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2007 Number 4

Program Report

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The Economics of Aging

David A. Wise*

Next year, the leading edge of the baby boom generation turns 62 and becomes eligible to receive Social Security benefits. Projecting forward, the U.S. population aged 62 and older will increase from 45 million to nearly 80 million over a period of just 20 years. Compounding the impact of the aging baby boomers are trends in longevity. At age 62, life expectancy is about 20 years for men and 23 years for women, and it is getting longer all the time. Whether this growing population of older Americans works or retires; how much they will have saved for their retirement; what health care they will need, and how much it will cost — are all critical questions. Also important are the policy questions: How will demographic trends affect the public and private retirement support programs that have traditionally been extended to retirees in the United States and around the world? Are these policies financially sustainable? Are they flexibly structured to accommodate a different population demographic, and how might they evolve in response to demographic trends? These questions motivate our research agenda in the Economics of Aging Program. Our aim is to understand more fully the relationships between age demographics, retirement and health care policy, economic behavior, and the health and economic circumstances of people as they age.

Begun in 1986, the NBER's Aging Program has developed primarily around large, coordinated research projects that simultaneously address several interrelated issues in the economics of aging. Extensive funding for

In 2007, we converted from issuing quarterly, seasonal issues to a system of numbered issues. This is the final issue of 2007 under the new numbering system: 2007 Number 4.

** Wise is Director of the NBER's Program on the Economics of Aging and the Stambaugh Professor of Political Economy at Harvard University's Kennedy School of Government. The numbers in brackets throughout the report refer to NBER Working Papers. The report has been prepared with the intensive collaboration of Richard Woodbury.*

NBER Reporter

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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. NIA has also supported our efforts to engage new investigators in studying issues in aging, to develop new research directions through pilot projects, and to bring together research teams to collaborate jointly in studying more complex issues and questions relating to aging. Thus the Aging Program has operated in an unusually interactive, coordinated, prospective and collaborative way. The Program has also benefited more recently from a Center grant from the Social Security Administration, which has enabled us to study in greater depth the challenges facing Social Security, its financial sustainability in the face of an older population, its economic structure, and the implications of various approaches to Social Security reform.

More than 100 papers are completed annually by participants in the NBER Aging Program. Some of these appear in a series of books published by the University of Chicago Press, the eleventh of which is forthcoming later this year.¹

Retirement Saving

One of the most important aging-related trends in the United States is the growth of targeted retirement saving. Over the past 25 years, personal retirement accounts have replaced defined benefit pension plans as the primary means of retirement saving and contributions to 401(k)-type plans have expanded dramatically. A series of studies by James M. Poterba, Steven F. Venti, and me has quantified this transition and considered its implications for the economic circumstances of future retirees (11974, 12834, 13081, 13091). Because 401(k) plans have not existed for the full careers of currently retiring workers, their impact is moderate now, but is becoming more significant with each wave of new retirees. The typical 401(k) participant retiring in 2000, for example, contributed only for about seven years. As time passes, many more new retirees will have participated in 401(k) plans; they will have contributed for a larger portion of their working careers; and their contributions will have compounded over longer periods of time. We project that if equity returns between 2006 and 2040 are comparable to those

observed historically, then by 2040 average projected 401(k) assets of all persons age 65 will be over six times larger than the maximum level ever achieved by traditional defined-benefit pension plans. If equity returns average 300 basis points below their historical value, we project average 401(k) assets that are 3.7 times as large as the peak value of DB benefits. Looking at individual households, we project that the average value of 401(k) assets of families at retirement will grow from about \$44,000 in 2000 to \$575,000 in 2040 assuming historical rates of return, or to \$348,000 assuming historical returns less 300 basis points. This represents a fundamental transition in the composition of post-retirement financial support in the United States.

Some of our recent analysis of 401(k) plans has considered how this growth could be affected by the asset allocation decisions of account holders. For example, recent research by Poterba, Joshua Rauh, Venti, and me compares several asset allocation strategies, including rules that allocate a constant portfolio fraction to various assets at all ages, and “lifecycle” rules that vary the mix of portfolio assets as the worker ages (11974, 12597). The results are sensitive to four features of markets and households: the return on corporate stock, the worker’s relative risk aversion, the amount of wealth held in other ways (outside of personal retirement accounts), and the investment expense ratios. At modest levels of risk aversion, or in the presence of substantial resources outside of personal retirement accounts, historical returns imply a higher expected utility from an equity-based allocation, rather than more conservative investment strategies. Also, when asset allocation is near the level that generates the highest expected utility, variation in expense ratios becomes more important than variation in asset allocation. Interestingly, expense ratios appear to be largely ignored in the asset allocation decisions of many investors, as shown in studies by Jeffrey Brown, Nellie Liang, and Scott Weisbenner (13169) and by James J. Choi, David Laibson, and Brigitte Madrian (12261).

Another piece of our research has

explored how the design of 401(k) plans affects worker participation, saving rates, and the allocation of savings across investment options. In one line of research, John Beshears, Choi, Laibson, Madrian, and Andrew Metrick analyze the important impact of the default provisions of 401(k) plans (11074, 12009). They find that more people participate when there is automatic enrollment. Participants are also influenced strongly by the default contribution rate, the default allocation among investment options, and the default approach to withdrawing funds. A related set of papers — also by Beshears, Choi, Laibson, and Madrian — looks at how a simplification of the decision process at enrollment can increase participation in the same way that automatic enrollment increases participation (11979, 12659). The most recent study by this research team looks at the extent to which employer contributions to 401(k) plans may crowd-out employee contributions.² They consider in particular what happened when a firm replaced its matching program with employer contributions that were not contingent on employee contributions, and find that employee participation and contribution rates did decline modestly after the plan change.

Related to the research on 401(k) plans are several analyses of the possibilities and complications of establishing an individual accounts component in the Social Security system. One concern with such a system is that workers might bear a greater risk from the uncertainties of investment returns. In one study on this topic, John B. Shoven and Sita Slavov illustrate that there is substantial “political risk” to participants in Social Security already, as the structure of taxes and benefits is frequently changed in response to economic and political pressures (12135). They find that “political risk” can be compared quantitatively to the “market risk” in a personal accounts retirement scheme. Thus the debate over personal accounts, they suggest, is not one of “safe” versus “risky” benefits, but one of portfolio choice.

Other studies have looked at ways to moderate the investment risks of

investment-based Social Security reform, including a study by Martin Feldstein that considers various trade-offs between a guaranteed minimum return and a probability distribution of possible higher returns (11084), a study by Andrew Biggs, Clark Burdick, and Kent Smetters on the pricing of minimum benefit guarantees,³ a study by Andrew Samwick on how changes in the progressivity of the Social Security benefit formula could be used to reduce the risks of investment-based Social Security reform (13059), and a study by John Geanakoplos and Stephen P. Zeldes on how one could convert Social Security into a system of personal accounts while preserving the progressivity of the current system.⁴ As an alternative to funding an investment-based Social Security system, Alan J. Auerbach and Ronald Lee have analyzed policies known as “Notional Defined Contribution” (NDC) plans, which mimic the characteristics of fully funded defined contribution plans, while retaining pay-as-you-go financing (12805). Using different versions of the system recently adopted in Sweden, calibrated to U.S. demographic and economic parameters, their study evaluates the possibilities of the NDC approach in improving fiscal stability.

Jeffrey Brown and Scott Weisbenner consider how people perceive savings-based, defined contribution retirement plans (DC plans) relative to traditional defined-benefit (DB) pension plans, when offered a choice between them (12842). They are analyzing an actual employment situation in which newly hired workers can make a one-time, irrevocable choice between a traditional DB pension plan, a portable DB plan, and an entirely self-managed DC plan. Interestingly, the results show that a majority of participants fail to make an active decision among these plan options, and are thus by default placed into the traditional DB plan. Individuals who are most likely to be financially sophisticated are more likely than other employees to choose the self-managed DC plan, despite the fact that, given the financial features of the various plans, the DC plan is likely to be inferior to the portable DB plan under reasonable

assumptions about future financial market returns.

Several other Aging Program studies look beyond the accumulation of savings in personal retirement accounts to their use in retirement. Jonathan S. Skinner has explored how much saving people will need in retirement (12981). He concludes that rising out-of-pocket medical expenses will increase the need for financial resources in retirement. Indeed the combination of eroding retiree health benefits and the risk of catastrophic future out-of-pocket health spending suggests that even conventional retirement planning recommendations could be too low. Amy Finkelstein, James M. Poterba, and Casey Rothschild consider the role of annuitization of retirement assets (12205). They analyze the impact of regulations that prevent insurance companies from selling different policies to men and women, and the redistribution of resources from men to women that is implicit in such regulations. They find that even in the absence of explicit gender-based policies, insurers may achieve some separation of their clients into different risk pools by offering differentiated products each of which will be attractive to individuals with a different risk profile.

In addition to studying asset accumulations in personal retirement accounts and their effect on the economic circumstances of individual households, program members have also analyzed the macroeconomic implications of retirement saving. For example, an earlier study by James M. Poterba (10851) evaluates critically the “asset market meltdown” hypothesis, which suggests that the growing number of retirees will cause asset prices to decline as they begin to draw down their savings. Poterba finds only modest evidence of a relationship between age demographics and asset prices. Axel Börsch-Supan, Alexander Ludwig, Dirk Krüger, and Joachim Winter have extended this work to account for global financial markets, and international capital flows across countries (11850, 13185). The idea behind their work is that international capital flows are likely to moderate the effects of age demographics on financial market returns

within any one country, as the timing and character of demographic changes vary around the globe. His simulations indicate that capital flows from rapidly aging regions to the rest of the world will initially be substantial, but that trends are reversed subsequently. Also important to the analysis is the inclusion in the model of social security reforms in various countries that move from largely pay-as-you-go financing to funded accounts; a change in policy that also influences financial markets and capital flows across countries.

Another study, focused back on the United States, looks at saving in the federal trust funds, and the intended accumulation of trust fund assets to support future benefit obligations (10953). Shoven and Slavov show that the trust fund build-up may not help future generations because of the adoption of the Unified Budget in 1970. They suggest that attempts to balance the Unified Budget while the trust funds were generating surpluses have led to higher government spending and personal and corporate income tax cuts within the rest of the federal government. Indeed, the surpluses in the trust funds appear to be offset, perhaps completely, by increased deficit spending by the rest of government.

Retirement Policy and Labor Market Behavior

Another theme of Aging Program research is the labor market behavior of older workers, and how it relates to retirement policy. The issue is important because potentially productive labor capacity is forgone through retirement; and because retirement has contributed to the growing financial pressures on public and private programs that provide income and health care support at older ages. It raises the question of whether people’s work and retirement decisions at older ages are chosen optimally, based on how individuals trade-off earnings and leisure over the life course, or whether they are distorted in some way by the incentives of the system. In early work in the Aging Program, we considered the significant impact of employer-provided pen-

sion plans in inducing retirement at ages younger than would occur without the plans. Over the past several years, we have looked at the influence on retirement of social security systems around the world. And most recently, we have revisited the incentives in public retirement programs in the United States.

Our work on international social security systems, now in its fifth phase, has brought together a team of investigators from Belgium, Canada, Denmark, Italy, France, Germany, Japan, the Netherlands, Spain, Sweden, the United Kingdom, and the United States. For each phase of the project, a set of parallel studies has been conducted on the social security system in each country; and these studies are then integrated to allow comparisons across countries. Results of each phase have been published in a series of research volumes.⁵ The first phase of the project mapped out the detailed policy characteristics of social security programs into measures of retirement incentives comparable across countries, showing the close relationship between the financial incentives in each social security system and the retirement behavior occurring in each country (6134). The second phase applied micro-data from each country to estimate more formally the relationship between social security provisions and retirement (9407). The third phase of the project has used the retirement model estimates from phase two to describe the fiscal implications of various illustrative social security reforms (11290). The fourth phase of the project (nearing completion now) deals with the relationship between social security, the generosity of social security benefits, and wellbeing (10466, 12303). By looking at the evolution of social security benefits over time, and the difference in social security policy across segments of the population, our recent research has documented how social security programs have affected well-being. We have also just initiated a fifth phase of the project on social security and well-being at younger ages, analyzing critically the claim made in some countries that social security was designed in part to induce older workers to leave the labor force in order to open

up job opportunities for younger people.

As with our international research, our study of retirement incentives in the United States is motivated by the increased financial pressures on our social security system, pressures that may be compounded by earlier retirement that is induced by the plans themselves. Recent work by Gopi Shah Goda, Shoven, and Slavov, for example, highlights the features of Social Security that discourage long careers, discourage work at older ages, and increase the number of years in retirement (13110). One example of the distortion in Social Security is how benefits are calculated based on the highest 35 years of earnings, thereby lowering the value of work beyond 35 years. Another distortionary aspect of the benefit formula is the redistributive benefits awarded to workers with short careers, which are similar to the redistributive benefits to lower income workers. Reinforcing the idea that workers respond to these incentives, Jeffrey B. Liebman, Erzo Luttmer, and David Seif find that retirement increases sharply when the current year's earnings crowd out a prior year's earnings in the Social Security benefit formula.⁶ In another interesting analysis of how Social Security provisions affect retirement, George J. Borjas compares labor market behavior of older immigrants and native born workers. He finds that the 10-year eligibility threshold for Social Security benefits leads to higher participation rates among older immigrants who have not yet met the 10-year threshold, an incentive that is not relevant for most native-born U.S. workers.⁷

Considering the relationship between Social Security eligibility and retirement behavior, the general improvements to population health and longevity, and the financial pressures on most retirement benefit programs, some suggest that the age of eligibility for retirement benefits should be adjusted upward. A study by David M. Cutler, Liebman, and Seamus Smyth develops two models for how an "optimal" early retirement age might be determined.⁸ As motivation for ongoing work using these models, the investigators present evidence that people aged 62 in

the 1960s or 1970s were in similar health to people aged 70 or more today. Shoven uses a similar theoretical basis in developing new methods for indexing benefit eligibility.⁹ He considers in particular the potential of indexing benefits to a fixed mortality risk, or to the number of years of remaining life expectancy.

Other research has looked at the impact of disability insurance on labor market behavior. For example, Börsch-Supan examines the substantial variation in enrollment in disability insurance across European countries and the United States.¹⁰ He finds that differences in disability insurance rules and benefit generosity across countries, and not differences in population demographics or health status, explain a larger part of the cross-national variation. David Autor and Mark Duggan consider the explosive growth of enrollment in the Social Security Disability Insurance (SSDI) program in the United States (12436). They emphasize three key explanations: 1) Congressional reforms to disability screening that enabled workers with back pain, arthritis, and mental illness to more readily qualify for benefits; 2) a rise in the after-tax DI income replacement rate, which strengthened the incentives for workers to seek benefits; and 3) a rapid increase in female labor force participation that expanded the pool of insured workers. Rena Conti, Ernst R. Berndt, and Richard Frank focus in greater depth on the effect of depression on early retirement and SSDI applications, identifying depression as an important piece of enrollment growth (12237). Amitabh Chandra and Samwick consider the magnitude of the disability risk, the extent of precautionary saving for potential disability, and the value of disability insurance (11605). They analyze both the decline in disability in the working age population over the past two decades and the value of disability insurance in protecting workers from disability risk. Because the probability of work disability is small, but the average size of the loss from disability is large, disability insurance is shown to be a more effective way to address disability risk, as compared with precautionary saving.

Health and Economic Circumstances around the World

Another theme of the Aging Program is the relationship between health and economic circumstances. It is well documented that those with more education, higher income, and larger accumulations of wealth, on average, live longer and healthier lives. This correlation between economic circumstances and health exists across individuals within countries, across countries with different standards of living, and over time. Our research has sought to understand the complexities of the relationship between health and economic circumstances, its causes, and how it is changing over time.

Two recent studies, one by Angus Deaton, and one by Abhijit Banerjee and Esther Duflo, explore the issue from a global perspective.¹¹ Deaton looks at a Gallup World Poll that asks identical questions in 132 countries around the world. He focuses on life-satisfaction (happiness) and health satisfaction and their relationships with national income, age, and life expectancy. He finds that happiness is strongly related to national per capita income; each doubling of income is associated with a close-to-one point increase in life satisfaction on a 0-10 scale. He also finds that the rate of deterioration in how people evaluate their health satisfaction as they age is much faster in poor than in rich countries. Despite these relationships, however, Deaton identifies too many anomalies in the links between life-satisfaction and life expectancy or HIV prevalence, or even between health-satisfaction and these measures, to make life-satisfaction a good summary indicator of human welfare in international comparisons. Banerjee and Duflo look at 15 countries with comparatively lower incomes, and compare the well-being of the very poor (living on less than \$1 a day), the poor (less than \$2 a day), and those who are slightly richer (between \$2 and \$4, and between \$5 and \$10 per day). Even at these extremely low standards of living, they confirm that the poor, and particularly the extremely poor, have higher mor-

tality rates than those who are somewhat better off.

Banerjee, Anne Case, Deaton, and Duflo have also studied the broader life circumstances of households in very poor areas, focusing on research sites in rural Rajasthan, India, a shack township outside of Cape Town, South Africa, and a rural South African site. Case and Deaton emphasize that there is no simple relationship between health and wealth in comparing the research sites.¹² Income levels vary by a ratio of 4:2:1, with urban South Africa richest and rural Rajasthan poorest; yet people living in these areas report a very similar list of symptoms of ill health. Because health, like well-being, is multidimensional, and because the components of health do not correlate perfectly with one another, or with income-based measures, they conclude that income on its own is likely to be misleading as a short-cut measure of international health. In India, a data collection effort being coordinated by Duflo has integrated a village survey, a health facilities survey, weekly facility visit reports, household surveys, and direct health measurements. Together, these data document poor health across much of the population, except in self-reported health, which is described more positively. Ongoing work is exploring the effectiveness of various interventions designed to improve health in the region. Related research by Banerjee, Deaton, and Duflo looks at the caste system in rural India, where most of the population is either Brahmin (the group considered dominant in India for over 3000 years) or Scheduled Tribes (the lower rung of India's social hierarchy).¹³ They find that Brahmin consistently report that they are healthier, even after controlling for expenditures, assets, job security, education, and an array of direct health measures. Thus caste ranking, and not economic ranking, appears more important.

Some of the variation in adult health is found to trace back to childhood experience. For example, Carlos Bozzoli, Deaton, and Climent Quintana-Domeque develop a model in which the early life burden of nutrition and disease is not

only responsible for mortality in childhood but also leaves a residue of long-term health risks for survivors, risks that express themselves in adult height, as well as in late-life disease (12966). Using data from numerous countries around the world, they find that differences in infant mortality relate strongly to cross-country and cross-cohort variation in adult heights. A related study by Case and Christina Paxson finds that as early as age 3, before schooling has had a chance to play a role, and throughout childhood, taller children perform better on cognitive tests (12466). Childhood test scores, in turn, explain part of the height premium in adult earnings later in life. Yet another study by Case documents the extent to which height and corn production, both markers of early life environment, are associated with better health outcomes in later life.¹⁴ She finds suggestive evidence that height is correlated with corn production in the year before birth, and that taken together height and corn production have large and significant effects on health in old age.

Bruce D. Meyer and Wallace Mok focus on another source of the correlation between health and economic circumstances, identifying a very significant decline in both income and consumption following the onset of a disability.¹⁵ Other studies focus on the particular influences of education on health. For example, Cutler, Mary Beth Landrum, and Kate Stewart find that the better educated are less likely to have functional disabilities and, also important, they cope more effectively with functional impairments when they occur (12040). Among those who have functional disabilities, better-educated people use substantially more assistive technology than the less educated and are more likely to use paid help. They are less likely to use help from relatives. Other work by Cutler and Adriana Lleras-Muney suggests that the influence of education is not just through increased income, but also through different thinking and decisionmaking patterns that relate to health behaviors as well as to health outcomes (12352). They estimate that the monetary value of the return to

education in terms of health is perhaps half of the return to education on earnings, so policies that affect educational attainment could have a large effect on population health.

Trends in Health and Disability

An accumulating body of research has identified significant and ongoing improvements over time in the functional ability of older people, both in the United States and throughout the world. The implications of declining disability are enormous, and measurable in both social and economic terms. This has motivated another major component of the Aging Program's research, dealing with the foundations of health and disability trends, what might be done to extend and even accelerate future improvements in health and functional ability, and how the benefits can be evaluated and quantified in economic terms. Some of this work is compiled in a forthcoming volume by the University of Chicago Press.¹⁶

One direction of research analyzes historical trends in health, functional ability, and longevity. For example, a recent study by Cutler, Deaton, and Lleras-Muney considers reasons for the long-term decline in mortality rates, starting in a few countries in the eighteenth century, and continuing to fall today (11963). In just the past century, life expectancy in the United States has increased by over 30 years. Their work identifies the application of scientific advances and technical progress (some of which is induced by income and facilitated by education) as the ultimate determinant of health. Dora Costa also considers long-term improvements in health and longevity over the past century.¹⁷ Her results show that in the past, occupation was an important determinant of vascular heart disease, congestive heart failure, and joint and back problems. Declining infectious disease rates and the shift from blue-collar to white-collar jobs contributed to improving health. Other factors were advances in medical technology, diffusion of medical knowledge, improvements in the food supply, rising incomes and

living standards, public health reforms, and improved personal hygiene. Paula Canavese and Robert W. Fogel look at historical trends in arthritis prevalence, specifically, and also emphasize medical advances, as well as public health, lifestyle, and the distribution of occupations as important causes of improved health over time.¹⁸

Interestingly, while the long-term historical foundations of health trends may differ in detail from those that matter now, the major categories of influence are much the same. Medical advances, public health initiatives, improved health behaviors, improved economic conditions, and higher educational attainment all were relevant then, and are still relevant today.

