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1 Introduction

1.1 Pensions and the Economics of Aging

Old age income security is one of society's most pressing concerns. A decline in family support of the aged, major increases in the length of retirement, and social security's long-term financial difficulty are all reasons for the growing anxiety. Consideration of current and past socioeconomic data provides a solid basis for this anxiety.

Between 1950 and 1970 the fraction of the aged living with their children declined from 31 to 9 percent.¹ Today fewer than 3 percent of elderly households receive income from their children.² These contributions represent less than 1 percent of the income of the elderly.³

Life expectancy for males at age 25 is 46.9 additional years, up from 44.6 years in 1950.⁴ Despite this increase, the average number of years worked by 25-year-old males has declined by 3.13 years.⁵ Together, these changes have almost doubled the expected duration of retirement and other nonworking periods for males from 5.93 years to 11.47 years. The ratio of nonworking to working years for males is now .32, more than twice the 1950 value. For females, growth in the expected work span, associated with dramatic postwar increases in labor force participation, has exceeded growth in the expected life span by 3.26 years. However, if one measures female work years on a male-equivalent earnings basis, the average young adult's expected nonworking period has increased by 3.60 years.⁶ According to this measure, 25-year-olds can now expect to spend 1.2 years out of the work force for every year they spend in the work force.⁷

Difficulties in financing an extended retirement without major family support have been eased considerably by sizable increases in real social security benefits. These benefits now represent the major source of income for 54 percent of the aged.⁸ However, the continued reliance on social security benefits as the primary source of old age income support is becoming increasingly unlikely. Demographic changes continue to place the Social Security System in a long-term financial crisis. Changes in fertility rates are expected to lower the ratio of social security contributors to beneficiaries from the current value of 3.2 to 1.5 by the year 2040.⁹ The 1983 social security legislation notwithstanding, unless additional measures are enacted shortly, social security tax rates, including health insurance tax rates, could rise as high as 25 percent by the early part of the next century to meet projected benefit payments.¹⁰

The rapid growth of private, state, and local pensions in the 1950s, 1960s, and 1970s represents a natural response to changes in family support of the elderly, an expansion of the retirement period, and uncertainty concerning the amount of retirement income one can expect from social security. Special tax incentives, a recognition of the advantages of group insurance policies, and the use of fringe benefits to avoid periodic government wage controls are important additional explanations of pension growth.

The American pension system is, however, more than simply the inevitable product of changing social, demographic, and economic conditions. Pensions themselves are playing an increasingly important role in shaping social conditions and altering economic behavior.

Today one in every 2.21 American workers is covered under a private, state, or local pension plan. Almost 30 percent of elderly households now receive pension benefits from these plans representing, on average, 31.39 percent of their total income. This pervasive economic institution, in conjunction with the Social Security System, enhances individual independence, but also diminishes a heretofore important economic function of the family.

In the economic arena, pensions raise a host of questions for labor, insurance, and financial markets. Structural features of many pension plans provide significant incentives for long-term employment with the plan sponsor, but also provide significant disincentives to continued employment beyond the plan's permissible retirement ages. Vesting, benefit, and retirement provisions determine pension compensation on the basis of general rather than specific employee characteristics. This feature of pensions may militate against hiring particular types of job applicants if nonpension compensation cannot appropriately adjust for particular worker attributes.

With respect to insurance, employer-sponsored pensions explain, in part, the trivially small private market in annuities. Presumably, pensions also affect the purchase of private life insurance; some workers purchase life insurance to protect their families against loss of pension income in the event of their early demise.

Pension funds are playing an increasingly important role in financial markets because of both the size of their holdings and their allocation across various financial assets. In 1950 pension reserves represented 1.9 percent of total household wealth; in 1980 pension reserves exceeded 6.0 percent of household wealth. Pension investments are highly concentrated in financial securities. Currently pension funds own close to 15 percent of all corporate stock, 26 percent of corporate bonds, and 5 percent of federal, state, and local government securities.¹¹ For the majority of pension plans, the portfolio decisions of pension fund managers directly affect the ultimate amount of pension income received by participating workers; in other cases, such decisions may influence the financial valuation of the employer's enterprise, since the firm may be legally obligated to pay specified pension benefits independent of the performance of the pension fund.

Pensions may also be affecting the nation's rate of saving. Employer-sponsored pensions obviously represent a substitute for household retirement saving, but the rate of substitution may be greater or less than dollar for dollar. A key feature of saving in the form of pension benefit accrual is the illiquidity of the investment. Young households unable to gain direct access to these funds or to borrow against these assets from formal financial institutions or their relatives may be reducing their consumption and raising their total saving above its alternative value. The tax-free accumulation of capital income within pension funds may provide incentives for increased total household saving to the extent that these tax advantages are affecting marginal household consumption decisions and not simply altering the allocation of a given amount of household saving between pension and nonpension saving vehicles. Pensions could also be altering national saving if workers systematically over- or underestimate the extent of retirement income forthcoming from their pensions. Similarly, stockholders of companies with unfunded pension benefit liabilities may systematically over- or undervalue these liabilities. Such practices would affect stock market valuations, stockholders' perceptions of their true net worth, and ultimately stockholders' consumption patterns.

Pensions raise many important questions for the economic performance of the economy. The answers to such questions are of importance to social scientists and to government officials charged with pension regulation. But those with the highest stake in the answers are surely the actual workers and employers who enter into the semicontractual relationship known as a pension plan.

1.2 Objectives and Organization

The purpose of this volume is to provide a reference base of pension data that is accessible to a wide audience ranging from economists studying compensating wage differentials, to officials of the Pension Benefit Guarantee Corporation charged with insuring pension funds, to the worker interested in comparing his or her pension plan with that of other

covered workers.¹² The book deals almost exclusively with private, state, large city, and other local pensions. Information on federal pensions, including the Social Security, Railroad Retirement, Civil Service, and Military Retirement Systems, is readily available in numerous other publications.¹³

The material is organized into six chapters. Chapter 2 details data sources and statistical procedures. Chapter 3 addresses pension coverage, including both its historical growth and its cross-sectional variation with demographic and economic characteristics of the working population. This chapter also surveys the receipt of pension income by the elderly, describes characteristics of the beneficiary population, and compares pension income with various measures of pre-retirement earnings. Chapters 4 and 5 examine the structure and financial status of private pension plans. Chapters 6 and 7 conduct a similar analysis for state and local plans. Structural features of pension plans include participation requirements, vesting and benefit formulae, benefit levels, requirements for early and normal retirement, provisions for cost of living adjustments, and protection for disability. Chapters 4 and 6 enumerate the number of plans with particular structural features and the number of pension participants affected by these features.

Chapters 5 and 7 present estimates of unfunded liabilities of private, state, and local pension funds, along with historic and current levels of pension fund contributions, benefit payments, and assets. These chapters describe how the portfolio composition of private pension funds varies with plan type, plan size, and industry. In addition, the financial chapters examine the historic performance of returns on pension investments using special information provided by five private sector surveys.

Data availability, time, and space limitations constrained the choice of topics and the detail of the analysis. Consequently, the treatment of private and public pension systems differs depending on the topic in question. For example, since almost 90 percent of state and local workers but fewer than half of private sector workers are covered by pensions, most of chapter 3 explores socioeconomic determinants of private sector pension coverage. The analysis of unfunded pension liabilities also differs for the private and public sectors. Chapter 7 presents liability estimates for public pension systems prepared by Dr. Frank S. Arnold on the basis of a uniform set of actuarial procedures. These estimates were prepared because official government reports of these liabilities are unavailable on an actuarially consistent basis. In addition, while previous unofficial studies have focused on particular segments of public pension systems, the differences in actuarial procedures used in these studies limit their comparability.¹⁴ In the case of private pension liabilities, official estimates calculated on a somewhat more consistent basis are available for many large corporations in their 1980 annual reports. These official estimates and the discount rates used in their calculation are presented in chapter 5.

