

## **Pacific Economic Cooperation Council**

Pacific Economic Outlook: Structure 2007 – Aging and Economic Growth Potentials in the Pacific Region Background Papers

# THE UNITED STATES

#### JEFFREY B. NUGENT AND GUILLAUME VANDENBROUCKE\*

#### ABSTRACT

Like other countries with low fertility rates and declining mortality rates, the United States has been experiencing considerable aging of its population. Also, with rather continuous increases in wage rates, capital accumulation, capital gains, and pension systems, people have been retiring earlier and spending more years in retirement. Many of these trends are expected to continue, thereby limiting the growth of its labor force, continuing to lower private savings rates and jeopardizing fiscal balances and the sustainability of the social security system. The effects of aging on innovation could also be negative, again lowering future economic growth. This paper examines the US experience in these respects, identifies the most significant adjustment mechanisms (including immigration) which could mitigate the adverse effects of aging on growth. Among the latter are age-specific labor force participation rates, savings rates, capital gains, fiscal balances, rates of return on capital, productivity, especially of older workers, and changes in public policy. Once these adjustment mechanisms are considered, the likely effects seem much less threatening.

#### 1. INTRODUCTION

Like other developed countries with low and declining mortality rates and low fertility rates, the United States is experiencing considerable demographic change. Among the most important of these changes are rising shares of the elderly in the population and, as a partial offset, immigration (legal and illegal) in the middle age groups. With increasing education and continual technological improvements, income and wealth have also been increasing. Indeed, the increases in wage rates and accumulation of wealth have been accompanied by capital gains due to increases in housing prices and the values of financial assets. Rising wealth and the increased availability of pension systems have been causing people to retire from the labor force earlier. There also seem to be secular changes in tastes from one generation to another, causing savings rates to fall.

Many analysts view these trends as indicating future declines in labor force participation, innovation, productivity, savings and investment, and therefore as harbingers of perhaps considerably slower economic growth in the next quarter century. The challenges posed by these trends are indeed substantial. This paper examines these trends and the various adjustment mechanisms employed to deal with their foreseen but unwanted consequences. Because of the potentially important adjustment mechanisms by individuals, businesses and government policy, the authors see little basis for believing that future growth is necessarily doomed. At the same time, however, it is by no means clear that the forthcoming responses will be sufficient to avert a significant reduction in growth.

The paper is organized as follows. Section 2, which follows, is devoted to two simple models aimed at identifying the fundamental demographic and economic consequences of rising wages from one cohort to another. Section 3 identifies the de-

<sup>\*</sup> The authors express their appreciation to the U.S. Department of Education's VI-b funds and the Center for International Business Education and Research (CIBER) of USC's Marshall School of Business for travel support, and to Stephanie Matthews and Mohamed Saleh for their help in preparing tables. They also express their appreciation to Akira Kohsaka, Johannah Branson, Chia-Yen Yang, Solikin, Cayetano Paderanga, Takashi Oshio, Kim Dietrich, Tony Makin, Ichiro Otani and especially Kazuo Ogawa, for their comments on earlier versions of this paper.

mographic trends with respect to the distribution of the population by age group, labor force participation, retirement age, years of retirement, working hours, and immigration. Section 4 examines the effects of the demographic changes on wealth accumulation, finance, private as well as government saving and productivity growth. It also calls attention to some heretofore largely overlooked influences such as relative price effects and cohort changes in life styles. Section 5 examines the policy implications derived from a quantitative examination of future growth prospects as well as the preceding analysis. It also identifies some potentially important adjustment mechanisms that may serve to mitigate the effects of aging on growth.

#### 2. AGING: SOME FUNDAMENTAL EFFECTS

The purpose of this section is to present some simple models that provide useful insights into the fundamental forces lying behind both the determinants and effects of population aging. The first subsection shows the effects of wealth accumulation and wage rates on fertility and hence population aging while the second shows the effects of population aging and rising wages (and wealth) on retirement.

#### 2.1 LABOR SUPPLY AND FERTILITY

Consider an agent with preferences defined over consumption, leisure and the number of children he chooses to have. Let such preferences be represented by the following utility function:

$$U(c,n,\lambda) = \frac{\left(c^{\alpha} n^{1-\alpha}\right)^{1-\sigma}}{1-\sigma} + A\lambda$$
(1)

where the variables c, n and  $\lambda$  represent consumption, the number of children, and leisure time, respectively. Suppose that each child requires the adult agent to spend time on it and hence outside the labor market. More specifically, suppose that each child requires  $\lambda$  units of time. Let the total time endowment of an agent be normalized to one. For an agent with n children, total leisure time is:

$$\lambda = 1 - \gamma n - h \tag{2}$$

where h represents hours spent working in the market. The agent's maximization problem can be written

$$\max_{c,n,h} \left\{ \frac{\left(c^{\alpha} n^{1-\alpha}\right)^{1-\sigma}}{1-\sigma} + A\left(1-\gamma n-h\right): c = wh \right\}$$
(3)

where w represents the real wage rate. Let  $\lambda$  represent the Lagrange multiplier associated with the budget constraint. The optimality conditions for this problem are:

$$c: \alpha \left( c^{\alpha} n^{1-\alpha} \right)^{-\sigma} \left( c/n \right)^{\alpha-1} = \lambda$$
(4)

$$n: (1-\alpha) \left( c^{\alpha} n^{1-\alpha} \right)^{-\sigma} \left( c/n \right)^{\alpha} = A\gamma$$
<sup>(5)</sup>
<sup>(6)</sup>

$$h: A = \lambda w$$

Equation (5) represents the relevant tradeoff inherent in the fertility choice. The

left-hand side of the equation represents the marginal utility benefit of an additional child and the right-hand side the marginal cost which is the product of the marginal utility of leisure, A, and the marginal time cost of a child,  $\gamma$ . The solution for fertility is

$$n(w) = Cw^{\alpha/\sigma - \alpha} \tag{7}$$

where C is a constant given by

$$C = \left[\frac{A}{\alpha} \left(\frac{1-\alpha}{\alpha\gamma}\right)^{\alpha-1} \gamma^{\sigma\alpha}\right]^{-1/\sigma}$$
(8)

Optimal fertility is a declining function of the real wage rate when (as would seem realistic)<sup>1</sup>  $\sigma > 1$ . Optimal labor supply is then given by

$$h(w) = \frac{\alpha}{1 - \alpha} \gamma C w^{\alpha/\sigma - \alpha}$$
<sup>(9)</sup>

Therefore, *h* also decreases as the real wage rate increases as long as  $\sigma > 1$ . To obtain parameters for this model, we solve the following minimization problem

$$\min_{\alpha,\sigma,\gamma,A} \sum_{t \in T} (n_t - n(w_t))^2 + (h_t - h(w_t))^2$$
(10)

where the set T is defined as  $T = \{1830, 1840, \dots, 1990\}$ . The solution is

α	σ	γ	A	
0.60	5.63	0.079	0.35	

Figure 1. Fertility in the long-run: the model simulation compared with actual US data



<sup>1</sup> Standard empirical estimates of  $\sigma$  are between 1 and 3. Laitner and Silverman (2005), for instance, estimate  $\sigma$  to be in the range of 1.49 to 1.58.





#### **2.2 RETIREMENT**

Next, consider a household living for T periods and choosing his consumption and saving rate, as well as the date at which he should retire, R. Suppose his preferences are defined over lifetime consumption, and leisure time enjoyed during the retirement period. Let such preferences be represented by the following utility function

$$\int_{0}^{T} e^{-\rho t} \frac{c(t)^{1-\sigma} - 1}{1 - \sigma} dt + A(T - R), \quad A, \sigma > 0$$
(11)

where  $\rho$  is the subjective discount rate and c(t) is consumption at instant *t*. The term A(T-R) is the utility from time spent retired (leisure). Before retirement, the household only works and receives a wage rate denoted by w(t). Assume that he is born without wealth and has to repay his debt before his life is over. His lifetime budget constraint can then be written as:

$$\int_{0}^{T} e^{-rt} c(t) dt = \int_{0}^{R} e^{-rt} w(t) dt .$$
(12)

The left-hand side of (12) represents the present value of consumption spending over the individual's lifetime. The discount rate, r, is assumed to be constant. The right-hand side represents the present value of income throughout the working life of the household. An underlying assumption is that there exists a market in which the household can freely lend and borrow at rate r.<sup>2</sup> The optimization problem of the household is then

$$\max_{c(t),R} \left\{ \int_{0}^{T} e^{-\rho t} \frac{c(t)^{1-\sigma} - 1}{1-\sigma} dt + A(T-R) : \int_{0}^{T} e^{-rt} c(t) dt = \int_{0}^{R} e^{-rt} w(t) dt \right\}$$
(13)

The optimality conditions associated with c(t) and the choice of the retirement

$$\int_{0}^{T} e^{-rt} c(t) dt = \int_{0}^{R} e^{-rt} w(t) (1-\tau) dt + b \int_{R}^{T} e^{-rt} dt$$

where  $\tau$  represents a labor income tax rate and b a social-security benefit. In this framework, an increase in b or a decrease in have the same effects as an increase in the wage rate in the original model: they make retirement more affordable and therefore reduce R. For a deeper discussion of social security, one needs a more refined theory of the social security taxes and benefits. This is beyond the scope of this simplified example.

