

# **The Fiscal Challenge of an Aging Industrial World**

## **A White Paper on Demographics and Medical Technology**

January 12, 2001

By Robert Stowe England

Director of Research of the Global Aging Initiative

Center for Strategic and International Studies

Washington, D.C.

## Executive Summary and Findings

The aging of industrial societies poses considerable risks for individuals facing retirement, developed and developing nations, the global economy and financial markets. This paper focuses on the demographic risks and their fiscal implications.

World political leaders have been grappling with the fiscal impact of aging populations intermittently since the early 1990s with limited success. Major reforms still remain to be enacted in Japan, Germany, France and the United States. Italy's substantial reforms are not likely to be sufficient to forestall fiscal and economic problems in the decades after 2010.

Official forecasts, at best, mildly underestimate longevity gains and mildly overestimate improvements in fertility. At worst, they are rosy scenarios that significantly understate the long-range fiscal challenge. The Global Aging Initiative at the Center for Strategic and International Studies commissioned a demographic study of the Group of Seven nations to get a clearer picture of the risks that may have been hidden behind official forecasts. The study was done by Mountain View Research of Los Altos, Calif.

Key findings of the Global Aging Initiative demographic study, which projects the long-term mortality trends of the Group of Seven nations from the last century into the next 50 years:

- Life spans could be greater than official projections -- in Japan's case as much as 10 years longer than official projections.
- Old age dependency ratios may be higher than official forecasts.
- Labor forces may decline more steeply.
- Projected budget increases may be substantially higher than present forecasts in several nations.
- Fiscal burdens are likely to be on average 10% higher in 2030 and 22% higher in 2050 than forecast by the Group of Seven nations.

Japan's economic stagnation in a time of global growth is most worrisome, and the prospect for mounting debt service costs poses a substantial risk for retirement funding. This danger is aggravated by the fact that Japanese longevity gains after age 65 could be higher than official forecasts by 17% in 2010, 35% in 2030, and 50% in 2050. These gains could roughly translate into similar increases in costs for old age benefits above those predicted by officials.

Despite more favorable demographics, the United States, too, faces higher costs for health care than official projections suggest.

- In the U.S., health care spending on the elderly could rise to \$25,000 per person by 2020, or 10% of GDP. Medicare costs alone could rise to \$14,309 per person or 5.24% of GDP.

This paper reviews some of the recent literature on demographics, medical technology and medical costs and incorporates information from interviews of more than 100 people around the globe, including government officials, economists, demographers, scientists, physicians, and ordinary people.

Even the GAI demographic projections may understate the problem, as there is a potential for medical breakthroughs that could quickly extend life by many years. While it is difficult to determine when these might occur and how soon they would be widely available, clearly the risk in both longevity and health care spending lie on the upside – barring major wars and unforeseen epidemics. Some breakthroughs – like a cure for Alzheimer’s – could dramatically lower long-term care costs, but may put pressure on pensions and health care spending as people live longer.

There are fiscal risks in potential gains in longevity and worries about health care rationing:

- Advances in medical technology could offer, according to some researchers and demographers, life spans of 150 years or more by 2050.
- This raises important questions about whether national health plans will cover most of the new innovations.
- Health care costs of new innovations could put upward pressure on budgets, especially in the U.S., and the elderly may find they cannot afford attractive new treatments if they have not saved sufficiently to afford additional insurance.
- Rationing may become more widespread and more systematic and increase inequities among the elderly.

But, since the elderly in all industrial countries will also have more political clout in the future, health options may converge toward the American model, rather than the other way around. Meanwhile, disability rates in the workforce can be expected to rise with increased participation by older workers.

In sum, it is important to recognize the expanding financial risks for governments that medical technology poses for aging populations. Demographic miscalculations have already taken a significant toll on welfare state finances. Continued increases in longevity, combined with intractably low birthrates, raise the danger that government old age benefit systems could collapse unless appropriate reforms are adopted in the near-term.

## Section One: An Overview

The quest for a longer life is as old as mankind. It has fired the imagination of dreamers throughout history – dreamers such as Juan Ponce de Leon, the Spanish conqueror and explorer who discovered Florida in the 16<sup>th</sup> Century in a quixotic quest to find the Fountain of Youth in the New World on behalf of King Ferdinand. He was already 53 when he began his quest. He died eight years later at age 61 from the wounds of a poison arrow in his stomach from hostile Indians he encountered during his attempt to colonize the territory.

Today it is medical scientists who are the adventurers who seek longer, healthier lives for all humankind. They are not dreamers or conquerors, but they wage a battle against the diseases and debilitating ailments of old age in laboratories and in clinical trials. Some pursue advances in molecular biology and genetic therapy they hope will lead to breakthroughs that will push life spans dramatically beyond 100 years.

The future offers a broad promise of startling potential advances in medical science. These include the potential for such things as genetically-engineered organ replacements derived from one's own DNA<sup>1</sup>, gene therapy against intractable ills such as Alzheimer's and cancer, the cure of inherited genetic defects, and the incorporation of new inanimate material into the biological world where it can create more durable organs, bones and other body parts for people.

The late Jeanne Calment of Arles, France lived the longest of any human so far with records to back up the claim. She knew Vincent Van Gogh and rode a bicycle until she was 100. She died at the age of 122 in 1997, blind, deaf and confined to a wheel chair, but lucid and cheerful to the end.

A number of gerontologists now theorize that 120 years is the high water mark for life expectancy. More and more people are expected to come closer to that limit in the next half century. Today there are 65,000 centenarians in the U.S. By 2050, there will be 1.1 million centenarians, according to the U.S. Bureau of the Census.<sup>2</sup> Fifty years hence the dwindling remnant of the post World War II baby boomers will still be around and able to recall the Beatles, flower power, the assassinations of President John F. Kennedy and Martin Luther King and the first lunar landing by man. These events will then seem as far away in time then as World War I seems today.

With the potential for new medical breakthroughs and the emergence of anti-aging therapies, some scientists on the forefront of medical research are growing more confident that humans can live even longer than gerontologists assume. "There is general optimism in the medical research community that we can extend life beyond 120 years,"

---

<sup>1</sup> Deoxyribonucleic acid is the primary genetic material of all cellular organisms.

<sup>2</sup> The U.S. Bureau of Census in its January 2000 report projects 1,095,000 centenarians in 2050 – 777,000 women and 318,000 men.

says William A. Haseltine, Chairman and Chief Executive Officer of Human Genome Sciences, a biopharmaceutical genomics company based in Rockville, Maryland.

Haseltine sees benefits arriving from medical research sooner than most. “I think we’ll see some of the new breakthrough technology, such as the ability to regenerate an entire organ sooner than people think. Some of it will be publicly available in 15 years and widely available in 30 years. This will push life spans beyond 120 years and closer to 150 years. Then, over the next 100 years, further breakthroughs will give people the equivalent of perpetual life,” he adds. (The promise of medical technology is discussed in more detail elsewhere in this report.)

There is considerable cause for joy in both past and future gains in longevity. In the last century humans made enormous gains in longevity. In the U.S., for example, life spans rose from 47 years in 1900 to 77 years<sup>3</sup> in 2000, propelled by improvements in sanitation early in the century, then by the arrival of antibiotics and finally with breakthroughs in the prevention and treatment of heart disease.

Elsewhere in the industrial world life spans have risen even higher. Japan takes the prize for longevity with average life spans for infants born in 2000 estimated to be 80.7 years.<sup>4</sup> Europe generally has higher longevity rates than the U.S., but not as high as Japan. Average life expectancy at birth in Sweden is 79.58.<sup>5</sup> In Italy, it’s 79.03 years<sup>6</sup>; France, 78.76 years<sup>7</sup>; and Germany, 77.44 years.<sup>8</sup>

Decreasing the rate of mortality in the future will, unlike in the past, lead to greater numbers of old people because the brunt of the gains are not being made against childhood diseases and infant mortality, not against diseases that prematurely sideline working-age people. Instead, they are being added at the end of life to people who are already living well past the age of retirement.

Yet, the industrial world is not entirely rejoicing about increasing longevity. It is instead worrying about how it will pay for social security pensions and publicly-funded old age health and long term care without going broke. They worry, too, about a decline in fertility. Younger age cohorts are smaller than older ones. And, since old age benefits are primarily financed through taxes out of the pockets of the working population through pay-as-you-go financing, the fiscal outlook is bleak.

In industrial nations around the world the process of aging will be greatly accelerated with the coming retirement of the baby boom generation. The impact is already being felt with early retirements at age 55 for those born in 1946 occurring in 2001. The first big wave will hit in 2008, when the first year of baby boomers reaches 62.

---

<sup>3</sup> U.S. Bureau of the Census, May 2000. Combined life span for males and females born in 2000 is 77.12, 79.90 for females and 74.24 for males.

<sup>4</sup> In Japan the average life expectancy for females at birth in 2000 is 84.05 years, for males it’s 77.51.

<sup>5</sup> In Sweden the average life expectancy for females at birth in 2000 is 82.37 years; for males it’s 76.95.

<sup>6</sup> In Italy the average life expectancy for females born in 2000 is 82.4 years; for males it’s 75.9.

<sup>7</sup> In France the average life expectancy for females born in 2000 is 82.89 years; for males it’s 74.85.

<sup>8</sup> In Germany the average life expectancy for females born in 2000 is 80.75 years; for males it’s 74.3.

It will steadily continue for the next 18 years in the U.S. and for shorter periods elsewhere. The coming transformation has recently been dubbed the “geezer glut”<sup>9</sup> in *Scientific American*.

While aging is proceeding at a similar pace in the U.S. and Europe and somewhat faster in Japan, variations in fertility rates are causing even more striking differences across the industrial nations. Where gains in longevity and declines in fertility are the greatest – Japan, Italy, Spain, and Germany – there is the prospect of depopulation and a declining workforce. This is true even in the case of Germany, which, unlike the other three nations, has a fair amount of immigration to offset population losses.

### **Japan is the Most Rapidly Aging Society**

**T**he fastest aging societies are those with the greatest declines in fertility. Again, Japan sets the pace. It has seen one of the sharpest fertility declines from more than 4 children per woman in a brief baby boom between 1947 and 1949 to an average 1.4 children per woman<sup>10</sup> -- or, as demographers call it, a 1.4 total fertility rate<sup>11</sup> in 1995, the last year it was officially reported by the Japanese government. This falls far short of the 2.1 total fertility rate necessary to replace the population and prevent its decline.

Japan’s low birth rate will lead to a loss of nearly one-fourth of its population between 2005 and 2050, according to the latest United Nations projections.<sup>12</sup> These levels of losses are historically correlated with devastating wars, famines or plagues. Some demographers and economists predict a population decline in Japan of as much as one-third by 2050, claiming that official population projections, reflected in the numbers provided by the UN, are overly optimistic in their assumptions that fertility rates will recover. The UN, for example, predicts Japan’s total fertility rate will rise to 1.75 by 2050.

Three large European nations have total fertility rate that are lower than Japan’s. In Spain the rate has fallen to a very low 1.15<sup>13</sup>. Italy’s is only slightly higher at 1.18. Germany also has a low rate of 1.37. Sweden’s fertility rate, which had risen to 1.8 during the mid-1990s, has fallen back to 1.5. At these rates, given the expected levels of immigration, these four countries will lose population over the next 50 years.

---

<sup>9</sup> Brandstrader, J.R. (2000), “From Baby Boom to Geezer Glut,” *Scientific American Presents The Quest to Beat Aging*, Summer, Vol. 11, No. 2, p. 22. New York, *Scientific American*.

<sup>10</sup> Japan’s total fertility rate in 2000 is reported at 1.4075 by the U.S. Census Bureau, International Data Base, May 10, 2000 update, at <http://www.census.gov/ipc/www/idbprint.html>

<sup>11</sup> Total fertility rate is defined as the average number of births a woman would have if she were to live through her reproductive years (ages 15-49) and bear children at each age at the rates observed in a particular year or period.

<sup>12</sup> The population of Japan is expected to rise from 125.5 million in 1995 to reach its peak at 127.5 million in 2005, thereafter falling continuously to 104.9 million in 2050. Source: *Replacement Migration: Is It A Solution to Declining and Ageing Populations*, New York, New York. Population Division, Department of Economic and Social Affairs, United Nations Secretariat, March 2000, p. 116.

<sup>13</sup>U.S. Census Bureau, International Data Base, May 10, 2000 update.

Germany will lose the most people in Europe over the next half century – 17.5 million, an amount equivalent to all of East Germany, or 21% of its current population.<sup>14</sup> Italy will lose almost as many – 16 million people, but from a smaller base, giving it a 28% decline in population<sup>15</sup>. Neither the U.S. Census Bureau nor the United Nations has an updated 50-year projection for Spain or Sweden that reflects their lower fertility rates since the last official projections in 1998.

Some parts of Europe are faring better. Both France, at 1.75, and the United Kingdom, at 1.73, have higher than the European average in fertility rates and, due to immigration, are expected to see only modest population declines over the next 50 years, according to official forecasts.

The United States faces one of the least troublesome prospects as an aging industrial nation. It, too, however, will see big increases in the number of elderly. The U.S. total fertility rate is 2.06, according to the U.S. Census Bureau. That's pretty close to replacement levels thanks to the several favorable trends. First, the total fertility rate for white American women has remained fairly high at 1.84<sup>16</sup>, much higher than overall fertility rates in Europe and Japan. At the same time, the total fertility rate for African-American women, although declining over the years, still remains above replacement level at 2.24. Most immigrants to the U.S. have a higher birth rate, boosting the overall fertility rate average for the U.S. Hispanics, who represent the largest single group of immigrants, have a 2.95 total fertility rate, with Mexicans, the largest group of Hispanic immigrants, having a 3.20 total fertility rate.

### **Labor Shortages Will Emerge With Baby Boomer Retirement**

**T**he pace of aging is set to accelerate when the first wave of the baby boom generation starts to retire in significant numbers in some countries in 2008. Already the issue of baby boomer retirement threatens to exacerbate labor shortages in the private and public sector where retirement plans allow for retirement long before age 65. For example, U.S. federal employees are eligible for retirement at 55 with 30 years of service. This gives the federal government a first taste of the coming impact of the baby boom retirement. Within five years 30 percent of the 1.6 million full-time employees in the U.S. federal government will be eligible to retire, and another 20 percent would be eligible for early retirement.<sup>17</sup> While it is not yet clear if all those eligible will retire, the magnitude of the potential shortfall is worrying the federal government. It may soon be hard pressed to fill all the vacant slots.

---

<sup>14</sup> Germany's population will fall from 82.1 million in 2000 to 64.6 million in 2050, according to United Nation's 2000 projections.

<sup>15</sup> Italy's population will fall from 57.3 million in 2000 to 41.2 million in 2050, according to the United Nation's 2000 projections.

<sup>16</sup> *National Vital Statistics Reports* (2000), Center for Disease Control and Prevention, National Center for Health Statistics, Volume 48, Number 3, March 28, pp. 35-36.

<sup>17</sup> Barr, Stephen (2000), "Retirement Wave Creates Vacuum," *The Washington Post*, May 7, pp. 1, 14.

The baby boom retirement, combined with lower fertility rates over the last several decades and into the future, will eventually create tight labor markets, even in Europe<sup>18</sup>, where there is currently high and intractable unemployment at 9% and higher rates. It will also tighten labor markets in Japan, where young people today are increasingly having difficulty finding jobs in an economy that has remained sluggish for ten years, a time known in Japan as “the lost decade.”

The working age population in Japan is expected to decline by 34% in 2050,<sup>19</sup> according to the United Nations’ medium-variant projections – one of three projections, including high-variant and low-variant, that the UN plots on a periodic basis. In Italy, the working age population will decline by an alarming 43%<sup>20</sup> by 2050. Germany’s working age population will fall by a hefty 23%.<sup>21</sup> Again, France and the United Kingdom fare better, with projected working age population declines of 11%<sup>22</sup> and 13%<sup>23</sup> respectively.

The U.S. working age population is expected to rise by 16%<sup>24</sup> over the next 50 years, a fairly sluggish pace compared to trends in the past half century. Meanwhile, Canada tops all the industrial nations with an expected gain in working age population of 18%<sup>25</sup>, aided by net migration rates<sup>26</sup> double those of the U.S. and a projected rise in the total fertility rate from 1.55 to 1.9.

The portion of the population over 65 in Japan will increase from 17.1% today to 31.8% in 2050. In Italy it will increase from 18.2% to 34.9%. In Germany it will rise from 16.4% to 28.4%. In the U.S. it will rise from 12.5% to 21.7% -- giving all of the U.S. a population profile of elderly Americans now found only in Florida – although the elderly may be unevenly distributed across the country and concentrated in some areas of the West and South, according to an analysis by the Milken Institute.<sup>27</sup>

---

<sup>18</sup>Unemployment will fall to near virtually zero by 2016, according to projections published in *The European Labour Market in Light of Demographic Change*, European Commission, Employment & Social Affairs, 1999, p. 4.

<sup>19</sup> Japan’s work age population is projected to fall from 86.3 million in 2000 to 72.4 million in 2025 and then to 57.1 million in 2050, *World Population Prospects, The 1998 Revision*, Volume I, Comprehensive Tables, published by the United Nations Secretariat’s Population Division, 1999.

<sup>20</sup> Italy’s working age population is projected to fall from 38.7 million in 2000 to 32 million in 2025 and then to 21.9 million in 2050. Source: UN, 1998.

<sup>21</sup> Germany’s working age population is projected to fall from 55.4 million in 2000 to 50.7 million in 2025 then to 42.6 million in 2050: Source: UN, 1998.

<sup>22</sup> France’s working age population is projected to fall from 38.6 million in 2000 to 37.7 million in 2025, then to 34.5 million in 2050. Source: UN, 1998.

<sup>23</sup> The United Kingdom’s working age population is projected to fall from 38.3 million in 2000 to 37.1 million in 2025, then to 33.4 million in 2050. Source: UN, 1998.

<sup>24</sup> The U.S.’s working age population is projected to rise from 183.7 million in 2000 to 205.1 million in 2025 to 213.1 million in 2050. Source: UN, 1998.

<sup>25</sup> Canada’s working age population is projected to rise from 21.2 million in 2000 to 23.7 million in 2025 to 25 million in 2050. Source: UN, 1998.

<sup>26</sup> Net migration rate is the net number of immigrants (total number entering the country less those leaving) per 1,000 people. The average rate in Canada between 1995 and 2000 was 5.6, while it was 2.8 in the U.S. Source: UN, 1998.

<sup>27</sup> Frey, William H. and Ross, C. DeVol, “America’s Demography in the New Century: Aging Baby Boomers and New Immigrants as Major Players,” Milken Institute, Santa Monica, Calif., pp. 9-12.

In spite of what appears to be a slower aging process in the U.S., the potential impact on Social Security and Medicare of aging populations will be significant, posing threats to the viability of both programs. According to U.S. Social Security Administration's official 2000 forecast, in 75 years income from the payroll tax will provide only two-thirds of what will be needed to pay for benefits. The cost of the program is slated to rise to 19.5% of payroll while the payroll tax will be only 13.3%, including increases already slated under current law. Thus, the cost of Social Security will rise from 4.2% to 6.8% of the gross domestic product (GDP).<sup>28</sup>

### **Medicare Costs Will Rise Sharply in U.S.**

Medicare in the U.S. faces a similar shortfall, according to official projections. The cost for Medicare Part B -- which pays for physician, outpatient hospital, home health, and others services for the aged and disabled -- rose 38% over the past five years to \$82.3 billion in 1999. The Federal Supplemental Medical Insurance Trust Fund, which administers Medicare Part B, is kept afloat mainly by infusions from general tax revenues. Premiums, which were \$45.50 a month in 1999, pay for only \$19 billion or 23% of the cost of the program. Medicare trustees noted "with great concern" that costs continue to rise faster than GDP and are projected to grow to 2.4% of GDP by 2075, two and one-half times the current level<sup>29</sup>.

Spending for Medicare Part A, which helps pay for hospital, home health, skilled nursing facility and hospice care for the aged and disabled, is also expected to "grow rapidly as a fraction of workers' earnings, from 2.8% in 199 to 6.7 % in 2075," according to official projections<sup>30</sup>.

If future U.S. Congresses are unable to raise payroll and income taxes to cover the projected shortfalls in Social Security and Medicare, as some now predict, it could mean benefit cuts. A host of alternatives have been suggested to avoid benefit cuts. There is some support in Washington for delaying the age of retirement for all, as well as for some type of pre-funding in return for benefit cuts. Other options include increasing immigration and expanding work-force participation of the elderly and segments of the working age population not now working. Raising fertility levels could also help, but the initial impact would begin only after about 20 years, even if a new baby boom were to occur in the coming year.

Similar dilemmas face the other nations of the industrial world, with other twists and complications that differentiate the scope of the problem, with the exception of the United Kingdom, where much of the old age pension program has been privatized. There is considerable room for increasing work force participation in Europe, where unemployment is high, and early retirement is pervasive. Increasing the workforce

<sup>28</sup> The Board of Trustees of the Federal Old Age and Survivors Insurance and Disability Insurance Trust Funds, "The 2000 Annual Report," p. 3.

<sup>29</sup> Board of Trustees, Federal Supplementary Medical Insurance Trust Fund, "2000 Annual Report," p. 2.

<sup>30</sup> Board of Trustees, Federal Hospital Insurance Trust Fund, "2000 Annual Report," p. 2.

participation of women is also seen as one way to address the problem in countries where female participation rates are low, such as Italy and Spain. Immigration is seen as a more difficult option in Europe than in the U.S., because of a growing political backlash against immigrants in many countries due to huge influxes since the fall of the Berlin Wall in 1989, followed by the wars in the Balkans throughout the 1990s, and the continuing heavy migration from North Africa. There have been a number of programs to raise fertility levels in Europe, with only modest and temporary success in such places as Sweden, and an even more modest but sustained result in France.

Japan faces all the problems of Europe with a further complication that it will continue to outpace the rest of the world with longevity gains. Its policy options are hampered by a sluggish economy that is still undergoing a restructuring after a decade of stagnation following the bursting of the bubble economy of the 1980s. The outlook is for continued sluggish growth of 1% a year or less. Indeed, the failure of the government to address a manifold of economic and fiscal problems, including taking steps to bring Social Security into balance, has led to even higher savings rates in a country with an already high savings rates, thereby depressing the consumer demand that is needed to strengthen the economy.

Japan's Department of Health and Welfare has calculated the levels of taxation necessary to sustain current benefits. The current Social Security burden represents about 18.5% of Gross Domestic Product (GDP). That is projected to rise to 33.5% by 2025. Meanwhile the overall tax burden on the Japanese people, including national and local taxes, will rise from 36.9% today to a range between 50% and 56% during the same period, according to official projections.

### **A Jump in Old Age Dependency Ratio Threatens Fiscal Crises**

**T**he growing imbalance between the population of people working and those retired threatens a future fiscal crisis in virtually every nation in the industrial world. This will happen because virtually all social security systems, including elderly health and nursing care, operate on a pay-as-you-go basis. That is, they are not pre-funded by contributions that are invested in liquid assets, which earn a return on those investments. Current workers support current retirees through the payroll tax (sometimes called a "contribution" in some countries), income tax and other taxes.

The old age dependency ratio is, then, the key economic indicator that economists and demographers watch in their forecasts. That's the number of people over 65 for each person of working-age population. Sometimes it's expressed as the support ratio, or the number of people of working-age population per each person 65 or older.

In Japan today there are 86.3 million working age people and 21.7 million 65 and over, according to the United Nations. That translates roughly into 4 working people for

each retiree or an old-age dependency ratio of 0.25<sup>31</sup>. That old age dependency ratio jumps to 0.46 in 2025 and then to 0.58 in 2050, when Japan will have 57.1 million working people and a very large 33.3 million cohort of people 65 or over. Then there will be only 1.7 workers for each retiree.

Italy faces an even more daunting rise in its old age dependency ratio, rising from 0.27 in 2000 to 0.42 in 2025 then to 0.66 in 2050. Germany's old dependency ratio will rise from 0.24 in 2000 to 0.37 in 2026 and finally 0.49 in 2050. France's rises to 0.44, with the United Kingdom rise to 0.42.

The U.S., which starts out much better than Europe or Japan with an old age dependency ratio of 0.19 in 2000, still climbs to 0.36 in 2050. Canada starts at the same ratio as the U.S., 0.19, but its ratio deteriorates a little more, coming closer to the levels in the U.K.

The prospect of these rising dependency ratios got the attention of the World Bank, which, after two years of research, declared in 1994 that pay-as-you-go systems around the globe were clearly unsustainable. "The world is approaching an old age crisis. . . . [and] existing systems of financial security for old people are headed toward collapse,"<sup>32</sup> it warned ominously at a time when public awareness of the extent of demographic transformation and potential fiscal fallout were just emerging.

The World Bank also urged careful consideration of how to reform old age pension systems. Reform policies to deal with aging societies, if not appropriate, could harm the world economy, while appropriate policies would promote economic growth. It's a theme behind nearly all the major reforms that have emerged in nations around the world since then to deal with the fiscal challenge of aging.

The future imbalance between workers and retirees in industrial nations could lead governments to make sharp cuts in old age benefits. Or, it could lead to big run-ups in debt that could destabilize some currencies and financial markets. Or, it could lead to big tax increases that would dampen economic growth or cause what some economists call "aging recessions." All three outcomes – benefit cuts, higher debt and higher taxes -- could occur simultaneously or in succession in any given country over the next three decades, as the aging crunch begins to hit.

The World Bank report followed on the heels of the currency crises in Europe in the early 1990s, which were partly the result of the perception by currency traders and speculators that the old age welfare programs of Europe were unsustainable and most worrisome in countries with high debt levels and sluggish growth. Such crises have the potential of wreaking havoc in financial markets around the world, as they did during the

---

<sup>31</sup> United Nations (1999), *World Population Prospects, 1998*. The old age dependency ratio is the ratio of the number of people 65 and over to the number of people between the ages of 15-64.

<sup>32</sup> World Bank (1994), *Averting the Old Age Crisis: Policies to Project the Old and Promote Growth*. New York: Oxford University Press, back page of paper back edition.

Asian crisis the began in 1997 and then led to a meltdown in August 1998 after Russia defaulted on its bonds.

The World Bank criticized pay-as-you-go systems for their generational inequity. It warned that when such systems mature, taxes are so burdensome on workers that some workers resort to “strategic manipulation” of the system to evade payroll and other taxes that support the system part of their working lives, while still qualifying for a generous benefit because the contributions are not tied explicitly to the benefit.<sup>33</sup> Instead, they are tied to the salary earned nearest retirement.

The World Bank report urged more pre-funding of benefits and a more diversified retirement system with more “pillars,” or sources of retirement income. Some European countries, such as Italy and France, have virtually no employer-sponsored pension systems. While Japan and Germany have such systems they are greatly underfunded. Only in the U.S. are the great majority of private pension plans – which cover only half the work force – fully funded.

