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NBER Reporter

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Program Report

The Economics of Aging**

David A. Wise*

The U.S. population is growing older and living longer. Yet older people have been leaving the labor force at younger and younger ages. Moreover, most Americans have saved very little. At the same time, the cost of medical care has been increasing. These demographic trends and changes in individual circumstances will contribute to some of the most important economic transitions and policy challenges for the coming decades. Understanding the determinants of retirement, the nature of saving for retirement, and how to more efficiently provide medical care are perhaps the most critical issues that demographic trends have forced on us. These and related issues make up the activities of the NBER's Program on the Economics of Aging.

Begun in 1986, the Aging Program has developed primarily around large, coordinated research projects that simultaneously address several interrelated issues in the economics of aging. Extensive funding for the program has been provided by the National Institute on Aging (NIA), both through multiple research grants and through a Center grant, which provides centralized infrastructure support to the Program effort.

The major research categories in the NBER's Program on the Economics of Aging are: 1) saving and the evolving financial circumstances of older Americans; 2) work and retirement decisions at older ages; 3) health care; and 4) aging around the world. In each of these areas, a major goal of the research is to better understand individual decisions as people age, and how these decisions are affected by individual circumstances and the economic incentive effects of government policies and programs. This article summarizes research in each of these areas.

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***This report has been prepared with the intensive help of Richard Woodbury of the NBER's Program on the Economics of Aging. Abstracts and full copies of the Working Papers of the Aging program can be found at www.nber.org.*

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Much effort also has been directed to attracting young researchers to this field. To that end, our NIA Fellowship Program provides annual fellowships to between five and ten graduate students who are beginning research on the economics of aging. It also provides two or three post-doctoral fellowships each year to recent Ph.D. recipients, enabling them to spend a year at the NBER to do research on issues in the economics of aging and health care. The combination of NIA support for research training and fellowships, new project development, data resource development, and smaller "exploratory" grant support has been instrumental in our efforts to expand the program, and to engage outstanding new scholars in research on aging.

Nearly 100 papers are completed annually on issues in aging by participants in the NBER Program. Some of these appear in a series of books published by the University of Chicago Press.¹

The Evolving Financial Circumstances of Older Americans

The way Americans provide for financial support in retirement is changing rapidly. All three of the traditional pillars of retirement support—Social Security, employer-provided pensions, and saving—are in transition. Potential changes in Social Security have received the most public attention. The aging of the population has made the continuation of current levels of real benefits from Social Security an uncertain prospect. Employers, too, are reacting to the increasing costs of their retirement benefits, with many of them discontinuing traditional pension benefits and retiree health insurance programs. At the same time, the rapid expansion of 401(k) programs, and the dramatic growth in savings in

401(k) and IRA programs, suggest a transition in personal savings as well. While most households retiring in the past had essentially no financial asset savings, that may not be true in the future. By the mid-1990s, at least one spouse in over half of U.S. families was eligible for a 401(k) plan, and over 70 percent of those who were eligible made contributions. Today, over \$100 billion is contributed annually to 401(k) plans.

The Growing Influence of Retirement Savings

A long series of studies by Steven Venti, James Poterba, and me has considered whether IRAs and 401(k) programs have added to personal saving, or whether they have simply replaced saving that would have already taken place in some other form.² Using a number of different data sources and analytical approaches, we have consistently demonstrated that the saving taking place in IRA and 401(k) plans is new saving.

Having identified IRA and 401(k) plans as important inducements to saving, we focused more recently on the implications of these savings for the financial status of retirees in the future. A central feature of this work is a detailed summary of eligibility, participation given eligibility, and contribution rates, by earnings decile and age.³ Based on conservative assumptions about future participation and contribution rates, we estimate the 401(k) assets of cohorts who will be age 65 in 2025 and 2035. For all but the lowest earnings decile, the projections suggest that 401(k) saving could represent a very substantial contribution to retirement income. Among those reaching age 65 in 2025, for example, the average level of 401(k) assets is likely to exceed the discounted value of Social Security benefits. Thus their 401(k) plans could contribute more to their retirement support than Social

Security. While these large financial asset accumulations are unlikely to be realized by families with the lowest lifetime earnings, 401(k) assets are projected to become a substantial fraction of Social Security wealth for families with lifetime earnings above the two or three lowest deciles.

One widely expressed concern is that employees changing jobs may have the opportunity to remove funds from their pension plans, leaving little for retirement. We studied the incidence and disposition of these lump-sum distributions and found that a substantial number of people with small balances do take money out of these accounts.⁴ However, most larger accounts paid out as lump-sum distributions are reinvested in ways that preserve the funds for retirement. Thus the vast majority of funds remain in personal retirement saving plans.

More recently we expanded our projections of the 401(k) accumulations of future cohorts of retirees to account for "leakage" caused by cash-out of 401(k) assets when people change jobs. Although cash-outs have some effect on accumulation, the foregone accumulation at retirement attributable to this leakage is only about 4 or 5 percent of assets that are retained until retirement.⁵

Research by Andrew Samwick and Jonathan Skinner has analyzed a closely related trend: the movement among employers away from defined benefit pension plans and toward defined contribution pension plans and employer-sponsored savings plans.⁶ They ask how this trend will affect the financial security of future retirees. Their simulations show that average and median pension benefits are higher under defined contribution plans than under defined benefit plans, and that minimum benefits are comparable. They argue, therefore, that the growth in defined contribution plans may strengthen

retirees' financial security.

In related work, John Shoven and I documented the very high tax rates on distributions from retirement saving plans—particularly those for savings distributions passing through an estate.⁷ Marginal tax rates on non-estate distributions were as high as 62 percent, while marginal tax rates on distributions passing through an estate were as high as 99 percent. Moreover, with moderate ongoing contributions to a 401(k) plan over a working career, these high tax rates could be faced by savers who did not have extraordinarily high incomes. However, perhaps in part because of these studies, these "success" taxes were eliminated as part of the Taxpayer Relief Act of 1997.

Alternative Theories of Saving

David Laibson's work has focused on nontraditional theories of saving, drawing on behavioral findings in experimental psychology.⁸ Laibson suggests that savings decisions are influenced in part by "hyperbolic" discounting—a form of discounting that uses relatively low discount rates to evaluate distant events, and increasingly high discount rates to evaluate more proximate events. The implication is that people want to plan for the future (such as by saving for retirement), but their long-term plans are impeded by temptation in the present. Laibson's work suggests that actual consumption and saving decisions over the course of life are in fact quite consistent with hyperbolic discounting.

Laibson's work also suggests that commitment mechanisms such as payroll deductions and early withdrawal penalties tend to increase saving among people making decisions based on hyperbolic discounting. These mechanisms are part of why 401(k) plans are so successful in pro-

moting saving. Specifically, by using payroll deductions and by imposing a financial penalty on early withdrawals, 401(k) plans tend to be more effective than other approaches in encouraging saving. Simulations suggest that 401(k) plans may raise the national saving rate by at least 89 percent.

The Composition and Annuitization of Retirement Saving

Andrew Samwick has initiated a number of research projects using the rich pension, earnings, and wealth data in the Health and Retirement Survey (HRS). A collaborative analysis by Alan Gustman, Olivia Mitchell, Samwick, and Tom Steinmeier finds that HRS households have a large proportion of their wealth in the form of entitlement benefits, rather than real and financial assets.⁹ The combination of pensions, Social Security, and health insurance accounts for half of the wealth held by all households in the HRS, for 60 percent of total wealth of the median HRS household, and for as much as 48 percent of the wealth of households between the 90th and 95th percentiles of the wealth distribution.

Jeff Brown, Mitchell, Poterba, and Mark Warshawsky have explored the role of annuities for older households, focusing initially on how annuities are priced.¹⁰ Using the Social Security Administration's mortality tables, which reflect death rates of the general population, they find that the expected present value of payouts associated with single-premium, immediate life annuities is approximately 80 cents per premium dollar. However, the mortality rates of those who actually purchase annuities are lower than the mortality rates for the entire population, which raises the expected future payout for these purchasers. When valued using the mortality rates of actual annuity buyers,

the (expected present discounted) value of the payouts rises to between 90 and 95 cents per dollar of annuity premium. Thus the pure administrative costs of purchasing an annuity appear to be less than 10 percent of the premium value for current annuitants.

Follow-up work by Poterba and Warshawsky has compared the pricing of annuities in the public market with the pricing in large group retirement saving plans.¹¹ They find even higher payout rates in the large group retirement savings programs, particularly in the annuity products offered by TIAA-CREF. Other follow-up work by Brown, Mitchell, and Poterba has considered the trade-offs among alternative annuity options for paying out retirement savings later in life, and the potential role of inflation-adjusted annuities.¹² Using plausible measures of risk aversion, they find that people would be expected to value a variable payout equity-linked annuity more highly than a real annuity because the additional real returns associated with common stocks more than compensate for the volatility of prospective payouts.

The Distribution of Social Security Benefits

Jeff Liebman has explored the effective returns to Social Security among individuals with different demographic and economic characteristics. As part of this project, he received special permission to use a confidential version of the Survey of Income and Program Participation that is linked to Social Security earnings histories. In preliminary work using these data, Liebman found higher rates of return from Social Security among those with lower incomes; those whose earnings were concentrated later in life; and married couples, especially married couples with unequal incomes. The large majority of Social Security recipients

had rates of return of between zero and 4 percent. About 19 percent of the sample had rates of return of between 4 and 8 percent; and only 4 percent of the sample had a rate of return above 8 percent.

Related work by Kathleen McGarry and Robert Schoeni shows that Social Security has had a dramatic influence on the living arrangements of elderly widows.¹³ Using data from the last six Census surveys, McGarry and Schoeni estimate the effects of rising income, particularly of rising income from Social Security, on living arrangements among widows. The share of elderly widows living alone rose from 18 percent in 1940 to 62 percent in 1990. McGarry and Schoeni find that almost two-thirds of this change can be attributed to increases in Social Security benefits over this period.

Demographic Change and Asset Prices

Poterba has explored the impact of changes in population age structure on the rates of return earned on bonds and stocks.¹⁴ Several recent popular articles have suggested that the rise in stock prices during the 1990s is partly attributable to the fact that baby boomers have entered "high saving" years. These studies also suggest that stock and bond prices may decline in the years ahead, when baby boomers in retirement begin to liquidate their assets. Poterba finds that households with significant asset holdings appear to decumulate their assets slowly (if at all) after retirement. This casts doubt on the "sell off" view, at least for the share of assets (excluding defined benefit pension assets) that households control directly. Poterba also considers the historical relationship between demographic structure and real returns on Treasury bills, long-term government bonds, and corporate stock. The results do not suggest any robust relationship between demo-

graphic structure and asset returns, although the ability to establish a statistically significant relationship is limited in historical data.

Aging, Saving, and Inequality

Using cohort data from numerous countries, Angus Deaton and Christina Paxson find that many people continue to save after retirement.¹⁵ This result is contrary to the traditional "lifecycle" explanation of saving in which people save only during their working years in order to support themselves (through dissaving) in retirement. The implication is that population aging will have a less pronounced effect on aggregate saving rates than otherwise might be anticipated. However, the effects of aging on distribution appear to be more significant: because of the more unequal distribution of income and wealth at older, as compared with younger, ages, population aging appears to result in a more unequal distribution in the population as a whole. In some countries, the distributional consequences of population aging may lead to more individuals living at very low income levels.

Deaton and Paxson also have examined how to measure poverty among the elderly, and more generally how to measure living standards of people at different ages, given that they live in households of different sizes and age structures.¹⁶ Their work is motivated by the fact that the official rate of poverty among the elderly in the United States is lower than the rate among younger age groups. They find, however, that the measurement of poverty of one age group relative to another is quite sensitive to assumptions made when defining poverty. Thus the "result" of lower poverty among the elderly can easily be turned around when different but equally plausible assumptions are made. For example, Deaton and Pax-

son experiment with different assumptions about the cost of children relative to adults, and the extent of "economies of scale" in larger households. While their research does not go as far as to propose different measures of poverty, it does highlight the fact that the measurement of an individual's economic welfare is no simple task.

Deaton and Paxson's work on aging and distribution most recently has been extended to analyses of health and the distribution of health status, as measured by body-mass index and by self-reported health status.¹⁷ As with the economic measures, the health measures become more widely dispersed with age. In addition to measuring the distribution of health over the life cycle, Deaton and Paxson look at the correlation between income and health over the life cycle. The positive correlation between health and socio-economic status is well documented. What Deaton and Paxson discover, however, is that the correlation is strongest during the highest income periods of life, rather than in retirement. Such an effect would be predicted by a model in which health status "causes" income—for example, through absence from work.

Innovative Survey Measures

A number of NBER investigators are working with the HRS and the Survey of Asset and Health Dynamics among the Oldest Old (AHEAD), two innovative new longitudinal surveys of Americans age 51 and older. One of the innovative components of these surveys is the use of a "bracketing" technique to measure wealth and consumption variables. Michael Hurd, Daniel McFadden, and their coauthors have analyzed biases in the data that these methods may cause.¹⁸ They find very substantial anchoring effects (biases toward an

initial bracketing value), enough so that changing the question format within reasonable ranges could induce variations by a factor of two in average savings balances or average consumption levels in the elderly population. This is a red flag that should alert researchers that response bias is a serious issue in surveys of the elderly, and that these surveys should build in sufficient experimental control so that any bias resulting from question format can be determined and possibly corrected.

Another innovative component of the HRS and AHEAD surveys is a series of questions about people's subjective expectations about their likelihood of surviving to particular ages. Hurd, McFadden, and Gan find that the distribution of responses is remarkably close to life tables, and that responses co-vary as one would expect with other variables, such as gender and smoking status.¹⁹ At more advanced ages (80 and older), the subjective mortality measures are found to be progressively more optimistic than are the life tables. The investigators find preliminary evidence that the subjective mortality measures help explain individual saving decisions, although their explanatory power is limited by the tendency of respondents to choose "round number" probabilities.

Labor Force Participation

There has been a long-term trend in the United States toward younger retirement. The widespread availability of post-retirement benefits is an important aspect of this national trend. Eligibility for employer-provided benefits can begin as young as age 50, and quite frequently occurs at age 55. Eligibility for Social Security benefits begins at age 62. Eligibility for Medicare begins at age 65. Likely reforms in these benefit programs will change their benefit struc-

ture, and their associated incentives for continued work versus retirement. Employers, too, will make adjustments in their employment practices in response to changing population demographics. What does this mean for the work and retirement decisions of older Americans in the future?

Pensions, Social Security, and Retirement

Robin Lumsdaine, James Stock, and I have conducted a series of studies demonstrating how traditional employer-provided pension plans encourage early retirement and penalize continuation in the labor force at older ages.²⁰ For example, company pension plans commonly provide early retirement benefits beginning at age 55. Although employees become eligible for larger pension payments by continuing to work, the increase is rarely large enough to compensate for the delay in receiving benefits. Because of this economic structure, pension plans have an enormous effect in inducing retirement at much younger ages than would occur without the plans.

Similar incentives for retirement exist in Social Security, although eligibility for Social Security occurs somewhat later than the early retirement age of most traditional pension plans. Samwick explores the combined influence of pensions and Social Security, using data that link the economic and demographic information of households with details of their pension formulas.²¹ He, too, finds that the most significant economic determinant of retirement is the accrual of retirement wealth that results from continued work. As much as one-fourth of the decline in labor force participation among older Americans in the early postwar period can be attributed to the growth in pension coverage.

Leora Friedberg also has explored the decline in labor force participation among older workers, focusing on the Old Age Assistance (OAA) program—a means-tested retirement benefit program that was far larger than Social Security during the 1940s. She finds that OAA benefits had a strong influence in inducing earlier retirement during this period.²²

Courtney Coile and Jonathan Gruber look at the work and retirement incentives in the current Social Security program. Using HRS data, they estimate the implicit tax or subsidy on work at each age. They find substantial variation in incentives across the population. At the median, they find a small subsidy on continued work between ages 62 and 64—equivalent to between 2.5 and 5.4 percent of earnings. However, because of the variability across individuals, about one-third of workers at age 62 have an implicit tax. The addition of private pension incentives does little to affect the work and retirement incentives at the median, but it substantially increases the variability in incentives across individuals.²³

Part-Time Work

In preliminary work using Current Population Survey data, Friedberg finds a substantial increase in part-time work among older Americans, particularly among men. Between 1980 and 1997, the percentage of workers who worked part time increased from 5.5 to 8.7 percent among men ages 55 to 59; from 9.9 to 18 percent among men ages 60 to 64; and from 44.7 to 46.4 percent among men ages 65 to 69. Using 1992 and 1994 data in the longitudinal HRS survey, Friedberg has also started to look at part-time work as a potential transition to retirement. For example, about 12 percent of working men age 60 to 61 reported working part time in the 1992 survey. Among those still working in 1994, 22.5 percent

were working part time. Thus part-time work appears to be an increasingly important approach to phasing into retirement. Continuing HRS re-interviews will enable us to learn more about these labor force transitions at older ages.

Health Insurance and the Labor Market

Brigitte Madrian has continued to advance our knowledge of how the availability and cost of health insurance influences labor market decisions regarding job mobility, retirement, and self-employment, for example. In a recent study done with David Cutler, she looks at how rising health insurance costs affect firms' employment decisions.²⁴ The theory is that employers may substitute hours of work per worker for the number of workers as a means of economizing on health insurance costs. The results show that rising health insurance costs over the 1980s increased hours worked of those with health insurance by up to 3 percent. In another recent study, Madrian and Lars Lefgren finds that the availability of health insurance influences transitions to self-employment.²⁵ They find that workers who have a spouse with health insurance are more likely to become self-employed if they have access to more generous continuation coverage; workers who have a larger family are less likely to become self-employed.

Health Care

The United States stands out as having the highest health care costs in the world. It is also a leader in the advancement of treatment technology. While health care is already a high-priority issue for policy evaluation and an ongoing target for policy reform, the aging of the population will only heighten attention to the costs and benefits associated with

our health care system. The NBER Program on the Economics of Aging has made a major investment in developing data resources for health care research. These resources now include comprehensive medical claims records for Medicare beneficiaries and employees covered by employer-provided health insurance plans, hospital discharge records from numerous states, Medicaid claims records, and survey data that link information about people's health and economic circumstances, their health insurance, and the health care they receive. A wide range of research activities is applying these data toward a better understanding of our health care system, the costs and benefits of treatments as they evolve over time, and the implications for costs and outcomes of alternative approaches to health policy.

