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Program Report

The Economics of Aging

David Wise*

The NBER's Program on the Economics of Aging began in 1986, when the baby boom generation was between the ages of 22 and 40, and when life expectancy at age 62 (the age of eligibility for Social Security) was nearly three years shorter than it is today. The program at its outset was created with a forward-thinking orientation, drawing together economists from multiple subfields of the profession to consider jointly what would become one of the most important demographic, social, and economic transitions of the twenty-first century. The underlying focus of the program is the study of the health and financial well-being of people as they age, and the larger implications of a population that is increasingly composed of older people.

Today, the substantive importance of research on aging has never been greater. The long-anticipated aging of the baby boom generation across the threshold of eligibility for Social Security and Medicare has arrived. Baby boomers are now between the ages of 50 and 68, and their initiation of retirement benefits is accelerating. The societal impact of aging baby boomers is compounded by increasing longevity. In just the next 20 years, the U.S. population aged 65 and older is projected to increase from 43 million to 76 million people.

The implications of these demographic trends are extensive, yet they are just one part of a complex dynamic of changing factors affecting people's well-being as they age. One such factor is a marked shift in employment-based retirement policy, away from traditional defined benefit (DB) pension plans and retiree health benefits, and toward 401(k)-type plans in which individuals manage their own retirement assets. Another factor is the implicit continuing changes in the public programs that benefit older people, most notably Social Security, Medicare, and Medicaid, as financial

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pressures from the current provisions of these programs intensify. A third factor is the substantial and ongoing effects of the Great Recession, many of which are still being assessed.

The landscape of health and health care is changing rapidly as well, with lower disability rates by age, continuing advances in medical technology and disease management, increases in health care costs, and significant reforms in health policy. Health affects one's ability to work at older ages, and is strongly associated with financial well-being. Our aim through program research is to advance our understanding of well-being in all its dimensions and to determine what can be done to improve well-being in this rapidly changing environment.

Over the last 28 years, the NBER's Program on the Economics of Aging has helped to transform this field from an exploratory new research area into a well-recognized and influential subfield of the economics profession. Throughout its history, the program has benefited from a substantial base of financial support from the National Institute on Aging (NIA), and from the leadership of a visionary program officer at NIA, Richard Suzman. NIA's recognition of the analytic value of economic research in aging and its support for a highly integrated program of investigators working collaboratively on aging issues was path-breaking. This support has been critical to development of the NBER program, the research subfield, and our understanding more generally of people's well-being as they age. The NBER's Aging Program continues to be anchored by NIA Center and Program Project grants, and by multiple NIA-funded research projects that are administered under the coordinating umbrella of the program. NIA support has been supplemented in recent years by Retirement Research Center and Disability Research Center grants from the Social Security Administration (SSA).

The program has thrived through its history by simultaneously recruiting and inspiring some of the most prominent, established economics scholars along with more emerging scholars to develop a research agenda on economic issues related to aging. This has had a magnetic effect on the size, scope, and productivity of the program as new researchers have been drawn into the field by the prominent senior scholars already working on aging issues. The program has also been leveraged by substantial research development support provided by NIA, includ-

ing an NIA-funded training program on the economics of aging and NIA funding for pilot projects. The training program alone has supported about 150 investigators, the large majority of whom have developed a long-term research agenda on the economics of aging. Nearly 100 pilot awards have also been supported by NIA, most of which have laid a foundation for larger-scale subsequent research projects. Both the training and research development opportunities in aging have expanded even further in recent years through the SSA-funded research centers.

One measure of the success of these training and development initiatives is that three of the five most recent recipients of the John Bates Clark Medal (awarded annually to the best economist under age 40) are active program affiliates who have been part of the program for most of their careers: Esther Duflo (2010 recipient), Amy Finkelstein (2012 recipient), and Raj Chetty (2013 recipient). Two Nobel Prize winners, Daniel McFadden and the late Robert Fogel, played an important role in building the program, as did several past officers of the American Economic Association (AEA) and some of the intellectual leaders in public economics, health economics, labor economics, financial economics, behavioral economics, and econometrics. What has emerged from this long-term commitment to training and recruitment is a multigenerational consortium of accomplished researchers who work together on important issues and create training opportunities for each new cohort of economists who become involved with the program over time.

Many of the studies taking place through the NBER's Aging Program are distributed initially as NBER Working Papers, examples of which are noted below. Some are also published in a continuing series of NBER research volumes on the economics of aging, the most recent of which are *Research Findings in the Economics of Aging* (2010),[1] *Explorations in the Economics of Aging* (2011),[2] *Investigations in the Economics of Aging* (2012),[3] and *Discoveries in the Economics of Aging* (2014).[4]

The research composition of the NBER's Program on Aging has evolved as the economics of aging field has matured. The overarching goal is to understand the health and financial well-being of people as they age, how well-being is affected by the changing environment in which people live, and what interventions might be effective in improving health and financial well-being. What is most apparent from the research carried out by program affiliates is the integral relationship between the multiple dimensions of people's well-being.

As we confront the demographic challenges of a substantially larger population of older people, opportunity lies in three sets of trends, all of which are a focus of continuing research. First, saving in 401(k) and similar plans is now a mainstream aspect of retirement preparation. Though large parts of the population appear to save too little, and access to employment-based saving programs is far from universal, a policy foundation for the accumulation of personal retirement resources is in place, and financial preparation can be improved through saving-related interventions. Second, many though not all measures of health are improving, and these improvements can be accelerated through health-related interventions. Third, it may be possible to allocate some of the bounty of longer and healthier lives to prolonging the labor force participation of some older workers, thereby helping to pay for higher Social Security and health care costs, and moderating the macroeconomic challenges we collectively face. But whether people work or retire at one age or another depends significantly on how we structure our public policies and work environments. Each of these issues is being considered in ongoing program research. The summary below describes examples of NBER publications and working papers that have been distributed in the last two years, and that bear on each of these issues.

Financial Well-Being

Among the resources that are potentially available to support people in their later years are Social Security, employer-provided pension benefits, financial asset savings, housing wealth, and earnings. In his 2014 Richard T. Ely Lecture to the AEA,[5] James Poterba presents an overview of changing retirement security, the increasing importance of individual decisions about saving, and the varying composition of financial resources available in retirement across different segments of the population. Among the research reviewed in that lecture is a series of studies co-authored with Steven Venti and me on the financial status of people as they age, the most recent of which demonstrates the strong lifelong relationships between health, education, Social Security income, financial assets, and depletion of financial assets in later life.[6]

As noted, a major trend of the last two decades is away from traditional employer-provided pensions and toward savings-based retirement programs, most notably 401(k) plans. John Beshears, James Choi, David Laibson, Brigitte Madrian, and others have an extensive research agenda on what motivates saving. The consistent finding of their research is that people tend to "follow the path of least resistance," participating more often when enrollment is automatic, and often following the default provisions of their employers' programs. People are also affected by other behavioral factors such as simplification, planning aids,[7] reminders, and commitment features.[8] Their most recent studies have looked at how small cues in plan descriptions can alter behavior,[9] the availability and utilization of 401(k) loans,[10] peer influences on saving,[11] and the use of Roth versus traditional 401(k) plans.[12]