The World Bank recommended that the pay-as-you-go systems be curtailed to offer a minimum benefit as a way of preventing poverty in old age. Then, countries should establish a second pillar: a mandatory retirement savings plan funded from worker’s incomes – an approach that has been adopted by Australia. These plans would be portable between employers and managed by the private sector, the World Bank said. Finally, it recommended that governments develop policies to encourage a more personal, voluntary savings as a third pillar of for retirement income. This would include such savings vehicles as the 401(k) plans<sup>34</sup> and Individual Retirement Account plans in the U.S.

If governments fail to take sufficient actions in the coming years, it could lead to more financial crises and economic fallout in the future. At the moment, financial markets appear to be betting that, in the long run, governments will avoid potential major crises by cutting benefits and/or raising taxes instead of running up debt. Government bond ratings remain high, based on these assumptions, according to Vincent Truglia, head of Sovereign Risk at Monody’s Investor’s Service in New York. “We expect almost every industrial nation to ‘default’ on its pension promises,” he has stated.<sup>35</sup>

### **Shrinking, Aging Populations May Bring Economic Decline**

**J**apan is one of the nations where some minor downgrades of government bonds have occurred. Its bonds still have very high ratings, but the outlook appears to be the

---

<sup>33</sup> World Bank (1994), *Averting the Old Age Crisis: Policies to Project the Old and Promote Growth*. New York: Oxford University Press, p. 12.

<sup>34</sup> The 401(k) plan name comes from the second of the Internal Revenue Code that was created in 1978 with the passage of Tax Reform Act of 1978.

<sup>35</sup> Truglia, Vincent J. (2000), “Public Sector Pensions in Industrialized Countries: A Rating Agency Perspective,” a paper presented at “The Graying of the Industrial World,” a conference sponsored January 25-26, by the Center for Strategic and International Studies as part of its Global Aging Initiative.

most troubling of any country. As the most rapidly aging country, Japan could show what dangers lie ahead for other nations facing depopulation and aging.

The economic fallout of aging in Japan promises to be worrisome. One possible downside of an expected 25 percent or more decline in the population of Japan by 2050 is “a long-term decline in the future of the Japanese economy,” according to Noriyuki Takayama<sup>36</sup>, professor of economics at Hitotsubashi University’s Institute of Economic Research.

“Some Japanese say that we can get much better and happier with a smaller population in Japan,” Takayama said in a speech at the Japanese Embassy in the U.S. in 1997, “and that since the population density would be much less, land prices would tend to be less expensive, and we could have higher salaries. Yes, I know that in the world there are some rich countries with a smaller population, such as Switzerland, Denmark and Sweden But the country we will be faced with in the future is rather different than these countries. We might have an upside-down population pyramid. A sharp decrease in the young labor force will take place. . . . A larger and larger proportion of the labor force will be middle-aged and elderly workers,” Takayama stated.

What does it mean to have an older workforce and fewer young people? “Generally speaking, young countries are more lively, energetic, and dynamic than others,” Takayama said. “As Japan gets older, less new investment will follow. A decline in the number of young people will decrease the savings rate. In summary, a probably consequence is a sharp decline in young labor, a decrease in the savings rate, and a decrease in capital formation. All these factors will contribute to the shrinking of the Japanese economy,” he concluded.

Takayama also predicts very paltry gains in real per-capita income. Per capita income gains can come from either a decline in the dependency ratio – the ratio of those who are not working to those who are working – and or from an increase in productivity. While continued investments will raise productivity of workers, Takayama argues, the rise in dependency could drag down productivity, cancel out the overall effect of higher productivity of workers on the economy.

In time “the Japanese keen appetite for longevity will be much abated,” predicted Takayama. “This what Jonathan Swift described in his famous novel, *Gulliver’s Travels*, Gulliver found a horrible word of old age after he had seen some immortals, as you know. In the end, things might change little between Luggnagg in the early eighteenth century and Japan in the middle of [this] century,” he said. The fictitious land of Luggnagg had among its population men and women known as *struldburgs* who did not have eternal youth, but eternal old age, with all its worst infirmities, ever growing older, sicker, more deformed, and more infirm --- but unable to die.

---

<sup>36</sup> Takayama, Noriyuki (1997), “Japanese and American Social Security Systems: Grappling with the Future,” Speech and discussion given at Japan Information and Culture Center, Embassy of Japan, Washington, D.C., March 27.

The prospect of longer lives is, then, a two-edged sword, not only because old age benefits are provided by the government and supported through taxation of workers, but also because it could have a dampening effect on the economy and global financial markets. Separate white papers for the Global Aging Initiative at the Center for Strategic and International Studies deal with the macroeconomic and financial market implications of aging populations. A fourth paper focuses on the impact on the ability of the U.S. and other Western nations to maintain global security guarantees.

## **Section Two: Industrial Nations Gauge the Fiscal Impact of Aging**

**T**he focus of this paper is the fiscal impact on aging societies – that is the impact on the government budgets of the industrial nations -- with a look at whether official demographic expectations are too rosy in both their projections for longevity and fertility. A clearer picture of the future impact, in turn, can help shape policy responses.

The World Bank set in motion a global approach to the issue of population aging. It fell to the Organization of Economic Cooperation and Development (OECD), however, to take on the task of making calculations of the impact on spending, budgets, the economy and the financial markets. The OECD, which is based in Paris, is a policy research group representing 29 countries, including the U.S. and Japan, which seeks to foster growth and cooperation among the world's leading industrialized market economies. It has been looking at the aging issue as least since 1988.<sup>37</sup>

While Europe today is enjoying growth, the economic outlook was grim in the early to mid 1990s, when the OECD was preparing a major study on the fiscal impact of aging populations. There were big deficits in most governments and speculators were taking down one European currency after another, forcing central banks to raise interest rates sometimes to sky high levels and threatening the viability of the European monetary system, which was based largely on having soft currency nations peg their currencies to the hard currency Deutsche mark.

The currency chaos that erupted then was threatening plans for European union and plans for a new European currency, the euro, which was to debut in 1999. The potential for even higher deficits and higher debts was troubling. “Looking to the future, things looked pretty bad,” recalls Douglas Fore, a former OECD researcher in Paris and now in New York at TIAA-CREF, which manages pooled retirement funds for college teachers. So, the decision by member countries to ask OECD to get a firmer handle on the scope of the impact of aging populations on budgets was derived from a concern at the highest levels in European governments, he says.

Direction for research at OECD comes from member countries, which twice a year – usually in April and October -- send representatives to Paris to meet with the OECD to discuss current and future research projects. There are usually two major topics at each of these discussions, a macroeconomic one and a microeconomic one – or sometimes there may be two microeconomic topics, according to Fore. The larger OECD members tend to have considerable influence over which topics are chosen.

OECD research is not always made public. When it is made public, it is first vetted with member countries before it is released. Data on the future fiscal impact of

---

<sup>37</sup> Organization for Economic Cooperation and Development (1998), *Aging Populations: The Social Implications*. Paris: OECD.

aging on the G-7 was first made public in 1996 in one of the chapters in an OECD book, *Future Global Capital Shortages: Real Threat of Pure Fiction?*<sup>38</sup> This publication highlighted a concern that future capital shortages could arise from heavy borrowing by industrial nations to sustain old age social security and health care spending that might occur at the same time there might be a decline in global savings. Declines in saving could lead to declines in investment and a slowing of the rise in living standards – or even a decline in living standards. The future adequacy of savings is the subject of a companion paper to this one as part of the Global Aging Initiative at the Center for Strategic and International Studies.

The study was quickly expanded from the original seven because “the smaller countries wanted to find out about it, too,” Fore says. OECD made projections for another 12 countries<sup>39</sup> -- or 19 nations in all in a subsequent Working Paper No. 168.<sup>40</sup> They calculated spending on old age pensions, health care and long term care.

### **Spending on Old Age Benefits To Take Bigger Portion of GDP**

**T**he findings were startling, and one of the first official indications of the seriousness of the challenge facing the industrial world. OECD simulations to 2070 showed pension or social security expenditures reaching a peak in the decade of the 2030s. The spending levels would rise to between 15% and 20% of GDP for Japan, Germany, France and Italy. Rising from 1995 levels of 5% to 12%. They showed less of an impact – rising from less than 5% to 8% of GDP -- in the U.S. and Canada.

There was virtually no impact in the U.K., where much of the state-provided pension was abolished and the current benefit is tied to inflation, not wages, and its value has fallen over the years. The peaks are reached by 2036 in Germany, Italy and France, while in Japan the peak is reached in 2045. Pension payments decline slightly after that as a portion of GDP. In the U.S. spending rises steadily until 2035 and then continues to rise very slowly thereafter. In Canada and the U.K. it peaks around 2035 and declines very slowly.

In calculating future per capita spending on health care to 2030, the OECD took a fairly conservative track and tied increases in costs to gains in productivity (which is assumed to advance at 1.5% a year). This assumption, OECD admitted, is lower than the growth rates in health care spending during the 1980s. The expenditures derived for each of the age groups, adjusted for productivity, were then projected forward by the growth in

---

<sup>38</sup> Leibfritz, Willi; Roseveare, Deborah; Fore, Douglas; Wurzel, Eckhard (1996), “Ageing Populations, Pension Systems and Government Budgets – How Do They Affect Saving?” *Future Global Capital Shortages: Real Threat or Pure Fiction?* Paris: Organization for Economic Cooperation and Development.

<sup>39</sup> OCED modeled the impacting of aging populations on the G-7, plus these countries: Australia, Austria, Belgium, Denmark, Finland, Iceland, Ireland, Netherlands, Norway, Portugal, Spain, Sweden.

<sup>40</sup> Roseveare, Deborah; Leibfritz, Willi, Fore, Douglas; and Wurzel, Eckhard (1996), “Ageing Populations, Pension Systems and Government Budgets: Simulations for 20 OECD Countries,” Working Paper No. 168. Paris: Organization for Economic Cooperation and Development.

their corresponding projected population age groups.<sup>41</sup> Health care costs and issues are discussed in more detail elsewhere in this paper.

OECD cautions that its simulations “should be regarded as indicative only – they are simply an attempt to illustrate the effects of demographics and should not be interpreted as projections of public health care spending.”<sup>42</sup>

Even with an approach that admittedly might understate actual cost increases, public spending on health care in the U.S. for those over 65 rises from 3.6% of GDP in 2000 to 6.7% in 2030. Canada likewise sees a big jump, from 2.7% to 5.7%. Fairly low levels of spending in Europe nearly double in some cases – from 1.9% to 3.4% in Italy; from 1.8% to 3.4% in Germany, from 2.0% to 3.5% in France, and from 2.6% to 3.9% in the U.K. Japan’s spending on the elderly rises from 2.2% to 3.7%.

OECD frankly acknowledged that its assumptions for this outlook were “relatively optimistic.” It admitted they included a “favorable interpretation of governments’ fiscal plans and of the ability to realize these plans,” acknowledging that budget reduction plans in various nations were “quite ambitious.”<sup>43</sup>

### **A Possible Huge Run-Up in Debt**

Looking ahead to 2030, OECD foresaw a huge run-up in debt and rising debt service for several countries. Japan’s plight was seen as the worst, with its budget deficit rising from 4.1% of GDP in 1995 to 22.8% in 2030 with debt service rising from 0.6% of GDP in 1995 to 14.7% in 2030.

Deficits were expected to fall between 1995 and 2000 in nearly all countries, then rise rather steeply. In 2030, the OECD had this line up: Italy, deficit at 15.7% of GDP; Germany, 11.6%; France, 10.2%. The forecast of a debt in the U.S. at 13% GDP is now seen to be way off target.

Debt would accumulate to Mount Everest levels in 2030. In Japan it would be 206% of GDP; Italy, 117%; France, 58%; the U.S., 58%, Germany, 41%; Canada, 37% and the U.K., 28%.

How did the 13 countries take these dire forecasts? “They thanked us profusely for opening their eyes,” recalls Fore. In the years since 1996, the forecasts have caused considerable heartburn for successive administrations in various industrial nations.

With fiscal situations having improved in most countries, there have been efforts in some quarters, notably from those who oppose substantive reform for old age public pension and health spending, to discredit the 1996 OECD projections. In some cases,

---

<sup>41</sup> Leibfritz, *et al*, p. 59.

<sup>42</sup> Leibfritz, *et al*, p. 59.

<sup>43</sup> Leibfritz, *et al*, p. 49.

however, the projections for 2000 have proven conservative. For example, Japan's deficit rose from 3.5% in 1996 to 6.0% in 1998 and is projected to hit 11% for the current year. By contrast, the OECD predicted in 1996 it would fall to 2% in 2000.

France's performance was slightly worse than OECD predicted, while Italy substantially beat the OECD prediction that its deficit would fall from 7.8% in 1995 to 3.5% in 2000. Spurred by the need to meet 3% target for budget deficits in the Maastricht Treaty,<sup>44</sup> Italy took giant strides in 1997 and 1998 to bring its deficit spending under control. Its actual deficit fell to 2.7% in 1998, 2.3% in 1999 and is predicted to be 1.3%<sup>45</sup> in 2000. The Maastricht Treaty definition of debt does not include the unfunded liabilities in Italy's pension system.

Germany also beat OECD's projections, but only slightly, and the U.S. surprised the world by moving into budget surpluses "as far as they eye can see," to use a phrase made popular in Washington during the period of budget deficits.

In considering policy options, the OECD suggested that raising labor force participation rates offered "the most scope"<sup>46</sup> for addressing the issue, especially because it was more politically feasible than some of the alternatives: funding pension plans, reducing benefits, raising payroll tax rates, or increasing immigration.

The OECD followed up its basic work on fiscal implications in 1996 with studies and models of the broader macroeconomic impact of the aging of industrial nations. In Working Paper No. 193, the OECD predicted that aging societies, absent any changes in current policies, would slow economic growth in Japan to 0.25% in the decade after 2030, while it would fall to 0.5% in Europe and 1.25% in the U.S. for the same decade.<sup>47</sup> Aging would also lead to a decline in savings and a slowing of gains in living standards. Another paper in 1998 looked at the macroeconomic effects of various reform proposals.<sup>48</sup>

### **The Group of Seven Elevates Aging to a High Priority**

In 1996 the challenges posed by aging societies was raised at the G-7 Summit when it met in Lyon, France. It was there Japanese Prime Minister Ryutaro Hashimoto introduced his Initiative for a Caring World. It laid down the principle that "each country will share its knowledge and experience of social security policies with other countries

---

<sup>44</sup> The Maastricht Treaty II required that all members of the European Union have deficits of no more than 3% GDP if they were to be part of the European Monetary Union and the new single currency, the euro, which was unveiled in 1999.

<sup>45</sup> Pagani, Steve (2000), Reuters, "Deficit to Drop to 1.3% of GDP This Year," *Italy Daily*, Published jointly by *International Herald Tribune* and *Corriere Della Sera*, Rome, June 30, p. 1.

<sup>46</sup> Leibfritz *et al.*, p. 77.

<sup>47</sup> Turner, Dave; Giorno, Claude; De Serres, Alain; Vourc'h, Ann, and Richardson, Pete (1998), "The Macroeconomic Implications of Ageing in a Global Context," Economics Department Working Papers, No. 193. Paris: OECD.

<sup>48</sup> Kohl, Richard and O'Brien, Paul (1998), "The Macroeconomics of Ageing, Pensions and Savings: A Survey," Economics Department Working Papers, No. 200. Paris: OECD.

for establishing a sustainable social security system.” The initiative also declared that nations would resolve “their respective problems.”

Prime Minister Hashimoto pointed in the initiative to one possible solution, the increasing labor force participation of the elderly – again echoing OECD’s finding. He stressed, for example, that it was necessary for the world “to do away with the stereotype that the elderly are helpless” and instead encourage the idea of “active aging.” This proposal carries considerable support within Japan, but a number of economists and demographers within Japan think this solution will be insufficient to meet the challenge of a country facing continue rapid aging.

The Hashimoto proposal garnered the support of French President Jacques Chirac, host of the Lyon conference, as well U.S. President Bill Clinton, who was slated to host the 1997 G-7 Summit in Denver, and the other nations at the conference.

The U.S., in its preparations for the Denver Summit, followed through on the idea of the knowledge exchange suggested by Prime Minister Hashimoto by commissioning an independent demographic assessment of how rapidly the G-7 nations were expected to age in the first half of the 21<sup>st</sup> Century. The task of commissioning the study fell on the U.S. National Institutes on Aging, which received its marching orders from the White House’s National Economic Council<sup>49</sup>, according to Richard Suzman, Associate Director for the Behavior Research Program at NIA, who oversaw the study.

“I went in and briefed them and made some suggestions about what kind of study should be done,” recalls Suzman. He spoke with the head of the unit in National Economic Council that was preparing for the G-8 Denver Summit (now including Russia) and briefed them on the kinds of studies that NIA had supported with grants in the past, including the stochastic approach developed by Ronald Lee, a professor of demography and economics at the Center for the Economics and Demography of Aging at the University of California at Berkeley, and Shripad Tuljapurkar, President of Mountain View Research in Los Altos, Calif., a demographer and former Professor of Biological Sciences at Stanford University.

The stochastic or probabilistic approach does not simply provide one, two or three scenarios for the future for mortality rates, fertility rates and immigration rates. It also gives its various scenarios a probability rating. Unfortunately, there was only enough funds from NIA to pay for a mortality series – leaving out the fertility and immigration components that are required to have a complete population forecast series.

---

<sup>49</sup> The National Economic Council was created by Executive Order on January 25, 1993. Its membership includes the President, Vice President, Secretary of State, Secretary of the Treasury, Secretary of Agriculture, Secretary of Commerce, Secretary of Labor, Secretary of Housing and Urban Development, secretary of Transportation, Secretary of Energy, the Administrator of the Environmental Protection Agency, Chair of the Council of Economic Advisers, the National Security Adviser, Director of the Office of Management and Budget, the U.S. Trade Representative and others. It was set up to coordinate the economic policy-making process with respect to domestic and international economic issues, to coordinate economic policy advice to the President, to ensure that economic policy decisions and programs are consistent with the President’s stated goals and to ensure those goals are being effectively pursued.

### Denver Summit Study Finds More Gains in Longevity

The demographic projections on mortality were another eye opener for world leaders. The forecast gains in longevity were considerably higher for some countries than those made by official projections.<sup>50</sup> For Japan, the Denver Summit study found that there was a 50% chance that Japanese men and women combined would have a life expectancy at birth of 90.91 in 2050, a forecast that is “higher than official ones by an astounding 8 years” from the official prediction of 81.95 years, according to Tuljapurkar, the lead author of the report, who made the results public in June in an article in *Nature*.<sup>51</sup>

The Denver Summit projections were also more optimistic than official forecasts on life expectancy for the other G-7 countries. The study found Italy’s official forecast off by 3.76 years for a total life span of 86.26, Canada by 3.59 years for a total of 85.26 years, France by 3.5 years for a total of 87.01 years, the U.S. by 2.46 years for a total of 82.91 years, Germany by 1.62 years for a total of 83.12 years, and the U.K. by 1.29 years for a total of 83.79 years.

What is the significance of such gains in longevity to fiscal costs and social burdens? Adding eight years could increase Japan’s spending in 2050 by 40% more than official forecasts would suggest, explains Tuljapurkar, who uses a rough calculation that proportional increases in the years of life added after age 65 roughly translate into equivalent increases in the dependency ratio. Thus, the addition of 40% more years after age 65 is roughly equivalent to another 40% increase in the cost of providing pensions, medical and nursing care to the elderly than previously thought.

For France, the Denver Summit found there was a 50% chance life expectancy would rise to 87.01 years in 2050. The difference could mean spending on old age benefits might rise to a level 19% higher than predicted by official data. For Italy, a life expectancy of 86.26 years in 2050 would also equal about 22% higher spending than officials forecast.

For Canada, a nation where the aging problem seems more manageable than most other industrial nations, 85.26 years of life expectancy in 2050 would mean roughly 22% higher spending than officially predicted. For the U.S., life spans of 82.91 years in 2050 will be roughly equal to 16% higher spending. For Germany the difference is 10%, and for the United Kingdom, it’s 7%.<sup>52</sup>

---

<sup>50</sup> Official projections in the Denver Summit study are taken from the following sources: for Canada, the forecasts follow the assumptions of the Canadian Pension Plan; for France, Germany, Italy and the United Kingdom, Data Shop Eurostat, Luxembourg; for Japan, from the National Institute of Population and Social Security Research of Japan, *Population Projections for Japan: 1996-2050*, Tokyo, 1997; for the U.S., the U.S. Social Security Administration. *Population Projection: 1997*, [www.ssa.gov](http://www.ssa.gov).

<sup>51</sup> Tuljapurkar, Shripad; Li, Nan; Boe, Carl (2000), “The Universal Pattern of Mortality Decline in the G-7 Countries,” *Nature*, Vol. 405, June 15, pp. 789-791.

<sup>52</sup> The Denver Summit projected life spans of 83.12 for Germany and 82.91 for the United Kingdom.

The Denver Summit study, in short, found the challenge of aging in industrial nations was larger and more difficult than previously thought. This is scarcely a startling finding. Many, if not most demographers using other approaches and methods have likewise concluded that life spans are likely to be greater than the numbers reflected in official forecasts. Some demographers forecast even longer life spans than the methods used in the Denver Summit study, and some of their findings are discussed below.

The communiqué issued by the G-8 in Denver put its second highest priority on “the opportunities and challenges of aging populations,” which it found were exceeded only by issues surrounding globalization. Citing Hashimoto’s Initiative for a Caring World as the basis for the G-8’s focus on this issue, the communiqué reviewed the discussions held at the Summit.

The G-8 offered this cautious platitude: “Some of our countries face major challenges in sustaining their public pension systems and would benefit from early action to restore balance.”<sup>53</sup> The communiqué also pledged to “identify gaps in our knowledge and explore developing comparable data in our nations to improve our capacity to address the challenges of population aging into the 21<sup>st</sup> Century.”

The Summit leaders discussed what sorts of policies would help to address the issues of aging. These included raising labor force participation, especially of seniors through “active aging,” and increased national savings rates. Investment in human capital, including maximizing opportunities for life-long learning, were cited “as ways to facilitate the continue work preparedness of mature adults.”

### **Group of Ten Adopts Principles for Reform**

**I**n the year following the Denver Summit, the task of assessing the economic and financial market implications of population aging fell to 23 deputies from the central banks and ministries of finance of the Group of Ten countries,<sup>54</sup> plus four observers from the International Monetary Fund, OECD, European Commission, and the Bank for International Settlements. The G-10 committee of deputies was chaired by Mario Draghi, Director General of the Treasury in Italy. BIS published the report of the deputies in April 1998<sup>55</sup> just ahead of the Birmingham Summit of the G-8 in England in May.

The G-10 report also contained policy recommendations, while noting that the best mix of policy reforms is often country-specific. Significantly, it recommended that pension reforms include funding or pre-funding pay-as-you-go systems. (See Appendix I for a summary of the Group of Ten study on aging.)

---

<sup>53</sup> Communiqué, Denver Summit of The Eight, June 20-22, 1997, Denver, Colorado.

<sup>54</sup> The Group of Ten countries actually includes 11 nations: the G-7 plus Belgium, the Netherlands, Sweden and Switzerland.

<sup>55</sup> Group of Ten (1998), “The Macroeconomic and Financial Implications of Ageing Populations.” Basel, Switzerland: Bank for International Settlements, April.

Despite the rhetoric at the Denver Summit and the urgency of action suggested by the G-10 report, the world's leaders in Birmingham did not have population aging on their agenda. They were focused instead on the more immediate Asian financial crisis and the potential global financial fallout that lay ahead. Since budget deficits were coming down, this took away the urgency the aging issue had in the prior year. Furthermore, Europe was caught up in the excitement of the formal approval of European Monetary System and Economic Union on May 2, only two weeks ahead of the Birmingham Summit. There were, some European officials admit, pressures to take the fiscal impact of aging off the agenda because it might impede the successful launch of the euro in January 1999.

Interest in the global aging issue has continued out of the limelight of high level gatherings of world leaders in the last two years as industrial nations continue to try, as the Denver Summit communiqué had urged, to identify gaps in knowledge and explore developing comparable data in industrial nations to improve their capacity to address the challenges of population aging. There has been some progress on this issue. Twenty-three OECD countries have agreed to participate in a program at the OECD that will provide projections of the impact of pension spending on national budgets using agreed common economic variables. This includes similar assumptions and models governing the labor market, unemployment and the underlying productivity rate driving gains in the gross domestic product.

The new project was initiated by Working Party I of the Economic Policy Committee<sup>56</sup> and is overseen by the Ad Hoc Working Group on the Fiscal Implications of Aging, according to OECD sources. This is being carried out using the same analytical framework as the OECD project. Results of the two projects are to be kept consistent. The European Union project is being carried out under the aegis of the Economic Policy Committee of the European Council of Ministers. (A progress report on the EU project is discussed below.) New OECD projections of the fiscal and macro-economic impact of population aging may be available to the public in 2001.

The OECD project builds on its work on aging published in 1996 and 1998. Those earlier studies used rather simplified models of pension spending. While they provided broad orders of magnitude of the possible changes in age-related spending, there were not based on models as detailed as now exist in most OECD countries. While most countries accepted the results as far as they went, some countries contested their validity, particularly where reforms had been under taken – Italy, for example. As a consequence the current project will use more developed models from the participating countries to improve the accuracy of spending projections. To the degree possible it will also include age-related spending items such as health care (and education spending and child allowances). The projections will be made on the basis of similar and common assumptions about selected macro-economic variables. This should provide policy makers with a better image of likely future developments in spending, according to the

---

<sup>56</sup> The Economic Policy Committee and its subgroupings are made up of representatives of the Ministries of Finance in the OECD countries (and the White House Economic Policy Council in the U.S.).

OECD. At the same time, it is hoped that the use of common assumptions will permit greater transparency as to why countries differ.

The Italian Treasury's model for calculating future costs for social security, for example, has been incorporated into the OECD's new project and is reflected in the OECD's latest Economic Survey for Italy, which was published in May.

The Italian Treasury model uses assumptions that some might question. It includes, for example, an assumption that workers will delay their retirement in the future and that workers between 55 and 65 will not have the same low work force participation rates they have today. While pension reforms are expected to gradually discourage early retirement, it is not clear how soon significant impacts will be felt in retirement decisions. This may not happen as quickly and thoroughly as the Italian Treasury model suggests.

Another assumption in the Italian Treasury model is trade unions and the government will successfully negotiate new agreements every 10 years to bring the system back into balance. If, for example, gains in life spans above current forecasts threaten to raise spending significantly, benefit cuts might be required to bring the system back in balance. This process may not go smoothly and may not reach a successful conclusion in a timely fashion.

The Italian projections using the current Italian Treasury model show that spending on social security pensions would have reached reach 22% of GDP by 2030 to 2035 without important reforms adopted in the 1990s. Spending on social security pensions is about 15-16% of GDP now. These simulations by the Treasury model are slightly above the OECD's original projection made in 1996 and 1998. This level of spending, the OECD suggested in 1996, would send Italy's budget deficit to 20.4% in 2030.

