

PART

# One

## The Aging Population: Issues for Retirement

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## CHAPTER 1

# Issues in Retirement

*We begin by discussing the changing demographics and the evolution of retirement.*

Over the course of decades we have evolved a hodge-podge of promises and policies relating to retirement. Our image of retirement has evolved from that of an infirm old age into a picture of ceasing work at a vigorous middle age, perhaps 60, having a life of leisure activities in a nice home with easy access to health care when it is needed and no financial worries. A confluence of issues have put this idyllic picture at risk. First is demographics: we are living longer. Second is affordability. Both public and private retirement provisions are at risk.

### Roots of the Problem

Social provision for retirement grew over the decades, without prior planning, as a series of responses to a variety of economic and social issues. The roots of the growing *retirement and pension* problem come from a number of areas:

1. The social desire to avoid poverty in the aged population, to insure income when one is too old to work.
2. The entitlement to leisurely old age meets up with changing demographics, age distribution becoming top heavy with fewer workers to support each retiree.
3. The attempt to put off labor negotiations by trading off current income for retirement income This led to company pensions.

Number 1 is both a reflection of a charitable instinct and the social trends of the elderly living independently of their families, who have often scattered

to other regions and no longer directly support them. This was the beginning of social security legislation. This is important; even though economics is considered the selfish science, nevertheless a social instinct exists.

Number 2 became a problem over time. This is the modern feeling that one should not need to work all of one's life. This led to various methods of shifting income into the future. When retirement benefits were first granted, the population was younger, originally few people were eligible and the benefits were modest. The program grew far beyond its roots into a full-blown provision for retirement income.

Number 3 is akin to the subprime crisis: business put off to the future the hard decisions and gave in to labor in the short term to avoid the longer-term issues of labor-management relations—this was good for neither and has left the economy deprived of real innovation, with huge unpayable debt and further distrust.

All jurisdictions and corporations have attempted to tinker with the problem: programs have been changed in marginal, efficiency-improving ways. Countries might, for example, increase the number of years used to calculate the base of the social security payment (for example, France went from counting the best 10 years to the best 25). These tactics do not solve the problem but they do ameliorate it. (See Chapter 8.)

In this chapter we look first at the changing demographics. Then we explore the evolution of the concept of retirement and the assets available on retirement. We conclude with a road map for the rest of the book.

## **1.1 LONGEVITY AND CHANGING DEMOGRAPHICS ACROSS THE WORLD**

Let's look at a compilation of various tables from the UN cited in Haas (2007). Together these paint a vivid picture of changing demographics. Table 1.1 shows that fertility rates have dropped below replacement in all countries in the survey except India. Japan was the earliest in the late 1950s; China was the latest through severe penalties for families with more than one child, a policy that began in 1979 and dropped the country below replacement beginning in the 1990s.

Table 1.2 shows the rapid growth in life expectancy from 1960–1965 to 2000–2005. There has been an average increase of 14.5 years in a 40-year period. In China the increase was more than 30 years and India almost 25. Russia added less than one year, so leaving it out would raise the average to more than 16 years. All these years are essentially added to retirement under current cultural expectations!

Table 1.3 presents the percent of the population over 65 in 1950, 2000, and projections for 2050. The numbers are astounding. On average almost

**TABLE 1.1** Fertility Rates by Country over Time

Country	Years 2000–2005	Years Fell below Replacement
Germany	1.32	1970–1975
Japan	1.33	1955–1960
Russia	1.33	1965–1970
UK	1.66	1970–1975
France	1.87	1975–1980
China	1.70	1990–1995
US	2.04	1970–1975
India	3.07	2025–2030 (projected)

Source: Haas (2007).

**TABLE 1.2** Life Expectancy

Country	1950–1955	2000–2005	% Increase
Japan	63.9	81.2	28.17
France	66.5	79.4	19.40
UK	69.2	78.3	13.15
Germany	67.5	78.6	16.44
US	68.9	77.3	12.19
China	40.8	71.5	75.25
Russia	64.5	65.4	1.40
India	38.7	63.1	63.05

Source: Haas (2007).

