the capital workweek. These provide information on the fraction of workers on late shifts that can be used to construct estimates of the fraction of workers in plants that operate one, two, or three shifts. The AWS data also require substantial processing to yield the aggregate component of shift employment. In this case, Shapiro makes use of a series for the aggregate component constructed by Joram Mayshar and Gary Solon. The CPS data contain information on the time at which workers start and end work and have the advantage of being based on a representative sample of the U.S. population. Unlike the other two measures, the CPS data are not limited to manufacturing. To form industry-level aggregates, Shapiro sums the number of workers per shift in each industry, using the CPS sampling weights.

The three different aggregate measures of the workweek of capital cover different periods but show similar behavior. By all measures, the workweek of capital in manufacturing is highly variable. The SPC measure, for example, is more than twice as variable, relative to its mean, than the workweek of labor. Dips correspond to recessions, and

peaks correspond to booms; the correlation with the workweek of labor is strong but by no means perfect. The SPC and AWS series, although they differ significantly in their estimates of average workweek, both display a noticeable upward trend, in contrast to the relatively trendless workweek of labor. The CPS series for manufacturing is somewhat less variable and, not surprising, the CPS data for the workweek of capital in nonmanufacturing sectors are substantially lower and less variable than the data for manufacturing.

How important are cyclical changes in the workweek of capital and employment? Shapiro explores this question by relating cyclical movements in the workweek of capital to the Federal Reserve Board's measure of capacity utilization, both in aggregate and by industry, and by examining the fraction of fluctuations in production employment over the cycle that is accounted for by the movement of workers on and off late shifts. At the aggregate level, as might be expected, the correlation between the workweek of capital and capacity utilization is high, ranging from 0.55 to 0.85, depending on the particular measure and period used. The aggregate data conceal dramatic differences in the average workweek of capital across industries, ranging from 45 to 50 hours in industries such as apparel, furniture, and leather, to more than 125 hours in paper, chemicals, petroleum, and primary metals. Although the correlations of the workweek of capital with output are uniformly positive, they vary widely. Compared with the average, the industries at either extreme of the distribution of the average workweek generally show less variation in the workweek and lower correlations between the workweek of capital and capacity utilization. For example, petroleum, the stereotypical continuous process industry, has the highest average workweek of capital (156.8 hours) and the lowest correlation between the workweek and capacity utilization (0.06). Typically, labor input and the workweek of capital move together. In order to understand the importance of capital services per se, Shapiro runs a bivariate regression, controlling for total labor hours. Even holding total labor input fixed, the workweek of capital remains a powerful explanatory variable for several industries—nonelectrical machinery, transportation equipment, paper, and rubber. However, in others the colinearity between the workweek of capital and labor hours makes it impossible to distinguish their roles. In explaining total manufacturing production, the capital workweek dominates production worker hours.

To what extent is variation in total employment accounted for by workers coming on and off late shifts? From the AWS sample, Shapiro estimates that the elasticity of employment on late shifts with respect to total employment is 1.62. Given the share of shift employment, this implies that 42 percent of change in employment occurs on late shifts. However, it is not possible to tell how much of the extra shift employment is associated with additional plant shifts. In many cases, the addition of shift labor must accompany the addition of the services of capital that was previously idle at night. Thus there is less reason for a decline in labor productivity with cyclical expansion than there would be if the increased labor hours were spread across a fixed total of capital. Regressions on the CPS data, separating continuous from noncontinuous process industries, give results consistent with this picture. In the continuous process industries the elasticity of late shift employment to total employment is well below 1.0; in the noncontinuous process industries it is well over 1.5. The two-digit detail shows substantial sensitivity of late shift employment in the capital-intensive assembly industries in which one would expect shiftwork to be an important margin, but there are also some surprises. Petroleum, for example, has a high elasticity. Shapiro runs similar regressions for nonmanufacturing industries. The most notable feature of these results is the typically low elasticity of shift employment for the service industries, even in cases where a substantial portion of the labor force is employed on a late shift.

