

Editors' Summary

THIS ISSUE of the *Brookings Papers on Economic Activity* contains articles, reports, and discussions presented at the fifty-fourth conference of the Brookings Panel on Economic Activity, which was held in Washington, D.C., on September 17 and 18, 1992. The first article examines the likely impact of resource limits and environmental degradation on world growth. The second presents a model of consumer saving behavior focusing on the desire to prepare against job loss and income decline. The first of three reports in this issue investigates the connection between equipment investment and economic growth. The second analyzes the first year of Russia's economic reform. The last provides new estimates of the income elasticity of money demand.

IN CONCLUDING his paper on global constraints to growth, William D. Nordhaus observes that "in the last three decades the environmental revolution has fundamentally changed our world view so that we can no longer assume that our planet will remain unaffected by human activities." He organizes the many, often disparate, arguments that have been made about limits to growth in order to shed light on the severity of those constraints and to inform policymakers about how they should confront them. Twenty years ago, the publication of *The Limits to Growth* focused a public debate on whether the world economy would be constrained by a shortage of essential material resources such as oil; a recent update of that book, *Beyond the Limits*, raises that issue anew. Today, both in public discourse and among analysts, concerns center on whether living standards would be limited not by what we can take out of the planet, but by what harm production does to the planet—global concerns such as greenhouse warming, acid rain, the ozone hole in the atmosphere, deforestation, and the extinction of species, as well as concerns closer to home about air, water, and soil pollution.

To illuminate the issues at stake, Nordhaus outlines a framework for analyzing world growth through time: real output depends on inputs of labor, capital, natural resources, land, and the level of technology. What Nordhaus calls true national income adjusts down for pollution and other externalities that detract from the quality of life. The highly complicated model used by the *Limits* authors fits within this generalized framework. They project that the fixed stock of natural resources and land in the world^d would inevitably lead to reduced living standards, and would do so in a time frame relevant to current generations. In the *Limits* model, this result follows from the diminishing returns that other factors, including labor, receive when they must work with the declining flow of services available from the depleting stock of natural resources. An expanding world population hastens the process of decline in average living standards. Taking account of pollution and other bad externalities, living standards measured by true national income must decline still faster.

The key ahistorical assumption in the *Limits* analysis has been the neglect of continuing technical progress, which both improves the amount of output produced by given inputs and facilitates the substitution of more abundant inputs for those that have grown more scarce and expensive. Although economists have long recognized this crucial omission from the *Limits* analysis, Nordhaus emphasizes that doing so does not resolve the issue. A proper assessment of global growth prospects is inevitably an empirical matter, so he turns to the data.

The long historical record reveals that the trend of U.S. productivity has indeed slowed in the past two decades. The subperiod 1973–89 was the only major interval since the 1870s in which aggregate productivity, measured for either the private or private nonfarm economy, rose less than 1.0 percent per year. (In manufacturing, measured productivity has about equaled the historical average, but Nordhaus notes that data for the latest period are buoyed by a method of accounting for technical improvements in data processing equipment that was not employed for technical improvements in earlier periods.) Both the exhaustion of natural resources that forces countries to move to less productive substitutes and the need to divert production to pollution reduction or cleanup contribute to slowing the growth of output and productivity. Summarizing a range of earlier studies including his own, Nordhaus reports that out of a total productivity slowdown of 1.5 percentage points between 1948–73 and 1973–80, about 0.25 percentage points can be attributed to such

developments; he suggests that their role since 1980 is almost surely smaller in light of the decline in energy prices and the decelerated burden of pollution control expenditures that has occurred. For additional evidence, he turns to extractive industries themselves, noting that if resource scarcity were a growing problem, it should show up in slowing or declining productivity in the extractive industries, which would use more capital and labor to obtain the increasingly scarce resource. He finds that productivity trends in extractive industries themselves are mixed, with only petroleum and natural gas showing a slowdown from earlier productivity trends.