<sup>&</sup>lt;sup>2</sup> One could write the household's budget constraint as

date, R, are

$$c(t):e^{(r-\rho)t}c(t)^{-\sigma} = \lambda$$
(14)

$$R: A = \lambda e^{-rR} w(R) \tag{15}$$

where  $\lambda$  is the Lagrange multiplier associated with the lifetime budget constraint. Equation (14) implies that consumption grows at a rate given by  $(r-\rho)/\sigma$ , i.e.  $c(t) = c(0)e^{(r-\rho)/\sigma t}$  where

$$c(0) = \frac{\int_{0}^{R} e^{-rt} w(t) dt}{\int_{0}^{T} e^{(r-\rho)/\sigma t - rt} dt}.$$
(16)

To analyze the effects of life expectancy, T, and the real wage rate (w) on the optimal retirement decision, one needs to resort to a numerical solution of the system of equations above. First, suppose that the wage rate grows at the constant rate g, such that  $w(t) = w(0)e^{gt}$ . The initial wage rate w(0) is important to the analysis. Let us compare the retirement rate of two different cohorts. Differences in their wages are mostly due to differences in w(0) since the growth rates of wages within cohorts are quite stable. The parameters chosen for the baseline model are given below. They are picked such that, at the initial date 0, (e.g., 1850) an agent works almost all his life.

σ	ρ	γ	A	g	w(0)	Т
2.0	0.01	0.04	1.0	0.02	1.0	1.0

The solution in this case is R=0.98. As shown in Table 2, in 1850, the life expectancy at age 20 was an additional 38 years for a male. Thus, R=0.98 means that retirement arrives at age 0.98\*38+20=57.5, i.e., a few months before the end of expected life. Consider now the end of the twentieth century. Between 1850 and 1988, the real wage rate rose by 6.3 times (Williamson, 1995) and again according to Table 2, the life expectancy at age 20 rose by a factor of 1.4. By changing the values of T and w(0) accordingly, the optimal age of retirement becomes:

T = 1.4, w(0) = 6.3	T = 1.0, w(0) = 6.3
R = 0.55	R = 0.39

From the first column of the above table, facing both real wage growth and the increased life expectancy, a household chooses to retire earlier (R=0.55), and enjoy the leisure benefits associated with the lifestyle of a retiree. In the second column, where only the wage rate is increased, the overall fall in the age of retirement is much greater (R=0.39). Hence, it is clear that the basic force behind the fall in retirement age observed in the United States is the rise in real wages across cohorts. If life expectancy had not increased, households would have reduced their age of retirement even further, suggesting that, by itself, increased life expectancy induces households to retire later. They can afford to retire earlier because they became more productive during their working years.

#### 3. DEMOGRAPHIC CHANGES INCLUDING LABOR FORCE PARTICIPATION

To what extent have the aforementioned implications of the simple models of labor supply, retirement and fertility been fulfilled in practice? The purpose of this section is to identify the past and foreseeable demographic changes affecting the U.S. economy and its growth and to compare them with the predictions of the simple theoretical models. As in most countries, the primary factor triggering demographic change is mortality. But, especially at the macro level, fertility, labor supply before retirement, and retirement behavior are also affected by other influences including immigration.

#### **3.1 MORTALITY**

Mortality rates have fallen continuously in the United States over the last 150 years. While in earlier years much of the fall was confined to infant, child, maternal and middle age mortality, in the last 20 years especially, somewhat more of the decline in mortality has been in the older age groups. As a result, additional life expectancy at birth rose from about 38 in 1850, to 49 in 1900, 68 in 1950 and 77 in 2000 and as shown in Table 1 is expected to rise to about 84 in 2050 (or even higher if the "high series" projections in the bottom half of the table are used).

Generally speaking, females have had higher life expectancies at virtually all ages than men and whites higher than non-whites. Table 2 shows the expected number of years that both white and non white males could expect to live at ages 20, 60 and 80 in different years from 1850 to 2005. Whereas in the 120 years between 1850 and 1970 there was a ten year increase in the expected years of survival for white males at age 20 (from 40.1 to 50.2), for those at age 60 the increase was only a half year (from 15.6 to 16.1). During the mere 35 years from 1970 to 2005, however, white males at age 60 enjoyed a full three-year increase in their expected years of survival compared to an increase in survival of those at age 20 from 50.2 in 1970 to 56.8 in 2005.

Put another way, males reaching the age of 20 in 1850 had a probability of survival to age 65 of 40 percent in 1850, about 50 percent in 1900, 67 percent in 1950, over 80 percent by 1990 and by 2050 it is expected to be about 90 percent. The lower portion of Table 1 shows that, even a male who was 65, could expect to live another 15.5 years by 1995 and another 20.3 years by 2050. Even at age 85 a woman could expect to live another 6.5 years in 1995 and by 2050 another 9.4 years (via the middle series estimates). Clearly, the average adult is expecting to live more and more of his/her life above the age of 65, though the prospects are less bright for African-Americans.

#### **3.2 FERTILITY AND POPULATION GROWTH**

Fertility rates have also fallen sharply over time. Total fertility rates were about 7 in 1900 but, as shown in Table 3, had fallen to 3.5 in 1955, falling sharply to a low of 1.79 in 1980, but rising to another peak (2.11) in 2005. These rates are expected to decline again to 1.85 in 2050.

With rather continuous net in-migration into the U.S. at moderate rates, mostly in the young adult ages, the rapidly declining mortality and not inconsequential fertility have resulted in considerable population growth. As shown in Table 4, the population tripled between 1880 and 1950 and is expected to double again by 2010. The only period of quite slow growth was during the depression of the 1930s and World War II, which was followed by the baby boom of the 1950s and early 1960s and accelerated immigration.

#### 3.3 AGE STRUCTURE OF THE POPULATION AND THE SHARE OF THE ELDERLY

Table 5 shows the growth of the population disaggregated into different age groups including three groups of elderly, i.e., 60-74, 75-89 and 90 and over. Note that while the numbers in the 0-14 group are expected to not quite double between 1950 and 2050, those in the 60-74 age group are expected to quadruple, and those in the 75-89 group to rise almost ten-fold.

As shown in Table 6, the result of these different trends is the rapidly growing shares of the different elderly age groups in the total population. The share of the 65 and older group as a whole, which was only 4.1 percent in 1900, had reached 12.4 percent in 2000 and is expected to rise to 20.7 percent by 2050. Note that the sharpest growth between 2000 and 2050 will be in the 85 and over age group, rising from 1.5 percent in 2000 to 5.0 percent in 2050.

#### 3.4 LABOR FORCE PARTICIPATION, DEPENDENCE RATES AND RETIREMENT

According to Costa (1998), labor force participation of men aged 65 and over was 58 percent in 1930 but by 2001 it had fallen to 17.5 percent. Table 7 shows that for each of the age groups 55-61, 62-64, 65-69 and 70 and over, there was a sharp decline in labor force participation rates between 1963 and 1985. A decline also occurred for women during the same period but was much more modest and confined to those aged 65 and older. The surprise in this table is that, with the exception of men in the 55-61 age group, there was a sharp reversal in this trend between 1985 and 2005. According to data provided by Gendell (2006), moreover, between 1995 and 2004 and again with the exception of men aged 55-61, there was also an increase in the percentages of employed men and women in these older age groups who were working full-time.

There would seem to be several possible explanations for the surprising reversal in labor force participation of older Americans. First, consistent with the model in Section 2, life expectancy has continued to increase but wage rates have tended to stagnate.<sup>3</sup> Second, outsourcing pressures have exercised a rather strong depressing force on wages. Third, globalization (and the integration of over a billion workers from South and East Asia into the world economy) has meant an enormous increase in the world supply of labor relative to capital, again depressing wage rates. Fourth, as explained below, rules about mandatory retirement and for drawing on social security have been relaxed in such a way as to delay retirement.

Table 8 shows projections of labor force participation from the Bureau of Labor Statistics from 2010 to 2050 for all age groups and gender groups. While the labor force participation rate of elderly females is lower than that of elderly males and is expected to stay that way, there seems little expectation of further decline among either group between now and 2050. Moreover, past trends have shown increasing labor force participation and more average hours worked among those of working age, and especially among women at age 55, 60, and 62. Note also that there was even a modest increase at these same ages for men between 1984-5 and 1998-99. Note also from Table 8 that further increases in labor force participation rates of women aged 25-34, 35-44 and 45-54 are expected between now and 2030.

<sup>&</sup>lt;sup>3</sup> According to U.S. Department of Labor, Bureau of Labor Statistics, average weekly earnings (in 1982 dollars) of non-supervisory workers in the private sector were \$290 in 1979-80 but \$280 in 2003. Similarly, from the National Income Accounts, the share of wages and salaries in GDP has fallen from 67.7 percent in 1980 to 63.5 percent in 2003.

While there would seem to have been a slight turnaround in the labor force participation declines of the oldest Americans based on simple time series evidence, the people who are reflected in these trends are of course different people. Therefore, one would like to hold constant at least the birth cohorts of the people involved since failure to do so could lead to biased results and misleading projections. Daeumer and Hayward (2000) conduct just such an analysis by examining separately the trends in cohorts born in different periods. This shows that from one cohort to another there have been falling participation rates by age, indicating that there may have been some changes in tastes or life style preferences leading to declining participation rates. Another contributing factor (as suggested in Section 2) is the increase in wealth (to be analyzed in the next section).

