

Developments in Risk Management for Retirement Security

Olivia S. Mitchell and Kent Smetters

PRC WP 2002-14

Pension Research Council Working Paper

Pension Research Council

The Wharton School, University of Pennsylvania
3641 Locust Walk, 304 CPC
Philadelphia, PA 19104-6218
Tel: (215) 898-7620 • Fax: (215) 898-0310
Email: prc@wharton.upenn.edu
<http://prc.wharton.upenn.edu/prc/prc.html>

This paper is to be published in *The Pension Challenge: Risk Transfers and Retirement Income Security*. Eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press, forthcoming.

Pension Research Council Working Papers are intended to make research findings available to other researchers in preliminary form, to encourage discussion and suggestions for revision before final publication. Opinions are solely those of the authors.

©2002 Pension Research Council of the Wharton School of the University of Pennsylvania. All Rights Reserved.

Developments in Risk Management for Retirement Security

Olivia S. Mitchell and Kent Smetters

Recent volatility in capital markets, along with longer-term trends in pension system design, has prompted questions about how well the evolving retirement system is performing. These issues are taking on additional force as massive global demographic change is producing the largest group of retirees in human history. Such economic and demographic challenges prompt policymakers, academics, financial practitioners, and pension participants young and old, to search for innovative and creative responses to what promises to be a more risky global retirement environment than in the past.

Over the years, employers and governments around the world have tried to protect against retirement insecurity by setting up defined benefit (DB) pension schemes. Under such plans, retirement benefits depend on service and salary, and benefits are usually paid as a life-long annuity to long-term employees who worked until retirement age. Yet as we show below, the traditional DB model has increasingly been supplanted with defined contribution (DC) plans in many countries. In the case of a DC plan, retirement saving tends to be more subject to employee control throughout the life cycle. For example, DC participants can often decide whether and how much to contribute to the plan, as well as where to invest the plan assets during the accumulation phase. Additionally, at retirement, DC plan assets can frequently be taken in a lump-sum form, rather than automatically converted to lifelong annuities.

Converting from DB to DC plans offers participants several advantages. On the accumulation side, workers gain more control over their retirement saving decisions, which may spur more attention to individual decision-making and responsibility. Members may also be better protected from the political risks that plague public pay-as-you-go retirement schemes.¹

Nevertheless, workers and retirees also take on new types of risk in DC plans. For instance, some people might save too little, or make poor investment choices, or have their portfolios eroded through administrative fees. In addition, participants bear uncertainty associated with investment returns and over how long they will live in retirement.

There is surely no uniquely perfect retirement system design that will apply to all countries for all economic circumstances, but there are just as surely lessons to be learned about how to make pensions more resilient. *The Pension Challenge: Risk Transfers and Retirement Income Security* (forthcoming) provides a range of new perspectives on how to better manage the wide range of retirement risks as capital and labor markets continue to evolve. In particular, with the recent market downturn and several highly-publicized corporate collapses, policymakers and plan members have begun to find appealing the idea of adding additional structure to both DC and DB plans – structure that would help protect plan participants against a range of risks. Below, we offer a brief analysis of why traditional defined benefit pension plan appears to be abandoned in favor of defined contribution plans. We also discuss some key risks that both defined contribution and defined benefit plans convey upon plan members, and we highlight some of the ways recommended by contributors to *The Pension Challenge: Risk Transfers and Retirement Income Security*, for managing these retirement risks.

Trends from Defined Benefit to Defined Contribution Plans

Conventional DB retirement plans pay retirement benefits based on a prespecified formula set by the plan sponsor, which can be a government, an employer, or some other entity. For example, in the US, a private sector DB plan might pay a retirement benefit equal to two percent of the worker's average wage during the last five years of work multiplied by his years of employment. A 30-year worker with earnings averaging \$50,000 per year over the last five

years before retirement could anticipate a yearly retirement annuity of \$30,000 ($=0.02 \times \$50,000 \times 30$). This worker would therefore receive a “replacement rate”, which is the pension benefit relative to his final pay, of 60 percent. In most DB plans the retiree continues receiving this benefit until he dies; some plans might pay some benefit to a surviving spouse, as well. The DB approach is also prevalent in global public pension systems: almost 170 nations have national social security retirement programs, many of which are based on the DB framework. In some cases, benefit payments are structured as a simple percent of final pay, while in others, more elaborate formulas are used that include redistributive features as well as survivors’ benefits.