The Growth and Distribution of Health Care Expenditures

Alan Garber, Thomas MaCurdy, and Mark McClellan have used Medicare claims data to help explore the composition and growth of Medicare expenditures over time. They confirm a high level of concentration in expenditures among relatively few beneficiaries. The top 10 percent of beneficiaries using Medicare services account for 64 percent of annual Medicare expenditures; the top 2 percent receiving services account for more than a quarter of expenditures. Less well known is that expenditure *growth* has been more concentrated over the past decade: the top 2 percent of beneficiaries accounted for almost one-third of Medicare expenditure growth. Thus Medicare expenditures have become even more concentrated over time. Garber, MaCurdy, and McClellan also find limited persistence in individual Medicare expenditures from one year to the next: that is, the number of

people with high expenditures over multiple years is very small.²⁶ Among Medicare beneficiaries with high expenditures in one year, subsequent death or reversion to lower expenditure levels is much more common than continued expenditure at high levels. These data are very similar to comparable data for younger persons covered by employer-provided insurance plans, as shown by Eichner, McClellan, and Wise, as discussed later in this article.

The use of costly medical treatments for the elderly has been a primary determinant of Medicare expenditure growth over time. In one example of this, Cutler, McClellan, and Joseph Newhouse explore the role of technology in increasing both costs—and benefits—associated with heart attack treatment.²⁷ The cost of treating heart attack patients has increased at an inflation-adjusted rate of about 4 percent annually. This expenditure growth has resulted entirely from the increasing use of intensive cardiac procedures (including cardiac catheterization, bypass surgery, and angioplasty). The costs of any given type of treatment has been essentially unchanged over time, and the incidence of heart attacks actually has been falling. Life expectancy following a heart attack also has improved in recent years, a trend that Cutler, McClellan, and Newhouse attribute largely to new medical interventions and increased use of existing interventions. Indeed, the value of improved health is estimated to outweigh the increased cost of heart attack care.

Another trend in health care expenditures relates to the age composition of spending. Cutler and Ellen Meara find dramatically higher spending growth among older health care recipients.²⁸ Between 1963 and 1987, real per capita medical spending on the elderly increased 8 percent annually, as compared with 4.7 percent for the population aged 1 to 64. Only

spending on infants increased as rapidly (9.8 percent per year) as spending on the elderly. Again, Cutler and Meara point to technological advances in treatment as the core factor in the disproportionate growth in costs among these groups.

Another major change in health care is occurring near the end of life. Garber, MaCurdy, and McClellan show that the nature of medical care near death is changing substantially, particularly for the increasing share of the elderly population whose deaths are from chronic conditions or are associated with frailty.²⁹ For the elderly dying of acute conditions like heart attacks, the vast majority of deaths occur in acute hospitals (inpatient and outpatient), and this pattern has not changed appreciably between 1988 and 1995. In contrast, the location of death has changed substantially for the elderly with chronic illnesses, like cancer, for which death is more predictable. For example, while over three-fourths of patients with heart attacks or hemorrhagic strokes near their death still die in the hospital, the proportion of patients with lung cancer dying in the hospital has fallen by more than half in the same period (from over 60 percent to under 30 percent). This decline in acute-hospital deaths was more than offset by growth in deaths in alternative settings that are financed by Medicare, especially hospice care (representing almost one-third of deaths in 1995) and non-acute hospitals. Relatively few elderly die without receiving any Medicare-covered services near the time of death.

The Composition of Firm Health Care Expenditures

Matthew Eichner, McClellan, and I have conducted a series of studies on employer-provided health insurance benefits, the composition and distribution of plan expenditures, and the cost and outcome implications of

alternative plan designs. A key finding from this work relates to the concentration of health care expenditures among a small percentage of covered individuals, and the persistence of individual health care expenditures over time. For example, the most expensive 20 percent of plan enrollees in 1990 accounted for over 85 percent of health care costs in 1990, and those same individuals still accounted for almost 50 percent of health care costs in 1992.

Eichner, McClellan, and I have paid particular attention to the implications of persistence for the feasibility of medical savings accounts, or MSAs.³⁰ An MSA is set up in combination with a catastrophic health care plan with a high deductible. Under these plans, a given amount is deposited each year in an employee MSA. All medical expenditures below a deductible—\$4,000 in the illustrative plan we consider—are paid out of this account. Any expenditures above the deductible are paid by the insurance plan. Such schemes are designed to provide consumers, and their health care providers, incentives not to spend money on care that offers only low marginal benefit. The viability of any MSA-based system, however, depends on the persistence of individual expenditures. The key substantive conclusion of this work is that expenditure persistence does not severely limit the feasibility of MSAs as a way to mitigate moral hazard and thus to more efficiently guide the purchase of health care. While there is clear persistence in health care expenditures, the proportion of persons who have high expenditures in successive years is very small. For example, only about 6.23 percent of plan enrollees had medical expenditures above \$1,000 in 1989 and 1991, and only 1.17 percent had expenditures above \$5,000 in each of those years. More recently, we have pursued this work using a six-year rather than a three-year panel of individual

expenditure data. Eichner and I also consider in some detail the potential balance in an MSA at retirement, accounting for different rates of return on account balances. This work is a precursor to thinking more intensively about the potential for combined MSA and 401(k)-like saving plans.³¹

Eichner, McClellan, and I have also analyzed the sources of cost differences across firms.³² There are three reasons for cost differences: 1) differences in the demographic attributes—age and gender—of enrollees, 2) differences in the illnesses that are treated—the rate of treatment, 3) and differences in the cost of treating illnesses. While the differences in costs across firms is quite large, it becomes even larger after accounting for differences in the demographic characteristics of plan enrollees. Another finding is that the cost of treatment for almost every diagnosis is higher in the plans that have the higher overall costs, but the likelihood of receiving treatment tends to be lower in the high-cost plans. The decomposition analysis also has allowed us to isolate the diagnoses for which the intensity of treatment (dollar cost) differences are the greatest. For example, the average cost of childbirth ranges across plans from a low of \$4,046 to a high of \$7,119. The proportion of deliveries by cesarean section ranges from 17 to 34 percent.

Isolating Incentive Effects from Selection Effects

Many U.S. employers offer a menu of health insurance options to their employees. Thus employees can choose among plans with different premiums, different deductibles and copayments, different coverage characteristics, and different health care management arrangements. Using the range of health plans offered at one large U.S. company, Eichner has explored the determinants of plan

choice and how these determinants relate to plan expenditures.³³ He finds that about half of the cost difference between the high-cost plans and the lower-cost plans results from “selection”—or the tendency of less healthy individuals to choose more generous health insurance. The other half results from covered individuals choosing more health care services when their insurance is more generous—that is, from plan incentive effects. He finds a rather substantial effect of plan incentive effects on expenditures, in some ways again highlighting the relationship between plan provisions and medical expenditures.

Socioeconomic Status, Health, and Longevity

Two recent studies have documented the strong relationship between wealth and mortality. Hurd, McFadden, and Angela Merrill use AHEAD data to examine the death rates of individuals aged 70 and older during the two-year period between the 1993 and 1995 surveys.³⁴ They find that individuals in the lowest wealth quartile were between two and three times as likely to die during this period as individuals in the highest wealth quartile. Attanasio and Hoynes find about the same differences in mortality rates using SIPP data.³⁵

One reason for the strong relationship between health and economic status is that adverse health events have adverse economic implications. Using HRS data, Tracy Falba and McClellan have focused on withdrawal from the labor force after an adverse health event.³⁶ They find that employed men who experience a major health event (such as a heart attack or stroke) are about 25 percentage points more likely to transition to zero hours of work than employed men without a health event; the average number of work hours declines by more than 600 per year. If the

acute health event is accompanied by a major decline in functional status, then the men are about 75 percent-age points more likely to transition to zero hours of work; their average number of work hours declines by about 1,700 more than men with no health events.

Aging Around the World

Population aging is occurring not just in the United States, but in every country of the world. While the specific demographic circumstances and the details of aging-related policies differ across countries, the fundamental challenges of funding social security and health care systems with growing populations of older people remain the same. The NBER Program on the Economics of Aging has initiated significant comparative work on aging in different countries, much of which is being done in collaboration with investigators overseas. These international comparisons are enabling us to study experiences and policy variation that do not exist in any single country.

Social Security and Retirement around the World

Jon Gruber and I have been directing a collaborative study on the public retirement income programs in 11 developed countries including the United States, and how these programs affect retirement decisions.³⁷ The project has involved scholars in each of the 11 countries who have expertise in retirement analysis.³⁸ Both the incentive structure of the policies and the changes in retirement behavior in the countries studied suggest a very strong relationship between policy provisions and retirement behavior.

We find a trend toward earlier retirement in every country. In the

early 1960s, for example, labor force participation among men between the ages of 60 and 64 was over 70 percent in every country studied. By the mid-1990s, the rate had fallen to below 20 percent in Belgium, Italy, France, and the Netherlands; to about 35 percent in Germany; to about 40 percent in Spain; to 53 percent in the United States; to 57 percent in Sweden; and to 75 percent (from 83 percent) in Japan. The earlier retirement, combined with the growing population of older persons, has placed enormous pressure on the financial solvency of retirement income systems around the world. This set of studies suggests that the retirement policies themselves contribute to the earlier retirement, often providing generous retirement benefits at young ages and imposing large financial penalties on labor earnings after the age of eligibility for retirement benefits. As a result of these incentives, there is a strong correspondence between the age at which benefits are available in each country and the age when people tend to leave the labor force.

The project has produced important findings both within the individual country studies and in the cross-national summaries that integrate them. Within countries, we find that people retire more often when it is financially beneficial, as defined by the benefit provisions of each country's social security system. The policy reforms that have changed the benefit structure in particular countries appear to have caused corresponding changes in the age of retirement in those countries. In comparing countries, we find earlier retirement in those with social security systems that "tax" continued work more heavily. So, in countries where the general tax burden on work at older ages is large, many more older persons choose to retire rather than to continue to work. The implication of these findings is that

social security programs themselves, by "taxing" continued work at older ages, actually are exacerbating their own financial problems.

The Economics of Aging in Japan and the United States

I have also been directing a long-term project on the economics of aging in Japan and the United States. This work has been done in collaboration with economists at the Japan Center for Economic Research (JCER).³⁹ Japan already has one of the oldest populations in the world, and the projections for the future elderly population are as high as in any country in the world. Studies have been done on retirement decisions in Japan and the United States, on the wealth accumulations and financial circumstances of older people in the two countries, on housing and living arrangements, on health care systems and costs, and on the implications of population aging on government finances and financial markets. Numerous NBER-JCER joint meetings have been held, stimulating collaborative research and interaction between economic scholars in both countries and resulting in several research volumes.

Provision for Aging in South Africa

David Bloom, Anne Case, Deaton, and I have been engaged in a project that brings together a small team of scholars from South Africa and the United States to collect data and conduct research on the pension system in South Africa.⁴⁰ South Africa's public pension system is unusual in comparison to the systems of other countries, in that prior labor force participation is not a condition of receiving benefits. Access is universal, although means-tested. Although intended for the elderly (women

qualify at age 60, men at 65), the pension system serves as a vital welfare program more generally and provides an important source of household income maintenance for a substantial portion of the population. For example, the benefit received by most black recipients is about half of average household income and more than twice the median per capita household income of the black population. The payment is three times the World Bank's cutoff for absolute poverty. Both the generosity and the universality of the system are likely to have significant implications for the health, family dynamics, labor market behavior, and well-being of the elderly, their extended families, and the overall population of South Africa. In particular, by extending such benefits to a large group of poor people, the government has made the presence of a pensioner in the household an important determinant of household well-being and may have significantly affected work and savings incentives for much of the population.

The main objectives were to devise, test, and apply methods for gathering data about the effects of South Africa's pension system, in a manner appropriate to the cultural, social, and economic conditions of the country, and to study the pension system's effects on the health, well-being, family dynamics, and labor supply behavior of the elderly and those who live with them. To date, we have conducted a series of pilot surveys and focus groups. Case and Deaton also have completed a study documenting some of the key characteristics of the pension system in South Africa.⁴¹

Future Work

In future work, we will pursue many of the issues discussed here and will initiate work in new areas as well. For example, the work on so-

cial security around the world is continuing, and we will initiate analogous comparisons on health care systems in several countries. In new work we will try to understand more clearly the relationship between wealth and health. We will pay considerable attention to the implications of increased personal retirement saving, and to some of the nontraditional explanations for people's decisions about how much to save. We will also explore changes in labor force behavior at older ages, changes in employment opportunities for older workers, changes in the composition of employer-provided retirement benefits, care-giving demands, and part-time work arrangements. We will continue to study the major components of medical expenditures and how they are changing, and the relationships among trends in disease prevalence, treatment patterns, expenditures, and outcomes. New work will consider the macro implications of health care expenditures, considering whether high-tech expenditures are worth their cost. We also have developed new research on treatment variation across the population and issues of differential access to appropriate care. And we will continue to pursue analysis of employer-provided health insurance systems. A new project on survey design and in particular the best way to collect accurate information on the financial status of households is also under way.

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Richard Blundell and Paul Johnson (United Kingdom).

³⁹ This group has included Yukiko Abe (Kyoto University), Seki Asano (Tokyo Metropolitan University), Hiroyuki Chuma (Hitotsubashi University), Tetsuo Fukawa (Institute of Public Health), Tatsuo Hatta (Osaka University), Naoki Ikegami (Keio University), Hiroki Kawai (JCER), Makoto Kawamura (Hosei University), Yukio Noguchi (Hitotsubashi

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Research Summaries

Technology and the Global Economy

Jonathan Eaton*

Since at least the eighteenth century, much of the world has experienced ongoing gains in the standard of living, a process that Simon Kuznets labeled "Modern Economic Growth." Economists have long sought to understand the forces behind this phenomenon. Accumulation of physical capital provided a simple and natural explanation. But Robert Solow's fundamental work in the late 1950s showed that capital accumulation could account for less than half of the growth in U.S. income per capita. Solow suggested that ongoing improvements in technology might tell the rest of the story. While subsequent work refined Solow's analysis, it did little to upset the basic conclusion that capital accumulation provides a very incom-

plete explanation for why countries grow.

While interest in growth waned in the 1970s, the last decade and a half has seen a resurgence of research on why incomes rise over time, and why some countries are richer than others. There are now a number of elegant *theories* of how technological progress drives growth. But in turning the spotlight to technology rather than to investment, Solow made the job of *quantifying* the sources of growth, and assessing how policies affect growth, much harder.

At the heart of the problem is measurement. We have imperfect, but usable, ways to measure resources diverted from other uses toward investment in capital. We can also gauge (much more roughly) how much capital is on hand. Such measures give us some handle on capital's contribution to growth over time and to differences in incomes across countries. But technology presents the empirical economist with a much more elusive concept. We do not observe people coming up with new ideas, and we cannot systematically trace how these ideas shape the process of production over time and space.

A number of basic questions, however, hinge on understanding how innovations occur, and how these innovations raise income levels around the world. For example: Do countries rely, for the most part, on their own innovations, or are the gains from innovation largely shared? Where does most innovation occur, and where are these innovations most rapidly put into practice? To the extent that the benefits of innovation seep across borders, do these gains spread through the exchange of products embodying these innovations, or through the diffusion of the ideas themselves?

The answers to these questions are of intrinsic interest, but they are also at the heart of any evaluation of the myriad government policies that affect innovation. For instance: What are the benefits and costs of tougher patent protection, and how are they shared across countries? Does a country recover the costs of giving research expenditures favorable tax treatment, or are the benefits largely dissipated through the diffusion of innovations abroad? What are the gains from coordinating research policies internationally? To what

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extent does greater openness spread the benefits of technical progress?

Sam Kortum and I are engaged in a research project that attempts to shed light on these issues. Our framework builds on recent advances in growth theory and trade theory. We take this theoretical framework to a number of sources of data. We look not only at productivity across countries and over time; we also use data on research effort, patenting, education, and bilateral trade.

Our research so far has pursued four broad sets of issues: 1) quantifying the contributions of innovation and diffusion to world growth, 2) explaining differences in research effort across countries, 3) analyzing the effects of national technology policies in an international context, and 4) assessing the role of trade in disseminating the benefits of technological advances between countries. I discuss our results on each category, and then turn to work-in-progress.

World Growth and the International Diffusion of Technology

In a series of papers, Kortum and I have sought to trace productivity improvements in different countries to the countries that generated the innovations behind those improvements.¹ Because they do nearly all of the world's research, countries that are members of the Organization for Economic Cooperation and Development (OECD) are our focus.

We use output per worker as a measure of the extent to which countries use innovations. Over the past two decades, OECD countries have tended to grow at very similar rates, maintaining fairly stable relative productivity levels. This observation is consistent with a world in which countries draw on a common pool of inventions, with more productive countries either taking advantage of more of these ideas, or implement-

ing them more quickly. It also suggests that not much can be learned about growth by relating the growth rates of different countries to various characteristics. Countries differ much more systematically in their relative income levels than in their growth rates.

To try to get some handle on where innovative activity occurs, we turn to various measures of research effort. Such data include research expenditure (private or overall) and research scientists and engineers (private sector or overall). Whichever number one looks at, the message is that most research is performed in just three countries: the United States, Germany, and Japan. (France and the United Kingdom follow, not very closely, behind.) Not only do these countries devote more resources toward R and D in absolute terms, but they also devote a larger fraction of their resources toward R and D than any but a handful of small, though technically advanced, countries including Sweden and Switzerland.

Hence research activity is quite concentrated, but a number of countries that do relatively little research enjoy high levels of productivity. For example, by most measures, productivity levels in France and Germany are very similar, but Germany does about twice as much research, both absolutely and relative to size. Such observations suggest that a large number of countries make use of innovations from a small number that concentrate on research.

Standard measures thus can give us some insight into who is benefiting from innovations and who is doing fairly straightforward research. But it is trickier to infer whose innovations countries are tapping. For this purpose, we turn to data on international patenting.

One feature of the international patenting system is that an inventor, in order to obtain patent protection in any particular country, has to take

out the patent there. Applying for a patent is costly, and most inventions are patented in only one country. So an inventor, in deciding to patent an invention in a particular country, probably expects that the invention has some chance of being used there. For example, the number of patents that French inventors take out in Japan might suggest something about how much technology is flowing from France to Japan. French inventors would have little reason to apply for a patent in Japan unless they thought it had a good shot at being used there sooner or later. Of course other factors would affect the decision as well, such as the cost of patenting in Japan, the size of the market there, and the quality of protection that the Japanese patent system provides a French inventor. Thus, inferring the extent of technology diffusion from the patenting data requires taking these other factors into account.