As shown in Table 9, while there was a significant increase in the number of dependents aged 65 and over relative to the labor force between 1975 and 1985, between 1985 and 2004 this percentage declined only modestly. While another spurt is expected between 2010 and 2030, after that this percentage is expected to remain rather constant through 2050. At the same time, since 1975 and continuing to 2050, the number of dependents below 16 years of age per hundred in the labor force has been decreasing and is expected to continue to do so through 2014 and beyond. Another rather remarkable statistic is the sharp fall in the working age dependents between 1975 and 1994. Even though no further decrease in this portion of the dependency ratio is expected before 2014, once can see the total dependency ratio is expected to fall slightly between 2004 and 2014, though perhaps rising after that. Hence, even if the increase after 2014 should be more than modest, the total dependence ratio should still be somewhat below what it was in 1975.

#### **3.5 IMMIGRATION**

Still another determinant of labor force participation, labor force growth and the age composition of the population is immigration which, in a country with higher wage rates and better working conditions than in most other countries, can be quite substantially affected by immigration policy. Table 10 shows the rates of immigration into the United States by five or ten year periods historically up to the late 1990s. It also shows the breakdown of immigration by both gender and age group. Relative to the aging population of US citizens, immigrants are typically younger and often of working age. Hence, immigration has been biased towards people of greater likelihood to be in the labor force for relatively long periods of time. This bias is likely to remain, serving to reduce both the rate of population aging and the decline in labor force participation relative to what they would be without immigration. Another benefit of immigration to long-term growth may derive from the skill bias in immigration policy. Not only is immigration more open to not only young people of higher education and technical skills but also to entrepreneurs who bring their own enterprises or links with other enterprises and sources of technology abroad. Moreover, fertility rates are generally higher for immigrant populations than for the domestic population, thereby increasing the below-16 component of the dependency ratio. Nevertheless, the rate of immigration relative to the total population is unlikely to exceed 1 percent per year.

#### 4. SAVINGS, WEALTH AND PRODUCTIVITY IMPACTS OF DEMOGRAPHIC CHANGES ON GROWTH

While the aforementioned effects of aging on labor supply growth constitute one important reason for believing that aging will slow future growth of the US economy, there are other potential links to slower growth. Chief among these are effects on saving and investment and on productivity growth.

#### **4.1 LIFE CYCLE SAVINGS**

The most direct relation between aging and savings behavior is that suggested by the life cycle theory of consumption and saving wherein individuals (as intermediated by the institution of the household) have a rather constant level of consumption throughout their life even though their income varies from well below average in their youth to some peak at say age 55 before falling sharply especially after retirement. This pattern follows most directly from labor force participation and the effect of experience on earnings. This implies that savings are negative during youth, positive during adulthood, and then falling and eventually negative during old age. The latter pattern, however, can be mitigated by asset accumulation during working years and hence asset income continuing into retirement.

Table 11, based on US household-level data sets calibrated in such a way as to be consistent with aggregate values in the National Income and Product Accounts for 1997, illustrates the way in which actual saving rates out of private income varied by age group in that year. The first column of the table shows the relative importance of the incomes of households of each different age group in total private income. The figures in the second column represent the savings rates out of income. Those in the age groups 35-54 account for almost two-thirds of total private income and virtually all of the saving. By contrast, households in the youngest and two oldest groups (20-34, 75-84, and 85+) have negative savings rates out of income. Qualitatively, therefore, these findings are clearly supportive of the life cycle theory of savings. Note, however, that the negative savings rates of the two oldest groups are relatively small in magnitude and have very little effect on the total private savings rate, and that people in the 65-74 age group have positive savings rates (on average). Hence, it is rather obvious that the wealth accumulation pattern has a fairly significant effect, mitigating the sharpness of the life cycle predictions. Another factor blunting the direct effect of aging is that a substantial part of the increase in the share of the elderly in the population occurs at the expense of a decline in the size of the young age groups which as shown in Table 11 have the most negative savings rates of all.

Such calculations of personal savings rates suffer from two well-known and important shortcomings. First, they are based on computing saving only indirectly as private disposable income less private consumption. Unfortunately, purchases of durable goods are treated as consumption even though they may provide useful consumption services for many years after purchase. This means that measured consumption is an overestimate of true consumption and thus measured saving an underestimate of true saving. Second, income in the National Accounts does not include capital gains which can be used to finance consumption expenditures. Rogers, Todar and Jones (2000) estimate the resulting underestimate of private saving to be some 3 percent of GDP and rising over time due to the rising importance over time of both capital gains and the share of durable goods in total consumption.

The dramatic accumulation of wealth in the US has already been noted, along with its potentially deleterious effect on labor force participation and thereby growth. Indeed, several links between wealth and future income growth have been identified. First, from the simple model of Retirement in Section 2, wealth (or permanent wage increases) could have an indirect effect on private saving by way of earlier retirement or at least lower supply of labor hours in older years. Second, there could be an indirect effect on total savings by way of increased government expenditures, especially on social security and medical care for the elderly, resulting in lower public savings rates. There can also be a direct effect of wealth accumulation on saving (coming through the diminishing marginal benefits of such accumulation). Finally, in the last part of this section, we shall discuss other effects of aging on growth, such as those through innovation and technological change. Before turning to any of these effects, however, we attempt to describe how asset and debt accumulation vary by age and type. This is useful in part because of the aforementioned shortcomings in the way savings rates are calculated.

#### 4.2 WEALTH ACCUMULATION BY AGE AND TYPE OF ASSET

The most comprehensive data on wealth accumulation by households over time is based on the Federal Reserve's Survey of Consumer Finances. Unfortunately, these surveys are undertaken only every few years and date back on a comparable basis only to 1983. They show clearly that American households have increased both their assets and liabilities in real terms. For example, Table 12 shows that, in just over a decade (from 1992 to 2004), households headed by persons aged 65 and over almost doubled their mean net worth at constant prices of 2004. Since the net worth of the median household headed by someone 65 and over grew by considerably less, this shows that wealth inequality among the elderly grew quite considerably over this period. This data demonstrating the importance of asset accumulation well into old age contrasts rather sharply with the negative savings rates for these older age groups indicated in Table 11 Even though real net worth increased very little for those in the youngest age group, this too is quite inconsistent with the substantial negative savings rate in Table 11.<sup>4</sup>

These same surveys show that the share of financial assets in total assets rose sharply from 1992 to 2001 in households of most age groups. For example, for all households, the share rose from less than 32 percent in 1992 to 42 percent in 2001, but then fell temporarily back to about 36 percent by 2004. There was also considerable change in the composition of financial assets, the shares of checking accounts, certificates of deposit, life insurance, and bonds falling sharply but the shares of mutual funds, retirement accounts and stocks (equity) rising sharply.

Table 13 shows the changes over time in the percentages of households of young and old age groups holding various kinds of non-financial assets. Over the period 1983-2004, the percentages of households in the 65-74 and 75 and over age groups owning vehicles, a primary residence and equity in non-residential property were generally higher than those in other age groups and also rising quite sharply over time. Although not shown in the table, the same surveys also show similar comparisons among age groups in the case of both financial assets and debts. It is quite clear that the rising ability of older households to own vehicles and residences is facilitated by their ability to borrow on the basis of loans secured by these asset

<sup>&</sup>lt;sup>4</sup> This is not because they failed to accumulate assets (like homes and automobiles) but rather that their accumulation of such assets was virtually entirely offset by increasing debt in the form of mortgages and consumer credit.

holdings. Indeed, financial innovations like reverse mortgages have constituted an important means allowing seniors to live more independently in their own homes to a greater extent than had been possible in the past.

#### 4.3 WEALTH, RISK, UNCERTAINTY, RELATIVE PRICE EFFECTS AND INCOME TYPES

Several other potentially adverse effects of population aging should be mentioned. First, an aging society could imply changes in risk, risk aversion, and uncertainty, again with possible consequences for saving and investment. While the risks of premature disability have declined suggesting that precautionary saving may have declined, the continuing rise in life expectancy at age 65 and the high costs of medical care and assisted living could offset this influence since the financial costs of old age disability have probably increased. Although insurance markets for these new and growing risks have also developed (at least gradually), the net effects of these changes in risk and uncertainty on precautionary and other saving could be positive instead of negative as generally presumed.

Second, Kopecki (2005) has identified changes in the relative price of leisure activities as another possible factor that might affect labor force participation and saving behavior of the elderly over time. Since expenditures on such goods are entirely discretionary, such expenditures could be expected to be price-elastic. She constructed an historical series in the relative price of leisure goods, showing that the cost of leisure goods has fallen over time (and presumably could be expected to continue to fall). A snapshot of the time allocations of American men of different ages in 1985 presented in Godbey and Robinson (1997) shows that older men spend considerably more time on recreation than younger men. Consistent with her data on the falling relative price of recreation goods, Kopecki (2005) also showed that the share in household budgets devoted to such expenditures has increased sharply over time. Since time is required to consume leisure, the falling relative price of recreation goods may have contributed both to the rise in the share of such goods in the household budgets, especially among the elderly, and to the observed secular decline in labor force participation rates among the elderly.

While the relative price of leisure is likely to continue to fall, the relative price of medical care and assisted living are likely to continue to increase. Since these expenditures are likely to be much less price-elastic, this change in relative prices could increase labor force participation and savings in years before old age. But saving during old age would seem to be reduced by this change in relative price of medical care. Savings behavior can also be affected by the extent to which these price changes are expected since savings would be induced prior to old age only if people anticipate the cost increases ahead of them. Hence, for these reasons it is unclear whether savings rates will rise or fall as a result of these relative price changes. Should labor force participation of the elderly continue to fall, and the younger aged households continue to dis-save, private savings rates may well decrease in the years ahead. But, combined with rising life expectancy and stagnant or even falling real wage rates, private savings rates could also rebound.