Only a fraction of the data in this volume is summarized in each section's discussion of principal findings. The textual description of key features of the data is intended to guide the reader's use of the tables rather than to provide a substitute for individual scrutiny of the tabulations.

The data are presented from a variety of perspectives suggested by underlying economic and social questions. They are also presented at various levels of aggregation, permitting the reader to quickly grasp central bivariate correlations without precluding a more detailed understanding of underlying multiple correlations. A final principle guiding data presentation is that dispersions around central tendencies can be as interesting as the central tendencies themselves. Therefore, to the extent possible, the book describes both the average characteristics of pension plans, participants, and recipients and the distribution of plans, participants, and recipients by pension and demographic characteristics.

1.3 The Emerging Role of Pensions in the American Economy: Postwar Patterns of Growth

Private, state, and local pensions now cover over 45.28 percent of the U.S. labor force. In 1950 the figure was 19.93 percent. Coverage of private wage and salary workers more

than doubled over the 1950s, 1960s, and 1970s, from 23.79 percent to almost 50 percent. Coverage of state and local government workers increased from 60 to 90 percent.

In 1980 over one-quarter of all individuals age 60 and over reported receipt of pension income from private, state, and local pension plans; the figure in 1969 was only 13 percent. Taking elderly households as the unit of analysis, the fraction reporting pension income rose from 18.4 to 27.9 percent over this period. The fraction of the elderly receiving pensions will almost certainly continue to grow through the 1980s and 1990s, reflecting recent increases in the fraction of U.S. workers covered by private, state, and local pensions.

Growth in pension fund contributions, benefit payments, and assets has been associated with this sizable growth in pension coverage and in the fraction of the elderly receiving pension benefits. In 1950 contributions to private pension funds represented 1.69 percent of total private sector wage and salary compensation. By 1975 the percentage was 5.10. Over the period 1950 to 1979 contributions per covered worker in constant 1980 dollars rose from \$731.77 to \$1,494.53. Contributions per covered worker (in 1980 dollars) for state and local pension plans increased from \$2,098 to \$3,272 between 1960 and 1980.

During the 30 years from 1950 to 1980 the annual growth rate in real pension benefit payments averaged 11 percent for private plans and 7.36 for state and local plans. Pension benefits in 1980 represented over 12 percent of the income of the elderly, up from 3 percent in 1950.

The size and composition of pension fund assets have changed considerably since 1950. In that year the assets of private, state, and local pension funds and the reserves of insurance companies held to meet insured benefit payments equaled \$60.24 billion (1980 dollars). The figure today exceeds \$650 billion. Public pension assets have grown at roughly the same rate as private pension fund assets. In 1950, 27.84 percent of total private, state, and local pension fund assets were held by state and local pension funds. In 1980 the fraction was 30.44 percent.

For noninsured private pension funds the share of assets invested in equities rose from 33.71 to 59.15 percent over the years 1955 to 1980. The equity share of state and local pension portfolios grew from 2.0 percent in 1950 to 21.3 percent in 1979. These figures likely understate the movement into equities, since investments in pooled funds increased steadily from 1950 to 1980. The equity share of pooled funds appears to be sizable.

1.4 A Profile of Pension Participants

In 1979 an estimated 30.2 of 67.3 million private sector workers were covered under private pension plans. Close to 70 percent of these 30.2 million were male, 89.36 percent were white, 56.36 percent were over age 40, 40.13 percent had post-high school education, 34.12 percent earned more than \$15,000 per year, 49.89 percent were white collar workers, and 44.19 percent worked in manufacturing. The composition of covered workers in the public sector is somewhat different. Of the 9.43 million 1979 public sector (state and local) covered workers, 49.24 percent were male, 87.18 percent were white, 44.09 percent were over age 40, 62.86 percent reported at least a high school education, and 30.99 percent earned more than \$15,000 per year.

The composition of covered workers along many of these dimensions largely reflects differential coverage rates by demographic and economic characteristics. For example, in the private sector, male pension coverage was 52.9 percent in 1979 while female coverage was only 33.3 percent. For white workers, the 1979 coverage rate was 45.2, somewhat larger than the 41.9 rate for nonwhites. Workers 46 years and older are more than 1.3 times as likely to report pension coverage as their younger colleagues. Close to half of private sector workers with a post-high school education report pension coverage; only 42.77 percent of less educated workers report coverage. Private sector workers with annual earnings in excess of \$15,000 are 2.19 times more likely to be covered by a pension than lower paid workers. For workers in white collar occupations the 1979 coverage rate is 46.55 percent, slightly larger than the 43.31 percent rate for blue collar workers.

Almost three-quarters of pension participants are enrolled in defined benefit plans; the

remainder are enrolled in defined contribution plans. Defined benefit plans determine pension benefits on the basis of formulae that typically take into account the worker's years of service, past earnings history, and age at retirement. In defined contribution plans benefits equal the return of principal plus income earned on explicit pension fund contributions made by, or for, each participating worker.

Private pension plan participants are highly concentrated in large plans; 78.06 percent of participants belong to plans with 1,000 or more covered workers. Almost half of all private pension participants are enrolled in union plans. This statistic is striking when compared with a less than 25 percent union representation among the total private U.S. work force. "Plan entity" is another important feature of pension plans. Private plans that cover workers of more than one employer—multiemployer plans—cover 18.61 percent of private pension participants.

While 44.87 percent of the U.S. work force reported pension coverage in 1979, only 21.43 percent indicated that they were vested. Almost one-fifth of covered workers indicated a lack of knowledge of their vested status. There is also a significant difference between male and female vesting rates. Covered female workers are 20 percent less likely to be vested than their covered male co-workers. The white-nonwhite differentials in vesting rates for covered workers are slightly smaller than the male-female differentials; 48.57 percent of white participants, but only 41.02 percent of nonwhites surveyed in 1979 indicated their pension benefits were vested. The probability that a worker's benefits are vested is strongly correlated with age. Fewer than one-third of covered workers below age 30, but more than 60 percent of covered workers above age 50 are vested.

1.5 A Profile of Pension Beneficiaries

In 1980, 6.64 million, or 19.94 percent, of the 33.30 million Americans age 60 or over reported receipt of income from either private, state, or local pension plans. For individuals age 70 and over, the fraction reporting pension income was 27.37 percent. Almost three-quarters of the 6.64 million beneficiaries received private pensions. Of these beneficiaries 18.47 percent were age 60 to 64; 31.93 percent were 65 to 69; 49.60 percent were 70 or older. Over 60 percent of private, state, and local beneficiaries were male; almost 94 percent were white. Although individuals with post-high school education constitute only 18.08 percent of these elderly cohorts, they represent 25.58 percent of private, state, and local pension recipients. Over 39.69 percent of the 1980 population of elderly individuals reported only a grammar school or junior high school education. These individuals account for only 27.47 percent of the 1980 pension recipients.

Pension recipients report greater than average levels of lifetime earnings, but only average levels of current annual income. Across all age groups, 7.06 percent of the 1980 elderly reported \$20,000 or more in annual income. Among elderly pension recipients the fraction is only slightly higher, 7.53 percent. However, for the 70 and over age groups, 5.81 percent of pension recipients reported \$20,000 or more in income, almost twice the percentage for the entire 70 and older age group.