Gabriel Aronovich, Jay Bhattacharya, Alan M. Garber, and Thomas E. MaCurdy study disability trends in the last 25 years, focusing on the role of arthritis, diabetes, hypertension, heart disease, stroke, overweight, and chronic obstructive lung disease.¹⁹ They find that primary prevention, as reflected in decreased disease prevalence, was not a leading factor in the advances made in elderly functioning between 1980 and 2000. Instead, the measured improvements in functioning reflect environmental, technological, and socioeconomic changes. Bhattacharya, Garber, and MaCurdy also consider the impact of the Balanced Budget Act (BBA) of 1997 on Medicare expenditures from 1997 to 2005.²⁰ Their results suggest that the BBA was successful in restraining expenditure growth among those who spend the most on health care, but had much less effect on low-end expenditures.

Other recent studies have looked at the pathways through which health declines. For example, Börsch-Supan, Florian Heiss, Michael D. Hurd, and I find that differences in self-reported health lead to dramatic differences in the likelihood of developing a disability subsequently.²¹ We also find very significant variation in pathways to disability across individuals with different education backgrounds, different incomes or wealth, or between those who are married and those who are single. At age 50, for example, people with eight or fewer years of edu-

cation are about four times more likely to be in poor health than people with 16 or more years of education. Landrum, Stewart, and Cutler focus on the clinical pathways through which health declines and identify dementia as a leading precursor to disability.²² Other conditions that often lead to disability include cardiovascular disease (particularly heart failure and stroke), fractures, Parkinson's disease, and arthritis. Condition-specific analyses have also been conducted, including a study by Cutler, Landrum, and Stewart on how medical advances have reduced disability from cardiovascular disease (12184).

Complementing the research on health is a series of studies on health-related behaviors, such as smoking, drinking, obesity, and control of blood pressure and cholesterol levels. For example, Cutler, Edward L. Glaeser, and Allison Rosen compare the risk factor profile of the population in the early 1970s with that of the population in the early 2000s (13013). Despite substantial increases in obesity in the past three decades, they find, the overall population risk profile now is healthier than it was. The largest contributors to these changes are reductions in smoking and better control of blood pressure. Increased obesity raised risk, but not by as much. The investigators raise a caution about the future, however. While smoking reductions can be expected to have continued impacts on improved health, future changes in obesity might more than overwhelm this trend. The optimistic side of this picture is the potential for better control of hypertension and high cholesterol among those who are overweight and obese. Other work by Cutler and Glaeser seeks to explain the differences in smoking, drinking, and other health-related behaviors across individuals in the United States (11100), as well as the differences in smoking rates between Europe and the United States (12124). The results show less correlation between different health-related behaviors than one might expect. One exception is those with more education, who have better health-related behaviors across multiple domains. In comparing smoking in Europe and the

United States, the authors find significant differences in beliefs about the health effects of smoking that, in turn, influence smoking rates.

Another area of our research has looked at trends in prescription drug costs, and the experience to date with Medicare Part D coverage for prescription drugs. For example, Bhattacharya, Garber, and MaCurdy find that expenditures on prescription drugs as a fraction of total medical expenditures grew sharply between 1992 and 2001.²³ The increase was especially large among recipients of Medicare disability insurance benefits, which was also the fastest growing segment of the Medicare population in the 1990s. Drug expenditures as a percentage of total medical expenditures rose from 10 percent to 16 percent among age-eligible Medicare beneficiaries, and from 12 percent to 25 percent for those enrolled in Medicare based on their disability. Rowilma Balza, Frank Caro, Florian Heiss, Byung-Hill Jun, Rosa Matzkin, Daniel McFadden, and Joachim Winter have studied Medicare Part D enrollment using an internet-based survey, finding that people's selection of a plan generally matches their health and financial circumstances in most cases.²⁴ Sendhil Mullainathan and Jeffrey Kling are also studying Medicare Part D enrollment and the factors influencing plan choice.

Amy Finkelstein has led a project on the market for long-term care insurance. In one study, Brown, Norma Coe, and she present evidence that Medicaid crowds out some of the demand that would otherwise exist for private long-term care insurance (12536). If every state moved from their current Medicaid asset eligibility requirements to the most stringent requirements allowed by federal law, for example, the demand for private long-term care insurance would rise somewhat, though the vast majority of households would still find it unattractive to purchase private insurance. Related work by Brown and Finkelstein illustrates the very large implicit tax that Medicaid imposes on the benefits paid from private insurance policies, and how this tax discourages private purchases of long-term care insur-

ance.²⁵ Finkelstein, Kathleen McGarry, and Amir Sufi find that those who discontinue their long-term care insurance policies have lower risk than those who keep them, leading to a riskier pool of individuals who remain covered, and to a less efficient market for long-term care insurance (11039). In a related finding, Brown and Finkelstein find that the typical long-term care insurance policy is marked up substantially above the expected benefits.²⁶

Economics, Psychology, Neurology and Genetics

One of the more innovative directions of Aging Program research has involved a series of investigations that are at the cross-section of multiple academic disciplines, and multiple frames of reference on human behavior. These include studies on the psychological foundations of economic decisionmaking, behavioral economics and experimental psychology, genetics, and neurology.

The work on psychology and economics has been applied most extensively to the study of saving in 401(k) plans, highlighting how individual saving decisions are motivated at least as much by psychological influences as by traditional economic factors. Aspects of program design, such as default provisions, framing, convenience, simplification, saliency of information, and pre-commitment become important in response to common behavioral qualities, such as procrastination and myopia. Many of the analyses of 401(k) plan design, described earlier in this report, are motivated by a mix of psychological and economic reasoning (10486, 11074, 11554, 11979, 12009, 12659). Some of these studies use choice experiments as an analytical tool to better understand economic behavior.

Other research relating to psychology and economics includes a study by Sumit Agarwal, John Driscoll, Xavier Gabaix, and Laibson on how the discount rates implied by financial decisions vary over the lifecycle (13191); a study by Choi, Laibson, and Madrian on how investors may use largely irrelevant financial information in making investment decisions,

depending on how the information is presented (12261); a study by Beshears, Choi, Laibson, and Madrian on the value of regulatory and individual pre-commitment strategies that reduce compulsive “in the moment” behaviors (11920); and a study by Gabaix and Laibson on how consumer markets may be manipulated by firms in response to myopic consumer decisionmaking (11755). Other studies by Gabaix, Laibson, Guillermo Moloche, and Stephen Weinberg have developed a model of bounded rationality in which individuals must make decisions with limited cognitive resources and limited time.²⁷

There are two major initiatives relating to genetics and economic behavior. In both, the aim is to identify genes relevant to human cognition and behavior, and to begin to quantify the relationship between them. First, Aging Program researchers have collaborated with researchers at other institutions to develop a panel of single-nucleotide polymorphisms (SNPs) in and near the genes that are most likely to relate to human cognition and economic behavior. They have also developed a methodological strategy that will be used to relate the characteristics of genes to economic decisionmaking and economic outcomes. A highly exploratory study by Daniel Benjamin, Christopher Chabris, Glaeser, Vilmundur Gudnason, Tamara Harris, Laibson, Lenore Launer, and Shaun Purcell identifies some important conceptual issues that will underlie “genoeconomics” research.²⁸ The other Program initiative on genetics and economics will draw on an enhanced version of the Longitudinal Study of Aging Danish Twins. The core LSADT data includes survey responses on health, cognition and functioning, as well as genetic and biological data from blood samples and cheek swabs. The enhanced version being used by Aging Program researchers includes a detailed economics supplement and a link to administrative data, enabling research on the potential role of genetics and heritability in influencing socioeconomic circumstances.

Research by Laibson and coauthors on the neurological basis of certain eco-

nomic decisions has applied neuro-imaging techniques to better understand the competing behavioral inclinations to be more impulsive, on the one hand, and more patient and carefully planned, on the other. An initial study by Jonathan Cohen, Laibson, George Lowenstein, and Samuel McClure finds that different areas of the brain are more or less actively stimulated, depending on the proximity of a prospective reward.²⁹ Some parts of the brain (the limbic system) appear to be stimulated only by immediately available rewards, and thus the power of temptation; other parts of the brain (the cortical system) value rewards at all time horizons. Continuing exploratory work is considering methods of “tuning down” the limbic responses that may lead to unhealthy impulsiveness, identifying individual differences in inter-temporal decisionmaking, and measuring the neural locus of self-regulation.

Concluding Observations

As emphasized in the introduction to this report, the Aging Program has been organized to a great extent around research themes and collaborative projects, many of which are described here. Among them are projects on the growth and determinants of retirement saving, retirement policy and labor market behavior, social security systems and retirement around the world, sustainable solvency for Social Security in the United States, the dynamic inter-relationship between health and economic circumstances over the life course, the causes and consequences of disability decline, the cost-effectiveness of medical advances, and economic decisionmaking in a multi-disciplinary context. Two new collaborative projects, likely to be featured in future Program Reports, are on population aging and the macroeconomy and national health accounts. We conclude with a preview of these initiatives.

Our new project on population aging and the macroeconomy is motivated by how demographic change transforms economic markets. The labor market must adapt to an older population base from

which to draw the productive labor force in the economy. Capital markets adjust to evolving age-based patterns of saving and investment behavior, and a dramatically increasing number of retirees. Industrial sectors are shifting to those products and services demanded by an older population, relative to those products and services used by those who are young. The demand for more and better health and long-term care services by an older population, by itself, will cause fundamental changes in the composition and character of the macroeconomy. Many other markets—education and training, recreation, housing, transportation, food, pharmaceuticals, almost any major market segment—must evolve to an older population demographic. There will also be implications for the macroeconomy as a whole: GDP, productivity, per capita income, and growth—all will be affected by demographic change. We have assembled a new research team to begin to consider these broader “macro” implications of demographic trends.

A second initiative, led by Cutler, deals with health care value and national health accounting. The goal of this project is to better relate what we spend on health and health care with the health outcomes that are obtained from that spending. Specifically, the project seeks to: 1) measure the health of the population; 2) understand how and why population health is changing; and 3) compare the costs and benefits of medical treatment changes over time. The project will also attempt to integrate in health measurements the multiple domains of health, including physical functioning, mental health, and the particular conditions that encompass health. Background work toward this integrated effort has been conducted in recent years, and has proceeded on two tracks: one focused on aggregate measurements and one focused on condition-specific analysis. Our hope is that the collaborative effort will be further enhanced by an outreach component, engaging academics, health care professionals and government officials in establishing workable national health accounts.

For more than two decades, the NBER Aging Program has focused widespread attention on population aging, and the health and economic circumstances of individuals as they age. It has also worked well in integrating a wide range of related research projects into a cohesive program, including regular interaction among members of the research team, extensive dissemination of research findings, external involvement in promoting aging-related research and data resource development in aging, organizing international collaborations and cross national comparisons of aging issues, sponsoring regular workshops and conferences on the economics of aging, and inspiring the collaborative engagement of both senior scholars and new investigators in the study of aging issues.

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Banks, Banking, and Crises

Gary Gorton*

The subprime mortgage credit crisis demonstrates that while financial intermediaries have changed in many ways, at root their problems remain the same. Indeed, the old problem of banking panics can reappear in new guises.

In the subprime mortgage crisis, investors without information about exactly which bonds have declined in value have refused to reinvest in the short-term obligations of structured vehicles, including Structured Investment Vehicles (SIVs) and Asset-Backed Commercial Paper Conduits. And, without financing from capital markets, these intermediary vehicles either must sell assets, causing the prices of a range of assets to fall and resulting in widespread losses, or must receive financing from their sponsor banks, reabsorbing the vehicles onto the balance sheet and resulting in decreased capital for the sponsoring banks. In this report I review my research on banks and banking, and look at bank crises in particular.

Implicit Contracting in Banking

In a 2006 paper, Nicholas Souleles and I studied the role of off-balance-sheet vehicles, like those mentioned above.¹ Such “special purpose vehicles” (SPVs) are legal entities with narrowly circumscribed roles; they are essentially thinly capitalized robot asset management firms, with no employees and no physical location. The assets of SPVs are financial obligations, typically commercial or consumer loans or mortgages, or

securities linked to such loans and mortgages. These assets may be originated by a single sponsoring financial institution, or may come from multiple originators. While the SPV owns the assets, the servicing of the assets (collecting the loan payments, repossessing the car, foreclosing on the house, and so on) is contracted out, commonly to the sponsor.

SPVs are a form of bank; they hold loans financed by short-term liabilities. The informationally opaque loans are originated by financial intermediaries and then sold to robot firms (SPVs) and financed in capital markets. Why don't banks just hold the loans, instead of selling them to SPVs? And, how can it be incentive-compatible for investors to buy SPV liabilities in capital markets, that is, why should investors in SPVs' liabilities believe that the loans held by SPVs are not lemons?

Souleles and I investigate these questions, arguing that the motivation for using SPVs is that they reduce bankruptcy costs because their assets avoid these costs. Off-balance-sheet financing is most advantageous for sponsoring firms that are risky or face large bankruptcy costs. Avoiding the potential “lemons problem” is more difficult because legal and accounting constraints require the SPV to be separate from the sponsor. SPVs are incentive-compatible because the sponsors can implicitly commit to subsidize or bail out their SPVs. In a repeated game context, this implicit contract can be supported by investors' threat not to invest in SPVs where the sponsor does not honor the implicit contract.

We test these predictions using a unique dataset on credit card securitizations and find that riskier firms securitize more and that the pricing on the

SPV debt includes a premium related to the sponsor's risk of default, in addition to the risk of the SPV's assets. Thus, it is not a surprise in the current credit crisis that sponsors are tending to their SPVs, reabsorbing them on-balance sheet in some cases and buying their liabilities in other cases.

Implicit contracts also arise in the area of loan sales, a phenomenon that should not happen according to the standard theory. A central idea in the theory of financial intermediation is that intermediaries produce information about potential borrowers that does not become known to outsiders; that is, it is private information.² From this point of view, loans should not be saleable in the capital markets because of lemons problems. Yet, starting in the 1980s, a market for loans opened in the United States that is now quite well developed. In two papers, George Pennacchi and I investigate these issues and also find support for the implicit contracting hypothesis.³

What Do Banks Do?

Because the loans in SPVs and those sold in loan markets are still originated by banks, the role of intermediaries is still important. What do banks do that is so important? On the asset side of their balance sheet, intermediaries produce information about potential borrowers and allocate credit. They also monitor borrowers and importantly, can restructure loans to try to control borrower behavior, as discussed in my paper with James Kahn.⁴ The role of banks in monitoring can be very significant, especially in economies that are more bank-oriented, for example Germany. Frank Schmid and I⁵ show that such bank-oriented economies, ones where the stock

* Gorton is a Research Associate in the NBER's Corporate Finance Program and the Robert Morris Professor of Banking and Finance at the Wharton School of the University of Pennsylvania.

market plays a much smaller role than in the United States, are a challenge to the notion that “efficient” financial markets are central to economic efficiency. James Dow and I link these two concepts of “efficiency” and also show how banks can allocate resources as efficiently as stock markets.⁶

On the liability side of bank balance sheets, banks create securities that are nearly riskless. Banks hold diversified portfolios (and historically could issue clearinghouse loan certificates when needed) so their liabilities, mainly demand deposits, can circulate as a means of exchange. Other liabilities, like certificates of deposit, are also important as near-money securities.⁷ This role of banks has evolved over many years. Before the U.S. Civil War there was no national currency and demand deposits were not widely used. Instead, banks printed their own money that circulated as a hand-to-hand currency. That period traditionally has been viewed as chaotic, with “wild cat” banks taking advantage of an unsuspecting public. However, this is not an accurate characterization of the period. In two studies on the pricing of free notes, I found a quite efficient market at that time.⁸ When notes circulated, they did so at a discount from par. The discount increased with the distance from the issuing bank. If a bank’s discount widened, there was an incentive to go to that bank and redeem the note. Monitoring banks in this period was based on market prices being efficient. It seems that bank panics started when demand deposits replaced bank notes. Being a claim jointly on a person’s account and the bank, demand deposits did not circulate, and the clearinghouse was born.

Banking Panics

Implicit contracts do not necessarily contemplate systemic problems, which may characterize the subprime crisis. There have been at least ten banking panics in U.S. history, but the last one, during the Great Depression, is a dim memory for most people. A banking panic

occurred when depositors at banks had reason to believe that their bank held assets of possibly lower value than they had previously believed. Banking panics tended to be a peculiarly American phenomenon because the United States had many banks (because of branching restrictions), resulting in less diversified portfolios than might otherwise have been the case.

Banking panics are not irrational, as Charles Calomiris and I show.⁹ Rather, they are rooted in a lack of information. Panics have tended to happen near business cycle peaks; with a recession coming on, there would indeed be some loans that would not be repaid.¹⁰ Depositors would go to their banks and demand their cash back, because the value of cash is easily determined, unlike the value of bank deposits. But the banking system could not honor these demands, since their loans are illiquid, so redemption was suspended. In fact, suspension was usually illegal, but was tolerated during panics.¹¹ The illiquidity of assets, and resulting plummeting prices should these assets be sold, meant that another solution needed to be found.

The Origins of Central Banking

The historical solution to panics evolved over the nineteenth century and the logic of the solution is at the root of much of central banking. The solution was the private organization of banks, called the clearinghouse. During normal times, bank clearinghouses did what the name suggests, clear checks. But during panics, when depositors were concerned about the failure of individual banks, the member banks transformed themselves into a single institution, one large diversified portfolio. The single institution would then issue claims—clearinghouse loan certificates—to replace demand deposits from individual banks. The loan certificates were claims on the joint portfolio of the member banks. Banks monitored each other’s loan portfolios to ensure that each was willing to share the liability of the group’s portfo-

lio. Essentially, banks created one giant portfolio of all member bank assets to diversity away the information asymmetry. Loan certificates that were backed by the banking system as a whole thus replaced depositors’ claims on individual banks. In 1984 and 1985 papers on my own, and in a 1987 paper with Donald Mullineaux and a recent paper with Lixin Huang, I have discussed the history and theory of bank clearinghouses.¹² These studies also show how central banking emerged from this institution.¹³

With the advent of the Federal Reserve System, the role of clearinghouses was diminished, with bank regulators taking over many of the clearinghouse regulatory functions. In the modern era, bank regulators face new challenges. For example, interest rate derivatives allow market participants to transfer the systematic risk of interest rate movements from one party to another. But, this does not diversify the risk. Where this risk ultimately resides is a question that I investigate with Richard Rosen.¹⁴

Also, the corporate governance of banks may give them an incentive to take risk, which Richard Rosen and I argue was the case in the 1980s and early 1990s.¹⁵ With disintermediation of chartered commercial banks by unregulated intermediaries, it has become harder for regulators to monitor risk in the broader banking system.¹⁶ Regulators cannot simply force banks to hold more capital because banks can simply exit the regulated industry by shrinking.¹⁷ One way to do that is by moving assets off-balance-sheet. The subprime crisis shows the affects of this: namely, in an important sense, risk in the banking system has been moved via credit derivatives and structured vehicles, out of the banking system. But, this has simply moved the “banking panic” to these vehicles. This, in part, is a by-product of bank regulation.

The problems of banking crises remain elsewhere in the modern world. Such problems can be large, as with the savings and loan crisis during 1988–92, or any of the forty or so crises in recent

history in other economies. These problems resulted in costs of 15-50 percent of GNP to clean up.¹⁸ So, Lixin Huang and I have studied the role of governments in bank bailouts.¹⁹ Basically, when the assets of the banking system need to be sold, it is not possible for private agents to purchase them for the simple reason that private agents don't have enough "liquidity." A private bank clearinghouse can create liquidity by creating money. But in the modern era, only the government or central bank can play this role. In the current crisis, the government has been less successful in playing this role, as of this writing.

Banks, Credit Crunches, and the Business Cycle

Historically, banking panics anticipated recessions. But, banks' credit allocation behavior also may be an autonomous part of the business cycle more generally. Large changes in bank credit allocation, sometimes called "credit crunches," appear to be an important part of macroeconomic dynamics. Bank lending is procyclical. Rather than change the price of loans—the interest rate—banks sometimes appear to ration credit. A dramatic example in the United States is the period shortly after the Basel Accord was agreed to in 1988, during which time the share of U.S. total bank assets composed of commercial and industrial loans fell from about 22.5 percent in 1989 to less than 16 percent in 1994. At the same time, the share of assets invested in government securities increased from just over 15 percent to almost 25 percent. More generally, it has been noted that banks vary their lending standards or credit standards.

Ping He and I study how banks compete in lending and how they set their lending standards.²⁰ Banks produce information about potential borrowers, but at the time they do not know how much information competitor banks are producing about the same borrowers. In a Green and Porter-style model of bank competition, we show that banking must involve credit crunches, periods when

banks cut back on credit, and increase the costly information production.

We test the model's predictions in a variety of loan markets by parameterizing the information that is at the root of bank beliefs about the behavior of other banks. It has been difficult to test models of repeated games, but we take a new approach in this work. The empirical tests are constructed based on parameterizing public information about relative bank performance that is at the root of banks' beliefs about rival banks' lending standards. In other words, proxies for banks' beliefs are directly constructed and their behavior is shown to be a function of changes in these variables. The relative performance of rival banks has predictive power for subsequent lending in the credit card market, where we can identify the main competitors. At the macroeconomic level, the relative bank performance of commercial and industrial loans is an autonomous source of macroeconomic fluctuations. In an asset-pricing context, the relative bank performance is a priced risk factor for both banks and nonfinancial firms. The factor-coefficients for nonfinancial firms are decreasing with size, consistent with smaller firms being more bank-dependent.

Summary

Banks and financial intermediation, generally, are at the core of the savings-investment process. The process of taking in consumers' savings and using these resources to finance investment happens in an opaque way, leading to information asymmetries that can cause panics and runs. This can take many different forms, as new financial innovations, such as credit derivatives and special purpose vehicles, can move risk off bank balance sheets. The subprime crisis is the latest lesson.