What patterns do we observe in international patenting? First, countries that put the most resources into inventive activity in fact do patent most broadly. The United States, Japan, and Germany dominate patenting by foreigners in other OECD countries. Second, larger countries are much more popular destinations for patent applications, suggesting that inventors in fact find the bother of applying for a patent much more worthwhile when the market in which they are seeking protection is large. Third, for similar reasons, higher costs of patenting (application fees, translation costs, and legal fees) tend to deter patenting. (Patenting in Japan is particularly expensive for foreigners.) Fourth, inventors are more likely to patent an invention at home than anywhere else. Fifth, inventors are more likely to take out patents in nearby countries than in countries far away. Japan, for example, is the largest foreign patenter in the United States and, after the United States, in

Canada. But in many European countries, West Germany beats out Japan.

The data themselves provide a lot of insight about what is going on. But getting a more precise picture of how innovation and diffusion drive world growth requires embedding these data into a framework that accounts for how markets allocate resources between current production and innovation, and how innovators decide where to patent their inventions. For this purpose we use a multicountry model of innovation and diffusion that incorporates these phenomena.

A key goal is to assess the contribution that different countries are making to growth around the world. Among other things, our approach allocates technical progress in each country, its "Solow residual," to the countries whose innovations drive it. We learn that the United States, Japan, and Germany are overwhelmingly the major sources of innovation in the world economy: More than half the growth of the countries we consider derives from innovations from these three countries. While the extent of international diffusion is substantial, it is not complete. Innovations appear to be about two-thirds as potent abroad as they are at home, and each country makes its greatest contribution to growth at home.

Why Some Countries Do Much More Research than Others

On average, countries in Europe do less research than the United States or Japan, not only in absolute terms but also relative to their size and resources. Moreover, countries within Europe vary enormously in the share of resources they devote toward research and in terms of how much patenting they do at home and abroad.

Eva Gutierrez, Sam Kortum, and I adapt our framework to evaluate

alternative explanations for such cross-country differences in research effort.² One possibility is that these differences reflect specialization in goods that are more or less research-intensive. Switzerland, for example, might do a lot of research because of its large pharmaceutical industry, and pharmaceuticals are research-intensive. This explanation holds, of course, only if the research needs to be done where the inventions are used. However, we find that countries that do a lot of research tend to do it across the board, in all industries. Hence cross-country differences in research effort seems to say more about differences in the countries themselves than in the goods that they produce.

It may be that some countries are simply better at doing research than others, or else that some countries provide greater rewards to doing research. We find that the second explanation seems to have much more to do with why many smaller European countries do so little research. Because of their small size and the difficulty of appropriating returns to inventions abroad, firms in these countries turn to other activities.

What Policy Can Do

Since patenting is a major component of our empirical analysis, a natural question is what patent protection contributes to innovation and growth. In fact, our results indicate that the current patent system provides only modest protection from imitation. On the one hand, even if an idea is not patented, it may take a while for someone to figure out how to copy it. On the other hand, patents eventually expire, and even an active patent does not provide an ironclad guarantee that an idea won't be stolen. Imitation is often hard to detect, and enforcing the patent can be costly. These difficulties are especially formidable for patents held abroad.

Indeed, we find that eliminating patent protection entirely would reduce world incomes by fairly small amounts. At the same time, a patent system that provides much tougher protection than the current one could do much to stimulate growth.

Most policies toward technology are pursued nationally. But as long as ideas cross borders, national policies have global effects. Consequently, there are many reasons to think that countries might benefit from coordinating and harmonizing technology policy. Gutierrez, Kortum, and I consider various aspects of technology policy in Europe. We find that there is enormous scope for free riding. Many policies that would benefit Europe as a whole generate such large cross-border externalities that they are not worthwhile at the national level. We find, for example, that tougher patent protection within the European Union (EU) would raise incomes everywhere, but the increase outside the EU is even greater. The reason is that non-EU countries benefit from the stimulus to research but do not have to bear the cost of the more pervasive monopoly power that tougher protection entails. Our results suggest that the payoff to providing European inventors a common market for their ideas is potentially quite large.

Technology and Trade

To what extent does trade bring the fruits of technological progress to foreign shores? The idea that trade can be explained by technology has its origins with David Ricardo. But the Ricardian model has resisted generalization to many countries and the incorporation of trade barriers—two extensions needed for any serious empirical analysis.

It turns out, however, that in our model of innovation these extensions are quite straightforward. Kortum and I extend our framework to ana-

lyze bilateral trade in manufactures among a sample of OECD countries.³

Among other things, we examine how the competing forces of technology and geography shape production and trade patterns in manufacturing. When transport costs are very high, countries with large internal markets tend to attract manufacturing, since inputs tend to be much cheaper there. As transport costs fall, large countries lose their edge to countries with better technology for producing manufactures regardless of their size. For example, we estimate that a drop in transport costs from their current levels will tend to shift manufacturing from Germany to Denmark, which will then find its relative isolation less of a handicap.

We also consider the classic question of the gains from trade in manufactures among our sample of countries. A dramatic finding is the extent to which they remain unexploited: at their current levels, trade barriers keep countries much closer to a world of autarky than to a world in which manufactured goods could be moved costlessly across borders.

Given the size of current trade barriers, to what extent can trade spread the benefits of technological progress through the exchange of goods embodying innovations? We find that

barriers are too high for trade to serve as the major conduit for the spread of new technology except, in some cases, to small countries very near the source of innovation. These results suggest that the benefits of innovation spread primarily through the transmission of the ideas themselves, rather than through the export of goods embodying them.

What's Next

Our work on the topics discussed so far is largely complete, but we regard it mainly as a platform from which to launch investigations of many additional questions. Right now we are exploring three fronts.

One project examines at a sectoral level the technology and trade issues that we have raised here. In particular, to what extent do countries carve out a comparative advantage in particular manufacturing activities through research efforts? A second project seeks to complete the link between our model of innovation and international trade: we explore the extent to which openness to trade fosters innovation and growth. Finally, Kortum and I have teamed up with Andy Bernard and Brad Jensen to connect our work, which focuses on aggregate measures of trade and innova-

tion, with their work on the productivity and export behavior of individual U.S. firms and establishments. It turns out that our methodology provides a simple way to link aggregate with plant-level data. One of our goals is to understand the connection between factors that affect trade at the aggregate level and what happens to individual plants. For example, we can relate the implications of greater openness for plant closings and for the fraction of remaining plants that export.

These completed and ongoing projects all involve linking economic theory to data about the world economy. A common goal is to provide a clearer quantitative picture of the role of technology in the global economy.

¹ J. Eaton and S. Kortum, "International Technology Diffusion," *International Economic Review*, 40, no. 3 (May 1999), pp. 1-33; "Trade in Ideas: Patenting and Productivity in the OECD," *Journal of International Economics*, 40 (May 1996), pp. 251-78; "Engines of Growth in the World Economy," *Japan and the World Economy*, 9 (1997), pp. 235-59.

² J. Eaton, E. Gutierrez, and S. Kortum, "European Technology Policy," *Economic Policy*, 27 (October 1998), pp. 405-38.

³ J. Eaton and S. Kortum, "Technology, Geography, and Trade" (originally published as "Technology and Bilateral Trade," *NBER Working Paper No. 6253*, November 1997).



Technological Change and the Labor Market

Ann P. Bartel and
Nachum Sicherman*

Economists have long been interested in the effect of technological change on the labor market. Our recent research has focused on how technological change influences the retirement decisions of older workers,¹ the skill acquisition of young workers,² and the interindustry wage structure.³ Since data on the rate of technological change faced by workers in their jobs is unavailable in any non-firm-level dataset, we have used industry-level measures of technological change instead. In our early work on retirement, we studied the manufacturing and nonmanufacturing sectors and used the Jorgenson productivity growth series as a proxy for the industry rate of technological change. In our work on skill acquisition and the interindustry wage structure, we restricted the analysis to the manufacturing sector because of the difficulties in accurately measuring technological change outside the manufacturing sector. We used a number of additional proxies for technological change: the NBER productivity series; the Census of Manufacturers series on investment in computers; the industry's R and D-to-sales ratio; the industry's use of patents; and the number of scientists and engineers employed within the industry. This approach has enabled us to examine the robustness of alternative measures of technological

change, thereby increasing our confidence in the results.

Technological Change and Retirement Decisions

Technological change can affect retirement decisions in two main ways: directly, through its effect on the amount of on-the-job training, and indirectly, through its effect on the depreciation rate of the stock of human capital. Economic theory does not clearly predict the effect of technological change on the optimal level of on-the-job training, though. This relationship depends on the effects of technological change on the marginal return to training, and on the complementarity and substitutability between schooling and training. If technological change and on-the-job training are positively correlated, then human capital theory predicts that workers in industries with higher rates of technological change will retire later.⁴ However, in industries that have higher rates of technological change, human capital will depreciate at a faster rate. These higher rates of depreciation will lead to a lower optimal level of investment, inducing earlier retirement. Hence, from a theoretical perspective, the relationship between the long-run variation in the rate of technological change across industries and the age of retirement is ambiguous. If there is a net positive correlation between on-the-job training and technological change, though, the industries that are characterized by higher rates of technological change will have later retirement ages.

Unexpected changes in the industry rate of technological change can also influence retirement decisions. For example, an unexpected increase in the rate of technological change will produce an increase in the de-

preciation rate of the human capital stock, leading to a revised rate of investment in human capital. If older workers are unlikely to revise their planned investments in human capital, then the higher depreciation rate will induce earlier retirement.

In our empirical work using the 1966-83 National Longitudinal Surveys of Older Men, we find that it is important to distinguish between long-run variations and unexpected changes in industry rates of technological change. Our two main findings are that workers in industries with higher average rates of technological change retire later than workers in industries with lower rates of technological change, and that an unexpected increase in the rate of technological change induces earlier retirement, especially for workers 65 and older.

Technological Change and the Skill Acquisition of Young Workers

Observed investments in training are the outcome of a supply and demand interaction between employers and workers. Technological change influences the incentives of both parties. One argument is that technological change makes formal education and previously acquired skills obsolete. As a result, both workers and firms will find it optimal to invest in on-the-job training in order to match the specific requirements of each wave of innovation. The alternative view is that general education enables workers to adjust to and benefit from technological change. Workers who expect to experience higher rates of technological change on the job therefore should invest more in schooling and rely less on acquiring specific training on the job. Hence it is impossible to predict from theory alone the direc-

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tion of the relationship between technological change and investments in formal company training.

We use the 1987–92 National Longitudinal Surveys of Youth (NLSY) to assess the relative importance of the competing effects. This dataset is particularly well suited to the task because it contains detailed information on all formal training spells experienced by the individual. Our findings indicate that production workers in manufacturing industries with higher rates of technological change are significantly more likely to receive formal company training. This is consistent with the notion that technological change makes previously acquired skills obsolete, thereby inducing workers and firms to invest in training to match the specific requirements of the latest innovation.

Technological change is also likely to affect the relationship between education and training. In general, more educated workers receive more training, either because human capital is an input in the production of new human capital or because individuals who are better “learners” invest more in both schooling and training. At higher rates of technological change, however, the training gap between the more and less educated narrows. In addition, we find that the proportion of individuals receiving training increases, and that firms are more likely to train individuals who have not received training in the prior period than those who were trained previously.

Technological Change and the Interindustry Wage Structure

Previous studies have found positive correlations between technological change and industry wages⁵ and between technological change and the ratio of the earnings of more educated relative to less educated work-

ers.⁶ Using the 1979–93 NLSY, we examine the role of observed and unobserved heterogeneity in explaining these positive relationships.

We show that wages in industries with higher rates of technological change are higher, even after we control for a variety of individual characteristics using the AFQT score. This result could reflect wage premiums that are attributable to: industry effects, such as compensating wage differentials or efficiency wages; labor mobility constraints that cause the results of demand shocks to persist; or continuous shocks in the industry. Alternatively, it could reflect the sorting of more skilled workers into industries with higher rates of technological change. We use a number of econometric procedures, based on fixed-effects models, and conclude that sorting is the dominant explanation for higher wages in industries with higher rates of technological change. Although, like other researchers,⁷ we find evidence of an industry wage premium after controlling for individual fixed effects, we show that this premium is not correlated with the industry rate of technological change. In addition, we document higher returns to education in high-tech industries and show that this education premium also results from greater selectivity on individual unobserved characteristics.

These individual unobserved characteristics could reflect innate ability, the home environment and the skills learned there, or school curriculum and school quality. The implications of our findings for wage inequality and its persistence depend on the relative importance of these factors. For example, if the unobserved characteristics largely reflect individuals’ innate abilities, then the wage differentials associated with technological change would be expected to persist over time. Similarly, if these unobserved characteristics capture the

home environment, which is also exogenous to the individual, then there will be a limited role for public policy intervention. If the unobservable characteristics largely reflect school curriculum or school quality, though, then public policy or individual choice could shape the allocation of these resources, thereby mitigating the effects of higher rates of technological change on wage inequality.

¹ A. P. Bartel and N. Sicherman, “Technological Change and Retirement Decisions of Older Workers,” *Journal of Labor Economics*, 11 (January 1993), pp. 162–83.

² —, “Technological Change and the Skill Acquisition of Young Workers,” *Journal of Labor Economics*, 16, (October 1998), pp. 718–55.

³ —, “Technological Change and Wages: An Interindustry Analysis,” *Journal of Political Economy*, 107 (April 1999), pp. 285–325.

⁴ This can be shown using the model in Y. Ben-Porath, “The Production of Human Capital and the Life Cycle of Earnings,” *Journal of Political Economy*, 75 (August 1967), pp. 352–65.

⁵ For example, see W. T. Dickens and L. F. Katz, “Inter-Industry Wage Differences and Industry Characteristics,” in *Unemployment and the Structure of Labor Markets*, K. Lang and J. Leonard, eds. New York: Basil Blackwell, 1987.

⁶ See S. G. Allen, “Technology and the Wage Structure,” NBER Working Paper No. 5534, April 1996; A. P. Bartel and F. R. Lichtenberg, “The Comparative Advantage of Educated Workers in Implementing New Technology,” *Review of Economics and Statistics*, 69 (February 1987), pp. 1–11; E. Berman, J. Bound, and Z. Griliches, “Changes in the Demand for Skilled Labor within U.S. Manufacturing Industries: Evidence from the Annual Survey of Manufacturing,” *Quarterly Journal of Economics*, 109 (May 1994), 367–98; and J. Bound and G. Johnson, “Changes in the Structure of Wages during the 1980s: An Evaluation of Alternative Explanations,” *American Economic Review*, 82 (June 1992), pp. 371–92.

⁷ See R. Gibbons and L. Katz, “Does Unmeasured Ability Explain Inter-Industry Wage Differentials?” *Review of Economic Studies*, 59 (1992), pp. 515–35.

Risk Management and Insurance

Kenneth A. Froot*

My research over the past several years has focused on two topics: corporate risk management, with a special emphasis on the insurance sector, and the portfolio flows of international investors. In this article, I first discuss the work on risk management, explaining why the insurance industry provides a wonderful set of experiments for testing some ideas about the subject. I then turn to my work on international portfolio flows.

Financial risk management is probably the central activity of financial intermediaries, including banks and insurance companies. Intermediaries take risks by investing their capital in illiquid and information-intensive financial activities. It is these imperfections in financial markets that allow intermediaries to make profits. But the imperfections are not merely a source of profit—they also create costs. That is, intermediaries must finance themselves by issuing claims that are at least partially illiquid and information-intensive. This suggests that exogenous shocks to intermediaries' financial capital should have implications for the pricing and availability of the instruments in which they invest.

How do financing imperfections influence financial policies, such as risk management, capital budgeting, and capital structure? For example, suppose that a financial firm becomes concerned about the feasibility or cost of raising equity capital, or

that its costs of carrying a given amount of capital rise. The marginal value of the firm's internal funds will have increased. As a result, that firm will wish to reduce risks to its capital in order to conserve on internal funds.

The first thing the firm can do is to hedge out any and all "market risks"—for example, risks that can be hedged without friction in the capital markets. These hedges have zero net present value from the market's perspective, since they are done at fair prices. However, they create additional firm value because they allow the firm to use less capital and to raise needed capital less often.¹

Having hedged all frictionless market risk, can the firm further reduce its risk? Yes, the firm can alter its capital budgeting policy by raising internal hurdle rates. At first blush, an increase in hurdle rates would seem to do little to conserve on internal funds. After all, industrial firms are more likely to reduce new investment than they are assets in place, so higher hurdle rates would not reduce risk quickly. In this regard, however, financial firms are special. Financial firms have larger and more liquid balance sheets. Higher hurdle rates would encourage a reduction in risk exposures.

However, it would not be optimal for a financial firm to raise all its hurdle rates by the same amount. Investments that co-vary positively with fluctuations in overall firm capital should receive higher hurdle rates. However, investments that co-vary negatively with internal capital should see their hurdle rates decline. In a recent paper, Jeremy C. Stein and I model these internal hurdle rates. We show that, in the presence of financing imperfections, optimal hurdle rates should include an additional factor driven by co-variance with internal capital. For internal

pricing, the price of capital at risk is measured by a risk-aversion term that reflects the shadow value of internal funds, whereas the quantity of capital at risk is measured by a given investment's covariance with the rest of the firm's portfolio.²

If financial imperfections are present, then negative shocks to financial-firm capital should be associated with increases in hurdle rates and more aggressive hedging. Unfortunately, it is difficult to provide unambiguous empirical evidence that an intermediary's capital position matters for pricing. That is because classical hurdle rates are not directly observable, and changes in intermediary capital are often endogenous. Consider the often-cited correlation between bank capital and bank lending, for example. One could argue that such a correlation emerges because losses reduce capital, causing banks to raise hurdle rates and cut back on lending. But it is difficult to rule out the alternative interpretation: that a decline in lending opportunities causes the decline in lending and the increase in observed lending rates. Under this interpretation, there is no need for a change in bank hurdle rates.

To determine which of these explanations is correct, one would need to observe either hurdle rates or losses that are unrelated to changes in investment opportunities. These conditions come close to being met in one area of the insurance markets—catastrophe (cat) insurance. Insurers purchase catastrophe re-insurance against natural disasters (such as hurricane, earthquake, freezing weather conditions, and the like) to offset losses triggered by such events on the policies they write. Such events stress insurer capital, since the trigger claims against many policies at once. Re-insurance treaties are

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traded contracts that permit insurers to pay a premium to hedge out portions of the cat risk embedded in their policies.

