

Rethinking Pension Reform

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A Primer on Pension Reform

DEFINITION OF TERMS¹

Pension reform evokes certain primary questions: What is a pension system? Why must it exist? And, what does the balance sheet of a pension system look like? The primary purpose of a pension system is to help households achieve an allocation of life resources by smoothing consumption over life, as postulated in the life-cycle hypothesis (LCH). This is achieved by transferring resources from working life to postretirement, when income dries up.² Before debating the appropriate form of pension plan, it is worthwhile to record the reasons for the existence of pension plans. There is a plethora of literature on the subject, and researchers have undertaken a wide range of empirical studies (World Bank 1994). For example, Logue and Rader (1997) have suggested that, from a corporate perspective, plans must be set up for insurance against uncertainty about retirement income, to create recruitment and retention incentives, and to formulate a tax-efficient means of saving. These conclusions may be restated under three main headings for country and corporate plans.

First, redistribution and social insurance are particularly valid for public systems. This is equivalent to undertaking a social obligation to ensure that all citizens, especially the old, have the requisite resources to meet their basic needs. However, the primary reason for the state to provide this arrangement is the belief that many citizens are myopic and do not accumulate adequate resources for retirement (Samuelson 1975, Aaron and Reischauer 1998). An extension of this paternalistic view is the opinion that many segments of society may not be sophisticated enough to set up appropriate arrangements. In short, these systems are established to prevent the state from having to support a large segment of retirees. Some experts argue that

¹ Adapted from Muralidhar (2001).

² Modigliani and Ando (1954) and Modigliani and Brumberg (1963).

the pension scheme of the United States is a social insurance scheme, not a savings scheme (Blahous 2000). Pension schemes can also be a redistribution mechanism for transferring resources from the well-to-do to the poorer segments of society that cannot afford to accumulate adequate reserves. Although redistribution features are not a prerequisite for a pension scheme, they differentiate a pension scheme from a “social security” scheme. Generally, schemes with redistribution tend to provide, or should provide, a basic (rather than a generous) minimum pension payment.

Second, private savings must be encouraged. As economic theory demonstrates, countries need savings for capital formation, and individuals need savings to support themselves in the nonearning phase of their lives. Using a variety of incentives (such as tax credits and deferrals) and mandated contribution rules, governments encourage citizens to increase their rate of saving. The greater the need for such savings, the higher the contribution rate and, potentially, the benefit.

Third, the desired behavior has to be induced. At a macro level, a pension scheme allows individuals to adopt a life-cycle model of consumption, thus protecting myopic and unsophisticated individuals (Modigliani and Ando 1963). This involves saving during working life to provide for postretirement. At the corporate level, pensions are a deferred wage payable only if the employee exhibits desirable characteristics, such as integrity and honesty. In addition, companies are able to induce the desired behavior by offering matching contributions to ensure that employees retire without anxiety. Pensions can be structured to attract employees to join an organization, stay longer (typical corporate DB), have job flexibility (cash balance plan), and so on. On the one hand, Blahous (2000) has suggested that social security schemes should encourage work rather than early retirement. On the other hand, the basic philosophy of a funded pension scheme is to set aside funds today and invest them appropriately to support future consumption (liability) – even in early retirement.

Pension systems can be broadly categorized by the benefits they promise and the way they finance that promise. There is, essentially, a choice between two types of pension plans: defined benefit (DB) and defined contribution (DC). Financing methods, generally described as “pay-as-you-go” (PAYGO) and funded, are briefly dealt with in the following sections.

DEFINED BENEFIT PENSION PLANS

The essence of a DB pension plan is that it provides a “defined benefit” – a *prespecified annuity* either in absolute currency or as a fraction of a measure of salary (for example, a defined percentage of the final salary or an average of some past years of salary). The guaranteed pension benefit could be in either real or nominal terms.