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¹² G. Gorton, "Private Bank Clearinghouses and the Origins of Central Banking," *Business Review, Federal Reserve Bank of Philadelphia* (January-February 1984), pp. 3–12; G. Gorton, "Clearinghouses and the Origin of Central Banking in the U.S.," *Journal of Economic History*, 45(2) (June 1985), pp. 277–83; G. Gorton and D. Mullineaux, "The Joint Production of Confidence: Endogenous Regulation and Nineteenth Century Commercial Bank Clearinghouses," *Journal of Money, Credit and Banking*, 19(4) (1987), pp. 458–68; G. Gorton and L. Huang, "Banking Panics and Endogenous Coalition Formation," *Journal of*

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¹⁵ G. Gorton and R. Rosen, "Corporate Control, Portfolio Choice, and the Decline of Banking," *NBER Working Paper No. 4247*, December 1992, and *Journal of Finance*, 50(5) (December 1995), pp. 1377–420.

¹⁶ G. Gorton, "Bank Regulation When 'Banks' and 'Banking' Are Not the Same," *Oxford Review of Economic Policy*, 10(4) (Winter 1994), pp.106–

19. The regulatory issues are quite different in transition economies; see G. Gorton and A. Winton, "Banking in Transition Economies: Does Efficiency Require Instability?" *Journal of Money, Credit, and Banking* 30 (1998), pp.621–50.

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¹⁸ S. Claessens, S. Djankov, and D. Klingebiel, "Financial Restructuring in East Asia: Halfway There?" *World Bank Financial Sector Discussion Paper No. 3*, 1999.

¹⁹ G. Gorton and L. Huang, "Liquidity, Efficiency, and Bank Bailouts" *American Economic Review* 94(3), (June 2004).

²⁰ G. Gorton and P. He, "Bank Credit Cycles," *Review of Economic Studies*, 2007, forthcoming.



NBER Profile: *Timothy Guinnane*

Timothy Guinnane was elected to the NBER's Board of Directors this fall to represent the Economic History Association. He is the Philip Golden Bartlett Professor of Economic History at Yale University.

Guinnane received his Ph.D. from Stanford University in 1988. He was a Visiting Scholar at the Russell Sage Foundation in 2000–1 and the Pitt Professor at the University of Cambridge in 2002–3. During 2007–8 he will be a Fellow at the Center for Advance Study in the Behavioral Sciences.

Guinnane's early research concerned demographic change in the nineteenth and early twentieth centuries, focusing on Ireland. His demographic interests continue, and he is currently working on projects that deal

with the fertility transition in Ireland and in Germany. Another interest is the problem of credit for poor people and how such lending has been organized in the past. He has written about the role of small-loan lenders in the United States in the early twentieth century as well as the cooperative credit systems that emerged in Germany and elsewhere in the nineteenth century. His most recent project matches three centuries of demographic and household-inventory data for the German kingdom of Württemberg, prior to World War I. This project aims to answer basic questions about when households began to accumulate assets, and so address a central puzzle in the process of industrialization in the past.



NBER Profile: *Harvey Rosenblum*



Harvey Rosenblum, the executive vice president and director of research at the Federal Reserve Bank of Dallas, has been elected to the NBER's Board of Directors representing the National Association for Business Economics (NABE). He is a past president of NABE.

Rosenblum received a B. A. in economics from the University of Connecticut and a Ph.D. in economics from the University of California, Santa Barbara. He began his career with the Federal Reserve as an economist with the Federal Reserve Bank of Chicago, advancing through the ranks to vice president and associate director of research in 1983. He was also a visiting professor of finance with DePaul University from 1973 until 1985. He joined the Dallas Fed as senior vice president and director of research in 1985 and was promoted to executive vice president in 2005.

A widely recognized expert on both national and Texas economies, Rosenblum has written articles for such publications as *The Journal of Finance*, *Wall Street Journal*, *Southwest Economy*, and *The Handbook of Banking Strategy*. Rosenblum is also a visiting professor of finance at Southern Methodist University, teaching courses in monetary policy, financial institutions and markets. His current research interests focus on monetary policy, inflation, and the growing impact of globalization on the U.S. economy and businesses.

Rosenblum also serves on the Board of the Texas Product Development and Small Business Incubator Council and as Executive director of the North American Association of Economics and Finance. He resides in Dallas, Texas with his wife Eileen. He has a daughter in Cambridge, Massachusetts, and a son in Hollywood, Florida.

Conferences

Inter-American Seminar on Economics

The NBER and the Universidad Torcuato di Tella (UTDT) in Buenos Aires, Argentina jointly sponsored this year's Inter-American Seminar on Economics on "Crime, Institutions, and Policies." The conference took place in Buenos Aires on November 29 and 30. The organizers were: **Sebastian Edwards**, University of California, Los Angeles and NBER; **Rafael Di Tella**, Harvard Business School and NBER; and **Ernesto Schargrodsky**, UTDT. They chose these papers for discussion:

Naci Mocan, Louisiana State University and NBER, and **Kaj Gittings**, Cornell University, "The Impact of Incentives on Human Behavior: Can We Make it Disappear? The Case of the Death Penalty"
Comments: Lucia Quesada, UTDT

Joao M. P. De Mello, Catholic University of Rio de Janeiro, and **Alexandre Schneider**, Secretary of Education for the city of Sao Paulo, "Age Structure Explaining a Large Shift in Homicides: the Case of the State of Sao Paulo"
Comments: Lucas Llach, UTDT

Brendan O'Flaherty and **Rajiv Sethi**, Columbia University, "Peaceable Kingdoms and War Zones: Preemption, Ballistics, and Murder in Newark"
Comments: Guillermo Cruces,

CEDLAS-UNLP

Ana Maria Ibanez and **Andres Moya**, Universidad de los Andes, "Do Conflicts Create Poverty Traps? Asset Losses and Recovery for Displaced Households in Colombia"
Comments: Martin Gonzalez Rozada, UTDT

Radha Iyengar, Harvard University and NBER, "Does the Certainty of Arrest Reduce Domestic Violence? Evidence from Mandatory and Recommended Arrest Laws"
Comments: Rafael Di Tella

Ernesto Schargrodsky and **Rafael Di Tella**, "Electronic Monitoring of Inmates"
Comments: Nestor Gandelman, Universidad ORT Uruguay

Angela K. Dills, Mercer University; **Garret Summers**, Harvard University; and **Jeffrey A. Miron**, Harvard University and NBER, "What Do Economists Know about Crime?"
Comments: Sebastian Edwards

Carlos Medina and **Leonardo Morales**, Banco de la Republica de Colombia; **Alejandro Gaviria**, Universidad de los Andes; and **Jairo Nunez**, Centro Nacional de Consultoria, "The Cost of Avoiding Crime: the Case of Bogota"

Comments: Alfredo Canavese, UTDT

Mirko Draca, London School of Economics; **Stephen Machin**, London School of Economics; and **Robert Witt**, University of Surrey, "Panic on the Streets of London: Police, Crime, and the July 2005 Terror Attacks"
Comments: Catherine Rodriguez, Universidad de los Andes

Maria Laura Alzua, IERAL-Fundacion Mediterranea; **Catherine Rodriguez**; and **Edgar Villa**, Universidad del Externado, "The Effect of Education on In-jail Conflict"
Comments: Andres Borenstein, British Embassy Buenos Aires

Sheng-Wen Chang, National Chengchi University; **N. Edward Coulson**, Penn State University; and **Ping Wang**, Washington University in St. Louis and NBER, "A Quantitative Study of Optimal Drug Policy in Low Income Neighborhoods"
Comments: Federico Weinschelbaum, UdeSA

Rodrigo R. Soares, University of Maryland and NBER, and **Joana Naritomi**, World Bank, "Understanding High Crime Rates in Latin America: the Role of Social and Policy Factors"
Comments: Alejandro Gaviria, Universidad de los Andes

Although decades of empirical research has demonstrated that criminal behavior responds to incentives, non-economists frequently express the belief that human beings are not rational enough to make calculated decisions about the costs and benefits of engaging in crime—therefore, they a priori draw the conclusion that criminal activity cannot be altered by incentives.

However, scientific research should not be driven by personal beliefs. Whether economic conditions matter, or deterrence measures—such as police, arrests, prison deaths, executions, and commutations—provide signals to people is an empirical question, which should be guided by a solid theoretical framework. **Mocan** and **Gittings** examine the relationship between state homicide rates

and death-penalty related outcomes (executions, commutations, and removals from death row). They alter econometric models in a number of directions to make the deterrence results disappear by deliberately deviating from the theoretically consistent measurement of the risk variables in a variety of ways. They further investigate the sensitivity of the results to changes in the estimation

sample (for example by removing high executing states from the sample) and weighting. Their basic results are insensitive to these and a variety of other specification tests performed in the paper. The results are often strong enough to hold up even under theoretically meaningless measurements of the risk variables. The findings are robust, providing evidence that people indeed react to incentives induced by capital punishment.

After reaching a historic peak by the end of the 1990s, homicides in large cities in the state of São Paulo dropped sharply. Several explanations have been advanced, most prominently improvements in policing, adoption of policies such as dry laws, and increased incarceration. **DeMello** and his co-authors show that demographic changes play a large role in explaining the dynamics of homicide. More specifically, they present evidence of a strong co-movement between the proportion of males in the 15–25 age bracket and homicides at the statewide and at city levels, and argue that the relationship is causal. They estimate that a 1 percent increase in the proportion of 15-to-24-year-old males causes a 4.5 percent increase in homicides.

Between 2000 and 2006 the murder rate in Newark doubled while the national rate remained essentially constant. Newark now has eight times as many murders per capita as the nation as a whole. Furthermore, the increase in murders came about through an increase in lethality: total gun discharges rose much more slowly than the likelihood of death per shooting. In order to explain these trends, **O’Flaherty** and **Sethi** develop a theoretical model of murder in which preemptive killing and weapon choice play a central role. Strategic complementarity amplifies changes in fundamentals, so areas with high murder rates (war zones) respond much more strongly to changes in fundamentals than those with low murder rates (peaceable kingdoms). In Newark, the changes in fundamentals that set off the spiral were a collapsing arrest rate (and probably a falling conviction rate), a reduction in prisoners, and a shrinking police force.

Internal conflicts entail large asset losses for segments of the civil population. Asset losses may compromise future welfare of households, leaving a legacy of structural poverty that is difficult to overcome. **Ibanez** and **Moya** analyze how asset losses occur during internal conflicts and the process of asset recovery after the shock. In order to achieve this objective, they concentrate on a particularly vulnerable group of victims of war: the displaced population in Colombia. They adopt quantitative and qualitative approaches to achieve this objective by: providing a detailed description of losses stemming from forced displacement; analyzing qualitative evidence to understand asset recovery processes for the displaced population; and estimating OLS, Instrumental Variable, and quartile regressions to identify the determinants of asset recovery. Their results indicate that recuperating or accumulating new assets is a rare event: only 25 percent of households are able to recuperate assets, and asset ownership seems still insufficient to overcome poverty. In addition, displaced households do not catch up as settlement in destination sites consolidates so, unless a positive intervention is implemented, displaced households will be locked in a low income trajectory and leaping forward to a high return asset level is highly unlikely.

Domestic violence remains a major public policy concern despite two decades of policy intervention. To eliminate police inaction in response to domestic violence, many states have passed mandatory arrest laws, which require the police to arrest abusers when a domestic violence incident is reported. These laws were justified by a randomized experiment in Minnesota that found that arrests reduced future violence. This experiment was conducted during a time period when arrest was optional. Using the FBI Supplementary Homicide Reports, **Iyengar** finds that mandatory arrest laws actually increased intimate partner homicides. She hypothesizes that this increase in homicides is attributable to decreased reporting. She investigates the validity of this reporting hypothesis

by examining the effect of mandatory arrest laws on family homicides where the victim is less often responsible for reporting. For family homicides, mandatory arrest laws appear to reduce the number of homicides. This study therefore provides evidence that these laws may have perverse effects on intimate partner violence, harming the very people they seek to help.

Schargrodsky and **Di Tella** study the arrest rates of individuals released from prison as opposed to those who were formerly being electronically monitored. They exploit the fact that electronic monitoring in Argentina is assigned to prisoners by judges with highly different preferences: some regularly assign prisoners to electronic monitoring while others never do so. Importantly, electronic monitoring is assigned without the requisite of a concomitant rehabilitation plan, facilitating the discussion of electronic monitoring as an individual policy. The researchers find that those “treated” with electronic monitoring have marginally lower arrest rates following their release than former prisoners treated in standard jails. Offenders who went through the electronic monitoring program have approximately 8 percent lower recidivism than offenders who went to prison. Moreover, among inmates under electronic monitoring, recidivism rates are actually lowest for those who by-passed jail by going directly from the police station to electronic surveillance. Offenders with a previous criminal record probably should be excluded from the electronic monitoring system, as their evasion and recidivism rates are high.

Dills, **Summers**, and **Miron** evaluate what economists have learned over the past 40 years about the determinants of crime. They base their evaluation on two kinds of evidence: an examination of aggregate data over long time periods and across countries, and a critical review of the literature. They argue that economists know little about the empirically relevant determinants of crime. This conclusion applies both to policy variables like arrest rates or capital pun-

ishment and to less conventional factors, such as abortion or gun laws. The reason is that even hypotheses that find some support in U.S. data for recent decades are inconsistent with data over longer horizons or across countries. The hypothesis that drug prohibition generates crime, however, is consistent with the long times-series and the cross-country facts about crime.

Medina and his co-authors study crime in Bogotá and find that households living in the highest socioeconomic stratum, stratum 6, are paying up to 7.2 percent of their house values to keep their average homicide rates the same and to avoid increasing them by a single standard deviation. Households in strata 5, those in the next richest group in the city, would be paying up to 2.4 percent of their house values to keep their average homicide rates. These results reveal the willingness to pay for security by households in Bogotá, and additionally, reveal that a supposed pure public good, like security, ends up propitiating urban private markets that auction security. These markets imply different levels of access to public goods among the population, and actually, the exclusion of the poorest.

Draca, Machin, and Witt contribute to two relatively small, but growing, literatures of high public policy relevance on the causal impact of police on crime and the economics of terrorism. They bring the two together by looking at what happened to crime before and after the terror attacks that hit central London in July 2005. The attacks resulted in a large redeployment of police officers to central London boroughs as compared to outer London — in fact, police deployment in central London increased by over 30 per-

cent in the six weeks following the July 7 bombings. In this time period, crime fell significantly in central relative to outer London. Study of the timing of the crime reductions and their magnitude, which types of crime were more affected, and a series of robustness tests looking at possible biases make them confident that their research approach identifies a causal impact of police on crime. Implementing an instrumental variable approach shows an elasticity of crime with respect to police of approximately -0.3, so that a 10 percent increase in police activity reduces crime by around 3 percent.

Using census data for Argentine prisons for the period 2002–2005, **Alzua, Rodriguez, and Villa** present evidence of the positive effect that prisoner education programs have on in-prison conflictivity, measured as sanctions or violent behavior of the prisoner. In order to overcome the problems of endogeneity of education, they explore an instrumental variables as well as a panel fixed effects approach. Their results show a decrease in participation in violent conflicts and bad behavior, which can be partially attributed to education.

The control of drug activity currently favors supply-side policies: drug suppliers in the United States face a much higher arrest rate and longer sentences than drug demanders. **Chang, Coulson, and Wang** construct a simple model of drug activity with search and entry frictions in labor employment and drug transactions, where the drug price and the distribution of population in a community are determined according to an occupational choice rule and a downward-sloping drug demand schedule. Through calibration analysis, they find

a strong “dealer replacement effect.” As a result, it is beneficial to lower the supply arrest rate and to raise the demand arrest rate from their current values. A tax-revenue neutral shift of 10 percent from supply-side to demand-side arrests can reduce the population of potential drug dealers by 22–25 thousand and raise aggregate local income by 380–400 million dollars at 2002 prices.

Soares and Naritomi discuss the pattern, causes, and consequences of the high crime rates observed in Latin America. Crime represents a substantial welfare loss and a potentially serious hindrance to growth. They conduct an informal assessment of the relative strength of the alternative hypothesis raised in the literature to explain the phenomenon. They argue that, despite being extremely high, the incidence of crime in the region is not much different from what should be expected based on socioeconomic and public policy characteristics of its countries. Estimates from the empirical literature suggest that most of its seemingly excessively high violence can be explained by three factors: high inequality, low incarceration rates, and small police forces. Still, country specific experiences have been different in many respects. The evidence suggests that effective policies toward violence reduction do exist and have been shown to work within the context of Latin America itself.

It is anticipated that these papers and discussions will be published in a University of Chicago Press conference volume. Its availability will be announced in a future issue of the *NBER Reporter*. The papers will also be available at “Books in Progress” on NBER’s website.

Economics of Agglomeration

An NBER Conference on the Economics of Agglomeration, organized by Edward L. Glaeser of NBER and Harvard University, took place in Cambridge on November 30 and December 1. These papers were discussed:

Edward L. Glaeser, and **Giacomo A.M. Ponzetto**, Harvard University, "Why Did the Death of Distance Hurt Detroit and Help New York?"
Discussant: Diego Puga, Universitat Pompeu Fabra and CREI

Thomas J. Holmes, University of Minnesota and NBER, and **Sanghoon Lee**, University of British Columbia, "Cities as Six-by-Six-Mile Squares"
Discussant: Joel Waldfofel, University of Pennsylvania and NBER

William R. Kerr, Harvard University, "Ethnic Inventors and Agglomeration"
Discussant: Jeffrey L. Furman, Boston University and NBER

Joel Waldfofel, "Who Benefits Whom in the Neighborhood? Demographics and Retail Product Geography"

Discussant: William C. Strange, University of Toronto

Amitabh Chandra and **Katherine Baicker**, Harvard University and NBER, "Agglomeration in the Health Industry"
Discussant: Stuart S. Rosenthal, Syracuse University

Stuart S. Rosenthal and **William C. Strange**, "Small Firms/Big Effects: The Impact of Agglomeration and Industrial Organization on Entrepreneurship"
Discussant: Gregory Lewis, Harvard University

Henry G. Overman, London School of Economics, and **Diego Puga**, IMDEA and Universidad Carlos III, "Labor Pooling as a Source of Agglomeration: an Empirical Investigation"
Discussant: Edward L. Glaeser

Matthew E. Kahn, University of California, Los Angeles and NBER, "New Evidence on Trends in the Cost of Urban Agglomeration"
Discussant: Joseph Gyourko, University of Pennsylvania and NBER

Pierre-Philippe Combes, University of Aix-Marseille; **Gilles Duranton**, University of Toronto; **Laurent Gobillon**, Institut National d'Etudes Demographiques; and **Sebastien Roux**, ENSAE, "Estimating Agglomeration Effects: Does Playing with Different Instruments Give a Consistent Tune?"
Discussant: Thomas J. Holmes

Joseph Gyourko; **Christopher Mayer**, Columbia University and NBER; and **Todd Sinai**, University of Pennsylvania and NBER, "What Accounts for Growing House Price and Income Dispersion Across Markets: Productivity, Sorting, or Both?"
Discussant: Matthew Kahn

Jed Kolko, Public Policy Institute of California, "Agglomeration and Co-agglomeration of Services Industries"
Discussant: Edward L. Glaeser

One of the great attractions of cities is that urban proximity speeds the flow of ideas. Improvements in communications technology could erode this advantage and allow people and firms to decentralize. On the other hand, if cities have an edge in producing new ideas, then communication technology may strengthen the demand for cities by increasing the returns to innovation. Improvements in communication technology can increase the returns to innovation by allowing new ideas to be used in more geographic locales. **Glaeser** and **Ponzetto** present a model that illustrates these two rival effects of communication technology on cities. They then show that the model can help us to understand why the past 35 years have been kind to

some cities, like New York and Boston, and devastating to others, like Cleveland and Detroit.

The empirical finding of Zipf's law for the size distribution of cities is one of the most celebrated in all of urban economics. In the literature, size generally refers to total population; this can be bigger in one city than another, both because of higher population density and because of having more land area. But one problem is that the land area of city units is often defined by arbitrary political and administrative considerations as opposed to considerations that urban economists would use to define the boundaries for scientific study. **Holmes** and **Lee** therefore examine the size distribution of cities looking only at the density mar-

gin, holding fixed the land-area margin. They focus on a particular land unit, a six-by-six mile square grid. Most of the United States was drawn up into such grids in the early 1800s for the purpose of land sales, and the resulting six-by-six mile squares were called townships. The researchers examine the population distribution across townships. Their main finding is that Zipf's law does not hold with six-by-six mile squares. When they do a Zipf's plot, not only is the slope not one, it is not even a straight line. Nevertheless, they do find some interesting empirical regularities that are robust over different cuts of the data. For example, the Zipf's plot has three regions. For small cities, the distribution is certainly not Pareto where there are always more

cities, the smaller the city size. Instead, on this end of the distribution, the density of city sizes actually decreases as size decreases. For intermediate size cities, the distribution is Pareto with a slope around 0.8. For large cities, the distribution is Pareto with a slope around 2. The researchers also propose an explanation for this “kink” between the intermediate and large cities using the monocentric city model.

The ethnic composition of U.S. inventors is undergoing a significant transformation with deep impacts for the overall agglomeration of U.S. innovation. **Kerr** applies an ethnic-name database to individual U.S. patent records to explore these trends in greater detail. He observes that the contributions of Chinese and Indian scientists and engineers to U.S. technology formation increase dramatically in the 1990s. At the same time, these ethnic inventors became more spatially concentrated across U.S. cities. The combination of these two factors helps to stop and reverse long-term declines in overall inventor agglomeration evident in the 1970s and 1980s. The heightened ethnic agglomeration is particularly evident in industry patents for high-tech sectors, and no similar trends are found in institutions constrained from agglomerating (for example, universities or government).