Another theory of saving that is closely related to the life cycle theory and risk aversion theories discussed above, but also quite distinct from them, is the permanent income hypothesis. According to this theory, saving rates out of different types of income are likely to vary, for example, being lower for stable income sources such as permanent income than for more volatile and less secure sources of income. Certain types of income like social security income or pensions might be thought of as more stable than income from earnings or asset income. While for most age groups earnings are the dominant source of income and its relative importance has not changed very much, for older persons this is not the case. Table 14 shows how the sources of income have changed over time for households with heads 65 and older. Note that several of these sources have seen trend reversals beginning in the mid 1980s, the shares of the relatively unstable source of income, namely, asset income, rising sharply before that but falling since then. Likewise, the shares of relatively stable social security and pensions rose rapidly during the 1962-84 period, but not since then. Consistent with the aforementioned turnaround in labor force participation of the elderly (especially of elderly women), the share of earnings fell sharply until 1984 but has risen steadily since then.

Quite naturally, as shown in Table 15 the relative importance of these different income sources differs substantially from one income group to another. In particular, the shares of social security and public assistance accounted for over 90 percent of income for those in the lowest income quintile of elderly households, but only 11 percent of income for those in the highest income quintile. Correspondingly, earnings and asset income accounted for only 3.5 percent of income for those in the lowest quintile but almost 60 percent for those in the highest income quintile.

As noted above, many factors including demographic changes may have exerted influence on private savings rates. Quite a few of these influences would seem to have exerted negative effects on personal saving. Table 16 shows the observed time path of personal savings rates at five year intervals from 1960 to 2005. Consistent with the hypothesized negative effects of most of these influences, the overall trend in the personal saving rate has indeed been a downward one. Yet, once again, the series demonstrates contrasting trends between 1960-80 and 1980-2005 periods. During the former period the personal saving rate was rising slowly, but, between 1980 and 2005, it plummeted from 10 percent of personal disposable income to -0.5 percent. Even if the downward trend were adjusted a few percentage points for the aforementioned shortcomings in the measurement of personal savings via the national accounts, the decline would still be quite ominous. We shall return to this in Section 5 below.

### 4.4 SOCIAL SECURITY, MEDICARE, PUBLIC SAVING AND TOTAL SAVING

Next, we turn to the effects of population aging on government spending, government budget balances and hence government savings. While many types of government expenditures such as defense, law enforcement, diplomacy, and regulation are rather insensitive to changes in the age distribution of the population, some are. Table 17 separates out those which are age-related and shows the relative importance of each type and their distribution by age group. One can see that, except for education, these expenditures are rather strongly biased in favor of the older age groups. The two largest components being, not surprisingly, transfer payments for health and social security. Since these are mandated by law, without further adjustments in the rules covering social security and Medicare expenditures or in the tax rates to pay for them, these programs will not be sustainable. Indeed, continued population aging could be expected to contribute to increasing fiscal deficits, and declining national savings and investment rates in the years ahead. Despite the substantial shortcomings in the US social security system and Medicare and its financing, the achievements of the system should not be neglected. Recalling the evidence from Table 15 showing that social security constitutes an especially large portion of income of the poorest 40 percent of households, the strengthening of social security in the earlier years through 1980 and its subsequent maintenance at that level would certainly seem to have contributed to the substantial fall (by at least 8 percent) in poverty rates among the two oldest age groups between 1982 and 2004 reported in US Census Bureau Population Survey (2006).

Table 18 brings these various components of saving together for selected years between 1960 and 2006. The entries of this table are in absolute terms (in billions of US dollars). Note that despite a slight fall between 2000 and 2004, total gross saving has increased over the whole period including between 2004 and 2006. Of the various components of that saving, the two components that were falling were personal saving and net saving of the federal government. State and local government saving seems to have been restored to small positive numbers by 2006. One source of private saving has continued to increase throughout the period, namely, "undistributed corporate profits". Since these corporations are largely owned by US nationals, this should in principle also be considered as personal saving. Indeed, this is the result of a trend in such corporations away from distributing their profits in the form of dividends and toward reinvesting these profits for the sake of capital gains and future profits. Hence, this is still another reason for believing that the private saving picture and trend in the US is not as bad as indicated in Table 16 and the personal saving column of this table. Yet, in any case, it is quite clear that between 2004 and 2006 over half of total gross saving in the U.S. is due to foreign saving (essentially the current account deficit of the U.S.) As noted in Council of Economic Advisors (2006), the profitability of U.S. corporations has probably helped attract net lending from abroad, thereby allowing the net investment rate to be higher than it would have been without foreign financing.<sup>5</sup>

#### 4.5 PRODUCTIVITY, INNOVATION, AND GROWTH

Of course, direct and indirect effects on savings rates and labor supply are by no means the only links between population aging and economic growth. Other possible links include age-specific differences in productivity, on-the-job training and other forms of human capital expenditures and their relation to innovation and technological change. Bartel and Sicherman (1993) show that industries undergoing technological change tend to have lower labor turnover rates and workers with longer working careers, suggesting that retirement may be delayed by technological change. These authors suggest that the reason is that the benefits of on-thejob training are likely to be greater (but the rate of human capital depreciation may also be greater, thereby leading to the opposite conclusion), especially when technological changes are unforeseen. Using data from the 1966-83 National Longitudinal Surveys of Older Men, Bartel and Sicherman (1993) show that workers in industries with higher rates of foreseen technological change retire later than those in industries where technological change is slower or less well foreseen.

Some studies, though based on very limited and perhaps outdated data, have sug-

<sup>&</sup>lt;sup>5</sup> Discussion of the sustainability of this heavy dependence on foreign saving to finance domestic investment is postponed to the next section.

gested that productivity declines with age.<sup>6</sup> At the same time, however, most jobs have become less physically demanding, thereby partially compensating for the negative effects of rising wage rates and wealth, decreased uncertainty and the declining relative price of leisure on labor force participation of the elderly. Various analysts (e.g., Arrowsmith and McGoldrick, 1997) have pointed out that labor force participation rates can be raised by identifying new methods of outsourcing jobs to people working in their homes on more flexible work schedules.

Other age-related effects on long run growth may depend on financial markets. For example, Poterba, Venti and Wise (2005) suggest that the effects on long term growth will depend substantially on (1) the extent to which households switch from consumption into various kinds of retirement accounts, and (2) the effects thereof on the rates of return on these accounts. An important development already observed in this respect has been the change from the more savings-depressing employer-based defined benefit retirement plans to the more pro-savings individual retirement accounts.

One other bright spot in U.S. economic growth over the last decade has been the resurgence in productivity growth that had declined rather sharply between 1973 and 1995. Table 19 shows the differences in growth rates of output, hours, labor productivity and the sources thereof for the periods 1959-2004, 1959-1973, 1973-1995 and 1995-2004. These are taken from Jorgenson et al (2006) and are based on data provided by the Bureau of Economic Analysis. Note that the growth rates of output and labor productivity both fell by 1 percent per annum between the 1959-1973 and 1973-1995 periods. Since 1995, however, despite the fairly severe recession of 2001, the growth rate of output has rebounded to nearly what it was in the earlier period. Note that the rebound has not been due to growth of labor hours but rather to an accelerating rate of labor productivity growth (to 2.64 percent per annum during 1995-2004 from the 1.39 percent per annum during 1973-1995). Preliminary evidence suggests that this rather phenomenal resurgence in productivity growth has continued into 2006. The resurgence in productivity growth, no doubt, has also contributed to the attraction of foreign finance and the rather robust growth of corporate profits.

The table also illustrates a theme that Jorgenson and other economists have been highlighting, namely, the large role that the Information Technology (IT) sector has played in this productivity growth. Not only has IT capital been growing very rapidly (indeed at over ten percent per annum), thereby contributing to capital deepening, but also the IT sector has benefited from rapid Total Factor Productivity (TFP) growth. Two factors mitigating the growth rebound since 1995 are the declining growth in labor hours and labor quality. Indeed, the aging of the labor force and the decline in the growth of highly educated youth entering the labor force may well have been contributing to this and may be expected to continue to do so for some time to come. Note, however, that these negative influences are quantitatively rather small.

#### 5. FUTURE GROWTH PROSPECTS IN THE LIGHT OF POPULATION AGING AND POTENTIAL EFFECTS OF POLICY CHANGES DESIGNED TO COPE WITH AGING AND ITS CONSEQUENCES

Given the offsetting influences and uncertainty about future trends in the relative importance and stability over time of both the income sources and the income

<sup>&</sup>lt;sup>6</sup> See for example Australian Productivity Commission (2005) for Australia. Note, however, that older workers often have lower absenteeism rates than younger workers (Doering et al 1983).

groups of elderly, the net direction of these effects on private saving rates is by no means obvious. Moreover, since most of these individual effects are hard to quantify with accuracy, it is hard to tell how significant any such effects might be. Most likely, however, in quantitative terms the net effects will be small. Similarly, the effects of these changes on labor force participation, labor supply of both younger and older workers, the rate of innovation and labor productivity are also difficult to predict.