In DB pension plans, participants, sponsors, or both make contributions that could change over time. The ratio of annuity or benefit to a measure of salary is known as the “replacement rate.” The participant may be unaware of any relationship between contributions and benefits. However, the administrators of the system and pension finance experts know there is a unique “budget constraint” that links contributions, returns, and benefits to a given replacement rate (Asad-Syed, Muralidhar, and van der Wouden 1998). This relationship is highlighted in equation 1.1 and discussed in detail in the appendix to this chapter. DB plans rely on an inter- and intragenerational pooling of investment and liability risk, which is called the social allocation of risk by Bateman, Kingston, and Piggott (2001).

DEFINED CONTRIBUTION PENSION PLANS

In DC pension schemes, participants, sponsors, or both make *prespecified contributions*. The plan specifies contributions either in absolute currency or as a fraction of a measure of salary (e.g., 10,000 U.S. dollars annually or 5 percent of annual pretax salary). These contributions may also be partially or totally voluntary. Participants invest contributions in assets. The final pension is uncertain (prior to retirement) because it depends entirely on asset performance of the accumulated contributions. Accordingly, two individuals with identical contributions but different investment portfolios can receive widely divergent pensions. Further, two individuals with identical contribution histories can receive widely divergent pensions over different time periods.³

An important point is, even in DC plans, it is possible for contributions to change over time. This could happen because of changes in tax laws (either for mandated or voluntary schemes) or if existing contributions provide an insufficient or excessive replacement rate. This leads us to make a very important distinction between a DB plan and a DC plan:

The essential characteristic of a DB plan is that the terminal outcome is defined (a target replacement rate to be paid to participants is articulated by a sponsor), whereas a DC plan is one in which the terminal outcome is variable.

Traditionally, corporate DB pension formulas define annuities based on the number of years of service multiplied by some accrual factor. Implicitly, the product of these two factors is the replacement rate. The problem with this statement of benefits is that the inclusion of years of service in the formula creates nonlinear growth in

³ Bader (1995), Bodie et al. (1988), and Blake (2000) provide a more detailed description of DB and DC plans.

pensions as one ages, leading individuals to stay with the pension-providing institution because the cost of leaving increases over time. This creates a perverse incentive to stay. This simple definition of benefits highlights one of the negative aspects of DB plans, which has put all DB plans in a bad light! Godoy and Valdes-Prieto (1997) have provided a general condemnation of all DB plans by suggesting that “[t]he defined benefit approach exposes workers to the risk of a low final wage on which benefits are based and must pay an implicit fee to the agents that provide the guarantee on investment returns.” (p. 70) This condemnation is unwarranted because a DB plan is only a promise to provide a guaranteed replacement rate, and there is no need to use the preceding formula to do so. One can see the relationship between contributions and returns in this simple equation:

$$\begin{aligned} \text{Nominal contributions over working life, compounded at the expected return on} \\ \text{assets (with or without volatility)} = \text{Expected final wealth at retirement} = \text{Expected} \\ \text{present value of desired annuity as of the retirement date (which can be related to} \\ \text{the replacement rate)} \end{aligned} \quad (1.1)$$

Nominal contributions are equal to the contribution rate multiplied by the nominal wage. For simplicity, assume the contribution rate is fixed (we will return to this assumption in Chapter 8). When returns are volatile, this equation characterizes a DC plan. If the volatility of returns is eliminated, either through an investment strategy or a guarantee, then final wealth and the present value of the annuity at retirement becomes a function of salary growth. In other words, if the rate of return is guaranteed, the replacement rate, which is the ratio of pension annuity to some measure of salary (last year or average of last 35 years) can be guaranteed, given salary growth. This equation can, therefore, also characterize DB plans. An example in Chapter 3 shows the simple and explicit relationship between contributions, investment returns, and pensions for given salary growth (see appendix to this chapter for technical details). Previous pension reform research has not recognized that good pension design can create a close link between DB and DC plans.

FUNDING METHODS

There are several ways to fund DB or DC plans. Presently, social security systems are overwhelmingly PAYGO, DB schemes in which current participants are required to make contributions used to pay the benefits of retirees. In a pure PAYGO, there is no accumulation of funds because all contributions are disbursed to service pensions. However, corporate or occupational DB or DC schemes tend to be funded (partially and fully). Funding requires an accumulation of funds before retirement to service future liabilities. Funds are invested in either marketable or nonmarketable assets.