For still more evidence on resource scarcity, Nordhaus examines the prices of resources and land. If appropriable resources were becoming scarcer relative to labor, resource prices should be rising relative to wages unless technical change were biased toward offsetting the resource scarcity. He presents long time series of relative resource prices, showing that most had declining relative prices until 1970, with little trend after that. For land, the story—contrary to popular wisdom—is slightly different, with a surprising decline in relative price until 1940 and only a modest increase since then. Only the relative price of standing timber, or stumpage, is higher today than it was at the start of the century. There was a break in the general downward trend after 1970, when many relative resource prices rose for a decade, but most renewed their downtrend during the 1980s. From all this evidence on prices, Nordhaus concludes that there is little evidence of increasing resource scarcity for any extended period in this century.

Nordhaus is keenly aware that the past may not be prologue, and turns to a number of studies to assess how environmental and resource limitations are likely to affect growth over the 1980–2050 period. He summarizes these results in terms of the growth drag that can be expected from different sources. For “market goods,” which have no significant externalities, market prices provide a good measure of the value of rising scarcity. He summarizes projections of what total output would be with known reserves of the resource with what output would be if new discoveries were sufficient to keep relative resource prices unchanged. These results suggest that, without new finds, declining stocks of energy fuels are projected to reduce world output by a little more than 10 percent by 2050; declining stocks of nonfuel minerals by another 2 percent; and limited land by between 3 and 4 percent.

For “environmental goods,” which have social costs and benefits that

are not captured in market transactions or which have significant externalities in production or consumption, a different methodology is needed. One can either estimate what it would cost to prevent degradation of the environment, or estimate the value of the losses or damages suffered by society as a result of degradation that is not prevented. The studies summarized by Nordhaus take both approaches. He reports that greenhouse warming is estimated to cost between 0 and 5 percent of output by 2050, depending on which study is accepted. Although this range is uncomfortably large, Nordhaus does not believe the estimates can be made more precise with current knowledge about the greenhouse phenomenon and its control, and chooses 2 percent of output as his best point estimate. He also reports that control of other pollutants, primarily measures to maintain air and water quality, imposes a further 3 percent growth drag by 2050. Combining all these estimates, he projects a total growth drag of 19 percent of world output from both resource depletion and environmental problems. This amounts to a reduction of 0.3 percentage points in the average annual growth rate of world GDP between 1980 and 2050, compared with an average growth rate of GDP per capita of around 1.5 percent per year over the last century in advanced industrial countries.

Nordhaus recognizes that even his careful estimates of how much environmental and resource constraints will limit growth are subject to great uncertainty, in large part because our scientific understanding of the interactions between human activity and these constraints is so incomplete. This points to the need for continuing efforts to improve that understanding. In addition, he notes the importance of recognizing when and how to intervene with markets and when to let markets operate unimpeded. With respect to appropriable natural resources, he urges the removal of taxes and subsidies that distort price signals, so that market forces can efficiently utilize the world's supplies over time. With respect to environmental matters, such as clean air and water and world greenhouse warming, the issues are completely different because market forces must be replaced by or supplemented with government interventions.

According to Nordhaus, environmental policies pose difficult choices in four areas: selecting where to intervene; finding the right level of intervention; choosing tools for intervention that minimize the net cost of the externalities and the policies for dealing with them; and coordinating

policies where either the problem or the intervention has international spillovers. He urges against waiting for uncertainties to be resolved before starting to act, both because they never will be and because we already have best estimates to guide us. Instead, he advocates establishing and strengthening the institutions that are needed for effective environmental intervention, and acting on the basis of current best judgments about long-run costs and benefits. He advocates further that we continue efforts to add to our scientific understanding of environmental problems and of efficient interventions.

DESPITE DECADES of research, predicting consumer behavior remains a challenge. During much of the current recovery, when surveys have revealed low levels of consumer confidence, consumption spending has been unusually sluggish. In the second article of this issue, Christopher D. Carroll presents a buffer-stock theory of saving that suggests this is not an accident. Increases in income uncertainty, holding expected income constant, raises the optimal buffer stock. Hence the perception of increased risk of future unemployment increases current saving. The model also has other distinctive implications. For example, as in other target saving models, the interest rate has little effect on saving.