Can the market for catastrophe risk help one understand whether financial imperfections are present? Most important is the transparency in cat-risk hurdle rates. In an essay published a few years ago, I constructed the returns from bearing cat risk exposures over a 20-year period using historical cat re-insurance contracts. I argued that historical cat losses as well as returns on catastrophe re-insurance appear uncorrelated with returns on other major asset classes.³ This suggests that the classical hurdle rate for cat risk is the risk-free rate, which is readily observable. The implication is that cat re-insurance premiums should equal cat re-insurance expected losses. While we cannot observe expected losses directly, they can be estimated indirectly using models produced by independent catastrophe modeling firms, of which there are several. While these models are no doubt imperfect, they provide objective, scientific estimates of expected contract losses. Thus it is possible to construct a crude, but presumably unbiased, estimate of the cat risk embedded in each cat contract.

Data on cat re-insurance contracts since 1970 suggest that, first, re-insurance premiums have on average exceeded expected contract losses. To reach this conclusion, Paul O'Connell and I model the event-loss distributions from five different natural perils across five U.S. regions. We then use the exposure patterns of U.S. insurers to develop estimates of the cat risk imbedded in the re-insurance treaties purchased by these insurers. We find that average premiums exceed expected losses by a multiple of four or five. That is, premiums have historically been four or five times expected losses, a shockingly large

differential. Even allowing for considerable measurement error in the models of actuarial risk, this suggests that cat premiums are far too high to be successfully explained by classical hurdle rates.⁴

In the same paper, we also demonstrate that after a cat event, cat re-insurance premiums increase strongly while the quantity of cat re-insurance purchased by insurers falls. These simultaneous movements in price and quantity are important in identifying the role of supply-versus-demand shocks. Prices could increase after a cat event because capital is depleted and re-insurers raise hurdle rates (that is, supply of re-insurance contracts when capital is depleted). Alternatively, premiums could increase because there is a surge in insurance and re-insurance demand following a cat event (that is, demand for re-insurance increases when there is an event). The change in quantity purchased is decisive in separating these two explanations: in the former, quantity decreases, whereas in the latter quantity rises. Our finding that the quantity of re-insurance purchased falls subsequent to an event suggests that a reduction in the supply of re-insurance is more important than any increase in demand for explaining premium levels and changes.

Next, we estimate re-insurance supply and demand curves explicitly in order to examine a critical prediction of the financial imperfection models: that intermediary hurdle rates reflect the co-variance of a particular cat risk with the intermediary's preexisting portfolio. We find that re-insurers do indeed increase their hurdle rate for those cat risks that are positively correlated with their preexisting portfolios. In other words, the supply of re-insurance for a particular cat risk falls as the risk is more highly correlated with U.S. nationwide cat risks. This is a direct contradiction of the classical hurdle rate

approach, and is consistent with the Froot and Stein model of financial intermediaries described earlier.

Some of these conclusions require us to assume that cat events do not trigger updates in the perceived (and modeled) probability of such events going forward. This assumption may not hold up however. The distribution of cat risk perceived by market participants may shift when events occur. This could lead event losses to be correlated with premium increases and for correlated risks to (potentially) command even higher premiums. To address this "probability updating" hypothesis, O'Connell and I examine how the re-insurance premiums on one type of peril change when a different peril occurs. For example, we look at how the premiums for southeastern U.S. hurricane risks change when an earthquake occurs in the western United States. We assume that earthquake losses do not help us understand how well Florida construction will hold up in high winds, even though an earthquake may teach us something about the vulnerability of California construction to ground motion. The data demonstrate strongly that an event loss from a particular peril increases subsequent re-insurance premiums for that peril, but also for all other perils. Probability updating cannot explain this result. Instead, it is consistent with the financial imperfections story, which predicts that re-insurer losses lead to higher charges for re-insurer risk assumption.⁵

A final pervasive fact about the cat-risk market is how little cat-risk transfer occurs. U.S. households and businesses are underinsured in general, and businesses in particular have relatively little cat-risk protection. Insurers who accumulate cat exposures by writing individual insurance policies purchase only a small amount of re-insurance, given the size of their exposures. In a well-

functioning capital market, a much larger fraction of cat exposures would be hedged. Inefficiency is suggested when a Long Island regional home insurer asks its policyholders to bear some of the risk that a large hurricane will strike Long Island, precisely the risk policyholders are trying to avoid.

While the financial imperfections theory explains these facts, a number of other explanations are also helpful, including 1) monopoly power on the part of re-insurers; 2) tax and agency inefficiencies in the organizational form that re-insurance takes; 3) the high frictional costs of re-insurance (attributable to the illiquidity of contracts and the ways in which they are transferred); 4) the presence of adverse selection and moral hazard, which tend to degrade the quality of the cat-risk market; 5) regulation of insurance rates by state insurance commissioners, which influence insurers' willingness to purchase re-insurance; 6) ex post reimbursements for cat losses from the government and industry pools, which distort incentives to purchase re-insurance; and 7) behavioral factors that may dampen demand for re-insurance, and particularly so for large event losses. In a recent essay, I examine the financial imperfections explanation in addition to these other explanations of the low levels of risk transfer.⁶ I conclude that financial imperfections are the single most robust explanation (although combinations of these other factors are very important). I also argue that recent and future developments in this market are going to be critical to finding the right answer.

These recent developments are telling indeed. In the past few years, cat re-insurance contracts have been securitized for the first time (that is, sold into the capital market as securities rather than absorbed by re-insurers as re-insurance treaties). It is

interesting to track the impact that these transactions have had. I detail the most important landmark cat securitization in a case focusing on the issue's pricing and its implications for risk management.⁷ This 1997 transaction involved the sale of a large fraction of a major insurer's cat exposure to the capital market. The premiums received by investors were very large (but in line with historical results): the premium over the risk-free rate was approximately seven or eight times expected losses.

However, some of these generous premiums have been transitory. Even though relatively little cat risk has been securitized to date, premiums have declined precipitously. For example, in 1998, the same major-insurer cat exposure was sold in an almost identical securitization. Here investors received approximately five or six times expected loss. In 1999, the same exposure is expected to reach the market once again in a similar security. But this time indications are that it will fetch only about four times the expected loss.⁸

These developments suggest that, first, securitization permits additional risk-bearing capacity to be supplied by investors. Re-insurers are no longer the only suppliers of capital. Second, the potentially lower cost of this new source of capital allows premiums to be bid down. Even though securitizations account for a small fraction of cat-risk transfer, they have made the market contestable. Third, new pressures for re-insurers to reduce their costs of capital and improve the efficiency with which they use capital will keep them competitive. But considerable reform in the way re-insurers source funds will occur.⁹

Finally, the insurance and re-insurance industries are beginning to adjust to changes in capital-raising capabilities, in risk-management techniques, and in information technology. This will ultimately lead to

considerable change in the organization of these industries, in the types of insurance policies and risk-management devices available to individuals and firms, and in the way these policies are distributed. Howard Kunreuther and I have started a project at the NBER devoted to understanding both the supply and demand sides of these changes. We held our first project meeting in February 1999, and the papers given at that meeting are posted on the NBER web site (<http://www.nber.org>).

¹ For a model of corporate risk management along these lines, see K. A. Froot, D. Scharfstein, and J. C. Stein, "Risk Management: Coordinating Corporate Investment and Financing Decisions," NBER Working Paper No. 4084, May 1992; revised in *Journal of Finance*, 48 (December 1993), pp. 1629-58.

² See K. A. Froot and J. C. Stein, "Risk Management, Capital Budgeting, and Capital Structure Policy for Financial Institutions: An Integrated Approach," *Journal of Financial Economics*, 47 (January 1998), pp. 55-82. (Revised from NBER Working Paper No. 5403, January 1996.)

³ See K. A. Froot, B. Murphy, A. Stern, and S. Usher, "The Emerging Asset Class: Insurance Risk," Special Report from Guy Carpenter and Company, Inc., July 1995. Reprinted in *Viewpoint*, 24, no. 3 (Summer 1995), pp. 19-28.

⁴ K. A. Froot and P. G. O'Connell, "On the Pricing of Intermediated Risks: Theory and Application to Catastrophe Reinsurance," NBER Working Paper No. 6011, April 1997.

⁵ See K. A. Froot, and P. G. O'Connell, "The Pricing of U.S. Catastrophe Reinsurance," NBER Working Paper No. 6043, May 1997, in *The Financing of Catastrophe Risk*, K. A. Froot, ed. Chicago: University of Chicago Press, 1999.

⁶ "The Limited Financing of Catastrophe Risk: An Overview," NBER Working Paper No. 6025, April 1997; Introductory essay in *The Financing of Catastrophe Risk*, K. A. Froot, ed. Chicago: University of Chicago Press, 1999.

⁷ See K. A. Froot and M. Seasholes, "USAA: Catastrophe Risk Financing," Case no. N9-298-007, Harvard Business School, Boston, 1998.

⁸ The evolution of these transactions is traced out in K. A. Froot, "The Market for Catastrophe Risk: A Clinical Examination," *Harvard Business School and Journal of Financial Economics joint confer-*

ence on clinical studies, July 1999, forthcoming. See also K. A. Froot, "The Evolving Market for Catastrophe Risk," *Harvard University*; published as a Marsh McLennan Securities and Guy Carpenter

& Co. White Paper, September 1998.

⁹ These issues are discussed in greater detail in the papers cited in footnote 8.



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Ann P. Bartel has been a member of the NBER's Program on Labor Studies since 1974. She is also a professor of Economics and Director of the Human Resource Management program at the Columbia University Graduate School of Business.

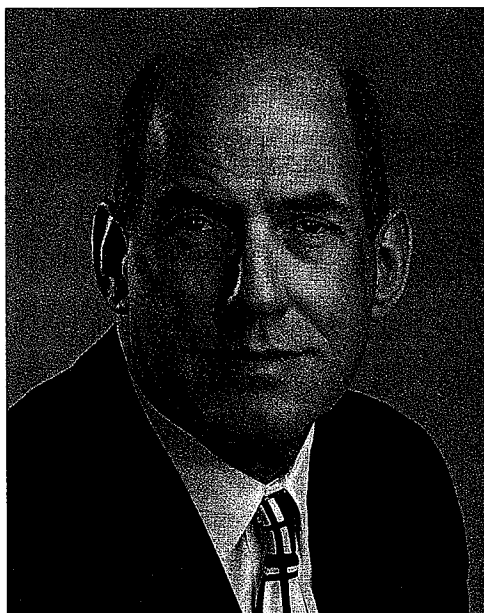
Bartel received her B.A. in economics from the University of Pennsylvania and her M.A. and Ph.D. in economics from Columbia University. After teaching at the University of Pennsylvania for two years, she

joined the economics faculty of Columbia's Graduate School of Business in 1976. She rose from an assistant to an associate professor in 1979, and was promoted to professor in 1986.

Bartel's husband, Charles, is an attorney. They have three children: Joseph, 21; Sharon, 18; and Jessica, 15. When she is not teaching or doing research, Bartel enjoys playing tennis and spending time with her family.



NBER Profile: *Jonathan Eaton*



Jonathan Eaton is a Research Associate in the NBER's Programs on International Trade and Investment and on International Finance and Macroeconomics. He is also a Professor, and the current Department Chair, of economics at Boston University.

Eaton graduated from Harvard University in 1972 and received his Ph.D. in economics from Yale University in 1976. He previously served on the faculties of Princeton University, Yale University, and the University of Virginia, where he was Merrill H. Bankard Professor of Economics. He has also held visiting positions at the Australian National

University, Tel Aviv University, and at the Universities of Geneva, Minnesota, Indonesia, Osaka, and Aix-Marseille. During 1987-8 he was a National Fellow at Stanford's Hoover Institution.

Eaton's research centers on international economics. Aside from his work on technology in the world economy, he has written on sovereign debt, trade policy, and international sanctions, among other topics.

His wife, Carolyn, is the principal of the Boston Ballet's Newton Studio. They live in Weston, Massachusetts, with two daughters, Tamara (14) and Hannah (11); two cats, Lucy and Mayflower; and a dog, Benny.

NBER Profile: *Kenneth A. Froot*

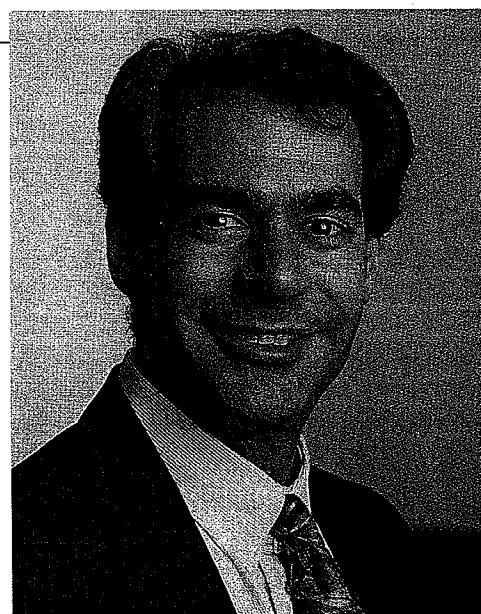
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Froot received his B.A. in economics from Stanford University and his Ph.D. in economics from the University of California at Berkeley. From 1986 to 1992, he taught at MIT's Sloan School of Management.

He was Visiting Assistant Professor at Harvard Business School in 1989-90 and again in 1991-3 before receiving his current chair in 1995.

Froot has served as a consultant to the Prime Minister of the Federal Republic of Slovenia, Yugoslavia, the International Finance Division of the Federal Reserve Board of Governors, and the World Bank. He is currently editor of the *Journal of International Financial Management and Accounting*.

Froot lives in Sudbury, Massachusetts, with his wife, Kathryn Herold, and his sons Mark and David. He enjoys playing squash, traveling, and "large exchange rate changes."



Conferences

Fourteenth Annual Conference on Macroeconomics

The NBER held its Fourteenth Annual Conference on Macroeconomics in Cambridge on March 26 and 27. The conference was organized by Ben S. Bernanke, NBER and Princeton University, and Julio J. Rotemberg, NBER and Harvard University. The following papers were presented and discussed:

Roberto Chang, Federal Reserve Bank of Atlanta, and **Andrés Velasco**, NBER and New York University, "Illiquidity and Crises in Emerging Markets: Theory and Policy"

Discussants: Abhijit Banerjee, MIT, and Nouriel Roubini, President's Council of Economic Advisers

Michael L. Mussa and **Miguel Savastano**, International Monetary

Fund, "The IMF Approach to Economic Stabilization"

Discussants: Martin S. Eichenbaum, NBER and Northwestern University, and Sebastian Edwards, NBER and University of California, Los Angeles

Takeo Hoshi, University of California, San Diego, and **Anil K. Kashyap**, NBER and University of Chicago, "The Japanese Banking Crisis: Where Did It Come from and Where Will It End?"

Discussants: Michael Hutchison, University of California, Santa Cruz, and Mark Gertler, NBER and New York University

Jonathan C. Heaton and **Deborah J. Lucas**, NBER and Northwestern University, "Stock Prices and Fundamentals"

Discussants: Annette Vissing-Jorgenson, University of Chicago, and John Y. Campbell, NBER and Harvard University

Fernando Alvarez, University of Chicago, and **Marcelo Veracierto**, Federal Reserve Bank of Chicago, "Equilibrium Search and Labor Market Policies"

Discussants: Giuseppe Moscarini, Yale University, and Alan B. Krueger, NBER and Princeton University

Jonathan A. Parker, University of Wisconsin, "Spendthrift in America" Discussants: David Laibson, NBER and Harvard University, and Anna Maria Lusardi, University of Chicago

Chang and **Velasco** focus on one factor behind financial and currency distress: international illiquidity, the situation in which a country's consolidated financial system has potential short-term obligations in foreign currency that exceed the amount of foreign currency it can access on short notice. Stressing the role of domestic banks, the authors argue that international illiquidity is what the very diverse recent crises in emerging markets have in common. Using a bank in a small, open economy with limited access to international capital as a model, the authors then study the role of capital inflows and the maturity of external debt, how real exchange rate depreciation can transmit and magnify the effects of bank illiquidity, options for financial regulation, the role of debt and deficits, and the implications of adopting different exchange rates.

Mussa and **Savastano** analyze the quantitative approach of the International Monetary Fund (IMF) to economic stabilization. They first deal with misconceptions about how the IMF operates, clarifying the process behind a typical IMF-supported program. Then they revisit some of the issues related to the economic substance of IMF programs, pointing out that, at the core, all such programs are concerned with the member country's actions in three areas: securing sustainable external finance; implementing demand-restraining measures, particularly in the initial stages of a program, that are consistent with available financing; and proceeding with structural reforms to promote growth and adjustment in the medium and longer term. The authors conclude by emphasizing that the intellectual doctrine associated with IMF financial programming

is primarily a recognition of essential accounting identities, coupled with basic behavioral relationships and forecasts of key economics aggregates, both of which are subject to revision in light of experience.

Hoshi and **Kashyap** argue that the deregulation leading up to the "Big Bang" played a major role in current Japanese banking problems. This deregulation allowed large corporations to switch quickly from depending on banks to relying on capital markets for financing. The authors show that large Japanese borrowers, particularly manufacturing firms, have now become about as independent of banks as comparable U.S. firms. Yet Japanese banks were constrained: even after deregulation, they were not given authorization to move out of traditional activities into new lines of business. Collectively, these developments meant that the

banks retained assets and had to search for new borrowers. Their new lending flowed primarily to small businesses and became much more tied to property than was previously the case. The authors conclude that the current problem of bad loans is quite large in Japan (about 7 percent of gross domestic product). Banks will have to fight to retain deposits, but, more importantly, even more firms will migrate to capital market financing. Using U.S. borrowing patterns as a guide, the authors show that this impending shift implies a massive contraction in the size of the Japanese banking sector.

Heaton and **Lucas** discuss the relationship between stock prices and fundamentals, emphasizing three broad categories of explanations for the recent price rise: changes in corporate earnings growth, preferences, or stock market participation patterns. Using 1989–95 data from the Survey of Consumer Finances to doc-

ument changes in stock holding patterns and reported attitudes toward risk, the authors look closely at how participation patterns have changed and how they affect required returns.

Alvarez and **Veracierto** explore the effects of different market policies on unemployment and labor force participation rates. They use a version of the Lucas-Prescott islands economy, with undirected search and endogenous labor force participation. They then introduce and analyze the effects of minimum wages, the degree of unionization, firing taxes, and unemployment insurance.

Over the past 20 years, the U.S. personal savings rate has fallen by 8 percentage points, and the ratio of consumption to GDP has risen by 6 percentage points. **Parker** reviews the important contemporaneous changes to the U.S. economy, asks how a canonical model might account for these shifts, and evaluates the state of theories and evidence

from household data. His analysis of a panel dataset of consumption, income, and wealth from two large surveys of U.S. households reveals that the changing age distribution plays no role in the consumption boom. Instead, younger cohorts consume a larger share of their income than older cohorts did at the same age. Increases in the wealth-to-income ratio can explain about one third of the boom, the author finds, and consumption growth and real interest rates over this period are highly correlated.

