Introduction

ANNUITIES ANCIENT AND MODERN

The annuity is a financial investment that entitles the investor — the annuitant — to a series of regular payments, usually monthly, over a period defined in the annuity contract. In the case of a simple life annuity, the payments stop upon the annuitant's death, although some life annuities provide for payments over a minimum specified period, like five or ten years, or until the death of the annuitant, whichever is longer.

The life annuity has the special property of entitling the annuitant to a regular income over the rest of the annuitant's life, regardless of how long he or she lives. It thus provides insurance to retired people against living for so long that they outlast their means, while generating substantially higher income than fixed interest investments, and obviating the need to skimp and hoard in old age. The life annuity also imposes discipline on spending in retirement, because it prevents retired people from spending their nest egg all at once. Unlike a bond, or a more conventional financial investment, an annuity normally cannot be resold. In the United States, and most other countries where there is a market for them, life insurance companies are responsible for funding life annuities, although other financial institutions or intermediaries may market them.

Annuities have an ancient lineage. The word annuity is derived from *annulus*, Latin for annual, and annuities figured in the financial affairs of the ancient Romans. In third century AD Rome, the law regarding wills and estates held that the lawful heirs to an estate should not receive an inheritance that was less than one-fourth of the value of the estate. Wealthy Romans would sometimes grant annuities to persons other than the lawful heirs. This stratagem might have served to dodge inheritance tax and to spite an unlucky relative. Some things never change.

In order to calculate the minimum share of an estate due to the lawful heir as well as liability to inheritance tax, Roman law needed some means of capitalizing the value of an annuity's income stream. The law relied on the following rule: if the recipient of the annuity was aged 30 or less, multiply the annual payment by 30; if the annuitant was aged 31 to 60, multiply the annual payment by the difference between 60 and the annuitant's age. This rule implied that a life annuity providing an annual income in the equivalent of 100 denarii (plural of *denarius*, a silver coin) had a maximum value of 3000 *denarii*, which obtained when the annuitant was aged 30 or less. Its value declined by 100 *denarii* for each additional year of age above 30, until it reached zero for an annuitant aged 60, an age few Romans would have attained.

Roman law did at least recognize that the value of a life annuity should decline with the initial age of the annuitant. Then and now, an annuity's value is determined in large part by the life expectancy of the annuitant. Life expectancy declines with age: the older an annuitant is, the smaller the number of payments he will receive. However, the rule that Roman law used to capitalize a life annuity resulted in a very rapid decline in the value of the annuity as the age of the annuitant increased. The capitalized value of a given annual income for life in the case of a 52-year-old would be twice that of a 56-year-old. The life expectancy of a 56-year-old, even in third century AD Rome, was probably not that much less than that of a 52-year-old, however, and a 60-year-old would not have had a life expectancy of zero years!

In the third century AD, the Roman jurist Ulpian proposed to modify the way annuities were valued. His innovation resulted in a more sensible relationship between the value of the annuity and the age of the annuitant. Specifically, Ulpian proposed that the ratio of premium to annual income should decline more smoothly, from 30 at age 20, to 20 at age 40, to 9 at age 50, 7 at age 55, and 5 at age 60.[1]

As Bernstein observes in *Against the gods: The remarkable story of risk* (1996), about 1400 years were to pass before the pricing of annuities became more sophisticated. A rigorous basis for the pricing of annuities required advances in applied probability theory and in the production of demographic statistics as well as the development of financial markets. An annuity provider needs reliable data on the life expectancy of potential annuitants of a given age and sex, and on how the number of

[1] This account of annuities in Roman times is drawn mainly from Greenwood (1940). Other sources are Marquis James (1947), Jack (1912), and Poterba (2001, 2005).

years of additional life varies among individuals of a given age. In 1693, Edmond Halley, discoverer of the comet that bears his name, constructed a table based on data from a German town giving life expectancies by age: the additional number of years a person aged 40, 45, 50, and so on could expect to live. The French mathematician De Moivre used Halley's table in his work on the mathematics of annuities.

Even before these advances, life annuities were being used in pre-Renaissance Europe by the Church and assorted annuity dealers to raise funds (Marquis James, 1947). Shakespeare invested a large part of his wealth near the end of his career in an annuity-like arrangement (Greenblatt, 2004). However, the provision of annuities was far from being confined to churches or individuals. The governments of both England and Holland had been using the sale of life annuities to raise money, in Holland's case as early as 1540 (Bernstein, 1996). Adam Smith notes the use of both "annuities on lives" and annuities for terms of years (certain annuities) by England in the time of William and Mary (Smith, 1789, pp. 992–93). Smith also refers to annuities with a term as long as 99 years, pointing out that their value should be very close to the value of a perpetual bond. Annuities with so long a term would have been inheritable. Life annuities were the largest part of the debt of the *ancien régime* on the eve of the French Revolution (Ferguson, 2001, p. 172). However, not until the late eighteenth century were annuities priced based on life expectancy. In the late seventeenth century, both Dutch and British governments were offering annuities at premiums that did not apparently vary with the age of the purchaser (Hacker, 1976). The terms they did offer imply that their exchequers did not have a good idea of the cost of the average annuity contract to their governments, and may also have reflected some default risk.