**TABLE 1.3** Population over 65 by Country over Time, %

Country	1950	2000	2050
India	3.3	4.9	14.8
US	8.3	12.3	20.6
Russia	6.2	12.3	23.0
UK	10.7	15.9	23.2
China	4.5	6.8	23.6
France	11.4	16.3	27.1
Germany	9.7	16.4	28.4
Japan	4.9	17.2	35.9
Average	7.4	12.8	24.6

Source: Haas (2007).

**TABLE 1.4** Median Age by Country over Time

Country	1950	2000	2050	Overall % Change
Japan	22.3	41.3	52.3	134.53
India	20.4	23.4	38.7	89.71
China	23.9	30.1	44.8	87.45
Russia	25.0	36.4	43.5	74.00
US	30.0	35.3	41.1	37.00
Germany	35.4	40.0	47.4	33.90
France	34.5	38.0	45.5	31.88
UK	34.6	37.7	42.9	23.99
Average	28.3	35.3	44.5	64.1

Source: Haas (2007).

25% of the population of these countries is projected to be over 65 in 2050. Already in 2000 the average (unweighted) is 12.8% so that would be a doubling of the proportion in the 65+ age bracket.

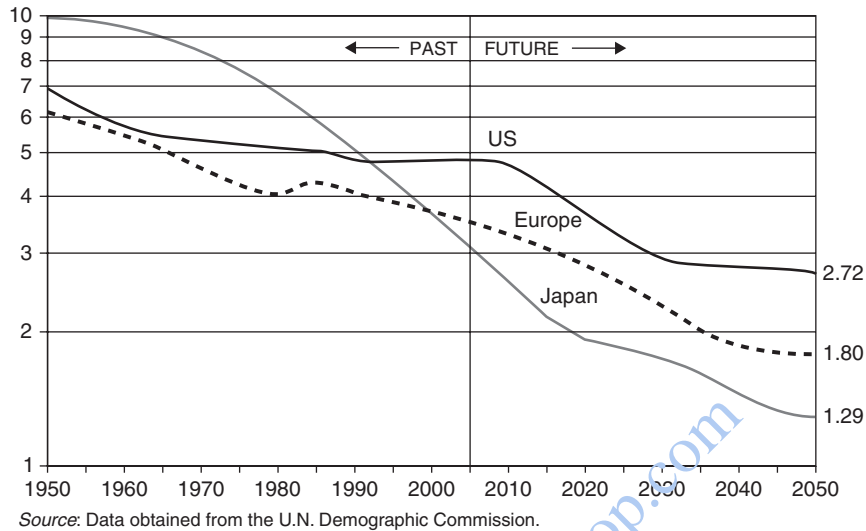
Table 1.4 presents the median age for selected countries in 1950, 2000, and projections for 2050. Again, the numbers are astounding. On average (unweighted), the median age is expected to rise from 28.3 in 1950 to 44.5 in 2050. The four countries that started with the lowest median ages have the highest increases: in the case of Japan more than doubling. The western countries starting out with median ages above 30 have lower increases, but still the level is significant.

Table 1.5 considers these numbers another way, presenting the support ratio by country, the number of workers per person over 65. In line with

**TABLE 1.5** Support Ratios by Country over Time

Country	1950	2000	2050
India	17.2	12.4	4.5
US	7.8	5.4	3.0
Russia	10.5	5.6	2.6
UK	6.2	4.1	2.6
China	13.8	10.0	2.6
France	5.8	4.0	2.1
Germany	6.9	4.2	2.0
Japan	12.1	4.0	1.4

Source: Haas (2007).