Pension recipients, as one expects, are much more likely to be out of the labor market than the typical elderly individual. The employment rate (fraction of population employed) of the post-60 population was 21.87 percent in 1980; for private, state, and local pension recipients it was only 12.33 percent. Apparently, for many of the elderly, the receipt of pension income is associated with a total cessation of employment. Thus, while pension coverage of workers and the generosity of their pension benefits is highly correlated with earnings, elderly pension beneficiaries in general report average levels of income.

There were 22.26 million households in 1980 headed by an individual age 60 or older. In slightly over half of these households, the household head was single. Of the single households, over three-quarters were headed by a female. In 1980, 35.49 percent of married households reported pension income; the comparable percentage was 23.82 for single male-headed households and 19.36 for single female-headed households. Although married households constitute less than half of total elderly households, they account for 63.06 percent of all 1980 households that received private, state, or local pension benefits.

1.6 The Structure of Private Pension Plans

In 1980 there were an estimated 616,642 private pension plans in the United States, an enormous growth from the 14,671 plans in existence in 1951. Approximately 65 percent of these plans were defined contribution, as opposed to defined benefit, plans. Defined contribution plans are disproportionately small plans, however, and cover less than one-third of private pension participants. Defined contribution plans average 34.17 covered workers, while defined benefit plans average 209.57 participants. Actually, most pension plans are fairly small. In 1977, 86.81 percent of defined contribution plans and 59.88 percent of defined benefit plans reported fewer than 25 participants. Over two-thirds of pension participants, however, are concentrated in the 5,000 largest plans that account for less than 1.5 percent of all plans.

Union plans tend to be quite large, averaging 797 participants; although they make up only 5.25 percent of all plans, their participants constitute almost half of all private covered workers. Over 38 percent of union participants are in multiemployer plans, and over 90 percent of multiemployer plan participants are union members. Multiemployer plans average 859 participants and cover 18.61 percent of private pension participants.

Subject to minimum standards established under the Employee Retirement Security Act of 1974 (ERISA), private pension plans are free to establish rules and requirements that govern participation, vesting, benefit accrual, ages of early and normal retirement, as well as provisions for receipt of disability benefits. There are a host of provisions that meet ERISA's requirements. As a consequence, there are a wide variety of pension plans. A description of the structure of U.S. plans requires examining each of the rules and requirements in turn.

1.6.1 *Pension Participation*

The initial date of pension plan participation determines, at a minimum, the date beyond which workers are formally enrolled in the plan and included in official reports to the government. For purposes of computing benefit accrual the date of plan participation is also the latest date that the plan can use. Some plans appear to use an earlier date for benefit accrual, such as the date employment commences with the plan sponsor.

About 50 percent of pension plans specify a minimum age requirement for plan participation. Most of these plans specify a service requirement as well. For plans with age requirements, over half specify age 25 as the initial age of participation; another 20 percent specify age 21. The plans specifying age 25 account for 72.56 percent of all participants in plans with age requirements. Plans with service participation requirements represent 70.06 percent of all plans. Virtually all plans with service requirements specify 3 years or less; plans with a one-year service requirement cover 87 percent of all workers in plans with a service requirement. Large plans often permit immediate participation. The 20.61 percent of pension plans with no participation requirements cover over 51.17 percent of pension participants.

Fewer than one-third of private pension plans restrict pension participation of elderly workers. These plans, however, cover 42.55 percent of all private pension participants. The maximum age for plan participation in these cases averages 61.78, where this average is weighted by the number of covered workers.

1.6.2 *Vesting and Portability*

Vesting provisions are a key structural feature of pension plans. Vested pension benefits are benefits to which the worker has a legal claim. Fewer than 4 percent of private covered workers are vested immediately. Slightly more than half are covered by 10-year "cliff vesting," which provides full vesting after 10 years of service, but no vesting prior to 10 years. Another 16.32 percent of pension participants belong to plans with cliff vesting at 3 or 5 years or with a partial, or "graded," vesting that specifies a schedule of vesting accrual. Almost 5 percent of covered workers are in plans with 10 years of graded vesting. Under this formula a worker's vesting rights typically increase by 10 percent for each of the first 10 years of service.

Vesting provisions differ markedly across plan types and industries. Almost two-thirds of defined benefit participants but fewer than one-quarter of defined contribution participants belong to plans with 10-year cliff vesting. Over 13 percent of defined contribution participants but only .62 percent of defined benefit participants enjoy immediate vesting. In wholesale trade 15.15 percent of participants face 10-year graded vesting; the comparable figure in mining is only 2.86 percent.

Data from the Department of Labor's EBS1 file suggest a surprisingly large degree of pension portability. Portability means that a worker can switch jobs and continue pension participation under the original pension plan or under an equivalent pension plan that credits the worker's past service with the former employer. According to the EBS1 data, close to half of all pension participants have portable pensions. Over one-fifth have portability with employers who are not cosponsors of the pension plans.

These figures should be viewed with considerable caution. They may in part reflect a confusion on the part of survey respondents as to whether the portability question really dealt with portability as opposed to vesting. On the other hand the correlation of portability with plan size suggests much more than simple coding errors. According to EBS1 data, fewer than one-quarter of participants in small plans with less than 25 participants but over two-thirds of participants in plans with 10,000 or more covered workers appear to have portable pensions. This high degree of portability reported by larger plans may in part reflect the ability of covered workers to carry service credits to related companies only—e.g. subsidiaries. In addition, industries such as construction in which workers often switch companies report much greater than average rates of portability.

1.6.3 *Benefit Provisions*

As mentioned, over 70 percent of pension participants are enrolled in defined benefit plans that base benefits on a specified formula. There are six commonly used defined benefit formulae. Plans with these six formulae account for 86.25 percent of defined benefit participants. Roughly two-fifths of the 86.25 percent of these defined benefit participants are enrolled in plans that relate benefits to past levels of earnings. The majority of these participants have formulae that are integrated with social security.

A large fraction of defined benefit participants, 43.02 percent, belong to plans that determine benefits independent of earnings. Of this 43.02 percent, 35.61 percent have benefits determined as a flat dollar amount related only to service. The other 7.14 percent receive a flat dollar benefit, independent of earnings or service. Since these formulae provide nominal payments independent of general price or wage increases, they appear completely unindexed with respect to inflation that occurs during the workers' years of service.

Two-thirds of plans specifying flat benefits independent of earnings are plans subject to collective bargaining agreements. These plans cover 79.76 percent of participants in plans with flat benefit formulae. Of the 10.07 million union participants subject to these benefit formulae, 3.88 million are members of multiemployer plans. Many of the flat benefit, multiemployer plans appear to be Taft-Hartley plans that combine features both of defined benefit and of defined contribution pensions. For these plans the erosion of real benefits due to inflation during the workers' years of service may be less significant. Under Taft-Hartley plans, employers make defined contributions to a trust that is, typically, jointly managed by the union and the employer. For ongoing plans, total payments to beneficiaries are typically determined by contributions to the trust fund and by the fund's investment performance. Trust fund assets are paid out to retired workers over time in the form of flat payments that may or may not be related to service. As additional contributions are made to the fund, its managers periodically may increase the designated dollar benefit amount in their benefit formula. From the perspective of workers as a group, then, many ongoing Taft-Hartley plans appear to operate much like defined contribution plans. From the perspective of the individual worker, however, these plans may more closely resemble defined benefit plans than defined contribution plans. This depends on the frequency of increases in benefit amounts. To the extent that revisions in benefit amounts occur infrequently over time,

particular workers may be absorbing a substantial inflation risk with respect to the real level of their first benefit check.