How useful are Shapiro's measures of the workweek of capital for accounting for the procyclical movements in productivity? He focuses on the standard Solow total factor productivity residual, which gives the percentage change in output not explained by the share-weighted percentage changes in inputs. As Robert Solow first noted, the cyclical movements in the estimated residual can be reduced by assuming that capital services themselves move with a cyclical variable. Solow examined the implications of adjusting the capital stock by the employment rate of labor. Shapiro follows Solow's strategy to assess a variety of other candidates that might capture the cyclical movement in capital services. In particular, he examines the implications of assuming that capital services are proportional to energy use, materials use, and his own estimate of the workweek of capital. Hence the standard residual is adjusted by the percentage change in each of these variables multi-

plied by capital's share. For a pooled sample of 450 industries over the period 1977–88, Shapiro calculates the correlation between the revised productivity residual and capacity utilization, again taken as a measure of the cycle. The unadjusted Solow residual shows the expected positive correlation with capacity utilization. With adjustment for variations in the employment of capital, the cyclical nature of the residual is no longer clear. The energy use adjustment substantially reduces the cyclical movement in the residual, the workweek of capital adjustment reduces the correlation to near zero, and adjustment by materials use implies slightly countercyclical behavior. Shapiro conducts a more formal test by regressing the residuals, adjusted and unadjusted, on total factor input growth, using instrumental variables. As expected, the unadjusted residual is highly cyclical, showing a substantial and precisely estimated coefficient on total factor input growth. When the workweek of capital is used, the cyclicality of productivity largely disappears. Energy use and materials use account almost as well for cyclic productivity. For all manufacturing, the results suggest that it is best to adjust the Solow residual by the workweek of capital, but energy use and materials use also appear to be fairly good proxies for capital utilization. However, the workweek of capital is not a relevant margin for industries that require around-the-clock operation. In these industries, energy use and materials use do a much better job of explaining the residual.

It is striking how important the capital workweek is in explaining fluctuations in capacity utilization for all manufacturing and how successful it is at eliminating cyclical movements in estimated productivity, when it does not appear to play such a major role for many industries individually. One explanation for this paradox is that the workweek is serving as a proxy for other cyclical factors. But Shapiro argues that the success of the workweek of capital in the noncontinuous process industries and its failure in the continuous process industries show that it is a genuine measure of capital services, not merely a proxy cyclical indicator. He further examines this possibility by freely estimating the coefficient on each of his measures of the capital workweek, rather than constraining the coefficients, a priori, to capital's share. If the freely estimated coefficient differs from capital's share, this is evidence that the measure is proxying for something other than capital services. For aggregate manufacturing, the estimated coefficient exceeds capital's share by

about a third; but this difference is not statistically significant. The results are quite similar for the noncontinuous process industries alone. For the continuous process industries, however, the coefficient on the workweek is roughly twice as large as it should be if it were strictly a measure of capital utilization. It appears that in such industries it is proxying for more general cyclical variation. In separate regressions, Shapiro finds overwhelming evidence that neither energy use nor materials use is a good proxy for capital services.

Shapiro offers a number of suggestions for improving the empirical measures of the workweek of capital. He believes that the Survey of Plant Capacity is one of the best sources of data on the workweek of capital in U.S. manufacturing, but that modest changes in survey design might have substantial benefits. He urges that the SPC be continued on a regular basis and that new data be added on employment per shift and on the size of the capital stock. He also urges the publication of much of this information, with various improvements in the weighting of observations.

Shapiro concludes that in industries in which the shiftwork margin is operative, variation in the workweek of capital explains a substantial amount of the variation in production and virtually all of the cyclical movement in productivity. Thus there is no sign of increasing returns to scale. Nor is there evidence of the productivity shocks that are assumed by real business cycle models. If such models are to have any claim to realism, their proponents need to identify some other driving force.