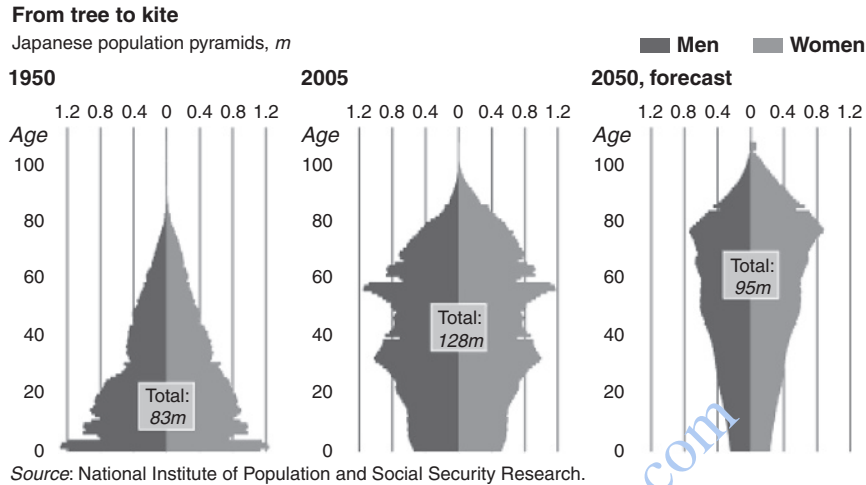


**FIGURE 1.1** Ratio of Population Aged 20–65 to Population Aged 65 and Older  
 Source: Siegel (2008).

the above numbers, this ratio goes from an average of about 10 in 1950 to 6.2 in 2000 and down to 2.6 in 2050. Figure 1.1 dramatically shows the changing age distributions over time in the three regions, the US, Europe and Japan.

Looking at the support ratios, it is indeed frightening to realize how few workers would be supporting the retirees. However, there have been times in the past when an aging population was also a concern. Europe in the 1920s to 1950s after much loss of population from two wars projected that problems would arise from an aging population. For example, in the UK they worried that the percentage over 65 would rise from 7.2% in 1931 to 17.5% in the late 1970s. This did not happen, of course, but as these tables show, we cannot think of all these older people as being unproductive and no longer contributing to their own support. A vigorous older age must mean a more productive 65-year-old! We will come back to this issue later.

Figure 1.2 shows most dramatically the impact of aging on the working age distribution. This is for Japan at three points of time, 1950, 2005, and projected for 2050 as the shape evolves from a tree to a kite. Children are generally less costly to support, and there is a long history of tax incentives and community support for child rearing including schools and after school activities. While in the older years, health care and other costs expand.



**FIGURE 1.2** Changing Age Distribution in Japan, 1950, 2005, 2050 est  
Source: *The Economist*, 2007.

Initially, when people retired out of necessity, the costs of support were lower. Now with the expectation of an active retirement the costs are greater.

Biffis and Blake in Chapter 10 consider financial instruments to insure individuals and pension schemes against longevity risk.

## 1.2 THE EVOLUTION OF RETIREMENT

People used to work as long as they could, often till they dropped. In order to *retire* in good health, there must be funds available to support the activities of the nonworking years.

When retirement came from necessity, and before modern health care, the requirements of the retired were minimal—keeping them comfortable and fed. Now people are retiring younger and in more vigorous health, so their consumption requirements are higher, and also modern health care is able to offer more services for the elderly and that too costs more.

The first income security insurance program was established by Otto von Bismarck in 1881. In part this was a response to social unrest at the time. This plan paid out the insurance at 70, at which age few working males were still alive (though at that time Bismarck himself was 74). The purpose was to offer protection from poverty when workers physically could no longer work and to protect widows and orphans of working males who

died young from loss of income. The minimum age was lowered to 65 in 1916 and became the initial standard of the US social security program.

There were some limited occupational plans in the 19th century. Belgium had compulsory insurance for seamen in 1844 and Italy in 1861. The UK had early plans for customs and civil servants (1859) and paid 1.67% of salary per year of employment up to two-thirds of salary, and blue collar plans paid about half the rate. Bismarck's plan was the first with broad coverage (40% in 1889 and 54% by 1895) (Clark, Munnell, and Orszag 2006). The destruction of net worth in wartime and depression led Europeans to push for more public income security plans.