The Italians contend that OECD's 1996 projections did not adequately take into account the major reforms of 1995 made by Parliament when Lamberto Dini was Prime Minister and the subsequent adjustments in the 1997 reforms under Prime Minister Romano Prodi. Under these reforms Italian officials say the average pension benefit in Italy will decline from about the current 60% to 65% of a worker's final pay (the so-called replacement level) to a future level to 45% by 2035, when the Dini reforms are fully phased in.

The new Economic Survey of Italy shows a dramatically changed outlook from the OECD's 1996 projections. Instead of sharply higher spending reaching 22% of the GDP, the survey shows spending rising very gently after 2000 to a peak of 15.8% in 2002, followed by a sloping decline as all the reforms are finally in place.<sup>57</sup> For a more detailed discussion of the reforms in Italy see Appendix II.

---

<sup>57</sup> *OECD Economic Surveys. Italy*. Paris: Organization of Economic Cooperation and Development, May 2000, p. 112.

The outlook for Italy remains clouded, in spite of an improved view from the OECD.

### **Ongoing Study for the EU's Economics and Finance Ministers Urges Reform**

In November 2000 a progress report<sup>58</sup> of an ongoing study of the fiscal impact of aging on 15 European Union nations was made public. The study is being done at the behest of the European Union's Council of Economic and Finance Ministers. As noted earlier, there are two such reviews of industrial nations that have been undertaken simultaneously. One is being done under the direction of the Economic Policy Committee for the OECD and the other by the Economic Policy Committee for the EU's ministers. The study for the European Union was done by the Economic Policy Committee's Working Group on the Implications of Ageing Populations, chaired by Prof. Vittorio Grilli of the Italian Treasury.

The study makes projections through 2050 for the budget impact of pension spending for 13 of the 15 EU countries (Greece and Luxembourg's projections are due in January 2001). The study relies on common economic assumptions on interest rates, productivity and economic development that were drawn up in collaboration with the OECD. It relies on the latest demographic data from Eurostat and contains two scenarios, one assuming no change in policies and another assuming adoption of a number of initiatives to improve labor market participation.

The current policy scenario assumes there will be a convergence of productivity growth rates of EU nations toward a 1.7% to 1.8% in the period between 2020 and 2030. The EU study also assumes that structural employment will fall by up to one-third of its 1999 level, narrowing the differences between nations, some of which have had unemployment about 10%.

According to Eurostat, the population of the EU 15 nations is expected to rise from 376.2 million in 2000 to 386.0 million in 2020. It will then fall to 384.6 million in 2030 and downward to 364.5 million.<sup>59</sup> The Eurostat median projections assume total fertility rates gradually converge to a range of 1.5 to 1.8 for various member EU nations.<sup>60</sup>

---

<sup>58</sup> Economic Policy Committee (2000), *Progress Report on the Impact of Ageing Populations on Public Pension Systems*. Opinion Addressed to the European Council of Ministers and the European Commission EPC/ECFIN/518/00-EN -- Rev.1, Brussels, November 6.

<sup>59</sup> Population projections for individual nations show greater variations. Germany's population will rise from 82.1 million in 2000 to 83.3 million in 2020, falling to 76 million in 2050. Italy's population will fall from 57.6 million in 2000 to 56 million in 2020 and fall further to 48.1 million in 2050.

<sup>60</sup> Total fertility rates will converge by 2050 to 1.5 in Germany, Spain, Italy and Austria (from 1.4, 1.5, 1.22, and 1.31 respectively). TFR will rise to 1.6 in Greece (from 1.34), to 1.7 in Portugal and Finland (from 1.53 and 1.73 respectively) and 1.8 in all other EU countries (Belgium, Denmark, France, Ireland, Netherlands, Sweden and the United Kingdom)

A second “Lisbon scenario” assumes a steadily rising average employment rate and labor participation rate for women. The European Council of Ministers met in Lisbon in March 2000 and set targets for 2010 for these indicators as part of its effort to seek full employment in Europe. They hope that reforms will push the employment rate from 61% to 70% by 2010 and an increase in the number of women in employment from an average of 51% to 60% by 2010. While the council set a target growth rate of 3%, the rate used in the model was determined by each member state, based on the impact of the suggested reforms, and assumptions on productivity. This scenario also assumes a substantial recovery in Europe’s low fertility rates (the high growth variant from Eurostat’s latest projections). Many, if not most, demographers would find Eurostat’s high growth variant to be an unrealistic assumption on which to base policy reforms.

Beyond 2010 there are even more improvements in labor participation under the Lisbon scenario. Both male and female participation rates rise and converge to 83% by 2045. This assumes increased participation by the elderly. Unemployment declines to 4% for both males and females by 2045. Productivity growth rates are assumed to converge to 1% by 2050. These are all highly ambitious goals that would require substantial reforms in most EU countries, where some of the reforms would face stiff political opposition.

The simulations of public spending in these scenarios were provided by governments of the participating EU nations. Under the mean Eurostat population projections, the EU population is expected to decline starting after 2020, due mostly to low fertility rates. By 2050 the population may be 3% lower than the current level. The old-age dependency ratio will rise from 27% to 53% by 2050. Under the Lisbon scenario, the EU population will increase by 17% by 2050.

Under the current scenario (no increase in labor participation rates and no substantial improvement in fertility) most EU nations will add between and 3% and 5% of GDP to pension spending. Here is how the increase breaks down for several nations: Germany, 4.3% by 2050; France, 3.9% by 2030; Belgium, 3.7% in 2040; Denmark, 4.5% by 2030; Ireland, 4.4% by 2050; Austria, 3.1% by 2030 and Finland 4.7% by 2040.

The impact is sharply higher in some countries: Spain’s pension spending will add 8.3% to GDP by 2050, while the Netherlands and Portugal will add an extra 6.2% by 2040 and 2030, respectively.

Some nations have a brighter outlook. In Italy and Sweden, for example, pension spending will add only 1.7% to GDP by 2030. In the case of Italy, however, this assumes all pension reductions will be made as planned. In view of the fact that there has no significant supplementary pension system that is in place, there are likely to be pressures to postpone future cuts. Such cuts, as noted in Appendix II, require periodic approval by Italy’s labor unions.

The projected increases in spending under this ongoing study are less than what might be expected given the increases in the dependency ratio, which suggests that

reforms made during the 1990s have had some impact on curbing the rate of spending growth on public pensions. The projected increases should also be weighed against the ability of various nations to shoulder larger spending burdens. For example, although Italy has a relatively low increase in spending on public pensions, 1.7% of GDP, it starts from the highest level of spending on pension in the UE, 14% of GDP in 2000. Italy also has gross public debt of over 100% of GDP and public pensions are financed on a pay-as-you-go basis. The situation in the Netherlands stands in stark contrast. Here spending is expected to increase by 6% of GDP over 40 years. However, in the Netherlands, most pensions are funded, and deferred taxes on contributions to pensions is expected to lead to an increase in tax revenues of 3% of GDP.

Under the Lisbon scenario, there is a distinct improvement in the outlook. For Portugal, the increased cost of pensions adds only 4.1% of GDP. Germany's peak addition to GDP is 2.3% instead of 4.3%. For France it is 1.1% instead of 3.9%. For Sweden and Italy, pension costs will stabilize.

Debt will also rise under both scenarios. For some EU nations debt will rise to levels over 200% of GDP, according to the review. This points to a need for pension reforms in these unidentified nations, the Economic Policy Committee concluded.

Since the progress report does not contain projections for health care spending on government budget balances, the Economics and Finance Ministers have requested that further work be carried out on the impact of aging on health care spending. The ministers have also plan to look at the overall sustainability of public finances as the review of the fiscal impact of aging continues.

The Working Group on the Implications of Ageing Populations conducted an analysis of its findings and reaffirmed its 1997 recommendation for the Economic Policy Committee to contain pension benefits, reduce public debt in the short term, tie benefits closer to contributions, and increase the role of funded pension schemes.

The Working Group suggested that policy makers give priority to reforms that would delay retirement age, particularly in early retirement schemes. Such reforms have the advantage of "smoothing the pension expenditure trend without reducing the living standard of the elderly," the report states.<sup>61</sup> The study also found that improvements in labor market participation, especially for women and workers 50 and over, will have significant positive effects on budgets and debt.

In November 2000 the Economics and Finance Ministers Council agreed to conduct annual examinations of the long-term sustainability of public finances. This high-level interest is prompted not only by concerns about the budgets of member nations, but also about the smooth functioning of the European Monetary Union and the euro.

---

<sup>61</sup> Economic Policy Committee, p. 9



### Section Three: A New Demographic Times Series and A Stochastic Approach

The development of alternative forecasts to the official ones can show how much difference a change in assumptions can have – or not have, as the case may be. There are, in fact, new ways of forecasting that should prove helpful in assessing the impact of aging populations. It can also measure how various policy changes might help or not help. Among these are the methodologies used in the Denver Summit study. There are two important innovations the authors use in their statistical modeling that are not employed by most demographers and actuaries who make official projections. One innovation is the use of a stochastic approach – one based on the probability of a given outcome – that was developed by demographer and economist Ronald Lee, in conjunction with Shripad Tuljapurkar, beginning in 1994.<sup>62</sup>

Lee also figures prominently in another new approach used in the projections for the Denver Summit G-7 study – a new time series on mortality. The new time series was the result of a pioneering collaboration in the early 1990s<sup>63</sup> with Lawrence R. Carter, a professor of sociology at the University of Oregon in Eugene.

Lee and Carter's new approach to statistical modeling of mortality took a longer look back in history – nearly a century -- to set the trend line for its forecasts. Official forecasts like those made by U.S. Social Security Administration and the U.S. Census Bureau rely more on recent mortality trends.

A thumbnail view of Lee and Carter's approach can be seen by simply taking the improvement in life spans from 1900 to 1988, from 47 to 75 years, and projecting that forward 75 years to 2065 and arriving at a life expectancy of 100. They wrote: "This increase would be welcomed by most of us, but it would come as a nasty surprise to the Social Security Administration, which plans a more modest life expectancy of 80.5 years." The official forecast for 2065 appeared too conservative to Lee and Carter in its assumptions about longevity gains in view of the fact that 46% of the population in 1987 was already living to 80 years, while 35% were living to 85.

To plot their trend line, Lee and Carter looked at age-specific death rates<sup>64</sup> in the U.S. from 1900 to 1988, where they are available. They left out of the model such one-time variation in rates as the 1918 influenza epidemic, which sent death rates for those age 25 to 34 soaring 150% above the trend line. They also omitted a surge and then a decline in deaths among young adult males from 1960 to 1980. Using this method, Lee and Carter found that over the stretch of nearly a century there was "an overall pattern of

---

<sup>62</sup> Lee, Ronald and Shripad Tuljapurkar, 1994. "Stochastic Population Projections for the United States: Beyond High, Medium and Low," *Journal of the American Statistical Association* 89 (428): 1175-1189

<sup>63</sup> Lee, Ronald D. and Lawrence R. Carter, "Modeling and Forecasting U.S. Mortality," *Journal of the American Statistical Association*, September 1992, Vol. 87, No. 419, pp. 659-671.

<sup>64</sup> They are available for the entire U.S. population from 1933 to 1987, but from 1900 to 1932 these data are available annually only for the death registration states, which may vary from the average for the whole U.S.

fairly regular change, with coincident movement of death rates at all ages.”<sup>65</sup> From this central observation, the authors extrapolated a statistical model for calculating future improvements in survival in each age category. It predicted that by 2050 average life expectancy for newborns in the U.S. would be 86.1 years (plus or minus 4.5 years).

Official forecasts of mortality rates are strikingly different from those of Carter, Lee, and Tuljapurkar. The actuaries at the U.S. Social Security Administration use a method for calculating future improvements in mortality that relies on the views of medical experts on the number of deaths by a given medical cause, such as complications from diabetes, cancer or stroke. The latest annual report of the Social Security in the U.S. notes in its assumption and methods section that it is basing its mortality projections for those over 65 on data from the National Center for Health Statistics by cause of death from 1968 to 1997.<sup>66</sup>

Death rates in the U.S. declined at an average rate of 1.2% between 1968 and 1997. Between 1982 and 1987, however, they declined more slowly at an average rate of 0.7%. The trustees chose for their medium term projection – the one they felt most likely to occur – a steady death rate decline of 0.7%, reflecting the slower gains in longevity since 1982. This translates into an expected lifespan by 2050 of 79.1 for men and 83.5 for women.<sup>67</sup> This falls significantly short of the 86.01 years average for men and women that Lee-Carter predicted in 1992.

A difference of a single year in life expectancy can have considerable impact on Social Security finances, according to Lee and Tuljapurkar. It has this effect because most of that average one-year gain occurs among people over 65 who are receiving Social Security and are covered by Medicare. In a study<sup>68</sup> done in 1995 the two researchers found that one extra year added to the lifespan requires a 3.6% reduction in benefits or a 3.6% increase in payrolls taxes to keep the system in actuarial balance. The estimated cost of a single extra year of life expectancy is \$4,462 per capita. In another study Lee and Tuljapurkar went back to 1953 and looked at forecasts of the Social Security Administration with forecast horizons of 5 to 35 years and found that Social Security on averaged underprojected subsequent costs by around 10%.<sup>69</sup>

The U.S. Bureau of the Census, which makes population projections for the U.S. and the entire world through its International Data Base – also relies on recent trends in mortality as the basis for its projections. “Instead of trends country by country, we looked at it on a global basis,” explains Peter Johnson, special assistant for demographic and

---

<sup>65</sup> Lee and Carter (1992), p. 660.

<sup>66</sup> Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds. 2000. *2000 Annual Report*, p. 146. Washington: Social Security Administration.

<sup>67</sup> The Board of Trustees of the Federal Old Age and Survivors Insurance and Disability Insurance Trust Funds, “The 2000 Annual Report,” p. 63.

<sup>68</sup> Lee, Ronald and Shripad Tuljapurkar (1997), “Death and Taxes: How Longer Life Will Affect Social Security.” *Demography* Vol. 34, pp. 67-81.

<sup>69</sup> Lee, Ronald and Shripad Tuljapurkar, “Population Forecasting for Fiscal Planning: Issues and Innovations.” Auerbach, A. and R. Lee, editors, *Demography and Fiscal Policy*, Cambridge University Press. Forthcoming.

economic studies. “We assume all countries will follow a logistic curve that will flatten out” when life spans reach the upper limit, which the bureau has pegged at 82.56 years for males and 88.4 years for females in its latest 2000 forecasts.

### **Fertility Forecasts Usually Miss Baby Booms, Baby Busts**

**F**orecasting changes in fertility rates is a more challenging exercise than forecasting mortality rates. There are wide swings in fertility -- baby booms and baby busts -- that are usually not foreseen by demographers, or anyone, for that matter. Official population projections adopt assumptions on fertility that seem to be pretty much guesswork, especially since there are often no explanations for the assumptions. The United Nations, for example, expects the total fertility rate to rise to 1.8 by 2050 in its current forecasts, considerably higher than the 1.4 to 1.5 levels in much of Europe and Japan. “These assumptions seem pretty reasonable,” says John Bongaarts, Vice President of the Population Council in New York. He points out that the total fertility rate in the U.S. fell in the late 1970s and early 1980s to 1.8 but it has since recovered to more than 2. “In Europe, it’s come down and come down further. What lies ahead, nobody really knows,” he says.

Bongaarts suspects, however, that women are “moving children to later ages,” that is they are delaying the age at which they have their children. This causes a “tempo distortion” to the total fertility rate.<sup>70</sup> At some point women may have the delayed children and there may be an upsurge in the total fertility rates and the current distortion of low fertility will “go away,” he suggests. When women are polled in most countries and asked how many children they want to have, the usually say they intend to have two children. Some may not marry or some may have jobs that interfere with their plans to have children, so they may not be born, Bongaarts notes. Yet, the basic desire to have two children should, in time, lead to a total fertility rate between 1.5 and 2.0, Bongaarts states.

The causes of the decline in fertility are attracting considerable attention in countries facing a population loss, like Japan and Italy. Demographers in Japan, for instance, point to the changing role of women as a key cause of the decline in fertility. As more women pursue a career, they are faced with the opportunity cost of having children -- the cost to their career of taking time off from work to have children. “The consensus on the economic causes of low fertility is the increasing opportunity cost for women for raising children,” says Another Yashiro, Professor of Economics at Sophia University and Senior Research Fellow at the Japan Center for Economic Research. “There are better job opportunities for women in the Japanese employment system and it’s hard to keep on working when married or having children,” he says.

When Japanese women are asked how many children they want, they often reply they want three. Yet, in fact, women are having only 1.4 children during their life. “In a sense children are luxury goods in Japan,” says Yashiro. They are what people would like

---

<sup>70</sup> Bongaarts, John and Griffith Feeney (1998), “On the Quantum and Tempo of Fertility,” *Population and Development Review*, Vo. 24, No. 2, June, pp. 271-291.

to have although they may not be able to afford them.” He points out that bankers, for example, without a working wife, have an average of three children and live in a big house, Yashiro says. If the costs of having children could be covered, then birth rates would rise, he suggests.

While it may not be possible to entirely cover the cost of having children, Yashiro thinks more needs to be done by government and employers to make it easier for women to continue working and have children, too – that is reduce the opportunity cost of having children. This includes more flexible working situations during the first year of rearing each child, the ability to work from home offices, and increased investment in child care facilities for working mothers.

### **Delay of Marriage, Motherhood Reduces Fertility in Japan**

Most of the polls asking about the desire to have children are taken of married, not single women. An alternative argument for low fertility in Japan centers around the growing delay in marriage by women and men driven, some claim, by an attitude of self-indulgence and avoidance of the responsibilities of marriage and child-rearing. Masahiro Yamada, Associate Professor of Sociology at Tokyo Gakugei University, argued in 1999 in his book, *Parasite Single no Jidai (The Age of Parasite Singles)* that “parasite singles” are contributing to Japan’s economic stagnation. They live at home and enjoy a richer lifestyle because they have no basic expenses and can spend their earnings on clothes, travel and hobbies. In his book Yamada cites a 1995 government survey that showed 59% of men and 65% of women aged 20 to 24 live with their parents, as do one in five men and one in eight women in the 30-34 age group. Yamada recommends levying a tax on those who live with their parents unless they can prove they are caring for them or taking over a family business.

A study<sup>71</sup> by John Ermisch and Naohiro Ogawa analyzed time series data from a 1990 survey of both single and married women. Those data reveal the median age for motherhood for women born between 1966 and 1968 was 26, more than two years later than the cohort born between 1946 and 1950. The authors found that the trend toward later marriage and motherhood can largely be explained by the potential of earning more because of higher educational attainment. However, these opportunities do not entirely explain the delay in marriage and age of motherhood, leaving room for changes in cultural attitudes toward marriage and motherhood.

Ermisch and Ogawa found a correlation between the level of educational attainment and age of motherhood. They predict that if this relationship persists, the women in the generation born in 1975 will marry at a median age of 27 years 11 months and become mothers at a median age of 28 years 7 months. More will never marry or

---

<sup>71</sup> Ermisch, John and Naohiro Ogawa (1994), “Age at Motherhood in Japan,” *Journal of Population Economics*, official organ of the European Society for Population Economics, Vol. 7, No. 4. Berlin, Germany: Springer-Verlag, pp. 393-420.

remain childless. This suggests fertility rates might decline rather than rise in the future, Ogawa says.

Some economists take another view of fertility based on the theories of the economics of the family. These economists generally argue that the increasing generosity of pension benefits provides a hedge against the decline in earning capacity. These earnings are replacing the role of middle-aged children who transferring earnings to, and care for elderly parents. There is recent empirical evidence to support this view in the case of the Italy, Germany, the U.S. and the U.K. in a study by Alessandro Cigno, professor of political science at the University of Firenze, and Furio C. Rosati from the University of Rome.<sup>72</sup>

Lee developed a new purely statistical approach to fertility forecasts using a new time series methodology in 1993.<sup>73</sup> This approach was further developed in a collaboration between Lee and Tuljapurkar. The two authors start from the premise that various economic theories and models of fertility, though highly developed and tested, “do not yet provide a useful basis for forecasting fertility.”<sup>74</sup> They also took a look at the track record for past predictions on fertility by the U.S. Bureau of the Census and have found they have missed “every turning point” and that their projections merely “mimic the level of fertility in the years immediately preceding the forecast.”<sup>75</sup>

### **Fertility Rebound May Be Less Than Official Forecasts**

**B**ecause there is so much uncertainty in making these predictions and because demographers do not understand why there are baby booms and busts, Lee and Tuljapurkar argue that “it would be prudent to consider the possibility that fertility may be lower in the long run” than even the high cost estimate of official bodies. In the U.S., they would mean that it might be lower than 1.7 children per women, a level assumed by the Office of the Actuary at the Social Security Administration for its high cost scenario.<sup>76</sup> For similar reasons, it would also be prudent to consider the possibility that fertility rates in Europe and Japan will not return to levels of 1.7 and 1.8, as many official forecasts assume, Lee and Tuljapurkar have concluded.

It was the development of a stochastic approach to demographics that has made it possible to assess the probabilities of changes in both fertility and mortality. As Tuljapurkar explained in a *Nature* article in 1997: “Traditional forecasts use a ‘high-

---

<sup>72</sup> Cigno, Alessandro and Furio C. Rosati, “Jointly Determined Saving and Fertility Behaviour: Theory and Estimates for Germany, Italy, UK and USA,” *European Economic Review*, 40(1996) 1561-1689.

<sup>73</sup> Lee, Ronald (1993), “Modeling and Forecasting the Time Series of U.S. Fertility: Age Patterns, Range and Ultimate Level,” *International Journal of Forecasting*, 9:187-202.

<sup>74</sup> Lee, Ronald and Shripad Tuljapurkar, “Population Forecasting for Fiscal Planning: Issues and Innovations.” Auerbach, A. and R. Lee, editors, *Demography and Fiscal Policy*, Cambridge University Press. Forthcoming.

<sup>75</sup> Lee, R. and S. Tuljapurkar, in Ed. Auerbach, A. and R. Lee. *Demography and Fiscal Policy* Forthcoming.

<sup>76</sup> Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds. 2000. *2000 Annual Report*, p. 133. Washington: Social Security Administration

medium-low' method, making a central forecast bracketed by two variants. Although the range between 'high' and 'low' indicates uncertainty, no probabilities are associated with the alternative outcomes, so it is difficult to interpret, employ and evaluate them. In contrast, a probabilistic forecast is valuable to anyone who must make a decision that turns on future events, because one may compute the odds of happy and nasty outcomes and turn decisions into informed gambles. This is no radical idea: investors, for example, routinely use estimated uncertainty to shape their decisions."<sup>77</sup>

Probabilistic or stochastic forecasting is different from high-medium-low scenario forecasting in a fundamental way. It does not attempt to predict the future, but to gauge the probability of certain outcomes. "When you adopt a scenario without saying anything about variability, you're select out one possible future," says Tuljapurkar. Speaking of the statistical approach used at Mountain View Research, he says: "Our job is not to predict the future but show outcomes that are possible and show whether the outcomes you hope for are possible outcomes."

The Lee-Tuljapurkar approach to fertility incorporates the historic patterns from past time series of fertility rates. They also incorporate the assumption that fertility rates in countries with lower fertility will recover to the higher levels of 1.7 to 1.8 officials predict. However, while official forecasts of fertility tend to assume that rates will recover rather quickly, usually within 10 years, the Lee-Tuljapurkar approach expects a recovery to take longer, more like 20 to 25 years. "The striking thing about official forecasts is their smooth transition to higher fertility levels with no booms and no busts," says Tuljapurkar. Historically, of course, there have been booms and busts, and it is assumed that this variable pattern will continue in the future. Recent experience in Sweden shows how unpredictable these patterns can be. There fertility rates went up for six years and then "proceeded to drop like a stone" over the next six years, says Tuljapurkar. Official forecasts smooth out these variations and move up the fertility rate quickly and keep it at a high level.

### **Stochastic Population Forecasts for the G-7 Countries**

**T**he Global Aging Initiative at the Center for Strategic and International Studies commissioned a study of the G-7 countries to complete the work begun by Lee and Tuljapurkar for the Denver Summit. The new study by demographers Tuljapurkar, Nan Li and Michael Anderson of Mountain View Research, adds both the fertility and immigration numbers to the model used in the previous study. While the Denver Summit study provided only the median projection from its model, the new Global Aging Initiative study calculates outcomes that represent a two-thirds probability of occurring from a series of 1,000 alternative projections of the future.

Why use two-thirds and not some other probability? "The conventional statistical thing is to pick a 95% probability interval with only 2 ½ % chance of being below that

---

<sup>77</sup> Tuljapurkar, Shripad (1997), "Taking the Measure of Uncertainty," *Nature*, Vol. 387, June 19, p. 760

and 2 ½% chance of being above that.” The problem with using a 95% probability interval is that “it tends to be fairly wide,” says Tuljapurkar. This would include such a range of numbers that it would increase the chances that policy makers would make mistakes. A two-thirds probability “is reasonably suggestive without showing larger uncertainty,” Tuljapurkar says.

The new study also analyzes the impact of various policy alternatives aimed at controlling the expected rise in the cost of population aging and those aimed at stemming declines in the working-age population. These findings, it is hoped, can serve as a benchmark or standard against which to compare official projections and discuss public policy responses.

The study found that official forecasts<sup>78</sup> in the G-7 countries, on average, “project an improbably high percentage of the young and an improbably low percentage of the elderly”<sup>79</sup> in 2010, 2030 and 2050. It also found that official forecasts underestimate the likely decline in the size of the working-age population, except in the U.S. and Canada. Countries with low fertility and low immigration were found to underestimate the likely decline in total population.

The Global Aging Initiative study found longer lives in the future than did the Denver Summit study, in part because it uses a two-thirds probability approach instead of using the median number of all the possible outcomes generated by the computer model. In some countries the gap between the study’s findings and official forecasts was even wider than the gap found in the Denver Summit study, which used a median forecast.

In the discussion that follows the median forecasts for longevity are compared to the high end of the two-thirds probability number, meaning there’s a two-thirds chance that longevity could reach as high as a given number. This essentially measures the high end of the risk that people will live longer. A comparison of the official median and the Global Aging Initiative median can be found in Charts 1, 2, and 3.

### **Longevity Gains in Japan Could Be Sharply Higher**

**T**he findings for Japan were the most troubling. The study found there was a two-thirds probability that life spans in Japan in 2050 will be as much as an astonishing 10.25 years longer than official median forecasts: 93.20 years versus 82.95 years. There was only a one chance in six that life spans would be lower than 90.59 years. That left the official Japanese forecast of 82.95 years nearly off the chart of probabilities.

---

<sup>78</sup> Official projections in the CSIS Global Aging Initiative study are taken from the following sources: for Canada, *Statistics Canada*, 1994; For France, Germany, Italy and the United Kingdom, Data Shop Eurostat; for Japan, from the National Institute of Population and Social Security Research of Japan, *Population Projections for Japan: 1996-2050*, Tokyo, 1997; for the U.S., the U.S. Social Security Administration, *Population Projection: 1997*, [www.ssa.gov](http://www.ssa.gov).

