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**Article**

## The economics of aging

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2007 Number 4

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## 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.

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*\* 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.*

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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.<sup>1</sup>

## 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.<sup>2</sup> 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,<sup>3</sup> 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.<sup>4</sup> 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.<sup>5</sup> 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.<sup>6</sup> 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.<sup>7</sup>

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.<sup>8</sup> 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.<sup>9</sup> 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.<sup>10</sup> 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.<sup>11</sup> 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.<sup>12</sup> 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).<sup>13</sup> 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.<sup>14</sup> 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.<sup>15</sup> 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.<sup>16</sup>

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.<sup>17</sup> 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.<sup>18</sup>

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.<sup>19</sup> 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.<sup>20</sup> 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.<sup>21</sup> 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.<sup>22</sup> 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.<sup>23</sup> 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.<sup>24</sup> 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.<sup>25</sup> 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.<sup>26</sup>

## 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.<sup>27</sup>

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.<sup>28</sup> 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.<sup>29</sup> 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.

<sup>1</sup> These volumes include *The Economics of Aging* (1989), *Issues in the Economics of Aging* (1990), *Topics in the Economics of Aging* (1992), *Studies in the Economics of Aging* (1994), *Advances in the Economics of Aging* (1996), *Inquiries in the Economics of Aging* (1998), *Frontiers in the Economics of Aging* (1998), *Themes in the Economics of Aging* (2001), *Perspectives on the Economics of Aging* (2004), *Analyses in the Economics of Aging* (2005) and *Developments in the Economics of Aging* (forthcoming).

<sup>2</sup> J. Beshears, J.J. Choi, D.I. Laibson, and B.C. Madrian, “The Impact of Employer Matching on Savings Plan Participation under Automatic Enrollment,” NBER Working Paper No. 13352, August 2007.

<sup>3</sup> A. Biggs, C. Burdick, and K. Smetters, “Pricing Personal Account Benefit Guarantees: A Simplified Approach,” in J. R. Brown, J.B. Liebman, and D.A. Wise (eds.), *Social Security Policy in a Changing Environment*, University of Chicago Press, forthcoming.

<sup>4</sup> J. Geanakoplos and S.P. Zeldes, “Reforming Social Security with Progressive Personal Accounts,” December 2005.

<sup>5</sup> The first three volumes, edited by J. Gruber and D. A. Wise, are *Social*

*Security and Retirement Around the World* (1999), *Social Security Programs and Retirement Around the World: Micro-Estimation* (2004), and *Social Security Programs and Retirement Around the World: Fiscal Implications of Reform* (2007), University of Chicago Press.

<sup>6</sup> J.B. Liebman, E.F.P. Luttmer, and D. Seif, “Labor Supply Responses to the Social Security Tax-Benefit Link,” RRC Working Paper NB06-12, December 2006. Available at <http://www.nber.org/programs/ag/rrc/books&papers.html>

<sup>7</sup> G. J. Borjas, “Social Security Eligibility and the Labor Supply of Elderly Immigrants,” Unpublished, 2007.

<sup>8</sup> D.M. Cutler, J.B. Liebman, and S. Smyth, “How Fast Should the Social Security Retirement Age Rise?” RRC Working Paper NB04-05, April 2006. Available at <http://www.nber.org/programs/ag/rrc/books&papers.html>

<sup>9</sup> J.B. Shoven, “New Age Thinking: Alternative Ways of Measuring Age, Their Relationship to Labor Force Participation, Government Policies and GDP,” NBER Working Paper No. 13476, October 2007.

<sup>10</sup> A. Börsch-Supan, “Work Disability, Health, and Incentive Effects,” in D.A. Wise (ed.), *Research Findings in the Economics of Aging*, University of Chicago Press, forthcoming.

<sup>11</sup> See A. S. Deaton, “Income, Aging, Health and Wellbeing around the World: Evidence from the Gallup World Poll,” NBER Working Paper No. 13317, August 2007; A. Banerjee and E. Duflo, “Aging and Death under a Dollar a Day,” MIT paper, 2007.

<sup>12</sup> A. Case and A. S. Deaton, “Health and Well-Being in Udaipur and South Africa,” in D.A. Wise (ed.), *Developments in the Economics of Aging*, forthcoming; and A. Case and A. S. Deaton, “Health and Wealth among the Poor: India and South Africa Compared,” *American Economic Review*, 2005.

<sup>13</sup> A. Banerjee, A. S. Deaton, and E. Duflo, “Traditional Dominance and Health Status in Rural India,” in D.A. Wise (ed.), *Developments in the Economics of Aging*, forthcoming.

<sup>14</sup> A. Case, “What’s Past is Prologue:

*The Impact of Early Life Health and Circumstance on Health in Old Age*," in D.A. Wise (ed.), *Research Findings in the Economics of Aging*, University of Chicago Press, forthcoming.

<sup>15</sup> B.D. Meyer and W.K.C. Mok, "Disability, Earnings, Income and Consumption," *Harris School of Public Policy Working Paper*, May 2007.

<sup>16</sup> D.M. Cutler and D.A. Wise (eds.), *Health in Older Ages: The Causes and Consequences of Declining Disability Among the Elderly*, University of Chicago Press, forthcoming.

<sup>17</sup> D. Costa, "Why Were Older Men in the Past in Such Poor Health?" in D.M. Cutler and D.A. Wise (eds.), *Health in Older Ages*..., *supra* note 16.

<sup>18</sup> P. Canavese and R. Fogel, "Arthritis: Changes in its Prevalence during the 19th and 20th Centuries," in D.M. Cutler and D. Wise (eds.), *Health in Older Ages*..., *supra* note 16.

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<sup>20</sup> J. Bhattacharya, A.M. Garber, and T.E. MaCurdy, "The Narrowing Dispersion of Medicare Expenditures

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<sup>25</sup> J. R. Brown and A. Finkelstein, "The Interaction of Public and Private Insurance: Medicaid and the Long-Term Care Insurance Market," *NBER Working Paper No. 10989*, December 2004.

<sup>26</sup> J. R. Brown and A. Finkelstein, "Why is the Market for Long-Term Care Insurance So Small?" *NBER Working Paper No. 10782*, September 2004, and *Journal of Public Economics*, forthcoming.

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