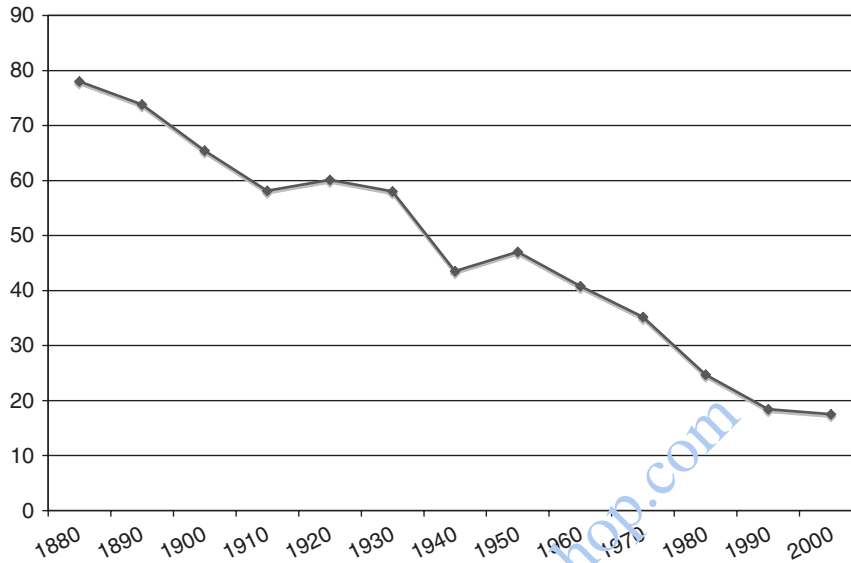
Originally when the retirement age was set at 65, the majority of people had already died. Then with slightly increased life spans, retirement was possibly the last 10% of adult life; about 40 years of work followed by perhaps 5 years of retirement. Now the ratio of working life to retirement has been squeezed on both sides. The average age at retirement has declined, and the life span has increased. Now in some countries people work only 30 years followed by 30 years of retirement (OECD 2008). The average rate of employment in OECD countries for ages 55–64 is 48% (and only 25% in France, 70% in Switzerland).

In 1880 75% of men older than 64 were working, by 1950 it was 47% and by 1998 less than 20%. Later people began to expect 10 years of retirement after 40 years of work. Clearly, for many people, retirement is more attractive than working. The ability to be idle for such spans of life was helped by the growth in pensions and income support. In 1961, when social security was amended to allow early retirement at 62 at a lower benefit there was a spike in people commencing retirement. But with a remaining life expectancy of more than two decades this is a huge waste of talent.

A study in 1930 looking forward to 1990 foresaw those 64+ would represent 12.6% of the population (underestimating the population growth). The report was not concerned as retirement needs were thought to be minimal (physical needs, health, comfort) so they underestimated the changes in expectation.

Some 75% of retirees go from full-time work to no work, while in the past people would hang onto some work as long as they could, moving into supervisory positions even on the farm.

The changes in the last 60 years in the US are striking: In 1910 the average retirement age for men was 75, in 1940 it was 68, by 2001 it was about 62. In 1960 men were expected to spend 50 of their 68 years of life in paid work. In 2000 they worked for only 38 of their 76 years. As recently as 1965, about two-thirds of workers did not begin drawing social security benefits until they were 65 or older. Now, more than half retire at 62 or younger, and three-quarters receive their first benefit checks before they are



**FIGURE 1.3** Labor Force Participation Rates of Men Age 65 and Over by Decade, Percent  
*Source:* Short (2006).

65 (Toner and Rosenbaum 2005). The notion of an active retirement has been invented, and retirement has become a 20-year stage in life. Company pensions clearly encompass three aspects: insurance (being old is like a disability), compensation (reward for a faithful career), and severance (payment to allow termination). Together these factors have led to an increase in the liabilities of the overall system. Under the social insurance program, workers earn entitlement to family benefits upon retirement, disability, or death. This breaks down into retired workers (61%), disabled workers (10%), families of retired and disabled workers (12%), and survivors of deceased workers (17%) (Schwartz and Ziamba 2007).

The trend toward earlier retirement and longer years of retirement will need to be reversed. Policies are being put in place to foster this transition. It is predicted that by 2030 at the latest, the age at which full retirement benefits start will have risen to the mid-70s in all developed countries, and benefits for healthy pensioners will be substantially lower than they are today. Indeed, fixed retirement ages for people in reasonable physical and mental condition may have been abolished to prevent the pensions burden on the working population from becoming unbearable.

### **1.2.1 Older Workers as a Growing Share of the Work Force**

The Labor Force is Aging: The Bureau of Labor Statistics (BLS) forecasts that, by 2014, the share of workers over 55 in the labor force will be 20%, up from the 15% in 2007. Most of these will be in the service sector, where most of the job growth will be. In part they will be replacing young people (BLS 2004). Also the BLS reported that, rather than retiring, over one-half of older workers are continuing to work in “bridge” jobs. This represents two forces: those who cannot afford to retire and those who want to explore other career paths and just want to keep active. The trend to greater workforce participation will increase as social security shortages will mean lower benefits especially for those who retire earlier (see Figure 1.3). Growing reliance on individual savings such as in 401(k)s and owner occupied houses will also make it more difficult to fund retirement. The BLS predicts that “traditional retirements will be the exception rather than the rule.” We explore these issues in this book.