Because of fixed costs, additional people nearby confer a benefit on each other by helping to make more retail products available. Yet, because product preferences differ across groups of consumers, the appeal of what’s available depends on the mix of consumers. If product preferences relate to consumer characteristics such as race, income, age, and ethnicity, then product availability will be stimulated by concentration of like individuals. The sensitivity of product availability to demographic mix of consumers has been documented for metropolitan-area products, such as newspapers, radio, and television, as well as one neighborhood-level product, restaurants. **Waldfogel** revisits the question for a broader group of local retail establishments. Using the Consumer

Expenditure Survey, he documents that preferences differ across groups. Then, using the 2000 Census and the 2000 Zipcode Business Patterns, he shows that the mix of products available is sensitive to the mix of local preferences. People therefore derive benefit through the product market from agglomerating with persons with similar product preferences, and this may help to explain patterns of residential segregation.

There is substantial variation in the quality of care delivered by different hospitals, and while overall quality has been rising over time, many hospitals still lag behind. **Baicker** and **Chandra** explore potential sources of this variation, and examine whether hospitals “learn” to provide higher quality from their neighbors, particularly in cities. They examine detailed hospital-level data on adherence to best practices in the treatment of heart attack, heart failure, and pneumonia for 2004–6, along with information on population and hospital characteristics. They find that hospitals are likely to improve the quality of care that they offer more quickly if there are nearby hospitals offering superior care. Hospitals are particularly likely to learn from nearby teaching hospitals, and while city hospitals often begin by offering lower quality care, they are likely to converge towards the standard of care offered by their higher quality neighbors.

Rosenthal and **Strange** consider the relationship between local industrial organization and agglomeration economies. They begin by presenting a model of agglomeration, industrial organization, and entrepreneurship. The model’s key prediction is the existence of a virtuous circle of urban entrepreneurship: the presence of small establishments produces an environment conducive to growth, in particular entrepreneurial growth. They then investigate this prediction empirically, showing that additional activity at smaller establishments is associated with a larger amount of entrepreneurial activity.

Overman and **Puga** provide empirical evidence on the role of labor market pooling in determining the spatial

concentration of U.K. manufacturing establishments. This role arises because large concentrations of employment iron out idiosyncratic shocks and improve establishments’ ability to adapt their employment to good and bad times. The researchers measure the likely importance of labor pooling by calculating the fluctuations in employment of individual establishments relative to their sector and averaging by sector. Their results show that sectors whose establishments experience more idiosyncratic volatility are more spatially concentrated, even after controlling for a range of other industry characteristics that include a novel measure of the importance of localized intermediate suppliers.

Crime, pollution, and congestion pose major challenges to big-city quality of life. **Kahn** uses several datasets to examine recent trends. In the case of pollution and crime, big cities recently have experienced sharp improvements. Still, commute times continue to be longer in big cities relative to smaller cities. Kahn examines the role of suburbanization of jobs and households in explaining these observed patterns. Employment suburbanization has reduced commute times for suburban residents. Residential suburbanization also has reduced population exposure to urban crime and pollution. These two disamenities are spatially concentrated in the center cities. This paper highlights the quality of life benefits from population sprawl.

Combes and his co-authors revisit the estimation of urbanization economies using French wage and TFP data. To deal with the “endogenous quantity of labor” bias (that is, urban agglomeration as a consequence of high local productivity, rather than a cause), they take an instrumental variable approach and introduce a new set of geological instruments, in addition to standard historical instruments. To deal with the “endogenous quality of labor” bias (that is, cities attract skilled workers so that the effects of skills and urban agglomeration are confounded), they take a fixed effect approach with wage data. They find modest evidence about the endogenous quan-

tity of labor bias and both sets of instruments give a similar answer. They find that the endogenous quality of labor bias is quantitatively more important.

Urban success increasingly has taken two different forms in the post-war era. One involves very high house price growth with relatively little population growth, while the other pairs strong population expansion with mild house price appreciation. Associated with this is a growing spatial dispersion of house prices and incomes, both across and within markets. **Gyourko** and his co-authors document the nature of this dispersion; they then ask what can account for this relationship, and propose and analyze two basic explanations. One is differences in urban productivity attributable to agglomeration economies—a mainstay of urban economics. The other is a preference-based explanation that relies on sorting, with the rich ultimately outbidding others for the scarce slots available in supply-constrained metropolitan areas. The evidence suggests that

pure sorting is at least partially responsible for the urban outcomes they see, but it also is clear that much more work is needed to pin down the relative contributions of these two basic factors.

Economic research on industry location and agglomeration has focused nearly exclusively on manufacturing. **Kolko** shows that services are prominent among the most agglomerated industries, especially at the county level. Because traditional measures of knowledge spillovers, natural resource inputs, and labor pooling explain little of agglomeration in services industries, he takes an alternative approach and looks at co-agglomeration to assess why industries cluster together. By considering the location patterns of pairs of industries instead of individual industries, the traditional agglomeration explanations can be measured more richly, and additional measures—like the need to locate near suppliers or customers—can be incorporated. The results show that co-agglomeration between pairs of services

industries is driven by knowledge spillovers and the direct trading relationship between the industries, especially at the zip code level. Information technology weakens the need for services industries to co-agglomerate at the state level, perhaps because electronic transport of services outputs lowers the value of longer-distance proximity. These results are in sharp contrast to results for manufacturing, for which labor pooling contributes most to co-agglomeration, and the direct-trading relationship contributes more to state-level co-agglomeration. These differences between services and manufacturing are consistent with simple models of transport costs.

These conference proceedings will be published by the University of Chicago Press in an NBER Conference Volume. Its availability will be announced in the *NBER Reporter*. The papers will also be available at “Books in Progress” on the NBER’s website.

The Economics of High-Skill Labor Markets

An NBER/Universities Research Conference on “The Economics of High-Skill Labor Markets” took place in Cambridge on December 14 and 15. Organizers Marianne Bertrand, NBER and University of Chicago, and Paul Oyer, NBER and Stanford University, chose these papers for discussion:

Dan W. Elfenbein, Barton H. Hamilton, and Todd R. Zenger, Washington University, St. Louis, “Entrepreneurial Spawning Among Scientists and Engineers: Stars, Slugs, and Small Firms”
Discussant: Julie Berry Cullen, University of California, San Diego and NBER

Andrew Hussey, University of Memphis, “Compensating Differentials, Tournaments, and the Market for MBAs”
Discussant: Scott Schaefer, University of Utah

Radha Iyengar, Harvard University and NBER, “An Analysis of the Performance of Federal Indigent Defense Counsel”

(NBER Working Paper No. 13187)
Discussant: David Abrams, University of Chicago

Donna K. Ginther, University of Kansas, and **Shulamit Kahn**, Boston University, “Gender Differences in Academic Mobility in the Sciences and Social Sciences”
Discussant: Jon Guryan, University of Chicago and NBER

Jeffrey Lin, Federal Reserve Bank of Philadelphia, “Innovation, Cities and New Work”
Discussant: David Autor, MIT and NBER

Peter Cappelli, University of Pennsylvania and NBER, and **Monika Hamori**, Instituto de Empresa, “Executive Job Search”
Discussant: Rakesh Khurana, Harvard University

Phil Oreopoulos, University of Toronto and NBER; **Till von Wachter**, Columbia University and NBER; and **Andrew Heisz**, Statistics Canada, “The

Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates”(NBER Working Paper No. 12159)
Discussant: Henry Farber, Princeton University and NBER

Karen Selody, University of California, Berkeley, “Employer Learning and the Gender Pay Gap for Top Executives”
Discussant: Kevin Hallock, Cornell University and NBER

Julie Berry Cullen, and **Michael J. Mazzeo**, Northwestern University, “Implicit Performance Awards: An Empirical Analysis of the Labor Market for Public School Administrators”
Discussant: Kevin Lang, Boston University and NBER

Amitay Alter, Stanford University, “Estimating the Return to Organizational Form in the California Venture Capital Industry”
Discussant: Ulrike Malmendier, University of California, Berkeley and NBER

Elfenbein and his co-authors examine the determinants of transitions from paid employment into self employment by scientists and engineers between 1995 and 2001. They find that those working in small firms are significantly more likely to become self employed than those working in large firms. Entrepreneurs coming from both small firms and from large firms are more likely to be high performers (stars) or low performers (slugs) as measured by their pay in their prior jobs; this finding is particularly pronounced among those leaving small firms. Finally, there is some evidence that entrepreneurs coming from small firms perform better than those who come from large firms: they are more likely to persist in self-employment and earn more in their first period of self-

employment, controlling for a number of other factors. The researchers explore the degree to which these relationships can be explained by theories that focus on differences in opportunity costs, the strength of pay-performance relationships, and diversity of activity sets, and the acquisition of entrepreneurial capital in firms of different size.

Hussey investigates the labor market effects of obtaining an MBA degree. Despite estimated positive returns to the degree on earnings, there is a *negative* reduced-form effect of the MBA on managerial attainment, a finding that is especially puzzling since managerial status and earnings are highly positively correlated. This reduced-form result is extremely robust. In particular, the evidence shows that the negative effect of

an MBA on managerial attainment is *not* attributable to: observed or unobserved productivity differences between MBAs and non-MBAs; differential worker sorting across observable dimensions like firm size or industry; or a probationary period following MBA attainment. While basic models of MBA attainment cannot explain the key empirical regularities, Hussey’s model of worker sorting on the basis of differential preferences over unobserved job or career tracks does allow for these findings. The model is estimated using a panel data set consisting of registrants for the Graduate Management Admissions Test (GMAT). Estimation produces a positive overall effect (on wages and managerial attainment) of an MBA, and demonstrates the existence of a compensating differ-

ential between positions with a higher likelihood of managerial attainment versus positions with a lower likelihood of managerial attainment.

The right to an equal and fair trial regardless of wealth is a hallmark of American jurisprudence. To ensure this right, the government pays attorneys to represent financially needy clients. In the U.S. federal court system, indigent defendants are represented by either public defenders who are salaried employees of the court or private attorneys, known as Criminal Justice Act (CJA) attorneys, who are compensated on an hourly basis. **Iyengar** measures differences in performance of these types of attorneys and explores some potential causes for these differences. Exploiting the use of random case assignment between the two types of attorneys, her analysis of federal criminal case level data from 1997–2001 from 51 districts indicates that public defenders perform significantly better than CJA panel attorneys in terms of lower conviction rates and sentence lengths. An analysis of data from three districts linking attorney experience, wages, law school quality, and average caseload suggests that these variables account for over half of the overall difference in performance. These systematic differences in performance disproportionately affect minority and immigrant communities and as such may constitute a civil rights violation under Title VI of the Civil Rights Act.

Ginther and **Kahn** first address whether academic women *are* actually less likely than men to *choose* to change employers for a better job. Indeed, there are strikingly different rates of mobility for those not forced to move—those with tenure—compared to those who are untenured (but tenure-track) or non-tenure track. So, they concentrate this examination of mobility on tenured academics who are not forced to leave, but instead only leave voluntarily. They construct two different measures of a “better job.” One measure of advancement is a higher salary in the new job; their second measure of a better job combines institutional prestige and the person’s

academic rank into a single “academic job quality” measure. They find that tenured women are more likely than tenured men to move to better jobs, particularly those with higher ranks rather than higher salaries. Children hurt men’s mobility to better jobs but actually may help women’s. Marriage does not affect either tenured men’s or women’s mobility. Finally, of those who move to higher paying jobs, there is no evidence that “women don’t ask,” except at the very highest levels.

Where does adaptation to innovation take place? The supply of educated workers and local industry structure matter for the subsequent location of new work, that is, new types of labor-market activities that closely follow innovation. Using census 2000 microdata, **Lin** shows that regions with more college graduates and a more diverse industrial base in 1990 are more likely to attract these new activities. Across metropolitan areas, initial college share and industrial diversity account for 50 percent and 20 percent, respectively, of the variation in selection into new work unexplained by worker characteristics. **Lin** uses a novel measure of innovation output based on new activities identified in decennial revisions to the U.S. occupation classification system. New work follows innovation, but unlike patents, it also represents subsequent adaptations by production and labor to new technologies. Further, workers in new activities are more skilled, consistent with skill-biased technical change.

Cappelli and **Hamori** examine an important measure of job search in the context of executive-level jobs, using a unique dataset from a prominent executive search firm that identifies whether executives have pursued offers to be considered for a position at other companies. The unique attribute of this search process is that the initial call from the search firm is essentially an exogenous event for the executives: they also learn so little about a possible offer at that point that their decision has to rely on a judgment about the likelihood that an eventual offer is better than their reserva-

tion price. The researchers find support for the commonsense notion that individuals whose current job circumstances appear superior to those elsewhere are less inclined to search. They also find, as search theory predicts, that executives with longer experience with a firm are less likely to search. Finally, they find that the broader an executive’s job experience across different labor market segments, the more likely they are to search, suggesting that a portfolio of experiences makes the likelihood of a good match with an unknown job offer more likely.

Oreopoulos and his co-authors analyze the long-term effects of graduating in a recession on earnings, job mobility, and employer characteristics for a large sample of Canadian college graduates with different predicted earnings using matched university-employer-employee data from 1982 to 1999. They then use their results to assess the role of search frictions in the labor market. They find that young graduates entering the labor market in a recession suffer significant initial earnings losses that eventually fade, but only after eight to ten years. They also document substantial heterogeneity in the costs of recessions and important effects on job mobility and employer characteristics, but small effects on time worked. They show that these adjustment patterns could be explained by endogenous search for better employers in the presence of time-varying search costs and comparative advantage. All results are robust to an extensive sensitivity analysis including controls for correlated business cycle shocks after labor market entry, endogenous timing of graduation, permanent cohort differences, and selective labor force participation.

Since the early 1990s the pay gap between men and women in the top five executive positions of S&P 1500 companies has persisted in the range of 25 to 45 percent. One explanation is that executives who sit on the board, or “insiders,” favor their male colleagues rather than rewarding performance when they set executive pay. **Selody** examines whether greater corpo-

rate board independence alleviates the gender gap in executive compensation. She tests the effect of the 2003 change to NYSE/NASD Corporate Governance Listing Standards that required boards to become more independent and disallowed inside board members to serve on the compensation committee. She compares the gender gap in compensation in firms that were required to convert to more independent boards with those that were not, before and after the reform. She finds that the gender gap in compensation *increased* in firms that converted to more independent boards relative to firms that were not required to increase board independence. She then considers two main hypotheses: 1) that more independent boards are more committed to shareholder value, and so pay women executives closer to their marginal product; or, 2) that outsiders on the board have less information about executives' marginal product and so initially rely on imprecise or biased prior beliefs about women's ability as a group until they learn more about individual executives' productivity. Additional evidence supports the second hypothesis. The increased gender pay gap in firms

whose boards became more independent diminishes as board members learn more about executives' productivity through repeated observation. And, the increase in the gap is not uniform: it does not widen for CFOs and Legal Counsels, occupations with more specific credentials. Selody also finds an asymmetry in the response of men's and women's compensation to movements in market value. Women's compensation increases comparably to men's when market value increases, but decreases by *more* than men's when market value decreases, consistent with the hypothesis that boards' prior beliefs come into play when they attribute an outcome to luck or ability.

School principals increasingly are being called on to provide educational leadership in schools in the United States. Although prior studies have determined that individual principals can make a big difference to a school's trajectory, relatively little is known about their career profiles and the rewards for success. The labor market for principals potentially can inject a profit motive for improving public schools in what otherwise is considered to be a relatively noncompetitive market. **Cullen** and **Mazzeo** rely on indi-

vidual longitudinal data on the universe of Texas principals from 1989 through 2006 to track how levels and changes in school performance affects principals' salaries and mobility across schools. They test whether the dramatic enhancements in school accountability that presumably increased principal accountability moderate these relationships.

Alter studies the gains to productivity from joint work of individuals with different levels of human capital within a firm. The analysis is based on a unique panel dataset that documents partners, investments, and investment outcomes of venture capital (VC) firms in California during 1979-2002. Alter finds that more successful venture capitalists recruit more new partners and that this effect increases when there is growth in the aggregate number of VC investments. Based on these findings, he develops and estimates a structural model that quantifies the increase in venture capitalists' productivity through skill leverage in the firm. He finds that joint work increased productivity of experienced and inexperienced partners by 8 percent.

Program and Working Group Meetings

Economic Fluctuations and Growth

The NBER's Program of Research on Economic Fluctuations and Growth held its fall meeting in Chicago on October 19. NBER Research Associates Olivier J. Blanchard of MIT and Martin S. Eichenbaum of Northwestern University organized this program:

Ricardo J. Caballero, MIT and NBER, and **Arvind Krishnamurthy**, Northwestern University, "Collective Risk Management in a Flight to Quality Episode" (NBER Working Paper No. 12896)

Critic: A. Craig Burnside, Duke University and NBER

Robert E. Lucas, Jr., University of Chicago and NBER, "Trade and the Diffusion of the Industrial Revolution" (NBER Working Paper

No. 13286)

Critic: Peter J. Klenow, Stanford University and NBER

William Adams, Citigroup, and **Liran Einav** and **Jonathan Levin**, Stanford University and NBER, "Liquidity Constraints and Imperfect Information in Subprime Lending" (NBER Working Paper No. 13067)

Critic: Jonathan Parker, Northwestern University and NBER

Manuel Amador, Stanford University and NBER, and **Pierre-Olivier Weill**, University of California, Los Angeles, "Learning from Prices: Central Bank Communication and Welfare"

Critic: Ricardo Reis, Princeton University and NBER

Gita Gopinath, Harvard University and NBER; **Oleg Itskhoki**, Harvard University; and **Roberto Rigobon**, MIT and NBER, "Currency Choice and Exchange Rate Pass-Through" (NBER Working Paper No. 13432)

Critic: Emi Nakamura, Federal Reserve Bank of New York and NBER

Nicholas Bloom, Stanford University and NBER; **Raffaella Sadun**, London School of Economics; and **John Van Reenen**, London School of Economics and NBER, "Americans Do I.T. Better: U.S. Multinationals and the Productivity Miracle" (NBER Working Paper No. 13085)

Critic: John Fernald, Federal Reserve Bank of San Francisco

Severe flight-to-quality episodes involve uncertainty about the environment and not simply risk about asset payoffs. The uncertainty is triggered by unusual events and untested financial innovations that lead agents to question their world-view. **Caballero** and **Krishnamurthy** present a model of crises and central bank policy that incorporates *Knightian uncertainty*. Their model can explain crisis regularities, such as market-wide capital immobility, agents' disengagement from risk, and liquidity hoarding. They identify a social cost of these behaviors, and a benefit of a lender-of-last-resort facility. The benefit is particularly high because public and private insurance are complements during uncertainty-driven crises.

Lucas proposes a model to describe the evolution of real GDPs in the world economy that is intended to apply to all open economies. The five parameters of the model are calibrated using the Sachs-Warner definition of openness

and time-series and cross-section data on incomes and other variables from the nineteenth and twentieth centuries. The model predicts convergence of income levels and growth rates and has strong but reasonable implications for transition dynamics.

Adams, **Einav**, and **Levin** present new evidence on consumer liquidity constraints and the credit market conditions that might give rise to them. Their analysis is based on unique data from a large auto sales company that serves the subprime market. They first document the role of short-term liquidity in driving purchasing behavior, including sharp increases in demand during tax rebate season and a high sensitivity to minimum down payment requirements. They then explore the informational problems facing subprime lenders. They find that default rates rise significantly with loan size, providing a rationale for lenders to impose loan caps because of moral hazard. They also find that borrowers at the

highest risk of default demand the largest loans, but the degree of adverse selection is mitigated substantially by effective risk-based pricing.

Amador and **Weill** present a micro-founded economy with money where agents are uncertain about an aggregate productivity parameter and the monetary aggregate. They show that when agents learn from the distribution of prices, an increase in public information about the monetary aggregate can reduce the information content of the price system and welfare.

A central assumption of open economy macro models with nominal rigidities relates to the currency in which goods are priced, whether there is so-called producer currency pricing or local currency pricing. This has important implications for exchange rate pass-through and optimal exchange rate policy. Using novel transaction level information on currency and prices for U.S. imports, **Gopinath**, **Itskhoki**, and **Rigobon** show

that even conditional on a price change, there is a large difference in the pass-through of the average good priced in dollars (25 percent) versus non-dollars (95 percent). This finding is contrary to the assumption in a large class of models that the currency of pricing is exogenous and is evidence of an important selection effect that results from endogenous currency choice. The authors describe a model of optimal currency choice in an environment of staggered price setting and show that the empirical evidence strongly supports the model's predictions of the relation between currency

choice and pass-through. They further document evidence of significant real rigidities, with the pass-through of dollar pricers increasing above 50 percent in the long run. Finally, they numerically illustrate the currency choice decision in both a Calvo and a menu-cost model with variable mark-ups and imported intermediate inputs and evaluate the ability of these models to match pass-through patterns documented in the data.

Bloom, Sadun, and Van Reenen show that U.S. multinationals operating in the United Kingdom (UK) have higher productivity than non-U.S. mul-

tinational firms in the UK, primarily because of the higher productivity of their information technologies (IT). Furthermore, establishments that are taken over by U.S. multinationals increase the productivity of their IT, whereas observationally identical establishments taken over by non-U.S. multinationals do not. One explanation for these patterns is that U.S. firms are organized in a way that allows them to use new technologies more efficiently. The authors develop a model of endogenously chosen organizational form and IT to explain these new micro and macro findings.