These papers and their discussions will be published by the MIT Press in the *NBER Macroeconomics Annual 1999*, Volume 14. Its availability will be announced in a future issue of the *NBER Reporter*.

The conference versions of the papers can be found at www.nber.org/books/macroannual/index.html.

Currency Crises

On April 22 and May 6, the NBER held two meetings in which currency crises in Thailand and Mexico, respectively, were discussed. These meetings were part of a major NBER project on economic and financial crises in emerging market economies. The project brings together NBER researchers, U.S. government officials, representatives of the countries themselves, and officials from international agencies (including the World Bank and the International Monetary Fund—the IMF) to discuss why the crises occurred in these countries,

what happened after the crises, and how the different economies have responded to IMF programs. These are background research meetings aimed at improving the understanding of the NBER researchers as they embark on specific research studies as part of the project.

Speakers at the meeting on Thailand included Takatoshi Ito, NBER and Hitotsubashi University, and Veerathai Santiprobhob, Ministry of Finance, Thailand.

Speakers at the meeting on Mexico included NBER researchers Aaron

Tornell of Harvard University, Sebastian Edwards of University of California at Los Angeles, Anne Krueger of Stanford University, and Peter Garber of Brown University. Also participating in the day's panel discussions were Andrew Berg of the IMF, Patricia Armendariz of Mexico's National Banking Commission, Ricardo Hausmann of the InterAmerican Development Bank, and others representing government, agencies, and commerce.

Organizational Change and Performance Improvement

As part of a major project on Industrial Technology and Production sponsored by the Sloan Foundation, the NBER organized a research project on "Organizational Change and Performance Improvement" directed by Susan Helper of Case Western Reserve University. The results of this project were presented at a conference in Santa Rosa, California, on April 22-24. The papers discussed were:

Donald Siegel, David Waldman, and **Jonathan Silberman**, Arizona State University, and **Albert Link**, University of North Carolina, Greensboro, "Assessing the Impact of Organizational Practices on the Performance of University Technology Transfer Offices: Quantitative and Qualitative Evidence"

Discussant: Adam B. Jaffe, NBER and Brandeis University

Ashish Arora and **Jai Asundi**, Carnegie-Mellon University, "Quality Certification and the Economics of Contact Software Development: A Study of the Indian Software Service Companies"

Discussant: David Cole, University of California, Berkeley

Jacques Mairesse, NBER and INSEE, and **Nathalie Greenan**, Centre d'Etude de l'Emploi, "Organizational Change and Productivity in French Manufacturing: What Do We Learn from Firm Representatives and Their Employees?"

Discussant: David Autor, Harvard University

V. G. Narayanan and **Ratna G. Sarkar**, Harvard University, "ABC at Insteel Industries"

Discussant: Edward P. Lazear, NBER and Stanford University

Michael R. Darby and **Lynne G. Zucker**, NBER and University of California, Los Angeles, "Local Academic Science Driving Organizational Change: The Adoption of Biotechnology by Japanese Firms"

Discussant: George P. Baker, NBER and Harvard University

Iain M. Cockburn, NBER and University of British Columbia, and **Rebecca Henderson** and **Scott Stern**, NBER and MIT, "The

Diffusion of 'Science-Driven' Drug Discovery in Pharmaceutical Research"

Discussant: Kenneth L. Sokoloff, NBER and University of California, Los Angeles

Richard N. Rosett, Rochester Institute of Technology, and **Joshua G. Rosett**, Tulane University, "Characteristics of TQM: Evidence from the RIT/USA Today Quality Cup Competition"

Discussant: David I. Levine, University of California, Berkeley

Susan Helper, "Complementarity and Cost Reduction: Evidence from the Auto Supply Industry" (NBER Working Paper No. 6033)

Discussant: Michael Piore, MIT

Kathryn L. Shaw, NBER and Carnegie-Mellon University, **Jon Gant**, Indiana University, and **Casey Ichniowski**, NBER and Columbia University, "The Evolution toward High-Involvement Organizations: Distinguishing Differences in Workers' Networks"

Discussant: John Roberts, Stanford University

Siegel, Waldman, Silberman, and **Link** ask how successful are licensing agreements between university technology transfer offices (UTTOs) and firms working to commercialize university-based technologies. Focusing on 113 American universities, they estimate that licensing production has constant returns to scale. Environmental and institutional factors explain some of the variation in relative productivity across universities, but some may be the result of organizational practices. Because there are no surveys of organizational practices in university/industry technology transfer (UITT),

the authors rely on an inductive, qualitative approach. Based on structured interviews of 55 UITT stakeholders at five universities, they conclude that university administrators need to consider: reward systems for UITT; informational and cultural barriers between universities and firms; and staffing practices in the UTTO.

Competitive pressures have induced many Indian software firms to apply for and receive quality certifications like the ISO-9000 and SEI-CMM. Despite the growing popularity of these certifications among Indian software developers, there is

little systematic evidence of their effect on organizational performance. Using data from 90 Indian software firms, **Arora** and **Asundi** articulate the ways in which quality certification can affect firm profits. They conclude that quality certification is primarily a signal and helps to attract business from overseas clients. Quality certification does not enhance the ability to secure higher prices, and has only a modest impact on the ability to increase software developed offshore.

Mairesse and **Greenan** first ask what variables best describe organizational change and performance in

general. They then use a large set of such variables to analyze organizational change in French manufacturing. The authors stress the vocabulary differences in the managerial terms used in France and the United States to describe organizational change. They then explain the origins of the COI survey, a French statistical study. Citing statistics on organizational change in French manufacturing and the results of surveys of firm representatives and workers, they show that organizational change seems to be correlated both with increased communication and with increased constraints on the shop floor, these two dimensions being independent from each other.

Narayanan and **Sarkar** analyze data from a single company, Insteel, to determine whether activity-based costing (ABC) provides new information to managers, and whether activity-based management (ABM) significantly affects product and customer-related decisions. From interviews with this firm's top managers, the authors find that Insteel's product prices reflect the cost of raw materials and freight costs, but do not fully account for conversion costs (labor and production overhead costs). Hence, there is little support for the hypothesis that product prices reflect all costs, even when a company does not have ABC information. After the ABC analysis was done at Insteel, the firm was more inclined to discontinue products found by the study to be unprofitable compared with products found to be profitable. The changes to the portfolio of customers served were similar, but not as striking as the decisions about product mix. This is consistent with senior managers' intuition that product-level decisions can be made faster than customer-level decisions.

In the United States, the local academic science base largely determines where and when biotechnology is adopted by existing firms or, much more frequently, exploited by new firms. In Japan, the new domi-

nant technology is almost exclusively introduced through organizational change in existing firms. **Darby** and **Zucker** show that for the worldwide pharmaceutical business (biotechnology's most important application), the performance enhancement associated with this organizational change is necessary for firms to remain competitive. Japan's sharply higher organizational change/new entry ratio, as compared with that of the United States, during the biotech revolution is a product of: Japan's relatively compact geography; institutional differences between Japanese higher education and research-finding systems; the venture-capital and initial public offering (IPO) markets; cultural characteristics and incentive systems that affect scientists' entrepreneurialism; and tort-liability exposure. Both local science base and pre-existing economic activity explain where and when Japanese firms adopt biotechnology, with the science base playing a somewhat larger role. While similar processes are at work in the two countries, stars in Japan induce entry or transformation of significantly fewer firms than do stars in the United States; pre-existing economic activity plays a greater role in Japan.

In the late 1970s, it became clear that new science-intensive techniques such as "rational drug design" had great potential as methods for identifying drug candidates. **Cockburn**, **Henderson**, and **Stern** document significant differences across pharmaceutical firms in the speed with which they adopted organizational practices associated with this technology, particularly the intensity of incentives provided to their scientists to participate in the community of "open science" through publishing in scientific journals. Differences in the speed and extent of adoption of these practices appear to be driven by variation across firms in their costs and benefits of doing so, which in turn are a function of heterogeneity in firms' technology/market focus. Firms heavily invested in cardiovas-

cular therapies, where the new techniques had (at least ex post) a higher payoff, adopted science-driven drug discovery more quickly.

Rosett and **Rosett** extend the empirical analysis of total quality management (TQM) used by **Wruck** and **Jensen** (1994) to 15 firms. They describe how TQM can be used, including: implementation issues; incentives and disincentives for several levels of employees within the corporate hierarchy; costs and benefits of the program; some measures of outcomes; and factors related to the success or failure of programs. They then outline the simple model of TQM that guided their interviews, use the model to interpret their interview results, and cite from the interviews remarks that bear on leadership, environment, rhetoric, monitoring, training, and evaluation and compensation.

Using survey data and interviews, **Helper** explores the determinants of average-cost reduction for 207 automotive suppliers in the United States and Canada between 1988 and 1992. In particular, she considers the efficacy of methods for mobilizing latent knowledge from decentralized sources—such as workers and customers—or "voice." Plants with voice practices did better than other plants, but only if they had a highly effective suggestion program for workers, or if they adopted at least two voice practices: for example, suggestions from workers plus long-term, information-rich relations with customers; or suggestions from workers plus efficiency wages for workers. Despite evidence that certain practices may be complementary in their performance, **Helper** finds little complementarity in adoption (for instance, firms with suggestion systems were slightly less likely to have "voice" with their customers). She attributes this outcome to incomplete diffusion of the organizational innovation of voice.

Shaw, **Gant**, and **Ichniowski** investigate differences in on-the-job activities of workers in innovative

versus traditional organizations, and theorize that moving toward a high-performance system requires pronounced change. They suggest that workers who are doing more problem solving on the job must have stronger ties to other workers than those who don't "problem solve"—they must have extensive networks of relationships that they rely on. To test this hypothesis, the authors go onsite to gather employee-level data

from seven steel mills on the communications links between employees. They show that a move to a high-performance workplace requires a reconfiguration of the entire system of interpersonal interactions in the workplace. In high-performance mills, most workers are actively involved in communication with their peers and managers. In contrast, in traditional mills, only a small subset of workers are actively involved in

such communications. Thus, to evolve from a traditional to a high-performance workplace, the firm must change the attitudes, knowledge base, and work activities of all employees.

These papers and their discussions will appear as an NBER conference volume published by the University of Chicago Press. The volume's availability will be announced in a future issue of the *NBER Reporter*.

The Impact of Recent State and Federal Reforms in Public Assistance and Social Insurance Programs

An NBER-Universities Research Conference on the Impact of Recent State and Federal Reforms in Public Assistance and Social Insurance Programs took place in Cambridge on May 14 and 15. Organizers Hilary W. Hoynes, NBER and University of California, Berkeley, and Jonathan S. Skinner, NBER and Dartmouth College, chose the following papers for discussion:

Katherine Baicker, Dartmouth College, "Government Decision-making and the Incidence of Federal Mandates"

Discussant: Howard Chernick, Hunter College

Michael Baker, University of California, Davis, **A. Abigail Payne**, University of Illinois, and **Michael Smart**, University of Toronto, "An Empirical Study of Matching Grants: The 'cap of CAP'"

Discussant: Arik Levinson, NBER and University of Wisconsin

Julie Berry Cullen, NBER and University of Michigan, and **David Figlio**, University of Florida, "Local Gaming of State School Finance Policies: How Effective Are Intergovernmental Incentives?"

Discussant: Elizabeth Powers, University of Illinois

Darren Lubotsky, University of California, Berkeley, "The Labor Market Effects of Welfare Reform"

Discussant: Lawrence F. Katz, NBER and Harvard University

Michael Camasso, **Carol Harvey**, and **Mark Killingsworth**, Rutgers University, and **Radha Jagannathan**, Princeton University, "New Jersey's Family Cap and Family Size Decisions: Some Findings from a Five-Year Evaluation"

Discussant: Stacy Dickert-Conlin, Syracuse University

Bruce D. Meyer, NBER and Northwestern University, "Do the Poor Move to Receive Higher Welfare Benefits?"

Discussant: Phillip B. Levine, NBER and Wellesley College

S. Rao Aiyagari, **Jeremy Greenwood**, and **Nezih Guner**, University of Rochester, "On the State of the Union"

No Discussant

Steven Raphael and **Lorien Rice**, University of California, San Diego, "Car Ownership, Employment, and Earnings"

Discussant: Susanna Loeb, University of California, Davis

Jane Millar and **Marianne Page**, University of California, Davis, and **Joanne Spetz**, Public Policy Institute of California, "Does the Minimum Wage Affect Caseloads?"

Discussant: David T. Ellwood, NBER and Harvard University

John Ham and **Lara Shore-Sheppard**, University of Pittsburgh, "The Impact of Public Health Insurance on Labor Market Transitions"

Discussant: Wei-Yin Hu, University of California, Los Angeles

Using several sources of exogenous increases in public medical spending, **Baicker** estimates that the

entire state portion of the burden of federally mandated spending is borne by decreases in other spending on

public welfare programs. These reductions are attributable in part to the substitutability of programs in the

voters' minds, but also in large part to the "stickiness" of government spending by budget category. States with greater racial differences between benefit recipients and voters, and states with less generous neighbors, reduce other spending on public welfare by even more, thus alleviating the burden that medical expansions impose on their taxpayers. There is no evidence that the existence of self-imposed tax and expenditure limits affects state reactions to these mandated shocks, though.

In federal systems, social expenditure often is funded by matching grants. Estimates of the effect of different matching rates on expenditures by subnational governments vary widely because of the inherent difficulties in identifying price and income effects of federal grants given the structure of the funding mechanisms in most countries. **Baker, Payne, and Smart** examine a recent reform in Canada, in which federal grants for welfare expenditures were "capped" (converted from an open-ended to a closed-ended matching grant); the cap applied to only three of ten provincial governments. They find that the affected provinces responded to the reform by reducing the growth rate of expenditures over the medium term: it was 8 to 9 percentage points lower than predicted in the absence of the cap.

Cullen and Figlio examine the efficacy of intergovernmental incentives within the context of special education finance. They first test the extent to which stronger fiscal incentives to classify students as "special needs" lead to higher rates of student disability. To measure this labeling response, the authors combine school and district-level data from the Schools and Staffing Surveys for 1987-8, 1990-1, and 1993-4, providing detailed information on state school finance formulas in each period. They then use the same data to

gauge the degree to which more aggressive labeling is accompanied by changes in the allocation of resources to special education. As fiscal incentives to classify marginal students increase, the relative quality of learning-disabled classes appears to decline in school districts in states with binding tax limits, whereas it improves for districts in other states. This may be evidence that constrained districts behave strategically by reassigning students to special education for fiscal gain.

The recent reform of the federal welfare system is meant to encourage recipients to leave welfare and enter the workforce. **Lubotsky** evaluates how labor markets in Michigan were affected when the General Assistance Program in that state was eliminated in 1991. General Assistance was a large-scale, state-administered program that provided benefits to people who fell through the cracks in federal antipoverty programs. In all, about 80,000 to 100,000 able-bodied adults lost benefits. Increased labor force participation among these people resulted in a decline in weekly hours among high school dropouts of 1.2 to 2.4 percent. There is little evidence of declines in hourly earnings, though, except in the Detroit area, where wages fell by about 5 percent.

The introduction of family cap welfare policies by a number of states (New Jersey was the first) has spurred new interest in the relationship between birth decisions and welfare benefits, and provides new opportunities for modeling the fertility responses of women on welfare to specific changes in benefits levels. A recently completed five-year evaluation of New Jersey's Family Development Program provides new evidence on the impact of well-defined incremental changes in benefit levels on births, abortions, and related behavior among women on welfare. **Camasso, Harvey, Kill-**

ingsworth, and Jagannathan analyze data on a randomly selected group from the several thousand N.J. Aid to Families with Dependent Children (AFDC) cases and from the entire welfare caseload over a six-year period that encompassed the implementation of New Jersey's Family Development Program. They discuss the data's implications for public policy after analyzing it for births and abortions and providing an overview of birth and abortion trends from 1991 to 1996.

Meyer examines the extent of welfare-induced migration using 1980 and 1990 U.S. Census data. He begins by discussing a number of methodological issues that suggest biases in past approaches used to study welfare migration. Using several different new methods, he then provides estimates that avoid many of the problems of past work. The estimates imply that there is welfare-induced migration, but it is modest in magnitude.

Aiyagari, Greenwood, and Guner construct an overlapping generations model of marriage and divorce to analyze family structure and intergenerational mobility. A simulated version of their theoretical prototype can generate an equilibrium, with a significant number of female-headed families and a high degree of persistence in income across generations. To illustrate the model's mechanics, the authors investigate the effects of two antipoverty policies: child support and welfare.

Raphael and Rice ask whether car ownership causes positive employment outcomes. They match state-level data on average car insurance premiums and average per-gallon gas taxes to a nationally representative sample containing information on car ownership and employment outcomes. Controlling for observable demographic and human capital variables, they find large differences in employment rates, weekly hours worked, and hourly earnings be-

tween those with and without cars. Car ownership has negative effects on wages, which is consistent with the hypothesis that employers located in states with high auto maintenance costs must pay compensating differentials to their employees. Differentiating by skill groupings, the authors find positive and significant employment and hours effect for all groups. Low-skilled workers experience larger car-employment effects. The effects on hours are comparable across skill categories. Again, the negative effects of car ownership on wages are insignificant for low- and medium-skilled workers and significant for high-skilled workers.

Although minimum wages are advocated as a policy that will help the poor, few studies have examined their effect on poor families. **Millar, Page, and Spetz** use variation in mini-

mum wages across states and over time to estimate the impact of minimum wage legislation on AFDC caseloads, thus directly assessing whether minimum wages benefit a group they are intended to help. The authors find that the elasticity of the welfare caseload with respect to the minimum wage is 0.35. This suggests that minimum wages are not an efficient policy for facilitating the transition from welfare to work.

An often-cited difficulty with moving low-income families out of welfare and into the labor force is the lack of health insurance in many low-wage jobs. The recent expansions in Medicaid to cover low-income children and pregnant women who are not eligible for cash benefits may help alleviate the problem by allowing disadvantaged household heads to accept jobs that do not provide

health insurance. **Ham and Shore-Sheppard** investigate whether expansion of public health insurance to cover children of working parents increases transitions from welfare to work and reduces transitions from work to welfare. They find some evidence that expanded Medicaid eligibility for children leads single mothers to exit welfare more quickly; however, this effect appears to be concentrated among long-term recipients (as proxied by recipients who begin the sample on welfare). Women with very young children are less likely to exit welfare and begin work than are women with older children; this indicates that expansions in health insurance for such women may not be enough to ease their welfare-to-work transitions.