## **1.3 PROVISION FOR RETIREMENT**

Individuals save to provide for retirement in a variety of ways: public pensions, occupational pensions (defined benefit (DB) and defined contribution (DC), which can be either protected or unprotected), and personal retirement savings. The role of pension assets on financial markets and economic stability provides a macro aspect to the retirement issue.

### **1.3.1 The Earliest Pensions**

Providing retirement for the military goes back at least to ancient Rome. Military service could be long: up to 20 years. Beginning at the time of Marius (about 100 BCE), legionaries often were granted allotments of land upon retirement and by the time of Caesar Augustus, they could expect a payment of 12,000 sesterces on retirement versus an annual salary of about 900. Also they encouraged retirement communities, often encouraging retired military to settle down where they had served (thus avoiding the return of large numbers of unemployed soldiers). The remains of one such community are found in the Moroccan desert. These were complete towns with civic areas, hospitals, baths, physicians (see Gowans, 2007).

In the seventeenth century, if a Plymouth colonist was wounded defending the community against Indians, as he was unable to work, he was so to

speak *retired* and would receive a pension to support him and his family. The pensions were funded by tax collections.

The first major retirement program in the US was that for the Union soldiers after the Civil War. It was a generous pension program replacing up to 30% of income (similar to social security) and reached 1 million participants by 1902. By 1900 21% of white males 55 and older were on pension. As well, by 1900 this pension program represented 30% of the federal budget.

### 1.3.2 Early Corporate Pensions

In 1875, the American Express railroad company established the first private pension plan in America. This is followed by banks, utility companies, and manufacturing companies that established company-funded retirement plans. Railroads used limited pensions for long-time employees as a way to encourage workers to retire for concerns about safety. Mandatory retirement was easier than dealing individually with the health of each employee. GE, DuPont, and Westinghouse were also early providers of pensions. Their retirement plans aimed at encouraging loyalty as they were investing a lot in human capital.

Corporate pensions were given a boost from the tax code. By 1926, employee benefits were virtually fully tax-deductible.

To contain wartime inflation, the Wage and Salary Act of 1942 froze wages. Firms then offered pensions and other benefits in their attempts to attract employees. Also pension contributions lowered the firm's taxes. In 1950 at General Motors, Charles Wilson created a company-run pension plan. He thought it would improve employee relations, though initially the United Auto Workers union objected. Wilson thought that lifetime employment with large corporations would be standard, and this was one way to build loyalty. At the time, pension benefits were usually not vested in the individual and so would be lost if the worker left the company. He did not foresee that these pensions would become a huge burden on the company (as of December 2008 GM had \$13.6 billion in unfunded pension liabilities, the salaried and hourly pensions together have \$84.5 billion in assets and \$98.1 billion in liabilities).

The growth of corporate pensions and health insurance arose as a *bribe* to prevent labor unrest without huge increases in wages. For salaried employees they helped to defer income and minimize the effect of high marginal tax rates. In both cases they represented short-term solutions that created longer-term problems. Pension promises remind one of the Sufi story—when asked to teach an elephant to talk, Nasrullah struck a bargain with the king setting the due date many years down the road . . . knowing that something

else would intervene in the meantime and he would not have to fulfill the promise. After all, the king was old and likely to die, or forget the promise. Barring bankruptcy, there is no simple way to avoid the corporate pension promises.

Between 1940 and 1950, the share of civilian workers covered by private pensions increased from about 7% to nearly 20%, while private health insurance rose from 10% to 50%. Many of the early pensions were pay-as-you-go defined benefit, and Drucker (1950) highlighted the problems of these pensions in an article called *The Mirage of Pensions*. When new DB pensions are started, even if firms make the ongoing payments, what hamstrings them are huge legacy costs associated with current employees. By 1960, private pensions grew to cover 30% of the labor force (23 million up from 3.7 million). In 1990, for example, about 57% of workplace pension benefits went to the wealthiest 20% of households. The next decades saw both regulation of private pensions and the establishment of various forms of individual tax deferred savings plans.

In 1973 the UAW won the right to a full pension with early retirement to commence after 30 years of work. This created an additional problem as initially pensions were net of social security. Retiring early meant the worker was not yet eligible for social security so received an enhanced pension to include social security benefits. Later, pensions became to be in addition to social security.