Figure 1.1. The pension fund balance sheet. Source: Muralidhar (2001). Adapted from *Innovations in Pension Fund Management* by Arun S. Muralidhar, © 2001 by the Board of Trustees of the Leland Stanford Jr. University, by permission of the publisher.

As a result, some combination of contributions and asset returns is used to service pensions. Some researchers (e.g., Logue and Rader 1997) have suggested that DC plans are always fully funded. This comment is true in the sense that the pension is entirely paid out of whatever capital has been accumulated, but it can be misinterpreted to suggest that the sponsor is indifferent to the size of the pension. Many researchers incorrectly assume that both sponsors and retirees are indifferent to the annuity paid out in DC plans. It is critical, even in a DC plan, for participants to have a target replacement rate (though it is not guaranteed) and to select their contribution, investment policy, or both to achieve that target. As a result, other researchers (Muralidhar and Van der Wouden 1998b) have suggested that DC plans are underfunded if the assets in the plan are insufficient to deliver a target replacement rate. Regardless of the funding method, a pension fund balance sheet can be distilled down as shown in Figure 1.1, for which different funding methods place greater emphasis on contributions or accumulated assets and asset returns to pay benefits. Similarly, reform can focus on changes to (i) benefits, (ii) contribution policy, and (iii) investment policy. Any, or all, of these may require changes in the institutional arrangements of the current social security system of a country.

COMPARING DB AND DC PENSION PLANS

DB plans spread investment risk across a large number of individuals of different ages and over different time horizons. These plans pool risk within a cohort and across cohorts. The plan sponsor, who generally bears the investment risk of the plan, has a much longer time frame and a much higher risk-bearing capacity than

individuals in the plan. In other words, in a DC plan the time horizon is the life of one individual, whereas in DB plans the time horizon is much longer (if not infinite). For these reasons, DB plans on average can take on more risk and generate higher returns, and their asset allocation policy tends to take longer to change than can individual plans (see also Orszag and Stiglitz 2001). However, by pooling assets, DB plans incur lower costs for managing assets.⁴ On the other hand, DC plans enable individuals to tailor their portfolio to the risk they wish to bear and allow for a better matching to their preferences. Individuals participate in all the gains and losses of their plan but incur higher costs in managing their assets.⁵

DB plans provide stable retirement income based on salary; DC plans offer less predictable retirement incomes owing to their dependence on investment performance. By their very nature, DB plans are less flexible (individuals have less freedom over their contributions) and are unresponsive to meeting the cash flow needs of individuals before and after retirement.

DB plans provide insurance for longevity. The possibility that the money will run out before the individual dies is largely nonexistent unless the sponsor defaults and there is no insurance coverage. Country schemes do not require insurance because the state is the sponsor and has the ability to tax citizens. In the United States, insurance for corporate plans is usually provided by agencies such as the Pension Benefit Guarantee Corporation (PBGC). However, individuals who contribute during their entire lifetime and die soon after retirement do not have the opportunity to bequeath a pool of funds to their heirs. DC plans do not provision for insurance, and annuities can be expensive to purchase. Often, it is difficult to access inflation-indexed life annuities in DC plans. However, bequeathing monies to heirs in the event of premature death is possible only in DC plans though DB plans offer survivor benefits.

A variant of the DC plan is the Provident Fund (PF) scheme, which is popular in Commonwealth countries. Under this scheme, individual contributions are pooled for investment and participants are credited an annual dividend, which is usually the rate of return on the assets. PFs also have some of the generational risk-sharing attributes of DB plans. In some cases, returns are smoothed over many periods to ensure that no one cohort is impacted by poor performance. However, this can create problems if the realized returns fall consistently, for the smoothing technique may result in promises exceeding available funds. If they are structured appropriately, PFs could be more optimal than individual DC plans from a macro investment

⁴ Blake (2000) has examined other noninvestment-related differences such as portability loss and cost of annuities. This paper finds that in the United Kingdom, total contributions into DC schemes tend to be much lower than those into DB schemes.