The model's predictions about saving depend crucially on the magnitudes of the income uncertainty. Hence Carroll begins by examining the nature and degree of uncertainty facing households so that the model can be parameterized and solved. For this purpose, Carroll uses the *Panel Study of Income Dynamics*, which has data for a large sample of households headed by the same individual for the period 1968–85. He describes family noncapital income as having two components: a permanent component, which is assumed to follow a random walk with drift; and a transitory shock component. A salient feature of the lower tail of the distribution of stocks that is particularly important to his model is the substantial concentration of observations at approximately zero income, corresponding to being jobless. Thus Carroll models income as being generated by the combination of two processes: one that occasionally generates zero income, and one that is well-behaved and operates whenever income is not zero. In his sample, households experience zero or near-zero income in about 0.65 percent of the years; in his simulations he makes the conservative assumption that such near-zero events are transitory shocks that occur with a probability of 0.5 percent

each period. Carroll infers from the data that about half the remaining variance is temporary and half is permanent. For his simulations, he makes the conservative assumption that each of these components has a standard deviation of 10 percent.

Armed with these estimates of the parameters governing the income process, Carroll calculates optimal consumption and saving behavior, including the short-term dynamic reaction of consumption, saving, and wealth to changes in the variables affecting the target level of wealth, and to large, transitory shocks that push the household far from the desired long-run level of wealth. As in the standard intertemporal model, the consumer with constant relative risk aversion is assumed to maximize expected discounted utility over a finite lifetime. With permanent income following a random walk, optimal consumption relative to permanent income can be shown to depend on several characteristics of the individual consumer: the time preference discount rate and degree of relative risk aversion; current wealth; and expected growth and uncertainty of future income, as well as the interest rate.

Optimal consumption behavior in the absence of uncertainty is familiar. Growth in consumption decreases the marginal utility of future, relative to current, consumption at a rate proportional to the degree of risk aversion. On the optimal consumption path, the decrease in marginal utility plus the rate of time preference exactly balances the real interest rate. Carroll assumes relatively high rates of time preference, rates that exceed the assumed interest rate by at least 5 percent. Hence in the absence of uncertainty, consumers would plan on decreasing consumption over time, going into debt during the early part of their life cycle, and repaying the debt in their later years.

With Carroll's assumptions, the only reason to accumulate wealth early in the life cycle is uncertainty about future income and the consequent uncertainty about future consumption. For an individual with constant relative risk averse preferences, uncertainty about future consumption raises the expected marginal utility of future consumption, for a given expected value. Hence *ceteris paribus*, future uncertainty will lower current consumption relative to future consumption, raising current saving and adding to wealth.

At low levels of wealth, uncertainty about income dominates the high rate of time preference so that individuals save and have expected rates of growth of consumption greater than the expected rate of growth of

income. At high levels of wealth, time preference dominates, leading to dissaving and consumption growth that is slower than income growth, or even negative. Optimal consumption depends only on the ratio of wealth to permanent income. The optimal consumption rule is essentially the same for all ages except for those nearest the end of life. The optimal rule makes precise the notion of the optimal buffer stock. There is a unique value of wealth relative to permanent income such that expected consumption growth is the same as the expected growth in permanent income and saving is just sufficient to maintain the target wealth-income ratio. Individuals with wealth below this level will save more, and plan on more rapid growth in consumption; individuals with wealth greater than this target will dissave and will plan for consumption growth slower than the growth in income.

Carroll calculates the wealth target, or optimal buffer stock, for a range of plausible parameter values. For degrees of risk aversion of three, target wealth varies from approximately 25 to 60 percent of a year's income, values that Carroll notes are in line with the advice often given to consumers. The target wealth ratio is quite responsive to the probability of zero income, as might be expected because the risk of that is a major source of the uncertainty about future income. Interestingly, target wealth barely responds to the interest rate, helping explain the insensitivity of saving to the interest rate.

What are the dynamics of consumption and saving in response to a surprise change in the target wealth ratio? Because he is interested in the model's capacity to explain the recent concurrence of low consumption and pessimistic expectations about employment, Carroll focuses on the response to an increase in the probability of unemployment. A doubling of the unemployment probability from one-half to 1 percent leads to an immediate reduction in consumption, followed by several years of increase, until consumption gradually returns to near its initial level, but with higher wealth. In the short run, saving is increased substantially, by approximately 4 percent of income.