Lowenstein (2008) presents three cases of corporate and agency pensions and shows how they have led to problems in the economy and to problems in the relations between unions and the organizations they work for. The cases discuss how pension debt brought General Motors, the New York subways, and the city of San Diego to the brink of bankruptcy. So what can we learn from these three cases?

- In the mid-twentieth century the growth in corporate pensions came as a reaction to wage and price controls as they were outside the controlled sphere.
- American business has paid a high price for avoiding a public social safety net. Unions would add a *fringe* at a low level one year, such as supplemental payments while laid off, and then after a couple rounds of negotiating have the benefit up to 95% of salary for six months.
- Company pensions originally had social security benefits subtracted, and later they became additional to social security but both are taxable benefits.
- But when times were good, the fact that benefits reduced corporate tax liabilities pushed benefits higher . . . unfortunately, sometimes it is better to pay the tax! And when times are bad, there are no taxes!

- San Diego raises another issue regarding civic sponsorship: if a city invests in a team by building a stadium, for instance, should they not have representation on the board akin to ownership which in turn would prevent a team from just leaving the city and moving elsewhere? Indeed why not?
- Early bankruptcies led to the creation of the pension retirement insurance corporation . . . but the problem has grown too massive for this to help . . . the pension and health care promises are too large . . . Pension Benefit Guaranty Corporation has become the insurer of the weak as strong companies do not provide pensions.

These pensions tend to be based on the last few years' salary, so employees are allowed to work extra overtime in the last years in order to increase their pensions. In a similar fashion, some UK professors close to retirement with low salaries, because they did not move to other universities, are moving in their final years to capture short-term higher salaries and much higher long run pensions and final buyouts. A 62-year-old getting a £20,000 raise receives a £10,000 yearly pension increase each year plus a much higher retirement lump sum payment (£30,000) when taking mandatory retirement at 65. Chapter 8 discusses a possible shift to lifelong versus final salary pensions. In this scheme you can adjust total pension or keep it constant. This would avoid the incentive to change jobs just to increase pensions.

By 1980, 83% of large- and medium-sized companies offered DB pension plans and almost all companies provided health care coverage for full-time employees and their families. By 2003, only 33% of large corporations were offering DB pensions and only 58% of private employers offered any health insurance. The success of this welfare capitalist model was based on the global dominance of US business. After World War II the US represented about half of all global production. From this strength, business was able to set prices and obtain surpluses to fund these benefits. They were then able without pain to make promises to workers for future income in the form of DB pensions. Starting gradually in the 1960s and gaining speed later, this dominance was challenged. No longer able to set oligopolistic prices, the surplus was hard to maintain. Once they faced international competition, these economic rents were at risk, but it took some time for the realization to hit home, and the promises continued. But industries did fall and the promises were broken: steel, airlines, now automobiles (see, e.g., Morris 2006).

To highlight how open ended the pension promise is, Lowenstein notes a GM retiree who started work in 1926 and died in 2006 at 111 having received pension and health benefits for 48 years! A similar example comes from the US social security program, which began in the mid-1930s.

Ida May Fuller of Ludlow, Vermont, received the first social security check 00-000-001 on January 31, 1940. She lived to age 100 and collected \$22,889 having made contributions of \$24.75. Here we see the first overhang or deficit created by initial social security recipients who were already well into their working years when the program was implemented. By 2001, one in six Americans were receiving monthly benefit checks either as elderly, disabled, or children whose parents had died (Schwartz and Ziamba 2007).

### **1.3.3 Total Assets on Retirement**

The current 2007–2008 economic situation reminds us that in times of crisis savings disappear. Institutions for saving have always been precarious, especially for the lower income groups. Some countries turned to the development of postal savings to make safe savings accounts available to low income people. The UK was the first to establish postal savings in 1861; at the time banks catered to the wealthy and were not accessible to all. Later, the post office offered insurance and annuities. There are still a number of countries where postal savings provides an important means of saving. The US provided similar postal savings from 1910 to 1966. Japan's is the most famous. Its post office was the world's largest savings bank with 198 trillion yen (US\$1.7 trillion) of deposits as of 2006 and more now in 2009, especially in dollars, with a higher valued yen. It is now in a 10-year process of privatization. For an additional example, Brazil's national postal service in 2002 formed a partnership with the largest private bank in the country (Bradesco) to provide financial services at post offices. This is a reminder of how important is the evolution of the financial system.