⁵ Blake (2000) states that “[a] DB scheme is invested in a portfolio containing: the underlying assets (and so, in part, a DC scheme) *plus* a put option *minus* a call option on these assets.”

TABLE 1.1 Investment characteristics of defined benefit and defined contribution pension

Defined benefits	Defined contributions
1) Provide stable benefits	1) Allow for matching of cash flows with needs
2) Plan sponsor bears risk	2) Individual bears risk
3) Pool investment risk	3) Individual has choice in investments
4) Provide insurance against longevity	4) Allow for bequeathing of wealth

A combination of DB and DC may be more advantageous

Source: Muralidhar (2001). Reprinted with permission from Muralidhar (2001).

perspective. The two main disadvantages of PFs are that (i) individuals bearing the investment risk are usually disconnected from the decision makers, and (ii) participants are unable to choose their investment policies and, therefore, have no control over the level of risk taken. The latter disadvantage can be addressed, to some extent, by offering a series of subfunds within a PF framework with each subfund offering a different risk profile (also called “life-cycle funds” targeting cohorts of different ages).

Table 1.1 summarizes the comparison of DB and DC plans. Clearly, a mix of the investment characteristics of DB and DC plans would satisfy a larger group of individuals than would any one type of plan. Innovative new plans that incorporate the beneficial characteristics of each type of plan can achieve the same objective. Some corporations in the United States provide a cash balance alternative requiring the plan sponsor to guarantee a rate of return on investments (either a fixed or variable rate). If the contribution rate and return are fixed, the replacement rate of the participant is also guaranteed for given salary growth. With a variable rate of return (for example, U.S. Treasury 10-year rate + 3 percent) the replacement rate is variable. This plan was designed to ensure a more linear and steady accrual of pension rights, which were not skewed to emphasize the last few years of service disproportionately.

It is important to note that choosing between DB and DC plans also has noninvestment implications. For example, DC plans require a well-educated, financially literate group to use the freedom of choice to ensure adequate replacement rates at retirement. DB plans have to be supported by strong governance structures to ensure that sufficient funds are soundly invested to meet future liabilities. The relative mix of DB and DC plans is likely to be country and individual specific (discussed in detail in Chapter 7).

Reformers have thus been led to suggest either multiple systems within a country or a single system with facets of both systems. The most notable example of a

multi-pillar system is the World Bank's three-pillar system (a mandatory PAYGO DB, a mandatory funded DC sponsored by the state or employers, and a voluntary DC). Bodie, Marcus, and Merton (1988) have argued for a hybrid minimum floor plan, where the DB is the floor. Our own proposal exploits many of these preferences.⁶ (These issues are discussed in detail later in the chapter and in Chapter 8.)

INDIVIDUAL VERSUS POOLED ARRANGEMENTS

A fair amount of the debate focuses on individual choice versus group arrangements. We therefore highlight the issues that may arise from these debates and articulate some of the trade-offs. Individual choice is most commonly raised in the context of portfolio selection, whereas pooled arrangements are generally discussed in the context of risk sharing in DB plans. The case for individual investment arrangements is predicated on allowing individuals the choice to select their desired portfolio and bestow inalienable property rights on their savings. Pooled DB arrangements imply lower costs but may be susceptible to government manipulation because governments can control these assets. However, it is possible for pooled arrangements to be made in DC-type structures: the most notable is a PF or U.S. Thrift Savings Plan (TSP) in which the investment function is pooled but the individual bears the market risk.⁷ Alternatively, Bateman, Kingston, and Piggott (2001) have pointed out that, in Australia, where mandated saving is made through employers, cost savings can be achieved by pooling through the employer (similar to TSP).