Clearly, then the net direction as well as magnitude of the aforementioned future effects of aging on savings rates, investment rates, fertility rates, labor force participation rates and overall growth rates will depend on a wide variety of household and other private sector behavioral adjustments. Each one of these may be difficult to predict individually, let alone together.

Our general hypothesis, however, is that many of these potentially negative effects of population aging on growth may be subject to behavioral and institutional adjustments which will limit their long-run impacts. Since considerable space would be required to discuss these comprehensively, we confine our attention to identifying several examples.

First, the discussion in Section 2 and 3 above traced population aging to preceding changes in fertility rates which, in turn, were due to rising wage rates, income and wealth. (The typical pattern wherein aging is realized is from a fertility boom followed by a fertility bust). But aging and other changes in the age structure of the population may have other effects that may be quite different. For example, if the age structure of the population and the age structure of the labor force becomes sufficiently affected, it may change the wage structure of different cohorts of workers. For example, as Easterlin (1987) has suggested, it could raise the return on human capital further, raising education and even possibly fertility rates above what they have been in recent decades.

Second, with the stock market and housing prices unlikely to appreciate at the rates of the last couple of decades, it is possible that the rate of wealth accumulation will be lower, inducing people to at least modestly reverse their declining saving and labor supply rates. Also, with old age constituting larger portions of expected lifetimes and the costs of health services and old age care expected to rise over time, two adjustments that as noted above seem already to have been taking place are (1) to work longer hours during working years and (2) to delay retirement. This is especially the case for women (because they outlive men).

Third, since travel is an important part of the leisure activities whose relative price has been falling but travel costs may be expected to rise due to rapidly rising energy costs, it is quite possible that this relative price change might reverse, decreasing these price-elastic expenditures on leisure in favor of other (less timeintensive) goods and services. Likewise, in view of the continually rising costs of medical care (which in the United States is largely due to paper work, insurance, legal costs and care delivery problems), it is quite possible that the current trend in the relative cost of medical care on consumption and hence lower savings rates will be reversed through efficiency –increasing organizational innovations.

Fourth, with foreseen problems in the sustainability of social security and private

pension schemes like those of the large automobile manufacturers, these important sources of income could look much less stable and secure in the future than in the past, thereby raising precautionary savings. .

Fifth, even if fertility rates and possibly even immigration rates should decline, with the capital requirements for the increasingly important IT component of capital also declining due to continuing TFP increases, the investment required to maintain steady-state capital per worker ratios at their current levels may also decline (Cutler et al 1990). If so, even if the national savings rate remains not much higher than it has been in the last few years, the capital labor ratio still could rise.

Sixth, if the effects of continuing integration of Asian and other developing countries with huge labor forces into the world economy should continue to depress wage rates, the rate of return on capital could rise.<sup>7</sup> This could be complemented by technological change, but, with the size of the economy and hence overall market size growing at a slower rate, one might also expect technological growth to slow down. But, this, in turn, could perhaps be offset by the effect of continuing growth in international competition on the incentive to innovate. Both these effects therefore, could contribute to higher labor supply growth and savings rates.

Even if these reversals and behavioral adjustments should not take place, productivity growth may continue at a rate sufficient to generate considerable growth. For example, Jorgenson et al (2006) foresee some negative effects of aging looming ahead, especially on savings and labor force participation, but believe that these will be relatively small, especially before 2015. Yet, their main conclusion is that, because there is no reason to believe that the productivity resurgence will dissipate in the near future, output growth should be able to continue at only slightly below 3 percent per annum over the 2005-2114 in their most likely scenario.

Even if more pessimistic projections prevail in these respects, as pointed out by Rogers et al (2000), much will depend on public policy, which could also be subject to considerable adjustment. While current failures to adjust fiscal policy are hardly heartening in this respect, note that, in the past at least, government policies have undergone some important adjustments. It is to these adjustments, both actual and potential, to which we now turn.

As noted above, labor force participation rates of older Americans had been falling sharply between the 1950s and 1970s. The progressive increase in Social Security, pension and medical benefits for the elderly is generally believed to have contributed to this trend since these benefits did not fully accrue to those continuing to work and earn more than a relatively low threshold amount of money.<sup>8</sup> By 1985, moreover, some 84 percent of American men aged 65 and over were no longer in the labor force and most were receiving social security payments.

As a result, even before that it became very clear that the "Pay-as-you-go" social security system, was not sustainable without important changes. To deal with this situation, in 1977 and again in 1983 the federal government passed amendments

<sup>&</sup>lt;sup>7</sup> Even aside from capital/labor ratios and marginal productivities, Brooks 2000 develops a model in which the elderly exchange equity capital for bonds (a safer assets) as they get older. Since older boomers, find themselves trying to sell their equities for bonds to an increasing small cohort, the model suggests that this would raise the price of bonds and lower the return on bonds. Note, however, that Poterba (2005) has found little evidence of effects of demographic changes on rates of return to assets from US time series data.

<sup>&</sup>lt;sup>8</sup> It should be recognized that until 1941 Social Security provided no income to people 65 and over whereas by the mid-1980s it had come to provide over 40 percent of the wage earnings of a full career single worker of average income, and over 60 percent if that worker had a dependent, nonworking spouse.

to the Social Security Act which brought an end to the progressive liberalization of benefits, even trimming them modestly. The ceiling on earnings above which an otherwise social-security-eligible person would lose some of his/her benefits was increased as was the reward for delaying the initial receipt of benefits. This more age-neutral policy was gradually phased in until completed in 2004. After 2004, therefore, there has no longer been any retirement penalty for delaying retirement beyond the normal retirement age (Burtless and Quinn, 2000). The 1983 amendment to the Social Security Act provided that by 2022 the normal retirement age would gradually rise from 65 to 67.

Another adjustment already under way is with respect to private sector pension programs. These had been dominated by defined benefit plans, which, like social security, embodied age-specific disincentives for work. In particular, these lifetime benefits would decline if one delayed beginning them past a certain designated age. However, over time, the relative importance of these types of private pension plans has declined in favor of defined contribution plans which have no such disincentive for working past a certain age.<sup>9</sup>

Another change has been in both federal and state policies with respect to mandatory retirement. In the early 1970s about half of all American workers were subject to mandatory retirement at a certain age (often 62-65). In 1978, this age was raised from 65 to 70 and, in 1986, all such mandatory retirement provisions were outlawed (on the grounds that they were discriminatory by age). For this reason, it is quite possible that these changes in public policy may have been at least partially responsible for the rising labor force participation rates among elderly households observed since the mid-1980s, especially for women.<sup>10</sup>

#### 6. CONCLUSION

The United States population is indeed aging, suggesting the possibility of declining labor force participation rates, private and public savings rates, investment rates, productivity growth and overall income growth rates. Yet, in view of the multiple ways in which household, business and government sectors may adjust, pessimistic projections of future growth are by no means assured. Households can react (and indeed already have begun to react) by working longer and more intensively during working years, saving more for old age, and seeking more efficient means of accumulating wealth and dealing with risk. While fertility rates are expected to decline slightly in the years ahead, this is in part because female labor force participation rates are likely to continue to rise. Businesses may adjust by trying to modify their work environments and outsource to elderly workers working on a more flexible basis in their homes. Such adjustments are facilitated by the rising importance of IT capital in the total capital stock and the trend in industrial structure toward services. Governments can adjust by increasing social security and Medicare taxes and reducing expenditures through inducing greater transparency and competition in service provision. Given that there will be fewer young people to educate, government and younger households should also save more as a result

<sup>&</sup>lt;sup>9</sup> Many unfunded liabilities however remain in the older plans and indeed there is some concern that the government may feel compelled to bail out some of these programs as they have in the case of airlines.

<sup>&</sup>lt;sup>10</sup> In 2005, in response to popular concerns for the sharply rising costs of pharmaceutical products, there was a slight reversal in the direction of government policy in that the medical benefits for prescription drugs for those on Medicare were increased. An attempt has been made to offset these costs by encouraging the elderly to enroll in lower cost medical groups (managed care). Recognizing that further adjustments will be necessary to keep the social security and Medicare systems financially viable, efforts were made in 2005 and 2006 to further amend these entitlement programs, but thus far without success. Clearly, as time goes on, the need for major adjustments will only become more urgent. Even in the absence of action, fears of the possible financial bankruptcy of social security and Medicare may trigger older workers to believe they should work longer and save more than they would have had they deemed these programs entirely secure and financially viable.

of not having to invest as much in schooling and health for the young, finding a way to finance the larger social security and Medicare programs should not be out of the realm of possibility.<sup>11</sup>

In any case, with relatively robust immigration rates and somewhat higher fertility rates than elsewhere, the United States is likely to feel less stress from population aging than many other high and even middle income countries. But even if it does, as Easterlin (1996) has pointed out, there is still no historical evidence suggesting that either slow population growth or a substitution of older dependents for younger ones will inevitably reduce growth.

<sup>&</sup>lt;sup>11</sup> This would be especially true if as suggested by Wander (1978) for Germany it costs more to bring a child up to the age of 20 than it does to support a retired person until his or her death.