An important historical appeal of the DB model was that it allowed workers to plan for retirement without requiring much knowledge about saving rates, portfolio choice, capital market risk, or mortality trends. In particular, as long as the plan sponsor can pay the benefits, the retirement payout is unrelated to the sponsoring firm’s stock value or to the investment performance of pension reserves. Furthermore, pension legislation in many countries requires plan sponsors to make good on these promises even if the underlying value of the pension reserve suddenly decreases. In the US, for instance, by law pension benefits must be paid even if the value of the pension pools falls; consequently, corporate stockholders are seen to bear pension investment risk, rather than DB plan participants. Moreover, since DB plans typically have paid out life annuities, the plan sponsor bears mortality risk as well.²

The past two decades have seen a rather pronounced movement away from the DB and toward a DC model. Under the DC approach, a worker contributes directly to his own retirement account that is then invested into a financial portfolio. The retirement benefit is then directly related to his own contributions (plus the sponsor’s, if any), as well as investment income earned over time. Figure 1 shows that the number of DB plans declined over time in the U.S., while DC

plans have grown dramatically, particularly the very popular 401(k) plans. In 1975, assets held in DC plans comprised 29 percent of all pension assets (including Individual Retirement Account funds), and the DC share has grown to 72 percent by 2001 (Poterba et al. 2001). During that same period, more than two dozen countries, spanning five continents, reformed their national retirement systems to include DC individual accounts (see Table 1). In most of these cases, participants exert some control over how their money is invested (subject to some constraints), and they receive the risk and reward for those investments. In yet other cases such as Singapore, Provident Funds have been established into which workers contribute; here participants are allocated a fixed return, akin to so-called “cash balance” plans.

Figure 1 and Table 1 here

While the movement toward DC plans seems to be a global phenomenon, we believe that somewhat different factors explain the DB to DC shift in the private versus the public sector. Specifically, we shall argue that the private sector change mainly reflects labor market dynamics, whereas the changes experienced in national retirement systems tend to be more reflective of demographic and political risks.

Challenges to Private Sector Pensions. Traditionally private sector DB pensions have had an important role in attracting and retaining workers (Lumsdaine and Mitchell, 1999). One way they do this is by offering additional lifetime compensation for those workers who remain with their employers for life (Clark and McDermed, 1990). In exchange for this positive aspect of DB plans, however, many also build in a “job-lock effect,” discouraging workers from leaving their jobs early in their careers.³

The way job-lock works may be illustrated with a simple example. Suppose that a new employee, call her Jane, works for the same firm for three years, and she earns \$30,000 in the

first year, \$40,000 in the second year, and \$50,000 in the third year. We further suppose that the company's DB formula specifies a yearly retirement benefit equal to one-quarter of the wage earned in Jane's last year of employment times the number of years she worked with the firm. At retirement, the employee would then be entitled to a benefit equal to \$37,500 ($=\frac{1}{4} \times \$50,000 \times 3$). Now alternatively, suppose that Jane earned the same annual salary each year, but instead she changed firms annually, working at three different companies, each having the same retirement formula. In this second case, when Jane retires, she will be entitled to a benefit from the first company equal to \$7,500 ($=\frac{1}{4} \times \$30,000 \times 1$), plus \$10,000 from the second firm ($=\frac{1}{4} \times \$40,000 \times 1$), plus a benefit of \$12,500 from the third company ($=\frac{1}{4} \times \$50,000 \times 1$). The total benefit in the second case would total \$30,000, or \$7,500 less than if she had remained with the first firm the entire time. Consequently the retirement formula provides a clear incentive to stay with the same employer, even if the worker's skills become more valuable with another company.

This hypothetical worker's benefit entitlement would have been even lower had she failed to "vest" before changing jobs. Vesting refers to the point at which a worker gains a legal right to an eventual retirement benefit. In the U.S., vesting rarely occurred before 10 years of service until recently, but legal changes now require vesting in private pensions within three years of coverage (Sass 1997). In any event, groups with higher job turnover rates, such as women, are much more prone than men to fail to vest under DB plans. This potential inefficiency has become particularly key as more women entered the labor force over the past two decades. Hence one motivation for the movement from DB to DC plans is to reduce this labor market distortion.⁴

To be sure, some "job lock" might be efficient, especially in industries that require a fair

amount of on-the-job training: employers can use job-lock to recapture some of their training investment. But fewer industries today are characterized by extensive on-the-job training; moreover, other mechanisms (such as deferred stock options) have been devised to provide incentive-based deferred compensation. As a result, DC plans are seen as more compatible with a mobile workforce in that they offer more portability: employees typically can roll over their accounts on changing employers, which undoes the job-lock problem quite readily.⁵