THE RAPID GROWTH achieved by many East Asian economies in recent decades has prompted a wide range of research aimed at understanding how these economies grew and at drawing lessons for other developing nations. Yet all this scrutiny has not produced agreement about the basic sources of their rapid growth. Uncertainty remains about the relative contributions of technical progress and capital accumulation and the role that government policies have played in stimulating growth. In the first of three symposium papers on the economies of the East Asian region, Susan Collins and Barry Bosworth review the areas of disagreement about the sources of growth, conduct a new empirical analysis of growth using a large sample of countries from all regions and at all stages of development, and provide new evidence about the proximate sources of the extraordinary growth in the region.

Views about the sources of East Asian growth inform policy pre-

scriptions for developing economies. Collins and Bosworth reason that if accumulation of human and physical capital is the key, countries wishing to grow fast must forgo consumption in order to achieve high levels of investment. If, instead, the key is to adopt existing technologies from more advanced economies—closing the idea gap—less sacrifice may be needed and more attention to strategies aimed directly at enhancing productivity may be appropriate. The authors observe that the strategies used to enhance productivity have ranged widely, including targeted intervention, subsidization of industries that have potentially high productivity, market friendly liberalization, and the opening of trade and capital markets. They also observe that, in practice, the high-growth Asian economies have adopted a broad range of government strategies aimed at both capital deepening and productivity enhancement.

Collins and Bosworth begin their empirical analysis by using growth accounting on eighty-eight countries that cover all stages of development. They apply a common methodology to the countries, decomposing the growth in output per worker from 1960 to 1994 into the contributions from the accumulation of physical and human capital and a residual measuring the change in total factor productivity. While this methodology does not directly identify the fundamental causes of growth, the authors reason that it provides essential information on the proximate sources and avoids many of the statistical problems that make the results of direct regression analysis suspect. The methodology needs only a minimum of assumptions: sufficient competition to ensure that the earnings of factors are proportional to their productivities, so that income shares measure their relative importance in production; and constant factor shares through time in each country, a condition that is broadly supported by the data. Any scale economies are attributed to the productivity residual.

Collins and Bosworth depart from the data used to measure stocks of physical and human capital in many previous studies. For physical capital, instead of using the usual assumption that the share of output devoted to investment is a useful proxy for the capital stock—which would only be appropriate for countries on steady-state equilibrium growth paths—they construct capital stock measures based on a perpetual inventory model. Across their sample of countries, they find no

significant correlation between their measure and the mean investment share, which indicates that the usual assumption is questionable. The authors assume a fixed capital share of 0.35 in the main analysis, although they show that their results are robust to varying the assumed capital share between 0.3 and 0.4.

To measure human capital, Collins and Bosworth start with estimates of employment, where they are available, and unpublished estimates of the labor force from the International Labour Organisation where they are not. As measures of labor quantity, the growth rate of these estimates differ from the population data that have been used in many earlier studies. To measure changes in labor quality, they construct weights based on the relative wage structure for workers with different years of schooling and use these to aggregate workers across educational levels in each country. The resultant index of labor quality differs noticeably from indexes that simply weight by years of schooling without reference to how years of schooling relate to relative earnings. The authors assume that the benefits of education, as measured by their quality index, are embodied in workers.

Collins and Bosworth present the results of their growth accounting for individual countries and also for aggregations of countries into several regions. They devote special attention to the East Asian region (excluding Japan, which they include in the industrial countries "region," and China, because of the quality of the data). Their principal finding is that the extraordinary growth in the East Asian economies has been driven by the accumulation of capital, especially physical capital, rather than by exceptional growth in total factor productivity. This result, which supports earlier research by Alwyn Young, is robust for the region as a whole over the entire period 1960–94 and also for most individual countries over shorter subperiods. However, for Taiwan, Thailand, and Singapore, and to a smaller degree Korea, they do find TFP growth well above average in the most recent interval, 1984–94. They also find that TFP growth has apparently been rapid in China over several time intervals, including the latest decade; but they review evidence from other sources indicating that the official data may overstate Chinese output and, thereby, the growth of TFP. They note that the contribution of TFP in East Asia, while lower than might have been expected in a region that is growing so rapidly, has been greater than

in other developing regions. In sub-Saharan Africa, the Middle East and North Africa, and Latin America, TFP growth has been negative since 1973.