#### Table 1. Life expectancy

Year	Life Expectancy at Birth						
	Total	Male	Female				
1950	68.2	65.6	71.1				
1960	69.7	66.6	73.1				
1970	70.8	67.1	74.7				
1980	73.7	70.0	77.4				
1990	75.4	71.8	78.8				
2000	77.0	74.3	79.7				
2025	80.6	77.6	83.6				
2050	83.9	81.2	86.7				

	1995	2050			
		Middle Series	Low Series	High Series	
Male					
At Birth	72.5	79.7	70.9	86.4	
Additional Years At Age 65	15.5	20.3	15.3	25.2	
Additional Years At Age 85	5.2	6.8	5.2	11.1	
Female					
At Birth	79.3	84.3	78.8	92.3	
Additional Years At Age 65	19.2	22.4	19.1	29.9	
Additional Years At Age 85	6.5	9.4	6.6	14.9	

Source:: http://www.cdc.gov/nchs/data/hus/hus05.pdf#027

## Table 2. Additional years of life at differnt ages

Veer	20			60	80	
Tear	White Males	Non-White Males	White Males	Non-White Males	White Males	Non-White Males
1850	40.1	34	15.6			
1900	42.2	35.1	14.35	12.62	5.1	5.1
1950	49.5	43.7	15.8	15.3	5.88	7.07
1970	50.2	44.4	16.1	15.4	6.18	7.57
1980	52.45	47.9	17.6	16.5	6.76	7.22
1990	54	49.0	18.7	17	7.1	7.0
2000	55.7	50	20	17.5	7.6	7.4
2005	56.8	51.7	20.9	18.4	8.3	8.2

Source: U.S. Department of Commerce, Bureau of Census, Historical Statistics of United States.

### Table 3. Fertility rate

Year	1955	1960	1970	1980	1990	2000	2005	2015	2050
Total Fertility Rate	3.45	3.71	2.55	1.79	1.92	2.05	2.11	2.08	1.85

Source: U.S. Census Bureau at the following websites:

Projections- http://www.census.gov/population/projections/nation/summary/np-t1.pdf

Historical Statistics- http://www.census.gov/population/censusdata/table-2.pdf

### Table 4. Population past and future

Year	Population (in thousands)
1880	50,189
1900	84,371
1930	138,439
1950	151,326
1960	179,323
1970	203,302
1980	226,542
1990	249,439
2000	275,306
2010	299,862
2020	324,927
2030	351,070
2040	377,350
2050	403,687

Source: U.S. Census Bureau at the following websites: Projections- http://www.census.gov/population/projections/nation/summary/np-t1.pdf Historical Statistics- http://www.census.gov/population/censusdata/table-2.pdf

Year		Population (in thousands) by age group									
	0-14	15-29	30-44	45-59	60-74	75-89	90+				
1950	40,997	34,717	33,311	24,746	14,596	3,904					
1960	56,077	35,512	36,204	29,049	18,208	5,622					
1970	57,938	50,271	34,737	33,323	21,169	7,614					
1980	51,308	62,008	43,198	34,414	25,668	9,249	672				
1990	53,864	58,372	59,282	35,551	28,675	12,049	987				
2000	58,554	56,276	64,474	50,490	28,866	15,040	1,608				
2010	59,445	62,668	58,445	63,338	37,406	16,251	2,310				
2020	64,500	63,628	62,121	60,250	52,158	19,119	3,153				
2030	69,194	67,187	66,717	58,801	56,575	28,744	3,853				
2040	73,943	73,312	68,882	65,462	52,479	36,874	6,400				
2050	79,783	77,873	74,942	67,890	57,213	36,095	9,889				

#### Table 5. U.S. population by age group, 1950-2050

Source: The following websites: http://www.census.gov/popest/archives/pre-1980/

http://www.census.gov/popest/archives/1980s/80s\_nat\_detail.html

http://www.census.gov/population/www/projections/natsum-T3.html

Year	Age in years (% of total population)							
	65-74	75-84	85+	65+ (total)				
1900	2.9	1.0	0.2	4.1				
1910	3.0	1.1	0.2	4.3				
1920	3.3	1.2	0.2	4.7				
1930	3.8	1.3	0.2	5.4				
1940	4.8	1.7	0.3	6.8				
1950	5.6	2.2	0.4	8.1				
1960	6.1	2.6	0.5	9.2				
1970	6.1	3.0	0.7	9.8				
1980	6.9	3.4	1.0	11.3				
1990	7.3	4.0	1.2	12.5				
2000	6.5	4.4	1.5	12.4				
2010	6.9	4.2	2.0	13.0				
2020	9.5	4.6	2.2	16.3				
2030	10.4	6.6	2.6	19.7				
2040	9.0	7.4	3.9	20.4				
2050	9.0	6.6	5.0	20.7				

## Table 6. Share of the elderly in the total population 1900-2050

Source: Computed from source given in Table 5

No or	Men				Women			
rear	55 to 61	62 to 64	65 to 69	70 years and over	55 to 61	62 to 64	65 to 69	70 years and over
1963	89.9	75.8	40.9	20.8	43.7	28.8	16.5	5.9
1965	88.8	73.2	43.0	19.1	45.3	29.5	17.4	6.1
1970	87.7	69.4	41.6	17.6	47.0	32.3	17.3	5.7
1975	81.9	58.6	31.7	15.0	45.6	28.9	14.5	4.8
1980	79.1	52.6	28.5	13.1	46.1	28.5	15.1	4.5
1985	76.6	46.1	24.4	10.5	47.4	28.7	13.5	4.3
1990	76.7	46.5	26.0	10.7	51.7	30.7	17.0	4.7
1995	74.3	45.0	27.0	11.6	55.9	32.5	17.5	5.3
2000	74.3	47.0	30.3	12.0	58.3	34.1	19.5	5.8
2005	74.7	52.5	33.6	13.5	62.7	40.0	23.7	7.1

## Table 7. Labor force participation of persons ages 55 and over by age group and sex, 1963-2005

Note: Data for 1995 and later years are not strictly comparable with earlier data due to a redesign of the survey and methodology of the CPS.

Source: Current Population Survey (CPS), U,S. Bureau of Labor Statistics

Age Group	Total Percentages								
	2010	2020	2030	2040	2050				
16-24	66.5	66.5	66.0	65.9	65.5				
25-34	87.1	87.9	87.6	87.4	87.3				
35-44	86.0	86.5	86.4	86.3	86.2				
45-54	83.8	84.0	83.9	83.7	83.4				
55-64	60.9	60.8	60.1	60.7	60.3				
65-74	22.1	22.9	22.5	22.1	22.5				
75+	5.5	6.1	6.1	5.8	5.5				
Age Group		I	Percentages of Mer	า					
16-24	67.9	67.6	67.2	67.3	67.0				
25-34	93.1	93.0	93.0	92.9	93.0				
35-44	92.3	92.2	92.1	92.1	92.1				
45-54	87.8	87.3	87.3	87.1	87.1				
55-64	67.0	66.1	65.7	66.5	66.2				
65-74	27.7	28.5	28.0	27.8	28.2				
75+	7.7	8.1	8.1	7.7	7.2				
Age Group		Pe	ercentages of Wom	en					
16-24	65.1	65.4	64.8	64.6	64.1				
25-34	81.4	83.0	82.4	82.1	81.8				
35-44	80.0	81.1	81.0	80.7	80.5				
45-54	80.0	80.8	80.7	80.4	79.9				
55-64	55.2	55.8	54.9	55.3	54.7				
65-74	17.3	18.1	17.6	17.2	17.4				
75+	4.0	4.6	4.7	4.4	4.1				

## Table 8. Labor force projections

 $Source: Bureau \ of \ Economic \ Analysis \ ftp://ftp.bls.gov/pub/special.requests/ep/labor.force/clra1050.txt$ 

## Table 9. Economic dependency ratio, 1975-2004 and projected 2014, by age (Per hundred in the labor force)

Group	1975	1984	1994	2004	2014
Total population	126.3	98.3	99.2	98.3	96.3
Under 16	61.4	45.8	47.7	44.1	42.1
16 to 64	44.2	30.5	28.8	33.0	31.5
65 and older	20.7	22.1	22.7	21.2	22.6

Source: U.S. Bureau of Labor Statistics

Years	Rates per 1000 in Population	Percent Males	Percent under 14 years	Percent 1444 years	Percent 45 years and over
1847-1854	14	59	23	67	10
1855-1864	5.2	58	19	71	10
1865-1873	8.4	62	21	66	13
1874-1880	5.6	63	19	69	12
1881-1893	8.9	61	20	71	10
1894-1898	3.9	57	15	77	8
1899-1914	10.2	68	12	82	5
1915-1917	2.3	59	16	74	10
1918-1930	3.6	56	18	73	9
1931-1946	0.4	40	15	67	17
1947-1960	1.5	45	21	64	15
1961-1970	1.7	45	25	61	14
1971-1980	2.1	46	24	61	15
1981-1990	3.1	52	18	66	16
1991-1998	3.6	52	17	65	18

 Table 10. Immigration by gender and age and average rates

Notes: From 1918-1970, the age breakdown is "Under 16" and "16-44." From 1971 to 1998, the age breakdown is "Under 15" and "15-44."

Sources: The EH.Net Encyclopedia of Economic and Business History (http://eh.net/encyclopedia)1820-1970: Historical Statistics of the United States (1976). Years since 1970: U.S. Immigration and Naturalization Service (various years).