The second area where these issues are discussed is in the context of pensions: individual arrangements for annuities tend to be more costly and generally may not provide individuals with sufficient insurance because the market may be incomplete (e.g., no life annuities, no protection against inflation or anxiety about adverse selection). However, there is a tendency to regard pooled arrangements as more susceptible to political risks such as changing of benefits (Diamond 1997b). Hence, the trade-off in designing systems is that policymakers have to decide between individual or pooled arrangements and to explicitly trade off choice and political risk versus risk sharing and lower cost.

⁶ Further, Muralidhar and van der Wouden (1998a) recommend that countries implement contributory defined benefit (CDB) plans in which the participant's contributions grow at a guaranteed real rate of return (guaranteed by the government). This plan engenders many of the advantages of DC plans (e.g., funded individual accounts, the possibility of borrowing) and at the same time provides insurance through the guarantee. They also suggest that individuals should complement such plans by investing additional funds in DC plans for supplementary savings. The corporate analog to the CDB plan is the cash balance plan.

⁷ In the TSP, individuals choose desired funds from a menu of options, but then all choices are aggregated and invested to reduce cost.

EXAMPLES OF PENSION SYSTEMS

This section examines pension systems for countries and companies and provides some background on the different characteristics they engender.⁸ The pension systems reviewed include the U.S. Social Security system, the Chilean and Mexican models, the Italian Supplementary System, the Hungarian and Malaysian models, and the U.S. 401(K).

Social Security System in the United States⁹

Established in the 1930s, the Social Security system is a mandated, public, DB system with very wide, compulsory participation. Few groups are permitted to opt out. The average pension benefit represents a replacement rate of approximately 50 percent of the best 35 years of salary history. Some adjustment is made to redistribute pensions to poorer participants; hence, individual replacement rates may differ from the average.¹⁰ To this end, the replacement rate offered to those with a poor income history is higher than for those with a higher income. Benefits are paid until death, include substantial indexation to inflation (since 1972), and are extended to survivors. The system was designed along the lines of a PAYGO system with current contributors largely financing pension payments. Today, the Social Security system is not a pure PAYGO system, for it was recognized in the mid-1970s that, with prevailing contributions, the system was unavoidably heading toward insolvency. As a result, the Greenspan Commission in 1982–83 recommended a sharp rise in contributions, which would permit building up a reserve – the so-called Trust Fund – to cover future shortages. Unfortunately, that reform is insufficient and new reforms are needed to avoid insolvency in the twenty-first century. There is no individual choice in this system.

Chilean DC Model

The Chilean model, implemented in 1981, involves gradual phasing out of the PAYGO plan and replacement by a mandatory DC plan. New workers can participate only in the DC plan, whereas participants in the PAYGO plan can choose between the old and new plan. Assets are managed by private companies (called Administradora de

⁸ For information on the U.K. pension system refer to Disney (1998); on European pension reform refer to Mantel and Bowers (1999); and on the Japanese system refer to Usuki (2002).

⁹ For more details, see Diamond (1996a) and Blahous (2000), Chapter 5.

¹⁰ As of 1999, monthly pension is 96 percent of the first \$505, 32 percent of the next earnings up to \$3043, and 15 percent for earnings above this level.

Fondos de Pensiones or AFPs) chosen by the participant from a list approved by the government. Individuals largely bear the risk of investment performance.¹¹ There are some guarantees in the Chilean system, including (i) a low social assistance benefit to those not covered by the mandatory plan, (ii) a state-guaranteed minimum pension of approximately 25 percent of the average wage if contributions are made for at least 20 years, (iii) a minimum profitability rate guaranteed for each pension fund relative to the average for the country, and (iv) state-guaranteed annuity payments if the insurance company fails (World Bank 1994). Variations of the Chilean scheme adopted in other parts of Latin America – in Argentina, Colombia, and Peru – offer a choice in the second pillar between a privately managed DC system and a public PAYGO DB system (Mitchell and Barreto 1997). However, individuals are permitted to make voluntary contributions to their funds to allow for early retirement (Godoy and Valdes-Prieto 1997).