Using data from Denmark, Chetty, John Friedman, Soren Leth-Petersen, Torben Nielsen, and Tore Olsen find that automatic contributions are more effective at inducing saving than subsidization or financial incentives.[13] Robert Clark, Jennifer Maki, and Melinda Sandler Morrill find that a simple informational flyer about their employer's 401(k) plan and the value of contributions compounding over a career significantly increase the likelihood of younger workers contrib-

uting to the plan.[14] In similar work, Gopi Shah Goda, Colleen Flaherty Manchester, and Aaron Sojourner find that providing plan participants with income projections, based on saving rates, also increases contributions.[15]

Related to saving rates is the decision of how to allocate one's savings among alternative investment options. Again, defaults are important, but so are the number of options available and the presentation of those options to plan participants. Clemens Sialm, Laura Starks, and Hanjiang Zhang show that while participants in defined-contribution (DC) plans rarely adjust their portfolio allocations, significant changes in investment composition still occur because of changes in the investment options offered by plan sponsors.[16] Beshears and his co-authors find that when people receive simplified investment disclosure information, they spend less time on their investment decisions, but do not change them significantly.[17] Fabian Duarte and Justine Hastings find that a government-defined fee index in the pension system in Mexico significantly influenced investment behavior, but the design of the index did not necessarily steer investors to the lowest cost funds.[18]

Because responsibility for retirement planning has shifted from employers to workers, questions have been raised about the importance of financial literacy, as well as the appropriate role for financial advisors. Recent papers by Hastings, Madrian, and William Skimmyhorn[19] and by Annamaria Lusardi, Olivia Mitchell, and Vilsa Curto[20] review the literature on financial education and financial literacy, documenting deficiencies in financial sophistication in survey data and poor performance of many individuals on test-based measures of financial literacy. A study by Lusardi, Pierre-Carl Michaud, and Mitchell shows that financial knowledge can potentially account for a large portion of wealth inequality.[21] It is not clear that the use of professional financial advisors helps, however. John Chalmers and Jonathan Reuter find that clients who choose brokers over self-directed investing tend to have riskier portfolios that underperform benchmark portfolios.[22] More actively managed investments also have higher fees. For example, Hastings, Ali Hortaçsu, and Chad Syverson find that advertising affects fund manager choice, and may raise average management fees in Mexico's pension system.[23]

This line of research on retirement saving has also analyzed the risk and return tradeoffs of different investment portfolios. For example, Mitchell and Stephen Utkus look at the role of target-date funds in shifting investment decisions from workers back to employers (or to fund managers) who adjust portfolios automatically based on a worker's investment horizon.[24] However, Pierluigi Balduzzi and Reuter find wide variability in returns to different target-date retirement funds.[25] Andreas Hubener, Raimond Maurer, and Mitchell consider how asset allocations interact with Social Security claiming, survivor benefit rules, and life insurance purchases.[26]

While accumulated savings is one aspect of financial well-being at older ages, a related question is how much money people need for financial security in later life. The biggest reason financial need may be changing is the growth of out-of-pocket medical costs. For example, a recent study by Goda, John Shoven, and Sita Slavov finds that after subtracting health spending from Social Security benefits, the average net Social Security benefit has grown more slowly than non-medical inflation.[27] In related work, Sanders Korenman and Dahlia Remler consider the feasibility of a health-inclusive poverty measure.[28] Further reinforcing the relationship between out-of-pocket medical costs and financial need, Clark and Mitchell find that public employees who anticipate receiving employer-provided health insurance in retirement save less than their private sector uncovered counterparts.[29]

In addition to studying saving and the need for saving, investigators in the Aging Program are analyzing how people use their accumulated assets in later life. Of particular interest is the relative importance of annuitized versus non-annuitized resources, and how they are affected by the financial decisions people make. Annuitized assets provide a steady stream of income for life, providing insurance against outliving one's resources. Social Security provides a base level of annuitized income which may be supplemented by traditional employer-provided pension plans or by private annuity products. Non-annuitized assets, on the other hand, are available for unexpected or irregular expenses, such as adverse health events.

Shoven and Slavov show the effect of delayed Social Security claiming as a low-cost approach to increasing people's annuity payment stream.[30] Those leaving jobs with a traditional pension plan may also have the option to retain or to cash out their pension annuities. Clark, Morrill, and David Vanderweide find that even among employees leaving their jobs before age 50, people often keep their annuitized pensions rather than cashing out of them.[31] The purchase of annuity products in the private market is less common. Poterba, Venti, and I analyze the amount of annuity income people could potentially purchase if they converted all of their non-annuitized financial assets to annuities.[32] We find that fewer than half of households could increase their annuitized income by more than $5,000 per year, but that wealthier households could purchase larger annuities.

Jeffrey Brown, Arie Kapteyn, Erzo Luttmer, and Mitchell suggest that one reason for the small private market for annuities is the difficulty of assessing their value.[33] Beshears, Choi, Laibson, Madrian, and Stephen Zeldes look at how the framing and structure of private annuity choices affect people's stated preferences, and how annuities might be structured to increase their appeal.[34] Brown, Jeffrey Kling, Sendhil Mullainathan, and Marian Wrobel find that annuities are more attractive when presented in a consumption frame than in an investment frame.[35] Vanya Horneff, Maurer, Mitchell, and Ralph Rogalla look at the annuity protections in Guaranteed Minimum Withdrawal Benefit variable annuities.[36] Felix Reichling and Kent Smetters find that when valuation risk is incorporated into models of household demand for annuities, the number of households

choosing to annuitize declines.[37]

Many public policy provisions also influence financial well-being in later life. Brown and Scott Weisbenner find that the Windfall Elimination Provision of Social Security reduces benefits proportionately more for households with lower lifetime earnings.[38] Alan Gustman, Thomas Steinmeier, and Nahid Tabatabai find that the 3.5 percent of households that are subject either to the Windfall Elimination or the Government Pension Offset rules have the value of their benefits reduced by an average of about one-fifth.[39] These authors also find that pension data reported in some surveys is understated relative to its contribution in supporting retirees.[40]

Health and Life Satisfaction

Finances and health are two fundamental aspects of well-being as we age. As we live longer, an important question is whether our lengthening life expectancies are characterized by poor health and functional disability, or by good health and functional independence. A particularly exciting finding of recent research, reported by David Cutler, Kaushik Ghosh, and Mary Beth Landrum, shows the compression of morbidity into a shorter period of time just before death.[41] If confirmed in continuing work, this means that the impacts of population aging will not be as severe as they might be if additional life expectancy involved many years of disability and need for care. In prior work, Cutler and Landrum compressed 19 health indicators into three summary measures of physical and social impairment, functional ability, and sensory impairment, which provided an important background to studying health trends.[42]