Carroll examines the consistency of the buffer-stock model with several stylized facts that other models, such as those centered on permanent income or liquidity constraints, have difficulty explaining. His model provides a simple explanation of the apparent link between aggregate consumption growth and income growth over periods of a few years or longer. In the buffer-stock model, these growth rates must converge;

otherwise wealth would explode either up or down. In his simulations this convergence occurs relatively rapidly; for example, the consumption growth rate adjusts 80 percent of the way to a changed income growth rate within four years of a shock. Neither permanent-income nor liquidity constrained models explain this close tie in growth rates.

The model also suggests why the saving rate does not decline in recessions. According to the simplest permanent-income model, when income is temporarily low, households should spend previous savings and borrow to cover expenses. Because the risks of unemployment increase in recessions, the buffer-stock model actually predicts increases in saving after controlling for income expectations. Using survey data, Carroll shows there is a significant positive relationship between expectations of increased unemployment and the fraction of consumers who believe it to be a bad time to draw down savings. He also reports a variety of results explaining aggregate personal saving or consumption by these expectation variables, and actual employment and personal income growth. Although the results are somewhat sensitive to correction for serial correlation and the use of instruments to correct for possible simultaneity bias, they suggest that even controlling for expectations about future income growth, consumers save more when the unemployment rate is high or when they expect it to increase.

It is possible to reconcile these results with the permanent-income model. But Carroll believes the most straightforward interpretation is that people save more when fears about job security increase, a natural implication of the buffer-stock model. The data do present one awkwardness for the buffer-stock model. They do not fit the model's prediction that, while worsened expectations reduce consumption immediately, consumption grows faster after the initial fall. Carroll suggests that allowing for inertia in consumption can reconcile the model with the data.

He notes that his model provides a different reconciliation of macroeconomic data and consumption theory than is usually proposed. Analysts generally invoke a failure of consumers to be sufficiently forward-looking or the existence of binding liquidity constraints in order to square the permanent-income hypothesis with short-run behavior. By contrast, Carroll's results suggest that the behavior is consistent with forward-looking consumers who adjust their saving in response to perceptions about the future.

Carroll asks whether the buffer-stock model can shed light on two puzzles for more traditional models of consumption and saving: the decline in the personal saving rate over the past 15 to 20 years and the weak growth of consumption in the current recession. The model suggests two potential, proximate reasons for a decline. First, because saving is needed to sustain the target wealth-to-income ratio, reductions in the growth of income will reduce the saving needed to achieve a given target ratio. However, the target itself depends inversely on the growth rate of income. Carroll shows that the first effect dominates, and that for plausible parameter values, the decline in income growth accounts for a bit less than half the decline in the personal saving rate in the 1980s. Second, the target rate itself depends on the need to buffer consumption from shocks. The increasing prevalence of two-earner households, the increased coverage of unemployment and health insurance, and the relaxation of borrowing constraints following financial deregulation in the late 1970s and 1980s are all candidates for lowering the wealth target.

Carroll speculates that all these changes may have played a role in lowering the saving rate, but notes that it is hard to quantify their importance or to be precise about the timing of their impacts. He notes the unemployment insurance system became somewhat less generous during the 1980s and yet the saving rate continued to decline. Similarly, the coverage of health insurance, which rose from 1960 to 1980, fell back during the first half of the 1980s. Carroll reviews a range of developments that are likely to have improved access to credit markets and reduced the need for buffer-stock savings, and suggests that easier credit may be the most plausible explanation for the low saving rate of the 1980s. He notes further that this reasoning is consistent with the gradual rise in the personal saving rate since the credit crunch at the end of the decade.

The other side of the recently increasing saving rate has been the slow growth of consumption. The natural explanation in the buffer-stock framework is that the target level of wealth has increased in response to low income growth and a higher unemployment rate. Using consumption equations estimated through the second quarter of 1990, Carroll finds that the inclusion of unemployment expectations accounts for about one-third of the overestimate in forecasting consumption growth through the second quarter of 1992. He concludes that the weakness in consumption growth is largely a rational reaction to justified pessimism about continuing high unemployment.