Even if individual benefits are adjusted on an annual basis, Taft-Hartley plans may still differ from defined contribution plans. In the case of pension plan termination, a Taft-Hartley plan, like a standard defined benefit plan, may face legal liabilities that exceed the current value of the plan's trust fund. Vested workers in such circumstances are treated like defined benefit participants rather than defined contribution participants.

The proportion of defined benefit participants covered by formulae not related to earnings rises rapidly with plan size. In plans with 10,000 or more participants, 48.49 percent of participants are covered by such formulae; the corresponding percentage for plans with fewer than 50 covered workers is less than 4. The fraction of defined benefit participants covered by social security integrated benefit formulae rises from 31.8 percent for plans with 100 to 250 workers to 38.5 percent for plans with 10,000 or more workers. There is also considerable variation in the use of particular formulae across industries; 68.75 percent of defined benefit participants in finance, insurance, and real estate but only 5.36 percent of such participants in construction have social security integrated formulae.

There seems to be great variation in the rate at which pension benefits replace pre-retirement wages depending on the type of benefit formula in use. Based on 1977 plan provisions, a hypothetical worker retiring in 1977 with 35 years of service and \$10,000 in earnings at the end of his or her career would have received, on average, \$2,254 among plans specifying the unit benefit formula. This formula computes annual benefits as a fixed percent of a specified earnings base multiplied by years of service. Among plans with formulae specifying a flat benefit related only to service, the benefit would have averaged \$3,385.

Replacement rates also vary depending on the participant's salary level. These variations occur chiefly because of plan provisions for social security integration. While Internal Revenue Service regulations do not permit qualified pension plans to discriminate in favor of highly paid workers, they do allow plans to integrate their benefit formulae with social security in order to counteract social security's provision of higher replacement rates for lower paid workers. Other factors held constant, plans with integrated formulae tend to provide higher replacement rates at higher levels of earnings. Among plans with a social security offset formula, for example, a hypothetical worker with 35 years of service and a final salary of \$40,000 would receive, on average, \$15,597, corresponding to a replacement rate of 38.99 percent. If the same worker retired with a final salary of \$10,000, however, his (her) benefit would average \$2,116 and his (her) replacement rate would be only 21.16 percent.¹⁵

For plans that do base benefits on earnings, the choice of the earnings base can significantly affect the worker's ultimate replacement rate. Across all earnings-based benefit formulae, the average replacement rate for a 1977 retiree earning \$20,000 prior to retirement is 38.85 percent in plans using a final or highest three years' earnings base; it is 14.79 percent for plans using a career average earnings base.

The replacement rates for hypothetical 1977 retirees differ significantly across industries. For earnings related formulae, the \$20,000 average replacement rate was 18.92 percent in retail trade and 41.91 percent in finance, insurance, and real estate. The \$20,000 replacement rate for non-earnings related formulae averaged 11.4 percent in manufacturing, but 21.60 percent in construction.

The replacement rates for hypothetical retirees in nonunion plans are larger than those for union plans for earnings related formulae, but smaller for non-earnings related formulae.

These average replacement rates for hypothetical retirees conveniently summarize a number of features of pension benefit formulae and demonstrate the sensitivity of these rates to the level of earnings and choice of earnings base. Whether certain industries or union plans or plans of a particular size, etc., actually provide lower than average replacement rates depends on the joint distribution of earnings, earnings bases, and benefit formulae across these pension plan characteristics. New Department of Labor data that permit the calculation of actual 1978 replacement rates suggest minor differences in replacement rates by sex, union status, and industry, but considerable differences by the recipient's age at first

receipt of pension benefits. Early retirees typically have larger replacement rates than normal retirees, reflecting a greater number of years of service with the plan sponsor.

1.6.4 *Normal and Early Retirement*

Almost 90 percent of pension participants are members of plans that specify a minimum age for normal retirement. This age averages approximately 65. In one-quarter of pension plans, covering 45.14 percent of all participants, there is also a service requirement for normal retirement, averaging close to 5 years on a participant-weighted basis. There appears to be relatively little variation in these requirements across plan type, plan size, industry, union status, and plan entity.

A surprisingly large fraction of private plans, 35.9 percent, do not permit early retirement. These plans, however, cover only 17.8 percent of participants. In the case of defined benefit plans only 11.62 percent of participants are completely precluded from early retirement. The typical early retirement age is 56. The typical service requirement for early retirement is about twelve and one-half years and affects over three-quarters of covered workers with an early retirement option.

Virtually all private pension participants who retire early may have their benefits specially reduced as a result of retiring early. For over 40 percent of participants, the application of a special benefit reduction depends on the age at early retirement and/or the worker's length of service. For the remaining set of potential retirees, a special benefit reduction is always applied for permissible retirement prior to the plan's normal retirement age. Certain plans, particularly those integrated with social security, provide supplemental early retirement benefits until the worker is eligible to begin collecting social security.

The plan's normal retirement age certainly demarcates the age beyond which a worker is free to retire and suffer no special benefit reduction. The normal retirement age can also determine the age at which benefit accrual ceases. For close to half of private pension participants, the normal retirement age only serves to make the former distinction; i.e. close to half of private pension participants can continue to accrue pension benefits beyond the plan's normal retirement age. Another 29.75 percent of participants are in plans that permit benefit accrual only until the employee reaches a specified age and/or has completed a specified length of service. The remainder of participants are in plans that permit no additional benefit accrual if the employee continues to work after satisfying the requirements for normal retirement.

1.6.5 *Cost of Living Adjustments and Disability Provisions*

Cost of living increases appear to be an important feature of many private pension plans. While few plans have provisions for automatic cost of living increases after retirement, most large plans periodically extend ad hoc increases to their retirees. In the period from 1976 to 1979, roughly two-thirds of large private pension plans extended increases averaging 21.88 percent, which is equivalent to roughly half of the rise in the Consumer Price Index over the same period.

Close to three-quarters of private pension plans, covering 84.11 percent of participants, provide disability coverage to their workers. The percentage varies across industries, from a high of 93.84 percent in construction to a low of 67.23 percent in finance, insurance, and real estate. Over two-thirds of participants covered by disability provisions face rather rigorous requirements for receipt of disability benefits. To receive disability benefits virtually all of these workers face service requirements that average 11.43 years. For a third of workers with disability service requirements, the service requirement is 15 years.

1.7 The Structure of State and Local Pension Plans

1.7.1 *Participation*

In contrast to private pension plans, state and local plans rarely have requirements for participation. In state-administered plans, only 9.05 percent of participants belong to plans

that restrict entrance on the basis of age and/or service. The percentage for large-city plans is 1.51; it is .61 for other large local plans and 27.48 for small local plans. Where such restrictions arise, the average age and service requirements are similar to those of private plans in the case of small local plans and somewhat smaller in the case of state, city, and other large local plans. While almost one-third of private pension plans prohibit participation of workers beyond a certain age, the comparable fraction for public plans is roughly one-fifth.

The federal government does not regulate state and local pension systems. Unlike private plans, therefore, public plans need not vest workers' benefits. Despite the lack of federal regulation, all state-administered and large-city plans as well as all other large local plans in the NBER 1978 City and Large Local Pension Survey (CLLPS) report vesting provisions. However, almost one-third of small local systems covering close to one-quarter of all participants in small local plans provide no vesting. On average, state-administered plans require about three fewer years of service for full vesting than do private plans. Large-city and other large local plans require roughly an equivalent length of service for full vesting, while those small local plans that permit vesting require, on average, almost four more years of service than private plans. Public pension systems seem to use cliff vesting exclusively. None of the public plans we encountered in this study reported gradual, or "graded," vesting.