Many factors affect health trends, and many can be influenced by public health interventions. For example, Samuel Preston, Andrew Stokes, Neil Mehta, and Bochen Cao project that future mortality will be affected by both reductions in smoking and increases in obesity, roughly offsetting for women, but with smoking reductions having a bigger effect for men.[43] Program researchers have also tested various behavior-change interventions. Recent work by Beshears, Choi, Laibson, Madrian, and Katherine Milkman investigates the power of planning prompts in inducing more people to keep colonoscopy appointments[44] or to increase flu vaccination rates.[45] Larger experimental interventions have been undertaken in poorer regions of the world including a recent study by Abhijit Banerjee, Sharon Barnhardt, and Duflo which examines attempts to better treat anemia with fortified salt.[46]

Changes in health insurance and health policy impact health as well, and program researchers have a diverse research agenda on health policy impacts. For example, using data from the Oregon lottery for Medicaid coverage, Finkelstein et al. find that increased insurance coverage led to higher health care utilization, lower out-of-pocket medical expenditures, and better self-reported physical and mental health.[47] Charles Courtemanche and Daniela Zapata find that the near universal coverage following health reforms in Massachusetts also led to improvements in multiple measures of health.[48] Martin Hackmann, Jonathan Kolstad, and Amanda Kowalski analyze other impacts of the insurance mandate in Massachusetts, finding significant decreases in premiums and average costs, smaller post-reform markups in the individual health insurance market, and a generally healthier mix of enrollees.[49]

Florian Heiss, Adam Leive, McFadden, and Joachim Winter look at plan choice in the implementation of Medicare Part D and find that a sizeable fraction of consumers are not making the best decisions among plan options.[50] This conclusion is reinforced in a study by Jason Abaluck and Jonathan Gruber, who find both inertia in plan choice and suboptimal decisions even among those who change plans.[51] In addition, Keith Marzilli Ericson finds that firms may raise premiums on existing enrollees, who are slower to change plans they already have, while charging less for comparable new plans.[52] Liran Einav, Finkelstein, and Paul Schrimpf find that there is substantial bunching of pharmaceutical spending just before the "donut hole," where insurance coverage is discontinuously reduced.[53]

Trends and patterns in health care spending are another subject of continuing program research. Amitabh Chandra, Jonathan Holmes, and Jonathan Skinner find that the slowdown in health care spending growth over the last decade is a result of three primary factors: the rise in high deductible insurance plans, state-level efforts to control Medicaid costs, and a general slowdown in the diffusion of new technology, particularly in the Medicare population.[54] Katherine Baicker, Michael Chernew, and Jacob Robbins find substantial cost-spillover effects in markets with a high concentration of Medicare managed care enrollees, lowering hospital costs for all seniors and for commercially insured younger populations.[55] Cutler, Skinner, Ariel Dora Stern, and David Wennberg find that the single most important factor causing regional variation in health care spending is physician beliefs about treatment and not differences in patient demand-side factors.[56]

A line of research on health care productivity tries to relate medical advances and medical spending to the health outcomes that are obtained from that spending. For example, Anne Hall and Tina Highfill analyze alternative approaches to calculating disease-based expenditure indexes.[57] Chandra, David Malenka, and Skinner look at the pace of new technology adoption, using as a case study drug-eluting stents which they find are adopted more rapidly at higher quality hospitals and at hospitals where patients are more likely to benefit from the technology.[58] Eric Budish, Benjamin Roin, and Heidi Williams find that longer periods of time between pharmaceutical innovation and commercialization can deter R&D investments, at least in part because patents have a fixed term.[59] Chandra, Finkelstein, Adam Sacarny, and Syverson find that the hospital industry has much in common with more traditional production sectors; for example, hospitals with higher productivity measures have comparatively larger and expanding market shares.[60]

As noted earlier in this report, much of the integrative research of the Program on Aging has found strong interrelation-

ships between well-being in the financial and health domains which persist throughout the life course. For example, Till Stowasser, Heiss, McFadden, and Winter describe the existing evidence on the links between socioeconomic status and health and they explain some of the challenges in assessing causal relationships.[61] Hilary Hoynes, Diane Whitmore Schanzenbach, and Douglas Almond find that access to food stamps in childhood leads to a reduction in obesity, high blood pressure, and diabetes later in life.[62] In a longer-term historical analysis of health and the economy, Dora Costa argues that scientific advances (including sanitation projects) played an important historical role in improving health and raising economic productivity.[63] Bruce Meyer and Wallace Mok find that the economic consequences of health impairments are profound.[64] Cutler and Adriana Lleras-Muney explore the relationship between education and health across countries, finding both that education affects health and, in some cases, that health may affect education.[65]

Extending beyond traditional measures of health, some of the most recent program research has considered well-being in a more general sense. For example, Daniel Benjamin, Ori Heffetz, Miles Kimball, and Nichole Szembrot identify 136 aspects of well-being that incorporate happiness and life satisfaction, goals and achievements, freedoms, engagement, morality, self-expression, relationships, and the well-being of others.[66] Exploratory work by Angus Deaton uses well-being data from Gallup surveys over the period of the financial crisis and finds, among other results, a close relationship with stock market performance.[67] In another application of Gallup data, Deaton and Arthur Stone find that elderly Americans who live with people under the age of 18 have lower life evaluations than those who do not: they experience worse emotional outcomes, less happiness and enjoyment, and more stress, worry, and anger.[68] McFadden has also evaluated well-being in work on "the new science of pleasure."[69]

Work and Retirement at Older Ages

While the determinants of work and retirement have been core components of the Aging Program since its inception, an important emerging angle of research is how people's capacity to work is changing over time, and the effect of public policies and work environments on older people's incentive to continue working. For example, Kevin Milligan and I document long-term trends in mortality risk in different countries, a measure of health that is comparable across countries and comparable over time within the same country. We find that at each mortality rate in 2007, if American men between the ages of 55 and 69 had worked as much as American men in 1977 they would have worked an additional 3.7 years, or 46.8 percent more.[70] Whether these improvements in health will translate into work behavior is complicated by and highly dependent upon policy. At the individual level, health is clearly a factor that influences work behavior, as quantified in a recent study by Gustman and Steinmeier.[71] At the economy-wide level, policy incentives as well as trends in overall health are likely to play a key role in affecting labor market activity.

I have been directing a long-term NBER project on Social Security and retirement around the world which has engaged an international team of investigators from Belgium, Canada, Denmark, Italy, France, Germany, Japan, the Netherlands, Spain, Sweden, the United Kingdom, and the United States. The current focus of the group is on this question: given health status, to what extent are differences in labor force participation across countries determined by the provisions of disability insurance (DI) programs?[72] Several studies from this project have been circulated recently as NBER Working Papers, including papers on Belgium,[73] France,[74] Germany,[75] and the United Kingdom.[76] Courtney Coile, who conducted the U.S. study for a forthcoming Aging volume, finds that leaving the labor force through DI is strongly related to education and policy incentives, even after controlling for the effects of health.[77] Coile, Milligan, and I draw together the findings from the country studies and identify several overarching themes.[78] We find, for example, that neither the variation in DI participation across countries nor the trends in participation within countries over time has much to do with health trends. Much larger factors are changes in DI policy, the financial incentives of the DI policies (in conjunction with other pathways to retirement), and the stringency of the applicant screening process. We also find a strong relationship between education and DI participation in all countries, even after controlling for health. It is also striking that the proportion of people aged 60 to 64 on DI is larger in the United States than in most other countries; there has been a large decline in DI since the mid-1990s and later in most other countries.