NEOCLASSICAL GROWTH theory has difficulty explaining why, over long periods, economies grow at very different rates. In the neoclassical model, differences in the fraction of output devoted to investment cannot affect the long-run growth rate. As a corollary, growth accounting done within this framework concludes that most of the differences in growth rates, either over time or between countries, are not due to differences in investment, but to residual factors. Recently there has been a resurgence of interest in models in which the share of output devoted to investment can permanently affect the rate of growth of output. Typically these models attribute a productivity enhancing externality to investment in physical or human capital so that the social returns to investment exceed the private returns. In the first report of this issue, J. Bradford De Long and Lawrence H. Summers extend their earlier work suggesting that equipment investment has such an externality and that equipment investment plays a special role in explaining economic growth.

De Long and Summers begin by citing several historians of technical change who believed that much technological knowledge is based on hands-on, trial-and-error experience that is difficult to transmit through education. Such hands-on experience presupposes investment in the equipment upon which to learn. If these productivity gains could be captured by the firms making the investment, they would be factored properly into the investment decision. But De Long and Summers suggest that such gains often cannot be captured. For example, workers with skills acquired from experience with new equipment at one firm will be valuable to firms down the street. In this view, the high social return from equipment investment exceeds the private returns earned by the investing firm. As a consequence, firms will invest less in equipment than is socially optimal, suggesting the desirability of policies that provide incentives to boost equipment investment.

De Long and Summers briefly summarize their previous empirical work that examined the relationship between the share of output devoted to investment and the growth in output per worker. In this earlier work, using a sample of 61 non-oil-exporting nations and covering the period 1960–85, the authors found that an increase of 3 or 4 percentage points in the share of GDP devoted to equipment investment is associated with an increase in GDP per worker growth of 1 percent per year. Differences in equipment investment accounted for much of the difference between fast- and slow-growing nations.

The authors extend their earlier work, concentrating their analysis in ways that are most relevant to the United States. They create a subsample of high-productivity countries—those having levels of GDP per worker at least 20 percent of the U.S. level in 1960 or 1985—to analyze along with their complete sample. They add data for the 1950s and for 1985–90 and assemble a long-run panel of seven nations—Argentina, Canada, Germany, Italy, Japan, the United Kingdom, and the United States—with eight periods of data each covering roughly 15 years. The authors analyze these data using different periods, estimation techniques, and explanatory variables. In addition to the equipment investment share, the basic regressions explaining growth rates include as explanatory variables the share of other investment, the country's productivity relative to U.S. productivity, and labor force growth. Supplementary regressions include a range of other variables that might offer alternative explanations of growth. De Long and Summers also use instrumental variables as a means of protecting against the possibility of reverse causation, with growth causing equipment investment, rather than the other way around.

The authors find a strikingly strong and consistent relation between the growth rate of output in a country and the share of output devoted to equipment investment. The result is at least as strong for the high-productivity subsample as for the full sample of countries. In the basic cross section regression for 1960–85, for example, the regression using the full sample accounts for about two-fifths of the variation of output growth, while the subsample regression accounts for three-quarters of the variation of output growth. Equipment investment always has a significant and large coefficient, and the coefficient is substantially larger than the coefficient on structures investment. The important role of equipment investment persists in the supplementary regressions that add other variables and use alternative estimation methods. It also persists when the high-productivity subsample is further stratified into countries that have 30, 40, 50, or 60 percent of U.S. productivity levels in the initial year, thus focusing ever more narrowly on countries resembling the United States in their stage of economic development. In nearly all these regressions, an additional 1 percent of output devoted to equipment investment is associated with between 0.20 and 0.25 percentage points of output growth.

The authors consider whether reverse causality is contributing to their results, with rapid output growth inducing high rates of investment.