Bureau News

Berndt is Acting Director of Productivity Program

NBER Research Associate Ernst R. Berndt is the new acting director of the NBER's Program on Productivity. Professor Zvi Griliches, NBER and Harvard University, who has directed

the program since its creation in 1978, is on leave from his position as Program Director. The program encourages economists to study issues relating to the productivity of U.S.

firms, including the determinants of investment, R and D, labor relations, and entrepreneurship. Professor Berndt is a member of the faculty of the MIT's Sloan School of Management.

International Finance and Macroeconomics

The NBER's Program on International Finance and Macroeconomics held its spring meeting in Cambridge on March 19. Charles M. Engel, NBER and University of Washington, and acting Program Director Andrew K. Rose, NBER and University of California, Berkeley, organized this program.

Michael B. Devereux, University of British Columbia, and **Charles M. Engel**, "Fixed versus Floating Exchange Rates: How Price Setting Affects the Optimal Choice of Exchange Rate Regime" (NBER Working Paper No. 6867)

Discussants: Alan Stockman, NBER and University of Rochester, and Cedric Tille, Federal Reserve Bank of New York

Allan Drazen, NBER and University of Maryland, "Interest Rates' Defense against Speculative Attack under Asymmetric Information"

Discussants: Robert Flood, International Monetary Fund, and Carlos A. Veigh, NBER and University of California, Los Angeles

Robert J. Hodrick, NBER and Columbia University, and **David Tat-Chee Ng** and **Paul Sengmueller**, Columbia University, "An International Dynamic Asset Pricing Model" (NBER Working Paper No. 7157)

Discussants: John Y. Campbell, NBER and MIT, and Kenneth A. Froot, NBER and Harvard University

V. V. Chari, University of Minnesota, and **Patrick Kehoe**, Federal Reserve Bank of Minneapolis, "Hot Money" (NBER Working Paper No. 6007)

Discussants: Jonathan Eaton, NBER and Boston University, and Enrique G. Mendoza, NBER and Duke University

Aart Kraay, World Bank, and **Jaume Ventura**, MIT, "Comparative Advantage and the Cross-section of Business Cycles"

Discussants: Fabrizio Perri, New York University, and Marianne Baxter, NBER and University of Virginia

Devereux and **Engel** investigate the welfare properties of fixed and floating exchange rate regimes. The optimal exchange rate regime may depend on whether prices are set in the currency of producers or the currency of consumers. Under floating exchange rates, the variance of home consumption is not influenced by foreign monetary variance when prices are set in consumers' currency. If prices are set in producers' currencies, or under fixed exchange rates, then there is transmission of foreign disturbances. The authors show that the exchange rate regime affects not just the variance of consumption and output but also their average levels. When prices are set in producers' currency, as in the traditional framework, there is a trade-off between floating and fixed exchange rates. Under floating rates, exchange rate adjustment allows for a lower variance of consumption. But exchange rate volatility itself leads to a lower average level of consumption. When prices are set in consumers' currency,

floating exchange rates always dominate fixed exchange rates.

Characteristics of speculative attacks, such as the role of asymmetric information and especially the use of high interest rates to defend a currency, are largely absent from existing models. **Drazen** presents a model of defending against speculative attacks by raising interest rates. Governments are optimizing and speculators are solving a dynamic signal extraction problem that is subject to imperfect information about the government's objectives and the evolution of fundamentals. Such a model may be useful in understanding the dynamics of speculative attacks.

Hodrick, Ng, and Sengmueller extend Campbell's (1996) asset-pricing model to study international equity returns in the G7 countries. In their model, expected returns depend on two sources of risk: the covariance of returns with the return on the world market portfolio; and the covariance of returns with the change in expected future discounted returns

on the market portfolio. To generate expected future returns, the authors consider the predictability of the world market portfolio, comparing it to the recent experience of the U.S. stock market. While the world market return may be less predictable than the U.S. return, the risk associated with changes in expected returns does appear to be priced by the market. The authors also compare the predictions of their dynamic model to those of the static Capital Asset Pricing Model. While both models do a good job of explaining the average returns on the G7 market portfolios, both fail to predict the high average returns on portfolios of high book-to-market stocks across countries.

Conventional wisdom says that capital flows between developed and developing countries are more volatile than can be justified by fundamentals. **Chari** and **Kehoe** construct a simple model in which frictions in international financial markets, combined with standard debt-default

problems, lead to volatile capital flows. These flows act as "a test of fire" for borrowing countries. If a country survives this test, its reputation is enhanced, and future capital flows become less volatile. Failing the test is associated with a loss of reputation and a decline in the amount of capital flows.

Business cycles are less volatile, and are more synchronized with the world cycle, in rich countries than in poor ones. **Kraay** and **Ventura** de-

velop two explanations for these conditions, both of which proceed from the observation that the law of comparative advantage causes rich and poor countries to specialize in the production of different commodities. Rich countries specialize in "high-tech" goods produced by skilled workers, whereas poor countries specialize in "low-tech" goods produced by unskilled workers. Cross-country differences in business cycles then arise as a result of asymmetries

among high-tech and low-tech industries. The authors focus on two such asymmetries. The first is based on the idea that cross-country differences in production costs are more prevalent in high-tech industries, sheltering producers from foreign competition, thus making them large suppliers in the markets for their products. The second asymmetry is based on the idea that production costs in low-tech industries might be more sensitive to the shocks that drive business cycles.

Public Economics

Members and guests of the NBER's Program on Public Economics met in Cambridge on April 8 and 9. Program Director James M. Poterba, NBER and MIT, organized the meeting and this program.

Dennis W. Epple, NBER and Carnegie-Mellon University, and **Holger Sieg**, Duke University, "The Tiebout Hypothesis and Majority Rule: An Empirical Analysis" (NBER Working Paper No. 6967)

Discussant: Caroline Minter Hoxby, NBER and Harvard University

Don Fullerton, NBER and University of Texas, and **Sarah West**, Syracuse University, "Can Taxes on Cars and on Gasoline Mimic an Unavailable Tax on Emissions?" (NBER Working Paper No. 7059)

Epple and **Sieg** analyze majority rule and Tiebout sorting within a system of local jurisdictions. In particular, they investigate whether observed levels of public expenditures satisfy the necessary conditions implied by majority rule in a general equilibrium model of residential

Discussant: Arik Levinson, NBER and University of Wisconsin

Martin S. Feldstein, NBER and Harvard University, and **Dan Altman**, Harvard University, "Unemployment Insurance Saving Accounts" (NBER Working Paper No. 6860)

Discussant: Matthew Eichner, Department of the Treasury

R. Glenn Hubbard, NBER and Columbia University, and **Kevin Hassett**, Federal Reserve System, "Organizational Form in the Hospital Industry"

Discussant: David M. Cutler, NBER and Harvard University

Douglas Shackelford, NBER and University of North Carolina, and **Mark Lang**, University of North Carolina, "Capitalization of Capital Gain Taxes: Evidence from Stock

Prices" (NBER Working Paper No. 6885)

Discussant: Andrew Samwick, NBER and Dartmouth College

Lawrence H. Goulder, NBER and Stanford University, and **Roberton C. Williams III**,

Stanford University, "The Usual Excess Burden Approximation Usually Doesn't Come Close" (NBER Working Paper No. 7034)

Discussant: Roger H. Gordon, NBER and University of Michigan

Stephen Coate, NBER and Cornell University, and **Timothy Besley**, London School of Economics, "Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Analysis" (NBER Working Paper No. 7084)

Discussant: Thomas J. Nechyba, NBER and Stanford University

choice. They control for heterogeneity among households, various characteristics of communities, the potential endogeneity of prices and expenditures, and the self-selection of households into communities of their choice. Finally, they estimate the structural parameters of the model

using data from the metropolitan Boston area, and their empirical findings support this approach.

Despite technological advances, an individual car's emissions still cannot be measured reliably enough to be taxed. **Fullerton** and **West** therefore solve for combinations of second-

best uniform taxes on gasoline, engine size, and vehicle age. They use data from the 1994 Consumer Expenditure Survey and from the California Air Resources Board and combine information on the expenditures of 1,353 individuals with other information on vehicle characteristics, including engine size, vintage, fuel efficiency, and emissions per mile. Starting from a zero-tax scenario, the authors find that 69 percent of the welfare improvement from an ideal Pigovian tax can be gained by the three-part instrument involving a tax on gas, a tax on size, and a subsidy to "newness." A gas tax alone reaches 60 percent of the gains from the Pigovian tax. These results are robust to variation in the elasticity of substitution among goods.

Feldstein and Altman examine a system of Unemployment Insurance Saving Accounts (UISAs) as an alternative to the traditional unemployment insurance system. Individuals are required to save up to 4 percent of wages in special accounts and to draw unemployment compensation from these accounts instead of taking state unemployment insurance benefits. If the accounts are exhausted, the government lends money to the account. Accounts that have positive balances at retirement or death are converted into retirement income or bequeathed. Negative account balances are forgiven at retirement age. The authors use the Panel Study of Income Dynamics to simulate this plan and show that almost all individuals have positive UISA balances and remain sensitive to the cost of unemployment compensation.

Hubbard and Hassett study the choice of not-for-profit versus for-profit

status for firms in the U.S. hospital industry. They find that among not-for-profit hospitals, government hospitals have higher relative input use, serve less-well-off markets, and have more bed days represented by Medicaid patients. Consistent with a role for noncontractible quality, not-for-profit hospitals with a relatively high share of revenues devoted to wages are less likely to convert to for-profit status. For-profits tend to acquire not-for-profits in markets in which households have relatively low levels of educational attainment or income. Not-for-profits are also more likely to shed not-for-profit status when there is no other government or not-for-profit hospital in the same market.

Shackelford and Lang assess the equity capitalization of capital gains taxes by evaluating stock price reactions around a likely change in expected capital gains tax rates: the May 1997 budget accord that led to a reduction in the long-term capital gains tax rate from 28 percent to 20 percent. Because dividends reduce current stock prices and future liquidation values, reductions in the expected capital gains tax rate should be particularly value-enhancing to firms that do not pay dividends or pay low dividends. Consistent with investors discounting share prices for expected capital gains taxes, the authors find that returns decrease as dividend yields increase. During the week of the budget accord, the mean return was 12 percent for non-dividend-paying stocks and 6 percent for dividend-paying stocks. No similar price movements were detected in the weeks preceding or following the accord. Among dividend-paying firms,

stock returns are negatively correlated with dividend yields.

Goulder and Williams show that the simple "excess-burden triangle" formula performs poorly when used to assess the excess burden from taxes on intermediate inputs or consumer goods. It ignores general equilibrium "tax interactions"—the ways a new commodity tax interacts with pre-existing taxes in other markets and thereby augments distortions in these markets. The significance of a tax-interaction with another market is proportional to the amount of revenue raised in the other market; this implies that in the United States, where factor taxes yield the bulk of government revenue, interactions with factor markets are most important. The authors also show that the distortion generated in factor markets is generally more important than the distortion in the market facing the new commodity tax. Finally, they offer a practical alternative to the simple excess-burden formula. Their alternative approximation formula yields estimates that are consistently within 5 percent of the actual excess burden.

Coate and Besley take a fresh look at the trade-off between centralized and decentralized provision of local public goods. Their political economy analysis assumes that under decentralization, public goods are selected by locally elected representatives, while under a centralized system, policy choices are determined by a legislature consisting of elected representatives from each district. They then study the role of taste heterogeneity, spillovers, and legislative behavior in determining the case for centralization.

Corporate Finance

The NBER's Program on Corporate Finance met in Cambridge on April 9. Program Director Raghuram Rajan, NBER and University of Chicago, organized the meeting. The program was:

Patrick Bolton and **Howard Rosenthal**, Princeton University, "Political Intervention in Debt Contracts: Moratoria and Bailouts" Discussant: Jesus Santos, University of Chicago
Jeremy Berkowitz, Federal Reserve System, and **Michelle J.**

White, University of Michigan, "Bankruptcy and Small Firms' Access to Credit"

Discussant: Mitchell Petersen, Northwestern University

Katrina Ellis, **Roni Michaely**, and **Maureen O'Hara**, Cornell University, "When the Underwriter Is the Market Maker: An Examination of Trading in the IPO Aftermarket"

Discussant: Manju Puri, Stanford University

George P. Baker and **Brian J. Hall**, NBER and Harvard University, "CEO Incentives and Firm Size" (NBER Working Paper No. 6868)

Discussant: Robert Gertner, NBER and University of Chicago

Gustavo Grullon, Rice University, **Roni Michealy**, and **Bhaskaran Swaminathan**, Cornell University, "Dividend Changes as a Sign of Firm Maturity"

Discussant: Robert McDonald, Northwestern University

Bolton and **Rosenthal** develop a simple, dynamic general equilibrium model of an agricultural economy in which poor farmers borrow from rich farmers. The authors allow for both idiosyncratic and aggregate shocks—so there may be default ex post. They consider equilibrium in the economy with and without political intervention, either in the form of a bailout or a moratorium. They then compare their results to historical evidence from the Panic of 1819 in the United States. With no aggregate uncertainty, political intervention always improves ex post efficiency and may also improve ex ante efficiency. Anticipated bailouts, but not moratoriums, will always occur in equilibrium. The threat of moratoriums also enhances efficiency. With aggregate uncertainty, the differences between moratoriums and bailouts may collapse, with both occurring only in bad times and improving ex ante efficiency.

Do personal bankruptcy laws affect small firms' access to credit? When a firm is unincorporated, its debts are personal liabilities of the firm's owner, so lending to that firm is equivalent to lending to its owner. If the firm fails, the owner has an incentive to file for personal bank-

ruptcy. States are allowed to set their own bankruptcy exemption levels, and they vary widely. The higher the exemption level, the more attractive it is for debtors who live in that state to file for bankruptcy. **Berkowitz** and **White** present a model of credit markets which shows that the supply of credit falls and demand for credit rises when noncorporate firms are located in states with higher bankruptcy exemption levels. The authors also find that high homestead and personal property exemptions are associated with an increased probability of noncorporate firms being denied credit. These exemptions do not affect the probability of corporate firms being denied credit, though. There is weak evidence that both types of firms receive smaller loans when located in states that have high bankruptcy exemptions, but no evidence that interest rates are affected by bankruptcy exemptions. A prior filing for bankruptcy nearly triples the probability that noncorporate firms are denied credit, the authors find.

Part of the contract between underwriters and issuers in an initial public offering (IPO) is that the underwriter will provide liquidity in the subsequent trading of the newly

traded security. **Ellis**, **Michaely**, and **O'Hara** examine the aftermarket trading activities in the first three months after the stock has gone public of underwriters, syndicate members, and other unaffiliated market-makers. They focus in particular on whether the provision of liquidity is a cost subsidized by the fees generated from the underwriting process, or a profit center unrelated to the underwriting activities. They find that the lead underwriter is by far the most dominant marketmaker in *every* IPO in their sample, taking a substantial inventory position in the aftermarket trading. The lead underwriter also engages in stabilization activity for less successful IPOs and uses the over-allotment option to reduce his inventory risk. After including the over-allotment option, the lead underwriter has a much smaller inventory exposure. Other syndicate members play a negligible role in aftermarket trading, the authors find. While the compensation to the underwriter arises primarily from fees, aftermarket trading does generate positive profits which are positively related to the degree of underpricing.

How can we reconcile the enormous differences in pay sensitivities between executives in large and

small firms? **Baker** and **Hall** show that between firms in the smallest and largest deciles in their sample, one measure of CEO incentives—the dollar change in CEO wealth per dollar change in firm value—falls by a factor of ten, while another measure of CEO incentives—the value of CEO equity stakes—increases by roughly the same magnitude. The crucial parameter, they find, is the elasticity of CEO productivity with respect to firm size. Their results suggest that CEO marginal product rises significantly, and that CEO incentives overall are roughly constant or decline slightly, with firm size. They also show that the appropriate measure of incentives depends on the type of CEO activity being considered. For activities whose dollar impact is the

same for large and small firms, such as the purchase of a corporate jet, the dollars-on-dollars measure is appropriate, and large firms suffer significant agency problems because of their weak incentives. For activities whose percentage impact is similar across firms of different sizes, such as a corporate reorganization, the equity stake measure is better, and the incentive problem faced by large firms is not as severe.

Grullon, Michealy, and Swaminathan ask whether dividends increase as firms mature. Clearly, firms become less risky as they mature and have fewer growth opportunities available. The authors show that firms whose dividends increase experience a subsequent decline in their systematic risk, the return on their

assets, and capital expenditures. The decline in a firm's risk manifests itself not only through the reduction in the systematic risk of equity but also through improvement in the firm's debt ratings. In addition, the positive market reaction to an increase in dividends, despite the subsequent decline in earnings and investments, is related to information about the decline in systematic risk (and the cost of capital). However, investors seem to underestimate the extent of the decline in risk and to overestimate the extent to which earnings will continue to grow following dividend increases. Finally, the authors show that the magnitude of the price drift in the three years after a change in dividends is larger when the change in the firm's systematic risk is greater.

Behavioral Finance

The NBER's Group on Behavioral Finance held its spring meeting in Cambridge on April 10. Project directors Robert J. Shiller, NBER and Yale University, and Richard H. Thaler, NBER and University of Chicago, organized this program.

Nicholas Barberis, Harvard University, **Ming Huang**, Stanford University, and **Tano Santos**, University of Chicago, "Prospect Theory and Asset Prices"

Discussant: Sendhil Mullainathan, NBER and MIT

Robert J. Shiller, "Measuring Bubble Expectations and Investor

Confidence" (NBER Working Paper No. 7008)

Discussant: Werner DeBondt, University of Wisconsin

Harrison Hong, Stanford University, and **Jeremy C. Stein**, NBER and MIT, "Differences of Opinion, Rational Arbitrage, and Market Crashes"

Discussant: Olivier J. Blanchard, NBER and MIT

William N. Goetzmann, NBER and Yale University, and **Massimo Massa**, INSEAD, "Index Funds and Stock Market Growth" (NBER Working Paper No. 7033)

Discussant: Andrew Metrick, NBER and Harvard University

Jeff Wurgler and **Ekaterina Zhuravskaya**, Harvard University, "Does Arbitrage Flatten Demand Curves for Stocks?"