The authors find that the contribution of educational advances has been larger in East Asia than in other regions, though it remains a relatively minor part of the growth story. They note that if, as some argue, educational attainment brings large spillover effects that are not captured in individuals' earnings, this would imply a still smaller role for pure TFP effects in East Asia.

Collins and Bosworth acknowledge that their growth accounting framework might have trouble distinguishing between the contributions of capital accumulation and TFP growth, either because technical advances might be embodied in new capital or because TFP growth might induce capital accumulation by raising the returns to capital. To further explore these issues, they turn to cross-country regression analysis. They relate each country's growth to measures of its initial conditions and the external environment that other researchers have used—income per capita, life expectancy, years of schooling, the terms of trade and its variability, and the investment share of GDP—and to regional dummy variables. They then perform the same analysis to explain separately the two components of growth—capital accumulation and TFP—calculated from their growth accounting.

The measures of initial and external conditions are significant in explaining national growth rates, although their importance, especially that of education and the terms of trade, is substantially reduced when regional dummies are added. The dummies indicate that the East Asian region grew substantially faster than the other underdeveloped regions, even taking account of the conditioning measures. When the same analysis is applied to explain the components of growth, the East Asian economies stand out for their capital accumulation but not for TFP growth. Furthermore, capital accumulation and TFP growth have only a very low correlation across countries, contrary to the prediction of some endogenous growth models.

As to the role of government, Collins and Bosworth distinguish between two groups of policies. The first comprises those generally agreed to have been helpful, such as stable macroeconomic policies and the promotion of education. The second group is more controversial. It includes policies of openness to trade and industrial policies with se-

lective interventions. The authors use cross-country regression analysis of the components of growth to look at the extent to which these components can be explained by macroeconomic variables and indicators of trade policy.

Overall, the authors find that the macroeconomic policy and openness measures account for about one-third of the otherwise unexplained difference between growth in East Asia and other developing regions. Countries with smaller budget deficits and more stable real exchange rates tend to grow more rapidly, smaller deficits being associated with faster capital accumulation and exchange rate stability associated with faster TFP growth. They find that the index of openness constructed by Jeffrey Sachs and Andrew Warner (*BPEA, 1:1995*) is strongly associated with growth. However, all of the association is with capital formation, not productivity growth, which casts doubt on Sachs and Warner's interpretation that openness permits poorer countries to import modern technology from wealthier ones. Based on their results as a whole, Collins and Bosworth suggest that the search for what worked in East Asia should be focused on what encouraged capital accumulation.

Finally, the authors question Paul Krugman's pessimistic assessment of the prospects for continued rapid growth in East Asia. They show that for most countries in the region, the stock of physical capital per worker is still less than half of that in the United States or Japan. The quality of the labor force will continue to improve as well-educated younger cohorts replace less educated retirees. They reason that this and the apparent improvement in TFP growth in the most recent decade can sustain the high return to capital and encourage the capital deepening that has been the main contributor to growth in the region.

JAPAN WAS THE first miracle growth economy and, throughout much of the postwar period, has been taken as a model for others to emulate. More recently, the boom and bust in Japan's financial markets and the extended slump in its economy have prompted doubts about the very institutions and policies that had previously been admired for their contributions to economic growth. In the second symposium paper, Takatoshi Ito looks at both the good and bad episodes in Japan's experience and asks what lessons they may provide.

Taking a century-long perspective, Ito identifies the period of near

10 percent growth between the late 1950s, when GDP caught up with its prewar trend path, and the early 1970s as Japan's miracle growth years. During the remainder of the 1970s and the 1980s, growth slowed to less than half this rate, although it remained fast enough to continue to narrow the GDP gap with the United States. In contrast to other East Asian miracle economies, total factor productivity was the most important source of growth in Japan during its miracle years.