1.7.2 *Benefit Provisions*

Virtually all state and local pension plans are defined benefit plans. However, some of these plans provide additional defined contribution benefits based on special employee contributions. Relatively few of the benefit formulae in the public defined benefit plans are integrated with social security. In the case of state-administered plans, for example, only 15.60 percent of participants are enrolled in integrated plans. For large-city plans the percentage is 27.64; it is 5.36 for other large public systems and 7.80 for small local systems. For private plans the percentage is 37.57. Part of the explanation for this difference is simply that many state and local governments do not participate in social security. In 1980 approximately 37 percent of state-administered pension participants and 51 percent of large-city pension and other large local pension participants were not covered by social security at their public sector job.

All public defined benefit plans surveyed in this book use past earnings to compute retirement benefits. State systems rely to a great extent on the unit benefit formula that determines benefits as a fixed percentage of a specified earnings base multiplied by the length of service. Almost two-thirds of state-administered pension plan participants are covered by this formula. The fraction is also quite large—80.53 percent—for large local plans other than large-city plans.

The substantial use of terminal years' earnings in computing the defined benefit earnings base significantly reduces the sensitivity of real public pension benefits to inflation that occurs during a worker's years of service. For over 80 percent of public pension participants, the earnings base is determined as the average of the highest five final years of earnings. In the case of private plans, over one-quarter of the 43.50 percent of defined benefit participants with earnings-based benefits receive pensions based on a career average of earnings.

Public pension plans appear to offer much more generous pension benefits than private plans. In the case of state-administered plans, for example, a hypothetical worker retiring in 1977 with a final salary of \$20,000 would have received an annual benefit equal to 57.00 percent of his (her) final salary. In the case of private defined benefit plans the average earnings related benefit replacement rate for a \$20,000 retiree in 1977 is only 29.39 percent. The proposition that public pensions are more generous than private pensions is supported by 1980 *Current Populations Survey* data indicating average benefits of \$3,850 for 65- to 69-year-old male private pension recipients, but \$4,654 for the corresponding state and local pension recipients. For female recipients in this age group, private benefits average

\$1,789, compared with public benefits for females of \$3,850. Pension benefits constitute less than 30 percent of the total income of private recipients. In contrast, public pension recipients in this age group receive roughly 40 percent of their income from pensions.

1.7.3 *Normal and Early Retirement*

Over 85 percent of all public systems and 100 percent of state-administered systems and other large local plans in the NBER CLLPS (1978) survey specify an age requirement for normal retirement. For state, large-city, other large local, and small local plans, the participant-weighted normal retirement ages average 60.11, 58.75, 62.44, and 62.55, respectively. The average normal retirement age for private plans is 64.71. Over half of public pension participants must satisfy service as well as age requirements to qualify for normal retirement. These service requirements average 10.10, 11.25, 14.15, and 15.09 years for state, large-city, other large local, and small local systems, respectively. In the case of large-city and small local plans, 9.09 and 13.16 percent of participants, respectively, face only a service requirement to qualify for receipt of normal retirement benefits. For both types of systems the average service requirement is 20 years.

With the exception of small local plans, the vast majority of public pension participants belong to plans with provisions for early retirement; 96.54 percent of state participants, 66.16 percent of large-city participants, 85.82 percent of other large local participants, but only 51.54 percent of small local participants have early retirement options. In the case of private pensions, 82.20 percent of participants are covered by early retirement provisions. For all four public pension groups the mean (participant-weighted) early retirement age, when one is specified, is roughly 54. The mean (participant-weighted) service requirement of plans specifying a service requirement ranges from .51 years in state plans to 1.23 years in small local plans. In private plans the early retirement age averages 56 while the mean service requirement is about 12 years.

1.8 The Financial Status of Private, State, and Local Pension Plans

Pension funds and pension reserves of insurance companies represent a growing repository of national savings. The 1980 value of these savings was \$650.7 billion, or 6 percent of total 1980 private sector net worth. Private pensions accounted for 69.24 percent of these assets. The current and future pension benefits that must be financed in part by these assets are equally sizable. For example, in 1980, 497 of the nation's largest corporations reported vested accrued liabilities of \$137.10 billion. Estimates of 1978 vested accrued state and local pension liabilities ranged from \$135.6 billion (assuming a 12 percent interest rate) to \$179.2 billion (assuming an 8 percent interest rate).

Measurement of these and other liability concepts is highly sensitive to the choice of interest rate used to discount future benefit streams, to projected rates of employee wage growth, and to assumptions about worker longevity and employment separation. Even if measurement were straightforward, there would still be major conceptual questions concerning the appropriate definition of pension liabilities. Two definitions considered in this book are accrued and projected liabilities. Accrued liabilities are essentially "shutdown" liabilities. They equal benefit obligations a plan would face if it terminated operation and paid off vested and, in the case of total accrued liabilities, unvested benefits using only past service and past levels of earnings to compute benefits. Projected liabilities equal the present expected value of benefits payable to current participants, assuming the plan continues in operation and that service and earnings of active participants increase at projected rates. Projected liabilities look to the future, while accrued liabilities are based solely on past experience.

The vested accrued liability concept may be most appealing to members of the legal profession, since it corresponds most closely to an enforceable legal claim. However, in certain circumstances, unvested accrued benefits also represent legal liabilities of the pension fund. Under ERISA, unvested accrued liabilities are residual claims on a terminating

private plan, provided that plan assets exceed the plan's vested accrued liabilities. Total and vested accrued liabilities are currently reported by most major corporations in accordance with the 1980 recommendation of the Financial Accounting Standards Board.

Actuaries often consider legal definitions of pension liabilities too narrow for purposes of judging the appropriate degree of pension funding or the true economic claim on plan sponsors. Legal pension claims—vested accrued benefits and, potentially, unvested accrued benefits—are paid, in practice, only in the case of plan termination. For ongoing pension plans that provide rapid growth in pension benefits as the worker accumulates more service and/or earns a larger wage, the assets required to fund projected liabilities will exceed those required to fund accrued liabilities based on past service and earnings experience.

Economists also find projected liability concepts interesting. For ongoing plans, projected benefits may represent implicit, if not legal, claims on plan sponsors. Contractual models of labor market behavior view workers and employers as entering into long-term agreements in which the worker provides a time path of labor services in exchange for a time path of total compensation. Within these models there need be little or no relation between this year's labor effort and this year's compensation. For example, young workers who consider joining a particular firm will consider the firm's projected pension benefit offer as well as its projected path of nonpension compensation in making their decision. In contrast to this contractual view of labor markets, traditional spot labor market theories predict that new hires consider only their immediate wage and accrued pension compensation. For young workers covered by plans with long service requirements for vesting, the value of immediate pension accrual may be zero. Hence, in the context of contractual labor markets, projected pension benefits simply represent one component of the employer's long-term compensation obligation, and projected rather than accrued liabilities are most relevant for considering the interactions of pensions and economic behavior.

Another example of the economic importance of projected, as opposed to accrued, liabilities involves the financial valuation of the plan sponsor's enterprise. If employers have effectively committed themselves to a long-term level of worker compensation including projected pension benefits, it is projected rather than accrued unfunded liabilities that represent a claim on the plan sponsor's nonpension assets and future profits.

In contractual labor markets, a comparison of projected pension liabilities with pension fund assets may provide little information about potential pension default. By assumption, the employer is committed to meeting all explicit and implicit compensation commitments. Hence, if pension fund assets are inadequate to meet projected pension liabilities, the firm will use its other assets to cover the difference. Therefore, while the size of unfunded projected pension liabilities is not necessarily indicative of the probability of default, it does indicate the size of the implicit lien on the employer's nonpension assets.