Munnell et al. (2009a) show that retirement savings fall short of expectations. Her typical worker with preretirement income of \$50,000 contributing 6% annually matched by 3% from the employer should have about \$320,000 but the actual was only \$75,000. They have defined a National Retirement Risk Index (NRRI) based on the resources available for retirement. They estimated that if people work to age 65 and annuitize *all* their assets, 44% will still be at risk to be unable to maintain their standard of living. When health care costs are included, 61% are at risk. Table 1.6 shows the wealth of a typical preretirement household. We will return to discuss some of these asset classes later.

### **1.3.4 The Contribution of Various Assets at Retirement**

Popular financial advice suggests that households should strive to replace 65–85% of preretirement income in retirement (Butrica, Goldwyn, and Johnson

**TABLE 1.6** Wealth of a Typical Household Approaching Retirement (55–64), 2007

Source of Wealth	Amount (\$)	% Total
Primary house	\$138,600	20
Business assets	15,900	2
Financial assets	29,600	4
401(k)/IRA	50,500	7
Defined benefit	122,100	18
Social Security	298,900	44
Other nonfinancial assets	21,000	3
Total	676,500	100

Source: Munnell et al. (2009a).

2005), but there appears to be little scientific basis for this estimate. A proper lifetime asset-liability analysis using multiperiod stochastic programming is suggested in Ziamba (2003); see also Consigli (2007) and Chapters 9 and 14–16 in this volume. Housing and health care are two of the largest categories of expenditure. About 25% of older people have mortgages—some have refinanced them for retirement while those who do not qualify for mortgages might fund some of their retirement with reverse mortgages.

The overall role of social security in funding retirement is ambiguous. While a poll found that only 20% of Americans who are not yet retired expect social security to be their major source of income when they stop working, 39% of retirees said that it was their major source of income. On the other hand social security appears to be becoming less important in overall funding (see Table 1.7). Leland and Wilgoren (2005) reported in the *New York Times* on the role of social security for the elderly. They

**TABLE 1.7** Major Sources of Financial Support in Retirement

52%	401(k) defined contribution plans, Individual Retirement Accounts, and Keogh plans for the self-employed
31%	Company pension plans that pay guaranteed retirement benefits
30%	Equity built up in a home
27%	Social Security

Source: Gallup Poll, April 2007.

found that the lowest third of the population rely on social security for more than 90% of their income; while the wealthiest third relies on social security for less than 50% of their income and the middle third for 50–90%. Thus the lowest third who really depend on social security face a relatively large decline in standard of living as social security strives to replace about half or less of their preretirement income, and they typically have been unable to garner other savings to fill the gap. To highlight the difference, Leland and Wilgoren report on two brothers which captures the range in benefits: one who had held a variety of low-paying jobs receives \$502 a month; the other and his wife, who had steady careers at the local school district, collect a combined \$2,400.

Social security regulations now have declining income replacement rates. From 2000 to 2030 income replacement is set to decline for low earners from 55.5% to 49.1%; for medium earners 41.2% to 36.5% and for maximum earners 27.3% to 24%. In that same period Medicare premiums will amount to more of the social security benefit, going from 6% to 7.2% with further increases set bring it to 13.6% in 2050. Further erosion will occur through taxation of benefits. With all the various deductions and adjustments the replacement rate in 2050 will be only 26.9% for those retiring at 65 and 20.8% for those retiring at 62.

Where is the rest of the income coming from? In 2001, about half of all US families owned a tax-favored retirement account with median balance of \$29,000. Older households had somewhat larger tax-favored savings, with a median value of \$55,000 for the 59% of families age 55–64 who had such accounts. As expected, tax-favored savings are concentrated among high-income households; the top 20% of the income distribution held two-thirds of the retirement savings accounts. The heavy reliance on social security among retirees up through the middle of the income distribution, the shift away from DB pensions, and increased use of 401(k) plans amplifies the importance of payout options that convert savings into guaranteed incomes during retirement (Reno 2005).