Discussant: Randall Morck, University of Alberta

Allen Potesman, University of Chicago, "Does Investor Misreaction to New Information Increase in the Quantity of Previous Similar Information? Evidence from the Options Market"

Discussant: Ming Huang, Stanford University

Barberis, Huang, and Santos propose a new framework for pricing assets, derived in part from the traditional consumption-based approach but also incorporating two long-standing ideas in psychology: Kahne-

man and Tversky's (1979) prospect theory and the evidence of Thaler and Johnson (1990) and others on the influence of prior outcomes on risky choice. Consistent with prospect theory, investors in the authors'

model derive utility not only from consumption levels but also from changes in the value of their asset holdings. The investors are much more sensitive to reductions than to increases in wealth. Moreover, the

investors' utility from gains and losses in wealth depends on prior investment outcomes: prior gains cushion subsequent losses, while prior losses intensify the pain of subsequent shortfalls. Studying asset prices in the presence of a representative agent with preferences of this type, the authors find that their model can explain the high mean, volatility, and predictability of stock returns. The agent's risk-aversion changes over time as a function of investment performance: this generates time-varying risk premiums, which in turn make prices much more volatile than underlying dividends. In combination with the agent's loss-aversion, the high volatility of returns generates large equity premiums.

Shiller presents evidence of changes in attitude among investors in the U.S. stock market, exploring two basic attitudes: bubble expectations and investor confidence. He produces five different time-series which indicate when investors expect a speculative bubble—an unstable situation in which an increase is anticipated only in the short run—and four different time-series which indicate when investors expect a negative speculative bubble. He also produces four different time series that indicate investor confidence. The time-series variation for these indicators is significant, and cross-correlations are generally positive. Finally, Shiller examines the behavior of the indicators and indexes through time and compares these indexes with other economic variables. One notable finding is the degree of high-frequency fluctuation, semester to semester, in the indexes.

Hong and **Stein** develop a theory of stock market crashes based on dif-

ferences of opinion among investors. Because of constraints on short sales, bearish investors do not initially participate in the market, and their information is not revealed in prices. However, if other previously bullish investors have a change of heart and bail out of the market, then the originally more-bearish group may become the marginal "support buyers." In that way, more will be learned about their signals. Accumulated hidden information thus tends to come out during market declines. This helps to explain large movements in prices unaccompanied by significant news about fundamentals; negative skewness in the distribution of market returns; and increased correlation among stocks in a falling market.

Goetzmann and **Massa** analyze the relationship between index funds and asset prices. They find a strong positive correlation between daily inflows into index funds and stock market returns. There is a strong negative correlation between fund outflows and stock market returns, except for outflows from funds with a very high initial investment requirement. These effects may be interpreted in two ways: either investor supply and demand affects market prices, or investors condition their supply and demand on intraday market fluctuations. The authors conclude that the market reacts to daily demand. However, only negative reactions appear to be attributable to past returns. Using the average market-timing newsletter recommendation over the period, the authors find that investors appear to react to "expert" advice about the market. Bullish newsletter sentiment is associated with greater inflows, although outflows are not explained well by news-

letter advice.

Because individual stocks do not have perfect substitutes, would-be arbitrageurs who aim to exploit relative mispricings face "arbitrage risk": the zero-net-investment portfolio that holds \$1 long in the mispriced stock and \$1 short in its closest substitutes is not riskless. In a simple model of the aggregate demand curve of a stock, this risk deters risk-averse arbitrageurs from flattening the curve at the efficient price. Consistent with this model, **Wurgler** and **Zhuravskaya** find that stocks that do not have close substitutes experience differentially higher price jumps upon inclusion into the S&P 500 Index. The results suggest that corrective price pressure is weakest, and other pricing anomalies are likely to be severest, among stocks without close substitutes.

A substantial body of stock price evidence has been (controversially) interpreted as supporting the claim that investors tend to underreact to single pieces or short strings of similar information and to overreact to long strings of similar information. **Poteshtman** tests for this phenomenon in the S&P 500 options market under the assumption that investors subscribe to a general stochastic variance option pricing model. His principal finding is that, under the assumed model, investor misreaction to a current change in instantaneous variance is increasing (along a scale that ascends from underreaction to overreaction) in the quantity of previous similar changes in instantaneous variance. The associated one-day deviation in at-the-money S&P 500 Index option prices is on the order of 3 percent.

Labor Studies

Members and guests of the NBER's Program on Labor Studies met in Cambridge on April 16. Program Director Richard B. Freeman and Lawrence F. Katz, both of NBER and Harvard University, chose these papers to discuss.

David Neumark, NBER and Michigan State University;

Kimberly Bayard, University of Maryland; **Judith K. Hellerstein**, NBER and University of Maryland; and **Kenneth R. Troske**, University of Missouri. "Sex

Segregation and Sex Differences in Wages within and across Plants: Evidence from Matched Employer-Employee Data" (NBER Working Paper No. 7003)

Daron Acemoglu and **Jörn-Steffen Pischke**, NBER and MIT, "Minimum Wages and On-the-Job Training" (NBER Working Paper No. 7184)

Zadia M. Feliciano and **Robert E. Lipsey**, NBER and Queens College, "Foreign Ownership and Wages in the United States, 1987-92" (NBER

Working Paper No. 6923)

Dora L. Costa, NBER and MIT, and **Matthew E. Kahn**, Columbia University, "Power Couples: Changes in the Locational Choice of the College Educated" (NBER Working Paper No. 7109)

Henry S. Farber, NBER and Princeton University, and **Kevin F. Hallock**, University of Illinois, "Changing Stock Market Response to Announcements of Job Loss: Evidence from 1970-97"

Neumark, Bayard, Hellerstein, and **Troske** assemble a matched employer-employee dataset covering all industries and occupations across all regions of the United States. They use this data to reconsider the relative contributions to the overall gender gap in wages of sex segregation as opposed to wage differences by sex within occupations, industries, establishments, and the like. They find that a sizable fraction of the gender gap in wages is explained by the segregation of women into lower-paying occupations, industries, establishments, and jobs within establishments. Nonetheless, a substantial part of the gap is attributable to the individual's sex. This finding contrasts sharply with earlier conclusions, based on narrower samples, which indicated that sex segregation alone accounted for the gender wage gap.

Acemoglu and **Pischke** demonstrate that when the assumption of perfectly competitive labor markets is relaxed, minimum wages actually can increase training of affected workers by inducing firms to train their unskilled employees. More generally, a minimum wage may increase training for workers constrained by it, while reducing training for those who must take wage cuts to finance it. The au-

thors find no evidence that minimum wages reduced training among low-wage workers at the time of state and federal increases in the minimum wage between 1987 and 1992.

Foreign-owned establishments in the United States pay higher wages than domestically owned establishments within the same industries and states: 5-7 percent more in manufacturing and 9-10 percent more in other industries. **Feliciano** and **Lipsey** find that even with establishment, state, and industry characteristics taken into account, the presence of foreign establishments is associated with higher overall wages in manufacturing in 1992, but not in 1987; outside of manufacturing, the foreign presence is associated with higher overall wages in both years. Also outside of manufacturing, increases in foreign ownership between 1987 and 1992 led to increases in overall average wages. Since there was no effect on wages in the domestically owned establishments, all of the overall changes apparently were explained by the foreign-owned establishments.

The rise of the dual-career household is a recent phenomenon spurred by the increase in married women's labor force participation rates and educational attainment rates. Inter-

ested in where such couples will live, **Costa** and **Kahn** document trends in locational choice between large and small metropolitan areas and non-metropolitan areas by household type from 1940 to 1990. They find that college-educated couples increasingly are concentrated in large metropolitan areas; at least half of this increase can be explained by the growing severity of the couples' "co-location problem." They also find that the chances of a college-educated couple living in a large versus a small city have increased over time. The relationship between rankings of university graduate programs and city size also has changed between 1970 and 1990, suggesting the importance of city size to firms' ability to attract the best workers. These results suggest that because skilled professionals increasingly have an equally skilled spouse, smaller cities may experience reduced inflows of human capital relative to the past, thus becoming poorer.

Using a sample of nearly 4,000 announcements of workforce reductions in 1,176 large firms between 1970 and 1997, **Farber** and **Hallock** study the reaction of stock prices to such announcements. They find that the stock market reaction was most

negative early in the period but has become less negative over time. One possible explanation for this change is that, over the past three decades, workforce reductions designed to

improve efficiency have become more common relative to those designed to cope with reductions in product demand. Although this ex-

planation shows some promise in accounting for at least part of the changing pattern over time, it cannot fully explain the trend.

Monetary Economics

Members of the NBER's Program on Monetary Economics met in Cambridge on April 23. Simon Gilchrist, NBER and Boston University, and Laurence M. Ball, NBER and Johns Hopkins University, organized the meeting. The program was:

Anil K Kashyap and **Raghuram Rajan**, NBER and University of Chicago, and **Jeremy C. Stein**, NBER and MIT, "Banks as Liquidity Providers: An Explanation for the Co-existence of Lending and Deposit Taking" (NBER Working Paper No. 6962)

Discussant: Donald Morgan, Federal Reserve Bank of New York

Michael D. Bordo, NBER and

Rutgers University, **Ehsan U. Choudhri**, Georgetown University, and **Anna J. Schwartz**, NBER, "Was Expansionary Monetary Policy Feasible during the Great Contraction? An Examination of the Gold Standard Constraint" (NBER Working Paper No. 7125)

Discussant: Christina D. Romer, NBER and University of California, Berkeley

Jordi Gali, Universitat Pompeu Fabra, and **Mark Gertler**, NBER and New York University, "Inflation Dynamics: A Structural Econometric Analysis"

Discussant: John Roberts, Federal Reserve System

Ricardo de O. Calvalcanti and **Neil Wallace**, Pennsylvania State University, "Inside and Outside Money as Alternative Media of Exchange"

Discussant: Randall Wright, NBER and University of Pennsylvania

Robert J. Shiller, NBER and Yale University, "Designing Indexed Units of Account" (NBER Working Paper No. 7160)

Discussant: Robert B. Barsky, NBER and University of Michigan

Adam S. Posen, Institute for International Economics, "Restoring Japan's Economic Growth"

Discussant: Kenneth D. West, NBER and University of Wisconsin

Kashyap, Rajan, and Stein ask what connects the traditional commercial banking activities of deposit-taking and lending. They observe that since banks often lend via commitments, or credit lines, their lending and deposit-taking may be two manifestations of the same primitive function: the provision of liquidity on demand. This observation leads the authors to argue that there will naturally be synergies between the two activities, to the extent that both require banks to hold large volumes of liquid assets (cash and securities) on their balance sheets: if deposit withdrawals and commitment take-downs are imperfectly correlated, the two activities can share any dead-weight costs of holding the liquid assets.

The recent consensus view that the gold standard was the leading cause

of the Great Depression stems from two propositions: 1) under the gold standard, deflationary shocks were transmitted between countries; and 2) for most countries, continued adherence to gold prevented monetary authorities from offsetting banking panics and blocked their recoveries.

Bordo, Choudhri, and Schwartz contend that the second proposition applies only to small, open economies with limited gold reserves, not the United States, the world's largest country and holder of massive gold reserves. The United States was not constrained from using expansionary policy to offset banking panics, deflation, and declining economic activity. The authors' simulations, based on a model of a large, open economy, indicate that expansionary open-market operations by the Federal Reserve at two critical junctures

(October 1930 to February 1931 and September 1931 through January 1932) would have helped to avert the banking panics that occurred without endangering convertibility. Indeed, had expansionary open-market purchases been conducted in 1930, the contraction would not have led to the international crises that followed.

Gali and Gertler develop and estimate a structural model of inflation that allows for a fraction of firms using a backward-looking rule to set prices. The purely forward-looking New Keynesian Phillips curve is a particular case of their model. The authors use measures of marginal cost, instead of an ad hoc output gap, as the relevant determinant of inflation. Real marginal costs are a significant and quantitatively important determinant of inflation. Backward-looking price setting, while statisti-

cally significant, is not quantitatively important. Thus the authors conclude that the New Keynesian Phillips curve provides a good first approximation to the dynamics of inflation.

Cavalcanti and **Wallace** study a random matching model of money in which a subset of people, called bankers, have known histories and the rest, called nonbankers, have unknown histories. Earlier the authors showed that if there are no outside assets, then an optimal arrangement has bankers issuing objects, bank notes, that are used in trades involving nonbankers. Here the same model is used to compare such exclusive use of inside money to the exclusive use of outside money. The authors show that the set of implementable outcomes using outside money is a strict subset of the set using inside money.

An indexed unit of account is a unit of measurement which employs an index, such as the consumer price index (CPI), to allow prices, wages,

or deferred payments to automatically adjust to changing economic conditions. Creating such indexed units is an important policy option for governments in countries with unstable prices or incomes. **Shiller** models the dynamics of prices when all prices are expressed in these units. Governments may choose to link units to a CPI or instead to a per capita income index, and there may be advantages to creating both kinds of units simultaneously. For example, downward rigidity of real wages might be reduced if wages were denominated in base income-indexed units of account. Base income would be defined so that the growth rate in the money value of the unit would be biased down relative to actual per capita income growth.

Japan's economic performance in the 1990s has been quite poor. Close analysis indicates that off-the-cuff analogies to the policy mistakes of the United States in the 1930s are

more than justified. In fact, a combination of fiscal austerity and financial laissez-faire prolonged and deepened a normal cyclical downturn in Japan after 1994. Since the summer of 1998, though, there have been significant policy reversals in a positive direction, particularly in regard to a clean-up of the banking system and true fiscal expansion in the Japanese government's budget for fiscal 1999. The greatest remaining danger to Japanese recovery is uncertainty about the Bank of Japan's monetary policy, particularly the bank's willingness to accommodate these policy initiatives. As a result, the policy debate in Japan has moved to consider the practical goals and methods for an inflation target, and their likely effect on interest rates, as the central issue. **Posen** offers a comparative political economy perspective on fighting deflation, and discusses the benefits of an announced finite inflation target.

International Trade and Investment

The NBER's Program on International Trade and Investment held its spring meeting in Cambridge on April 23 and 24. Program Director Robert C. Feenstra, NBER and University of California, Davis, chose these papers for discussion:

Francisco Rodriguez, University of Maryland, and **Dani Rodrik**, NBER and Harvard University, "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence" (NBER Working Paper No. 7081)

Daniel Treffer, NBER and University of Toronto, and **Huiwen Lai**, University of Toronto,

"Competing Models of Monopolistic Competition: An Econometric Antitrust Case"

Donald R. Davis, NBER and Harvard University, and **David E. Weinstein**, NBER and University of Michigan, "An Account of Global Factor Trade" (NBER Working Paper No. 6785)

Wolfgang Keller, NBER and University of Texas, "Geographic Localization of International Technology Diffusion"

Lee G. Branstetter, NBER and University of California, Davis, "Is FDI a Channel of R and D

Spillovers? More Evidence from Japan's FDI in the United States"

Andrew B. Bernard, NBER and Yale University, **Jonathan Eaton** and **Samuel Kortum**, NBER and Boston University, and **J. Bradford Jensen**, Carnegie-Mellon University, "Plants and Productivity in International Trade: A Ricardian Reconciliation"

James E. Anderson, NBER and Boston College, and **Douglas Marcouiller**, Boston College, "Trade, Insecurity, and Home Bias: An Empirical Investigation" (NBER Working Paper No. 7000)

Do countries with lower policy-induced barriers to international

trade grow faster than other similar countries? **Rodriguez** and **Rodrik**

point out that, in many cases, the indicators of "openness" used by re-

searchers are poor measures of trade barriers or are highly correlated with other sources of bad economic performance. In certain other cases, the methods used to ascertain the link between trade policy and growth have serious shortcomings. Their analysis of earlier work uncovers little evidence that open trade policies—that is, lower tariff and nontariff barriers to trade—are associated significantly with economic growth.

Trefler and **Lai** model the general equilibrium effects of product prices using the Consumer Expenditure Survey monopolistic competition model. They then use the model to estimate the compensating variation associated with trade liberalization. They find that the gains from liberalization are much larger than those usually reported. However, they determine that the good fit of the model is driven largely by a data identity. The model also inappropriately assumes unit income elasticities and omits trade. Further, the performance of the model differs across industries. Thus, the model would need to be modified before it could be usefully applied to policy questions.

Davis and **Weinstein** consider various explanations of the failures of the Heckscher-Ohlin-Vanek (HOV) formulation and their relationship to the data on technology and absorption. They show how a few simple and plausible amendments, verified directly by this data, confirm the HOV theory. Countries export the services of abundant factors, and in approximately the right magnitude. Thus, HOV works.

Can certain small countries gain in productivity relative to other small countries because they are geographi-

cally closer to the world's technology leaders? **Keller** estimates how the R and D spending of five major nations affects productivity in nine smaller OECD countries. His sample encompasses most of the world's innovative activity and more than two-thirds of its manufacturing activity from 1970 to 1995. He finds that the productivity effects of R and D decline with the geographic distance from the sender to the recipient country. On average, an increase of 10 percent in distance from the five major countries is associated with a single percentage point decline in the productivity level. Further, he finds that international sources of technology diffusion are about twice as important for productivity in the smaller OECD countries as are the country's own R and D investments. The diffusion of international technology also has become increasingly more important over the sample period.

Branstetter uses a modified version of the framework developed by Jaffe (1986) to measure international spillovers of R and D at the firm level for a group of Japanese firms. He also introduces a new framework for measuring international spillovers of R and D at the firm level using patent citations. Branstetter then tests the hypothesis that Japanese firms with substantial foreign direct investment (FDI) in the United States are able to make better use of R and D spillovers from the United States in their own innovative activity. He also tests the hypothesis that "indigenous" U.S. innovators benefit more from the R and D of Japanese firms with substantial FDI in the United States than from Japanese firms in general. He concludes that FDI increases the flow

of R and D spillovers in both directions.

Bernard, Eaton, Kortum, and **Jensen** attempt to reconcile observations about plant-level exporting behavior with international trade theory and the aggregate volume of trade. Their framework accommodates trade among many countries separated by trade frictions in an environment of imperfect competition. Using data on bilateral trade, they seek to explain several facts: the wide dispersion of measured productivity across U.S. plants; the higher measured productivity of exporters; the small fraction of active producers who actually export; the small fraction of revenue earned from exports, even by plants that do export; and the much larger size of plants that export. Their model picks up these features and comes close to estimating their magnitudes.

Using a model of import demand in which transactions costs impose a price markup on traded goods, **Anderson** and **Marcouiller** estimate the reduction in trade caused by corruption and imperfect contract enforcement. They find that inadequate institutions constrain trade far more than tariffs do, and that omitting indexes of institutional quality from the model leads to an underestimate of home bias. Using a broad sample of countries, the authors find that the traded goods expenditure share declines significantly as income per capita rises. The variation in the effectiveness of institutions across countries offers a simple explanation of the observed global pattern of trade, in which high-income, capital-abundant countries trade disproportionately with one another.

Higher Education

Members and guests of the NBER's Project on Higher Education, directed by Charles T. Clotfelter, NBER and Duke University, met in Cambridge on April 30 and May 1. They discussed these papers:

John Bound, NBER and University of Michigan, and **Sarah Turner**, University of Virginia, "Going to War and Going to College: Did the GI Bill Increase Educational Attainment?"