Market Microstructure

The NBER's Working Group on Market Microstructure met in Cambridge on October 19. Group Director Bruce Lehmann of University of California, San Diego; Eugene Kandel, Hebrew University, Jerusalem; and Avanidhar Subrahmanyam, University of California, Los Angeles, jointly organized the meeting. These papers were discussed:

Viral Acharya, London Business School, and **S. Viswanathan**, Duke University, "Moral Hazard, Collateral, and Liquidity"
Discussant: Itay Goldstein, University of Pennsylvania

Emre Ozdenoren and **Kathy Yuan**, University of Michigan, "Feedback

Effects and Asset Prices"
Discussant: Alex Edmans, University of Pennsylvania

Francis X. Diebold, University of Pennsylvania and NBER, and **Georg H. Strasser**, University of Pennsylvania, "On the Correlation Structure of Microstructure Noise in Theory and Practice"
Discussant: Gideon Saar, Cornell University

Terrence Hendershott, University of California, Berkeley, and **Pamela Moulton**, Fordham Graduate School of Business, "The Shrinking New York Stock Exchange Floor and the Hybrid Market"
Discussant: Paul Bennett, New York

Stock Exchange

Eldar Nigmatullin, State Street Global Advisors, and **Konstantin Tyurin** and **Hao Yin**, Indiana University, "Heterogeneous VAR Dynamics of Limit Order Book Depth, Trade Imbalance, and Volatility on the NYSE"
Discussant: Christine Parlour, University of California, Berkeley

Thomas Chemmanur, Boston College; **Shan He**, Louisiana State University; and **Gang Hu**, Babson College, "The Role of Institutional Investors in Seasoned Equity Offerings"
Discussant: Michael Roberts, University of Pennsylvania

Acharya and **Viswanathan** consider collateral as a way to relax rationing in a moral hazard set-up. Rationed firms must liquidate some of their assets. Non-rationed firms purchase assets, but their borrowing capacity also is limited by moral hazard. The equilibrium price exhibits cash-in-the-market pricing and depends on the entire distribution of liquidity shocks in the economy. As the intensity of moral hazard varies, the

equilibrium price and the level of collateral requirements will be negatively related. Contrary to models in which collateral requirements are exogenously specified, here collateral has a stabilizing role on prices: for any given intensity of moral hazard problem, asset sales are smaller and equilibrium price, in turn, is higher in the presence of optimal collateral requirements. This price-stabilizing role implies that the ex-ante debt capac-

ity of firms is higher with collateral, which in turn stabilizes prices further, resulting in an important feedback: collateral reduces the proportion of ex-ante rationed firms and thus leads to greater market participation.

Feedback effects from asset prices to firm cash flows have been documented empirically. This finding raises a question: how are asset prices determined if price affects the fundamental value, which in

turn affects the price? In such an environment, by buying assets that others are buying, investors insure high future cash flows for the firm and subsequent high returns for themselves. Hence, investors have an incentive to coordinate, which may generate self-fulfilling beliefs and multiple equilibria. Using insights from global games, **Ozdenoren** and **Yuan** pin down investors' beliefs, analyze equilibrium prices, and find that strong feedback leads to higher excess volatility.

Diebold and **Strasser** use market microstructure theory to derive the cross-correlation function between latent returns and market microstructure noise. The cross-correlation at zero displacement is typically negative, and cross-correlations at nonzero displacements are positive and decay geometrically. When market makers are very risk averse, the cross-correlation pattern is inverted. The results may be useful for choosing among different market microstructure models and estimation of noise-robust measures of realized volatility.

At the end of 2006 the New York Stock Exchange (NYSE) introduced its Hybrid market. Hybrid greatly expanded electronic trading and reduced floor trading. Using this change as an instrument for floor activity, **Hendershott** and **Moulton** test the benefits of the repeated interactions available on the floor against the costs of on-floor traders being advantaged relative to off-floor traders. They find that measures of trading costs increase as floor activity decreases. In addition, cooperation on the floor decreases and transitory volatility increases. However, Hybrid increases

speed of execution. Together these findings support the existence of a tradeoff along these measures of market quality. Hybrid moved the NYSE to a different position on that tradeoff.

Nigmatullin, Tyurin, and Yin use a recent sample of data on Dow Jones (DJIA) stocks traded on the NYSE to study relationships between the state of the limit order book and high-frequency returns, volatility, and other market variables in the framework of heterogeneous vector autoregressions. They show that most of the information contained in the limit order book can be captured by four interpretable common factors related to the book's "shape". They demonstrate that these common factors have significant interactions with price volatility and instantaneous returns, even after controlling for total trade volume and signed order flow. However, the estimated coefficients across stocks exhibit considerable heterogeneity, which should be taken into account for proper inference. The impulse-response analysis reveals significant feedback between the shape of the limit order book and transaction volume, bid-ask spread, return, and short-run volatility.

Chemmanur, He, and Hu use a large sample of transaction-level institutional trading data to study the role of institutional investors in Seasoned Equity Offerings (SEOs), and in particular, to distinguish between a "manipulative trading" role and an "information production" role, as postulated by the theoretical literature on SEOs. The data allow them to explicitly identify institutional SEO share allocations for the

first time in the literature. They study whether institutional investors have private information about SEOs and its consequences for SEO share allocation, institutional trading before and after the SEO, and realized trading profitability, and the SEO discount. Their results can be summarized as follows: First, institutions are able to identify and obtain more allocations in SEOs with better long-term returns. Second, more pre-offer net buying of the SEO firm's equity by institutional investors is associated with more institutional SEO share allocations, and also more post-offer net buying. Third, institutions flip only a small fraction of their SEO share allocations: 3.2 percent during the first two days post-SEO. However, this lack of flipping does not appear to be costly to institutional investors: there is no significant difference between the extent of underpricing and the realized profitability of institutional SEO share allocation sales. Fourth, institutional investors' post-SEO trading significantly outperforms a naive buy-and-hold trading strategy in SEOs. Further, the profitability of post-offer trading in SEOs where institutions obtained allocations is higher than that of trading in SEOs where they did not obtain allocations. Finally, more pre-offer institutional net buying and larger institutional SEO share allocations are associated with a smaller SEO discount. Overall, these results are consistent with an information production rather than a manipulative trading role for institutional investors in SEOs.

International Finance and Macroeconomics

NBER's Program on International Finance and Macroeconomics met in Cambridge on October 26. NBER Research Associates Charles Engel, University of Wisconsin, and Linda Tesar, University of Michigan, organized the meeting. These papers were discussed:

Pierpaolo Benigno, Luiss Guido Carli and NBER, "Portfolio Choices with Near Rational Agents: A Solution of Some International-Finance Puzzles" (NBER Working Paper No. 13173)

Discussant: Laura Veldkamp, New York University

Harald Hau, INSEAD, and **Helene Rey**, London Business School and NBER, "Global Portfolio Rebalancing

under the Microscope"

Discussant: Michael B. Devereux, University of British Columbia

Stephanie E. Curcuru, Federal Reserve Board; **Tomas Dvorak**, Union College; and **Francis E. Warnock**, University of Virginia and NBER, "Cross-Border Returns Differentials" (a revised version of NBER Working Paper No. 13074)

Discussant: Kristin Forbes, MIT and NBER

Philip R. Lane, Trinity College Dublin, and **Jay C. Shambaugh**, Dartmouth College and NBER, "Financial Exchange Rates and International Currency Exposure" (NBER Working Paper No. 13433)

Discussant: Roberto Rigobon, MIT and NBER

Ceyhan Bora Durdu, Federal Reserve Board; **Enrique G. Mendoza**, University of Maryland and NBER; and **Marco E. Terrones**, International Monetary Fund, "Precautionary Demand for Foreign Assets in Sudden Stop Economies: An Assessment of the New Merchantilism" (NBER Working Paper No. 13123)

Discussant: Ariel Burstein, University of California, Los Angeles and NBER

Emmanuel Farhi, Harvard University and NBER, and **Xavier Gabaix**, New York University and NBER, "Rare Disasters and Exchange Rates: A Theory of the Forward Premium Puzzle"

Discussant: Eric Van Wincoop, University of Virginia and NBER

Benigno analyzes a dynamic model of consumption and portfolio decisions in which agents seek robust choices against some misspecification of the model's probability distribution. This near-rational environment can, at the same time, explain imperfect international portfolio diversification and break the link between cross-country consumption correlation and the real exchange rate as usually implied by standard preference specifications. Portfolio decisions imply moment restrictions on asset prices that are useful for extracting information on the degree of near-rationality present in the data.

The dramatic increase in the gross stock of foreign assets and liabilities has revived interest in the portfolio theory of international investment. Evidence on the validity of this theory has always been scarce and inconclusive. **Hau** and **Rey** derive testable empirical implications from microeconomic foundations. They then use a new comprehensive dataset on the investment decisions of approximately 2,000 international equity funds domiciled in four different currency

areas to revisit the empirical relevance of international portfolio rebalancing. The disaggregated data structure allows them to examine whether foreign-exchange-and-equity risk triggers the predicted rebalancing at the fund level. They find strong support for portfolio rebalancing behavior aimed at reducing both exchange rate and equity risk exposure for most countries.

If the United States persistently earned substantially more on its foreign investments ("U.S. claims") than foreigners earned on their U.S. investments ("U.S. liabilities"), there would be an increased likelihood that the current environment of sizeable global imbalances would evolve in a benign manner. However, **Curcuru**, **Dvorak**, and **Warnock** find that the returns differential of U.S. claims over U.S. liabilities is far smaller than previously reported and, importantly, is near zero for portfolio equity and debt securities. For portfolio securities, they confirm their finding using a separate dataset on the actual foreign equity and bond portfolios of U.S. investors and the U.S. equity and bond

portfolios of foreign investors; in the context of equity and bond portfolios, they find no evidence that the United States can count on earning more on its claims than it pays on its liabilities. Finally, they show that their finding of a near zero returns differential is consistent with observed patterns of cumulated current account deficits, the net international investment position, and the net income balance.

Lane and **Shambaugh** aim to gain a better empirical understanding of the international financial implications of currency movements. To this end, they construct a database of international currency exposures for a large panel of countries over 1990–2004. They show that trade-weighted exchange rate indexes are insufficient for understanding the financial impact of currency movements. Further, they demonstrate that many developing countries hold short foreign-currency positions, leaving them open to negative valuation effects when the domestic currency depreciates. However, they also show that many of these countries have substantially reduced their

foreign currency exposure over the last decade. Last, they show that their currency measure has high explanatory power for the valuation term in net foreign asset dynamics: exchange rate valuation shocks are sizable, not quickly reversed, and may entail substantial wealth shocks.

Financial globalization was off to a rocky start in emerging economies hit by Sudden Stops since the mid-1990s. Foreign reserves grew very rapidly during this period, and hence it is often argued that we live in the era of a New Merchantism in which large stocks of reserves are a war-chest for defense against Sudden Stops. **Durdu, Mendoza, and Terrones** conduct a quantitative assessment of this argument using a stochastic intertemporal equilibrium framework with incomplete asset markets in which precautionary saving affects foreign assets via three mechanisms: business cycle volatility, financial globalization, and Sudden Stop risk. In this framework, Sudden Stops are an equilibrium outcome produced by an

endogenous credit constraint that triggers Irving Fisher's debt-deflation mechanism. Their results show that financial globalization and Sudden Stop risk are plausible explanations of the observed surge in reserves but business cycle volatility is not. In fact, business cycle volatility has declined in the post-globalization period. These results hold whether they use the formulation of intertemporal preferences of the Bewley-Aiyagari-Hugget class of precautionary savings models or the Uzawa-Epstein setup with endogenous time preference.

Farhi and Gabaix propose a new model of exchange rates that yields a theory of the forward premium puzzle. Their explanation combines two ingredients: the possibility of rare economic disasters and an asset view of the exchange rate. Their model is frictionless, has complete markets, and works for an arbitrary number of countries. In the model, rare worldwide disasters can occur and affect each country's productivity. Each country's exposure to disaster risk varies over time according to a mean-revert-

ing process. Risky countries command high risk premia: they feature a depreciated exchange rate and a high interest rate. As their risk premium reverts to the mean, their exchange rate appreciates. Therefore, the currencies of high interest rate countries appreciate on average. This provides an explanation for the forward premium puzzle (a.k.a. uncovered interest rate parity puzzle). They then extend the framework to incorporate two factors: a disaster risk factor and a business cycle factor. They calibrate the model and obtain quantitatively realistic values for the volatility of the exchange rate, the forward premium puzzle regression coefficients, and near-random walk exchange rate dynamics. Finally, they work out a model of the stock market, which allows them to make a series of predictions about the joint behavior of exchange rates, bonds, options, and stocks across countries. The evidence from the options market appears to be supportive of the model.

Political Economy

The NBER's Working Group on Political Economy, directed by Alberto Alesina of Harvard University, met in Cambridge on October 26. These topics were discussed:

"Long Term Persistence", **Luigi Guiso**, European University Institute; **Paola Sapienza**, Northwestern University and NBER; and **Luigi Zingales**, University of Chicago and NBER

"Votes or Money? Theory and Evidence from the U.S. Congress", **Matilde**

Bombardini, University of British Columbia, and **Francesco Trebbi**, University of Chicago and NBER

"Parochial Politics: Ethnic Preferences and Politician Corruption", **Abhijit V. Banerjee**, MIT and NBER, and **Rohini Pande**, Harvard University

"Momentum in Presidential Primaries", **Brian Knight**, Brown University and NBER, and **Nathan Schiff**, Brown University

"Segregation and Black Political Efficacy", **Elizabeth Olmshans Ananat**, Duke University and NBER, and **Ebonya Washington**, Yale University and NBER

"Accountability, Selection, and Experience: Theory and Evidence from U.S. Term Limits", **James Alt**, Harvard University; **Ethan Bueno de Mesquita**, University of Chicago; and **Shanna Rose**, New York University

Is social capital long lasting? Does it affect long-term economic performance? To answer these questions, **Guiso, Sapienza, and Zingales** test Putnam's conjecture that today's marked differences in social capital between the North

and South of Italy are attributable to the culture of independence fostered by the free city states experience in the North of Italy at the turn of the first millennium. The researchers show that the medieval experience of independence does have an

impact on social capital *within* the North, even when they instrument for the probability of becoming a city state with historical factors (such as the Etruscan origin of the city and the presence of a bishop in year 1,000). More impor-

tantly, they show that the difference in social capital between towns that had the characteristics to become independent in the Middle Ages and towns that did not exists *only* in the North (where most of these towns did become independent), not in the South (where the power of the Norman kingdom prevented them from doing so). Their difference-in-difference estimates suggest that at least 50 percent of the North-South gap in social capital is attributable to the lack of a free city state experience in the South.

Bombardini and Trebbi investigate the relationship between the size of interest groups, in terms of voter representation, and their campaign contributions to politicians. The authors uncover a robust hump-shaped relationship between the voting share of an interest group and its contributions to a legislator. This pattern is rationalized in a simultaneous bilateral bargaining model where the size of an interest group affects the amount of surplus to be split with the politician (thereby increasing contributions), but is also correlated with the strength of direct voter support that the group can offer instead of money (thereby decreasing contributions). The model yields simple structural equations that are estimated at the district level, with data on individual and PAC donations and local employment by sector. This procedure yields structural estimates of electoral uncertainty and politicians' effectiveness as perceived by the interest groups. The approach also implicitly delivers a novel method for estimating the impact of campaign spending on election outcomes: the authors find that an additional vote costs a politician between 100 and 400 dollars depending on the district.

Banerjee and Pande examine how increased voter ethnicization, defined as a greater preference for the party representing one's ethnic group, affects politician quality. If politics is characterized by incomplete policy commitment, then ethnicization reduces average winner quality for the pro-majority party with the opposite true for the minority party. The effect increases with greater numerical dominance of the majority (and thus

social homogeneity). Empirical evidence from a survey on politician corruption that the authors conducted in North India is remarkably consistent with their theoretical predictions.

Knight and Schiff investigate the role of momentum in sequential voting systems, such as the U.S. presidential primary. In particular, they develop and estimate a simple discrete choice econometric model with social learning, which generates momentum effects. In the model, voters are uncertain about candidate quality, and voters in late states attempt to infer the information held by voters in early states from aggregate voting returns. Candidates experience momentum effects when their performance in early states exceeds voter expectations. The magnitude of momentum effects depends on voters' prior beliefs about the quality of candidates, expectations about candidate performance, and the degree of variation in state-level preferences. The empirical application focuses on the 2004 Democratic primary. The authors find that Kerry benefitted substantially from surprising wins in early states and took votes away from Dean, who stumbled in early states after holding strong leads in polling data prior to the primary season. The estimated model demonstrates that social learning is strongest in early states and, by the end of the campaign, returns in other states are virtually ignored by voters in the latest states. Finally, the authors simulate the election under a counterfactual simultaneous primary and find that the primary would have been much closer under such a system because of the absence of momentum effects.

The impact of segregation on Black political efficacy is theoretically ambiguous. On one hand, increased contact among Blacks in more segregated areas may mean that Blacks are better able to coordinate political behavior. On the other hand, lesser contact with non-Blacks may mean that Blacks have less political influence over voters of other races. **Ananat and Washington** investigate this question empirically. They find that exogenous increases in segre-

gation lead to decreases in Black civic efficacy, as measured by an ability to elect Representatives who vote liberally and, more specifically, in favor of legislation that is favored by Blacks. This tendency for Representatives from more segregated metropolitan statistical areas (MSAs) to vote more conservatively arises in spite of the fact that Blacks in more segregated areas hold more liberal political views than do Blacks in less segregated locales. The authors find that this decrease in efficacy is driven by greater divergence between Black and non-Black political views in the most segregated areas. Because Blacks are a minority in every MSA, increased divergence by race implies that the mean Black voter viewpoint is farther away from the mean voter viewpoint. The authors offer suggestive evidence that this increased divergence is attributable to both lower "contact" and to selection of more conservative non-Blacks into more segregated MSAs. Thus, reduced Black political efficacy may be one reason that Blacks in exogenously more segregated areas experience worse economic outcomes.

Previous theoretical and empirical research on term limits has focused on the problem of accountability—that is, the possibility that term-limited politicians exert less effort than those who are eligible to run for reelection. **Alt** and his co-authors present a model with both accountability and selection effects, in which term limits not only cause incumbents to shirk but also interfere with voters' ability to reelect high-quality candidates. The authors also show how this model can be extended to address the possibility that incumbent quality increases with experience in office. They evaluate the model by taking advantage of variation in gubernatorial term-limit laws across states and over time. They find evidence suggesting that term limits not only cause politicians to shirk, but also reduce expected incumbent quality by limiting voters' ability to select competent politicians and by limiting incumbents' ability to gain experience in office.

Public Economics

The NBER's Program on Public Economics met in Cambridge on November 1 and 2. NBER Research Associates Mihir A. Desai of Harvard Business School and James R. Hines, Jr. of the University of Michigan organized this program:

B. Douglas Bernheim, Stanford University and NBER, and **Antonio Rangel**, California Institute of Technology and NBER, "Beyond Revealed Preference: Choice Theoretic Foundations for Behavioral Welfare Economics"
Discussant: Daniel Silverman, University of Michigan and NBER

Eduardo M. Engel, Yale University and NBER; **Ronald Fischer**, University of Chile; and **Alexander Galetovic**, University of the Andes, "The Basic Public Finance of Public-Private Partnerships" (NBER Working Paper No.13284)

Discussant: Raj Chetty, University of California, Berkeley and NBER

Alan J. Auerbach and **Ronald Lee**, University of California, Berkeley and NBER, "Welfare and Generational Equity in Sustainable Unfunded Pension Systems"
Discussant: Peter A. Diamond, MIT and NBER

Gregory Mills, Abt Associates; **William G. Gale** and **Emil Apostolov**, Brookings Institution; **Rhiannon Patterson**, U.S. Government Accountability Office; and **Gary V. Engelhardt** and **Michael Eriksen**, Syracuse University, "Effects of Individual Development Accounts on Asset Purchase and Saving Behavior: Evidence from a Controlled Experiment"
Discussant: Katherine Baicker, Harvard University and NBER

Louis Kaplow, Harvard University and NBER, "Optimal Policy with Heterogeneous Preferences"
Discussant: Ivan Werning, MIT and NBER

Hanming Fang, Duke University and NBER, and **Alessandro Gavazza**, Yale University, "Dynamic Inefficiencies in Employment-Based Health Insurance Systems: Theory and Evidence" (NBER Working Paper No. 13371)
Discussant: Amy Finkelstein, MIT and NBER

Simeon Djankov, **Caralee McLiesh**, and **Rita Ramalho**, World Bank; **Tim Ganser**, Kennedy School of Government; and **Andrei Shleifer**, Harvard University and NBER, "The Effect of Corporate Taxes on Investment and Entrepreneurship"
Discussant: Joel Slemrod, University of Michigan and NBER

Bernheim and **Rangel** propose a universal choice-theoretic framework for evaluating economic welfare with the following features: 1) In principle, it encompasses all behavioral models; it is applicable irrespective of the processes generating behavior, or of the positive model used to describe behavior. 2) It subsumes standard welfare economics both as a special case (when standard choice axioms are satisfied) and as a limiting case (when behavioral anomalies are small). 3) Like standard welfare economics, it requires only data on choices. 4) It is easily applied in the context of specific behavioral theories, such as the β, δ model of time inconsistency, for which it has novel normative implications. 5) It generates natural counterparts for the standard tools of applied welfare analysis, including compensating and equivalent variation, consumer surplus, Pareto optimality, and the contract curve, and permits a broad generalization of the first welfare theorem.

6) Though not universally discerning, it lends itself to principled refinements.

Engel, **Fischer**, **Galetovic** note that public-private partnerships (PPPs) cannot be justified because they free public funds. When PPPs are desirable because the private sector is more efficient, then the contract that optimally trades demand risk, user-fee distortions, and the opportunity cost of public funds is characterized by a minimum revenue guarantee and a cap on the firm's revenues. Yet income guarantees and revenue sharing arrangements observed in practice differ fundamentally from those suggested by the optimal contract. The optimal contract can be implemented via a competitive auction with realistic informational requirements, and risk allocation under the optimal contract suggests that PPPs are closer to public provision than to privatization.