<sup>79</sup> Tuljapurkar, Shripad, Nan Li and Michael Anderson (2000), “Stochastic Population Forecasts for the G-7 Countries,” May. Prepared for the Center for Strategic and International Studies, Washington, D.C.

**Table 1**  
**Comparison of Forecasts of**  
**Life Expectancy at Birth**

	<b>2010</b>	<b>2030</b>	<b>2050</b>
<b>Canada</b>			
Official Median*	81.25	82.10	82.10
GAI Median**	80.73	83.66	86.56
<b>France</b>			
Official Median	80.50	82.80	83.50
GAI Median	80.75	83.93	86.99
<b>Germany</b>			
Official Median	78.90	80.90	81.50
GAI Median	78.39	80.65	82.90
<b>Italy</b>			
Official Median	79.95	81.95	82.50
GAI Median	80.74	83.68	86.46
<b>Japan</b>			
Official Median	81.59	82.48	82.95
GAI Median	84.35	88.50	91.93
<b>United Kingdom</b>			
Official Median	79.45	81.75	82.50
GAI Median	78.98	81.52	84.19
<b>United States</b>			
Official Median	77.80	79.25	80.45
GAI Median	78.06	80.65	83.21

\*Official projections in the CSIS Global Aging Initiative study are taken from the following sources: for Canada, Statistics Canada, 1994; For France, Germany, Italy and the United Kingdom, Data Shop Eurostat; for Japan, from the National Institute of Population and Social Security Research of Japan, Population Projections for Japan: 1996-2050, Tokyo, 1997; for the U.S., the U.S. Social Security Administration. Population Projection: 1997, [www.ssa.gov](http://www.ssa.gov).

\*\*GAI=Global Aging Initiative study by Mountain View Research, June 2000.

Japan's life expectancy outlook in 2030 is also quite troubling for Japan's budget planners. Here the study found there was a two-thirds probability that life spans would be as much as 7.3 years longer: 89.78 versus 82.48. Even as soon as 2010, study found a two-thirds probability that Japan's official projection for life spans would be off by as much as 3.73 years: 85.29 versus 81.58.

On the fertility side, the findings of the Global Aging Initiative study are similar to official projections, except they are more variable over time and show a slower start to an expected recovery in fertility. This is partly due to the fact Japanese officials expect fertility to recover only to 1.6 from its present 1.4 children per women.

**Table 2**  
**Added Years After Age 65 Above Official Forecasts**  
**In Global Aging Initiative Study By Mountain View Research**  
**Official Median Versus GAI Median**

	<b>2010</b>	<b>2030</b>	<b>2050</b>
<b>Canada</b>			
GAI Extra Years over 65	-0.52	1.56	4.46
GAI Proportional Gain	-3.2%	9.1%	26.1%
<b>France</b>			
GAI Extra Years over 65	0.25	1.13	3.49
GAI Proportional Gain	1.6%	6.4%	18.9%
<b>Germany</b>			
GAI Extra Years over 65	-0.51	-0.25	1.40
GAI Proportional Gain	-3.7%	-1.6%	8.5%
<b>Italy</b>			
GAI Extra Years over 65	0.79	1.73	3.96
GAI Proportional Gain	5.3%	10.2%	22.6%
<b>Japan</b>			
GAI Extra Years over 65	2.76	6.02	8.98
GAI Proportional Gain	16.6%	34.4%	50.0%
<b>United Kingdom</b>			
GAI Extra Years over 65	-0.47	-0.23	1.69
GAI Proportional Gain	-3.3%	-1.4%	9.6%
<b>United States</b>			
GAI Extra Years over 65	0.26	1.40	2.76
GAI Proportional Gain	2.0%	9.8%	17.9%

\*Additional years forecast after age 65 in Global Aging Initiative study by Mountain View Research, June 2000, comparing median GAI with median official forecast.

\*\*Proportional gain in numbers of years after 65 in forecast in Global Aging Initiative study by Mountain View Research, comparing median GAI with median official forecast.

Official projections in the CSIS Global Aging Initiative study are taken from the following sources: for Canada, Statistics Canada, 1994; For France, Germany, Italy and the United Kingdom, Data Shop Eurostat; for Japan, from the National Institute of Population and Social Security Research of Japan, Population Projections for Japan: 1996-2050, Tokyo, 1997; for the U.S., the U.S. Social Security Administration. Population Projection: 1997, www.ssa.gov.

The study also finds no big gap between its own findings and official forecasts of Japan's coming steep decline in the size of its labor force. The study finds in its median forecast that the working age population will be 94% of 1995 levels in 2010, falling to 82% in 2030, and 66% in 2050. Official Japanese forecasts show the working age population falling to 93% of 1995 levels in 2010, then to 80% in 2030 and 63% in 2050.

The study finds the outlook for dependency ratios worrisome in spite of expected improvements in fertility. The difference is negligible in 2010 but grows very large by 2050. The study's two-thirds probability forecast is for a level as high as 0.79 – a far cry

from the official forecast of 0.59. There's only a one-sixth probability it will be lower than 0.69, making the official forecast only marginally probable.

What does this all mean for the outlook for Japan? In general it means that the need for reform has become more urgent. More specifically, it means that there's a two-thirds probability that life spans after age 65 will be as much as 59% longer than official projections. That means that the fiscal burden for Japan in 2050 could roughly be as much as 59% greater than anticipated.

The outlook in 2030 is also problematical. The study finds that there's a two-thirds probability that life spans after 65 will be as much as 43% greater than official projections. It means the budgetary impact may be as much as 43% greater than anticipated.

What may be even more disappointing is that even the outlook for 2010 is challenging for Japanese policy makers. The study finds that there's a two-thirds probability that life spans after 65 will be as much as 23% greater than official projections. Roughly, again, that means that spending on old age pensions, health care and nursing care could be 23% higher than expected in only ten years.

### **Italy's Old Age Spending Could Be Higher Than Official Forecasts**

**T**he outlook for Italy is also suggests higher costs for old age pensions and health care than official forecasts suggest. The study found that in 2050 there is a two-thirds probability that life spans will be as much as 6.31 years longer than the official projection: 88.81 versus 82.50. In 2030 the difference may be 3.89 (85.84 versus 81.95) years and in 2010 it could be 2.26 years (82.21 versus 79.95). This means that spending on old age benefits in Italy may be as much as 32% higher than official forecasts in 2050, and 23% higher in 2030 and 15% higher in 2010.

There's also bad news for Italian budget forecasters in the study's findings on that nation's old age dependency ratio. There's a two-thirds probability that the ratio maybe as high as 0.85 in 2050, far higher than the official projection of 0.61, and higher than any of the other G-7 nations, including Japan. The dependency ratio is higher in the study partly because Italy predicts its fertility rate will rise to 1.5 sooner than is predicted by the study. There's a one-sixth chance that the dependency ratio in Italy will be lower than 0.69, which means the official projection is highly unlikely to occur.

### **Germany's Working Age Population May Fall Faster**

**G**ermany's official projections are closer to those found in the Global Aging Initiative study, but there remain some differences. The study found that there's a two-thirds probability in 2050 that life spans in Germany may be as much as 4.03 years longer than official forecasts (85.08 versus 81.50). In 2030 they may be 1.66 years longer (82.56 versus 80.90) while in 2010 they may be less than a year longer at 0.78 (79.68 versus

78.90). This suggests there's a two-thirds probability that spending on old age benefits in Germany may be as much as 25% higher in 2050 than official forecasts. It may be 10% higher in 2030 and 5.6% higher in 2010.

---

**Table 3**  
**Forecasts of the**  
**Old Age Dependency Ratio**

---

	<b>2010</b>	<b>2030</b>	<b>2050</b>
<b>Canada</b>			
Official Median	0.20370	0.34810	0.36500
GAI Median	0.19069	0.32974	0.36402
<b>France</b>			
Official Median	0.28140	0.43960	0.51150
GAI Median	0.27777	0.44928	0.59112
<b>Germany</b>			
Official Median	0.31740	0.44680	0.50920
GAI Median	0.30802	0.45591	0.59710
<b>Italy</b>			
Official Median	0.33440	0.46470	0.60780
GAI Median	0.32911	0.49578	0.76325
<b>Japan</b>			
Official Median	0.34540	0.47220	0.59160
GAI Median	0.35049	0.52958	0.73424
<b>United Kingdom</b>			
Official Median	0.27330	0.41520	0.47120
GAI Median	0.27102	0.40605	0.48364
<b>United States</b>			
Official Median	0.21400	0.35300	0.37100
GAI Median	0.21469	0.36124	0.39320

GAI=Global Aging Initiative study by Mountain View Research, June 2000.

Official forecasts are taken from the following sources: for Canada, Statistics Canada, 1994; For France, Germany, Italy and the United Kingdom, Data Shop Eurostat; for Japan, from the National Institute of Population and Social Security Research of Japan, Population Projections for Japan: 1996-2050, Tokyo, 1997; for the U.S., the U.S. Social Security Administration. Population Projection: 1997, [www.ssa.gov](http://www.ssa.gov).

---

Germany's working age population may fall slightly faster than it is forecasting. The study's median forecast for 2030 is that the working age population will be 84.5% of its 1995 level. The official forecast is that it will be 86.7%. By 2050 the study's median forecast is that Germany's working age population will be 70% of the 1995 level, while officials predict it will be 81%.

Germany has the third highest old age dependency ratio among G-7 countries and it is expected to keep that ranking in 2050, even though France, which follows behind it, is expecting more gains in longevity. France's higher fertility rate partly compensates for

its gains in longevity. The study predicts that in 2050 there's a two-thirds probability that Germany may have an old age dependency ratio as high as 0.67, far higher than the official forecast of 0.51. There's a one-sixth chance that the ratio could fall lower than 0.54, making the official forecast highly improbable.

France also faces higher spending on old age benefits than officials now predict. The discrepancy here is smaller than for Japan or Italy. The study finds a two-thirds probability in 2050 that life spans in France could increase to as much as 5.79 years longer than official forecasts (89.29 versus 83.50). In 2030 life spans may be 3.20 years longer (86.00 versus 82.80) and in 2010 they may be 1.59 years longer (82.09 versus 80.50). Based on these extra years lived after 65, spending on old age benefits could rise as much as 31% higher than official forecasts in 2050, 18% higher in 2030 and 10% higher in 2010.

France faces the prospect a higher dependency ratio than officially acknowledged. The study finds a two-thirds probability that the old age dependency ratio may be as high as 0.64 in 2050, far higher than the official projection of 0.51, and nearly as high as Germany's ratio. There's a one-sixth chance that the dependency ratio in France will be lower than 0.55 in 2050, making the official projection highly improbable.

### **Americans May Live As Much As 2.85 Years Longer in 2030**

**T**he U.S., too, may face more budget difficulties than officially acknowledged, enough to give fresh new headaches to forecasters at the Social Security Administration, the Office of Management and Budget, as well as the Congressional Budget Office. There's a two-thirds possibility that life spans in 2050 could be as much as 4.45 years longer than projections by the Social Security Administration (84.90 versus 80.45). In 2030 it could be 2.85 years longer (82.10 versus 79.25) and in 2010 it could be 1.16 years longer (78.96 versus 77.80). This could mean that old age spending in the U.S. could be as much as 29% higher in 2050 than officially projected. In 2030 it could be 20% higher and in 2010 it could be 9 % higher.

Despite the study's finding that the official outlook for the size of the labor seems to be on target, the U.S. old age dependency ratio could be somewhat worse in 2050 than officially forecast. The study's median projection for 2050 is for an old age dependency ratio of 0.39, slightly higher than the projection from official numbers of 0.37. However, there's a two-thirds chance that the ratio could be as high as 0.44 in 2050. The differences between forecasts are much lower for 2030, but the same pattern can be seen.

The United Kingdom's official forecasts are close to the study's projections. Even so, there are some potential points for worry. The study finds a two-thirds probability that life spans in 2050 will be as much as 4.63 years longer than official forecasts. (87.13 versus 82.50). That suggests that spending on old age benefits could be 26% higher than predicted (because life spans after 65 years are 26% longer). For 2030, the difference may be as much as 2.22 years (18.97 versus 16.75) and old age spending may have to be

as much as 13% higher. For 2010, the difference is small: 1.01 years (15.46 versus 14.45). Even so, this could represent a 7% increase in old age spending.

The outlook for the U.K. is helped by both fertility (ranging from 1.7 to 1.8) and immigration. These, in turn, help sustain a steady working age population at least through 2030 and they prevent steep declines between 2030 and 2050. The study's forecasts on old age dependency are almost identical to official forecasts. By 2050 there's a two-thirds probability that the old age dependency ratio could be as high as 0.54, while the official forecast is 0.47.

For Canada there is a big difference in the official and study forecasts for life expectancy. The study finds a two-thirds probability that life spans in 2050 will be as much as 6.05 years longer than the official projection (88.15 versus 82.10). Yet, because of the high rate of immigration, the study's median forecast is that Canada's working age population in 2030 may be 134% of the 1995 level, higher than the official projection of 129%. The study's median forecast for Canada's old-age dependency ratio is almost identical to official forecasts, which show it rising from 0.20 in 2010 to 0.35 in 2030 and 0.37 in 2040 (there is no official Canadian forecast for 2050).

### **Ongoing Study for the EU's Economics and Finance Ministers Urges Reform**

In November 2000 a progress report<sup>80</sup> of an ongoing study of the fiscal impact of aging on 15 European Union nations was made public. The study is being done at the behest of the European Union's Council of Economic and Finance Ministers. As noted earlier, there are two such reviews of industrial nations that have been undertaken simultaneously. One is being done under the direction of the Economic Policy Committee for the OECD and the other by the Economic Policy Committee for the EU's ministers. The study for the European Union was done by the Economic Policy Committee's Working Group on the Implications of Ageing Populations, chaired by Prof. Vittorio Grilli of the Italian Treasury.

The study makes projections through 2050 for the budget impact of pension spending for 13 of the 15 EU countries (Greece and Luxembourg's projections are due in January 2001). The study relies on common economic assumptions on interest rates, productivity and economic development that were drawn up in collaboration with the OECD. It relies on the latest demographic data from Eurostat and contains two scenarios, one assuming no change in policies and another assuming adoption of a number of initiatives to improve labor market participation.

The current policy scenario assumes there will be a convergence of productivity growth rates of EU nations toward a 1.7% to 1.8% in the period between 2020 and 2030. The EU study also assumes that structural employment will fall by up to one-third of its

---

<sup>80</sup> Economic Policy Committee (2000), *Progress Report on the Impact of Ageing Populations on Public Pension Systems*. Opinion Addressed to the European Council of Ministers and the European Commission EPC/ECFIN/518/00-EN -- Rev.1, Brussels, November 6.

1999 level, narrowing the differences between nations, some of which have had unemployment about 10%.

According to Eurostat, the population of the EU 15 nations is expected to rise from 376.2 million in 2000 to 386.0 million in 2020. It will then fall to 384.6 million in 2030 and downward to 364.5 million.<sup>81</sup> The Eurostat median projections assume total fertility rates gradually converge to a range of 1.5 to 1.8 for various member EU nations.<sup>82</sup>

A second “Lisbon scenario” assumes a steadily rising average employment rate and labor participation rate for women. The European Council of Ministers met in Lisbon in March 2000 and set targets for 2010 for these indicators as part of its effort to seek full employment in Europe. They hope that reforms will push the employment rate from 61% to 70% by 2010 and an increase in the number of women in employment from an average of 51% to 60% by 2010. While the council set a target growth rate of 3%, the rate used in the model was determined by each member state, based on the impact of the suggested reforms, and assumptions on productivity. This scenario also assumes a substantial recovery in Europe’s low fertility rates (the high growth variant from Eurostat’s latest projections). Many, if not most, demographers would find Eurostat’s high growth variant to be an unrealistic assumption on which to base policy reforms.

Beyond 2010 there are even more improvements in labor participation under the Lisbon scenario. Both male and female participation rates rise and converge to 83% by 2045. This assumes increased participation by the elderly. Unemployment declines to 4% for both males and females by 2045. Productivity growth rates are assumed to converge to 1% by 2050. These are all highly ambitious goals that would require substantial reforms in most EU countries, where some of the reforms would face stiff political opposition.

The simulations of public spending in these scenarios were provided by governments of the participating EU nations. Under the mean Eurostat population projections, the EU population is expected to decline starting after 2020, due mostly to low fertility rates. By 2050 the population may be 3% lower than the current level. The old-age dependency ratio will rise from 27% to 53% by 2050. Under the Lisbon scenario, the EU population will increase by 17% by 2050.

Under the current scenario (no increase in labor participation rates and no substantial improvement in fertility) most EU nations will add between 3% and 5% of GDP to pension spending. Here is how the increase breaks down for several nations:

---

<sup>81</sup> Population projections for individual nations show greater variations. Germany’s population will rise from 82.1 million in 2000 to 83.3 million in 2020, falling to 76 million in 2050. Italy’s population will fall from 57.6 million in 2000 to 56 million in 2020 and fall further to 48.1 million in 2050.

<sup>82</sup> Total fertility rates will converge by 2050 to 1.5 in Germany, Spain, Italy and Austria (from 1.4, 1.5, 1.22, and 1.31 respectively). TFR will rise to 1.6 in Greece (from 1.34), to 1.7 in Portugal and Finland (from 1.53 and 1.73 respectively) and 1.8 in all other EU countries (Belgium, Denmark, France, Ireland, Netherlands, Sweden and the United Kingdom)

Germany, 4.3% by 2050; France, 3.9% by 2030; Belgium, 3.7% in 2040; Denmark, 4.5% by 2030; Ireland, 4.4% by 2050; Austria, 3.1% by 2030 and Finland 4.7% by 2040.

The impact is sharply higher in some countries: Spain's pension spending will add 8.3% to GDP by 2050, while the Netherlands and Portugal will add an extra 6.2% by 2040 and 2030, respectively.

Some nations have a brighter outlook. In Italy and Sweden, for example, pension spending will add only 1.7% to GDP by 2030. In the case of Italy, however, this assumes all pension reductions will be made as planned. In view of the fact that there has no significant supplementary pension system that is in place, there are likely to be pressures to postpone future cuts. Such cuts, as noted in Appendix II, require periodic approval by Italy's labor unions.

The projected increases in spending under this ongoing study are less than what might be expected given the increases in the dependency ratio, which suggests that reforms made during the 1990s have had some impact on curbing the rate of spending growth on public pensions. The projected increases should also be weighed against the ability of various nations to shoulder larger spending burdens. For example, although Italy has a relatively low increase in spending on public pensions, 1.7% of GDP, it starts from the highest level of spending on pension in the UE, 14% of GDP in 2000. Italy also has gross public debt of over 100% of GDP and public pensions are financed on a pay-as-you-go basis. The situation in the Netherlands stands in stark contrast. Here spending is expected to increase by 6% of GDP over 40 years. However, in the Netherlands, most pensions are funded, and deferred taxes on contributions to pensions is expected to lead to an increase in tax revenues of 3% of GDP.

Under the Lisbon scenario, there is a distinct improvement in the outlook. For Portugal, the increased cost of pensions adds only 4.1% of GDP. Germany's peak addition to GDP is 2.3% instead of 4.3%. For France it is 1.1% instead of 3.9%. For Sweden and Italy, pension costs will stabilize.

Debt will also rise under both scenarios. For some EU nations debt will rise to levels over 200% of GDP, according to the review. This points to a need for pension reforms in these unidentified nations, the Economic Policy Committee concluded.

Since the progress report does not contain projections for health care spending on government budget balances, the Economics and Finance Ministers have requested that further work be carried out on the impact of aging on health care spending. The ministers have also plan to look at the overall sustainability of public finances as the review of the fiscal impact of aging continues.

The Working Group on the Implications of Ageing Populations conducted an analysis of its findings and reaffirmed its 1997 recommendation for the Economic Policy Committee to contain pension benefits, reduce public debt in the short term, tie benefits closer to contributions, and increase the role of funded pension schemes.

The Working Group suggested that policy makers give priority to reforms that would delay retirement age, particularly in early retirement schemes. Such reforms have the advantage of “smoothing the pension expenditure trend without reducing the living standard of the elderly,” the report states.<sup>83</sup> The study also found that improvements in labor market participation, especially for women and workers 50 and over, will have significant positive effects on budgets and debt.

In November 2000 the Economics and Finance Ministers Council agreed to conduct annual examinations of the long-term sustainability of public finances. This high-level interest is prompted not only by concerns about the budgets of member nations, but also about the smooth functioning of the European Monetary Union and the euro.

---

<sup>83</sup> Economic Policy Committee, p. 9

## Section Four: Evaluating Policy Prescriptions

Global Aging Initiative's study by Mountain View Research also evaluated frequently cited policy prescriptions to contain the rising costs of aging populations and stem declines in the working age population. It looked at raising the retirement age, a frequently proposed solution to aging populations. This policy is doubly attractive because it keeps more workers paying taxes into the system while delaying the time when workers will become retirees and become dependent on government spending.

The study finds, however, that tweaking around the edges of the retirement age – as some propose – would not be a complete solution. Using median forecasts, the study found that there's a 50% chance that the retirement age in Japan would have to be raised to more than 80.9 years in 2050 to keep its old age dependency ratio constant at 1995 levels. Even in 2010, it would require raising retirement age to 71.4 years. In 2030, it would be 78.3 years. In Japan most older workers are willing to work but those aged 60 to 65 sometimes find it difficult to find work.

Part of the problem is Japan's seniority based wage system that rewards older workers and penalizes younger workers, according to Atsushi Seike, Professor of Labor Economics at Keio University in Tokyo. It also makes it difficult for firms to keep older workers past aged 60 because they are so expensive. In a 1998<sup>84</sup> study published in *Kenai Bonsai (Economic Analysis)* Seike and seven other authors examined the impact of the pension system and mandatory retirement on labor force participation of men aged 60 to 64. (Most workers start new jobs after 60 because of mandatory retirement.) Participation in the labor forced by men aged 60 to 64 fell from 84% in the 1960s to 71% at the end of the 1980s, then rose to 75% in 1998, much higher than in Europe and the U.S. Seike *et al* found that the pension benefit plus mandatory early retirement at 60 prematurely removed valuable human capital of men aged 60 to 64 from the workforce. "Eligibility for the public pension reduces the participation by 15%," says Seike.

Seike *et al* recommend that the social security benefit be reduced to a flat rate basic benefit instead of an earnings-related benefit. To make up the shortfall in retirement income, workers could save through a private or employer-sponsored pension plan. Having multiple pillars of income for retirement would encourage workers to remain at work longer and that, in turn, would provide an additional benefit to the economy and to society, the authors suggest.

All the other G-7 countries may face sharp increases in their retirement age if they rely on that alone to keep the old age dependency ratio constant at the 1995 level. The Global Aging Initiative study's median forecast for the U.S., for example, suggests that retirement age might have to be raised to 74.6 years in 2050. It might also require very

---

<sup>84</sup> Seike, Atsushi, Hitoshi Hayami, Masahiro Abe, Masahiko Tsutsumi, Atsuhiko Yamada, Osamu Ichinose, Masahito Nakajima (1998), "Analysis of the Utilization of Older People's Human Capital in the Labor Market in the Aging Society." *The Economic Analysis*, No. 155, October 1998. Tokyo, Japan: Economic Research Institute of the Economic Planning Agency.

high retirement ages in 2050 in all the G-7 countries: Italy, 79.3 years; France, 78.3 years, Germany, 77.4 years; Canada, 75.9 years; the United Kingdom, 74.7 years.

### **Efforts To Raise Fertility Show Mixed Results**

Another popular policy prescription is to adopt policies to increase fertility levels in order to slow the pace of increase in the old age dependency ratio. In Europe Sweden and France have adopted policies that have been credited with improving fertility, but sometimes for only a brief time, as was the case in Sweden. Many of the policies suggested, including bonuses for children and other financial support, have not proven effective. For example a European Union<sup>85</sup> survey of research on policies to promote fertility reported that research in France suggests that a policy that provides payments to families for the third birth may have an effect on fertility rates in low-income families. However, maternity leave and benefits do not appear to have significantly raised fertility in France.

The EU survey also found that except in places like Sweden and Denmark and the Netherlands (and to a lesser extent France, Germany, and the United Kingdom) the decline in fertility has been associated with a delay in marriage, which entails a delay in the age of women at the time of first childbirth. This is especially true in Italy, Spain, Portugal and Greece.

Even where marriage is in decline, an informal family unit appears to exist. In the United Kingdom, for example, 80% of extramarital births are jointly registered by both parents and 75% of parents were living together at the same address. Yet, even for cohabiting couples who are not married there has been an increasing tendency to postpone children. In fact, the mean age of women at childbirth in the EU rose steadily from the low 20's in the 1960s to reach 28.9 years in 1995.<sup>86</sup> This means that the reproductive phase in women's lives has been concentrated into a shorter period of time at a later age in most countries, which leads to fewer births. These trends echo those in Japan described above, where less than 1% of babies are born outside of marriage.

As in Japan, also in Europe there has been criticism of those who delay marriage and children. In Italy, where unemployment delays the start of careers and marriage, single men sometimes live with their mothers until they are nearly 40. They are sometimes lampooned as selfish and self-indulgent for this behavior, living off their parents while allegedly taking too much time finding work and building a career.

The Global Aging Initiative study found that only in Japan would higher fertility rates have a significant impact on old age dependency ratios. With a higher total fertility rate, the study's median forecast for Japan's old age dependency ratio in 2050 would be

---

<sup>85</sup> Hantrais, Linda, editor (1999). *Interactions Between Socio-Demographic Trends, Social and Economic Policies*,” Cross National Research Papers, Fifth Series. Cross-National Research Group, European Research Centre, Loughborough University, Leicestershire, Great Britain. April, pp. 3-19.

<sup>86</sup> Hantrais, L., ed. (1999), *Interactions Between Socio-Demographic Trends, Social and Economic Policies*,” 1999, p. 23.

0.62, significantly lower than the dependency rate of 0.73 for the baseline fertility projections. Higher fertility rates would make virtually no difference in Italy, Germany and France, the study concludes.

### Higher Immigration Can Lighten Budget Burden

**H**igher immigration, on the other hand, could improve the old age dependency ratio in 2050 for Italy, France and Germany. (The study assumes zero immigration for Japan.) The study's median forecast for Italy's old age dependency ratio is 0.70 with high immigration and 0.76 with baseline immigration patterns. Germany's old age dependency ratio would be 0.53 instead of 0.60 with higher immigration. For France the difference is smaller: 0.57 instead of 0.59.

While the projected changes for high fertility in Japan and high immigration in Italy, Germany, and France have a significant impact on the old age dependency ratio, in and of themselves they would fall far short of the goal of keeping dependency rates constant.