Ito discusses several features of the Japanese economy, contrasting the positive assessments made of them during the years of rapid growth with the criticisms made of them since the economy has stagnated. *Lifetime employment* had been seen as stabilizing the labor market and promoting a range of skills through on-the-job training. With employment growing slowly or declining in many sectors, observers now question whether firms can keep the promise of lifetime employment in the future. They also fear that future growth industries will require more specialized skills that may rapidly become obsolete and are therefore not suited to lifetime employment arrangements. The *main bank system*, in which banks own both debt and equity, serve on boards, and monitor management, had been seen as eliminating the inefficiencies associated with asymmetric information between the providers and users of capital. Since the decline in stock prices and the rise in loan defaults, observers now question the ability of banks to properly monitor corporations and allocate capital. The horizontal and vertical *keiretsu* had been seen as monitoring their constituent firms, promoting their long-run orientation, and offering them scale economies. Now *keiretsu* appear less relevant, since the sectors that are expected to grow in the future are not associated with them. The government's *industrial policy* had played an important role by targeting certain industries for growth and export promotion and providing them with subsidies and protection. Today, industrial policy is hardly relevant, in part because trade conflicts have shifted Japanese priorities away from export promotion and toward domestic consumption and market opening.

Looking ahead, Ito suggests that Japanese policymakers will actively pursue more liberal policies on land use, deregulation, and other measures to enhance competition. Candidates for deregulation include airlines, telecommunications and broadcasting, financial services, and distribution. He also notes that major demographic changes will affect Japan's saving and investing balances in the future. The ratio of work-

ing age to retirement age populations is projected to decline from 5.8 in 1995 to 2.3 in 2025, or even lower if recent low birth rates are maintained. He expects that this change will reduce the historically high household saving rate and with it the current account surplus, domestic investment, which has already declined in the 1990s, or both.

Ito finds both differences and commonalities between Japan and other rapidly growing economies in the region. All have had relatively well-educated populations. All increased the share of exports in GDP and the share of manufacturing in total output. In most, government actively promoted the export sector. However, in contrast to Japan, most other Asian economies either did not try to target industries for import substitution, or were unsuccessful in doing so. While in Japan securities markets have been inefficient and banks have been the main financial intermediaries, in Hong Kong, Singapore, and Malaysia securities markets have been active. Ito also notes that the East Asian economies have differed widely in their openness to foreign investment and in their reliance on domestic saving, and he finds little relation between growth and changes in real exchange rates across countries.

CHINA HAS GROWN rapidly since the inception of economic reforms in 1978, and real GDP growth has averaged 10 percent since 1984. It has also emerged as a significant trading nation, accounting for 3 percent of world exports in 1995. While other Asian nations had earlier achieved comparable growth rates, starting with Japan in the 1950s, China's development has been distinctive in that the country had been a closely controlled socialist state and only gradually opened to private enterprise and the outside world. But, even more than its history, it is China's size that makes it so special today. In the third symposium paper of this volume, Barry Naughton examines China's development to date and projects some likely features of its future development.

In the initial stages, China's reforms focused on the domestic economy, and the country moved only cautiously away from its previous isolation from the world economy. Naughton shows that trade was concentrated in special economic zones (SEZs), of which Guangdong province, adjoining Hong Kong, was and is the most prominent. The SEZs had little connection to the rest of the domestic economy, and the foreign investment that they attracted was initially aimed at export trade. Until 1991, both the output and the exports of foreign-invested

enterprises (FIEs) rose gradually to just over 4 percent of China's GDP. After 1991, the pace of foreign investment quickened. The output of FIEs soared to over 15 percent of GDP in 1994, and more than half of this additional output went to the domestic market rather than to exports. As Naughton observes, these abrupt recent changes illustrate why simply extrapolating past trends is inadequate for projecting China's future growth and trade. To better inform such projections, he analyzes structural changes and the transition strategy underlying current economic policies.

One key structural change follows from China's unusual demographic structure and its consequences for labor force growth. Naughton reports that during 1978–91, growth of the working age population averaged 2.5 percent a year and growth of nonagricultural employment averaged 5.4 percent a year. Echoing the birth limitation policies introduced in the mid-1970s, growth in the working age population slowed to only 1.2 percent a year during 1991–95, and the U.S. Census Bureau projects zero growth by 2015. Assuming that agricultural employment continues to decline at the 2.1 percent rate of recent years, Naughton projects that annual nonagricultural employment growth will slow to 4.1 percent during 1995–2005, to 2.2 percent in the following decade, and to only 0.7 percent during 2015–25, with a corresponding slowdown in total output growth.