Numerous other NBER studies have also explored relationships between policy and labor market behavior at older ages. Looking at Social Security policy, Gustman and Steinmeier estimate generally increasing work at older ages from three potential changes to Social Security policy: raising the early retirement age, raising the normal retirement age, and eliminating the payroll tax.[79] Alexander Gelber, Damon Jones, and Daniel Sacks find considerable bunching at the kink points in the Social Security earnings test that appears to persist even when individuals reach an age at which they are no longer subject to the earnings test, or following legislative changes that eliminate the earnings test for some groups.[80] Jingjing Chai, Maurer, Mitchell, and Rogalla find that a lump sum payment for delaying retirement could increase the average retirement age by as much as two years.[81] Neeraj Kaushal finds that the expanded pension system in India had a modestly negative effect on the labor supply of older men, but not of women.[82]

Looking at DI policy, Andreas Kostøl and Magne Mogstad find that many DI recipients have considerable capacity to work and can be induced to work more using financial incentives.[83] David Autor, Mark Duggan, and Gruber find

that when people need to wait longer to claim private DI benefits, they are less likely to claim the insurance and more likely to work.[84] Timothy Moore finds that roughly one-fifth of the DI recipients who lost benefits as a result of the 1996 removal of drug and alcohol addictions as qualifying conditions for DI subsequently returned to work.[85]

With regard to health insurance policy, Shoven and Slavov find that among state and local government employees, access to retiree health coverage raises the probability of leaving the labor force between the ages of 60 and 64 by 5.1 percentage points, or about 28 percent.[86] Maria Fitzpatrick finds that after the introduction of retiree health insurance for a group of public teachers, the percentage still employed at age 65 drops from 51 to 29 percent.[87] Steven Nyce, Sylvester Schieber, Shoven, Slavov, and I also find very significant increases in early retirement among firms offering more generous retiree health benefits in the private sector, based on an analysis of employee-level data in 64 large firms.[88]

Studying other workplace programs, Steven Allen, Clark, Maki, and Morrill find that employer-based retirement seminars affect people's planned retirement age and planned age of claiming Social Security benefits.[89] Fitzpatrick and Michael Lovenheim document the impact of early retirement incentives on the teaching profession.[90] Goda, Jones, and Manchester look at the influence of selection and incentives in influencing work mobility between DB and DC pension systems.[91] Interestingly, Chalmers, Woodrow Johnson, and Reuter find that within Oregon's integrated DB-DC pension system, employees receiving DC benefits are more likely to retire before the normal retirement age than employees receiving the DB benefit.[92]

The health of the macroeconomy has its own effect on labor market behavior. For example, Yuriy Gorodnichenko, Jae Song, and Dmitriy Stolyarov find that flows into both full and partial retirement increase when the unemployment rate rises.[93] However, Andreas Mueller, Jesse Rothstein, and Till von Wachter find no evidence that expiring unemployment insurance benefits lead to a rise in DI applications.[94]

The fiscal challenges of population aging heighten the importance of our continuing research on these issues, as the baby boom generation moves from the most productive and highest earning phase of their careers to the ages when people have traditionally retired. The implications for the U.S. economy are enormous as the cost of government programs rises, with fewer people in the labor force to pay for them and, at least potentially, a reduction in the aggregate productive capacity of a smaller labor force. In confronting fiscal challenges, Axel Börsch-Supan reviews various approaches considered or implemented in Europe, including contribution or benefit rate changes, indexation of benefits to dependency, measures to induce longer working lives, adapting retirement age to life expectancy, and more reliance on private savings.[95] Alan Auerbach, Lorenz Kueng, and Ronald Lee evaluate the intergenerational impacts of different tax and benefit adjustments to social security policy.[96]

A final example of the looming fiscal challenges of population aging and the importance of labor market behavior in confronting these challenges is the unfunded liability of retiree pension and state and local government health care benefits. Byron Lutz and Louise Sheiner estimate the total unfunded liability for state and local health care benefits at more than $1 trillion, or about half the amount of unfunded pension obligations.[97] Robert Novy-Marx and Joshua Rauh estimate that without policy changes, full funding of state and local pension systems over the next 30 years would require that contributions increase by 2.5 times, reaching 14.1 percent of revenues.[98] These authors also consider public pension reforms that link benefits to investment performance.[99]

Researchers in the Economics of Aging Program will continue to explore the potential for policy to motivate, or at least facilitate, the many positive societal trends that will help meet the demographic challenges ahead: improving health, increasing saving, extending productive working lives, and enhancing well-being as the population ages.

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Research Summaries

Labor Market Adjustment to International Trade

David Autor and Gordon Hanson*

The past two decades have seen a fruitful debate on the impact of globalization on U.S. labor markets. Research by economists in the 1990s revealed that while international trade, particularly in the form of offshoring, was associated with modest increases in the wage premium for skilled labor, other shocks, including skill-biased technical change, played a more important role in the evolution of the U.S. wage structure.[1] Recent evidence suggests that since the early 1990s, expanding global trade, propelled by China's spectacular growth, is playing a much larger role in the U.S. labor market.

One factor limiting trade's impact on U.S. labor was that, historically, imports from low-wage countries were small. As recently as 1990, low-income countries accounted for less than 4 percent of U.S. manufacturing imports. With China's emergence as a global economic power, the situation has changed markedly. Today, China accounts for one-fifth of the manufactured goods that the United States purchases from abroad.

The causes of China's manufacturing surge are its strong comparative advantage in labor-intensive production coupled with a rapid overall rate of economic growth. Its comparative advantage, which lay dormant during the decades of global economic isolation imposed by Mao, was unleashed in dramatic fashion by the reforms of the 1980s and 1990s, which also contributed to progressive increases in the country's aggregate productivity. For U.S. manufacturing, which still accounts for the majority of U.S. trade, China's expansion repre-

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sents a substantial competitive shock. Compounding the effects of this shock are trade imbalances in both China and the United States. Large Chinese trade surpluses along with large U.S. trade deficits mean that increases in U.S. imports from China have not been offset by corresponding increases in U.S. exports to China.

The emergence of China from being a technologically backward and largely closed economy to the world's third largest manufacturer in just two decades provides a unique opportunity to learn about the impact of international trade on labor market outcomes. In a series of recent papers with various co-authors, we have sought to trace out these impacts.