The United Nations Population Division earlier in 2000 came to some conclusions similar to those in the Global Aging Initiative study in a report called *Replacement Migration*.<sup>87</sup> The UN study concluded that increases in fertility are unlikely to be sufficient to address the fiscal and economic challenges posed by aging populations over the next 50 years, especially in low fertility countries. In the case of France, for example, even if fertility rose to an improbable 2.35 children per woman in the decade of 2040 to 2050, it would raise the potential support ratio – the number of working age people<sup>88</sup> per older person – from 2.26 to 2.52. The UN report concludes that “among the demographic variables, only international migration could be instrumental in addressing population decline and population aging in the short to medium term.”<sup>89</sup>

The UN report comes to two different conclusions about immigration. “Is immigration a solution? Yes, it can be a solution to declining population. No, it's not a solution for aging populations,” says Joseph Chamie, Director of the Population Division at the UN.

The level of immigrants needed to prevent a population decline in Germany would be 17.2 million over the next 50 years. To prevent a decline in the working force it would take 24.3 million immigrants or 486,600 a year. To keep the support ratio (or the old age dependency ratio) constant, it would require a staggering 181.5 million or 3.6 million a year. The UN is predicting that Germany will take in only 10.2 million immigrants over the next half century and, therefore, will not be able to prevent a population decline.

---

<sup>87</sup> United Nations Population Division (2000), *Replacement Migration: Is It A Solution to Declining and Ageing Populations?* New York, United Nations Secretariat, March.

<sup>88</sup> The UN uses people aged 15 to 64 for its working age population while the Global Aging Initiative study by Mountain View Research uses people aged 20 to 64.

<sup>89</sup> United Nations (2000), *Replacement Migration*, p. 7

The immigration numbers required for Japan, which has virtually zero immigration, are enormous. To prevent a population decline, Japan would have to bring in 17.1 million immigrants over the next 50 years, 342,820 a year. To keep the size of the labor force constant, it would need 32.3 million or 646,640 a year. To keep the support ratio or old age dependency ratio constant, Japan would need 523.5 million – more than four times its current population – or 10.5 million a year.

Italy would need 12.6 million immigrants or 251,380 a year to prevent a population decline. It would need 18.6 million or 371,920 a year to keep the working age population constant. And, it would need 113.4 million or 2.27 million a year to keep its support ratio or old age dependency ratio constant. The UN is projecting, however, its average 70,000 immigrants a year from 1995 to 2000, and then fall to 34,000 by 2005 and to zero by 2025.

Even for the U.S. the number of immigrants needed to keep the support ratio or old age dependency ratio constant is fairly high: 592,572 million or 11.9 million a year. Instead, the U.S. will likely have net immigration of 38 million or 760,000 a year, three times the number of immigrants needed to keep the U.S. population from declining.

“The message for policy makers is clear,” says Chamie. “The sooner they start dealing with it, the easier it will be to deal with it.”

Immigration is likely to play only a minor role in addressing the challenges of aging populations, Chamie concludes. So, most nations face “situations that are not very palatable.” If benefits are reduced, the elderly are not happy and workers are unhappy because their parents are not getting enough, he says. Plus, the elderly are a strong political constituency in some nations that can prevent benefit cuts. In Europe labor unions are powerful and likely to successfully defeat proposed benefit cuts. Raising the retirement age also is unpopular because people want to retire earlier, not later, Chamie says. Even raising participation rates for women might be self-defeating by driving down fertility rates, he adds.

For a related discussion on the viability of various policy reform options, see Appendix III on Germany’s current moves to embrace pension reform.

## Section Five: Is There A Maximum Life Span?

Demographers and scientists are fascinated with the issue of whether or not there is a maximum life span. The answer to that question is important to any discussion of the impact of aging on budgets, the economy and financial markets. If there is no maximum, the gains in longevity will not have a cap. That suggests that spending on aging populations will also continue rising with no absolute theoretical limit. On the other hand, if there is a maximum, then what is it? The answer to that question, too, can help analyze the budget, economic and financial risks facing the world as populations age in industrial nations.

Twenty years ago, it was commonly accepted in actuarial circles that life spans peaked at the age of 80 or so. This assumption was based on a number of factors, including statistics on mortality rates for various diseases that plague the elderly, as well as an assumed biological limit to human life.

In an article in the *New England Journal of Medicine*, James F. Fries, M.D., from the Department of Medicine at Stanford University Medical Center, stated emphatically in 1980 that the “length of the human life is fixed.”<sup>90</sup> He set the outside limit at 85 at a time when the life expectancy of white women in the U.S. was 77, for white men, 70. Citing reliable statistical data in England going back to 1837, Fries was persuaded that there was no increase in the number of centenarians, conclusive evidence he felt of a limit to the natural life span. He also noted that advances in life spans had occurred because of fewer deaths for those under 40, while life spans for people over 40 had barely budged.

Fries cited biological evidence organisms have a finite number of times that their fibroblast cells can divide and keep the organism young. In humans, it is approximately 50 times. After that the cells first fail to grow, and then die, even though they have sufficient nutrients to go on living.<sup>91</sup>

“Medical progress may increase the number of cell doublings, learn to slow organ decay, or extend the maximum life span in some other way, notwithstanding its failure to do so to date,” Fries wrote in 1980, “But it is highly unlikely that any such change will occur during our lifetime.”<sup>92</sup>

Fries argued that improvements in medical science can reduce the time that one is sick, a process known as compression of morbidity. This held out hope that innovations in medical science would not lead to higher medical costs but to lower costs as the period of time spent sick would be reduced.

---

<sup>90</sup>Fries, James F. (1980), “Aging, Natural Death, and The Compression of Morbidity,” *The New England Journal of Medicine*, July 17.

<sup>91</sup> Hayflick, L. (1977), “The Cellular Basis for Biological Aging,” in: Finch L.E., Hayflick, L., editors, *Handbook of the Biology of Aging*. New York: Van Nostrand Reinhold: 159-86.

<sup>92</sup> Fries (1980), p. 133.

Life, Fries wrote, is defined by “internal homeostasis”<sup>93</sup> or internal equilibria maintained by the body’s organs. Fries wrote. In young adult life, the organs – the heart, lungs, kidneys and liver – have the functional capacity that is four to ten times what is required to sustain life. This organ reserve allows humans to restore internal homeostasis when it is imperiled by external threat. Over time there is a linear decline in the capacity of organs beginning at the age of 30, Fries noted. As organ reserve decreases, so does the ability of the organs to restore homeostasis. “The inevitable result is death,” Fries concluded.<sup>94</sup>

Fries compared the human body of the future when medical advances would reduce the period of morbidity to a very short span to the one-hoss shay [vernacular for one-horse carriage] immortalized by U.S. poet Oliver Wendell Holmes. “These considerations suggest a radically different view of life span and society, in which life is physically, emotionally and intellectually vigorous until shortly before its close, when, like the marvelous one-hoss-shay, everything comes apart at once and repair is impossible.”

Today, however, the average life span for women in Japan is already pushing beyond Fries’ theoretical limit, even as gerontologists now believe the maximum life span is 120 years and medical researchers are convinced that innovations can break that time barrier and push it out to 150 years or more. Yet, actuaries at social security administrations around the world are reluctant to abandon the notion that life spans are fairly limited.

### **Demographers Find Mortality Rate Deceleration After 85**

Some demographers challenge the claim there is a maximum life span is 85 years, and they fault official forecasts that rely on such assumptions. One challenger is James W. Vaupel, Director of the Max Planck Institute for Demographic Research in Rostock, Germany. “Almost all demographers think that mortality for people between age 60 and 80 will continue to come down,” says Vaupel. The difference is what happens after 80, he says.

Vaupel is one who contends that mortality improvements will continue even for the oldest old. “We’re poised for a medical breakthrough, which could come with advances in treating cancer, stroke and Alzheimer’s,” Vaupel says. “We may not understand the process of aging in the next few years, but we will in 50 years,” he predicts.

Vaupel predicts that a newborn child today will by age 50 be able to take advantage of these expected breakthroughs and “can live past 100 in good health.”

---

<sup>93</sup> Homeostasis is a tendency to stability in the normal body states of the organism achieved by control mechanisms activated by negative feedback, such as occurs when a high level of carbon dioxide in extra-cellular fluid triggers the lungs to breathe deeper to bring in more oxygen and decrease the carbon dioxide concentration.

<sup>94</sup> Fries (1980), pp. 130-131.

Maybe by the time that same person reaches 100 years of age, there could be even more advances and he or she can live to be 150, he adds.

---

**Table 4**  
**Average Annual Rates of Improvement in Female Mortality (Percentages) for Aggregation of Denmark, Finland, Norway, and Sweden, for Sexagenarians, Septuagenarians, Octogenarians, and Nonagenarians**

Time Period	Age Category			
	Sixties	Seventies	Eighties	Nineties
1900's – 1920's	0.3	0.2	0.1	0.0
1920's – 1940's	0.7	0.4	0.2	0.0
1940's – 1960's	1.7	1.0	0.6	0.5
1960's – 1980's	1.5	2.1	1.7	1.2

---

**Kannisto et al. (1994)**

Vaupel bases his view to some extent on that fact that mortality rates have fallen dramatically since 1950 in women aged 85, 90, and 95. These gains are even more impressive since 1970, he adds. Vaupel cites the work of Vaino Kannisto and the data on mortality collected by Odense University in Denmark and others to build his argument.<sup>95</sup> (See Tables 4 and 5.) Those data show the combined female central death rates (collected by government officials) for Denmark, Finland, Norway, and Sweden. The death rate for centenarians in these four countries in the years between 1930 and 1949 was 70.1%.<sup>96</sup> Nearly half a century later between 1989 and 1993 that rate had fallen to 48.5%. For nonagenarians the death rate was 33% between 1930 and 1949. But, between 1989 to 1993, it fell to 23.4%. Octogenarians also saw an improvement for the same time periods from 16.1% to 9.1%. Septuagenarians, too, saw death rates improve from 6.4% to 3.1%.

New mortality studies of death rates of whites in the U.S. find that mortality rates are substantially lower than those of Europe and Japan at age 90, even though mortality before age 65 or 70 is substantially higher in the U.S. Survival rates in the Upper Midwest of the U.S. were 50% higher than Europe and Japan, while those in the Deep South were 20% higher. "It is possible that the U.S. advantage stems from better health conditions for the elderly," Vaupel says.

---

<sup>95</sup> Kannisto, Vaino (1994), "Development of Oldest-Old Mortality, 1950-60." Odense University Press, Odense, Denmark. Kannisto, V. (1996), *The Advancing Frontier of Survival: Life Tables for Old Age*, Odense University Press, Odense, Denmark; Kannisto, v. J. Lauritsen, A. R. Thatcher, J. W. Vaupel (1994), "Reductions in Mortality at Advanced Ages: Several Decades of Evidence from 27 Countries," *Population and Development Review* 20(4): 793-810.

<sup>96</sup> Kannisto, V. (1994) *Odense Archive of Population Data on Aging*.

Industrial nations are increasing the number of centenarians at a rate of 8% a year, according to Vaupel. A demographic analysis by Vaupel and B. Jeune has shown that the decline in mortality data is by far the most important factor in the explosion of the centenarian population,<sup>97</sup> more important that the increase in births a century ago and the decline in childhood diseases.

---

**Table 5**  
**Female Central Death Rates (Percentage) for Aggregation of Denmark, Finland, Norway, and Sweden, for Sexagenarians, Septuagenarians, Octogenarians, Nonagenarians, and Centenarians, in Two Periods 1930 – 1949 and 1989 - 1993**

Time Period	Age Category				
	Sixties	Seventies	Eighties	Nineties	100+
1930 – 1949	2.4	6.4	16.1	33.9	70.1
1989 – 1993	1.1	3.1	9.1	23.4	48.5
Change:	1.3	3.3	7.0	10.5	21.6

**Kanninsto et al. (1994)**

---

Benjamin Gompertz<sup>98</sup> first proposed in 1825 that the force of mortality increases exponentially with age for mankind, based on the data he had available. With a growing volume of reliable data about older ages, however, demographers now see the trajectory of mortality taking a different course after age 80. Instead of increasing exponentially, mortality decelerates after 80 perhaps to a maximum or ceiling around age 100, according to the data.

“Mortality deceleration at advanced ages came as a surprise, indeed as a shock, to many biologists and gerontologists,”<sup>99</sup> says Vaupel. Demographers, however, had long thought this to be true, he notes. With the increasing volume of reliable data for people over 80 and over 100, this has now been shown to be the case.

Lately more contenders have been moving up the age ladder to challenge the longest-lived record holder, Jeanne Calment of France, who lived to be 122. Currently the 119-year-old Sarah Clark Knauss of Allentown, Pa., is the oldest living person, according

---

<sup>97</sup> Vaupel, J. W., B. Jeune (1995), “The Emergence and Proliferation of Centenarians” in B. Jeune, J.W. Vaupel (eds.) *Exceptional Longevity*, Odense University Press, Odense, Denmark.

<sup>98</sup> Gompertz, Benjamin (1825), “On the Nature of the Function Expressive of the Law of Human Mortality,” *Philosophical Transactions* 27:510-519.

<sup>99</sup> Vaupel, J. W. (1997) “Demographic Analysis of Aging and Longevity,” Speech delivered to the XXIIIrd IUSSP General Population Conference, Beijing, China, October 17, 1997.

to *Guinness Book of Records*. The world's oldest man is also an American, Benjamin Harrison Holcomb of Carnegie, Okla. He turned 111 on July 3, 2000.

The prospect of growing numbers of people of advanced age could have enormous consequences in aging nations. For example, in China Vaupel, Zeng Yi and Zhenglian Wang did a study<sup>100</sup> in 1997 that forecast that the population of Chinese over 65 will grow from 63 million in 1990 to 400 million in 2050. The population 85 and older will grow from 2.3 million in 1990 to 80 million in 2050, a 36-fold increase. By 2050 the population over 85 in China may exceed the total current population of Germany.

---

<sup>100</sup> Zeng, Y., J. W. Vaupel, Z. Wang (1997), "Household Projection Using Conventional Demographic Data," in W. Lutz and J. W. Vaupel (Eds.) *Rethinking Population Projections*.

## Section Six: Science's Quest for Longer, Healthier Lives

A review of the theories of aging and the progress of research and trials to both extend life and treat and cure diseases can provide some guidance on the potential for medical research to extend human life and improve the health and lifestyles of the elderly. What follows below is some of the highlights of ongoing medical research. It is not possible to quantify the impact of this research at present – only to define its broad potential. Expected progress in medical research adds more uncertainty to forecasts of spending on the elderly. Most of the risk seems to be that life spans will be longer than expected, and therefore, that spending on pensions and health benefits will be higher. A closer look at medical costs follows this discussion on medical research.

A variety of theories of aging have emerged over the past two decades and have formed the basis for ongoing research. These theories tend to fall into two basic varieties. One is programmed theories that assume that aging follows a biological timetable and is genetically programmed into living beings, including humans. Error theories, on the other hand, are based on the idea that environmental assaults on the systems of living beings gradually cause organs and components to break down and ultimately cease to perform.

The free radical theory of aging, first proposed by Denham Harman at the University of Nebraska in 1954,<sup>101</sup> has garnered perhaps the most attention and has been tested for many years in a number of animal experiments that limit caloric intake to extend aging. Oxygen free radicals are unstable molecules that can damage proteins, membranes, and nucleic acids, particularly DNA, including the DNA in mitochondria, the organelles within the cell that produce energy, according to the National Institutes of Health.<sup>102</sup> Free radicals have been implicated not only in aging but in such diseases as cancer, heart disease, cataracts, and neurodegeneration.

Tests on more than 22 species have found that limiting calorie intake can increase life spans by 20% to 40%. Experiments on rodents funded by the NIA have found a 30% to 40% increase in the length of life and delayed age-related pathology through caloric restriction. “So, clearly we’re in the process of extending the health span and the life span,” says Huber Warner deputy Associate Director of the Biology of Aging Program at NIH. “There is no reason to believe this will not work in humans.”

The reason Warner is hopeful about the potential for humans is that NIA is finding encouraging signs in NIA-funded trials on 200 rhesus and squirrel monkeys that have been underway at the University of Maryland Medical School in Baltimore and at the University of Wisconsin in Madison for more than a decade. “We’re seeing the same

---

<sup>101</sup> Harman, D. (1955), “Aging: A theory based on free radical and radiation chemistry.” *Journal of Gerontology*, 11:298-300.

<sup>102</sup> National Institutes of Health. In search of the secrets of Aging, NIH Publication Number 93-2756.

kind of changes in monkeys that we've seen in rodents. But, it's too soon to know if it leads to a retardation of pathology and an extension of life," Warner says. Changes noted in the calorie-restricted monkeys include in measurements of lean body mass, fat, blood pressure, triglycerides and insulin in older monkeys at levels that are usually associated with younger monkeys.<sup>103</sup> Success in tests on monkeys would make it more likely that caloric restriction can retard pathology and extend the lives of humans.

Tests on humans would be unethical. However, the next best thing has been in progress for generations on the Japanese island of Okinawa, where calorie intake is only about 70% of the rest of Japan. Okinawans have about 40 times the number of people over 100, less diabetes and less cancer than the rest of Japan.<sup>104</sup> The longer lives and better health cannot be conclusively linked with the diet. However, it does seem like a promising explanation.

The closest thing to a scientific experiment on humans so far occurred accidentally in 1991 to 1993 when eight people spent two years living in Biosphere 2 in the Arizona desert. Because of unexpected problems in climate and agriculture in the experiment, the participants had to restrict their diets to 1,500 calories a day. Among them was gerontologist Roy L. Walford from the University of California at Los Angeles, who for several years had restricted his own diet to one-third fewer calories. Walford monitored the other seven participants and found the measurements of cholesterol, blood pressure and glucose metabolism improved among the biospherians.<sup>105</sup> However, since it was later learned that some of the participants left the biosphere, contrary to the rules of the experiment, these data are ultimately not entirely persuasive.

NIA has also funded research into the use of anti-oxidants on senescent accelerated mice. "The use of anti-oxidants on those mice increased life," Warner says, but it has not yet increased life for normal mice.

Other research has found that levels of anti-oxidants in animals have been correlated with life span. Research in this field is just beginning to bear fruit, Warner says, and it's not clear yet whether it suggests a comparable extension of life in humans. "There may be a practical limit," he says. "Life spans could go to the 110s and 120s," Warner says, "but I'm not ready to predict it will reach 150." This is a soft extrapolation of research completed so far and not a hard assessment, Warner notes.

Glucose is thought to be another culprit in the aging process. When glucose molecules attach to proteins, this produces a chain of reactions that leads to the crosslinking or binding of the proteins, which, in turn, alters their roles. Such crosslinks are called advanced glycation end-products or AGEs. They toughen tissues and may

---

<sup>103</sup> Henig, Robin Marantz (2000), "Living Longer: What Really Works?" *Scientific American Presents*, Volume 11, No. 2, Summer 2000. p. 35.

<sup>104</sup> Taubes, Gary (2000), "The Famine of Youth." *Scientific American Presents*, Volume 11, No. 2, Summer, p. 48.

<sup>105</sup> Henig (2000), pp. 36-37.

cause deterioration. AGEs have been linked with stiffening connective tissue, hardened arteries, clouded eyes, loss of nerve function and loss of kidney function. Increased production of AGEs occurs in younger people who have diabetes, which is sometimes described as an accelerated model of aging. Research has discovered that the body produces macrophages that combat glycosation and the production of AGEs. Diabetes researchers are investigating drugs that could supplement the body's natural defense by blocking AGE formation.

The deterioration of DNA by oxygen free radicals, ultraviolet light and other toxic agents is thought to be another cause of aging. The agents cause deletions and mutations in the sequence of DNA bases in the genetic code and scientists theorize that the accumulation of DNA damage leads to the malfunctioning of genes, proteins, cells, tissues and organs. Gerontologists are researching the enzyme systems that detect and repair damaged DNA. As people age, the DNA repair processes decline, which may explain why cancer is so much more common among the elderly.

Scientific researchers have learned that mitochondrial DNA damage accelerates with age. The DNA in mitochondria age faster than nuclear DNA, possibly because it is here that electrons are stripped from glucose and other energy-rich foods and converted into fuel to power cells. It is during this process that free radicals are generated. Late onset diabetes has been traced to defects in mitochondria. Research is focusing on what causes the damage and how it can be prevented.

### **Anti-Aging Therapies Attempt to Reverse or Slow Aging**

**H**ormone therapy is another active area of anti-aging research. This includes research on estrogen, human growth hormone, melatonin, testosterone and DHEA,<sup>106</sup> which is a weak male hormone and a precursor to some other hormones, including testosterone and estrogen.

Human growth hormone (HGH) rejuvenated a small group of men aged 60 and over in a 1989 trial in Veterans Administration hospitals in Milwaukee and Chicago.<sup>107</sup> The injections increased their lean body mass and reduced fat. When they stopped the therapy, the improvements were reversed. Estrogen replacement therapy has been tried to slow the bone thinning that occurs after menopause in women.

Most of these hormones are used in anti-aging therapies even though some of the claims made about them have not been scientifically established. Also, some have had adverse effects. DHEA, for example, has been linked with increased risks of breast and prostate cancers, as well as with liver problems.

HGH in particular has become a favorite product offering on the Internet, where it is often hailed as a youth elixir in mass junk mailings. Its misuse has led to some medical

---

<sup>106</sup> DHEA is the abbreviation for dehydroepiandrosterone.

<sup>107</sup> National Institutes of Health. In search of the secrets of Aging, NIH Publication Number 93-2756.

problems, according to a report<sup>108</sup> in the *Financial Times* of London. For example, because it causes cells to proliferate, HGH has been linked to some cancers. Also, overuse of HGH has been associated with high blood pressure, heart disease and carpal tunnel syndrome. In 1999 the American Association of Clinical Endocrinology became concerned enough about the misuse of HGH to issue strict new guidelines.

Perhaps some of the most promising research yet has come in the areas of altering the biological clock within cells and in research on the human genome. Progress in these area offers hope that the current assumed barrier of 120 years might be extended to 150 year or longer. Three years ago Dwayne A. Banks and Michael Fossel wrote about the potential of altering the human life span in the *Journal of the American Medical Association*. Banks is from the Center for the Economics and Demography of Aging at the University of California at Berkeley and Fossel is from Michigan State University College of Human Medicine. They had this to say:

“Recently, there has been a conceptual shift in our understanding of aging. The possibility of extending the maximum life span has gone from legend to laboratory. This change has been prompted by a growing academic literature that suggests that the aging process itself, as well as the consequent and fundamental cellular changes that occur in age-related disease, is modifiable. This revision in views, if borne out, has profound clinical implications for the incidence of age-related diseases. Furthermore, the fiscal impact on government expenditures in the areas of health and social security will be perplexing even if only a modicum of these views hold true.”<sup>109</sup>

Banks and Fossel contend that the two main theories of aging –damage from accumulated errors and programmed by genetic regulation – are not contradictory, but complementary. Changes in gene expression can prevent or allow damage to cells and organisms. From this observation, the two scientists challenge the notion of a maximum life span. This “dogma” has been destroyed by experiments that genetically alter fruit flies and nematodes to dramatically extend their lives, they claim. Cancer research has further given evidence that cells can alter their genetic makeup so they do not age and die.

Normal somatic cells have a defined number of times that they can replicate. Skin fibroblasts, for example, have about 50 divisions before they show senescence. Scientists theorize that cell senescence is the result of an altered pattern of gene expression that is initiated and regulated by telomeres.<sup>110</sup> These are stretches of DNA and the proteins that bind them and which protect the ends of chromosomes. They seem to operate like a

---

<sup>108</sup> Griffith, Victoria (2000), “Dangerous Promise,” *Weekend FT (Financial Times)*. London, England: May 27-28, p. II.

<sup>109</sup> Banks, Dwayne A. and Michael Fossel (1997). “Telomeres, Cancer, and Aging: Altering the Human Life Span.” *Journal of the American Medical Association*, Vol. 278, No. 16, pp. 1345-1348, October 22/29)

<sup>110</sup> Harley, C.B., A. B. Flutter, C. W. Greedier (1990), Telomeres shorten during aging of human fibroblasts. *Nature*. 1990;345:458460

clock. The telomere is shortened each time a cell divides until it is very short, at which point the cell ceases to replicate and goes into a senescent state.

The enzyme telomerase can restore telomeres and keep their length the same. It does this in germ cells, such as eggs and sperm. While skin fibroblasts and most cells can not express telomerase, cancer cells can. This ability is linked to their biological immortality.

The realization that the aging process can be changed at the cellular level has implications for cellular aging and also offers the promise of eventually curing cancer, Banks and Fossel suggest. The possibility that life spans can be extended and that there might be increased compression of morbidity “only increases the already considerable variance in estimates” of the health care costs of the elderly, Banks and Fossel concluded.

The potential of gene therapy was dealt a setback in September 1999 with the death of Jesse Gelsinger, a teenager from Tucson, Ariz. He was undergoing an experimental therapy for a rare metabolic disorder and suffered a fatal reaction to some of the genetic material he was given. The potential for bioengineering has, in fact, generated a powerful political movement of those opposed to it, either in humans, animals or plants, which some scientists fear might retard advances in medical science.

Despite setbacks, gene replacement therapy is scoring a number of victories in the battle against cancer. No therapy has yet been approved by the Food and Drug Administration but a number of clinical trials are underway, including one on p53, a tumor suppressor. Treatment of defective p53 genes has caused tumors to shrink and the cancer to disappear in trials sponsored by Schering-Plough Corp., Aventis SA, and Introgen Therapeutics, Inc. The results have been promising enough to prompt the sponsors to begin large studies of the therapy to treat ovarian and head-and-neck cancers, according to the *Wall Street Journal*.<sup>111</sup>

New breakthroughs in treating diseases of the elderly are announced with growing regularity. In May Canadian surgeon James Shapiro reported to the American Society of Transplant Surgeons<sup>112</sup> that he and fellow surgeon Jonathan Lakey had successfully transplanted human pancreatic islet cells, which generate insulin, into eight patients who once had chronic diabetes. The therapy allowed them to lead more ordinary lives without daily injections of insulin.

The cells used in the therapy were extracted from the pancreata<sup>113</sup> of dead donors, then kept alive, purified and injected into the portal vein, which leads to the liver. The cells flowed with blood into the liver where they settled. Even though they were not in the pancreas, they produced enough insulin to allow patients to go without daily injections. The lack of an adequate supply of pancreatic islet cells poses a problem for

---

<sup>111</sup> Johannes, Laura (2000), “Gene Therapy, Much Maligned, Is Promising In Some Cancer Trials,” *Wall Street Journal*, May 4, p. 1.

<sup>112</sup> Boseley, Sarah (2000), “Experts hail diabetes ‘breakthrough,’” *Washington Times*, May 15, p. A12.