Naughton stresses that Chinese policymakers initially viewed rapid labor force growth as a constraint on reforms that threatened to raise unemployment. Until the 1990s, the government took responsibility for full employment and promoted jobs in agriculture, community-owned enterprises, state-owned enterprises (SOEs), urban collectives, and government. Starting in 1991, this pattern has changed dramatically. Employment in broad categories of private nonagricultural enterprises has risen three to four times as fast as it did in the previous five years, and agricultural employment has declined. Employment in community-owned township and village enterprises—which compete in the market economy even though they are publicly owned and had been growing in number since the inception of reform—also expanded sharply over this period.

In examining China's transition strategy, Naughton distinguishes between its two main elements, one concerned with introducing market forces to the domestic economy and the other with opening China to

foreign trade. The transition toward a market economy has primarily relied on the entry of new domestic producers rather than on the privatization of state-owned enterprises. Today, SOEs are concentrated in certain manufacturing industries, utilities, and natural resource extraction; their share of industrial output declined from 78 percent in 1978 to 31 percent in 1995. The strategy for opening to foreign trade and world market forces has been more complex. Since the start of the reforms, China has taken many conventional steps toward these ends: the currency has been devalued and the distinction between official and swap market rates has been eliminated; restrictions on convertibility have been greatly eased, with full current account convertibility expected by the end of 1996; the right to trade has been extended to a great many firms; nontariff barriers have been substantially reduced; and pricing for domestic firms involved in trade has been increasingly related to world prices. Although these measures represent considerable liberalization from the tightly closed prereform economy, most domestic firms still operate in a regime that is oriented toward import substitution, with imports and exports funneled through state-run foreign trade corporations.

The major innovation in the trade arena has been the creation of an export promoting regime, in which rules and regulations are designed to attract foreign investment and permit foreign-invested enterprises to bypass the domestic regime. These FIEs, operating with a minimum of administrative interference and often with tax preferences, are concentrated in Guangdong and Fujian provinces—where they have benefited greatly from proximity to Hong Kong and Taiwan—and to a lesser extent in other coastal provinces. FIEs have been responsible for much of the country's export growth. Since 1991, they have also been a growing factor in the domestic market, toward which they have directed over half of their rapidly increasing output.

Although Chinese exports have expanded rapidly, Naughton observes that the country's economic development has proceeded very differently from the export-led development of Japan, Korea, and Taiwan. These other countries restricted foreign investment inflows, whereas China has encouraged them. They maintained stable, probably undervalued, currencies as their exports expanded, whereas China's real exchange rate has fluctuated, with a tendency toward overvaluation as a result of the large foreign investment inflows. And they relied on

domestically owned firms to manufacture and export, whereas China has relied on FIEs.

The special circumstances under which the FIEs operate in China lends them some unusual characteristics. Initially, much of their export volume came from enterprises based in Hong Kong and Taiwan that had relocated the more labor-intensive parts of their production. The Chinese value added in such exports is relatively low. More recently, domestic firms have gained access to many of the export promotion regime's preferences by forming joint ventures with FIEs. Chinese value added content in their exports should be higher. Large investment inflows to China have contributed to substantial real appreciation of the yuan, despite the accumulation of foreign exchange reserves by the government. Naughton expects direct foreign investment to continue at a high rate because the Chinese domestic market has such great growth potential. Eventually, as real appreciation reduces the competitiveness of the export sector, he expects FIE production for the domestic economy to offset a slowdown in export growth rates. From the Association of Southeast Asian Nations (ASEAN), Naughton identifies the populous "ASEAN four" (Indonesia, Thailand, Malaysia, and the Philippines) as direct competitors with China in the production of labor-intensive exports. He sees the ongoing need for foreign investment as a force to pressure China and the ASEAN nations to liberalize their economies.