Local Labor Market Impacts of Import Competition

Because trade shocks play out in general equilibrium, assessing their causal effects presents a conceptual and empirical challenge. One needs to map many industry-specific changes (attributable, say, to industry productivity growth in China) into a small number of aggregate outcomes. Our solution to this "degrees of freedom" problem is to use regional economies as laboratories in which to study the labor market consequences of trade.[2]

In work with David Dorn, we relate changes in labor-market outcomes from 1990 to 2007 across U.S. local labor markets to changes in exposure to Chinese import competition.[3] These local labor markets are subject to differential trade exposure according to their initial patterns of industry specialization. Some regions, such as Raleigh, North Carolina, specialize in industries such as furniture that are heavily exposed to trade with China, whereas others, such as Fresno, California, specialize in fruit and vegetable products that are lightly exposed.

We find that greater import competition from China affects local labor markets not just through manufacturing employment, which unsurprisingly is adversely affected, but also along other margins which have escaped notice in earlier research. Local labor markets facing rising low-income country imports as a result of China's growth experience increased unemployment, decreased labor-force participation, and increased use of disability and other transfer benefits, as well as lower average wages. Notably, import shocks trigger a decline in wages that is primarily observed outside the manufacturing sector. Reductions in both employment and wage levels lead to a drop in the average earnings of households. These changes contribute to rising transfer payments through multiple federal and state programs. The largest transfer increases are for federal disability, retirement, and in-kind medical payments. Unemployment insurance and income assistance play a significant but secondary role. Trade Adjustment Assistance (TAA), which specifically provides benefits to workers who have been displaced by import competition, accounts for a negligible part of the trade-induced increase in transfers.

The differential take-up rates of TAA and of Social Security Disability Insurance (SSDI) that we document are particularly notable. TAA grants are temporary, whereas most workers who collect disability receive SSDI benefits until retirement or death. For regions affected by Chinese imports, the estimated dollar increase in per capita SSDI payments is more than 30 times as large as the estimated dollar increase in TAA payments. This implies that workers are far more likely to use SSDI to insure themselves against increases in import competition than to use TAA.[4]

Import Competition and the Great U.S. Employment "Sag" of the 2000s

Even before the Great Recession, U.S. employment growth was unimpressive. Between 2000 and 2007, the economy gave back the considerable jump in employment rates it had achieved during the 1990s, with major contractions in manufacturing employment being a prime contributor to the slump. This pre-Great Recession U.S. employment "sag" of the 2000s is widely recognized but little understood. In work with Daron Acemoglu, Dorn, and Brendan Price, we explore whether rising import competition from China played a significant role in this sag — both directly through import competition-induced reductions in U.S. manufacturing employment, and indirectly through spillovers to employment in other upstream and downstream sectors inside and outside of manufacturing.[5]

Our approach includes analysis at both the national industry level and the local labor market level. These two perspectives are helpful for framing the mechanisms through which increased import competition affects aggregate employment. One impact of import competition on employment is through direct competition — intuitively, industries more exposed to rising imports contract output and reduce the number of workers on the payroll. This direct impact leads to further indirect effects on upstream industries that supply inputs to the affected industry and on downstream industries that purchase inputs from the affected industry. Our national industry perspective allows us to capture these upstream and downstream effects explicitly via input-output linkages between industries. However, the national industry data miss two other potentially important impacts: the offsetting positive employment effects that occur as workers displaced by trade find jobs in other sectors, and the further negative employment effects of initial job loss on aggregate demand. Helpfully, we are able to capture a portion of these latter two effects in our data on local labor markets. Thus, the impacts of trade on employment observed in national industry and local labor market data give us two complementary perspectives on the aggregate employment effects that we seek to identify.

We estimate that import competition reduced aggregate U.S. employment between 600,000 and 1.25 million jobs between 1991 and 2011. This reduction constitutes a meaningful contribution to the aggregate U.S. employment sag in this period. But it is nevertheless modest relative to the decline in U.S. manufactur-

ing employment of 5.2 million workers between 2001 and 2011, and more modest still when compared to the aggregate employment sag including non-manufacturing. The exercise serves as an additional step toward quantifying the full employment impact of increasing import competition on the U.S. labor market. Perhaps as important, the multiple angles of attack used in our analysis underscore the considerable conceptual challenges in drawing general equilibrium inferences from national and sub-national data.

Estimating Trade Impacts for Individual Workers

In work with Dorn and Jae Song, we widen our focus from market-level reactions to import competition, and study adjustment at the worker level.[6] What happens to workers employed in industries that undergo a sharp increase in import competition? Are the consequences for individual worker earnings, employment, and uptake of government transfers merely transitory or do they persist over the longer run?

Using worker-level data from the U.S. Social Security Administration (SSA), we estimate the impact of exposure to Chinese import competition on cumulative earnings, employment, movement across sectors, movement across regions, and receipt of Social Security benefits over the period 1992 to 2007. By exploiting links between workers and their employers observable in the SSA data, we are able to study four margins of worker adjustment: the change in earnings at the initial employer (that is, the worker's place of employment before the increase in imports from China), the change in earnings associated with job loss, the change in earnings associated with uptake of government benefits, and the change in earnings associated with moving between employers, industries, and/or regions. Decomposing changes in earnings across these margins — and capturing how they vary by worker characteristics — reveals where in the adjustment process labor market frictions arise and which types of workers face larger burdens in adjusting to shocks.

Labor economists are interested in the long-run consequences of job loss. To deal with the challenge of distinguishing involuntary from voluntary worker separations from employers, previous researchers have studied episodes of mass layoffs in which plants let go a substantial fraction of their employees within a short span of time. Perhaps not surprisingly, the repeated finding of mass layoff studies is that workers suffer an immediate loss in earnings that they partially, but not fully, make up through subsequent employment. Perhaps more surprisingly, this earnings loss, in proportional terms, appears to be similar across workers at different skill levels. Our analysis allows us to revisit the consequences of job loss in the context of rising import competition.

Our data provide clear evidence that workers more exposed to trade with China experience lower cumulative earnings, lower cumulative employment, and greater receipt of SSDI over the sample window of 1992 through 2007. Strikingly, trade exposure increases job churning across firms, industries, and sectors, but not across regions. Workers more exposed to import competition spend less time working for their initial employer, less time working in their initial narrow manufacturing industry, and more time working elsewhere in manufacturing and outside manufacturing altogether.

While trade exposure has comparatively modest earnings effects on the median exposed worker — of approximately 3 percentage points per year — the magnitudes of job churn and adjustment in earnings and employment differ substantially across demographic groups. Reductions in cumulative earnings are concentrated among workers with low initial wages, workers with low tenure at their initial firm, workers with weak attachment to the labor force, and those employed at large firms with low wage levels. Trade competition also affects the careers of high-wage workers, who are able to rapidly separate from their initial employers and to move to other firms, often outside manufacturing. High-wage workers frequently make these adjustments prior to large-scale layoffs at their initial firm, and without notable declines in earnings. Low-wage workers instead stay longer in their initial trade-exposed firms and industries, are more likely to separate from their initial firm during mass layoffs, and incur greater losses of earnings both at the initial firm and after moving to other employers. Thus, while trade exposure induces augmented job churn for both high- and low-wage workers, the consequences for their overall earnings are distinct: high-wage workers appear to primarily obtain "safe harbor" in equally highly paid work, often outside of manufacturing. Low-wage workers, by contrast, churn primarily within the manufacturing sector and experience reduced earnings at both the initial employer, where the initial shock transpired, and at subsequent employers.