By the nineteenth century, insurance companies in England and other European countries, armed with more reliable data on mortality rates and the statistical techniques necessary to exploit them, were able to offer both life annuities and term certain annuities, the latter making payments for a specified period whether or not the annuitant survived. Hacker (1976) reports that tables devised in 1780 by Richard Price, who worked from parish registers in Northampton, were the standard source for both British and American insurance companies until well into the second half of the nineteenth century.

References to annuities are common in nineteenth century fiction. The novels of Jane Austen and Charles Dickens are replete with them: one wonderful example is found in *Nicholas Nickleby*: "At every small

deprivation or discomfort which presented itself in the course of the four-and-twenty hours to remind her of her straitened and altered circumstances, peevish visions of her dower of one thousand pounds had arisen before Mrs. Nickleby's mind, until at last she had come to persuade herself that of all her late husband's creditors she was the worst used . . . And yet she had loved him for many years. . . . Such is the irritability of sudden poverty. A decent annuity would have restored her thoughts to their old train at once" (1839, p. 126). In *Hard Times*, Dickens caricatures utilitarian philosophy when he has Mr. Gradgrind speak of the calculations of "various life insurance and annuity offices, among other figures which cannot go wrong," which have established that life expectancy has increased. Balzac's *Père Goriot* also includes several references to annuities, including a transaction where old Goriot sells a life annuity in exchange for an annuity with a smaller regular payment to raise money for his daughters. References to annuities in Victorian times would have included annuities funded by private estates and individuals as well as annuities provided by insurance companies.

As the annuities business grew, life insurers developed databases on the mortality of annuitants. They were able to verify what intuition and common sense had already told them. People who buy annuities have longer life expectancies than the population at large of the same age. The average 65-year-old who purchases an annuity will live longer than the average 65-year-old who does not. A line from Jane Austen's *Sense and Sensibility*, well known to both Janites and students of annuities, puts it with her characteristic brevity: "... people always live forever when there is any annuity to be paid them" (1811, p. 10). As the book's subsequent chapters will explain, this difference between the life expectancies of annuitants and nonannuitants, between individuals who purchase annuities and those who do not, is a key to understanding how annuity markets work. Part of it may simply reflect the facts that the demand for annuities depends on income, and that income is related to longevity. However, even when income differences are taken into account, the life expectancy of annuitants appears to be longer than the population at large. This phenomenon is what is meant by adverse selection.

Concern over the consequences of adverse selection explains why many economists have thought that it would be a mistake to rely on the voluntary purchase of private annuities to provide a large share of retirement income. Lawrence Thompson (1998, p. 31) notes that where the market for private annuities is entirely voluntary, adverse selection can be a serious enough

problem to limit the market's effectiveness. Diamond and Orszag (2004, pp. 72–3) voice similar concerns.

With the growth of the welfare state leviathan in most industrial and some emerging market economies in the second half of the twentieth century, governments assumed a major responsibility for the provision of income in retirement. This is particularly true of the countries of Western and Northern Europe. The retirement benefit that social security pays in the United States is less generous than the benefits bestowed by the large continental European systems, but it plays a very important role in alleviating poverty among the elderly in America.

Public pension systems normally provide a benefit to retired people in the form of a life annuity with a regular monthly payment. In most countries, the benefit is indexed to the cost of living, and is increased once a year in line with the increase in the consumer price index. In some countries, it has been indexed to wages, with the result that its purchasing power varies with the real wage. The public pension or the annuity that the public pension system provides thus provides both longevity insurance and inflation insurance.[2] Given the importance attached to protecting family members in the event of the death or disability of a contributor to social security, the American social security benefit package also includes a disability pension, a benefit for the spouse of the contributor whether or not she has worked outside the home, as well as a benefit in the event of the contributor's death or the dissolution of the marriage, and survivors' benefits for other family members. The same is true of most OECD public pension systems, although these benefits can take many forms.