Choice of an appropriate pension liability concept is also an important problem for government officials charged with oversight of pension tax treatment. Contributions to pension funds are deductible by the employer and therefore reduce the employer's current corporate or personal income tax liability. Excess contributions to pension funds are a potential mechanism for deferring taxation of the employer's profits. Such excess contributions defer rather than eliminate tax liabilities because future repatriation of excess assets from the pension fund to the employer are taxable to the employer. Another tax advantage of pension funds that may lead to overfunding relative to a reasonable, although not necessarily legal, standard is that capital income on pension fund investments accumulates free of tax. One way in which plan sponsors might attempt to minimize their tax liabilities is to borrow money to fully fund or, if possible, overfund their true underlying pension liabilities. Assuming these funds can be invested at rates comparable to those at which the initial loan is secured, the plan sponsor receives interest deductions on corporate or personal taxable income, but receives interest, or other forms of capital income, tax free through the pension fund. The extent to which this type of tax avoidance occurs is poorly understood, as is the potential for repatriation of excess assets from the pension trust fund.

If one considers vested accrued liabilities as the relevant measure of pension indebtedness, the majority of pension plans of major U.S. corporations appear to be adequately funded, if not overfunded, according to their own official reports. The 1980 annual reports of 497 of the Fortune 1,000 largest U.S. corporations include estimates of total accrued and vested accrued pension liabilities. They also list the 1980 market value of pension fund assets available to meet these liabilities. Across all 497 corporations vested accrued liabilities totaled \$137.10 billion while pension fund assets equaled \$133.3 billion. For over half of these corporations, pension fund assets exceed vested accrued liabilities. Fifteen corporations reported assets that were twice the value of their vested accrued liabilities. Only 7 of the 497 corporations had assets representing less than 50 percent of their vested accrued liabilities, and two of these corporations have only recently established their pension plans.

General Motors and Chrysler rank first and second in terms of largest 1980 unfunded vested accrued liabilities. These unfunded liabilities are \$4.08 and \$1.28 billion, respectively. General Motors' \$13.35 billion of assets represent, however, 77 percent of its \$17.44 billion vested accrued liabilities. Chrysler's \$1.75 billion pension assets, on the other hand, are only 58 percent of its \$3.02 billion vested accrued liability. In this sample the corporation with the largest excess of assets over vested accrued liabilities is Western Electric with a \$1.67 billion vested accrued pension surplus. To place these figures in some perspective, Chrysler's 1980 unfunded vested liability per employee is \$9,566; Western Electric's corresponding surplus per employee is \$9,435.

While the 1980 corporate annual reports do not report projected liabilities, a rough sense of the relation between projected and accrued liabilities may be obtained by comparing the present volume's estimates of these two liability concepts in the case of state and local pension plans. For state-administered, large-city, other large local, and small local plans the ratios of projected to vested accrued liabilities are 2.35, 1.78, 2.13, and 2.70, respectively, discounting at a 12 percent nominal rate. Using an 8 percent nominal rate, these ratios are 2.23, 1.77, 2.06, and 2.51, respectively. Application of the highest and lowest of these ratios, 2.70 and 1.77, to the \$137.10 billion vested accrued liabilities of the 497 corporations in the NBER Fortune 1,000 samples leads to projected liability estimates ranging from \$370.17 billion to \$242.67 billion for these companies. The corresponding range of estimates of unfunded projected liabilities is \$236.87 billion to \$109.37 billion. Under the assumption that projected liabilities for these corporations are twice vested accrued liabilities, as many as 231 of the 497 corporations may be less than 50 percent funded with respect to projected liabilities.

Appraisal of the financial condition of state and local pension plans is also highly dependent on the definition of pension liabilities and the method used to measure these liabilities. Chapter 7 presents estimates of accrued (total and vested) and projected liabilities for different long-term rates of inflation. Nominal interest rates are assumed to rise point for point with inflation. The nominal interest rate is taken to equal a 3 percent real rate plus the assumed rate of inflation. This assumption in conjunction with actual nonindexed state and local benefit formulae as well as less than complete cost of living adjustments of recipient's benefits makes liability estimates highly sensitive to inflation.

For 1978 the estimated value of total accrued liabilities of state-administered pension plans is \$137.84 billion calculated using an 8 percent interest rate. Use of a 12 percent interest rate lowers the estimate of these liabilities to \$100.43 billion. The 1978 value of total state pension assets equaled \$125.18 billion, 90.81 percent of the 8 percent liability but 124.64 percent of the 12 percent liability. As a group, then, state pensions are more than fully funded assuming a 12 percent interest rate and over 90 percent funded assuming an 8 percent interest rate.

In general, large-city pension systems and other large local systems are somewhat less well funded with respect to total accrued liabilities than are state plans. In 1979 the twenty cities with the largest number of pension participants reported combined assets of \$20.34 billion. These assets represented 67.50 percent and 83.39 percent of large-city total

accrued liabilities calculated at 8 and 12 percent interest rates, respectively. For other large local pension plans, combined 1979 assets of \$3.17 billion covered 74.96 percent and 98.23 percent of total accrued liabilities at respective interest rates of 8 and 12 percent.

Small local plans, as a group, are much more poorly funded than the other public pension systems. Assuming an 8 percent interest rate, a random sample of public pension plans with 500 or fewer participants are 47.23 percent unfunded with respect to total accrued liabilities; they are 63.91 percent unfunded using a 12 percent interest rate.

While public pension plans in the aggregate appear fairly well funded in terms of total accrued liabilities, there is considerable heterogeneity across pension plans. Based on an 8 percent interest rate, for example, seven state plans are less than 50 percent funded with respect to total accrued liabilities, twelve states have funding ratios between .5 and .75, eighteen states fall between .75 and 1, and thirteen states are more than fully funded. The corresponding funding ratios for large cities range from essentially zero in the case of Indianapolis to 1.61 in the case of Milwaukee. For other large local plans and small local plans the dispersion in funding rates of accrued liabilities is equally significant. Part of this dispersion may, however, reflect the use of a uniform wage distribution by age and service in these actuarial calculations.

The financial condition of public employee pension systems appears much poorer from the perspective of projected liabilities. In contrast to a \$137.84 billion total accrued liability at an 8 percent interest rate, the 1978 projected liability of state plans computed at the same interest rate is \$294.87 billion. State pension assets in 1978 of \$125.18 billion represented less than 43 percent of projected liabilities. For large-city plans, projected liabilities exceed total accrued liabilities by a factor of 1.36 under both 8 and 12 percent interest rate assumptions. Similar ratios apply for other large local and small local pension systems. Under the projected liability definition of pension obligations, 74.00 percent of state plans, 52.27 percent of large-city plans, and 75.89 percent of other large local plans are less than 50 percent funded assuming an 8 percent interest rate.

1.9 Pensions in the American Economy: Problems and Prospects

The statistics in this volume raise a number of concerns about the performance of the U.S. pension system in providing old age income security to American workers. One issue is the complexity of pension provisions. While the Employee Retirement Income Security Act of 1974 has substantially standardized pension provisions, considerable latitude remains in the choice of plan features. A typical worker today might face age and service restrictions on plan participation, a graduated vesting schedule, portability with a specified set of coparticipating employers, a social security step-rate integrated benefit formula, an optional peak years or terminal years earnings base, age- and service-specific early retirement benefit reduction rates, supplemental early retirement benefits, partial actuarial increases in benefits for work beyond the plan's normal retirement age, and limited cost of living adjustments. Additional features would establish the worker's eligibility for disability benefits as well as the level of those benefits. Each of these provisions can significantly influence the employee's expected pension compensation. In addition to digesting a host of rules and regulations relating to structural features of the pension plan, an informed worker should be familiar with the pension plan's financial condition since pension plan default can wipe out pension claims of unvested workers and reduce a vested worker's expected pension compensation by the difference between projected and accrued benefits.