They point out that such accelerator effects should operate on investment in structures as well as in equipment and their regressions find no unusually high coefficient on structures investment. They examine the association between equipment prices on the one hand, and equipment investment and growth on the other for further evidence of causality. If high rates of investment were a consequence, rather than a cause, of growth, they argue, relative equipment prices would be higher in rapidly growing countries as high demand pressed on available supply. If instead policies favorable to equipment investment led to rapid output growth, equipment prices would be low in the high-growth countries. The evidence from their sample of 31 high-productivity countries follows the second pattern: countries with relatively low equipment prices tend to have high rates of equipment investment and rapid rates of output growth. They offer other supporting evidence in an extended comparison of the poor postwar performance of Argentina, where populist policies discouraged investment, and the outstanding growth of Japan, where equipment investment was favored through low relative equipment prices and other policies.

De Long and Summers find further support for their view that equipment investment yields high social returns in a more refined analysis of total factor productivity (TFP) growth. Using their sample of 31 high-productivity countries, and with any reasonable assumptions about depreciation and the private return to equipment investment, they show that the implied TFP growth is not independent of the share of equipment investment in output, as standard neoclassical models require. Instead they find a strong connection between the two that implies social returns on the order of 20 percent per year. They associate these returns with the idea that equipment investment is a trigger of learning-by-doing that enhances overall productivity.

De Long and Summers find the evidence of a causal connection between equipment investment and growth persuasive enough to justify policies aimed at encouraging it. Given that international capital markets are imperfectly integrated, the level of national saving helps determine the level of national investment, so the authors advocate deficit reduction as a means of meaningfully increasing the rate of equipment investment. Conversely, they see as counterproductive policies that favor investing in assets other than new equipment, such as tax laws favoring real estate or structures that can be readily leveraged by bor-

rowing. They view measures that directly reduce the tax burden on new equipment investment, such as an investment tax credit, as especially potent ways of increasing future economic growth.

WHEN RUSSIA embarked on its program of radical economic reform earlier this year, it inherited enormous economic problems from the communist regime that it supplanted. The reform program has ended centralized direction of the economy and is fostering the spread of market forces. But it has been frustrated on other important fronts, leading some observers to believe that the reform program and the Yeltsin government that has promoted it could both soon be political casualties. In the second report of this issue, David Lipton and Jeffrey D. Sachs analyze this historic first year of Russia's economic reform, identify the dangers to further progress, and outline the steps they see as essential for continuing reform.

The authors start by describing the economic legacy that Russia inherited. Politically, it included an entrenched power structure and a set of policies and priorities that were inconsistent with the drive to a market-oriented free economy and the end of the cold war. Structurally, it included a concentration of resources in heavy industries—many associated with the military-industrial complex (MIC)—and the neglect of the consumer and service industries; collective ownership of almost all productive resources; and the command-control system of prices, resource allocation, and international trade. Completely missing was a legal framework with which to support free market activity and private ownership. The reformers also inherited a 1991 budget deficit of 20 percent of GDP; a monetary overhang that represented a large increase in potential demand; more than \$65 billion in foreign debt, a lack of foreign exchange and a loss of export revenues because of declining oil production; and wages that had risen faster than controlled prices for years.

Lipton and Sachs describe how economic reform has contended with these inherited problems with mixed popularity and success. Early in 1992, most prices were freed in order to restore the flow of goods into retail outlets, do away with wasteful queuing by shoppers, and eliminate the monetary overhang. Price liberalization succeeded in these aims, but did so with an unpopular 250 percent rise in average consumer prices and a tenfold increase in many individual prices. GDP has declined sharply, both because of a lack of essential imports and as an inevitable

part of the transition away from old to new production patterns. While the freeing of prices eliminated the inherited monetary overhang, money and credit creation has since been relaxed to a dangerous degree as the central bank, which is operating out of step with reform plans, has been satisfying the desire for credit from powerful subsidized enterprises in the industrial sectors.

In the authors' opinion, critics within Russia have exaggerated the severity of current economic problems and have blamed them on the reforms when, instead, many reflect political resistance to reforms or are the inevitable consequence of the economic legacy from the old regime. These debates raise the question of whether the reform movement is politically viable. Large steps still must be taken in privatizing enterprises and freeing markets and trade. Although many new small enterprises have been created, 85 percent of the economy is still state-owned. Plans for mass privatization of most enterprises are scheduled to be implemented within the coming year. Controls remain on exports of most raw materials and semi-finished products, and on trade among the newly independent states of the former Soviet Union.