Actual and projected population aging threatens the financial viability of

Pay-As-You-Go (PAYGO) pension programs in many countries. Reforms that adjust the general level of taxes or benefits in PAYGO programs can address the problem of fiscal sustainability, but would have little effect on incentives for work. A new kind of pension program, called Notional Defined Contribution or Non-financial Defined Contribution (NDC), is intended to address both fiscal stability and labor supply incentives. Sweden has developed and implemented an NDC system and some other countries have followed suit. Germany has recently adopted pension reforms that reflect some of the NDC principles, and France is also considering doing so. NDC plans are intended to mimic the structure and incentives of Defined Contribution plans, but with rates of return that are feasible within the PAYGO framework. **Auerbach** and **Lee** analyze generational uncertainty and risk sharing in a context of economic and demographic uncer-

tainty, with the goal of finding more general properties of a variety of PAYGO pension systems. They compare the performance of the Swedish system and variants based on it, the German system, and versions of the U.S. system, modified to ensure fiscal sustainability.

Mills and his co-authors evaluate the first controlled field experiment on Individual Development Accounts (IDAs). Including their own contributions and matching funds, treatment group members in the Tulsa, Oklahoma program could accumulate \$6,750 for home purchase or \$4,500 for other qualified uses. Almost all treatment group members opened accounts, but many withdrew all funds for unqualified purposes. Among renters at the beginning of the experiment, the IDA increased homeownership rates after four years by 7–11 percentage points and reduced non-retirement financial assets by \$700–\$1,000. The IDA had almost no other discernable effect on other subsidized assets, overall wealth, or poverty rates.

Optimal policy rules—including those regarding income taxation, commodity taxation, public goods, and externalities—are typically derived in models with preferences that are homogeneous. **Kaplow** reconsiders many central results for the case in which preferences for commodities, public goods, and externalities are heterogeneous. When preference differences are observable, standard second-best results in basic settings are unaffected, except those for the optimal income tax. Optimal marginal income tax rates may be higher or lower on types who derive more utility from various goods, depending on the nature of preference differences and the concavity of the social

welfare function. When preference differences are unobservable, all policy rules may change. The determinants of even the direction of optimal rule adjustments are many and subtle.

Fang and **Gavazza** investigate how the employment-based health insurance system in the United States affects individuals' life-cycle health-care decisions. They take the view that health is a form of human capital that affects workers' productivity on the job and derive implications of employees' turnover on the incentives to undertake health investment. Their model suggests that employee turnover leads to dynamic inefficiencies in health investment and, particularly, it suggests that an employment-based health insurance system in the United States might lead to an inefficiently low level of individual health during individuals' working ages. Moreover, they show that under-investment in health is positively related to the turnover rate in the workers' industry and increases medical expenditure in retirement. The authors provide empirical evidence for the predictions of the model using two datasets, the Medical Expenditure Panel Survey (MEPS) and the Health and Retirement Study (HRS). In MEPS, they find that employers in industries with high turnover rates are much less likely to offer health insurance to their workers. When employers offer health insurance, the contracts have higher deductibles, and employers' contributions to insurance premiums are lower in high turnover industries. Moreover, workers in high turnover industries have lower medical expenditures and undertake less preventive care. In HRS, the authors find instead that individuals who were employed in high turnover industries

have higher medical expenditures when retired. The magnitude of these estimates suggests a significant degree of intertemporal inefficiency in health investment in the United States as a result of the employment-based health insurance system. The authors also evaluate and cast doubt on alternative explanations.

Shleifer and his co-authors present two new datasets that might be of interest to researchers and describe some basic statistical relationships using these and other datasets. The first dataset computes comparable effective corporate tax rates for 85 countries, using a survey of PriceWaterhouseCoopers local offices designed to estimate all corporate, labor, and "other" taxes that each country levies on "the same" firm. The researchers show that these rates are sharply lower than marginal tax rates around the world. The second dataset, collected from national statistical offices, presents official registration rates by new firms in 62 countries. The authors use these datasets, as well as additional publicly available data, to present cross-country evidence that corporate taxes have a large and significant adverse effect on corporate investment and entrepreneurship. They are also associated with a larger unofficial economy, greater reliance on debt versus equity finance, and possibly lower economic growth. Although the tax data presented here has some advantages over what is already available, it is also limited in a number of ways. It does not consider taxes that do not enter the profit and loss statement (such as the VAT), or where the statutory incidence is not on the business. Nor can the researchers deal with the crucial issues of incidence.

Health Care

The NBER's Health Care Program met in Cambridge on November 8. NBER Research Associate Mark Duggan, University of Maryland, organized this program:

David M. Cutler, Harvard University and NBER, and **Adriana Lleras-Muney**, Princeton University and NBER, "Understanding Differences in Health Behaviors by Education"

Amalia R. Miller, University of Virginia, and **Catherine E. Tucker**, MIT, "Can Healthcare IT Save Babies?"

M. Kate Bundorf and **Daniel P. Kessler**, Stanford University and NBER; **Natalie Chun**, Stanford University; and **Gopi Shah Goda**, Harvard University, "Do Consumers Respond to Quality

Information? The Case of Infertility Clinics"

Ana Aizcorbe, Bureau of Economic Analysis, and **Nicole Nestoriak**, Bureau of Labor Statistics, "Changes in Treatment Intensity, Treatment Substitution, and Price Indexes for Health Care Services"

Douglas Almond, Columbia University and NBER; **Lena Edlund**, Columbia University; and **Marten Palme**, Stockholm University, "Chernobyl's Subclinical Legacy: Prenatal Exposure to Radioactive Fallout and School Outcomes in Sweden" (NBER Working Paper No. 13347)

Joseph J. Doyle, Jr., MIT and NBER, "Returns to Local-Area Health Care

Spending: Using Health Shocks to Patients Far From Home" (NBER Working Paper No. 13301)

Hanming Fang, Duke University and NBER, and **Alessandro Gavazza**, Yale University, "Dynamic Inefficiencies in the Employment-Based Health Insurance System: Theory and Evidence" (NBER Working Paper No. 1337133 — see "Public Economics Program Meeting" earlier in this issue)

Martin Gaynor and **William Vogt**, Carnegie-Mellon University and NBER, and **Samuel Kleiner**, Carnegie-Mellon University, "Analysis of Hospital Production: An Output Index Approach"

Using a variety of datasets in two countries, **Cutler** and **Lleras-Muney** examine the relation between education and health behaviors. With a number of different theories, they are able to account for a good share of the education gradient. Income, health insurance, and family background account for about 30 percent. Their most surprising result is that education seems to influence cognitive ability, and cognitive ability in turn leads to healthier behaviors. They estimate that cognitive ability accounts for about 20 percent of the education gradient. Many economic theories stress the role of tastes in explaining behavioral differences: better educated people will have lower discount rates or risk aversion. None of their proxies for discounting or risk aversion explain any of the gradients in health behaviors. They also find that theories that suggest that personality factors, such as sense of control of one self or over one's life, do not account for much of the education gradient. Finally, they find some evidence that the social environment is healthier for the better educated, and accounts for about 10 percent of the education gradient.

The United States has a higher infant mortality rate than most other developed nations. Electronic medical records (EMR) and other healthcare information technology (IT) improvements could reduce that rate, by standardizing treatment options and improving monitoring. **Miller** and **Tucker** use variations in state medical privacy laws that affect the usefulness of healthcare IT to quantify how much healthcare IT improves neonatal outcomes. They find that adoption of healthcare IT by hospitals in a county significantly reduces infant mortality rates in that county, and that the gains are significantly larger for African-Americans than for Whites. They also find that adoption of radiological information systems in particular matters more in counties with above-average ultrasound use.

Although policymakers have increasingly turned to provider report cards as a tool to improve health care quality, existing studies of their effects provide mixed evidence that they influence consumer choices. **Bundorf** and her co-authors examine the effects of providing consumers with quality information in the context of fertility clinics

providing Assisted Reproductive Therapies (ART). They report three main findings. First, clinics with higher birth-rates had larger market shares after versus before the adoption of report cards. Second, clinics with a disproportionate share of young, easy-to-treat patients had lower market shares after versus before adoption. This suggests that consumers take into account information on patient mix when evaluating clinic outcomes. Third, report cards had larger effects on consumers and clinics from states with ART insurance coverage mandates. The researchers conclude that quality report cards have potential to influence provider behavior in this setting.

Aizcorbe reported on plans by the Bureau of Economic Analysis (BEA) to construct a set of satellite accounts for health that will provide supplementary measures for health spending. Measures for this large and growing sector of the economy have limitations that have been documented in the academic literature. The problems are particularly acute for the official price indexes that the BEA uses to deflate nominal expenditures into

measures of real spending. One problem with these price indexes is that they do not accurately account for the introduction of new treatments that provide the same outcomes—in terms of improved health—but at lower cost. Preliminary results from work by BEA researchers demonstrated that this problem is numerically important for indexes that cover a wide range of conditions. Work is currently underway to explore different strategies and data sources to correct this problem.

Japanese atomic bomb survivors irradiated 8–25 weeks after ovulation subsequently suffered reduced IQ [Otake and Schull, 1998]. Whether these findings generalize to low doses (less than 10 mGy) has not been established. **Almond, Edlund, and Palme** exploit the natural experiment generated by the Chernobyl nuclear accident in April 1986, which caused a spike in radiation levels in Sweden. In a comprehensive dataset of 562,637 Swedes born 1983–8, the researchers find that the cohort in utero during the Chernobyl accident had worse school outcomes than adjacent birth cohorts, and this deterioration was large

est for those exposed approximately 8–25 weeks post conception. Moreover, they find larger damage among students born in regions that received more fallout: students from the eight most affected municipalities were 3.6 percentage points less likely to qualify to high school as a result of the fallout. These findings suggest that fetal exposure to ionizing radiation damages cognitive ability at radiation levels previously considered safe.

Health care spending varies widely across markets, yet there is little evidence that higher spending translates into better health outcomes, possibly because of endogeneity bias. The main innovation in **Doyle's** paper compares outcomes of patients who are exposed to different health care systems that were not designed for them: patients who are far from home when a health emergency strikes. The universe of emergencies in Florida from 1996–2003 is considered, and visitors who become ill in high-spending areas have significantly lower mortality rates compared to similar visitors in lower-spending areas. The results are robust across different types

of patients and within groups of destinations that appear to be close demand substitutes.

Gaynor, Kleiner, and Vogt develop and estimate a new model of hospital costs, using a new output index to examine the cost efficiencies brought about by increases in the magnitude of operations (scale economies) and the variety of services offered (scope economies) by hospitals. Using this output index, the researchers estimate a translog cost function with a dataset of 320 California hospitals for the year 2003. Their results show that scale economies are exhausted at a higher level than previously estimated (around 280 beds). There is evidence of scope economies between primary and secondary care, and between tertiary and outpatient care. The cost function specification also allows for the possibility of scope economies across conditions within primary, secondary, and tertiary care. The estimates show scope diseconomies across conditions for more intensive types of treatment (tertiary and secondary care) and scope economies across conditions for less intensive types of treatment

Monetary Economics

The NBER's Monetary Economics Program met in Cambridge on November 9. Susanto Basu and Peter N. Ireland, both of NBER and Boston College, organized this program:

Hess Chung, Indiana University, and **Eric M. Leeper**, Indiana University and NBER, "What Has Financed Government Debt?" (NBER Working Paper No. 13425)

Discussant: James Hamilton, University of California, San Diego and NBER

Gauti B. Eggertsson, Federal Reserve Bank of New York, "Was the New Deal Contractionary?"

Discussant: Dale Henderson, Federal

Reserve Board

Gita Gopinath, Harvard University and NBER; **Oleg Itskhoki**, Harvard University; and **Roberto Rigobon**, MIT and NBER, "Currency Choice and Exchange Rate Pass-Through" (NBER Working Paper No. 13432)

Discussant: **Paolo Pesenti**, Federal Reserve Bank of New York and NBER

Lawrence Christiano, Northwestern University and NBER; **Cosmin Ilut**, Northwestern University; and **Roberto Motto and Massimo Rostagno**, European Central Bank, "Monetary Policy and Stock Market Boom-Bust Cycles"

Discussant: John C. Williams, Federal Reserve Bank of San Francisco

Francois R. Velde, Federal Reserve Bank of Chicago, "Chronicle of a Deflation Unforetold"

Discussant: Ricardo Reis, Princeton University and NBER

Patrick J. Kehoe, Federal Reserve Bank of Minneapolis and NBER, and **Virgiliu Midrigan**, Federal Reserve Bank of Minneapolis, "Sales and the Real Effects of Monetary Policy"

Discussant: Emi Nakamura, Columbia University and NBER

Equilibrium models imply that the real value of debt in the hands of the

public must equal the expected present-value of surpluses. Empirical models of

fiscal policy typically do not impose this condition and often do not even include

debt. Absence of debt from empirical models can produce non-invertible representations, obscuring the true present-value relation, even if it holds in the data. **Chung** and **Leeper** show that small VAR models of fiscal policy may not be invertible and that expanding the information set to include government debt has quantitatively important implications. Then they impose the present-value condition on an identified VAR and characterize the way in which the present-value support of debt varies across types of fiscal shocks. The role of expected primary surpluses in supporting innovations to debt depends on the nature of the shock. Debt is supported almost entirely by changes in the present-value of surpluses for some fiscal shocks, but for other fiscal shocks surpluses fail to adjust, leaving a large role for expected changes in discount rates. Horizons over which debt innovations are financed are long—on the order of 50 years or more.

Can government policies that increase the monopoly power of firms and the militancy of unions increase output? **Eggertsson** studies this question in a dynamic general equilibrium model with nominal frictions and shows that these policies are expansionary when certain “emergency” conditions apply. He argues that these emergency conditions—zero interest rates and deflation—were satisfied during the Great Depression in the United States. Therefore, the New Deal, which facilitated monopolies and union militancy, was expansionary, according to the model. This conclusion is contrary to the one reached by **Cole** and **Ohanian** (2004), who argue that the New Deal was contractionary. The main reason for this divergence is that the current model incorporates nominal frictions so that inflation expectations play a central role in the analysis. The New Deal has a strong effect on inflation expectations in the model, changing excessive deflation to modest inflation, thereby lowering real interest rates and stimulating spending.

A central assumption of open economy macro models with nominal rigidities relates to the currency in which goods

are priced, whether there is so-called producer currency pricing or local currency pricing. This has important implications for exchange rate pass-through and optimal exchange rate policy. Using novel transaction-level information on currency and prices for U.S. imports, **Gopinath**, **Itskhoki**, and **Rigobon** show that, even conditional on a price change, there is a large difference in the pass-through of the average good priced in dollars (25 percent) versus non-dollars (95 percent). This finding is contrary to the assumption in a large class of models that the currency of pricing is exogenous and is evidence of an important selection effect that results from endogenous currency choice. The researchers describe a model of optimal currency choice in an environment of staggered price setting and show that the empirical evidence strongly supports the model’s predictions of the relation between currency choice and pass-through. They further document evidence of significant real rigidities, with the pass-through of dollar pricers increasing above 50 percent in the long-run. Finally, they numerically illustrate the currency choice decision in both a Calvo and a menu-cost model with variable mark-ups and imported intermediate inputs and evaluate the ability of these models to match pass-through patterns documented in the data.

Christiano and co-authors explore the dynamic effects of news about a future technology improvement which turns out *ex post* to be overoptimistic. They find that it is difficult to generate a boom-bust cycle (a period in which stock prices, consumption, investment, and employment all rise and then crash) in response to such a news shock, in a standard real business cycle model. However, a monetized version of the model that stresses sticky wages and an inflation-targeting monetary policy naturally generates a welfare-reducing boom-bust cycle in response to a news shock. They explore the possibility that integrating credit growth into monetary policy may result in improved performance. They also discuss the robustness of their analysis to alternative specifications

of the labor market, in which wage-setting frictions do not distort ongoing firm/worker relations.

Suppose the nominal money supply could be cut literally overnight by, say, 20 percent. What would happen to prices, wages, output, **Velde** asks? The answer can be found in 1720s France, where just such an experiment was carried out, repeatedly. Prices adjusted instantaneously and fully on one market only, that for foreign exchange. Prices on other markets (such as commodities) as well as prices of manufactured goods and industrial wages fell slowly, over many months, and not by the full amount of the nominal reduction. Coincidentally or not, the industrial sector (as represented by manufacturing of woolen cloths) experienced a contraction of 30 percent. When the government changed course and increased the nominal money supply overnight by 20 percent, prices responded much more, and the woolen industry rebounded.

In the data, a sizable fraction of price changes are temporary price reductions referred to as sales. Existing models include no role for sales. Hence, when confronted with data in which a large fraction of price changes are sales related, the models must either exclude sales from the data or leave them in and implicitly treat sales like any other price change. When sales are included, prices change frequently and standard sticky price models with this high frequency of price changes predict small effects from money shocks. If sales are excluded, prices change much less frequently and a standard sticky price model with this low frequency of price changes predicts much larger effects of money shocks. **Kehoe** and **Midrigan** add a motive for sales in a parsimonious extension of existing sticky models. They show that the model can account for most of the patterns of sales in the data. Using their model as the data generating process, they evaluate the existing approaches and find that neither well approximates the real effects of money in their economy in which sales are explicitly modeled.

Macroeconomics and Individual Decisionmaking

The NBER's Working Group on Macroeconomics and Individual Decisionmaking met in Cambridge on November 10. NBER Director George Akerlof, University of California, Berkeley, and NBER Research Associate Robert J. Shiller of Yale University organized this program:

"Social Identity and Preferences", **Daniel J. Benjamin**, Cornell University; **James J. Choi**, Yale University and NBER; and **A. Joshua Strickland**, Yale University
Discussant: Karla Hoff, World Bank

Truman Bewley, Yale University,

reporting on his ongoing field study of pricing

"The Power of the Family", **Alberto Alesina**, Harvard University and NBER, and **Paola Giuliano**, Harvard University
Discussant: Mark Rosenzweig, Yale University

"Decisionmakers as Statisticians: Diversity, Ambiguity and Robustness", **Nabil I. Al-Najjar**, Northwestern University
(No discussant)

"Depression Babies: Do Macroeconomic Experiences Affect Risk-Taking?", **Ulrike Malmendier**, University of California, Berkeley and NBER, and **Stefan Nagel**, Stanford University and NBER
Discussant: John Ameriks, The Vanguard Group

"Aggregation Reversals and the Social Formation of Beliefs", **Edward L. Glaeser**, Harvard University and NBER, and **Bruce Sacerdote**, Dartmouth College and NBER
Discussant: Abhijit Banerjee, MIT and NBER

In two laboratory experiments, **Benjamin, Choi, and Strickland** examine whether norms associated with one's social identity affect time and risk preferences. When they make ethnic identity salient to Asian-American subjects, the subjects make more patient choices. When they make race salient to black subjects, the non-immigrant blacks (but not the immigrant blacks) make more risk-averse choices. Making gender identity salient causes choices to conform to gender norms that the subject believes are relatively more common. These results provide evidence that identity effects play a role in shaping U.S. demographic patterns in economic behaviors and outcomes.

Alesina and Giuliano study the importance of culture, as measured by the strength of family ties, on economic behavior and attitudes. They define their measure of family ties using individual responses from the World Value Survey regarding the role of the family, and the love and respect that children need to have for their parents, for over 70 countries. They show that strong family ties imply more reliance on the family as an economic unit that provides goods and services and less on the market and the government for social insurance. With strong family ties home production is higher; labor force participation of women and

youngsters and geographical mobility are lower. Families are larger (higher fertility and higher family size) with strong family ties, which is consistent with the idea of the family as an important economic unit. The researchers present evidence on cross-country regressions. To assess causality, they look at the behavior of second generation immigrants in the United States and use a variable based on the grammatical rule of pronoun drop as an instrument for family ties. Their results overall indicate a significant influence of the strength of family ties on economic outcomes.

Al-Najjar studies individuals who use frequentist statistical models to draw secure or robust inferences from i.i.d. data. The main contribution of this paper is a steady-state model in which distinct statistical models are consistent with empirical evidence, even as data increases without bound. Individuals may hold different beliefs and interpret their environment differently even though they know each other's statistical model and base their inferences on identical data. The behavior modeled here is that of rational individuals confronting an environment in which learning is hard, rather than ones beset by cognitive limitations or behavioral biases.

Malmendier and Nagel investigate whether differences in individuals' experiences of macroeconomic shocks affect

long-term risk attitudes, as is often suggested for the generation that experienced the Great Depression. Using data from the Survey of Consumer Finances from 1964–2004, the authors find that birth-cohorts that have experienced high stock market returns throughout their life report lower risk aversion, are more likely to be stock market participants, and, if they participate, invest a higher fraction of liquid wealth in stocks. They also find that cohorts that have experienced high inflation are less likely to hold bonds. These results are estimated controlling for age, year effects, and a broad set of household characteristics. The estimates indicate that stock market returns and inflation early in life affect risk-taking several decades later. However, more recent returns have a stronger effect, which fades away slowly as time progresses. Thus, the experience of risky asset payoffs over the course of an individuals' life affects subsequent risk-taking. These results explain, for example, the relatively low rates of stock market participation among young households in the early 1980s (following the disappointing stock market returns in the 1970s depression) and the relatively high participation rates of young investors in the late 1990s (following the boom years in the 1990s).

In the past two elections, richer peo-

ple were more likely to vote Republican while richer states were more likely to vote Democratic. This switch is an aggregation reversal, where an individual relationship, like income and Republicanism, is reversed at some level of aggregation. Aggregation reversals can occur when an

independent variable affects an outcome both directly and indirectly through a correlation with beliefs. For example, income increases the desire for low taxes but decreases belief in Republican social causes. If beliefs are learned socially, then aggregation can magnify the connection

between the independent variable and beliefs, which can cause an aggregation reversal. **Glaeser** and **Sacerdote** estimate the model's parameters for three examples of aggregation reversals and show with these parameters that the model predicts the observed reversals.