An informed worker should also understand the investment decisions of the pension fund's portfolio manager. In the case of defined contribution plans these decisions directly influence the worker's expected retirement benefit as well as its variance, since the pension fund manager is, quite simply, investing the worker's money. In the case of defined plans, pension fund investment decisions influence the probability of plan default.

Even given complete knowledge of the plan's structural features and its financial status, the calculus required to estimate both the level of future pension compensation and the risk

of receiving that compensation is difficult at best. The worker needs to formulate fairly precise expectations about the course of inflation and real interest rates; he (she) needs to understand the set of probabilities that determine both life expectancy and the chances of experiencing employment termination prior to retirement age; finally, the worker needs to be able to actuarially discount future benefit streams and assess their risk with respect to variations in the inflation rate, potential changes in employment conditions, and other factors.

The complexity of pension provisions also poses difficult problems for employers. To "meet the market" in terms of total worker compensation, the employer must appreciate the value of nonwage as well as wage compensation being offered by his (her) competitors and be able to assess the increment to total compensation associated with his (her) own pension plan. The free market presumably alleviates some of the employer's informational problems associated with pensions. For example, employers may not need to understand precisely how 10-year as opposed to 5-year cliff vesting affects workers' perceptions of their total compensation offer. Employers can, in principle, experiment with different components of their compensation package until they attract the requisite quantity and quality of workers. But this line of argument ultimately throws the informational requirements back to the worker. Workers need to be able to assess the relative attractiveness of different pension plans in order to arbitrage differentials in total compensation across employers.

The limited data available on worker familiarity with pension plan provisions provide some basis for concern. In 1980, 8.05 percent of U.S. private wage and salary workers responded "don't know" to a U.S. Census survey asking whether they were covered by a pension. Of those workers who reported pension coverage, almost one in five did not know whether their pension was vested. The "don't know" response to the vesting question was given by 27.85 percent of workers age 18 to 25, but only 12.43 percent of covered workers age 56 to 60. These rates are sufficiently high to suggest even more limited knowledge by workers of precise provisions of benefit formulae: retirement requirements, cost of living adjustments, and the like.

Additional research is needed to determine the full extent of informational problems in the pension area. If there is a significant lack of information, how does this fact affect the efficient operation of the U.S. labor market and what are the distributional implications of these informational problems with respect to wages and profits? The answers to these questions are of interest to all Americans, even those who never anticipate participating in a pension plan. As a nation, we are providing sizable tax incentives to saving in the form of pensions. Official estimates place the 1980 revenue losses to the U.S. Treasury from pension savings incentives at \$36.7 billion, or \$229 per adult American.¹⁶ Is the current structure of the U.S. pension system delivering the saving and labor market results that are commensurate with this national investment? If not, what public policy approaches are needed to strengthen the U.S. pension system in meeting these objectives?

A second area of concern suggested by this study is the extreme sensitivity of real pension benefits to inflation. A recent study by Dr. Robert Clark based on newly available Department of Labor data indicates that most beneficiaries, particularly those in large plans, can expect some type of cost of living adjustment, although not necessarily on an annual basis. On average, cost of living adjustments actually awarded fall far short of fully protecting the real value of private pension benefits. During the period 1973 to 1979, years that witnessed a 63 percent increase in the Consumer Price Index, mean nominal pensions for beneficiaries in Dr. Clark's sample rose by 22.04 percent. For these beneficiaries real benefits fell by 25.27 percent over the period.¹⁷

Approximately 55 percent of state and local pension plans explicitly specify partial or total cost of living adjustments. Despite this fact the estimates in chapter 7 indicate that an increase in inflation by 4 percentage points can reduce the real value of state, large-city, other large local, and small local vested accrued pension benefits by 24 percent, 31 percent, 22 percent, and 19 percent, respectively.

Unexpected changes in the economy's long-term rate of inflation can affect a recipient's initial real pension benefit and changes in the level of real benefits during retirement years. In

1979, 14 percent of private defined benefit plans covering 27 percent of active pension participants specified benefit formulae that potentially make the real level of the first year's pension benefit quite risky to inflation occurring during the participant's working years. One example is a defined benefit plan that computes the worker's pension on the basis of a lifetime average of nominal earnings. Assuming the worker's nominal earnings just keep pace with inflation, every percentage point of inflation prior to the worker's retirement devalues (in real terms) the value of earnings received at the beginning of the worker's career and therefore lowers the real value of average lifetime earnings. For plans using this earnings base, a lower real value of average lifetime earnings means a smaller initial real benefit received by the worker. Assuming the plan provides no cost of living adjustments, real pension benefit payments will further decline at the rate of inflation during each year of retirement.

The real losses or gains to pension participants and beneficiaries due to inflation are associated dollar for dollar with real gains or losses to the employer. Hence a decline in the inflation rate can quickly turn what would otherwise be a quite solvent pension fund into an acutely underfunded pension system. According to estimates reported here, 201 of 363 state, large-city, and large local plans have assets in excess of 75 percent of vested accrued pension liabilities assuming a 9 percent long-term inflation rate (12 percent nominal interest rate). At a 5 percent inflation rate (8 percent nominal interest rate), only 171 of these 363 public plans have assets that exceed 75 percent of their vested accrued liabilities. While no comparable data have yet been developed to determine the sensitivity of private defined benefit pension finances to inflation, there is every reason to expect a similar degree of inflation sensitivity.

The apparent lack of explicit arrangements to pool these inflation risks between workers and employers does not preclude the possibility of implicit risk pooling arrangements. These can take the form of periodic revisions of pension benefit formulae that affect current as well as future workers. Additional longitudinal data are needed to determine the frequency of revisions of inflation-sensitive benefit formulae. But evidence of benefit revisions would not, by itself, lessen concern about inflation risk; one also needs to determine that such revisions are not effectively paid for in the form of lower nonpension compensation.

Another way in which workers and employers can hedge these inflation risks is to purchase assets whose real return is positively correlated with inflation in the case of workers and is negatively correlated with inflation in the case of employers. For example, pension participants with home mortgages or other nominal liabilities gain from a rise in inflation because they can repay their debts in cheaper dollars; this real capital gain on their nominal debt from inflation may partly or totally offset inflation's reduction in the real value of nominal pension benefits. Similarly, employers can hold nominal assets whose real value falls with inflation, thus offsetting employers' gains from paying lower real pension benefits.

In short, the American pension system appears highly sensitive to inflation. Implicit insurance arrangements may in effect be redistributing the gains and losses arising from changes in the rate of inflation, but as yet there is no compelling evidence that such is the case. Alternatively, workers and employers may be self-insuring against pension-inflation risks by adjusting their private portfolios, but the extent of such behavior is not well understood.