Naughton expects Chinese policymakers to unify the two trade regimes in coming years. To do so would broaden the country's export base and reduce the distortions of the present dual system, recover some revenues now lost to tax preferences in the export regime, and tap the human skills that are located outside the SEZs. A broader export base would extend the prosperity that a few coastal provinces have recently enjoyed and help to meet the competition that is arising from other, less-developed countries in the region. However, Naughton believes that the single system that evolves from the unification of the two trade regimes will be less liberal for the FIEs than their present regime with all its preferences.

IN THE FIRST of three extended comments by symposium participants, Stanley Fischer emphasizes how much economists still do not understand about the East Asian growth miracle. He notes that the

nations of the region have pursued a range of specific policies, so that no one can be identified as crucial to success. While research like that reported in the papers of this symposium provides useful generalizations about what aids growth, not all countries fit these general findings either. Even the undoubtedly correct emphasis on capital formation leaves Hong Kong as an exception. And how to raise saving rates and encourage capital formation remains a difficult question.

While acknowledging these gaps in economists' understanding, Fischer does describe broad features that he believes contributed to the success of most successful economies and could inform the policy choices of other countries wishing to grow. Governments were adaptable; they relied on the private sector for production and on market forces to provide competition, even while using industrial policies to direct resource flows. Governments also laid heavy emphasis on macroeconomic stability and reacted swiftly against a threat of instability. No country tolerated double-digit inflation, none pursued an excessively easy macroeconomic policy, and most have had small governments and small budget deficits.

Fischer finds particular grounds for optimism about development in the successes of Malaysia, Indonesia, and Thailand. Unlike China, Japan, or Korea, none of these countries had ever been an advanced economy in the past. What is more, Malaysia has succeeded while ensuring that the benefits of growth reach the indigenous population, and Indonesia seemed an unlikely candidate for sustained growth thirty years ago. Each of these countries has shown good economic management, although with different styles; government has been very active in Malaysia and Indonesia but less so in Thailand. Each country has broad-based primary education, and each has been relatively open to imports and has maintained reasonable macroeconomic stability. Although these countries are running large current account deficits and experiencing large capital inflows, and therefore are vulnerable to an abrupt reversal of confidence, Fischer believes that their current high rates of investment provide protection against such a shock, since reducing investment provides a relatively smooth way to adjust. Looking beyond the East Asian successes, he notes that Chile has stabilized and raised its growth rate, although it has few of the characteristics commonly associated with East Asia. He also observes that both in Chile

and in New Zealand, which is a more recent success story with little resemblance to the East Asian countries, it took years from the beginning of reform and stabilization before the growth process took hold.

Fischer concludes with a distinctly positive assessment of growth prospects for the East Asian region and for other regions as well. He calls particular attention to India, where reforms have begun to yield steady growth of about 5 to 6 percent a year, which could quicken as the growth process takes hold. And he believes that rapid growth in India, in turn, will help to start the growth process elsewhere in South Asia.

MOST STUDIES of East Asian economies have focused on the contribution of positive elements to growth. By contrast, in the second extended comment Edward Lincoln observes that all Asian nations have, at some time, operated with some degree of official corruption, private collusion, artificial prices, and other interferences with market forces, and he considers why these obvious mistakes and distortions have not had clear negative effects. He suggests that the costs of such rent-seeking activities might become important in the longer run, even though they have not suppressed entrepreneurial activity to the point of choking off growth. As an example, he notes that the moral hazard inherent in the structure of Japanese banking eventually led to huge losses and bad debts and warns that China and other Asian nations may face similar problems in the future.

In the wake of Japan's rapid development, governmental involvement in the economy through industrial policy has received particular attention from both policymakers and analysts. Lincoln notes that Japan's growth occurred with rapid gains in total factor productivity, which, in turn, were commonly attributed to its wide-ranging industrial policies. Many observers thought the Japanese pattern typical of Asian nations generally. Yet the Collins and Bosworth paper in this volume, as well as some earlier studies, show that productivity growth has not been exceptional in Asian economies other than Japan, a finding that could call into question the contribution of industrial policies. However, Lincoln observes that by providing a generally favorable environment for business, with the government guiding and subsidizing investment and tolerating cartels that protect profits, industrial policy reduced nor-

mal short-term business risk and encouraged banks to lend and firms to invest. He thus reasons that industrial policies may have been a force for growth through their effects on capital formation, even if they did not yield exceptional gains in productivity.