The life annuities sold by life insurance companies – the book will refer to them as private annuities when it is important to distinguish them from the annuity that the public pension system provides – are not very popular these days. Apart from a few countries where the purchase of annuities is required or strongly encouraged, no country has a large market for private annuities. This lack of demand stems in part from the public pension system's provision of a close substitute. The sponsors of the defined benefit pension plans that American corporations have established for their employees do purchase annuities on a group basis for retiring employees,

[2] Full inflation insurance requires that the lag in the adjustment of the benefit to increases in the price level be short, or that inflation remain low. The combination of large jumps in the price level and a substantial adjustment lag can entail huge swings in the real value of the benefit. The experience of Argentina during the hyperinflation of 1989–90 is a sobering example. Even monthly adjustments with a lag of one month could not prevent large gyrations in the real value of pensions from month to month (Mackenzie, 1995).

but the market for individual annuities, particularly that for life annuities, is small. The market for what are known as variable annuities is quite large, but these instruments lack the basic features of a life annuity. They are more like a mutual fund, with an option to buy an annuity with a regular fixed payment or one with a payment that varies with the value of portfolio of financial assets in which the variable annuity has been invested.

RENAISSANCE

Despite the small size of private annuity markets in most countries, private annuities should come back into vogue. Some basic demographic and economic trends are increasing the size of annuity markets. In particular, population aging around the world has strained the finances of the world's public pension systems, which has encouraged or prompted calls for reforms to these systems that will diminish the role of the public pension in the provision of retirement income and enhance that of annuities and similar financial instruments. At the same time, the demand for annuities has been boosted by a decline in the importance of traditional defined benefit employer pension plans, and the related rise in defined contribution plans (these terms are explained below and defined in the glossary). Finally, the growing share in the total population of older people must have a direct effect on annuity markets, because demand for annuities increases with age.

A global demographic transition. The world is undergoing a momentous demographic transition. Until well into the nineteenth century, even the industrialized nations of Europe had young populations. Few of their citizens lived to see their 70th birthday, and population growth was gradual. With the combination of advances in public health, and notably the revolution in the approach to infectious diseases, improved sanitation and personal hygiene, and a general improvement in living standards, infant mortality dropped and the life expectancy of adults increased (Lee, 2003; IMF, 2004b).

The aging of the world's population continued in the twentieth century under the impetus of declining fertility rates and increased longevity. Between 1950 and 2000, the median age in the more developed regions of the world, as classified by the United Nations, grew from 28.6 years to 37.3 years.[3] The share of the population aged 65 years or over grew from 8 percent to 14 percent. The population was also aging in other regions,

[3] The UN classification includes Canada, United States, Japan, Australia, New Zealand, and the countries of western Europe in the more developed regions category.

Table I.1. *Elderly dependency ratios of the world's population and major regions estimates and medium variant from WPP, The 2002 Revision*

	Elderly dependency ratio[a]		
	1950	2000	2050
World	9	11	25
More developed regions	12	21	44
Less developed regions	7	8	22
Africa	6	6	10
Asia	7	9	26
Europe	13	22	49
Eastern Europe	10	19	48
Northern Europe	16	24	41
Southern Europe	12	24	60
Western Europe	15	24	48
Latin America and the Carribean	7	9	29
North America	13	19	33
Oceania	12	15	30

[a] The elderly dependency ratio is the ratio of the number of persons aged 65 or over to the number of persons aged 15–64
Source: United Nations 2003b

although demographically speaking, it remained young. At the same time, falling birth rates and increasing life expectancies of older persons were causing a decline in the child dependency ratio – the ratio of the number of children aged 0–14 to the number of persons of working age – 15–64 and an increase in the elderly dependency ratio – the ratio of the number of persons aged 65 and over to the number of persons of working age.

The aging of the world's population will continue. In its medium variant, which is based on conservative demographic assumptions, the Population Division of the United Nations Department of Economic and Social Affairs projects that the elderly dependency ratio for the more developed regions will increase from 21 percent in 2000 to 44 percent by 2050 (see Table I.1). The aging of the populations of Eastern Europe is particularly pronounced, but population aging in Northern and Western Europe leaves that region with an elderly dependency ratio that is noticeably higher than that of North America.

The sheer increase in the numbers of older persons is striking. The number of persons aged 60 or more is projected to grow from 606 million in 2000 to 1.9 billion in 2050. The increase in the less developed areas is particularly marked, although the numbers of persons in this age group who live in the developed areas is projected to increase from 232 million in 2000 to 394 million in 2050. More striking still is the projected growth in the number of persons aged 80 years or more. In 2000, the world was home to an estimated 69 million octogenarians. By 2050, their number is projected to grow to 377 million (UN, 2003b, p. 16–17). This more than fivefold increase boosts their share of the world's population from 1.1 percent in 2000 to 4.2 percent in 2050. No less than 21 countries, including France, Germany, Italy, and Japan are projected to have an octogenarian population that equals at least 10 percent of total population. China alone is projected to have 98 million persons in this age group, and India 47 million. Despite the large margin of error to which any demographic projections are subject, the conclusion that the share of the elderly in the world's population will increase greatly is inescapable.