These findings are complementary to the local labor market approach of our other research. The variation in disruptions to earnings and employment induced by trade that we identify reveals the presence of frictions in moving workers between jobs. Absent such frictions, wages would equalize for similar workers at all moments of time and we would detect no wage differences across workers, either in the short or long run. That we find substantial evidence of outcome differences suggests that frictions are materially important. Though our worker-level perspective prevents us from estimating the impact of international trade on equilibrium employment or wages for entire skill groups, it allows us to see differences across workers in adjustment to greater import competition. These adjustment burdens may color how workers perceive global economic integration.

Conclusions

Economic theory suggests that trade with China yields aggregate income gains for the U.S. economy. What our findings add to this well understood insight is that the distributional consequences of trade and the offsetting, medium-run efficiency losses associated with adjustment to trade shocks are substantial. These aspects of labor market adjustment to trade are often

overlooked in research on trade because of a focus on wages as the sole channel of trade adjustment. The consequences of Chinese trade for U.S. employment, household income, and government benefit programs may contribute to public ambivalence toward globalization and specific anxiety about increasing trade with China.

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[2] *Important precursors to our work include G. J. Borjas and V. A. Ramey, "Foreign Competition, Market Power, and Wage Inequality: Theory and Evidence," NBER Working Paper No. 4556, November 1993, and* Quarterly Journal of Economics, *110 (4) (1995), pp. 1075–110; and P. Topalova, "Trade Liberalization, Poverty, and Inequality: Evidence from Indian Districts," NBER Working Paper No. 11614, September 2005, and in A. Harrison, ed.,* Globalization and Poverty, *Chicago,IL: University of Chicago Press, (2007), pp. 291–336.*

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[4] *Two related papers include D. H. Autor, D. Dorn, and G. H. Hanson, "The Geography of Trade and Technology Shocks in the United States," NBER Working Paper No. 18940, April 2013, and* American Economic Review: Papers and Proceedings, *103 (3) (2013), pp. 220–5; and "Untangling Trade and Technology: Evidence from Local Labor Markets," NBER Working Paper No. 18938, April 2013. In this work, we juxtapose the effects of trade and technology on employment in U.S. local labor markets between 1990 and 2007. Regional exposures to trade and technology are uncorrelated, conditional on initial manufacturing employment.*

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Economic Consequences of Gender Identity

Marianne Bertrand*

An increasingly discussed explanation for why women and men experience different labor markets is the existence and persistence of gender identity norms. Influential research by George Akerlof and Rachel Kranton[1] has imported into economics insights from social psychology regarding an individual's social identity and how it can influence behaviors and choices. These researchers define identity as one's sense of belonging to one or multiple social categories. One's identity encompasses a clear view about how people who belong to that category should behave. In their model, identity directly enters the utility function: identity influences economic outcomes because deviating from the behavior that is expected for one's social category is assumed to decrease utility. Hence, people's economic actions can in part be explained by a desire to conform with their sense of self. Akerlof and Kranton apply their model to the concept of gender identity. In this case, the two relevant social categories are those of "man" and "woman," and these two categories are associated with specific behavioral prescriptions which, if violated, will decrease utility.

Gender identity norms may help to explain why occupational segregation by gender has been slow to disappear. Women may feel discomfort entering certain professions, and men may feel dis-

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comfort if women enter these professions if the professions are strongly "gendered" (for example, only men, not women, are bankers). This is related to Claudia Goldin's pollution theory of discrimination,[2] which also assumes that men derive utility from their work not just because of the wage they earn but also because of how their image is affected by where they work and with whom they work. In Goldin's model, men want to keep women away from certain jobs because broad female participation in those jobs would reduce the prestige men obtain from working in them. The reduction in prestige in Goldin's case is driven by the signals that might be sent to outsiders about the qualifications required to perform these jobs if too many women enter them. In other words, Goldin's model is closer to a statistical discrimination model while Akerlof and Kranton's is more directly reminiscent of a taste-based discrimination model.

Another application is women's labor force participation. As long as there is a strong behavioral prescription indicating that "men work in the labor force and women work in the home," gender identity norms could explain why women have been slow to increase their labor force participation. Nicole Fortin uses data from the World Values Surveys to assess how women's sense of self relates to their labor force participation in a sample of OECD countries.[3] She shows that the social representation of women as homemakers and men as breadwinners appears quite predictive of women's labor force participation across countries. Fortin re-examines a similar question in a single country, the United States, over a longer time period (1977 to 2006).[4] A more central motivation in this particular paper is to provide an explanation for the slowdown in the closing of the gender gap in labor force participation in the United States since the mid-1990s (see for example Francine Blau and Lawrence Kahn[5]). Fortin shows that the evolution of gender role attitudes over time appears to map well with the evolution of female labor force participation. Women's gender role attitudes steadily became less traditional, with more and more women disagreeing with the notion that husbands should be the breadwinners and wives should be the homemakers, and more egalitarian, with more and more women agreeing with the notion that they are as capable as men in the workforce, until the mid-1990s when these trends reversed. Raquel Fernandez and Alessandra Fogli study the labor force participation of second-generation American women.[6] They use past values of female labor force participation in these women's country of ancestry as cultural proxies for gender identity norms. Controlling for individual and spousal socioeconomic backgrounds, they find that American women whose ancestry is from higher labor force participation countries work more. Spousal culture also appears to matter in explaining the labor force participation of these women.

Figure 1: Distribution of Relative Income within Couples

Motherhood has been shown to be particularly disruptive to women's labor force participation and earnings. With Lawrence Katz and Goldin, I demonstrate that much of the large gender gap that emerges over time between male and female graduates of top MBA programs is attributable to gender differences in hours worked and frequency of career interruptions; the presence of children is the main contributor to women's shorter work hours and greater career discontinuity.[7] The fact that work-family balance considerations are more binding for mothers than for fathers could be seen as another manifestation of gender identity norms (for example, "a working mom cannot have a warm relationship with her child") that have not fully adjusted to improving educational and labor market opportunities for women.

Another behavioral prescription often associated with gender identity is that "a man should earn more than his wife." With Emir Kamenica and Jessica Pan, I explore the possible manifestations of this gender identity norm in patterns of relative income within households, marriage formation, wives' labor force participation, marital satisfaction, and the division of home production.[8] Using U.S. administrative data on individual income, we show that the distribution of relative income within couples (wife income/(wife income + husband income)) exhibits a sharp drop to the right of .5, for example, when a wife starts to earn more than her husband. This is shown in Figure 1, above.