Higher Education Working Group

The NBER's Working Group on Higher Education, directed by Charles T. Clotfelter of Duke University, met in Cambridge on November 15. The following papers were discussed:

Joshua Angrist, MIT and NBER, and **Daniel Lang** and **Philip Oreopoulos**, University of Toronto, "Incentives and Services for College Achievement: Evidence from a Randomized Trial"

Glenn Ellison, MIT and NBER, "Is

Peer Review in Decline?"

Bruce A. Weinberg, Ohio State University and NBER, and **Belton M. Fleisher** and **Masanori Hashimoto**, Ohio State University, "Pitfalls in Evaluating Instruction: The Case of Higher Education"

Judith Scott-Clayton, Harvard University, "What Explains Rising Labor Supply Among U.S. Undergraduates, 1970–2003?"

David Johnson, Wilfrid Laurier University, "Interprovincial Variation in University Tuition and the Decision to Continue to Attend University: Evidence from Youth in Transition Survey in Canada"

Marcelo Rezende, Federal Reserve Board, "The Effects of Accountability on Higher Education"

Many North American college students have trouble satisfying degree requirements in a timely manner. **Angrist** and his co-authors report on a randomized field experiment involving two strategies designed to improve academic performance among entering full-time undergraduates at a large Canadian university. One treatment group ("services") was offered peer advising and organized study groups. Another ("incentives") was offered substantial merit-scholarships for solid, but not necessarily top, first-year grades. A third treatment group combined both interventions. Service take-up rates were much higher for women than for men, and for students offered both services and incentives, than for those offered services alone. No program had an effect on men's grades or other measures of academic performance. However, the fall and first-year grades of women in the combined group were significantly higher than those of women in the control group, and women in the latter group earned more course credit and were less likely than those in the control group

to be on academic probation. These differentials persisted through the end of the second year, in spite of the fact that incentives were given in the first year only. The results suggest that the study skills acquired in response to a combination of services and incentives can have a lasting effect, and that the combination of services and incentives is more promising than either alone.

Over the past decade there has been a decline in the fraction of papers in top economics journals written by economists from the highest-ranked economics departments. **Ellison** documents this fact and uses additional data on publications and citations to assess various potential explanations. Several observations are consistent with the hypothesis that the Internet improves the ability of high-profile authors to disseminate their research without going through the traditional peer-review process.

Weinberg and his co-authors study methods for evaluating instruction in higher education. They explore student evaluations of instruction and a variety of

alternatives, and develop a simple model to illustrate the biases inherent in student evaluations. Measuring learning using grades in future courses, they show that student evaluations are positively related to current grades but uncorrelated with learning, once current grades are controlled. They also show that the weak relationship between learning and student evaluations arises in part because students are not aware of how much they have learned in a course. In the conclusion of their paper they discuss alternative methods for evaluating teaching.

Today's college enrollees are more likely to work, and work more, than those of the past. October CPS data reveal that since 1970, average labor supply among 18-to-22-year-old full-time, four-year undergraduates has nearly doubled, from 5 hours to 9.6 hours per week. Nearly half of these "traditional" college students work for pay in a given week, and the average working student works 21 hours per week. Borrowing constraints are a plausible culprit, but would have to be much more pervasive than commonly thought

to explain rising employment even among wealthy students. **Scott-Clayton** evaluates the credit constraints hypothesis along with several alternative explanations for the increase in student labor supply, including changes in demographic composition, rising wages, rising returns to work experience, declines in educational quality, institutional crowding, and declining preferences for leisure. Using multiple data sources, she concludes that none of these alternative hypotheses come close to fully explaining the dramatic change over time. When broadly defined to include “fuzzy” constraints on borrowing for discretionary consumption as well as self-imposed constraints on borrowing, credit constraints may be driving the trend even among high-income populations.

The Youth-in-Transition Survey allows identification of a series of decision points where youth already in uni-

versity decide whether to continue or to exit without graduating. This is a specific aspect of university participation. **Johnson** finds that there is little evidence that either a higher level of tuition or a change in tuition alters the probability that a Canadian youth, once in university, leaves without obtaining a degree. Thus any policy effort around university persistence for youth should focus on non-tuition factors, and debate around the appropriate level of tuition should not focus on persistence.

Rezende analyzes the effect of an accountability system in the Brazilian college market. For each discipline, colleges were assigned a grade that depended on the scores of their students on the ENC, an annual mandatory exam. Those grades were then disclosed to the public, giving applicants information about college quality. The system also established rewards and penalties based on the col-

leges’ grades. He finds that the ENC had a substantial effect on different measures of college quality, such as faculty education and the proportion of full-time faculty. The detailed information from this unique dataset and the fact that the ENC started being required for different disciplines in different years allow him to control for time-specific effects, thus minimizing the bias caused by policy endogeneity. Indeed, he finds strong evidence on the importance of controlling for time-specific effects: estimates of the impact of the ENC on college quality more than double when he does not take those effects into account. The ENC also positively affects the ratio between applicants and vacancies, and decreases the faculty and the entering class sizes. The results suggest that its introduction fostered competition and favored colleges entering the market.

Education Program Meeting

NBER’s Program on Education, directed by Carolyn M. Hoxby of Stanford University, met in Cambridge on November 16. These papers were discussed:

Luigi Zingales, University of Chicago and NBER; **Paola Sapienza**, Northwestern University and NBER; **Luigi Guiso**, Ente Luigi Einaudi; and **Ferdinando Monte**, University of Chicago, “Math and Gender”

Victor Lavy and **Daniele Paserman**, Hebrew University and NBER, and **Analia Schlosser**, Princeton University, “Inside the Black of Box of Ability

Peer Effects: Evidence from Variation in High and Low Achievers in the Classroom”

Peter Arcidiacono and **Aurel Hizmo**, Duke University, and **Patrick Bayer**, Duke University and NBER, “Beyond Signaling and Human Capital: Education and the Revelation of Ability”

Meta Brown and **Ananth Seshadri**, University of Wisconsin, Madison, and **John Karl Scholz**, University of Wisconsin, Madison and NBER, “A New Test of Borrowing Constraints for Education”

Giacomo De Giorgi, Stanford University; **Michele Pellizzari**, IGIER-Bocconi, and **Silvia Redaelli**, Bocconi University, “Be as Careful of the Books You Read as of the Company You Keep: Evidence on Peer Effects in Educational Choices”

Derek Neal, University of Chicago and NBER, and **Diane Whitmore Schanzenbach**, University of Chicago, “Left Behind By Design: Proficiency Counts and Test-Based Accountability”(NBER Working Paper No. 13293)

Zingales and his co-authors use the Program for International Student Assessment (PISA) to analyze the gender gap in mathematics and reading in 41 countries. They find that, on average, 15-year-old girls underperform in mathematics and outperform in reading

with respect to boys. Further, the gender gap in mathematics is negatively correlated with the level of emancipation of women in society suggesting that, at least in part, the gap is environmentally driven. In emancipated societies the gender gap in math is not reduced by higher

investment in math (more homework and instructional time), or different educational styles, or by increasing women’s self esteem. Women’s emancipation affects relative math performance by changing the role models: in emancipated society, the role models are gender-neutral and

women are equally influenced by other successful men and women; in less emancipated society, women's achievement is affected by successful students of the same gender.

Lavy and his co-authors estimate the extent of ability peer effects in the classroom and explore the underlying mechanisms through which these peer effects operate. They identify as high ability students those who are enrolled at least one year ahead of their birth cohort ("skippers") and as low ability students those who are enrolled at least one year behind their birth cohort ("repeaters"). They show that while there are marked differences between the academic performance and behavior of skippers/repeaters and the regular students, the status of skippers and repeaters is mostly determined by first grade; therefore, it is unlikely to have been affected by classroom peers (and to suffer from the reflection problem). Using within-school variation in the proportion of these low and high ability students across cohorts of middle and high school students in Israel, they find that the proportion of high achieving peers in class has no effect on the academic performance of most regular students but it does affect positively the outcomes of the brightest among the regular students. In contrast, the proportion of low achieving peers has a negative effect on the performance of regular students, especially those located at the lower end of the ability distribution. An exploration of the underlying mechanisms of these peer effects shows that, relative to regular students, repeaters report that teachers are better in the individual treatment of students and in instilling the capacity for individual study. However, a higher proportion of low achieving students results in deterioration of teachers' pedagogical practices, with detrimental effects on the quality of inter-student relationships and the relationships between teachers and students, and somewhat increases the level of violence and classroom disruptions.

In traditional models of ability sig-

naling, higher ability workers acquire more education and employers use education to statistically discriminate in setting wages. **Arcidiacono** and his co-authors argue that education plays a much more direct role in the labor market. Using data from the National Longitudinal Survey of Youth (NLSY), they show that college allows individuals to directly reveal their ability to potential employers. Their results suggest that ability is observed nearly perfectly for college graduates but is revealed to the labor market more gradually for high school graduates. Consistent with the notion that ability is directly revealed in college market, the researchers do not find any racial differences in wages or in returns to ability for college graduates. By contrast, blacks earn 6–10 percent less than whites of comparable ability in the high school market, a difference that might arise as a result of statistical discrimination. The fact that a wage penalty exists for blacks in the high school but not the college labor market also helps to explain why, conditional on ability, blacks are more likely to earn a college degree.

Models of investment and borrowing for education typically treat the family as a unitary decisionmaker. Doing so may conceal the nature of borrowing constraints, because adults with college-age children are likely to be at a life-cycle stage where credit constraints are not important. **Brown** and his co-authors instead propose a simple model of altruistic parents and a child in which both parties can make investments for education and other purposes and parents can transfer cash to their child. The model implies that educational investment is inefficient for inter-generationally constrained parent-child pairs. The constraint arises because parents of constrained children rationally do not pay the share of college expenses that is assumed by federal financial aid formulas. The model highlights new empirical implications of borrowing constraints for education, which the researchers examine making use of data from the Health and Retirement Study and the NLSY-

97. The data are consistent with quantitatively important borrowing constraints for higher education.

De Giorgi and his co-authors investigate whether peers' behavior influences the choice of college major. Using a unique dataset of students at Bocconi University and exploiting the organization of teaching at this institution, they are able to identify the endogenous effect of peers on such decisions through a novel identification strategy that solves the common econometric problems of studies of social interactions. Results show that, indeed, one is more likely to choose a major when many of her peers make the same choice. The authors estimate that, when it diverts students from majors in which they seem to have a relative ability advantage, this effect leads to lower average grades and graduation mark, a penalty that could cost up to 1,117 USD a year in the labor market.

Neal and his co-author, based on fifth grade test scores from the Chicago Public Schools, show that both the introduction of No Child Left Behind (NCLB) in 2002 and the introduction of similar district level reforms in 1996 generated noteworthy increases in reading and math scores among students in the middle of the achievement distribution. Nonetheless, the least academically advantaged students in Chicago did not score higher in math or reading following the introduction of accountability, and the researchers find only mixed evidence of score gains among the most advantaged students. A large existing literature argues that accountability systems built around standardized tests greatly affect the amount of time that teachers devote to different topics. These results for fifth graders in Chicago, as well as related results for sixth graders after the 1996 reform, suggest that the choice of the proficiency standard in such accountability systems determines the amount of time that teachers devote to students of different ability levels.

Asset Pricing

The NBER's Asset Pricing Program met in Cambridge on November 30. **Monika Piazzesi**, NBER and University of Chicago Graduate School of Business, and **Motohiro Yogo**, NBER and the Wharton School, University of Pennsylvania, organized this program:

Joao F. Gomes, University of Pennsylvania, and **Lukas Schmid**, University of Lausanne, "Levered Returns"

Discussant: John C. Heaton, University of Chicago and NBER

Claudio Campanale, Universidad de Alicante; **Rui Castro**, University of Montreal; and **Gian Luca Clementi**, New York University, "Asset Pricing in a Production Economy with Chew-Dekel Preferences"

Discussant: Lu Zhang, University of Michigan and NBER

Oliver Boguth, **Murry Carlson**, **Adlai Fisher**, and **Mikhail Simutin**, University of British Columbia, "Conditional Risk, Overconditioning, and the Performance of Momentum Strategies"

Discussant: Jonathan Lewellen, Dartmouth College and NBER

Martin Lettau, New York University and NBER, and **Jessica A. Wachter**, University of Pennsylvania and NBER, "The Term Structures of Equity and Interest Rates"

Discussant: Kenneth J. Singleton, Stanford University and NBER

Hanno Lustig, University of California,

Los Angeles and NBER; **Chad Syverson**, University of Chicago and NBER; and **Stijn Van Nieuwerburgh**, New York University and NBER, "IT, Corporate Payouts, and the Growing Inequality In Managerial Compensation"

Discussant: Ellen McGrattan, Federal Reserve Bank of Minneapolis and NBER

Laurent E. Calvet, Imperial College London and NBER; **John Y. Campbell**, Harvard University and NBER; and **Paolo Sodini**, Stockholm School of Economics, "Fight or Flight? Portfolio Rebalancing by Individual Investors" Discussant: Markus K. Brunnermeier, Princeton University and NBER

Gomes and his co-author revisit the theoretical relationship between financial leverage and stock returns in a dynamic world where both the corporate investment and finance decisions are endogenous. They find that the link between leverage and stock returns is more complex than the static textbook examples suggest and usually depends on the investment opportunities available to the firm. In the presence of financial market imperfections, leverage and investment are generally correlated, so that highly levered firms are also mature firms with relatively more (safe) book assets and fewer (risky) growth opportunities. The researchers use a quantitative version of their model to generate empirical predictions concerning the empirical relationship between leverage and returns. They test these implications in actual data and find support for them.

Campanale and his co-authors provide a thorough characterization of the asset returns implied by a simple general equilibrium production economy with convex investment adjustment costs. When households have Epstein–Zin pref-

erences, there exist plausible parameter values such that the model generates unconditional mean risk-free rate and equity return, and volatility of consumption growth, which are in line with historical averages for the U.S. economy. Consistent with the data, the price-dividend ratio is pro-cyclical and stock returns are predictable (increasingly so as the time horizon increases), while dividend growth is not. The model also implies realistic values for the correlation of the risk-free rate with output growth and consumption growth and the correlation pattern between risk-free rate, equity return, and equity premium. The risk implied by the model is rather low. Given the work of Rabin (2000) among others, it is not surprising that the Epstein–Zin agent exhibits a much higher risk aversion when faced with substantially larger risks. This shortcoming, however, does not extend to the case in which agents are disappointment averse, in the sense of Gul (1991). When faced with a lottery that has a coefficient of variation one hundred times as large as that implied by this model, a disappointment averse agent displays the same rela-

tive risk aversion as an expected utility agent with logarithmic utility!

Recent empirical studies evaluate the performance of investment strategies using contemporaneously measured loadings to proxy for conditional risk. **Boguth** and his co-authors demonstrate that such procedures lead to potentially large biases in alpha when payoffs are nonlinear. They combine lagged portfolio and component realized betas with standard instruments to improve performance analysis, and find that conditioning information reduces momentum alphas by 20–40 percent relative to unconditional estimates. Overconditioned alphas are up to 2.5 times larger than appropriately conditioned measures.

Lettau and **Wachter** propose a dynamic risk-based model capable of jointly explaining the term structure of interest rates, returns on the aggregate market, and the risk and return characteristics of value and growth stocks. Both the term structure of interest rates and returns on value and growth stocks convey information about how the representative investor values cash flows of differ-

ent maturities. The researchers model how the representative investor perceives risks of these cash flows by specifying a parsimonious stochastic discount factor for the economy. Shocks to dividend growth, the real interest rate, and expected inflation are priced, but shocks to the price of risk are not. Given reasonable assumptions for dividends and inflation, they show that the model can simultaneously account for the behavior of aggregate stock returns, an upward-sloping yield curve, the failure of the expectations hypothesis, and the poor performance of the capital asset pricing model.

Three of the most fundamental changes in the economy since the early 1970s have been the increase in the importance of organizational capital in production, the increase in managerial income inequality, and the increase in payouts to the owners of firms. **Lustig** and his co-authors suggest that there is a unified explanation for these changes: the arrival and gradual adoption of information technology since the 1970s has stim-

ulated the accumulation of organizational capital in existing firms. Because owners are better diversified than managers, the optimal division of rents from this organizational capital has the owners bearing most of the cash-flow risk. In the model here, the IT revolution benefits the owners and the managers in large successful firms, but not the managers in small firms. The resulting increase in managerial compensation inequality and the increase in payouts to owners compare favorably to those established in the data.

Calvet and his co-authors investigate the dynamics of individual portfolios in a unique dataset containing the disaggregated wealth and income of all households in Sweden. Between 1999 and 2002, the average share of risky assets in the financial portfolio of participants fell moderately, implying little aggregate rebalancing in response to the decline in risky asset prices during this period. The researchers show that these aggregate patterns conceal strong household-level evidence of active rebalancing, which on average off-

sets about one half of idiosyncratic passive variations in the risky asset share. Sophisticated households with greater education, wealth, and income, and with better diversified portfolios, tend to rebalance more actively. There is some evidence that households rebalance towards a higher risky share as they become richer. The researchers also study the decisions to enter and exit risky financial markets, and patterns of rebalancing for individual assets. They find that households are more likely to fully sell directly held stocks if those stocks have performed well, and more likely to exit direct stockholding if their stock portfolios have performed well; but these relationships reverse for mutual funds. The results are consistent with previous research on the disposition effect among direct stockholders and performance sensitivity among mutual fund investors. When households continue to hold individual assets, however, they rebalance both stocks and mutual funds to offset about one sixth of the passive variations in individual asset shares.

Corporate Finance

The NBER's Program on Corporate Finance met in Cambridge on November 30. Paola Sapienza, NBER and Northwestern University, and Luigi Zingales, NBER and University of Chicago, organized this program:

Ernst Fehr, University of Zurich, and **Susanne Krehmelmer** and **Klaus M. Schmidt**, University of Munich, "Fairness and the Optimal Allocation of Ownership Rights"
Discussant: David S. Scharfstein, Harvard University and NBER

Florian Ederer and **Gustavo Manso**, MIT, "Incentives for Innovation: Evidence from a Laboratory Experiment"
Discussant: Christian Zehnder, Harvard

University

Laura Bottazzi, Bocconi University; **Marco Da Rin**, Tilburg University; and **Thomas Hellmann**, University of British Columbia, "The Importance of Trust of Investment: Evidence from Venture Capital"
Discussant: Bruce Carlin, University of California, Los Angeles

Ron Kaniel and **David T. Robinson**, Duke University, and **Cade Massey**, Yale University, "The Importance of Being An Optimist: Evidence from Labor Market"
Discussant: Paola Sapienza

Steven N. Kaplan and **Morten Sorensen**, University of Chicago

and NBER, and **Mark Klebanov**, University of Chicago, "Which CEO Characteristics and Abilities Matter?"
Discussant: Roberto Weber, Carnegie Mellon University

Camelia M. Kuhn, Northwestern University, and **Brian Knutson**, Stanford University, "The Impact of Affect on Beliefs, Preferences and Financial Decisions"
Discussant: Colin Camerer, Caltech

Discussion on the Future of Corporate Finance:
Malcolm Baker, Harvard University and NBER
Antoinette Schoar, MIT and NBER
Christopher Hennessy, University of California, Berkeley

Fehr and his co-authors report on several experiments on the optimal allo-

cation of ownership rights. The experiments confirm the property rights

approach by showing that the ownership structure affects relationship-spe-

cific investments and that subjects attain the most efficient ownership allocation despite starting from different initial conditions. However, in contrast to the property rights approach, the most efficient ownership structure is joint ownership. These results cannot be explained by the self-interest model, nor by models that assume that all people behave fairly, but they are largely consistent with the theory of inequity aversion that focuses on the interaction between selfish and fair players.

In a controlled laboratory experiment, **Ederer** and **Manso** show that the combination of tolerance for early failure and reward for long-term success is effective in motivating innovation. Despite receiving lower average wages, subjects under such an incentive scheme were more innovative and produced higher profits than subjects under fixed-wage and standard pay-for-performance incentive schemes. These results suggest that incentives, as long as appropriately designed, are useful in motivating creativity and innovation.

Bottazzi and her co-authors examine the effect of trust in a micro-economic environment, where it is clearly exogenous. Using hand-collected data on European venture capital, they show that the Eurobarometer measure of trust among nations significantly affects investment decisions. This holds even after they control for investor and company fixed effects, geographic distance, information, and transaction costs. The national identity of venture capital firms' partners also matters for the effect of trust. The researchers also consider the relationship between trust and sophisticated contracts involving contingent

control rights. They find that trust and sophisticated contracts are complements, not substitutes.

Kaniel and his co-authors show that dispositional optimism is a stable personality trait with a pronounced effect on job search outcomes. Studying a cohort of MBA students, they find that repeated within-person measurements of dispositional optimism are highly correlated over time and are not explained by major life events, such as classroom performance or job placement outcomes. Dispositional optimism does affect job market perceptions and outcomes. Optimistic students tend to place less weight on the importance of landing a job after graduation. They also believe that their initial starting salaries will be higher than those of their peers, but these beliefs do not materialize. In spite of these negatives, optimists outperform their peers in the job search process in many respects. They are more likely to hold summer internships by the spring of their first year, and they receive full-time job offers faster than their peers. There is no evidence, however, that they find lower quality jobs, and that this accounts for faster times to first job offer.

Using a detailed dataset with assessments of CEO candidates for companies involved in private equity (PE) transactions—including both buyout (LBO) and venture capital (VC) deals—**Kaplan** and his co-authors study how CEOs' characteristics and abilities relate to hiring decisions, PE investment decisions, and subsequent performance. The candidates are assessed on more than 40 individual characteristics in seven general areas: leadership, personal, intellectual, motivational, interpersonal,

technical, and specific. In general, all characteristics and abilities are highly correlated. For both LBO and VC firms, outside CEO candidates are more highly rated than incumbents. Both LBO and VC firms are more likely to hire and invest in more highly rated and talented CEOs, and the investors also value "soft" or team-related skills in the hiring decisions. However, these skills are not necessarily associated with greater success. For LBO deals in particular, "hard" abilities and execution skills predict success. Finally, the researchers find that incumbents are no more likely to succeed than outside CEOs, holding observable talent and ability constant.