401(K) Plans and Individual Retirement Accounts (IRAs) in the United States

These schemes are most prevalent in the United States and are most commonly referenced when discussing funded DC plans. Under the 401(K) schemes, both employers and employees contribute to these funds from pretax income. Participants are free to choose investment strategies from within a set of chosen private providers who manage the assets for the participants. They are allowed to borrow from their account, within limits and at their discretion, but must repay under established rules.

Under the IRA, individuals set up the plan directly if they meet certain eligibility criteria. Participants have sufficient choice in the structure (i) to select their asset allocation (a mix of bonds and equities; international and domestic assets) and (ii) to select preferred manager(s) from a short list of managers and mutual funds. Participants either have full discretion over asset allocation and fund selection (self-directed plans) or can delegate the responsibility to the service provider. Withdrawal of funds is permitted to finance certain activities, but if these monies are not returned before retirement, the participant incurs a tax event because the IRA is no longer a tax-deferred saving. The pension is the annuity that can be purchased from service providers given the accumulation at retirement.

In both systems, participants have some discretion over the level of contributions, but there are limitations on maximum contributions. These caps on contributions exist because such savings are tax deferred. However, the caps have changed over time, allowing participants to change the amount they contribute to these plans.

¹¹ This, in some way, serves the role of the first pillar in the World Bank framework.

Italian Scheme (and Australian Superannuation Schemes)

Italy has long relied on a PAYGO scheme supplemented by a severance pay fund, which are both noted for their oppressiveness (Modigliani and Ceprini 1998). Mandated pension contributions account for more than 40 percent of workers' pay. An interesting facet is that the benefits are based on the *realized* rate of income growth, giving the scheme a DC flavor. Most recently, Italy has been experimenting with a reform that allows workers to shift their severance pay fund contributions to individual accounts in common funds of their profession. These investments are for an initial period, after which workers are permitted to switch to the mutual fund of another profession or to funds that are broader. Hence, despite being privately managed individual accounts, there is a limited choice of investment vehicles and a somewhat arbitrary grouping of participants by profession (rather than age, income, or risk-bearing capacity).

Although Australia has corporate DB plans, in the Australian version of DC plans employers are directed to provide the plans, but superannuation companies can compete for participants. As a result, there are superannuation schemes at the company or industry level, but private firms can set up master trusts to offer accounts to individuals (Bateman et al. 2001). Australia is an interesting example, for there is little by way of investment restrictions or guarantees, which contrasts with the system in Hungary. A big risk in these systems is that the asset allocation applied to participants may not be appropriate because investment strategies are applied to broad groupings based on age (and do not account for wealth, consumption patterns, or desired annuity of individual participants). Scheiwe (2001) provides an interesting critique of the Australian model.

Mandatory Provident Funds

Under these schemes, prevalent in countries formerly under the Commonwealth (such as India and Malaysia), individuals contribute to the system, which then aggregates funds in a central pool. Such schemes are generally offered to private sector employees (Asher 1998, Thillainathan 2002). The pooled fund is then invested in different assets, and the participants earn dividends on their contributions, which are essentially equal to the returns of the investment strategy. In some countries, dividends are smoothed over a few years of returns to reduce volatility, which leaves open the possibility that the system will be "underfunded" if a series of negative returns occurs. It is not clear how such deficits will be covered. In Malaysia, a minimum guarantee of 2.5 percent is offered to participants. Participants have individual accounts but no choice. Generally, participants are allowed to borrow against these funds to purchase houses or make other investments that are deemed socially useful.

Bateman and Piggott (1997) have provided evidence to suggest that pooling has kept costs low, but the perverse incentive structure inherent in such funds may have led to decent returns for Malaysia albeit lower than those offered by the market.

Mexico

There are many similarities between the pension schemes in Mexico and Chile, except that Mexicans, who were under the old PAYGO DB and switched to the DC plan, have been offered (at retirement) the choice to get a pension based either on their actual accumulation or an assumed equivalent participation in the old DB (i.e., what the accumulation would have been if they had earned the PAYGO internal rate of return). Hence, the DC component of Mexico's reform can be viewed as being similar to that of Chile's with an explicit retirement guarantee for current participants. Future participants are given a minimum pension linked to the minimum wage at the time of retirement, as in the Chilean scheme. At retirement, participants can choose either to purchase an annuity from a private vendor or receive programmed withdrawals from the fund manager. The annual amount is based on the balance, including interest, divided by life expectancy. The annuity from the private vendor cannot be less than the minimum pension guarantee (Sales-Sarrapy, Solis-Soberon, and Villagomez-Amezcuca 1996).