In U.S. Census data, we also show that within a marriage market over time, when a randomly chosen woman becomes more likely to earn more than a randomly chosen man, the marriage rate declines (see also Tara Watson and Sara McLanahan[9]). Looking within couples, we show that when the probability that the wife's potential income exceeds her husband's actual income is higher, the

wife is less likely to participate in the labor force. We also provide suggestive evidence that this specific gender identity norm might influence the quality of marriage, with couples where the wife earns more than the husband reporting being less happy. Finally, using the American Time Use Surveys, we show that the gender gap in home production, how much more time the wife spends on non-market work than the husband, is larger in couples where the wife earns more than the husband, a finding that runs counter to standard models of the division of labor within the household.

One could also ask whether gender identity norms are responsible for gender differences in psychological attributes, such as attitudes toward risk, negotiation, and competition, which have been related to differences in career choices and earnings between men and women[10] and might contribute to women's underrepresentation at the very top of the corporate hierarchy.[11] Psychologists have shown that people expect women to be docile and men to be confident and self-assertive. Some have argued that a higher degree of risk aversion is viewed as the norm for females while part of the male identity is to be a risk-taker. These expectations could be part of socially constructed gender norms, rather than a reflection on innate differences; behaving according to these expectations may reflect a willingness to conform to what is expected from one's social category.

In a laboratory setting, Daniel Benjamin, James Choi, and A. Joshua Strickland study how making salient a specific aspect of one's gender or racial identity affects a subject's likelihood of making riskier choices or more patient choices.[12] The study consists of generating exogenous variation in identity effects by temporarily making more salient ("priming") a certain social category and seeing how the subjects' choices are affected by this priming. The gender identity salience manipulation is done through a questionnaire at the beginning of the experiment in which subjects are asked to identify their gender and whether they are living on a coed versus a single-sex dormitory floor. While the study uncovers some rich patterns with respect to racial identity, making gender salient appears to have no significant effects on either men's or women's patience, or their level of risk aversion. Of course, it is possible that the experimental priming was too weak to temporarily affect preferences.

Assuming that the gender identity model is relevant to women's labor market outcomes, one is left with the question of what drives the strength of gender identity norms. In an identity model, the changes in women's labor market outcomes over the last decades could only have occurred in conjunction with deep societal changes in the strength and meaning of the male and female social categories. Innovations in contraception may have contributed to altering women's identity in the 1960s and 1970s. As Goldin and Katz show, the introduction of the birth control pill led to both an increase in women's investment in schooling and an increase in the age at first marriage.[13] This, Goldin argues, meant that women's adult identities were less influenced by traditional gender roles, as these identities were now more likely to be formed before marriage and more influenced by career considerations.[14]

Other papers have discussed the influence of nurturing in the formation of gender identities. Many believe that gender role attitudes are largely determined in early childhood, and several papers have documented something akin to an intergenerational transmission of gender identity norms. Fernandez, Fogli, and Claudia Olivetti[15] provide an explanation for why men may differ in how traditional their views are with respect to whether women belong at home or in the workplace. They argue that a significant factor in the steady increase of women's involvement in the labor force has been the growing number of men being raised in families with working mothers. These men may have developed less stereotypical gender role attitudes, with weaker association between their masculinity and being the only or main breadwinner in their household. In particular, they show that men whose mothers worked are more likely to have working wives. This finding suggests a virtuous cycle: with more of these "new" men around, women should rationally invest more in labor market skills and thereby expose their sons to this less traditional family structure.

Olivetti, Eleonora Patacchini, and Yves Zenou explore how the work behavior of a teenager's own mother, as well as that of her friends' mothers, affect the work decisions of that teenager once she becomes an adult.[16] They find that both intergenerational channels positively affect a woman's work hours in adulthood, but the cross effect is negative, indicating the existence of cultural substitutability. That is, the mother's role model effect is larger the more distant she is (in terms of working hours) from the friends' mothers.

While the literature discussed above suggests the malleability of gender identity norms over rather short horizons (one generation), other work suggests stickiness of these norms in the longer term. Alberto Alesina, Paola Giuliano, and Nathan Nunn show that ethnicities and countries where ancestors practiced plough cultivation, which required more physical strength than shifting cultivation and hence was less suited to female labor, today have beliefs that exhibit greater gender inequality as well as lower rates of female labor force participation.[17] They identify the causal impact of plough cultivation use by exploiting variation in the historical geo-climatic suitability of the environment for growing crops that differentially benefited from the adoption of the plough.

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Taxes and International Mobility of Talent

Emmanuel Saez*

Tax-induced international mobility of talent is a controversial public policy issue, especially when tax rates differ substantially across countries and migration barriers are low as in the case of the European Union. High top tax rates may induce top earners to migrate to countries where the tax burden is lower, thereby limiting the redistributive power of governments by creating tax competition. Such concerns have featured prominently in recent tax policy debates in Europe, including the introduction of the 50 percent top marginal tax rate in the United Kingdom in 2010 (reduced to 45 percent in 2013) and a temporary 75 percent top marginal tax rate on labor income in France in 2013–14. Furthermore, the introduction in many European countries of preferential tax schemes for high-skilled foreign immigrants represents *prima facie* evidence of tax competition in internationally integrated labor markets. Preferential tax schemes for high-skilled foreign workers have been introduced in Belgium, Denmark, Finland, the Netherlands, Portugal, Spain, Sweden, and Switzerland. A summary of all such existing schemes in OECD countries is provided by OECD.[1] The key empirical question is how international migration by high-skilled workers responds to tax differentials across countries.

An enormous body of empirical literature has studied the effect of taxation on labor supply, earnings, and reported income for tax purposes *within* countries. In our 2009 study, Joel Slemrod, Seth Giertz, and I review the large recent literature on the effects of marginal tax rates on reported income.[2] However, there is almost no empirical work on the effect of taxation on the mobility of workers *across* countries. In two recent studies, we investigate the importance of tax-induced migration effects among top earners.

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Evidence from the European Football Market

In our 2010 paper, Henrik Kleven, Camille Landais, and I study whether top tax rates affect the international mobility of football players in Europe.[3] International mobility among football players has recently been the subject of heated discussion in the United Kingdom in connection with the increase in the top marginal tax rate from 40 percent to 50 percent. Supposedly, the star player Cristiano Ronaldo moved from Manchester United to Real Madrid in 2009 partly to avoid the announced 50 percent tax in the United Kingdom and to benefit instead from the so-called "Beckham Law" in Spain, a preferential tax scheme offering a flat tax of 24 percent to foreign residents. The nickname for this tax scheme was coined a few years earlier when another star player, David Beckham, also moved from Manchester United to Real Madrid to benefit from the scheme. Arsène Wenger, the emblematic manager of Arsenal Football Club, commented on the U.K. tax reform by saying that "with the new taxation system, (...), the domination of the Premier League will go, that is for sure."[4]

The football market offers three important advantages for the study of mobility. First, international mobility has been very common in the professional football market since the Bosman ruling by the European Court of Justice in 1995 that lifted pre-existing restrictions on player mobility. In the absence of such restrictions, cross-border mobility is higher in the football market than in most other markets owing to the fact that the game is the same everywhere and involves very little country-specific human capital. This makes the football market a valuable laboratory to begin the study of tax-induced mobility across countries. Football players may provide an upper bound on the migration response to taxation for the labor market as a whole. Obtaining an upper bound is crucial for gauging the potential importance of this policy question, especially in the long run as labor markets become more international and country-specific human capital declines in importance.