Lipton and Sachs see three key threats to progress in the immediate future. First, key reforms may be derailed by old power structures in the military-industrial complex. In the past, production in the MIC was sustained by heavily subsidized access to energy and other raw materials, access to scarce foreign exchange, and a continuing stress on industrial investment in the national budget. The MIC is destined to shrink greatly in importance as the economy is exposed to market pressures and changing budget priorities, and those accustomed to its privileged position will not accept these changes easily. Second, the powerful industrial sector, which makes up a much larger share of the economy in the Soviet Union than does its counterpart in the United States, and which wants continued subsidies and bank credit in order to survive, could thwart the attempts to tighten fiscal and monetary policies, which Lipton and Sachs see as essential to heading off hyperinflation. Third, public unrest with economic hardship could stop the drive to privatize enterprises and to open the economy to international trade; both these efforts will accelerate the dislocation of some workers and firms in the short run.

Lipton and Sachs are critical of the role played by the international financial institutions of the West, and the governments that control

them, during the initial stages of the reform program. The IMF initially frustrated Russian attempts to tighten monetary policy by not encouraging separate currencies for the other former republics, which would have given Russia better control over the ruble. And the IMF provided little technical assistance for creating a monetary and banking system. In addition, the IMF failed to mobilize the heralded \$24 billion aid package, with the result that Russia received little or no long-term support for its balance of payments—only some short-term trade credits at market interest rates—and no direct budgetary support that could have purchased needed imports without depreciating the ruble and adding to inflation.

While keenly aware of the political risks that the reformers face, Lipton and Sachs believe that reform can succeed. They cite the recent improvements in the Polish economy and the parallels between the early stages of reform in Russia and Poland as evidence that the Russian reform program can work if given time and political support. They see as three important priorities of reform privatization, creation of a social safety net, and redirection of production from the military-industrial sector to civilian uses. But the most urgent problems, in their view, are the continued liberalization of markets, including freeing foreign trade, and the stabilization of the macroeconomy through tighter fiscal and monetary policies. To get control over fiscal policies, they propose raising more revenues through value added and income taxes to replace revenues formerly obtained by taxing enterprises, a new division of responsibilities between the central and local governments, and tighter control over the subsidies that have historically supported enterprises. They argue that monetary policy must be insulated from the political pressures to support enterprises through cheap credit, and must be made accountable to the overall strategy of the reform program.

Despite their failure to provide effective help in the past, Lipton and Sachs see the major industrial nations and the international financial institutions as having an important role to play in keeping the reform program moving forward. They urge the IMF to provide intensive technical assistance to the fledgling monetary and banking sectors in Russia and to speed up promised aid conditional on the Russian central bank's adoption of a tighter monetary policy. They ask for World Bank funds for restructuring the economy, with conditionality that promotes privatization and the infrastructure investments needed to support private ac-

tivity. And they urge the European Bank for Reconstruction and Development to encourage development of the private sector by promoting local, start-up firms in cooperation with private capital.

THE DEMAND for money plays a central role in macroeconomic models of all descriptions, Classical, Keynesian, New, or Old. Its role is central in many explanations of the price level and inflation rate and in models of output and employment. And it has often provided the underpinnings for the conduct of monetary policy by the Federal Reserve. Yet the demand for money has been hard to estimate empirically. Attempts to estimate it using aggregate time-series data are plagued by a number of problems, including the endogeneity of income, interest rates, and prices, all of which affect, but are also affected by, the demand for money; changes over time in what financial instruments are used as money or are close substitutes for it; and ambiguities in the choice of an interest rate to measure the opportunity cost of holding money, and in how to specify the short-run dynamics of adjustment in money demand. In the final report of this volume, Casey B. Mulligan and Xavier Sala-i-Martin sidestep many of these issues by estimating the demand for money using cross-sectional data for U.S. states for the period 1929–90.