Hungary¹²

Hungary offers an interesting twist to the three-pillar model. Pension reform initiated in 1997 created a system with a mandatory PAYGO DB, a mandatory-funded second pillar (which is DC in broad structure), and a voluntary DC third pillar. The second pillar is the responsibility of nonprofit mutual funds, wherein contributing members are also owners of the fund. The fund organizations create the appropriate oversight structure and staff key positions with professionals. These organizations then have the freedom to delegate any of the responsibilities (from administration to asset management) to for-profit third parties. The appointment of a master custodian, though, is mandatory. Guarantees for the mandatory DC component are provided by a central guarantee fund (GF), and a minimum pension of 25 percent of the first-pillar pension is offered to eligible participants. The pension funds pay the GF an insurance premium equal to 0.3–0.5 percent of member's contributions and, although the government provides the ultimate backstop, the GF is expected to cover

¹² This section derives extensively from Parniczky (1998).

all payments through the internal reserve created by the collection of premiums. A series of regulations recommend portfolio diversification and other matters relating to prudent investment of assets, including the need to link assets with liabilities. In addition, the pension fund is required to offer a minimum return guarantee through an internal reserve fund, suggesting an element of smoothing of earned returns versus returns credited to member accounts. Payments to the first pillar are largely from employers, whereas payments to the second pillar are largely from employees. Employees in service before 1997 had the choice of not contributing to the second pillar, but new entrants have no such choice.

SUMMARY

The recent profusion of proposals on how to reform social security arrangements in the United States and other countries has inevitably confused the subject with private arrangements for the provision of retirement wealth. “Privatization” of social security is loosely defined and is often a misnomer. It has also been suggested that plans must be either defined benefit (DB) or defined contribution (DC) or be similar to models in the United States or Chile. This chapter has defined certain key terms and provided examples of different pension schemes and reforms around the world. It has raised an important distinction between DB and DC plans, namely, that the pension outcome in DB plans is defined and guaranteed, whereas DC plans have variable pension outcomes. This distinction is important because contributions need not be fixed in DB and DC plans. The remainder of the book will leverage this chapter to show that the optimal structure can be created through only two pillars that combine the best aspects of DB and DC schemes, PAYGO and funded schemes and individual accounts with pooled investment of assets.

APPENDIX 1.1. The Link between Contributions, Expected Returns, and Replacement Rates

This section, adapted from Asad-Syed, Muralidhar, and van der Wouden (1998), develops the notion that a guaranteed return on contributions provides a one-to-one relationship between contributions and replacement rates.

The following formulas are used to calculate the periodic benefit payments that an annuity can provide given a certain amount of wealth. The major assumptions are that annuity payments are made at the beginning of each period and all variables are deterministic.

If $ExpR = ExpI$, then

YearlyBenefit

$$= \left[\frac{(1 + ExpI)^{(1-\# \text{ Years})}}{(1 + ExpR)^{(1-\# \text{ Years})} + (1 + ExpI)^{(1-\# \text{ Years})} \cdot (1 + ExpR)^{(2-\# \text{ Years})}} \cdot \left(\frac{(1 + ExpI)^{(\# \text{ Years})} - (1 + ExpR)^{(\# \text{ Years})}}{(ExpI - ExpR)} \right) \right] \times EndBal. \quad (A1.1.1)$$

If $ExpR = ExpI$, then

$$YearlyBenefit = \frac{EndBal}{\# \text{ Years}}, \quad (A1.1.2)$$

where

EndBal is the total present value of the annuity (BALANCE NEEDED AT RETIREMENT),

ExpR is the assumed return in the annuity calculation (EXPECTED RETURN),

ExpI is the increase in the benefit payments of the annuity (EXPECTED BENEFIT INFLATION), and

#Years is the number of benefit payments the annuity provides (LIFE EXPECTANCY).