Lincoln notes two important side effects of such policies. One is domestic misallocation of investment, which often becomes apparent only after some time. The other is the impact that such overinvestment in particular industries has on other nations whose own industries are threatened by the overproduction. He observes that this adverse impact on other producers has been the source of extended trade conflicts between the United States and Japan, and that it now motivates the U.S. government's efforts to have China conform to World Trade Organization (WTO) rules and to push the Asia Pacific Economic Cooperation (APEC) as a vehicle for moving Asian nations to adopt open trading policies.

Lincoln identifies political stability as an important ingredient of successful growth in many Asian countries. He contrasts their situation with the often violent political environment in Africa, ideological struggles in Latin America, and ongoing conflicts in the Middle East. He also observes that within Asia, those countries that have most recently suffered from war or violent repression, including Vietnam, Cambodia, Burma, and the Philippines, have had the weakest economic performance. Looking ahead, he sees political uncertainty as the biggest potential stumbling block in Asia's economic future.

IN THE THIRD extended comment, Yung Chul Park discusses two important features of the growth of the East Asian economies and their integration with the economies of Europe and North America. The first is the widespread acceptance of liberal economic policies. The second is the emergence of China as a trading nation. Liberalization has led most of the East Asian countries to lower tariff rates and nontariff barriers and to open and deregulate their capital markets. Trade outside the region has developed along lines of comparative advantage, with the East Asian nations exporting manufactured goods to and importing services from Europe and North America. The opening of financial markets has attracted foreign capital, which, in turn, has spurred the investment boom. The emergence of China has led to growing trade and investment ties with other nations in the region, which has helped

to propel their economic growth and encouraged the integration of all the economies in the region.

As useful as these developments have been, Park notes that some observers see them posing problems for the future. In particular, portfolio investment to the East Asian countries excluding Japan is often voiced as a concern. It surged from $10 billion in 1983–89 to $63 billion in 1990–94, and, some believe, could be withdrawn at any time, leading to financial chaos like that recently experienced by Mexico. He recalls Krugman's warning that such instability could emerge as investors recognize that East Asia's rapid growth is bound to slow because it has been based on high levels of investment rather than on increases in efficiency. Park does not agree that such a pessimistic outcome is inevitable, or even very likely. He argues that rapid growth can be sustained if investment rates remain high and that the foreign capital inflows needed to finance investment will remain strong if the rate of return to capital remains high, as he expects. Although the longer-term incentives to foreign investment thus remain strong, he acknowledges that there is a genuine risk of destabilizing speculation. To discourage speculative inflows and outflows, he suggests some form of capital controls, coordinated internationally so as not to interfere with global financial integration.

Park discusses the worries that other East Asian nations have about China. First, they doubt that China will open its markets to the same extent that they have done or that China will abide by the rules of fair trade. As a consequence, they fear that they will be inundated by inexpensive Chinese manufactured goods and thus experience a slowdown in real wage growth, especially for unskilled workers. Second, they worry that China's bilateral trade surplus with the United States could provoke a protectionist backlash against the whole East Asian region. And third, they fear that China will use its growing influence and power to play its economic rivals off against each other.

To head off such outcomes, Park sees an urgent need for the United States and the European Union to assist China's entry into the world trading community. Bringing China into the WTO would permit departures from fair trade to be taken up in a multilateral forum. Membership in the WTO would also make it easier for China's central government to deal with protectionist pressures arising in individual provinces. Park also wants the United States to assume a greater leadership role in APEC

and to reduce the dependence of other East Asian nations on China by starting discussions to bring them into the North American Free Trade Agreement. Finally, he suggests that ASEAN be expanded to include the poorer nations of the region so as to reduce their dependence on China and facilitate closer trade relations with countries outside Asia.