<sup>113</sup> Pancreata is the plural of pancreas.

this therapy, but Shapiro expects that the islet cells could be replicated by cloning techniques within five years. The results of the experiments were reported in the *New England Journal of Medicine*.<sup>114</sup>

Stephen Clement, M.D., director of Georgetown University's Diabetes Center was both upbeat and circumspect about the potential of the Shapiro and Lackey's new treatment for diabetes in an interview with August Bribbin of the *Washington Times*: "It is not a cure. It's close, but it's not a cure. It does translate into a therapy we can do in every medical center in the United States overnight. And there are issues to overcome."<sup>115</sup>

There's also been progress in gene therapy for heart disease. Boston physicians treating chronically ill heart-attack victims reported in August 2000 that they had successfully used gene therapy to spur the growth of new blood vessels and greatly improve cardiac health. While two earlier experiments in gene therapy had tried to improve heart health, this was the first study that "demonstrated improvement in blood flow to the heart," Dr Jeffery M Isner told the *Washington Times*<sup>116</sup> in August 2000. Isner is Professor of Medicine and Pathology at Tufts University School of Medicine. The researchers inserted a gene called VEGF (for vascular endothelial growth factor) directly into the heart through a small chest incision. Six months after the gene injection, heart-attack patients receiving the gene therapy reported the number of pain attacks fell from 48 a week to 2.

Even Parkinson's disease is yielding to gene therapy in tests on primates in an study conducted at sites in Chicago and Lausanne, Switzerland, according to press release from Rush-Presbyterian-St. Luke's Medical Center in Chicago.<sup>117</sup> The results of the research were published in October 2000 in *Science*.<sup>118</sup> Rush scientists, headed by Jeffrey H. Kordower used as their experimental therapy a special virus, lenti-GDNF (glial-derived neurotrophic factor) that was developed their colleagues in Switzerland at the Lausanne University Medical School.

GDNF strengthens and protects brain cells that might die as a result of Parkinson's disease. Three groups of monkeys were given the therapy. The first group of eight, elderly monkeys with early Parkinson's symptoms were treated with six injections and afterward were found to have higher levels of dopamine usually found in younger monkeys. A second group of 20 young monkeys were given the chemical MPTP, which produces a Parkinson's disease-like state in monkeys and humans. Once the monkeys showed signs of Parkinson's, they were given a lenti-GDNF injection. Tests showed that the Parkinson's symptoms had disappeared. Finally, a third group of normal monkeys

<sup>114</sup> *New England Journal of Medicine*, July 27, 2000.

<sup>115</sup> Gribbin, August (2000a), "Diabetes therapy cuts need for shots," *Washington Times*, June 6, 2000, p. 1.

<sup>116</sup> Gribbin, August (2000b), "Gene therapy spurs growth of new blood vessels," *Washington Times*, August 29, 2000, p. 1.

<sup>117</sup> Rush-Presbyterian-St. Luke's Medical Center (2000), "Gene Therapy Shown To Protect and Reverse the Debilitating Effects of Parkinson's Disease in Pre-Clinical Studies." Chicago, Rush-Presbyterian-St. Luke's Medical Center Press Release, October 27.

<sup>118</sup> Kordower et al (2000). *Science*, October 27.

received lenti-GDNF. Eight months later high levels of the virus were found in the animals. “The study suggests a new approach to forestall disease progression in newly diagnosed Parkinson’s disease patients by delivering potent trophic factors with effects that are long-term and non-toxic,” Kordower claims.

### Scientists Seek To Reset Biological Clock

William Haseltine, chairman of Human Genome Sciences, sees great potential in advances that could lead to the generation of new organs from stem cells.

Research using stem cells from fetuses has raised ethical and moral issues and such research is prohibited in most places. However, Swedish research on mice has discovered that stem cells from the brain can be used to make other body tissues, leading to the hope of eliminating the ethical dilemmas that block stem cell studies.<sup>119</sup> In the Swedish study, as reported in *Science* in June 2000,<sup>120</sup> scientists separated neural stem cells from adult mouse brains and grew them in cultures in the laboratory. These cells were genetically tagged and inserted into fertilized chicken eggs or mouse embryos. The researchers found that about 12% of the stem cells changed into different organ tissues in the developing embryo. “These studies suggest that stem cells in different adult tissues may be more similar than previously thought,” wrote Jonas Frisen at the Karolinska Institute in Stockholm.

There is also the potential of resetting the biological clock (the telomeres) to zero, just as nature does it by resetting the biological clock of parents’ DNA to zero in newborn children. When this technology is available, “then we can continue to replace bodily parts and do so indefinitely,” Haseltine says.

Further down the road there will be a new revolution in material sciences at the atomic level, says Haseltine. Once this engineering is mastered in both the biological and non-biological world, “we can integrate the physical world in a seamless way into the biological world.” This opens up a whole new vista. “We may substitute part or all of the body with more durable materials. Nanoscale prosthesis by the use of extremely small implantable devices will also revolutionize our approach to treatment of damage to the nervous system and sensory organs.” Haseltine says.

Some visionaries even see the entire body being replaced by a new one, which will then be attached to the “old head.” This can occur by cloning one’s own headless body, whose growth could be accelerated in a lab. Then the old head could be attached to the new body through new technology that will allow for reattaching a spinal cord. “We can do it in seven years if there is adequate funding,” notes Ronald Klatz, president of the American Academy of Anti-Aging Medicine in Chicago. It would require the kind of

---

<sup>119</sup> Associated Press (2000). “Stem cells from brain can make body tissue,” *Washington Times*, June 2, p. A10.

<sup>120</sup> Clarke, Diane L., Clas B. Johansson, Johannes Wilbertz, Biborka Veress, Erick Nilsson, Helena Karlstrom, Urban Lendahl, Jonas Frisen (2000). “Generalized Potential of Adult Neural Stem Cells,” *Science*, Vol. 288, June 2. <http://www.sciencemag.org>.

intense funding that was made available for the Manhattan Project that developed atomic bomb in the 1940s or that put a man on the moon in the 1960s, Klatz says.

The AAAAM, or A4M as it abbreviates its name, is a non-profit medical society founded in 1993 by a group of scientists who actively promote anti-aging medicine. It has 8,600 members in 55 countries. Its main work has been to conduct training seminars for physicians to keep them up to pace on breaking developments. They maintain a web site to inform both physicians and medical consumers.<sup>121</sup>

### **Tiny Computers May Fight Disease, Aging In Bloodstream**

There's also the potential for nanotechnology to eventually build a molecular size computer which can function as "anti-aging and anti-disease PacMen so small that a million can dance on the head of a pin," Klatz says. They can be injected into the bloodstream where they will float around looking for cancer and viruses and will gobble them up. They will read DNA and snip out aberrant errors. Such technology could be available somewhere between 15 and 30 years, Klatz predicts.

"This is the stuff of science fiction, Klatz admits, "but we are not even a full life time away from achieving it, he says. That will usher in a time when a 105-year old can be as vigorous as a 55-year-old and it will be sometimes difficult to tell one from another. Humanity will be able then to create "an ageless society," Klatz says.

While some on the frontiers of scientific innovation expect sizable extensions of life expectancy, others in the medical profession remain unconvinced. James Fries, for one still believes that 85 is a maximum, but notes that it is a maximum *mean* for life expectancy not the absolute maximum life span. If someone lives to 100 or 120, it is wrong to assume that most people can live that long, he says.

If life spans were actually increasing, then life expectancy from age 85 should be increasing over time, Fries postulates. However, he notes, life expectancy after 85 in the U.S. has been locked in at 6.1 years from 1980 to 1998, the last year with full data. Further, he notes life expectancy for women at 65 has barely budged during the same time, rising from 18.6 years in 1980 to 19.1 years in 1998.

"What you basically take home from this lesson," Fries says, "is that regardless of whether or not there is a fixed limit to life, we are going to operate as we were for the foreseeable future." That means it will take another 50 years to increase the average life expectancy of women at age 65 to 20 years. The advances in longevity have occurred by compressing morbidity, not extending the natural span of life, Fries says. Two years ago he reaffirmed his views on a maximum life span at 85 in another article<sup>122</sup> jointly authored in the *New England Journal of Medicine*. It in the authors, including Fries,

<sup>121</sup> The web site for the American Association of Anti-Aging medicine is <http://www.worldhealth.net>.

<sup>122</sup> Vita, Anthony J., Richard B. Terry, Helen B. Hubert, and James F. Fries (1998). "Aging, Health Risks, and Cumulative Disability," *New England Journal of Medicine*, Vol. 338, No. 15, April 9, pp. 1035-1041.

concluded that quitting smoking, staying slim and exercise postpone disability and compress it into fewer years at the end of life.

Fries does not dismiss the possibility there will be some breakthroughs that could genetically extend life. "I'm less critical that I used to be because the science was so awful" back in 1980, when he first wrote about the maximum life span at 85. Since then there have been some impressive gains in science, including the discovery of telomeres, cloning, and the possibility of modifying genetic characteristics, and even generating new organs from an individual's DNA. Yet, Fries is not yet swayed. "There have been interesting experiments, but nothing conclusive has happened. So, I'm still skeptical," Fries says. "It's possible some of this might actually work. Theoretically, it could extend the maximum life span," he says. "I don't think it will happen in our lives," he adds.

When can we expect new drugs and therapies to be adopted and actually play a role in extending human life spans? Dale Bredesen, M.D., President and Chief Executive Officer of the Buck Institute for Research in Aging in Novato, Calif., says that question really has two parts. One has to do with extending the mean life span and the other has to do with extending the maximum life span. Buck Institute's 40 scientists are involved with research in both areas.

"The mean lifespan has been extended in the last century in large part due to changes in infant mortality and treatments altering life-ending events, such as hypertension, stroke, arteriosclerosis, and intracerebral hemorrhage," Bredesen explains.

### **Genetic Profiles Could Help Prevent Disease**

**O**ne of the things that Buck Institute is trying to do is to use new discoveries about the human genome to profile patients to determine if they are headed for, say, Alzheimer's, cancer, or Parkinson's. "Instead of waiting until it shows up, you go in when someone is 20 to 30 years old and take actions to head off the disease," Bredesen says. The genes for Alzheimer's, for example, do not just affect the brain but can also affect other parts of the body. "Abnormal skin cells can indicate a propensity for degeneration of the brain," Bredesen suggests. This could alert doctors to a potential danger and prompt them to begin therapies early to prevent Alzheimer's. "An ounce of prevention can be worth a pound of cure," he says.

Buck Center is also doing research to expand the maximum life span. "Ultimately at 110 to 120 your body is likely to have problems" even if you never have a major disease, he says. Scientists at Buck are looking at some of the areas of research that have held promise for extending life. So far, a lot remains unexplained. "There's a big, big hole at this point," says Bredesen.

The potential for antioxidant therapy has a possible down side, Bredesen notes, because free radicals can play a useful role, too. If drugs or therapies were to shut off normal cell death, it could have the potential of fostering cancer, he says. Telomerase therapy may prove to be insufficient to affect the maximum life span, too. "Telomeres

don't explain mouse aging," he says. While in humans shorter telomeres means a shortening of life, mice have longer telomeres that do not shorten that much by the time they die, he says.

Breakthroughs affecting the maximum human life span may be a long way off. There may be compounds developed in experiments on nematodes, for example, that might help slow human aging, Bredesen says. But, there will be ethical questions about using them because it will be difficult to establish whether or not a given compound extends human life. There will be questions about how these compounds should be introduced and who should take them. "If we had a biological aging test, either from a blood test or smear, we could make measurements," Bredesen says. But, for now, there is no such test. A doctor cannot tell you how old you are biologically. All this makes it near impossible to predict when breakthroughs affecting the maximum life span might be made available to humans, either in trials or for widespread use, he concludes.

### **Progress in Research on Treatment for Alzheimer's Disease and Arthritis**

During the last year, scientists have reported progress in finding drug treatments for a number of the ailments and diseases of the elderly. Among these is the development of a possible vaccination for Alzheimer's. Results of studies of an investigational drug were presented at the July 2000 World Alzheimer Congress. The vaccine, known as AN-1792, removes amyloid brain plaque that is associated with the Alzheimer's. It is a synthetic form of a naturally occurring protein that prompts the body to produce proteins that tag the amyloid in the brain for removal by special scavenger cells. The Federal Drug Administration gave Elan Pharmaceuticals to green light to test the vaccine on 100 people with mild to moderate disease after animal studies of the vaccine found it was safely tolerated by rabbits, guinea pigs and monkeys.

Dale Schenk, Vice President of Discovery Research at Elan, gave a progress report on the AN-1792 study. He told the Congress that two dozen U.S. patients had already received at least one dose of AN-1792 with no bad side effects, according to the *Washington Post*.<sup>123</sup> He also reported that another 80 patients will be receiving multiple doses as the study continues.

A team of research scientists from the University of Toronto confirmed the findings of Elan Pharmaceuticals in tests of AN-1792 on mice, and further found that the removal of plaque was associated with improved brain function. This research group is led by Peter St. George-Hyslop and Christopher George Janos. In their study, vaccine-treated mice treated were better able to find their way through a maze than mice without any treatment. Much more research must be done on humans, however, before it will be known if there is any effect on preventing, slowing or reversing the onset of Alzheimer's.

In October 2000, a team of researchers at the University College of London led by Jonathan Edwards reported a cure for the treatment of the debilitating disease of arthritis,

---

<sup>123</sup> Squires, Sally (2000), "New Weapons Against Alzheimer's Disease," *Washington Post Health Magazine*, July 18, p. 9.

according to a report in the *electronic Telegraph*.<sup>124</sup> The treatment works by eradicating the body's supply of B-cells, which are white blood cells that make antibodies to defend the body against viruses and bacteria. Errant B-cells can make antibodies that attack healthy tissue, such as joints and tissues in the body. When such errant cells replicate themselves and attack the body's joints, it causes arthritis. This occurs because of a genetic mistake, according to Prof. Edwards.

The scientists tested a drug therapy that eliminates the body's B-cells. The body then generates new B-cells, nearly all of which do not attack the body's joints and tissues, thereby relieving the patient of nearly all the symptoms of arthritis. Prof. Edwards made public the results so far of a test of the therapy in 20 patients at a meeting of the American College of Rheumatology. He told the gathering that 18 months after the therapy, the first five patients in the study reported no pain except residual pain from damage already done. The patients had suffered from rheumatoid arthritis for an average of 20 years. Only two of the 20 patients have received no benefit. There were virtually no side effects for any of the patients treated. The initial findings of the study are to be published in *Rheumatology*. Prof. Edwards also stated that the therapy might offer hope to patients of other auto-immune disease, such as lupus, Chron's disease and multiple sclerosis. The researchers are working to refine the therapy so that only errant B-cells are targeted and destroyed.

Both conventional drugs and biotechnology drugs are playing a role in the fight against disease of the elderly. A report<sup>125</sup> on the progress of treating a wide range of diseases of the elderly through biotechnology products was published in September 2000 by Biotechnology Industry Organization.

---

<sup>124</sup> Matthews, Robert (2000), "Breakthrough as scientists discover cure for arthritis." London: *electronic Telegraph*, Issue 1983, Sunday, October 29.

<sup>125</sup> PAREXEL International Medical Marketing Services (2000), "Biotechnology's Impact on Disease of the Elderly: A White Paper." Washington, D.C.: Biotechnology Industry Organization, September.

## Section Seven: Will Medical Advances Increase or Decrease Costs?

There is ongoing debate about whether medical advances will lead to lower or higher spending by governments on the elderly. Will medical advances make more people healthier at older ages and, thus, reduce health care costs? Or, will medical advances keep more sick people alive longer, sustained by expensive medical treatments?

This debate, to some extent, echoes the debate about a maximum life span. Kenneth G. Manton, Research Professor and Director of the Center for Demographic Studies at Duke University in Durham, N.C., is one demographer who has tackled Fries's idea there is a fixed maximum life span and that improvements in medical science and in behavior were pushing more and more people closer to that limit.<sup>126</sup> He also found it implausible that under ideal conditions the compression of morbidity would allow people to extend their healthy lifestyles close to 100% of the maximum life expectancy.

“The existence of a trend toward compression of mortality and/or morbidity and disability would have profound implications for the future of health and life insurance, the demand for health services, the size and age structure of the healthy work force, human capital inputs into U.S. economic productivity, and quality of life among the elderly,” Manton and Burton Singer wrote in 1994.<sup>127</sup> “If the ‘ideal’ compression pattern . . . represented a realistic objective for the U.S. population, the current rate of expansion of long-term care facilities and supporting personnel would clearly not continue,” the authors stated.

To make their case against Fries, Manton and Singer cited the findings of experiments where maximum life spans were increased in laboratory animals. For example, laboratory studies on gene mutations extended the life of the nematode *Caenorhabditis elegans*. Survivor curves did not rectangularize for the nematodes, but merely shifted to the right in their usual sloping curve showing a gradual decline in survival at longer and longer life spans.<sup>128</sup>

Manton and Singer also cite statistical data that showed that the mortality slope for humans has shifted to the right as more and more people live longer. It has not tended to rectangularize or even slope at a more downward angle at the latest ages. They authors also cite data from Vaupel and others that mortality actually decelerates after age 85. They also note that mortality patterns in developed countries have begun to evolve, and that “the past data on which the perceptions of compression were initially based are now

---

<sup>126</sup> Manton, K.G. and Burton Singer (1994), “What’s the Fuss About Compression of Mortality?” *Chance*, Vol. 7, No. 4, pp. 21-30.

<sup>127</sup> Manton, K.G. and B. Singer (1994), p. 22.

<sup>128</sup> Brooks, A., G. Lithgow and T. Johnson (1994) “Mortality Rates in a Genetically Heterogeneous Population of *Caenorhabditis elegans*,” *Science*, 263, 668-671.  
Kenyon, C., T. Cheng., E. Geusch, A. Rudnor and R. Tabtiang (1993). “A *C. elegans* Mutant That Lives Twice as Long as Wild Types,” *Nature*, 336, 461-464.

subject to question.”<sup>129</sup> Conclusions derived from earlier data may not be valid, they assert.

Manton, Eric Stallard and Singer have also calculated how lifestyle and behavior risk factor interventions to improve health – exercise, diet and no smoking -- could dramatically increase the size of the elderly population in the future, and thereby increase all old age costs.<sup>130</sup> This could sharply increase the costs of Medicare, assuming, as Manton *et al* do, that the average age-specific health status of people remains constant.

Manton *et al* used data from the subjects in the Framingham, Mass., study in their “what if” scenario test. Risk factor intervention consisted of switching to a new behavior of no smoking, adequate exercise and a low-fat diet beginning in 2006. This intervention would produce a two-thirds increase in the male population at age 65 in 2040 (36 million instead of 21.6 million highest projection by Census Bureau in 1989). The populations of males age 85 and above increased five fold above official projections (from 1.6 million to 9.8 million.)

### **Will Age-Specific Health Status Remain Constant?**

Some economists share demographer Manton’s view that the average age-specific health status will remain constant in the future. This assumption suggests Medicare and other health care costs will rise dramatically as populations age, according to John B. Shoven, Professor of Economics at Stanford University, Michael D. Topper, professor of economics at the College of William and Mary, and David A. Wise, Professor of Political Economy at Harvard University in book on the economics of aging.<sup>131</sup>

“[O]ne might think, for example, that the average 75-year-old male will be healthier in 2040 than in 1990, corresponding to his increase in life expectancy and improvements that can be anticipated in medical technology” wrote Shoven *et al* a decade ago. “However, the improvements in medical technology cuts both ways in terms of the average health status of elderly individuals. While it is reasonable to assume that some elderly will be healthier and have health status equivalent to that of younger individuals in the previous generation, others may survive into the older age cohorts because of improved medical technology, but their health status may still be relatively poor for their age,” the authors stated.

Using what they deemed to be a conservative assumption that age-specific per capita spending on health care will remain constant in the future rather than rise, Shoven

<sup>129</sup> Manton, K.G. and B. Singer (1994), p. 30.

<sup>130</sup> Manton, Kenneth G., Eric Stallard, and Burton H. Singer (1994), “Methods for Projecting the Future Size and Health Status of the U.S. Elderly Population,” Wise, David A. (Ed.), *Studies in the Economics of Aging*, Chicago: University of Chicago Press, pp. 41-77.

<sup>131</sup> Shoven, John B., Michael D. Topper, and David A. Wise (1994), “The Impact of the Demographic Transition on Government Spending,” Wise, David A. (Ed.), *Studies in the Economics of Aging*. National Bureau of Economic Research. Chicago and London: University of Chicago Press, pp. 13-37.

*et al* took the population projections of the Social Security Administration in 1989 and forecast the impact of the demographic change on all federal transfer payments. They found that while the total population will grow 27.5% by 2040, total federal spending on transfer payments will rise by 65%, Social Security payments will rise by 103%, and Medicare will 125%.<sup>132</sup>

The author's conclusion: "Even if age-specific costs can be contained for these programs (a big "if"), their total costs will grow enormously as a result of the aging of our society. While it is conceivable that economic growth will permit us to afford these programs, most, if not all, of the fiscal dividend provided by growth over the next 50 years will have to be devoted to financing these programs. If we do not contain age-specific costs or if we do not experience robust growth, then the pressures to curtail these government programs will be overwhelming."<sup>133</sup>

Shoven *et al* then took Manton and Singer's optimal risk factor projections of a larger elderly population that, in the extreme case, would survive because all Americans would have changed their lifestyles and behavior in 2006. This was done to gauge a theoretical high side of spending. Shoven *et al* found that total spending on transfer payments could increase 172%. Social Security spending could rise 265% and Medicare spending could skyrocket 390%.<sup>134</sup>

### **U.S. Health Care Spending Could Hit 10% Of GDP In 2020**

Other methods for projected health care costs have shown even more startling increases in health care spending. A 1998 working paper<sup>135</sup> by economist Victor R. Fuchs of Stanford University, sponsored by the National Bureau of Economic Research, found elderly health care spending on the elderly will require 9.9% of GDP by 2020. Per capita health care consumption by the elderly will reach \$25,000. By comparison it was 4.3% in 1995 and \$9,231 per person. When looking only at Medicare spending, Fuchs found that the spending level would rise from 1.9% of GDP in 1995 to 4.51% of GDP in 2020. Spending per person would rise from \$4,114 in 1995 to \$11,107 in 2020.

Fuchs made his first set of cost projections based on observed trends in personal health consumption of the elderly between 1985 and 1995, when costs rose an average 5.77% year. If, however, one uses the longer time span between 1975 and 1995 to measure trends of consumption by older Americans, one gets a 6.82% average annual

<sup>132</sup> Total federal spending on transfers would increase from \$668.80 billion in 1990 to \$1,138 billion in 2040. Social Security spending would increase from \$203.41 billion in 1990 to \$412.44 billion in 2040. Medicare spending would increase from \$77.94 billion in 1990 to \$175.50 billion in 2040.

<sup>133</sup> Shoven, John B., Michael D. Topper, and David A. Wise (1994), "The Impact of the Demographic Transition on Government Spending," Wise, David A. (Ed.), *Studies in the Economics of Aging*, Chicago: University of Chicago Press, p. 26.

<sup>134</sup> Total federal spending on transfer payments would rise from \$651.436 billion in 1990 to \$1,768.967 billion in 2040, using constant 1986 dollars. Social Security spending would rise from \$193.603 billion in 1990 to \$707.589 billion in 2040. Medicare spending would rise from \$73.586 billion to \$360.909 billion.

<sup>135</sup> Fuchs, Victor R. (1998) "Provide, Provide: The Economics of Aging," National Bureau of Economic Research, June 4.

increase in spending. Using this assumption, Shoven *et al* forecast even higher spending by 2020. Personal health care spending by the elderly would rise to 10.8% of the GDP or \$29,445 per person. Counting only Medicare, the spending would rise to 5.24% of the GDP or \$14,309 per person.

**Table 6**  
**Consumption of Health Care and Income Available for Other Goods and Services,  
Americans Age 65 and Over**

	1975	1985	1995	2020	2020
<b>Population<sup>a</sup></b>					
Millions	22.7	28.5	33.5	53.2	53.2
As Percent of Total Population	10.5%	11.9%	12.8%	16.5%	16.5%
<b>Medicare<sup>b</sup></b>					
Per Person (Dollars)	1,473	2,716	4,114	14,309 <sup>c</sup>	11,107 <sup>d</sup>
Total (Billions)	33	77	138	762	591
As Percent of GDP	0.8%	1.3%	1.9%	5.24%	4.51%
<b>Total Personal Health Care<sup>e</sup></b>					
Per Person (Dollars)	3,485	6,088	9,231	29,445 <sup>c</sup>	24,391 <sup>d</sup>
Total (Billions)	79	174	310	1,567	1,298
As Percent of GDP	1.9%	3.0%	4.3%	10.8%	9.9%
<b>Income Available for Other Goods and Services<sup>f</sup> (CPS)</b>					
Per Person (Dollars)	9,241	10,492	11,203	9,803 <sup>g</sup>	9,059 <sup>h</sup>
Total (Billions)	210	299	376	522	482
As Percent of GDP	5.0%	5.2%	5.2%	3.6%	3.7%
<b>Income Available for Other Goods and Services<sup>f</sup> (CPS Adjusted)</b>					
Per Person (Dollars)	13,054	16,188	15,367	14,233 <sup>g</sup>	9,162 <sup>h</sup>
Total (Billions)	296	462	515	758	488
As Percent of GDP	7.1%	8.1%	7.1%	5.2%	3.7%

NOTE: All dollar amounts in 1995 dollars adjusted by the GDP implicit deflator

- a. Population data and projections for 2020 from the U.S. Census Bureau, middle series.
- b. B. Health Care Financing Review Statistical Supplement 1997.
- c. Estimated from extrapolation of trend in age-specific rate of expenditures 1975-95 and Census Bureau population projections.
- d. Estimated from extrapolation of trend in age-specific rate of expenditures 1985-95 and Census Bureau population projections.
- e. Estimated from relationship between total personal health care and Medicare in 1977 (for 1975) and 1987 (for 1985, 1995, and 2020) (Waldo et al 1989).
- f. Estimated from personal income (Current Population Survey, March 1976, 1986, 1996) less taxes (Feenberg 1998 personal communication) less private health care expenditures (ratios of private to total personal health care from Waldo et al 1989).
- g. Estimated from extrapolations of 1975-95 trends in personal income and private health care.
- h. Estimated from extrapolations of 1985-95 trends in personal income and private health care.

Source: Fuchs, Victor R. "Provide, Provide: The Economics of Aging," National Bureau of Economic Research, June 4, 1998.

By comparison, official assumptions seem optimistic. Medicare projections, for example, still assume that growth in costs per enrollee will slow over the next 25 years to about the growth of the average wage. The official 2000 report on spending projected spending on Medicare to rise from 2.29% in 1999 to 3.50% in 2020<sup>136</sup> – somewhat below Fuchs’s forecast conservative scenario where costs would reach 4.51% of GDP.

The Congressional Budget Office plotted the long-term effect of population aging using official Medicare assumptions on health care costs in December 1999.<sup>137</sup> They found that spending on Social Security, Medicare and Medicaid would rise from 7.9% of GDP in 1998 to 15.7% in 2050. Medicare accounts for most of the increase. As a percent of federal non-interest outlays Medicare alone would increase from 13% to 25% from 1998 to 2020, while Medicaid would rise from 7% to 13%. Social Security spending would rise from 24% to 27%. Spending on these programs for the elderly will rise from 45% of total outlays to 60% of total outlays in 2030, the CBO projected.