		Base Case fro	m Survey Data	20-64 versus 65 and Older		
Age	Share of Private Income (%)	Private Saving as Percentage of Private Income	Contribution to Aggregate Private Saving Rate	Private Saving as Percentage of Private Income	Contribution to Aggregate Private Saving Rate	
20-34	19.8	-26.3	-5.21	7.94	1.57	
35-44	26	11.1	2.89	7.94	2.06	
45-54	23.8	24.6	5.85	7.94	1.89	
55-64	13.1	23.1	3.03	7.94	1.04	
65-74	9.4	2.6	0.25	-0.08	-0.01	
75-84	5.8	-1.3	-0.07	-0.08	-0.01	
85+	2.2	-8.8	-0.19	-0.08	-0.01	
All	100	6.55 (average)	6.55 (sum)	6.55 (average)	6.55 (sum)	

Table 11. Private income shares and saving rates by age group, 1997

Source: Rogers, Toder and Jones (2000) based on various sources of household-level data, calibrated to be consistent with the aggregate values in the National Income and Product Accounts.

Table 12. Family net worth in thousands of U.S. dollars by age groups (1992- 2004)												
Age of Head (Years)	1992		1995		1998		2001		2004			
	Median	Mean										
Less than 35	12.1	59.9	14.8	53.2	10.6	74	12.3	96.6	14.2	73.5		
35-44	58.7	175.5	64.2	176.8	73.5	227.6	82.6	276.4	69.4	299.2		
45-54	74.3	353.2	116.8	364.8	122.3	420.2	141.6	517.6	144.7	542.7		
55-64	150.3	445.2	141.9	471.1	148.2	617	193.3	775.4	248.7	843.8		
65-74	129.6	377.7	136.6	429.3	169.8	541.1	187.8	717.9	190.1	690.9		
75 or more	114.5	281.2	114.5	317.9	145.6	360.3	161.2	496.2	163.1	528.1		

Source: Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances, Federal Reserve Bulletin.

			Investment	Investment Real Estate		Other	Any Non	
Age of Head (Years)	Vehicles	Primary Residence	Other Residential Property	Other Equity in N Residential Property		Ion-Residential Property		
Less than 35								
1983	83.3	38.7	10.4		10.3	9.1	87.2	
1989	80.6	37.6	7.9		10.3	9.4	83	
1992	84.1	36.9	8.2		8.5	8.2	86.1	
1995	83.8	37.9	4.2	3.6	8.3	7.2	87.1	
1998	78.3	38.9	3.5	2.7	7.2	7.3	83.3	
2001	78.8	39.9	3.4	2.8	7	6.9	83	
2004	82.9	41.6	5.1	3.3	6.9	5.5	88.6	
<u>65-74</u>								
1983	80.2	78.9	27.2		12.3	5.6	91.8	
1989	81.1	77.1	25		8.1	12.8	92.6	
1992	85.9	79.3	25.1		8.5	6.5	91.6	
1995	82.5	79.5	16.1	16.2	8.7	9	92.6	
1998	83.4	81.5	18.4	15.3	10.1	10.3	92	
2001	81.3	82.5	13.7	12.9	11.6	9.7	91.6	
2004	89.1	81.3	19.9	10.6	8	9	95.6	
<u>75 or more</u>								
1983	57.8	69.5	16.9		6.4	1.4	79.6	
1989	66.1	69.6	16.3		4.4	7.8	85.8	
1992	72.8	77	15.8		3.8	8.8	91.2	
1995	72.2	72.8	12.2	6.4	3.7	5.6	89.9	
1998	69.8	77	13.6	8.1	2.7	7	87.2	
2001	73.9	76.2	15.2	8.3	2.4	6.2	86.4	
2004	76.9	85.2	9.7	7.7	5.3	8.5	92.5	

# Table 13. Percentages of families holding non-financial assets, by younger and older age groupsand type of asset (1983-2004)

Source: Consumer Finances Survey Reports (1983-2004), Federal Reserve Bulletin.

Year	Total	Social Security	Asset Income	Pensions	Earnings	Other
1962	100	31	16	9	28	16
1967	100	34	15	12	29	10
1976	100	39	18	16	23	4
1980	100	39	22	16	19	4
1984	100	38	28	15	16	3
1988	100	38	25	17	17	3
1992	100	40	21	20	17	2
1996	100	40	18	19	20	3
1998	100	38	20	19	21	2
2000	100	38	18	18	23	3
2002	100	39	14	19	25	3
2004	100	39	13	20	26	2

## Table 14. Distribution of sources of income for married couples and nonmarried persons, age65 or older

Note: These data refer to the civilian non-institutionalized population.

Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement; 1963-2005, Survey of the Aged; and 1968 Survey of Demographic and Economic Characteristics of the Aged.

ncome Source	Lowest fifth	Second fifth	Third fifth	Fourth fifth	Highest fifth
Total	100.0	100.0	100.0	100.0	100.0
Social Security	82.6	83.4	66.6	47.5	18.9
Asset income	2.3	3.8	6.0	8.4	17.8
Pensions	3.5	7.0	16.6	25.7	21.2
Earnings	1.2	2.8	7.1	15.7	40.1
Public assistance	8.4	1.6	0.9	0.2	0.1
Other	2.0	1.5	2.7	2.6	1.9

## Table 15. Sources of income for married couples and nonmarried persons of age 65 or older

Note: Quintile limits are \$10,399, \$16,363, \$25,587, and \$44,129.

Source: Same as in Table 14.

Table 16. Personal saving rates in percent

Year	Percent of Disposable Personal Income
1960	7.3
1965	8.6
1970	9.4
1975	10.6
1980	10.0
1985	9.0
1990	7.0
1995	4.6
2000	2.3
2005	-0.5

Source: U.S. Bureau of Economic Analysis and Economic Report of the President

Age		Public Education (\$)			
	Social Security (\$)	Other Retirement (\$)	Health (\$)	All Other Publ	ic Transfers (\$)
0-19	108	_	532	107	3,779
20-34	58	33	404	561	1,200
35-44	205	48	694	608	521
45-54	418	1,078	746	707	0
55-64	1,950	1,078	990	707	0
65-74	7,620	2,862	5,836	591	0
75-84	8,901	2,862	9,463	591	0
85+	8,681	2,862	15,266	591	0
Average across total population	1,311	594	1,547	471	1,438

Table 17. Age-related per capita expenditures by all levels of government, 1997

Source: Same as in Table 11

Year	Total Gross Saving	Total Net Saving	Net Private Saving	Personal Saving	Undis- tributed Corporate Profits	Net Govern- ment Saving	Federal	State and Local	Net Saving as % of National Income	Foreign Saving
1960	111.3	55.8	44.3	26.7	17.6	11.5	7.2	4.3	10.5	-3.2
1980	549.4	206.5	251.3	201.4	49.9	-44.8	-53.6	8.8	7.4	-11.4
1990	940.4	258.0	422.7	299.4	123.3	-164.8	-172.0	7.2	4.5	76
2000	1770.	582.7	343.3	168.5	174.8	239.4	189.5	50.0	5.8	397
2004	1572	136.8	549.1	151.8	397.3	-412.3	-406.5	-5.9	0.9	851
2005	1612	7.1	319.7	-41.6	354.5	-312.5	-309.2	-3.3	0.1	776
2006Q2	1909	342	441.0	-62.0	504.0	-110.0	-137	27	2.5	823

Table 18. Net saving of the United States for selected years 1960 -2006 by source

Source: U.S. Bureau of Economic Analysis

## Table 19. Sources of output and productivity growth by period

	(1)	(2)	(3)	(4)	(5)
Variable	1959-2004	1959-1973	1973-1995	1995-2004	Col. (4)- Col.(3)
Output Growth	3.34	3.96	2.84	3.59	0.75
Hours Growth	1.38	1.55	1.46	0.95	-0.51
Average Labor productivity Growth	1.96	2.41	1.39	2.64	1.25
Capital Deepening (CD)	1.04	1.16	0.81	1.43	0.62
CD in IT	0.39	0.19	0.37	0.78	0.41
CD in Other	0.65	0.97	0.44	0.65	0.21
Labor Quality	0.28	0.34	0.28	0.19	-0.09
TFP Growth	0.63	0.91	0.30	1.02	0.72
IT-related TFP Contribution	0.21	0.08	0.21	0.43	0.22
Other-related TFP Contribution	0.42	0.83	0.09	0.59	0.50

Note: The contributions of an output or input is the share-weighted real growth rate of that input.

Source: Jorgenson, Ho and Stiroh (2006, Table 1, p 11)

#### REFERENCES

Aizcorbe, Anna M. Arthur B. Kennickell and Kevin B. Moore 2003. Recent Changes in U.S. Family Finances from the 1998 and 2001 Survey of Consumer Finance, Federal Reserve Bulletin, (Jan).

American Association of Retired Persons 1995. Valuing Older Workers. Washington, D.C.: American Association of Retired Persons.

Anderson, Patricia M. Alan L. Gustman and Thomas L. Steinmeier 1999. "Trends in Male-Labor Force Participation and Retirement: Some Evidence on the Role of Pensions and Social Security in the 1970s and 1980s, Journal of Labor Economics 17 (4), 757-783.

Arrowsmith, James and Ann E. McGoldrick 1997. "A Flexible Future for Older Workers? Personnel Review, 26 (4), 258-273.

Australian Productivity Commission 2005. Economic Implications of an Aging Australia.

Azwell, Scott 2005 "Absence Management Can Increase Productivity of Older Workers" in National Underwriter Life and Health v 109 (40), p66.

Bartel, Ann P. and Nachum Sicherman 1993. "Technological Change and Retirement Decisions of Older Workers", *Journal of Labor Economics* 11 (1) 162-183.