Population aging and pension reform. Population aging and reforms to public pension systems that address the fiscal pressures that aging entails will increase the demand for private annuities. The increase in demand will result from both changes in the terms of conventional public pension plans and more radical reforms to public plans that change their structure. The typical public pension plan is financed on what is known as a pay as you go basis. The payroll taxes levied on the wages and salaries earned by active labor force participants pay for the pensions of retired people.

Population aging strains the finances of public pension systems. The number of retired people increases faster than the number of labor force participants, with the result that pension benefits increase faster than the payroll tax revenues that finance them. The conventional solution to this financial imbalance is some combination of increases in payroll tax rates and a reduction in average pensions. This reduction can be accomplished in any number of ways: for example, by indexing pensions, once granted, to consumer prices instead of wages (wages normally grow faster than prices); by indexing the contribution of past wages to the pensionable base to consumer prices rather than wages; or by increasing the minimum age at which a worker can retire.

The financial difficulties of public pension systems have increased the attractiveness of the more radical solution that takes the form of the partial or complete privatization of pension plans. Pension privatization establishes an individual or personal account for each person currently

contributing to public pension plans (the book will refer to privatization as an individual accounts reform). In the United States, individual accounts reform proposals typically take one of two forms. In the first, known as a "carve-out," several percentage points of the payroll tax that finances social security are simply diverted to an account established in the contributor's name. In the second, known as an "add-on," the contribution to the individual account is added on top of the payroll tax, and levied on the same base. In some add-on proposals, the additional money for the accounts comes in whole or in part from the general revenues of the budget; in others, it comes directly from the participants. Since the coverage of social security in the United State and public pension plans in other countries is in principle universal or near universal, a public pension system with an individual accounts component is tantamount to a universal compulsory savings plan.

In the typical individual accounts reform proposal, the account holder exercises some discretion over how the monies in her account are invested during the contributory period. The income that an account will generate for the account holder in retirement will depend on the total value of the contributions she makes, and the average return they earn. However, whether the funds that accumulate in the account will generate a steady flow of income that will last through retirement will depend on how the funds are invested at retirement and the form that distributions (withdrawals) from the account actually take.

One of the basic issues this book will address is the amount of discretion the account holder should have over distributions from her account at retirement. In Chile, which pioneered the individual accounts reform, the account holder who is eligible for retirement typically uses most if not all of the funds that have accumulated in his account either to purchase an annuity from a private annuity provider or to finance a series of programmed withdrawals. If the account holder has enough money to fund an annuity with a regular payment that achieves both a minimum level and a specified replacement ratio, the residual balance in the account is at the account holder's disposal. Similar arrangements can be found in other countries that have adopted a variant of the Chilean system. This requirement must increase the demand for private annuities and might increase it greatly.

It is not necessary that private insurance companies (or other private financial institutions) administer distributions from individual accounts. Instead, the annuity could be provided directly by the state, through a specialized agency or public financial institution, or even the agency

responsible for administering what remains of the public pension system. Indeed, the question of whether the distribution phase of an individual account pension should be privatized as it was in Chile is another basic issue that the designers of reform need to confront.

An individual accounts reform is bound to diminish the role of the public pension in the provision of retirement income. In Chile, for workers just entering the labor force or older workers who chose to transfer to the new system, the public pension was completely replaced by the annuity funded by accumulated contributions plus earnings. The payroll tax that financed the public pension was simply eliminated. The public pension is now a minimum pension paid only to those Chileans with too little in their accounts to purchase an annuity with a regular payment above the minimum that the law requires. The typical individual accounts reform proposal for the United States would have the income from the individual account replace only part of the benefit that social security would normally pay. But the role that the social security benefit plays in supporting Americans in retirement will be diminished.

An increase in the demand for private annuities can be expected even if governments do not require their citizens to purchase them. Even without an individual accounts reform, population aging will require a change in the terms of public pension systems to prevent their collapse. The average age at which people retire will increase, and pensions will be lower than what they otherwise would have been. The pressures on public pension systems mean that retired people will need to find alternative sources of income in retirement. They will have to save more while they work or work longer, and they will need to make a decision about what to do with these additional savings when they retire.[4] The issue of the adequacy of private saving is particularly important in the United Kingdom, where the public pension is not particularly generous (UK Pensions Commission, 2004).

The demise of employer-provided defined-benefit pension plans. A defined benefit plan is so termed because the plan defines the way the benefit is calculated. A typical defined benefit plan makes the pension vary with the average salary earned in the last few years before retirement (the pensionable base) and the number of years of contributions. For example,

[4] A declining public pension, other things being equal, raises the amount of savings (the retirement nest egg) people will need to achieve a given standard of living in retirement. Working longer has the opposite effect, since it lowers the saving rate needed to achieve a given amount of savings upon retirement. Nonetheless, unless life expectancy in retirement declines, the increase in the working period does not reduce the demand for annuities.