The U.S. may be headed for a showdown on the costs of public spending on health care, even if one only uses the likely conservative official forecasts of spending. Pressures from the elderly to spend more will rise even as pressures from the working-age population will grow to curtail spending. Medical technology can exacerbate or alleviate this clash. It is not entirely clear how it will play out.

If breakthroughs extend life and are costly, there may be intense pressure to fund them through Medicare. The experience with dialysis is a case in point. Here the benefits to kidney patients were rightly seen to be enormous, but costly. First approved in 1972, federal funding for dialysis is now provided for 250,000 Americans. By 1994 the End Stage Renal Disease Program cost \$8 billion. “In funding dialysis, Congress ushered in an era in which high technology was to become both a medical blessing and a financial curse,” claims physician William B. Schwartz, M.D., Professor of Medicine at the University of Southern California.<sup>138</sup>

### **Alzheimer’s Breakthrough Could Save \$50 Billion Yearly In U.S.**

**A** breakthrough in the treatment of Alzheimer’s could have the most potential cost saving impact, provided the treatments were not prohibitively expensive. Presently the overall cost of caring for people with Alzheimer’s in the U.S. is estimated to be between \$80 billion and \$100 billion a year by the Alzheimer’s Association. The National Institute on Aging has reported that if the onset of Alzheimer’s disease could be delayed by five years, the nation would save \$50 billion a year.

---

<sup>136</sup> Board of Trustees of the Federal Supplementary Medical Insurance Trust Fund. 2000. *The 2000 Annual Report*. Washington: Social Security Administration, p. 61.

<sup>137</sup> Congressional Budget Office (1999). “The Long-Term Budget Outlook: An Update,” December 14, 1999. Washington. Congressional Budget Office.

<sup>138</sup> Schwartz, William B. (1998), *Life Without Disease: The Pursuit of Medical Utopia*. Berkeley: University of California Press.

Improvements on the treatment of heart attacks have also been seen to have benefits that outweigh the costs. The treatment of patients with cardiovascular disease costs about \$110 billion annually or \$14,000 per hospital care alone for Medicare patients, and the costs have been increasing at a rate of 4% a year. A study of the value of treating heart attacks suffered by Medicare patients was done by David Cutler, Professor of Economics at Harvard University; Mark McClellan, Stanford University; and Joseph Newhouse at the Harvard Medical School.<sup>139</sup>

Mortality rates from heart attacks, which have been declining for decades, have been brought down by changes in treatments, such as the use of aspirin, beta blockers, thrombolytic drugs, and invasive procedures, Cutler *et al* report. Changes in behavior by individuals have played only a minor role. Why, then, are costs rising? Using data on the Medicare population between 1984 and 1991, the authors found that higher costs were almost entirely due to an increasing intensity of medical treatments. How do the costs compare to the benefits? They authors estimate that between 1984 and 1991, life expectancy after a heart attack rose by 8 months, a benefit they authors concluded outweighs the cost.

Cutler believes that Medicare costs will continue to rise over the next 40 to 50 years as more and more technology is found that has clear benefits. “The basic thing is that medicine can do more, so we will spend more,” he says. The increase in medical care is going to occur in all countries, not just the U.S. Higher spending is occurring at all ages, he notes. It’s more expensive for women to give birth, for example. “Someone hurt skiing will get an MRI,” he says. Demography alone will drive up spending about 30% over the next 40 to 50 years, Cutler predicts. He thinks those who benefit from medical technology should be the ones who assume the burden, rather than putting off on to future generations.

### **What Role Will Rationing Play?**

**R**ising Medicare costs are expected to lead to calls for rationing of care for patients who are very old or who appear to be terminally ill, as it already has in countries with socialized medicine. Schwartz fears there will be no public debate of rationing in America and this will cause the U.S. to stumble toward the British model. He describes this approach as “making rationing decisions only in a tacit and ad hoc manner, [which] may prove to be the only practical and politically acceptable approach.”<sup>140</sup> Schwartz proposes adopting a strategy for rationing that would weigh the costs of a procedure or therapy against the expected benefits. A \$200,000 heart transplant with a high expected benefit for a particular patient may have a lower benefit per dollar than a \$50,000 hip replacement for a patient with a much lower expected benefit, Dr. Schwartz noted.

---

<sup>139</sup> Cutler, David and Mark McClellan and Joseph Newhouse (1998). “The Costs and Benefits of Intensive Treatment for Cardiovascular Disease.” Cambridge, Mass: National Bureau of Economic Research.

<sup>140</sup> Schwartz (1998), p. 102.

Any form of rationing in the U.S. is likely to focus on spending in the last six months of life, which accounts for 30% of all Medicare spending.<sup>141</sup> Economists Jonathan Skinner and John E. Wennberg looked into the issue of costs and benefits in a study<sup>142</sup> examining the different spending levels on Medicare patients in the last six months of life in Miami and Minneapolis. The two cities are on the opposite ends of the national distribution in the intensity of care during the last six months of life. Inpatient hospital spending was twice as high in Miami, \$14,212, as it was in Minneapolis, \$7,246. There were more visits by the primary physician in Miami, 12.5 versus 7.1 in Minneapolis. And, there was a larger difference in the number of visits by specialists: 25.4 in Miami versus 4.7 in Minneapolis.

Skinner and Wennberg then looked at variations in spending and outcomes across 306 hospital referral regions in the U.S. and found no evidence of any benefits from higher spending levels. Regional survival rates following heart attacks, stroke and gastrointestinal bleeding were not correlated with more intensive health care spending. They authors conclude that regions providing more intensive care are not gaining net health benefits over regions providing less care.

Cutler believes there will be great resistance in the U.S. to rationing and, in fact, pressures to undo rationing will grow in countries across the industrial world where rationing exists. “Rationing is increasingly less accepted around the world,” Cutler says. From the U.K., Canada, Germany and France there is increasing talk of easing constraints and giving patients more choice, he says. Japan does not ration health care even though it controls prices.

The Organization for Economic Cooperation and Development in a major report in 1994 concluded that “[w]ithout more fundamental reforms than those implemented in the 1980s, tax increases or service cut-backs appear unavoidable.”<sup>143</sup> The OECD found that two characteristics of the health market may lead to “excess provision of services.” One problem is that patients lack the information necessary for informed choice. They rely on the same medical professionals who provide the service. These professionals, however, have a conflict of interest. The second problem is moral hazard for patients, who may consume more services and medical products than they need because they do not face the full marginal costs of acquiring them. There’s also a moral hazard for health care providers to over-supply medical services when a third party pays most of the costs, a problem most associated with fee-for-service health care.

Among its policy recommendations, OECD suggested the governments take a proactive role on new medical technologies and “make clear that new technologies will be purchased only when there are clear therapeutic and/or cost advantages.” While

---

<sup>141</sup> Lubitz, J. and G. Riley (1993). “Medicare program expenditures,” *Health Care Financing Review* 1992 Annual Supplement: 23-54.

<sup>142</sup> Skinner, Jonathan and John E. Wennberg (1998), “How Much is Enough? Efficiency and Medicare Spending in the Last Six Months of Life.” Cambridge, Mass: National Bureau of Economic Research, Working Paper 6513.

<sup>143</sup> Oxley, Howard and Maitland MacFarlan (1994). “Health Care Reform: Controlling Spending and Increasing Efficiency. Paris: Organization for Economic Cooperation and Development.

recognizing this might be a disincentive for medical research, the OECD authors raise the possibility that governments should steer research and absorb part of the research costs.

The OECD paper also recognized patient dissatisfaction with few consumer choices over health care in many countries. While noting that consumer choice is driving up prices in the U.S., the authors suggest that there may be a case for allowing purchasing of additional health services and insurance for private services. Where this has been tried in the United Kingdom, it creates pressure on the National Health Service to raise its pay to doctors.

### **Drug Price Controls In The U.S. Could Dampen Research**

**P**ressures are also likely to grow in the U.S. to control pharmaceutical prices as political leaders look around the world and see lower prices everywhere but the U.S. Does the U.S. subsidize the lower costs in other countries? One who used to doubt this, Robert Helms, Director of Health Policy Studies at the American Enterprise Institute -- now thinks "there's a grain of truth in that claim." Some in Congress who believe there is a subsidy, also believe that the U.S. should impose cost controls in America so that costs will be more evenly distributed around the world.

Helms believes that prices of pharmaceuticals derives partly from different intensities of demand from one market to another. For the pharmaceutical companies "the large unregulated U.S. market drives their decisions about R&D." As long as the drug companies can recover their costs in the U.S., they can ship to other countries with price controls and still make money on those markets -- as long as the foreign countries cannot reship back to the U.S. And, indeed, that is the case. "All you have to do is cover the variable costs," explains Helms. Price controls in the U.S. would upset this whole arrangement, he says, and probably lead to less research and development and slow down the advance of medical technology.

If there are price controls, pharmaceutical companies will not walk away from products in R&D that are near approval, Helms says, but they will walk away from longer range products with little chance of a big payoff. "They will gradually walk away from risky R&D," he says. John E. Calfee, a resident scholar at AEI, contends that recent experience supports this view.<sup>144</sup> After President Clinton introduced a health care proposal in 1993 that would have let the government set prices on breakthrough drugs, pharmaceutical companies cut their R&D spending. While the U.S. pharmaceutical industry had increased its spending on R&D an average of 11% between 1981 through 1993, it fell to 3% in 1994 and 4% in 1995. Since 1996, when Congress decisively defeated the Clinton administration's health care plan, spending increase for R&D have again averaged 11% a year.

---

<sup>144</sup> Calfee, John E (2000). "Prices, Markets, and the Pharmaceutical Revolution." Washington, D.C: The AEI Press, 2000.

Helms thinks that Congressional concern about pharmaceutical prices is misdirected and contends that it is the volume of services and not prices that is driving up health care costs. Calfee notes that data from Health Care Financing Administration and the Bureau of Labor Statistics show that volume, not price is driving increasing in spending on drugs. Drug price increases generally stayed below 4% between 1993 and 1998, driven mostly by disproportionate increase in spending on more innovative therapies. The largest increases between 1997 and 1998 involved heart medications and antidepressants. This spending was driven by the success of cholesterol-reducing drugs and improved antidepressants.

### **Disability Rates Are Declining Across Industrial World**

Finally, there's the question of publicly-financed spending on long-term care. Disability rates will be a major factor in future costs. Here there's some good news, but it may still not prevent huge increases in spending on long-term care.

In a 1998 study<sup>145</sup> the OECD examined the question of whether declining mortality rates were also accompanied by a healthier elderly population. The study built on the work of Manton, who had found in a 1997 study that disability rates were declining in the U.S., contrary to forecasts in the 1980s, and that the decline was accelerating.<sup>146</sup>

The OECD study found that severe disability had declined in nine countries between 1990 and 1994. The gains are mainly found in younger age groups (65-80) and are greater for men than women. The study found that the decline was pronounced in private households. However, since more elderly are being taken out of institutions and being given home health care, the rate of disability has often risen in the institutionalized population. Five countries had significant gains: France, Germany, Japan and the U.S. There were mixed results in Canada and Sweden while Australia, the Netherlands and the U.K. had very moderate or no gains.

While the disability rates were declining, the total number of disabled persons will rise because of the huge demographic shift in the coming half century. The OECD found that Japan would see a 74% increase in the number of elderly living in institutions by 2020. (This projection was before Japan introduced government insurance for long-term care in 2000.) Canada would see a 61% increase while the growth would be 33% in the U.S. Other European nations were forecast to have lower growth rates: Germany, 26%; France, 29%, the U.K., 18%, Sweden, 27%. Italy was not included in the study.

---

<sup>145</sup> Jacobzone, S. and E. Cambois, E. Chaplain, J. M. Robine (1998), "The Health of Older Persons in OECD Countries: Is It Improving Fast Enough To Compensate For Population Ageing?" Labour Market and Social Policy – Occasional Papers No 37. Paris: Organization for Economic Cooperation and Development.

<sup>146</sup> Manton, K.G., L. Corder and E. Stallard (1997), "Chronic Disability Trends in Elderly United States Populations, 1981-1994," Proceedings of the National Academy of Science, Vol. 94, pp. 2593-2598.

The number of disabled living at home would grow even faster. There would be a 74% rise of disabled elderly in Japan between 2000 to 2020. In Canada there would be a 62% increase. In the U.S., a 41% jump; Germany, 38%, France, 54%, Sweden, 29%.

The sharp increases in the number of disabled will push up spending on publicly-financed long term care as a portion of each nation's GDP. Japan would face a 102% increase in spending between 2000 and 2020, rising from 0.75% to 1.54%. Canada would see a 48% increase in long-term care spending, from 0.5% to 0.81% of GDP. In the U.S. long-term care spending would rise 21%, from .068% to 0.82% of GDP. In Germany, it would rise 38%, from 0.71% to 1.02% of GDP. In France, it would rise 51%, from 0.60% to 0.98% of GDP.

In conclusion, it's clear that forecasts on health care spending and long term care are going to be highly uncertain for the foreseeable future. A number of trends could drive the costs higher than official projections. Indeed, most of the risk seems to that costs will be higher, not lower. In this case, it's prudent for nations, health care providers and individuals to consider how to prepare for the chance that spending will be higher, perhaps sharply higher than official projections.

## APPENDIX I

### Summary of Group of Ten Study on Aging April 1998

Twenty-three representatives from the Group of 10, responding to an initiative taken at the Group of Seven Summit in Denver in 1997, undertook an assessment the economic and financial market implications of population aging. The representatives came from the central banks and ministries of finance of the Group of Ten countries,<sup>147</sup> plus four observers from the International Monetary Fund, OECD, European Commission, and the Bank for International Settlements. The Group of Ten includes 11 nations: the G-7 plus Belgium, the Netherlands, Sweden and Switzerland.

The G-10 committee of deputies was chaired by Mario Draghi, Director General of the Treasury in Italy. BIS published the report of the deputies in April 1998<sup>148</sup> just ahead of the Birmingham Summit of the G-8 in England in May.

The main findings of the G-10 study are below:

- Aging populations will lead to a slowdown in growth of living standards as measured by consumption per capita – unless the declines in the workforce are offset by increases in labor productivity and the effective supply and utilization of labor.
- Growth in the gross domestic product will be depressed by 0.5% to 1% point per year in many G-countries between 2010 and 2030.
- Government spending in the G-10 countries will rise sharply over the next several decades. If advances in medical technology come at ever-increasing cost and if the incidence of health expenditures on the elderly continues to rise, the fiscal burden could become substantial.
- Government revenues will deteriorate, especially in countries that are tied more to income and payroll taxes. Those more dependent on consumption or value added taxes face a softer blow.
- Budget deficits will reach unsustainable levels under recent policies. This will create a severe drag on national saving at a time when saving will be critical to fostering gains in labor productivity.
- The flow of savings into retirement accounts will increase over the next decade. The continued growth of retirement savings, depending on how they are invested, could reduce rates of return and equity premiums. Savings could flow out of these accounts after the baby boom generation retires and its saving rate declines unless savings for younger people rise above historical levels.

---

<sup>147</sup> The Group of Ten countries actually includes 11 nations: the G-7 plus Belgium, the Netherlands, Sweden and Switzerland.

<sup>148</sup> Group of Ten. “The Macroeconomic and Financial Implications of Ageing Populations.” Basel, Switzerland: Bank for International Settlements, April 1998.

- Current account trade and financial balances will continue to improve for aging countries, as they have for Italy and Japan, two of the nations with the most advanced aging of their populations. If, however, savings rates in the G-10 decline as the aging progresses, then the current account balances would decline.

The G-10 set these following principles as ones to follow when devising reforms:

- Early action is urgent because the burden of adjustment for governments and individuals increases the longer action is delayed.
- Encourage more growth to offset the negative effects of aging on living standards by saving and investing more now.
- Cut national budgets or, better still, reduce national debts in a manner that does not decrease private saving.
- Increase the supply and efficient utilization of labor. Eliminate disincentives to continued labor force participation by older workers.
- Reform old age pension systems by increasing funding or pre-funding of pay-as-you-go systems.
- Eliminate rules that unnecessarily inhibit portfolio diversification and risk management by retirement funds and other similar investors.
- The relaxation of investment restrictions, including control on international capital flows, should be accompanied by measures to enhance the stability of the international financial system. This would include sound macro-economic policies, effective prudential supervision and regulation, and policies to promote financial transparency and disclosure.
- Resist efforts to curtail trade and capital flows that may be a natural and transitory consequence of population aging.

## APPENDIX II

### The Case of Italy: Are Past Reforms Enough?

Italy undertook some of the most ambitious reforms in the early and mid 1990s as part of an effort to resolve a financial crisis that sent the Italian lira plunging. It was also as part of a package to bring Italy's budget deficit into conformity with the requirements for monetary union. In 1991, for example, Italy's social security system was so far out of balance that it would have required raising payroll taxes from 26.4% -- the rate in effect then -- to somewhere between 35% and 44%, depending on how much of the revenues might be relegated to an income tax on all Italians and not just those still employed,<sup>149</sup> according to economist Agar Brugiavini, assistant professor in the Department of Economics at the University of Venice and a research associate at the Institute for Fiscal Studies in London.

Italy's retirement system was one of the most generous in Europe and represented nearly all retirement income for most Italians. There is virtually no employer-sponsored pension system like that in the U.S. A typical married male worker before 1992 could expect to earn 80.9% of his income at retirement, according to Brugiavini. Such a worker had incentives to retire before normal retirement age or see the value of his total retirement package reduced.

Brugiavini analyzes the system to show why it encourages early retirement. She calculated that a typical married male worker's social security wealth peaked at 280 million lira at age 55 (the earliest year for retirement) if he had worked at least 35 years.<sup>150</sup> At age 55 the worker would have a pension equal to 72.6% of his pay. If he collects a pension, he doesn't have to pay the payroll tax, which was then 24.6%. So, working beyond 55 seems foolhardy, when you could actually have nearly the same after-payroll-tax income -- 72.6% for retiring vs. 76.5% -- for continuing to work.

A worker at age 58 could get a Social Security annuity equal to 78% of his pay. So, working any longer would mean less take-home pay, when you factor in the payroll tax required for workers.

In 1992 Italy's Parliament adopted a pension reform sponsored by Prime Minister Giuliano Amato which very gradually raised normal retirement age from 60 to 65 for men and from 55 to 60 for women by 2032. The basis for computing the initial Social Security benefit was changed from the average of the last 5 years of real earnings with an inflation adjustment that enriched the benefit formula to a career average of earnings. The cost of living indexation of benefits was changed from the very costly inflation rate plus

---

<sup>149</sup>Brugiavini, Agar (1999). "Social Security and Retirement in Italy," Editors: Gruber, Jonathan and David A. Wise, *Social Security and Retirement Around the World*. A National Bureau of Economic Research Conference Report. Chicago and London: University of Chicago Press, p. 196.

<sup>150</sup> Brugiavini (1999), p. 218.

real earnings growth to a simple indexation to inflation. These reforms were to be phased in over a period of 30 years.

While still maintaining a pay-as-you-go system, the Amato reforms instituted a phantom account that tracked the contributions for each worker and which formed the basis for computing the final benefit. This reform made it more difficult for people to move in and out of the so-called “formal sector,” where they paid the high 33% pay roll tax or contribution rate, and still collect a substantial benefit. The “informal sector” is that portion of workers who work “off the books” and who pay no taxes on their incomes.

In 1995 Italy’s Parliament passed a more ambitious reform sponsored by Prime Minister Lamberto Dini that adopted a contribution-based method of calculating the initial Social Security benefit. In the OECD’s view, this change will lead to a major decline in the benefit for individuals retiring early and a marked improvement in the neutrality of the system in early retirement decisions.

The Dini reforms, according to Brugiavini, changed the replacement rate for the retirement benefit from 80.9% to 54.7% for the typical married male worker who retires at 62 when the program is fully phased in by 2035 for workers who began working after the Dini reform became law.<sup>151</sup>

Actual average replacement rates in Italy differ from the typical examples computed by Brugiavini. One reason is that the self-employed have lower payroll taxes and, thus, a lower-than-average retirement benefit.

Italy’s average replacement rate is 75%, among the highest for industrial countries, according to calculations by Jonathan Gruber and David A. Wise.<sup>152</sup> France and The Netherlands are the highest at 91%. Belgium is next at 77%. Then follow in order: Spain, 63%; Germany, 62%; Japan and Sweden, both 54%; the United Kingdom, 48%, and the U.S., 41%.

Italy’s forecasts on spending for pensions assumes there will be 10-year periodic adjustments of the final benefit based on changes in longevity, according to a provision in the Dini reforms. These adjustments, however, are not automatic and require negotiations with trade unions before they can be implemented. There is no assurance that political agreement can be reached at these 10-year intervals. If this were the case, the transition period would be extended and the actual budget impact of aging could be higher than Italian projections.

---

<sup>151</sup> Brugiavini (1999), p. 222.

<sup>152</sup> Gruber, Jonathan and David A. Wise, editors (1999). Gruber, J and D. A. Wise, “Introduction and Summary,” *Social Security and Retirement Around the World*. Chicago and London: The University of Chicago Press, p. 29.

## Generational Accounting Can Show Burden On Future Generations

Generational accounting is one method economists use to take a different look at budget liabilities to get a better handle on the fiscal impact of aging populations and to raise in a more concrete manner issues of generational equity. Its “goals are to assess the sustainability of fiscal policy and to measure the fiscal burdens facing current and future generations,” according Alan J. Auerbach, professor of Economics and Law at the University of California at Berkeley, Laurence J. Kotlikoff, professor economics at Boston University, and Willi Leibfritz, head of the Department of Macroeconomic and Fiscal Studies at the Institute for Economic Research<sup>153</sup> in Munich, Germany. OECD has drawn on such calculations in its analysis but considers it only one of a number of methods that can be used to assess the fiscal sustainability.

How does generational accounting work? It calculates the future taxes owed by unborn generations for expenditures of current generations. To make this calculation one has to first make a calculation of the present value of the government’s projected future purchases of goods and services and then add its official net financial liabilities or debt service.<sup>154</sup> From this total one subtracts the present value of projected future net tax payments of current generations. That leaves the present value of the total amount of liabilities being transferred to future generations.

Nicola Sartor, professor of public finance at the University of Verona, has applied the generational accounting approach to Italy.<sup>155</sup> Without the Dini reforms Sartor found that pension policies as of 1995 put a \$209.9 billion<sup>156</sup> burden onto generations born in 1996 and thereafter. Sartor also calculated that future Italian generations would pay 224% more in taxes than current generations for the same benefits and services from government if policies remain unchanged.

Generational accounts also break down by age group and can be calculated for an individual. Auerbach *et al* calculated comparisons across 12 nations. That found that a 25-year Italian in 1995, for example, faced a net tax bill for the rest of his life of \$250,500,<sup>157</sup> meaning that even including the old age benefits he would be expected to receive, this worker would still pay in \$250,500 more than he received. A 25-year old German faced an even more daunting prospect: \$416,300 in net lifetime taxes for the rest of his life. A 25-year old Japanese man faced \$360,400 in net taxes. These were much higher than the level in the U.S., which was \$175,400 for a 25-year-old American male.

---

<sup>153</sup> Auerbach, Alan J. and Laurence J. Kotlikoff and Willi Leibfritz, editors (1999). *Generational Accounting around the World*. A Project of the National Bureau of Economic Research. Published in Chicago and London: The University of Chicago Press.

<sup>154</sup> *Ibid*, p. 2.

<sup>155</sup> Sartor, Nicola (1999), “Generational Accounts for Italy,” Editors, Auerbach, A. J. and L. J. Kotlikoff and W. Leibfritz, *Generational Accounting around the World*, pp. 299-323.

<sup>156</sup> Base year is 1995 and the exchange rate is assumed to be 0.61 dollars per 1,000 Italian lira.

<sup>157</sup> Auerbach, Kotlikoff and Leibfritz (1999), p. 82, Table 4-4. These numbers are scaled by the ratio of U.S. per capita GDP to the country’s per capita GDP.

Sartor found that the burden on future Italians could vary enormously if some key assumptions were changed. Future population projections used by the National Institute for Population Research in Italy assume that fertility will recover from its current low level of 1.2 children per woman to 1.8 by 2044. Sartor's baseline generational accounting is based on this assumption. If, however, the fertility rate remains low at 1.2, then the burden on future generations is \$379.5 billion, and that future generations would pay 325% more than current generations in taxes for the same benefits and services. Even in the most optimistic case -- if fertility rates were to return to replacement levels or 2.1 children per woman by 2044 -- the outcome is fairly bleak for future generations. They would be saddled with \$274 billion in debt from current generations and would pay 206.9% more in taxes.

Sartor also look at variations in productivity growth and found little difference in burdens placed on future generations whether the productivity growth was 1.5%, the baseline assumption, or 1% or even 2%. Sartor then made calculations that Italy could miraculously reduce its debt to zero. In that case the future burden falls by almost half, from \$209.9 billion to \$128.1 billion. The increase in the tax burden on future generations is greatly reduced, falling from a 224% increase to a 98% increase.

Sartor also looked at holding the population constant -- either by higher birth rates or immigration -- and found that the total burden was almost cut in half, \$209.9 billion to \$131.2 billion. This provided a considerable improvement in the per capita burden on future generations. Instead of a 224% increase in lifetime taxes, there would be only an 18% increase.

Finally, even taking into consideration the Dini reforms, Sartor found little difference from the baseline case. The total debt to future generations still remains high at \$200.9 billion, requiring a 185% increase in taxes on future generations.

The reduced pension income from the Dini reforms to the pay-as-you-go system is to be made up from a new voluntarily funded supplementary retirement savings system instituted in the early 1990s.

Under this new system, unions and employers negotiate a contribution formula into a *previdenza complementare*, a defined contribution plan for workers in discrete industrial and business groups. With government workers being added to the potential rolls of savers, these funds will have an estimated total of 20.8 million workers will be eligible to participate in these funds. Until the last few years the *previdenza complementare* were doing poorly in attracting interest among workers and employers, even though they were authorized in 1993. Total assets in March 2000 stood at only \$650 million. Reforms undertaken during the Massimo D'Alema regime have added tax deductibility to contributions under certain circumstances, which has made the plans more popular, according to Stefano Fassina, economic adviser to the Prime Minister.

To offset an expected decline in retirement income under the Amato and Dini reforms adopted in 1992 and 1995, Italy authorized the creation of a new type of

supplementary pension fund that would be similar to a defined contribution fund in the U.S. It's called a *previdenza complementare*, and funds are set up through negotiations between trade unions and employers in discrete industrial and business groups.

Typically funding arrangements for these closed funds have employees contribute 2% with a 2% match by employers. In addition to matched contributions, workers may elect to contribute another amounts up to 12% of their salary with a cap of 10 million lira (about \$5,000) a year. These deductions were introduced in January 2000, when Italy also began a new feature for the *previdenza complementare* that allows accounts to be set up in the name of non-working dependents using the residual part of the maximum deduction not used by the worker who sets up these accounts.