To improve income in retirement there have been shifts toward both working part time and working longer (5% greater share) as well as receiving marginally more from employer pensions and out of social security and other assets in the period 1980 to 2000 (Social Security Administration). At the same time there has been a great shift from DB (from 60 to 15%) to DC (from 18% to 55%) pensions (with a shift from 22% to 30% covered by both). This shows an increase in financial risk for the retired.

Total savings falling though a greater share of net worth is in housing equity. Alicia Munnell, who heads the retirement research center at Boston College states: “Nobody is enjoying much in terms of growth in net worth. No one has enough to support themselves in retirement for 20 years.” This

is supported by the Fed's 2004 survey, which reports that just under half of all families held retirement accounts. The typical family's savings (including retirement accounts) fell to \$23,000, down \$7,000 from three years earlier. For households headed by a retired person, the typical savings fell from \$34,400 to \$26,500. Also, the 95% of Americans 55 to 64 who had any savings at all typically had \$78,000, which is only about 1.5 times their median annual earnings.

Rich and Porter (2006) reported that housing wealth is increasingly funding retirement via reverse mortgages (the income of many of the elderly does not qualify them for normal mortgages). From 2001 to 2004 household net worth barely increased, to \$93,100 from \$91,700. While total savings dropped by 23%, the value of homes rose 22%. Just over 69% of Americans owned their own homes in 2004 (76% for retiree households). The median value of their homes jumped to \$160,000 in 2004 from \$131,000 three years before, a rise of 22% (for retirees value \$130,000). While few plan to draw equity from their homes it is an insurance policy that more and more are calling on.

### Roadmap

In Part I, Chapter 2 investigates a variety of macro economic costs for retirement and highlights the important shift from DB to DC pension schemes, which shifts a lot of the risk from employers to employees and thus retirees. Chapter 3 looks at the various pillars of retirement and various reforms including proposals for reforming social security, pensions in trouble before the crisis. Chapter 4 defines various asset classes and presents their historical returns and risks. Chapter 5 explores the 2007–2009 economic crisis and its impact on retirement assets.

Part II includes more in-depth analyses of some of these issues. Chapter 6 investigates the role of population aging in savings behavior. They discover that savings rates have a hump shape, starting out low and then increasing before declining. This can be explained by considering that young workers in establishing themselves in their careers are both creating skills and thus building up a higher expected stream of income in the future and are investing in homes, and as we have seen, home ownership is an important component of expected retirement income. Chapter 7 presents a continuous time model of intergenerational surplus management applicable for life and other insurance companies, pension funds, and other organizations. Chapter 8 analyzes the shift from final salary to career average pensions and uncovers a number of advantages in career average schemes including improved pension equity among different types of workers and the possibility of reducing the disincentive to continued work after peak income has been

earned. Chapter 9 presents a stochastic programming model to help the DB pension system survive. It uncovers substantial industry concentration of the DB problem with industry problems and pension funding issues impacting each other, something that is confirmed by the bankruptcies in the auto industry. Policy simulations help create rules for the troubled industries. Chapter 10 evaluates using capital markets to more effectively deal with the longevity risk imposed on pensions and insurance companies which could both offer additional capacity and liquidity to the market, as well as more transparency. Chapter 11 looks at the long-term retirement funding of national and state-level governments, which have been adopting two strategies: contributing more money and increasing their risk profile in the hopes of boosting returns. Chapter 12 looks broadly at issues relating to decumulating assets on retirement and includes a study of the risks of own company stock, and options related to housing, annuities, insurance, etc.

Part III brings the various issues together in an all-encompassing modeling framework. Chapter 13 discusses some of the important lessons in successful investment for the long term including lessons from endowment management and the great investors. Chapter 14 describes a successful case study of the development of a multiperiod stochastic programming model for the Siemens Austria pension plan, which has been in use since 2000 for pension plans and regulators. Chapters 15 and 16 construct and then implement a similar model for individuals, asset-liability planning over time.

Chapter 17 summarizes the key issues in the aging-retirement dilemma. Innovation in concepts of retirement and retirement funding is needed. Caring for the elderly and the infirm is a societal problem, not just a family problem. Indeed it is a mark of how civilized a society is. Moreover, it is a key job creation opportunity and a mark of real services. We are now at a key time to reevaluate retirement in its economic and social aspects. So the question is in order to deal with these issues we will need to change the social contract that has led to the expectation of a long, leisurely retirement.

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