The authors estimate the demand for two concepts of money, which they call MX1 and MX2, for which data are available state by state. Their narrow measure of money, MX1, is the demand deposits held at banks by individuals, partnerships and corporations (since 1987 they use noninterest bearing deposits, regardless of the depositor), a measure close to aggregate M1 excluding currency. Their broad measure, MX2, adds saving and time deposits and includes the holdings of public entities. Although MX1 and MX2 do not correspond directly with M1 and M2, Mulligan and Sala-i-Martin report that the sum of their measures across states is highly correlated with the conventional measures. There is a great deal of cross-state variation in per capita holdings of their money measures. In a given year the cross-state dispersion in MX1 per capita is comparable to the temporal dispersion of M1 over the period 1929–90, and the cross-section dispersion of MX2 is much greater than the time-series dispersion of M2.

Mulligan and Sala-i-Martin concentrate on estimating the income elasticity of money demand. They first report year-by-year cross-

section estimates for MX1 demand, using only per capita income as an explanatory variable. Point estimates of the income elasticity are above 1.0 for all years before 1963 but fall below 1.0 for the period 1963 to 1980. Standard errors in individual years tend to be quite large. The estimated income elasticity, pooling years, is significantly greater than 1.0. Although they cannot reject the hypothesis that the elasticity is constant over the sample period when the alternative is allowing elasticities to differ year to year, separate pooled estimates for the first and second half of the sample differ significantly. The authors conclude that, without controlling for other variables, estimates of income elasticities are unstable.

The pattern of year-to-year estimates suggests that slow regional diffusion of new financial technologies in the 1960s and 1970s may be responsible for the apparent variation in income elasticities. This leads the authors to use the share of income originating in the agricultural sector as an additional regressor on the grounds that the diffusion of new technologies is likely to start in urban areas and to extend only slowly to rural areas. Adding this agricultural variable makes a significant difference in the cross-sectional equations from 1950 through 1980. In these years, agriculture has a significant positive relationship to holdings of MX1. Interestingly, when this variable is included, the point estimates of the income elasticity for these years are all above 1.0, although they are not typically significantly so. When the data for all years are pooled, the estimate for the income elasticity is 1.3, even larger than in the simpler equation; it is also no longer possible to reject at the 5 percent level the hypothesis that the income elasticity is the same in the first and second half of the sample.

One possible explanation of the large estimates of income elasticity is that states with high income are more likely to be financial centers, attracting out-of-state depositors and experiencing a high ratio of financial transactions to income. However, Mulligan and Sala-i-Martin find that omitting New York from the sample has only a small effect on the estimated elasticity. When fixed-state effects are removed, which also removes the effects of any cross-state correlation of income and banking activity, estimates of the income elasticity in the authors' preferred equation fall by about 10 percent, but are still well above 1.0 for the sample period as a whole. The inclusion of state effects in equations esti-

mated for subperiods suggests that the income elasticity is substantially lower during the first part of the period and substantially higher during the period 1960–90.

The authors experiment with substituting retail sales for income as an explanatory variable. Although retail sales appears to perform satisfactorily, with coefficient estimates much like those for income, when both variables are included in a pooled regression, income wins out; the coefficient on retail sales becomes small and insignificant.

The authors report estimated equations for MX2 similar to those estimated for MX1. Again, the equation including only income per capita yields income elasticities that are unstable over time. For the authors' preferred equation, which includes the agricultural variable, coefficient estimates are less variable, with point estimates of the income elasticity almost always greater than 1.0 (although lower in the later part of the period than in the earlier part).

The authors find it surprising that the income elasticity has been so stable for both MX1 and MX2 for a period that includes the Great Depression, World War II, the oil shocks, and the Reagan-Volcker years, and that the estimates of the elasticity are systematically larger than 1.0. They offer two conjectures for explaining such a high elasticity. First, they suggest the possibility that economic development is associated with less vertical integration, leading to an increase in transactions between firms relative to transactions within firms, and so to a growth in transactions relative to income. Second, they suggest that economies of scale may exist in the monetary transactions of households, with large households needing less money per person than small. Insofar as higher income is associated with smaller families, this would increase the demand for money relative to income.