Additional funds can be added to the employer's and employees' contributions by reallocating funds from an existing severance payment fund – *Fondo per il Trattamento di Fine Rapporto* -- which receives a stream of money from a payroll tax of 7%. Now this sinking fund is spent entirely at the discretion of the employer. Up to a total of 12% of contributions made by the employer and employees are tax deductible if a portion of the payroll tax dedicated to the *Fondo per il Trattamento di Fine Rapporto* is redirected to the *previdenza complementare*.

While the new closed funds through collective bargaining could cover virtually 90% of Italy's employees, according to Fassina, so far it has not generated much savings. The most success has come in the mechanical sector, where 23% of the 1.2 million workers of the industry are members of the *Cometa* fund set up in December 1998. The other big success is the chemical industry, where 215,000 workers (40% of the industry) participate in the *Fonchim* fund set up in December 1997. There is also a *Fondo Fiat* in which 90% of 17,000 managers at Fiat take part, and a *Fondenergia*, which has participation by 59% of the 50,000 workers of the energy sector. Unions and the government have also agreed to set up funded pension funds for government employees, with 4 million potential participants. That would bring the total eligible for closed funds to 11.5 million.

A separate system of open funds has been set up for the self-employed and professionals. There is no limit on what one can contribute to these open funds, which are offered by financial companies. The tax deductions for contributions to the open funds are the same as those for the closed funds. So far, the *Fondo Dentisti* for 40,000 dentists has been set up. Another 30 pension funds are collecting members in the private sector with a potential membership of 6 million workers.

With a potential 20.8 million workers participating in the new funded supplementary pension plans, this system may be poised to contribute to a significant increase in retirement savings. As of March 2000, the accumulated assets in the funded supplementary pensions was \$650 million.

There is some interest in Italy for accelerating the transition period for the Dini reforms. This would be done to lower Italy's high payroll tax to improve the competitiveness of its businesses, says Fassina. This would, of course, mean lower benefits sooner than expected, which might encounter stiff political opposition. If benefits were to be cut, he says, one possible solution is to increase contributions to the *previdenza complementare* from the *Fondo per il Trattamento di Fine Rapporto*. This might work if contributions from the severance fund were raised to a level sufficient to guarantee to the trade unions that workers will have the same replacement rate when income from the pay-as-you-go system is combined with the new benefit from the *previdenza complementare*.

### APPENDIX III

## Evaluating Germany's Policy Choices

The case of Germany provides a useful illustration of the dilemma posed by various pension policy reform options. Much work has been done in this area by economist Axel Börsch-Supan, Director of the Institute for Economics and Public Policy and Chair of Macroeconomics and Public Policy at the University of Mannheim, Germany. He concluded in a 1998 study<sup>158</sup> that “the German pay-as-you go mechanism cannot be fixed by any single policy measure alone.”

The German pension system has a high average replacement rate of 70% and generous survivor and disability benefits that are often even at higher replacement levels than the old-age pensions. “As a result, public pensions and related public transfers to the aged are by far the largest pillar of retirement income and constitute about 85% of the income of households headed by persons 65 and older,”<sup>159</sup> according to Börsch-Supan.

Worker contributions finance about 80 percent of the budget of the German public pension system. The contribution rate or payroll tax is 19.3%, paid in equal parts of the employer and employee. The rest of the financing comes from revenues from the federal government that are roughly equivalent to 9% of gross wages. Thus, the system's costs represent about 28% of worker's pay. Benefits are computed on a life-time contribution basis. The initial benefit is a combination of the employee's average wages over his earning history and years of service. In spite of reforms in 1992, there are still incentives to retire early, especially on a claim of disability. This is one reason the average retirement is at age in Germany is 59.5.

Börsch-Supan calculated that the contribution rate in Germany would have to rise to 30% of gross income if the current replacement rate and current labor force participation rate remain the same. The health insurance contribution rate, at 12.5% in 1998, will have to increase by almost half to 17.5% of payroll. The contribution rate for long-term care insurance, now only 1.7%, will have to double by 2035 to cover expected benefits. To keep the contribution rates steady at 20.3% of payroll would required a 50% cut in benefits.

The alternatives of sharp increases taxes or drastic benefit cuts needed to bring the system into balance led Börsch-Supan to conclude in 1998 that “the pay-as-you-go pension system is in a serious dilemma, if not on the verge of collapse.”<sup>160</sup>

Increasing the retirement age, while politically appealing in Germany, would not solve the dilemma, Börsch-Supan says. To fully compensate for the effects of population aging, the average retirement age would have to increase by 9.5 years to about age 69 in

---

<sup>158</sup>Börsch-Supan, Axel H. (1998), “Germany: A Social Security System on the Verge of Collapse,” In: H. Siebert (ed.) *Redesigning Social Security*: Tübingen: J.C.B. Mohr (Paul Siebeck).

<sup>159</sup>Börsch-Supan, Axel H. (1999). “Pension Reform in Germany: To Fund or Not To Fund,” Working Paper. University of Mannheim, Department of Economics.

<sup>160</sup>Börsch-Supan (1998)

2035. “It is unlikely that the labor market is sufficiently flexible to permit this to happen,” says Börsch-Supan.<sup>161</sup> Similarly, part-time retirement will also not alleviate the pension crisis. It would take 18 years of half-time work to offset the aging effect in Germany, Börsch-Supan concluded – one year longer than the 17 years of life expectancy at age 60.

Another possible policy option is increasing female labor force participation. Even if female participation were at the same level as men, it would only lop off 6 percentage points of the nearly 17 percentage points increase needed to pay for pensions, health care, and long-term care, Börsch-Supan has calculated.

Immigration, too, presents problem. To keep the system in balance would require 800,000 persons a year every year from now until 2035, according to Börsch-Supan. However, he adds, a steady inflow of 300,000 immigrants could reduce the social security contribution rate by one third, provided the immigrants have a labor force participation rate similar to the current labor force.

Similarly, tightening disability benefits is not a real solution. Currently, 27% of male workers and 20% of female workers use disability to retire before 60, most of them at ages 54 to 59. Even if all early retirement were to end, the average retirement age would increase by only 2.3 years for men and 1.9 years for women.

While it may be possible for a combination of these options to work – later retirement, more immigrants, higher participation rates for women -- Börsch-Supan suggests it is not clear that labor markets can absorb all the additional labor supply.

Age cohort inequity adds a further complication to either reducing benefits or raising contribution rates. If the current contribution tax (or payroll tax) is maintained, for example, it would lower the benefit by half by 2035 and, in the process, generate negative rates of return for all age cohorts born after 1950. On the other hand if the replacement rate is kept the same and the contribution rate is raised, age cohorts born after 1967 will have negative rates of return, Borsch-Supan says.

This impossible choice where one age group or another receives a negative rate of return is a compelling argument for a funded system, Börsch-Supan concludes. This is true even if one assumes all the funds are invested in government bonds and earn only 4% a year. Happily, actual returns should be closer to the long-term historical rate of 7.4% annual return for investments in the German corporate sector, he states.

### **Walter Riester Introduces Reform Proposal In Germany**

**T**he debate over pension reform in Germany has intensified since Labor Minister Walter Riester introduced in May 2000 a reform package that would lower the social

---

<sup>161</sup> Börsch-Supan (1998).

security benefit in the future from 70% of average earnings gradually to 64% in 2030 and then to 54% in 2050, while keeping payroll taxes under 22%. The plan also called for a new supplementary funded pension system that is intended to provide a benefit that would keep retirement income at present levels, offsetting the cuts in social security, with the hope that the supplementary funded pension could increase the overall final combined retirement income.

While there was brief talk about making the supplementary private pension mandatory, as some of the trade unions demanded, it was made voluntary with a number of incentives to attract worker participation.

Riester's initial plan called for a transition period for all the proposed changes. Contributions into the new funded system would be taken from workers pay, beginning at 0.5% in 2001, rising to 4% by 2008. Low income workers would receive an annual subsidy for their funded benefit, beginning at 250 Deutsche marks annually, and rising to 400 DM by 2008. The investments would be allowable only in state approved investment vehicles, certified by the finance minister and dedicated entirely to retirement income.

Riester's proposal was attacked by trade unions and from within his own Social Democratic Party. Employers and the political opposition, too, threw a few brickbats. The strongest opposition came from the trade unions. The Christian Democratic Union opposition also opposed Riester's proposal for a guaranteed minimum pension, which was promptly withdrawn. After some additional concessions, the CDU agreed to support the reform package.

The German Federation of Trade Unions (Deutscher Gewerkschaftsbund or DGB) has demanded that half the private pension system be paid by the employer, not the employee and that the pay-as-you-go pension remain at 68% of average earnings rather than fall to 64% in 2020. Some DGB leaders have also supported setting the private pension contribution at 2.5% instead of 4.0%. The IG Metall metalworkers' union has also opposed the reform, in spite of the fact that Riester was the union's vice president before becoming minister for labor.

Under opposition from the trade unions, the Schroeder government in November 2000 decided to postpone the introduction of the private pension system by year until 2002 and to delay any cuts in the pay-as-you-go pension until 2003. This angered the Green Party, which is the junior partner in the ruling government coalition. "We're shelving the problems that pensioners face still further into the future," said Green parliamentary leader Kerstin Müller she said, "at the cost of the young. The Greens won't stand for that."<sup>162</sup>

The debate intensified during late December 2000 and early January 2001 and some of the details of the final law remained unclear as of mid-January, although the Schroeder government indicated that expect a law to be enacted by late January.

---

<sup>162</sup> *The Militant* (2000). "Greens push German gov't attack on pensions," New York: *The Militant*, Vol.64/No.45, November 27, 2000.

Under the latest version of the proposed legislation available when this paper was completed, worker contributions into the supplementary system would be gradually increased over an 8-year period beginning in either 2002 or 2003 (ending in either 2010 or 2011. (While the Greens want still the plan to begin in 2002, an election year, the Social Democrats want it to begin in 2003.)

In the first year workers would be allowed to contribute tax-free 1% of their gross income up to a maximum threshold level (above which they are not taxed for their social security contribution), which currently stands at 8,700 Deutsche marks. Two years later, they could contribute 2%; then 3% after another two years, and 4% after eight years – all tax free. In addition to the tax-favored treatment for worker contributions, all contributors would receive an additional subsidy into the supplementary private pensions from government.

There also remains some opposition to giving a subsidy to all workers because it will be costly, which might affect the provisions in the final law that is passed. Even so, the current subsidy and tax preferences will be sufficient to encourage workers to participate on a “practically universal” level, achieving one of key goals of the pension reform, according to Prof. Meinhard Miegel, Director of the Bonn Institute for Economic and Social Research.

Contributions into the new supplementary pension will lower the basis for calculating the pension in the pay-as-you-go system. When the private pension system is fully-phased in at 4% of income, the calculations for the initial pension benefit will be based on the income of workers after the 4% increase. Benefits in the pay-as-you-go system are based on average lifetime pay and thus, will be calculated on a lower pay basis, lowering the final benefit.

The final round of the debate on pension reform is also complicated by an adjustment to be made in 2011 in how pensions will adjust annually. Pensions in Germany do not have Cost of Living Adjustments or COLA's, as in the U.S. Instead they are adjusted according to an index that captures the average increase in income by active workers. Annual adjustments beginning in 2011, under the latest proposal, would be based on increases in the average gross income instead of the average net income. This change was made to avoid steep increases in benefits that would be caused by an ongoing change in income tax rates that will drive up net incomes faster than gross incomes. A broad income tax law already in effect lowered the top income tax rate from its 1999 level of 53% level to 51% in 2000. In 2001 it falls to 48% and continues to be phased in at lower levels until it reaches 42% in 2005. Legislators are debating even adding another cut to the annual adjustment beyond switching to an increase tied to the average net income that would scale back the adjustment to somewhere between 75% to 90% of the adjustment.

It remained unclear at the deadline for this paper just exactly what level of benefit would exist under the reform, or whether the benefit in 2030 would be 64%, 62% or some other average of a worker's lifetime income.

Leaders in the center-right opposition parties believe that while the Riester plan is an important step forward, it ultimately does not do enough to bring the system into balance. "It is not an adequate response. The level of pensions remains much too high," says Meinhard. The Council of the Minister of Economics, an advisory group, also recently stated that the current proposed pension reforms would leave pension levels unsustainably high.

## BIBLIOGRAPHY

Auerbach, Alan J. and Laurence J. Kotlikoff and Willi Leibfritz, editors (1999). *Generational Accounting around the World*. A Project of the National Bureau of Economic Research. Published in Chicago and London: The University of Chicago Press.

Barr, Stephen (2000), "Retirement Wave Creates Vacuum," *The Washington Post*, May 7, pp. 1, 14.

Board of Trustees of the Federal Old Age and Survivors Insurance and Disability Insurance Trust Fund (2000), "The 2000 Annual Report." Baltimore, Md.: Social Security Administration.

Board of Trustees, Federal Supplementary Medical Insurance Trust Fund (2000), "2000 Annual Report." Baltimore, Md.: Social Security Administration.

Board of Trustees, Federal Hospital Insurance Trust Fund (2000), "2000 Annual Report." Baltimore, Md.: Social Security Administration.

Bongaarts, John and Griffith Feeney (1998), "On the Quantum and Tempo of Fertility," *Population and Development Review*, Vo. 24, No. 2, June, pp. 271-291.

Börsch-Supan, Axel H. (1998), "Germany: A Social Security System on the Verge of Collapse," In: H. Siebert (ed.) *Redesigning Social Security*: Tübingen: J.C.B. Mohr (Paul Siebeck).

Börsch-Supan, Axel H. (1999), "Pension Reform in Germany: To Fund or Not To Fund," Working Paper. University of Mannheim, Department of Economics, 1999.

Brandstrader, J.R. (2000), "From Baby Boom to Geezer Glut," *Scientific American Presents The Quest to Beat Aging*, Summer, Vol. 11, No. 2. New York, *Scientific American*

Brooks, A., G. Lithgow and T. Johnson (1994) "Mortality Rates in a Genetically Heterogeneous Population of *Caenorhabditis elegans*," *Science*, 263, 668-671.

Brugiavini, Agar (1999), "Social Security and Retirement in Italy," Editors: Gruber, Jonathan and David A. Wise, *Social Security and Retirement Around the World*. A National Bureau of Economic Research Conference Report. Chicago and London: University of Chicago Press.

Calfee, John E (2000). "Prices, Markets, and the Pharmaceutical Revolution." Washington, D.C: The AEI Press.

Cigno, Alessandro and Furio C. Rosati, "Jointly Determined Saving and Fertility Behaviour: Theory and Estimates for Germany, Italy, UK and USA," *European Economic Review*, 40(1996) 1561-1689.

Congressional Budget Office (1999), "The Long-Term Budget Outlook: An Update," December 14, 1999. Washington. Congressional Budget Office.

Cutler, David and Mark McClellan and Joseph Newhouse (1998). "The Costs and Benefits of Intensive Treatment for Cardiovascular Disease." Cambridge, Mass: National Bureau of Economic Research, 1998.

Denver Summit of The Eight, "Communique," June 20-22, 1997, Denver, Colorado

Economic Policy Committee (2000), *Progress Report on the Impact of Ageing Populations on Public Pension Systems*. Opinion Addressed to the European Council of Ministers and the European Commission. EPC/ECFIN/518/00-EN -- Rev.1, Brussels, November 6.

Ermisch, John and Naohiro Ogawa (1994), "Age at Motherhood in Japan," *Journal of Population Economics*, official organ of the European Society for Population Economics, Vol. 7, No. 4, Spring. Berlin, Germany: Springer-Verlag, pp. 393-420.

*The European Labour Market in Light of Demographic Change*, European Commission, Employment & Social Affairs, 1999.

Eurostat, *Demographic Statistics, 1997*. Luxembourg: Office for Official Publications for the European Communities.

Frey, William H. and Ross, C. DeVol (2000), "America's Demography in the New Century: Aging Baby Boomers and New Immigrants as Major Players," Milken Institute, Santa Monica, Calif., March 8.

Fries, James F. (1980), "Aging, Natural Death, and The Compression of Morbidity," *The New England Journal of Medicine*, July 17.

Fuchs, Victor R. (1998), "Provide, Provide: The Economics of Aging," National Bureau of Economic Research, June 4.

Gompertz, Benjamin (1825), "On the Nature of the Function Expressive of the Law of Human Mortality," *Philosophical Transactions* 27:510-519.

Gruber, Jonathan and David A. Wise, editors. Gruber, J and D. A. Wise (1999), "Introduction and Summary," *Social Security and Retirement Around the World*. Chicago and London: The University of Chicago Press, 1999, p. 29.

Gribbin, August (2000a), "Diabetes therapy cuts need for shots," *Washington Times*, June 6, 2000, p. 1.

Gribbin, August (2000b), "Gene therapy spurs growth of new blood vessels," *Washington Times*, August 29, 2000, p. 1.

Griffith, Victoria (2000), "Dangerous Promise," *Weekend FT (Financial Times)*. London, England: May 27-28, p. II.

Group of Ten (1998). "The Macroeconomic and Financial Implications of Ageing Populations." Basel, Switzerland: Bank for International Settlements, April.

Hantrais, Linda, editor (1999), *Interactions Between Socio-Demographic Trends, Social and Economic Policies*," Cross National Research Papers, Fifth Series. Cross-National Research Group, European Research Centre, Loughborough University, Leicestershire, Great Britain, April, pp. 3-19.

Harman, D. (1955): "Aging: A theory based on free radical and radiation chemistry." *Journal of Gerontology*, 11:298-300.

Hayflick, L. (1997), "The Cellular Basis for Biological Aging," in: Finch L.E., Hayflick, L., editors, *Handbook of the Biology of Aging*. New York: Van Nostrand Reinhold, 1977: 159-86.

Henig, Robin Marantz (2000). "Living Longer: What Really Works?" *Scientific American Presents*, Volume 11, No. 2, Summer, p. 35.

Jacobzone, S. and E. Cambois, E. Chaplain, J. M. Robine (1998), "The Health of Older Persons in OECD Countries: Is It Improving Fast Enough To Compensate For Population Ageing?" *Labour Market and Social Policy – Occasional Papers No 37*. Paris: Organization for Economic Cooperation and Development.

Kannisto, Vaino (1994), "Development of Oldest-Old Mortality, 1950-60." Odense University Press, Odense, Denmark. Kannisto, V. (1996), *The Advancing Frontier of Survival: Life Tables for Old Age*, Odense University Press, Odense, Denmark; Kannisto, v. J. Lauritsen, A. R. Thatcher, J. W. Vaupel (1994), "Reductions in Mortality at Advanced Ages: Several Decades of Evidence from 27 Countries," *Population and Development Review* 20(4): 793-810.

Kannisto, V. (1994) *Odense Archive of Population Data on Aging*.

Kenyon, C., T. Cheng., E. Geusch, A. Rudnor and R. Tabtiang (1993). "A *C. elegans* Mutant That Lives Twice as Long as Wild Types," *Nature*, 336, 461-464.

Kohl, Richard and O'Brien, Paul (1998), "The Macroeconomics of Ageing, Pensions and Savings: A Survey," *Economics Department Working Papers*, No. 200. OECD, Paris.

Lee, Ronald (1993), "Modeling and Forecasting the Time Series of U.S. Fertility: Age Patterns, Range and Ultimate Level," *International Journal of Forecasting*, 9:187-202.

- Lee, Ronald D. and Lawrence R. Carter (1992), "Modeling and Forecasting U.S. Mortality," *Journal of the American Statistical Association*, September 1992, Vol. 87, No. 419, pp. 659-671.
- Lee, Ronald and Shripad Tuljapurkar (1997), "Death and Taxes: How Longer Life Will Affect Social Security." *Demography* Vol. 34, pp. 67-81.
- Lee, Ronald and Shripad Tuljapurkar, "Population Forecasting for Fiscal Planning: Issues and Innovations." Auerbach, A. and R. Lee, editors, *Demography and Fiscal Policy*, Cambridge University Press. Forthcoming.
- Lee, Ronald and Shripad Tuljapurkar (1994), "Stochastic Population Projections for the United States: Beyond High, Medium and Low," *Journal of the American Statistical Association* 89 (428): 1175-1189
- Leibfritz, Willi; Roseveare, Deborah; Fore, Douglas; Wurzel, Eckhard (1996), "Ageing Populations, Pension Systems and Government Budgets – How Do They Affect Saving?" *Future Global Capital Shortages: Real Threat or Pure Fiction?* Paris: Organization for Economic Cooperation and Development.
- Lubitz, J. and G. Riley (1993). "Medicare program expenditures," *Health Care Financing Review* 1992 Annual Supplement: 23-54.
- Matthews, Robert (2000), "Breakthrough as scientists discover cure for arthritis." London: *electronic Telegraph*, Issue 1983, Sunday, October 29.
- Manton, K.G. and Burton Singer (1994), "What's the Fuss About Compression of Mortality?" *Chance*, Vol. 7, No. 4, pp. 21-30.
- Manton, K.G., L. Corder and E. Stallard (1997), "Chronic Disability Trends in Elderly United States Populations, 1981-1994," *Proceedings of the National Academy of Science*, Vol. 94, pp. 2593-2598.
- Manton, Kenneth G., Eric Stallard, and Burton H. Singe (1994), "Methods for Projecting the Future Size and Health Status of the U.S. Elderly Population," Wise, David A. (Ed.), *Studies in the Economics of Aging*, Chicago: University of Chicago Press, pp. 41-77.
- The Militant* (2000). "Greens push German gov't attack on pensions," New York: *The Militant*, Vol.64/No.45, November 27, 2000
- National Institutes of Health. In search of the secrets of Aging, NIH Publication Number 93-2756.
- National Institute of Population and Social Security Research of Japan, *Population Projections for Japan: 1996-2050*, Tokyo, 1997.

*National Vital Statistics Reports*(2000), Center for Disease Control and Prevention, National Center for Health Statistics, Volume 48, Number 3, March 28, pp. 35-36.

Organization for Economic Cooperation and Development (1998), *Aging Populations: The Social Implications*, Paris: OECD.

Organization for Economic Cooperation and Development (2000), *OECD Economic Surveys. Italy*. Paris: OECD, May.

Oxley, Howard and Maitland MacFarlan (1994).“Health Care Reform: Controlling Spending and Increasing Efficiency. Paris: Organization for Economic Cooperation and Development.

Pagani, Steve (2000), Reuters, “Deficit to Drop to 1.3% of GDP This Year,” *Italy Daily*, Published jointly by *International Herald Tribune* and *Corriere Della Sera*, Rome, June 30, p. 1.

PAREXEL International Medical Marketing Services (2000), “Biotechnology’s Impact on Disease of the Elderly: A White Paper.” Washington, D.C.: Biotechnology Industry Organization, September.

Roseveare, Deborah; Leibfritz, Willi, Fore, Douglas; and Wurzel, Eckhard (1996), “Ageing Populations, Pension Systems and Government Budgets: Simulations for 20 OECD Countries,” Working Paper No. 168. Paris: OECD.

Rush-Presbyterian-St. Luke’s Medical Center (2000), “Gene Therapy Shown To Protect and Reverse the Debilitating Effects of Parkinson’s Disease in Pre-Clinical Studies.” Chicago, Rush-Presbyterian-St. Luke’s Medical Center Press Release, October 27.

Sartor, Nicola (1999), “Generational Accounts for Italy,” Editors, Auerbach, A. J. and L. J. Kotlikoff and W. Leibfritz, , *Generational Accounting around the World*. Chicago and London: The University of Chicago Press.

Schwartz, William B. (1998), *Life Without Disease: The Pursuit of Medical Utopia*. Berkeley: University of California Press.

Seike, Atsushi, Hitoshi Hayami, Masahiro Abe, Masahiko Tsutsumi, Atsuhiko Yamada, Osamu Ichinose, Masahito Nakajima (1998), “Analysis of the Utilization of Older People’s Human Capital in the Labor Market in the Aging Society.” *The Economic Analysis*, No. 155, October. Tokyo, Japan: Economic Research Institute of the Economic Planning Agency.

Shoven, John B., Michael D. Topper, and David A. Wise (1994), “The Impact of the Demographic Transition on Government Spending,” Wise, David A. (Ed.), *Studies in the*

*Economics of Aging*. National Bureau of Economic Research. Chicago and London: University of Chicago Press, pp. 13-37.

Skinner, Jonathan and John E. Wennberg (1998), "How Much is Enough? Efficiency and Medicare Spending in the Last Six Months of Life." Cambridge, Mass: National Bureau of Economic Research, Working Paper 6513.

Social Security Administration (U.S.) (1998), *Population Projection: 1997*, [www.ssa.gov](http://www.ssa.gov).

Squires, Sally (2000), "New Weapons Against Alzheimer's Disease," *Washington Post Health Magazine*, July 18, p. 9.

Taubes, Gary (2000). "The Famine of Youth." *Scientific American Presents*, Volume 11, No. 2, Summer, p. 48.

Takayama, Noriyuki (1997), "Japanese and American Social Security Systems: Grappling with the Future," Speech and discussion given at Japan Information and Culture Center, Embassy of Japan, Washington, D.C., March 27.

Truglia, Vincent J. (2000), "Public Sector Pensions in Industrialized Countries: A Rating Agency Perspective," a paper presented at "The Graying of the Industrial World," a conference sponsored January 25-26, by the Center for Strategic and International Studies as part of its Global Aging Initiative

Tuljapurkar, Shripad (1997), "Taking the Measure of Uncertainty," *Nature*, Vol. 387, June 19, p. 760

Tuljapurkar, Shripad; Li, Nan; Boe, Carl (2000), "The Universal Pattern of Mortality Decline in the G-7 Countries," *Nature*, June 15.

Turner, Dave; Giorno, Claude; De Serres, Alain; Vourc'h, Ann, and Richardson, Pete (1998), "The Macroeconomic Implications of Ageing in a Global Context," Economics Department Working Papers, No. 193. Paris: OECD.

United Nations (2000), *Replacement Migration: Is It A Solution to Declining and Ageing Populations*, New York, New York. Population Division, Department of Economic and Social Affairs, United Nations Secretariat, March.

United Nations (1999), *World Population Prospects, The 1998 Revision*, Volume I, Comprehensive Tables, published by the United Nations Secretariat's Population Division.

U.S. Census Bureau (2000), International Data Base, May 10, 2000 update.

Vaupel, J. W. (1997) "Demographic Analysis of Aging and Longevity," Speech delivered to the XXIIIrd IUSSP General Population Conference, Beijing, China, October 17, 1997.

Vaupel, J. W., B. Jeune (1995), "The Emergence and Proliferation of Centenarians" in B. Jeune, J.W. Vaupel (eds.) *Exceptional Longevity*, Odense University Press, Odense, Denmark.

Vita, Anthony J., Richard B. Terry, Helen B. Hubert, and James F. Fries (1998). "Aging, Health Risks, and Cumulative Disability," *New England Journal of Medicine*, Vol. 338, No. 15, April 9, pp. 1035-1041.

World Bank (1994), *Averting the Old Age Crisis: Policies to Project the Old and Promote Growth*. New York: Oxford University Press.

Zeng, Y., J. W. Vaupel, Z. Wang (1997) "Household Projection Using Conventional Demographic Data," in W. Lutz and J. W. Vaupel (Eds.) *Rethinking Population Projections*.