YearlyBenefit in formulas (A1.1.1) and (A1.1.2) provides the amount of the first payment of the annuity. If the EXPECTED BENEFIT INFLATION is zero, all further payments of the annuity are of the same value. If the EXPECTED BENEFIT INFLATION is larger than zero, the benefit payments increase periodically with this percentage. The replacement rate is now represented by the ratio of this *YearlyBenefit* amount to the final or average career salary of the participant.

The following formulas are used to calculate the amount of wealth the participant has accumulated at retirement:

If $CapR \neq SalGrowth$, then

EndWealth

$$= \left[\frac{StartSal \cdot ContriRate \cdot ((1 + SalGrowth)^{(\# \text{ Periods})} - (1 + CapR)^{(\# \text{ Periods})}) + IniWealth \cdot (SalGrowth - CapR)(1 + CapR)^{(\# \text{ Periods})}}{(SalGrowth - CapR)} \right]. \quad (A1.1.3)$$

If $CapR = SalGrowth$, then

$EndWealth$

$$= StartSal \cdot ContriRate \cdot (\# Periods) \cdot (1 + CapR)^{(\# Periods)} \\ + IniWealth \cdot (1 + CapR)^{(\# Periods)}, \quad (A1.1.4)$$

where

$IniWealth$ is the wealth the participant starts with when they begin contributing to the savings scheme (INITIAL ACCOUNT BALANCE);

$CapR$ is the expected investment return on the contributions made to the savings scheme by the participant (EXPECTED RETURN ON CONTRIBUTIONS),

$SalGrowth$ is the expected salary growth of the participant during their career (EXPECTED SALARY INCREASE),

$\#Periods$ is the number of periods the participants make contributions to the savings scheme (the difference between RETIREMENT AGE and CURRENT AGE),

$StartSal$ is the starting salary of the participant when he or she starts contributing to the savings scheme (CURRENT SALARY), and

$ContriRate$ is the fixed contribution rate of the participant, a percentage of the participant's salary that is saved in each period (CONTRIBUTION RATE).

Define $EndWealth$ to be the amount accumulated by the participant at the time of retirement. This can be used as input for the annuity payment formulas (A1.1.1 and A1.1.2), which determine the yearly benefit stream the participant can afford to buy with this total $EndWealth$ amount.

The next set of formulas determines the savings rate (contributions rate) of the participant, which provides a predetermined expected amount of wealth at retirement.

If $CapR \neq SalGrowth$, then

$ContriRate$

$$= \left[\frac{(CapR - SalGrowth) \cdot (IniWealth \cdot (1 + CapR)^{(\# Periods)} - EndWealth)}{StartSal \cdot (1 + CapR) \cdot ((1 + SalGrowth)^{(\# Periods)} - (1 + CapR)^{(\# Periods)})} \right] \quad (A1.1.5)$$

If $CapR = SalGrowth$, then

$$ContriRate = \frac{EndWealth - IniWealth \cdot (1 + CapR)^{(\# Periods)}}{StartSal \cdot \# Periods \cdot (1 + CapR)^{(\# Periods)}}. \quad (A1.1.6)$$

Formulas (A1.1.5) and (A1.1.6) produce a percentage that represents the amount the participant has to contribute in each period as a percentage of salary to achieve the targeted *EndWealth*.

As is evident from the preceding formulas, selecting a replacement rate for given demographic parameters (such as number of years of employment, life expectancy) and economic variables (salary growth, postretirement inflation, return on the postretirement annuity) is equivalent to selecting a contribution rate and rate of return on investments, and vice versa. In other words, one can target a replacement rate and then select an optimal contribution rate if there is some assurance about returns. Therefore, guaranteeing a rate of return on investments for a given contribution rate and other parameters effectively ensures a guaranteed replacement rate. Hence, a DB scheme can be assured if the return on assets can be guaranteed.