Borsch-Supan, Axel and Joachim Winter, 2005. "Enhancing Models of International Capital Flows to Evaluate Issues of Demographic Change" NBER Working Paper, October 2005

http://www.nber.org/programs/ag/rrc/NB05-04%20Boersch-Supan%20Final.pdf

Bosworth, Barry P., Ralph C. Bryant, and Gary Burtless, 2004. "The Impact of Aging on Financial Markets and the Economy: A Survey," The Brookings Institution, July 2004

http://www.brookings.edu/views/papers/20040722survey.htm

Brooks, Robin 2000. What Will Happen to Financial Markets when the Baby Boomers Retire?

Burtless, Gary and Joseph F. Quinn 2000. "Retirement Trends and Policies to Encourage Work among Older Americans"

Charles, Bob and Phil Collins, "Pensions in Asia: Potential Becomes Reality," Watson Wyatt Worldwide (Retirement Practice in Asia) http://www.watsonwyatt.com/asia-pacific/taiwan/news/pressrelease/ Pensions%20in%20Asia.pdf

Cutler, David M., James Poterba, Louise Sheiner and Lawrence H. Summers 1990. "An Aging Society: Opportunity or Challenge?", *Brookings Papers on Economic Activity*, 1, 1-73. Daeumer, and Mark P. Hayward 2000. "Cohort Changes in Labor Force Attachment, Working and Non-working Life Expectancies of Older Men", State College: Pennsylvania State University, Population Research Institute, Working Paper 00-04

Doepke, Matthias (2005): "Child Mortality and Fertility Decline: Does the Barro-Becker Model Fit the Facts?", *Journal of Population Economics* 18(2), 337-366 http://www.econ.ucla.edu/doepke/research/mortality.pdf

Doering, M., S.R. Rhodes and M. Schuster 1983. *The Aging Worker*. Beverly Hills: Sage.

Easterlin, Richard A. 1987. *Birth and Fortune: The Impact of Numbers on Personal Welfare*. Chicago: University of Chicago Press.

Easterlin, Richard A. 1996. *Growth Triumphant: The Twenty-first Century in Historical Perspective*. Ann Arbor: University of Michigan Press, esp. Ch 9.

Eckstein, Zvi, M. Pedro and K.I. Wolpin 1999."A Quantitative Analysis of Swedish Fertility Dynamics: 1751-1990", *Review of Economic Dynamics*, 2, 137-165, . http://www.tau.ac.il/%7Eeckstein/pdf/Eckstein\_Mira\_Wolpin.pdf

Elmendorf, Douglas and Louise Sheiner 2000."Should America Save for its Old Age? Fiscal Policy, Population Aging, and National Saving", *Journal of Economic Perspectives* 14 (3), 57-74.

Farrell, Diana 2005. "The Coming Demographic Deficit: How Aging Populations Will Reduce Global Savings," McKinsey Global Institute, January 2005. http://www.mckinsey.com/mgi/publications/demographics/Executive Summary.asp

Fogel, Robert 2005 "Changes in the Physiology of Aging in the 20<sup>th</sup> Century", NBER Working Paper Series WP 11283 March 2005.

Gendell, Murray 2006 "Full-Time Work Rises among U.S. Elderly" Population Reference Bureau

Godbey, Geoffrey and John P. Robonson 1997. Time for Life. University Park, PA: The Pennsylvania State University Press.

Greenwood, J. and G. Vandenbroucke, 2005. "Hours worked: Long-run trends," *Economie d'Avant Garde*, Research report No 10.

Guest, Ross Griffith University, Brisbane, Australia, "Population Aging, Capital Mobility, and Optimal Saving," *Journal of Policy Modeling* 

International Monetary Fund, 2005. "Aging and Pension System Reform: Implications for Financial Markets and Economic Policies," a report prepared at the request of the Deputies of the Group of Ten by an experts groups chaired by Ignazio Visco, Banca d'Italia, September .

http://www.imf.org/external/np/g10/2005/pdf/092005.pdf

Jackson, Richard 2005. Preparing for China's Aging Challenge: The Demo-

graphics and Economics of Retirement Policy in the 21st Century, Center for Strategic and International Studies (CSIS), May 1, . http://www.csis.org/component/option,com csis pubs/task,view/id,885/

Jorgenson, Dale W., Mun S. Hkevin J. Stiroh 2006. Potential Growth of the U.S. Economy : Will the Productivity Resurgence Continue ? Business Economics, January 2006.

Kalemli-Ozcan, S. and D. N. Weil 2005. "Mortality Change, the Uncertainty Effect, and Retirement," Mimeo. http://ideas.repec.org/p/hou/wpaper/2004-04.html

Kim, Soyoung and Jong-Wha Lee, 2005. "Demographic Changes, Saving, and Current Accounts: An Analysis of Panel VAR Model," Korea University, August 2005 http://www.korea.ac.kr/~jwlee/papers/aging 2005aug16.pdf

Koga, Maiko 2005. "The Decline of Japan's Saving Rate and Demographic Effects," Bank of Japan Working Paper series, July 2005

http://www2.e.u-tokyo.ac.jp/~seido/conference/2004 6thMacro/6thMacro Koga. pdf

http://www.mckinsey.com/mgi/publications/demographics/index.asp

Kopecky, Karen. A. (2005): "Explaining the Trend in Retirement," Economie d'Avant Garde, Research Report No. 12, University of Rochester. http://ideas.repec. org/p/roc/ecavga/12.html

Krueger, Alan and Jom-Steffen Pischke 1992. "The Effect of Social Security on Labor Supply: A Cohort Analysis of the Notch Generation", Journal of Labor Economics 10 (4), 412-437.

Laitner, J. and D. Silverman, 2005. "Estimating Life-Cycle Parameters from Consumption Behavior at Retirement," National Bureau of Economics, Working Paper No 11163.

Lee, Jong-Wha and Soyoung Kim, "Global Implications of Demographic Changes" Korea University, August 2005

http://www.korea.ac.kr/~jwlee/papers/keynote\_aging\_0816.pdf

McMorrow, Kieran and Werner Roeger, The Economic and Financial Market Consequences of Global Aging (New York: Spring-Verlag Press, 2004)

Poterba, James 2005. "Demographic Structure and Asset Returns" in Robin Brooks and Assaf Razin, eds. Social Security Reform: Financial and Political Issues in International Perspective. Cambridge: Cambridge University Press, 268-306.

Poterba, James, Steven Venti, and David A. Wise, "Demographic Change, Retirement Saving, and Financial Market Returns,"

Quinn, Joseph F. 1991. The Nature of Retirement: Survey and Econometric Evidence in A. Munnell, ed, Retirement and Public Policy. Dubuque, Ia: Kendall/Hunt

Quinn, Joseph F. 1999. "Has the Early Retirement Trend Reversed?" Chesnut Hill, MA. Retirement Research Consortium and Boston College. Prepared for the 7<sup>th</sup> Annual Conference of the Retirement Research Consortium, August 11-12, 2005, Washington, D.C.

http://www.bc.edu/centers/crr/papers/Seventh\_Paper/Poterba1.pdf

Rogers, D., E. Toder and L. Jones 2000. Economic Consequences of an Aging Population: The Urban Institute (http://www.urban.org/url.cfm)

Schultz, T. Paul 2004. "Demographic Determinants of Savings: Estimating and Interpreting the Aggregate Association in Asia," Economic Growth Center, Yale University, December 2004 http://www.econ.yale.edu/growth pdf/cdp901.pdf

Shulz, James H. Allan Borowski and William H. Crown 1991. Economics of Population Aging: The Graying of Australia, Japan and the United States. New York: Auburn House.

Siegel, Jeremy 2005. "What Happens to Financial Markets when Baby Boomers Retire?" speech at Center for Strategic and International Studies (CSIS) Global Aging Forum, November 16, 2005. http://www.csis.org/component/option,com\_csis\_events/task,view/id,777/

Stevens, Glenn 2005. Deputy Governor of the Reserve Bank of Australia, "Finance and the Aging Population," address at the Financial Planning Association of Australia, Ltd., November 16, 2005. http://www.bis.org/review/r051118d.pdf

United States Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 1960-2005, Series P-60, No 222.

United States, Council of Economic Advisors, 2006. *Economic Report of the President* 2006.

Wander, H. 1978 "Zero Population Growth Now: The Lessons from Europe" In T. J. Espenshade and W.J. Serow, eds. *The Economic Consequences of Slowing Population Growth*. New York: Academic Press, 41-69.

Wang, Feng, University of California Irvine and Andrew Mason, University of Hawaii and East-West Center, "Demographic Dividend and Prospects for Economic Development in China," paper prepared for UN Expert Group on Social and Economic Implications of Changing Population Age Structures, Mexico City, August 31-September 2, 2005.

http://www.un.org/esa/population/publications/EGMPopAge/5\_FWang.pdf

Warr, Peter 1994. "Age and Job Performance" in J. Suel and R. Creemer eds, Work and Ageing: A European Perspective. London: Taylor and Francis.

Whaples, R. (1990). The Shortening of the American Work Week: An Economic and Historical Analysis of its Context, Causes, and Consequences, Ph.D. the-

sis, University of Pennsylvania.

Williamson, J.G., 1995. "The Evolution of Global Labor Markets Since 1830: Background Evidence and Hypotheses." *Explorations in Economic History*, 32(2), April, 141-196.