Second, extensive data on the careers and mobility of professional football players can be gathered for most countries over long time periods. For this project, we have gathered exhaustive data on the career paths of all first-league football players for 14 European Union countries over the past 30 years, as well as performance data for all first-league teams.

Third, and most importantly, there are many sources of variation in tax policy which can be exploited to identify the causal effect of taxation on mobility in the football market. In particular, a number of countries have experimented with special tax schemes offering substantially lower tax rates to immigrant football players, including Denmark (1991), Belgium (2002), and Spain (2004). An analysis of these tax schemes produces convincing evidence that international mobility patterns do indeed respond to taxation. For example, when Spain introduced the Beckham Law in 2004, the fraction of foreigners in the Spanish league immediately and sharply started to diverge from the fraction of foreigners in the comparable Italian league. Moreover, exploiting the specific eligibility rules in the Beckham Law, we show that the extra influx of foreigners in Spain is driven entirely by players eligible for the scheme with no effect on ineligible players.

Combining the evidence from tax reforms in all 14 European countries in

our sample, we find that the location decisions of players are very responsive to tax rates. But because labor demand by football clubs is relatively rigid — there can only be so many players in a club and only so many clubs in each national league — we also find strong evidence of sorting effects. Top-quality players are much more responsive than lower-quality players. In fact, we find that tax cuts to foreigners in a given country attract top-quality foreign players, but crowd out lower-quality foreign players as well as some domestic players.

Evidence from the Danish Preferential Tax Scheme for Highly Paid Foreigners

With Kleven, Landais, and Esben Anton Schultz in 2013, I study quasi-experimental variation created by a Danish preferential tax scheme for high-earning immigrants enacted in 1992.[5] Under this scheme, the tax rate on labor earnings is reduced to a flat rate of about 30 percent for a period of up to three years. Eligibility for the scheme requires annualized earnings above a threshold (indexed to average earnings growth and equal to about 100,000 euros in 2009), corresponding roughly to the 99th percentile of the distribution of individual earnings in Denmark. This scheme is much more generous than the Danish regular tax system, which imposes a top marginal tax rate of about 62 percent above 47,000 euros (as of 2009). Absent the special tax scheme, workers with earnings above the scheme threshold would face average income tax rates of around 55 percent, about twice as high as the scheme rate. At the end of the three years of preferential tax treatment, the taxpayer becomes subject to the ordinary Danish tax schedule on subsequent earnings.

We find striking evidence that the scheme had a very large effect on the number of highly paid foreigners in Denmark. Figure 1 summarizes our results. It shows that the number of foreigners in Denmark above the eligibility threshold, the group affected by the tax scheme, doubles after the scheme is introduced relative to the number of foreigners slightly below the threshold. The latter represents a comparison group not affected by the tax scheme. This effect builds up in the first five years of the scheme and remains stable afterward. As a result, the fraction of foreigners in the top one-half of 1 percent of the earnings distribution is 7.5 percent in recent years compared to a 4 percent counterfactual absent the scheme. This very large behavioral response implies that the revenue-maximizing tax rate for a scheme targeting highly paid foreigners is relatively small, about 35 percent. This corresponds roughly to the current tax rate on foreigners in Denmark under the scheme once we account for other relevant taxes, such as value-added taxes (VAT) and excises. Importantly, the revenue-maximizing tax rate on natives is much higher because the response of migration with respect to the net-of-tax rate among expatriate natives is very small. In other words, highly skilled expatriates, who would be eligible for the scheme if they haven't been in Denmark for three years, do come back more because of the scheme.

It can therefore be desirable from a single-country revenue perspective to adopt such preferential schemes targeting highly paid foreigners. At the same time, these schemes impose negative fiscal externalities on other countries by reducing their capacity to collect taxes from top earners. This tension between country welfare and global welfare in the design of individual income tax policy has loomed large in the debate about tax competition for a long time, but our paper provides the first compelling evidence that this is indeed a major empirical issue. Absent international tax coordination, preferential tax schemes to high-income foreigners could substantially weaken tax progressivity at the top of the distribution. International policy coordination and the design of rules regulating such special schemes in the European Union is therefore likely to be an important part of the European Union policy debate in coming years.

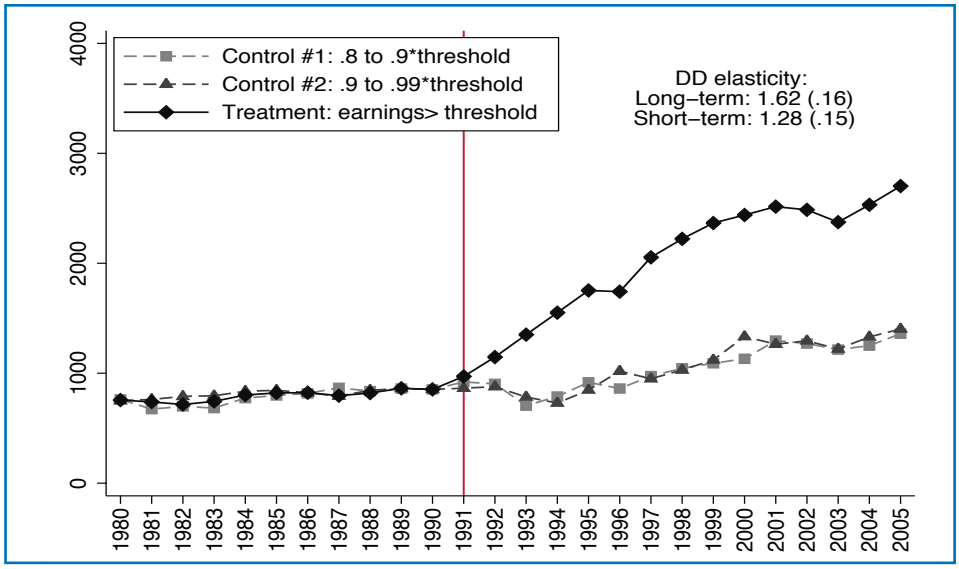

Figure 1: Migration Effects of the Danish Preferential Tax Scheme: Number of Eligible vs. Ineligible Foreigners over Time

Notes: This figure shows the number of foreigners with earnings above the scheme eligibility threshold (treatment series) from 1980 to 2005. As control groups, it reports the number of foreigners in Denmark with earnings between 80 percent and 90 percent of the threshold (control 1) and with earnings between 90 percent and 99.5 percent of the threshold (control 2). Both control series are normalized so that they match the treatment series in 1990: the year before the scheme was first implemented. The vertical line at year 1991 denotes the year the scheme was first implemented. The scheme was enacted in 1992 and applied retrospectively to all contracts starting after June 1, 1991.