Recent neuroeconomics research suggests that incidental affect can influence financial choices by changing activation in brain areas related to emotion processing. Thus, changes in one's affective state due to stimuli unrelated to the financial decision at hand may change people's propensity to take financial risks. **Kuhnen** and **Knutson** examine whether this effect operates through preferences, beliefs, or both, and test the generality of the phenomenon. They find that affective stimuli can influence subjects' beliefs about investing as well as their preferences. Specifically, valenced stimuli change risk preferences, while arousing stimuli increase subjects' confidence in probability estimation. However, the affective stimuli no longer influence financial risk taking in one-shot investment decisions if they lack immediate feedback. These findings help to illuminate both how and when incidental affective stimuli can influence financial risk taking.

International Trade and Investment

The NBER's Program on International Trade and Investment met at the Federal Reserve Bank of San Francisco on November 30–December 1, 2007. Program Director Robert C. Feenstra of NBER and University of California, Irvine, organized the meeting and chose these papers for discussion:

Donald R. Davis, Columbia University and NBER, and **James Harrigan**, Federal Reserve Bank of New York and NBER, "Good Jobs, Bad Jobs, and Trade Liberalization" (NBER Working Paper No. 13139)

Elhanan Helpman, Harvard University and NBER, and **Oleg Itskhoki**, Harvard University, "Labor Market Rigidities, Trade, and

Unemployment" (NBER Working Paper No. 13365)

Erhan Artuc, Koc University, Turkey; **Shubham Chaudhuri**, World Bank; and **John McLaren**, University of Virginia and NBER, "Trade Shocks and Labor Adjustment: A Structural Empirical Approach" (NBER Working Paper No. 13465)

Pol Antras, Harvard University and NBER, and **Robert W. Staiger**, Stanford University and NBER, "Offshoring and the Value of Trade Agreements"

Gordon H. Hanson, University of California, San Diego and NBER, and **Chong Xiang**, Purdue University, "Testing the Melitz Model of Trade:

An Application to U.S. Motion Picture Exports"

Johannes Moenius, University of Redlands; **James E. Rauch**, University of California, San Diego and NBER; and **Vitor Trindade**, University of Missouri, "Gravity and Matching"

Pol Antras, and **Ricardo J. Caballero**, MIT and NBER, "Trade and Capital Flows: A Financial Frictions Perspective" (NBER Working Paper No. 13241)

Joshua Aizenman, University of California, Santa Cruz and NBER, and **Mark Spiegel**, Federal Reserve Bank of San Francisco, "Takeoffs" (NBER Working Paper No. 13084)

Davis and **Harrigan** merge the Melitz (2003) model with a heterogeneous firm variant of the Shapiro-Stiglitz (1977) model of efficiency wages. Their combined model features involuntary unemployment and heterogeneous wages for homogeneous labor. The selection effects of trade liberalization operate according to firm marginal cost, as in Melitz. But here these marginal costs reflect both variation in marginal physical productivity and firm-specific efficiency wages. For this reason, firms vulnerable under trade liberalization have high firm wages relative to firm productivity, possibly for both high- and low-wage jobs, or what workers may perceive as "good" or "bad" jobs. The labor rents associated with "good" jobs distort producer output decisions and tend to raise aggregate unemployment. The firm exit decision effectively treats the wage received by labor as an externality, since exit is driven by high marginal costs, whether because of low physical productivity or high wages. The merged model provides a convenient framework for articulating the efficiency enhancing effects of trade, even as it makes sense of claims that trade may threaten

(some) good jobs at good wages.

Helpman and **Itskhoki** study a two-country two-sector model of international trade in which one sector produces homogeneous products while the other produces differentiated products. The differentiated-product industry has firm heterogeneity, monopolistic competition, search and matching in its labor market, and wage bargaining. Some of the workers searching for jobs end up being unemployed. Countries are similar except for frictions in their labor markets. The researchers study the interaction of labor market rigidities and trade impediments in shaping welfare, trade flows, productivity, price levels, and unemployment rates. They show that both countries gain from trade but that the flexible country—which has lower labor market frictions—gains proportionately more. A flexible labor market confers comparative advantage; the flexible country exports differentiated products on net. A country benefits by lowering frictions in its labor market, but this harms the country's trade partner. And, the simultaneous proportional lowering of labor market frictions in both countries benefits

both of them. The model generates rich patterns of unemployment. Specifically, trade integration—which benefits both countries—may raise their rates of unemployment. Moreover, differences in rates of unemployment do not necessarily reflect differences in labor market rigidities; the rate of unemployment can be higher or lower in the flexible country. Finally, the researchers show that the flexible country has both higher total factor productivity and a lower price level, which operates against the standard Balassa-Samuelson effect.

The welfare effects of trade shocks depend crucially on the nature and magnitude of the costs workers face in moving between sectors. The existing trade literature does not directly address this, assuming perfect mobility or complete immobility, or adopting reduced-form approaches to estimation. **Artuc** and his co-authors present a model of dynamic labor adjustment that does and, moreover, which is consistent with a key empirical fact: that intersectoral gross flows greatly exceed net flows. Using an Euler-type equilibrium condition, they estimate the mean and

the variance of workers' switching costs from the U.S. March Current Population Surveys. They estimate high values of both parameters, implying both slow adjustment of the economy and sharp movements in wages in response to a trade shock. Simulations of a trade liberalization indicate that despite the high estimated adjustment cost, in terms of lifetime welfare, the liberalization is Pareto-improving. The explanation for this surprising finding—which would be missed by a reduced-form approach—is that the high variance-to-costs ensures high rates of gross flow; this helps spread the liberalization's benefits around.

Antras and **Staiger** study the trade policy choices of governments in an environment in which some of the trade flows being taxed or subsidized involve the exchange of customized inputs, and the contracts governing these transactions are incomplete. They show that the second-best policies that emerge in this environment entail free trade in final goods but not in intermediate inputs, since import or export subsidies targeted to inputs can alleviate the international hold-up problem. They next show that the Nash equilibrium policy choices of governments do not coincide with internationally efficient choices, and that the Nash policies imply an inefficiently low level of intermediate input trade across countries. The reason is that in their environment trade policy choices serve a dual role: they can enhance investment by suppliers but, because of ex-post bargaining over prices, they can also be used to redistribute profits across countries. The inefficiencies inherent in the Nash policy choices of governments not only result in suboptimal input subsidies, but also in positive distortions in final-good prices, even when countries cannot affect world (untaxed) prices in those goods. As a result, an international trade agreement that brings countries to the efficiency frontier will necessarily increase trade in inputs, but it may require a reduction in final-goods trade. When governments are not motivated by the impact of their policies on ex-post negotiated international input prices, the resulting policy choices are efficient, and hence a modified

terms-of-trade interpretation of the purpose of trade agreements can be offered, but only when governments maximize real national income. If government's preferences are sensitive to political economy (distributional) concerns, the purpose of a trade agreement becomes more complex, and cannot be reduced to solving a simple terms-of-trade problem.

Hanson and **Xiang** develop a simple empirical method to test two versions of the Melitz (2003) model, one with global fixed export costs and one with bilateral fixed export costs. With global costs, import sales per product variety (relative to domestic sales per variety) are decreasing in variable trade costs, as a result of adjustment occurring along the intensive margin of trade. With bilateral costs, imports per product variety are increasing in fixed trade costs, because of adjustment occurring along the extensive margin. The researchers apply their approach to data on imports of U.S. motion pictures in 44 countries over 1995–2005. Imports per product variety are decreasing in geographic distance, linguistic distance, and other measures of trade costs, consistent with adjustment to these costs occurring along the intensive margin. There is relatively little variation in the number of U.S. movies that countries import but wide variation in the box-office revenues per movie. The data thus appear to reject the bilateral-fixed-export-cost model in favor of the global-fixed-export-cost model.

Moenius, **Rauch**, and **Trindade** develop a gravity model of international trade in which border effects, impacts of migrants, and effects of past trading relationships are all based in networks of entrepreneurs. In their model workers leave their former employers to become entrepreneurs, and found new firms by partnering with former colleagues or with workers who left a different employer. In the absence of migration, the first type of partnership creates trade only within a country and the second type creates trade both within and across countries, so that total trade displays country border effects. Migrants, however, can match with former colleagues across country boundaries. Similarly, past trading relationships facil-

itate search for partners across country boundaries. This model generates a decomposition of bilateral trade into number of partnerships or matches and value per match. Standard gravity model variables are shown to affect number of matches and value per match differently; distance, for example, is predicted to decrease number of matches but leave value per match unaffected. Following Besedes and Prusa (2006), who count "relationships" between the United States and its trading partners by the number of product varieties for which positive trade is observed, they use these "links" and "value per link" as their empirical proxies for number of matches and value per match. Preliminary estimates using OECD data on trade and migration, both within the OECD and between the OECD and non-OECD countries, and U.S. Department of Commerce trade data, support the sharpest predictions of the theory for the impacts on number of links and value per link of distance, migrants, colonial ties, and the interactions between them.

The classical Heckscher-Ohlin-Mundell paradigm states that trade and capital mobility are substitutes, in the sense that trade integration reduces the incentives for capital to flow to capital-scarce countries. **Antras** and **Caballero** show that in a world with heterogeneous financial development, the classic conclusion does not hold. In particular, in less financially developed economies (South), trade and capital mobility are complements. Within a dynamic framework, the complementarity carries over to (financial) capital flows. This interaction implies that deepening trade integration in South raises net capital inflows (or reduces net capital outflows). It also implies that, at the global level, protectionism may backfire if the goal is to rebalance capital flows, when these are already heading from South to North. This perspective also has implications for the effects of trade integration on factor prices. In contrast to the Heckscher-Ohlin model, trade liberalization always decreases the wage-rental in South: an anti-Stolper-Samuelson result.

Aizenman and **Spiegel** identify factors associated with takeoff—a sustained

period of high growth following a period of stagnation. They examine a panel of 241 “stagnation episodes” from 146 countries; 54 percent of these episodes are followed by takeoffs. Countries that experience takeoffs average 2.3 percent annual growth following their stagnation episodes, while those that do not average no growth; 46 percent of the takeoffs are “sustained,” that is lasting eight years or longer. Using probit estimation, the researchers find that de jure trade openness is positively and significantly associated with takeoffs. A single

standard deviation increase in de jure trade openness is associated with a 55 percent increase in the probability of a takeoff in their default specification. They also find evidence that capital account openness encourages takeoff responses, although this channel is less robust. Measures of de facto trade openness, as well as a variety of other potential conditioning variables, are found to be poor predictors of takeoffs. The authors also examine the determinants of nations achieving sustained takeoffs. While they fail to find a significant

role for openness in determining whether or not takeoffs are sustained, they do find a role for output composition: takeoffs in countries with more commodity-intensive output bundles are less likely to be sustained, while takeoffs in countries that are more service-intensive are more likely to be sustained. This suggests that adverse terms-of-trade shocks prevalent among commodity exports may play a role in ending long-term high growth episodes.

Behavioral Finance

The NBER's Working Group on Behavioral Finance, directed by NBER Research Associates Robert J. Shiller of Yale University and Richard H. Thaler of the University of Chicago's Graduate School of Business, met in Cambridge on December 1. The following papers were discussed:

Philippe Bachetta and **Elmar Mertens**, University of Lausanne, and **Eric Van Wincoop**, University of Virginia and NBER, “Predictability in Financial Markets: What Do Survey Expectations Tell Us?”

Discussant: Kenneth A. Froot, Harvard University and NBER

Harrison Hong, Princeton University, and **Marcin Kacperczyk**, University of Munich, “Competition and Bias”

Discussant: Kent Womack, Dartmouth College

Malcolm Baker, Harvard University and NBER; **Robin Greenwood**, Harvard University; and **Jeffrey Wurgler**, New York University and NBER, “Catering through Nominal Shares Prices”

Discussant: Richard H. Thaler

Daniel Dorn, Drexel University, and **Gur Huberman**, Columbia University, “Preferred Risk Habitat of Individual Investors”

Discussant: Nicholas C. Barberis, Yale University and NBER

Paul C. Tetlock, Yale University, “All the News that's Fit to Reprint: Do Investors React to Stale Information?”

Discussant: Terrance Odean, University of California, Berkeley

George Korniotis, Federal Reserve Board, and **Alok Kumar**, University of Texas, “Superior Information or a Psychological Bias? A Unified Framework with Cognitive Abilities Resolve Three Puzzles”

Discussant: Brigitte C. Madrian, Harvard University and NBER

There is widespread evidence of excess return predictability in financial markets. For the foreign exchange market, a number of studies have documented that the predictability of excess returns is closely related to the predictability of expectational errors of excess returns. In this paper, **Bachetta** and his co-authors investigate the link between the predictability of excess returns and expectational errors in a much broader set of financial markets, using data on survey expectations of market participants in the stock market, the foreign exchange market, and the bond and money markets in various countries. The results are striking. First, in markets where there

is significant excess return predictability, expectational errors of excess returns are predictable as well, with the same sign and often even with similar magnitude. This is the case for forex, stock, and bond markets. Second, in the only market where excess returns are generally not predictable, the money market, expectational errors are not predictable either. These findings suggest that an explanation for the predictability of excess returns must be closely linked to an explanation for the predictability of expectational errors.

Hong and his co-author attempt to measure the effect of competition on bias in the context of analyst earnings fore-

casts, which are known to be excessively optimistic because of conflicts of interest. Their instrument for competition is mergers of brokerage houses, which result in the firing of analysts because of redundancy (for example, one of the two oil analysts is let go) and other reasons, such as culture clash. The researchers use this decrease in analyst coverage for stocks covered by both merging houses before the merger (the treatment sample) to measure the causal effect of competition on bias. They find that the treatment sample simultaneously experiences a decrease in analyst coverage and an increase in optimism bias, the year after the merger, relative to a control group

of stocks; this is consistent with competition reducing bias. The implied economic effect from this natural experiment is significantly larger than estimates from OLS regressions that do not correct for the endogeneity of coverage. And, this effect is much more significant for stocks with little initial analyst coverage or competition.

Baker and his co-authors develop and test a catering theory of nominal stock prices. The theory predicts that managers set share prices at lower levels when investors place higher valuations on low-price firms and at higher levels when investors favor high-price firms. Using several measures of time-varying catering incentives based on valuation ratios, split announcement effects, and future returns, the researchers find empirical support for these predictions in both time-series and firm-level data. The cross-sectional relationship between capitalization and nominal share price suggests that managers may be trying to categorize their firms as small firms when investors favor small firms.

The preferred risk habitat hypothesis, introduced here by **Dorn** and his co-author, is that individual investors select stocks with volatilities commensurate with their risk aversion; more risk-averse indi-

viduals pick lower-volatility stocks. The investors' portfolio perspective overlooks return correlations. The data, 1995–2000 holdings of over 20,000 customers of a German broker, are consistent with the predictions of the hypothesis: the portfolios contain highly similar stocks in terms of volatility; when stocks are sold they are replaced by stocks of similar volatilities; and, the more risk averse customers indeed hold less volatile stocks. Cross-sectionally, the more risk averse investors also have a stronger tendency to invest in mutual funds. Major improvements in diversification are concentrated during periods when investors add money to their account.

Using news data on S&P 500 firms, **Tetlock** investigates stock market responses to public news stories that may contain stale information. He uses several empirical proxies for news articles with old information, including variables based on past news events, media coverage, analyst coverage, and liquidity. He finds that market reactions to stale news stories partially reverse in the next week. By contrast, reactions to stories with more new information reverse to a much smaller extent, or even continue. Return reversals after stale news stories are much larger in stocks with a

high fraction of small trades. These results and others are consistent with the hypothesis that individual investors overreact to stale information, exerting temporary pressure on asset prices.

Korniotis and his co-author show that a portfolio choice framework with cognitive abilities resolves three recent puzzles identified in the retail investor literature: portfolio concentration, excess trading, and local bias. In all three instances, portfolio decisions could be induced by superior information or a psychological bias. Using imputed cognitive ability measures and both investor-level and aggregated stock-level tests, the researchers show that high cognitive ability investors hold concentrated portfolios, trade actively, and prefer to hold local stocks because of an informational advantage. Consequently, they earn higher risk-adjusted returns. In contrast, the decisions of low cognitive ability investors reflect psychological biases (overconfidence and familiarity), which lead to lower risk-adjusted performance. Overall, both behavioral and rational explanations for the three puzzles are supported empirically, but they apply to low and high cognitive ability investor groups, respectively.

Technological Progress and Productivity Measurement

The NBER's Program on Technological Progress and Productivity Measurement, directed by Ernst R. Berndt of MIT, met in Cambridge on December 7. These papers were discussed:

Timothy Bresnahan, Stanford University and NBER; **Shane Greenstein**, Northwestern University and NBER; and **Rebecca Henderson**, MIT and NBER, "Organizational Diseconomies of Scope and Creative Destruction"
Discussant: Boyan Jovanovic, New York University and NBER

Nick Bloom, Stanford University and NBER; **Raffaella Sadun**, London School of Economics; and **John Van Reenen**, London School of Economics and NBER, "Measuring and Explaining Firm Organization Across Firms and Countries"
Discussant: Robert Gibbons, MIT and NBER

Ian Dew-Becker, Harvard University, and **Robert J. Gordon**, Northwestern University and NBER, "The Role of Labor-Market Changes in the Slowdown of European Productivity Growth"

Discussant: Nick Bloom

Petra Moser, Stanford University and NBER, "Why Don't Inventors Patent?"
Discussant: F. Michael Scherer, Harvard University

Ana Aizcorbe and **Nicole Nestoriak**, Bureau of Economic Analysis, "Changes in Treatment Intensity, Treatment Substitution and Price Indexes for Health Care Services" (See "Health Care Program Meeting" earlier in this issue for a description of this paper.)
Discussant: Ernst R. Berndt

Bresnahan and his co-authors model the internal organization of the firm to

answer a longstanding question about creative destruction. Incumbent dominant

firms, long successful in an existing technology, are often much less successful in

a new technological era. Theories of firm heterogeneity explain only part of this phenomenon, by examining how new firms (entrepreneurs or other outsiders to the industry) have the capability to invent technologies existing dominant firms do not. This heterogeneity cannot, however, explain the difficulties of merging a new firm into the incumbent dominant firm, or of creating a division in the incumbent dominant firm to compete in the new era. The researchers show that *diseconomies of scope* between new and old businesses supplied by the same firm explain the pattern of unsuccessful dominant firms. Critically, the scope diseconomies do not arise from differences between the old and new technologies (which could be accommodated by a firm-within-a-firm organizational model.) Instead, scope diseconomies arise because an old business and a new business have optimal relationships to customers or to markets which are inconsistent with one another. This model thus locates the solution to the Schumpeterian puzzle in the organizational economics of the firm.

Bloom and his co-authors collect original data on the degree of decentralization in several thousand firms located in the United States, Europe, and Asia. Specifically, they focus on the autonomy of local plant managers from their Corporate Headquarters in their decisions over hiring, investment, production, and sales. They find that American and Northern European firms are much more decentralized than those from Southern Europe and Asia, both domestically and as multinationals abroad. Three factors are associated with greater decentralization; first, stronger product market competition, which arguably makes manager's local knowledge more important because

of greater time-sensitivity of decisionmaking. Second, higher trust in the plant's region of location (and/or multinational's home country), which may help to sustain effective delegation because of enhanced cooperation. And third, the prevalence of hierarchical religions, such as Catholicism and Islam, which may lead managers to have weaker preferences for autonomous decision making. These factors appear important across countries, across regions within countries, and for multinationals according to their country of ownership. If—as suggested by the literature—decentralization is complementary to some forms of information and communication technology, then Catholic countries with lower trust and competition, like France and Italy, may benefit less from an era of rapid technological change than Protestant countries with greater trust and competition, like Sweden and the United States.

Dew-Becker and **Gordon's** paper is about the strong negative tradeoff between productivity and employment growth. They document this tradeoff in the raw data, and in regressions that control for the two-way causation between productivity and employment growth, and they show that there is a robust negative correlation between productivity and employment growth across countries and time. They simplify the task of explaining intra-EU differences in the performance by reducing the dimensionality of the issue from the 15 EU countries to four EU country groups, chosen by geography. They provide a comprehensive analysis of the role of policy and institutional variables in causing changes in productivity and employment per capita growth across these country groups. Using both a calibrated theoretical model and several

reduced-form regressions, they document the strong effects of European policies that raised labor costs, such as the tax wedge, employment and product market regulation, unemployment compensation, and union density, in causing employment to fall and productivity to rise before 1995, and for this process to be reversed after 1995. They conclude with policy implications and propose a new framework for thinking about EU policy reforms. Their new policy framework suggests that policy changes be assessed as much on their effects on government budgets as on productivity, or employment, because the productivity-employment tradeoff causes some policy changes to have a negligible effect on growth in output per capita.

Moser argues that the ability to keep innovations secret may be a key determinant of patenting. To test this hypothesis, she examines a newly-collected dataset of more than 7,000 American and British innovations at four world's fairs between 1851 and 1915. Exhibition data show that the industry where an innovation is made is the single most important determinant of patenting. Urbanization, high innovative quality, and low costs of patenting also encourage patenting, but these influences are small compared with industry effects. If the effectiveness of secrecy is an important factor in inventors' patenting decisions, then scientific breakthroughs, which facilitate reverse-engineering, should increase inventors' propensity to patent. The discovery of the periodic table in 1869 offers an opportunity to test this idea. Exhibition data show that patenting rates for chemical innovations increased substantially after the introduction of the periodic table, both over time and relative to other industries.

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NATIONAL BUREAU OF ECONOMIC RESEARCH

1050 Massachusetts Avenue
Cambridge, Massachusetts 02138-5398
(617) 868-3900

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