A third general question concerning pensions and economic performance involves the impact of pensions on worker retirement. The years 1950 to 1980 witnessed a remarkable decline in the labor supply of the elderly. In 1950, 25 percent of Americans age 65 and over participated in the labor force;¹⁸ in 1980 that figure was roughly 12 percent.¹⁹ Labor force participation rates of 55- to 64-year-olds dropped from 70 percent in 1960 to 60 percent in 1979.²⁰ Not only are there proportionately fewer late middle aged and elderly Americans currently working in the U.S. economy, but those who do work are working fewer hours. In 1957, 21 percent of employees over age 65 worked part-time;²¹ the 1980 figure was 43 percent.²²

The Social Security System's earnings test potentially imposes a heavy implicit tax on the continued work of the elderly and may in large part explain the major postwar shift toward

early retirement.²³ Structural features of many U.S. pension plans, however, also impose major penalties for continued work effort with the current employer. Because of the difficulties of changing jobs late in life, private, state, and local pension plans may be inducing millions of elderly workers to leave the labor force. The mechanism by which the Social Security System and many pension plans induce retirement after these system's retirement ages is simply not to fully compensate the worker for forgoing current receipt of pension income.

In 1979, 22.76 percent of workers participated in plans that did not credit additional years of service beyond normal retirement for purposes of computing retirement benefits. Another 28.55 percent of covered workers were enrolled in plans that credited additional service after the normal retirement age only up to a specified age, on average, 70. Even for plans that credit service for some or all years after normal retirement, the increase in future pension benefits associated with continued work may not adequately compensate for the forfeit of current benefits. The degree to which additional years of credited service constitute the equivalent of an actuarial increase in accrued pension benefits depends on the particulars of the plan's benefit formulae and, in many cases, the worker's rate of nominal wage growth.

Workers whose continued employment after additional years of service is no longer credited usually receive no special reward for delaying receipt of their benefits. Three-quarters of covered workers participate in plans that provide neither for current benefit payments nor for increases in future benefits to workers whose additional years of service are no longer being credited. For workers in this situation, an additional year of employment with the plan sponsor means a complete loss of that year's pension benefit. This feature obviously provides a healthy inducement to discontinue employment with the plan sponsor.

Incentives for job separation can also be significant prior to the worker's attainment of the plan's normal retirement age. Once the worker passes the age at which early retirement benefits are first available, there is often a disincentive to continue employment with the plan sponsor. Many plans allow their participants to retire early with no reduction in their accrued benefits. Among plans that do apply a reduction, the reduction is often less than actuarial, causing workers who continue working for the plan sponsor to suffer a net loss measured in present value. Almost one-quarter of 1979 private covered workers were in plans that specified "actuarial increases" for delaying retirement. The remaining participants were in plans that provided special increases that are apparently quite small relative to an actuarially fair increase. On the basis of a 5 percent interest rate assumption and 1971 group mortality tables, McGill (1979) indicates that, between age 62 and age 65, the benefit increase needed to insure actuarial fairness is 24.8 percent. For private pension participants with nonactuarial benefit increase formulae, the rate of benefit increase between ages 62 and 65 averages 8.2 percent. While other features of a plan's regular benefit formula can provide benefit increases for additional service, these data suggest that many pension participants face significant work disincentives even prior to the plan's normal retirement age.

Many economists argue that there are sensible and compelling reasons for firms to induce retirement through their benefit provisions. After a certain age the worker's productivity may drop below his (her) current wage. In this case the worker may prefer to retire rather than continue to work at a wage commensurate with his (her) diminished abilities. Inducing retirement through implicit pension benefit taxation is seen as a way to terminate the worker while preserving his or her dignity. Other economists (Lazear 1981, 1982 in particular) view these retirement incentives as part of an elaborate long-term contractual relationship in which the firm enforces diligence by paying the worker less than he (she) is worth when young and more than he (she) is worth when old. Tilting the age-compensation schedule in this manner keeps workers on their toes by providing greater and greater incentives to continue employment. It also permits the firm to pay higher wages than would otherwise be the case. After some optimal point, however, the firm discontinues the "carrot and stick" compensation schedule and terminates the worker. Again, the loss of pension benefits due to continued employment serves as a dignity-preserving device for inducing worker separation.

While the proverbial “invisible hand” of efficient competition may well be guiding the design of these and other structural features of the American pension system, verification of this proposition is difficult. As research on these issues continues, it is important that workers, employers, and policymakers fully understand the extent of work disincentives built into many U.S. pension plans.

Worker mobility and job entry are additional economic issues affected by pensions. Close to three-quarters of private pension participants and virtually all public pension participants belong to defined benefit plans whose benefit and vesting provisions often generate steeply rising paths of accrued benefits prior to the plan's early or normal retirement ages. This tilted age profile of pension compensation provides workers with significant incentives to remain at the current job, and thereby reduces labor mobility. Pension compensation is not, of course, the only device that can be used to promote job stability and inhibit labor mobility. Employers can alter the path of nonpension compensation to achieve similar results.

As in the case of pension provisions that induce retirement, the disincentives to job mobility associated with many defined benefit plans may actually improve the efficient operation of the labor market. The provision of larger additional pensions and, *ceteris paribus*, total compensation as the worker acquires more service may be enforcing higher levels of worker performance. Better performance may result if the worker fears that diminution of current work effort could jeopardize his (her) future receipt of compensation. Incentives for long-term employment may also reflect the employer's desire to insure a reasonable return on investment in firm-specific training of young workers.

The challenge for future research is to determine whether disincentives to job mobility really represent an efficient economic institution or are simply the unintended consequence of pension provisions instituted for other purposes. One explanation for defined benefit provisions, for example, has nothing to do with worker incentives; it associates the original design of defined benefit plans with unions. Most defined benefit plans base benefits on length of service and possibly past earnings rather than past contributions. By adopting defined benefit rather than defined contribution plans, unions insured older union members attractive pensions in the near future. But this choice may have had the unintended consequence of steepening the total compensation-service profile. The fact that 86.05 percent of union participants but only 63.05 percent of nonunion participants are enrolled in defined benefit plans supports this argument.

Pension provisions may also be affecting hiring patterns to the extent that wage compensation is not fully adjustable. Suppose a firm with a defined benefit pension plan considers hiring either a 40-year-old male or a 40-year-old female, both of whom are equally qualified for the job. According to current mortality schedules (which unfortunately do not distinguish between working and nonworking women), 40-year-old women will live on average 6 more years than 40-year-old males.²⁴ The firm can therefore expect to pay the female 6 more years of pension benefits than the male, assuming that both will become vested and terminate employment at the same age. If the firm for reasons of worker harmony or fear of charges of job discrimination is forced to pay identical wages to 35-year-olds independent of sex, the firm will have an incentive to hire the 35-year-old male over the 35-year-old female. Racial differences in longevity could according to this argument lead to a hiring bias in favor of nonwhites. White males' life expectancy at 35 is 38.2 years; it is 34.5 years for nonwhite males. For females the difference by race in life expectancy at age 35 is 3.1 years.²⁵

A similar hiring bias against older workers can occur among firms with defined benefit plans. If the firm must pay identical wages to a new 25-year-old employee as it pays to an equally productive 45-year-old employee, the firm's total labor costs will be significantly greater for the 45-year-old because benefit accrual occurs more rapidly the closer the worker is to retirement age. Sorting out the effects of pensions on hiring of the aged may be of critical importance in reversing the postwar trend toward early retirement.

This section has discussed several of the challenges and opportunities that the U.S. pension system presents for the American economy. An understanding of the interaction of

pensions and economic performance is becoming increasingly important: in the realm of labor, insurance, and financial markets, U.S. pensions are sufficiently large to alter market outcomes dramatically. In the years ahead, private, state, and local pensions are likely to assume an even greater role in providing income security for the aged. Analysis of the economic impact of pensions presupposes a basic set of statistics describing the institution. A primary objective of this book is to provide basic pension data in a convenient format that will both inform and stimulate research in the economics of pensions.