Discussant: Thomas J. Kane, NBER and Harvard University

Judith Li, Harvard University, "Estimating the Effect of Federal Financial Aid on College Tuitions: A Study of Pell Grants"

Discussant: Andrew Dick, University of Rochester

Caroline M. Hoxby, NBER and Harvard University, "Benevolent Colluders? The Effects of Antitrust Action on College Financial Aid and Tuition"

Discussant: Ronald G. Ehrenberg, NBER and Cornell University

George Johnson, University of Michigan, "Trends in the Relative Earnings of Tenure-Track Faculty, 1973-95"

Discussant: John Pencavel, Stanford University

Donna Ginther, Washington University, and **Kathy Hayes**, Southern Methodist University, "Gender Differences in Salary and Promotion in the Humanities"

Discussant: David Zimmerman, Williams College

The end of World War II brought a flood of veterans to America's colleges and universities. Yet there is little evidence to suggest that military service, combined with the availability of postwar educational benefits, actually led men to increase their investments in higher education. **Bound** and **Turner** use the structure of the draft during the war years and the changing manpower requirements in the armed forces to compare the educational attainment of veterans and nonveterans in this era. From surveying census data, the authors find that the net effects of military service and the widely available funding for college through the G.I. Bill led to only a modest gain in postsecondary educational attainment of veterans. For white men, the combination of military service and the availability of veteran's benefits did lead to moderate increases in educational attainment, though.

During the past 15 years, tuition has consistently risen faster than inflation at colleges and universities across the United States. Keeping college affordable is a central goal of current federal policy: the government increased the maximum Pell Grant by \$125 to \$3,125 for the 1999-2000 academic year, and passed the

Taxpayer Relief Act of 1997, which was designed to provide college students and their families with \$40 billion in tuition tax breaks over the next five years. However, one concern about Pell Grants and tuition subsidies in general is that they do not keep college affordable because they encourage colleges to raise their tuitions in order to capture the federal money for themselves. **Li** provides some empirical evidence on the extent to which increases in Pell Grants have generated higher college tuitions. Using a new dataset, she examines how individual colleges' altered their tuitions in response to changes in the Pell Grant program between 1984 and 1994. She also differentiates between the responses of proprietary schools and those of private and public schools, and between two-year schools and four-year schools.

In 1990-1, the U.S. Department of Justice (DOJ) investigated private colleges for price-fixing, concentrating on "Overlap" colleges that met to coordinate the calculation of need for students admitted to multiple colleges in the group. As a result, the Overlap meetings were discontinued. **Hoxby** analyzes the effects of this antitrust action on tuition and finan-

cial aid, paying special attention to its social welfare consequences. She finds that the antitrust action caused aid money to be redirected from lower-income to higher-income families, and this caused the enrollment of poor and minority students to decrease. The antitrust action also coincided with a slowdown in the rate of increase in college tuition, but that slowdown was slightly greater at colleges that were not investigated by the DOJ. **Hoxby** further shows that the slowdown in tuition growth did not generate a similar slowdown in the growth of tuition revenue at all colleges, because some colleges simultaneously began to discriminate more against needy students in admissions.

Johnson examines the salary structure within academia and compares it to that of other high-skilled labor. He uses data for scientists (including economists) and engineers from the National Science Foundation Survey of Doctorate Recipients of 1973, 1979, 1989, and 1995. His results are similar to those for the labor force as a whole: there has been a large, steady increase in the rate of unexplained salary dispersion. He also finds that the age differential for salaries in academia has declined, but that there remain gender and ethnic salary dif-

ferentials. Looking at the average adjusted salary of academics relative to other high-skilled workers, Johnson finds that academics have done significantly better than most other groups since 1979.

Ginther and **Hayes** also use data from the Survey of Doctorate Recipients to evaluate gender differences in

salaries and promotion for academics in the humanities. They find that gender salary differences over time can be explained largely by academic rank. There are substantial gender differences in promotion to tenure, though, even after controlling for individual productivity and demographic characteristics. However,

these differences shrink for the most recent Ph.D. recipients. Thus, the authors conclude that gender discrimination for academics in the humanities tends to operate through differences in promotion, and that these promotion differentials are shrinking over time.

Asset Pricing

The NBER's Program on Asset Pricing, directed by John Y. Campbell, held its spring meeting in Cambridge on May 13. Dimitrios Vayanos and Jiang Wang, NBER and MIT, organized the program and chose the following for discussion:

Torben G. Andersen, Northwestern University, **Tim Bollerslev**, NBER and Duke University, **Francis X. Diebold**, NBER and University of Pennsylvania, and **Paul Labys**, University of Pennsylvania, "The Distribution of Exchange Rate Volatility" (NBER Working Paper No. 6961).

Discussant: Ludger Hentschell, University of Rochester

Wayne E. Ferson, NBER and University of Washington, and **Andrea Heuson** and **Tie Su**, University of Miami, "How Much Do Expected Stock Returns Move over Time? Answers from the Options Market"

Discussant: John C. Heaton, NBER and Northwestern University

Martin Lettau and **Sydney Ludvigson**, Federal Reserve Bank of New York, "Consumption, Aggregate Wealth, and Expected Stock Returns"

Discussant: Kenneth R. French, NBER and MIT

Peter Bossaerts, California Institute of Technology, "Learning-Induced Securities Price Volatility"

Discussant: Lars P. Hansen, NBER and University of Chicago

Michael W. Brandt, University of Pennsylvania, and **Pedro Santa-Clara**, University of California, Los Angeles, "Simulated Maximum Likelihood Estimation of Multivariate Diffusions with an Application to Interest Rates and Exchange Rates with Stochastic Volatility"

Discussant: Matthew P. Richardson, NBER and New York University

Luboš Pástor, University of Chicago, and **Robert F. Stambaugh**, NBER and University of Pennsylvania, "Comparing Asset Pricing: An Investment Perspective"

Discussant: Ravi Jagannathan, NBER and Northwestern University

Using high-frequency data on Deutschemark and yen returns against the dollar, **Andersen**, **Bollerslev**, **Diebold**, and **Labys** estimate daily exchange rate volatility and correlation for an entire decade. The authors characterize their joint distribution both unconditionally and conditionally. They find high contemporaneous correlation both across volatilities and between correlation and volatilities. There is also pronounced and highly persistent variation in both volatilities and correlation over time.

Ferson, **Heuson**, and **Su** estimate the predictability of stock returns

implied by option prices, the "option-implied R-squares." They use monthly data from 1975 to 1997 for 15 large common stocks and from 1986 to 1997 for the Standard & Poors 500 Index. The authors estimate that the implied volatility horizon is one month for one-month options on individual stocks. The option-implied R-squares for individual stocks average 20 percent, which is higher than the regression R-squares on a standard set of marketwide lagged instruments. The implied volatility horizon for the S&P 500 Index is shorter than one month, and the option-implied

R-squares is indistinguishable from zero.

Lettau and **Ludvigson** study the role of detrended wealth in predicting stock returns. They define a transitory movement in wealth as one that produces a deviation from its shared trend with consumption and labor income. Using quarterly U.S. stock market data, they find that these trend deviations in wealth are strong predictors of both real stock returns and excess returns over a Treasury bill rate. They also find that this variable is a better forecaster of future returns at short and intermedi-

ate horizons than is the dividend yield, the earnings yield, the dividend payout ratio, and several other popular forecasting variables.

Bossaerts provides a mathematical foundation for the empirical observation that volatility accompanies large movements in security prices: significant downward price corrections almost never seem to occur in an orderly way (they are called "panics") and, likewise, substantial price run-ups are equally erratic (they are called "bubbles"). What Bossaerts refers to as "market beliefs" actually lead to lower bounds on the volatility of securities prices as a function of the mean return. He documents the presence of a clear, U-shaped pattern in the relationship between return and volatility for the daily returns of the Dow Jones and

S&P 500 indexes since 1883. His explicit calculation of the theoretical bounds suggests that the volatility marginally may have been too low for moderate price increases.

Brandt and **Santa-Clara** develop a new econometric method for estimating the parameters of a diffusion from discretely sampled data. Compared with existing estimators of continuous time models, their method is particularly effective for multivariate diffusions, is very transparent and adaptive, and inherits all the desirable asymptotic properties of the unattainable maximum likelihood estimator. Using this method, the authors estimate a new continuous time model of the joint dynamics of interest rates in two countries and of the exchange rate between the two countries' currencies. Their empirical results offer

several new insights into the dynamics of exchange rates.

Pástor and **Stambaugh** investigate the portfolio choices of investors who optimize mean variance by using sample evidence to update prior beliefs centered on either risk-based or characteristic-based pricing models. With dogmatic beliefs in such models and an unconstrained ratio of position size to capital, optimal portfolios can differ across models to economically significant degrees. The differences are reduced substantially by modest uncertainty about the models' pricing abilities: when the ratio of position size to capital is subject to realistic constraints, the differences in portfolios across models become even less important or, in some cases, nonexistent.

Market Microstructure

Members of the NBER's Research Group on Market Microstructure met in Cambridge on May 14. Bruce Lehmann, University of California, San Diego; Andrew Lo, NBER and MIT; Matthew Spiegel, University of California, Berkeley; and Avanidhar Subramanyam, University of California, Los Angeles, organized this program.

David Cushing, ITG, Inc., and **Ananth Madhavan**, University of Southern California, "Stock Returns and Institutional Trading at the Cross"

Discussant: Simon Gervais, University of Pennsylvania

Lawrence Harris, University of Southern California, and **Vankatesh Panchapagesan**, Washington University, "The Information Content of the Limit-Order Book: Evidence from the NYSE Specialist Actions"

Discussant: Mark Lipson, New York Stock Exchange

Clifford Ball and **Tarun Chordia**, Vanderbilt University, "True Spreads and Equilibrium Prices"

Discussant: Charles Cao, Pennsylvania State University

Thierry Foucault, HEC, **Ailsa Röell**, Princeton University, and

Patrik Sandås, University of Pennsylvania, "Imperfect Market Monitoring and SOES Trading"

Discussant: Paul Schultz, University of Notre Dame

Bruno Biais and **Sébastien Pouget**, Toulouse University, "Learning to Play Equilibrium Strategies in Experimental Financial Markets: Does Microstructure Matter?"

Discussant: Utpal Bhattacharya, Indiana University

Closing prices are used to calculate portfolio returns, to tally the net asset values of mutual funds, and as a basis for certain types of contracts and after-hours trading. Conse-

quently, many institutional traders seek to trade at or near the close, which in turn gives rise to concerns about associated imbalances and possible gaming behavior. **Cushing**

and **Madhavan** empirically analyze the behavior of stock returns at the market close for stocks of the Russell 1000, using both transaction-level data for June 1997 to July 1998 and

the complete record of all market on close order imbalance indications issued by New York Stock Exchange specialists. The authors show that the last five minutes of the trading day explain a disproportionate fraction of the variation in daily returns—almost 18 percent in portfolios—although the closing period constitutes only 1.3 percent of trade time. This return phenomenon reflects both a higher fraction of nonblock trades and higher sensitivity of price to the flow of nonblock orders in the closing period. Finally, they find that systematic return reversals following order imbalance publications are consistent with temporary price pressure that is related to liquidity trading.

Specialists compete with limit-order traders to provide liquidity at the New York Stock Exchange. Since specialists see all system limit orders, they enjoy a unique advantage in this competition. **Harris and Panchapagesan** examine whether the limit-order book is informative about future price changes and whether specialists use this information when trading. The authors consider three actions that specialists can take when a market order arrives: stop the order; fill the order immediately at the quoted price; or fill the order immediately at an improved price. Using SuperDOT limit orders in the TORQ database, the authors find that the limit-order book is informative, especially about short-term price movements. They also find that the specialists use this information in a way that favors them (and sometimes the floor community) over the limit-order traders. The results are more evident for active stocks, in which the competition between specialists and limit-order traders is more in-

tense. The authors also show that specialists in lower-priced stocks are less likely to initiate such actions because of the binding tick size.

Stocks and other financial assets are traded at prices that lie on a fixed grid determined by the minimum tick size permitted in the market. Consequently, observed prices and quoted spreads do not correspond to the equilibrium prices and the true spreads that would exist in a market with no minimum tick size. **Ball and Chordia** model the equilibrium movements of two latent variables, equilibrium price and spread, using a bivariate autoregressive process with correlated errors. They estimate the parameters governing the movements of these variables using transaction prices and information on quoted bid-ask spreads. Because of the econometric complexities created by rounding to a discrete grid, the authors use Monte Carlo Markov Chain methods to estimate the parameters. Analyzing a selection of large, heavily traded U.S. stocks, they find that most of the quoted spread is attributable to the rounding of prices, and that the adverse selection component is nonexistent or very small.

Foucault, Röell, and Sandås develop a theoretical model of price formation in a competitive dealership market. The model is designed to match some of the key institutional features of the Nasdaq's Small Order Execution System (SOES). Market-makers post firm quotes and choose how intensively to monitor the arrival of news. Because monitoring is costly, marketmakers do not monitor the arrival of news continuously. Imperfect monitoring thus creates profit opportunities for speculators (comparable to SOES bandits), who also

monitor the arrival of news in order to pick off "stale" quotes. The fact that market monitoring is a *public good* for the marketmakers provides further profit opportunities for the speculators. The presence of speculators widens the spread as marketmakers protect themselves against the risk of being picked off. Prices are more likely to reflect news when speculators enter the market and the aggregate level of monitoring increases. Thus, the presence of speculators in the authors' model affects the trade-off between the bid-ask spread and price discovery.

Biais and Pouget characterize the strategies played in the perfect Bayesian equilibriums of trading games with differential information and experimentally analyze deviations from and convergence to these equilibrium strategies. They consider three different market microstructures: 1) a continuous, oral double auction market; 2) a call market followed by a continuous market; and 3) a pre-opening period followed by a call market and then a continuous market. The proportion of actions inconsistent with equilibrium is significantly lower for a market in which there is a pre-opening period; this suggests that offering a platform to the agents to communicate about preplay, such as the pre-opening period, enhances their ability to learn equilibrium strategies. Focusing on the orders placed during the continuous trading phases of the market (while considering the three market structures), the authors find that the proportion of orders inconsistent with equilibrium decreases significantly as subjects become more experienced.

Bureau Books

Tax Policy and the Economy

Tax Policy and the Economy, Volume 13, edited by James M. Poterba, is now available from the MIT Press. This volume includes papers on such topics as the relationship between tobacco taxes and public policy to discourage smoking, the response of nonprofits to the Unrelated Business Tax, and the distributional impacts of proposed changes to the Social Security system.

The volume should interest academic economists, tax policymakers, and corporate tax specialists. Its price is \$30.00 (cloth), or \$15.00 (paperback). It may be ordered directly from the MIT Press at 5 Cambridge Center, Cambridge, MA 02142; or by email to mit-press-orders@mit.edu. The MIT Press's web site is <http://mitpress.mit.edu/journals.tcl>.

Poterba is Director of the NBER's Program on Public Economics and the Mitsui Professor of Economics at MIT.

Yankeys Now: Immigrants in the Antebellum U.S., 1840-1860

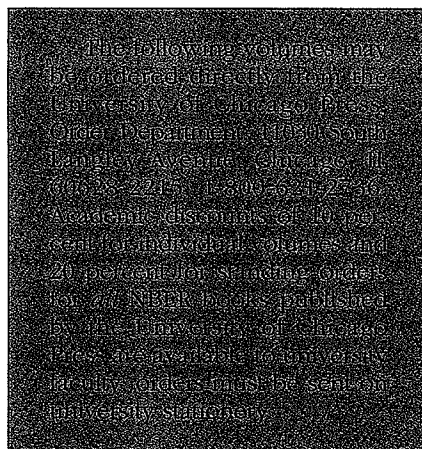
Yankeys Now: Immigrants in the Antebellum U.S., 1840-1860, by Joseph P. Ferrie, is available from Oxford University Press for \$49.95.

The volume focuses on the first great wave of European migration to the United States before the Civil War, providing a detailed look at how these immigrants were changed by their relocation and how the American economy responded to their arrival. Comparing data on 2,400 British, Irish, and German migrants with information on more than 4,000 native-born Americans as followed through the 1850 and 1860 U.S. Censuses, Ferrie traces their geographic movements within the United States and describes their changing economic fortunes. His research turns up little evidence that the immigrants' arrival negatively

affected this country's labor force (excluding craft workers in the Northeast). This finding demonstrates the American economy's ability to absorb additions to its workforce while also illustrating the range of opportunities available to nineteenth-century immigrants drawn to the United States.

Ferrie is a Research Associate in the NBER's Program on Development of the American Economy and a professor of economics at Northwestern University.

Information about ordering this book can be found at the Oxford University Press web site: www.oup-usa.org.



The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research

The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research, edited by Frank J. Chaloupka, Michael Grossman, Warren K. Bickel, and Henry Saffer, is available from the University of Chicago Press for \$53.00. This NBER Conference Report brings together six papers by economists and six by behavioral scientists and commentary

on each. The topics covered include cigarette smoking, alcohol consumption, drug use, and the effects of substance use and abuse on employment. This volume is intended to give economists and behavioral scientists involved in work on substance abuse the opportunity to explore common interests and to share methods and research findings.

Chaloupka is a Research Associate in the NBER's Program on Health Economics and a professor of economics at the University of Illinois, Chicago. Grossman is Director of the NBER's Program on Health Economics and a distinguished professor of economics at the City University of New York Graduate School. Bickel is a professor of psychiatry and psychology at the University of Vermont. Saffer is a Research Associate in the NBER's Program on Health Economics and a professor of economics at Kean University of New Jersey.

Monetary Policy Rules

Monetary Policy Rules, edited by John B. Taylor, is available from the University of Chicago Press for \$70.00. This NBER conference report presents the latest thinking on monetary policy, asking what types of rules and policy guidelines function best. This collection of nine papers and ten commentaries presents findings on the potential response of interest rates to such variables as rates of inflation, unemployment, and exchange rates. It illustrates that simple policy rules are more robust and more efficient than complex rules with multiple variables. This volume should interest both academic economists and policymakers.

Taylor is a Research Associate in the NBER's Programs on Economic Fluctuations and Growth and Monetary Economics. He is also the Mary and Robert Raymond Professor of Economics at Stanford University and a former member of the President's Council of Economic Advisers.

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Titles of all papers issued since May 1999 are presented below. For previous papers, see past issues of the *NBER Reporter*. Working Papers are intended to make results of NBER research available to other economists in preliminary form to encourage discussion and suggestions for revision before final publication. They are not reviewed by the Board of Directors of the NBER.

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