Another rationale for the shift on pension offerings notes that employers in many developed countries have begin to face tight labor markets in particular skill areas along with global product-market competition (Lofgren et al., 2001; Mitchell et al., forthcoming). The combination suggests that compensation packages must be more flexibly designed so as to accommodate the diverse needs of a more heterogeneous and less rapidly growing workforce. For example, a DC plan typically offers employees more control over how much to contribute, how their money is invested, and how to withdraw it, as compared to traditional DB plans.⁶ In addition, DC plans are more flexible in terms of retirement age, unlike DB plans that generally subsidize early retirement but penalize continued work at older ages.⁷ Both factors suggest that DC plans are more likely to grow more popular in the private sector, in the future.

Challenges to Public Sector Pensions. Pension plans in the public sector have also undergone substantial change in the last two decades. Traditionally, national social security systems were of the DB variety, mostly operated on a pay-as-you-go basis. Operating them on an unfunded basis means that participants are exposed to fluctuations in annual tax revenues, inasmuch as current revenues are needed to pay benefits each year. Consequently, workers find themselves exposed to the risk that shortfalls will require raising taxes, and retirees in traditional DB systems worry about unexpected costs and possible benefit cuts due to demographic changes

and political uncertainty.

Appreciation of these risks over the last two decades prompted many countries to follow in Chile's footsteps, after that nation adopted a DC structure in 1981 for its national retirement system (Schwarz and Demirguc-Kunt, 1999). Many developing countries appear to have followed suit in response to situations of crisis and breakdown in their national programs; very few set aside adequate public pension reserves for their national old-age systems.⁸ In developed countries, DC partial or full conversions appear to have been motivated by forecasts of future demographic change and long-run cost concerns (Smetters and Park, in progress).

Plan Design and Investment Risk

Adopting a DC plan affords workers and retirees additional, and sometimes welcome, control over their retirement saving and income. On the other hand, this added flexibility also brings new risks, some of which workers and retirees appear relatively ill-equipped to handle. In this section we discuss ways in which plan sponsors transfer retirement system risks to participants, and how this risk transfer can be better handled by good plan design.

The main source of risk we focus on here is investment risk, which is key since the value of DC accounts at retirement depends on the worker's and sponsor's contributions, as well as the investment returns earned over the working lifetime.⁹ In the case of private-sector conversion from DB to a DC plan, the risk is transferred directly from shareholders to workers. In the case of national social security DB to DC conversions, the nature of the risk transfer likely depends on what happened to promises made under the traditional system and how those promises were spread between pensioners and taxpayers. New risks faced by workers under national DC plans might actually be *less* than risks borne under unfunded old system, though DC investment risks may seem more transparent to workers.

It is essential to note that investment risk is unavoidable when attempting to advance-fund future retirement consumption, irrespective of whether a pension system is based on the defined-benefit model or the defined-contribution model. While those who oppose augmenting social security systems with personal saving accounts often point to investment risk as a reason to oppose them, they miss an important point: true advance funding of future pension liabilities always requires an increase in capital holdings, and the risk associated with capital assets must be borne by someone. In a DB model, this risk tends to be passed on to future social security taxpayers in the form of risky tax rates, or to beneficiaries in the form of risky benefits. In a pure DC model, this risk is borne by beneficiaries and so it must be managed.

Although investors sometimes think that investment risk becomes less important over the long run, most experts know that this position is not accurate (e.g., Bodie, 1995). Indeed, there have been 15 years in the twentieth century alone in which the real value of the US stock market fell over 40 percent in the succeeding decade.¹⁰ The stock market declined by about 50 percent in real terms, between 1973 and 1975, and it did not return to its pre-1973 level for almost a decade. More recently, the U.S. stock market has given up almost five years of growth including the earnings during the fast-growth late 1990s. Even at current values, price-earnings ratios exceed their historic average, and a high price-earnings ratio may foretell yet another decline, following a “mean reversion” process outlined by various financial economists.¹¹ Also, though U.S. capital markets have performed well over the last century, the same has not been true for major foreign markets, which returned an average real return of 1.5 percent over the century (Goetzmann and Jorion, 1996).

One important lesson from the literature is that DC plan participants must have access to high-quality, trustworthy investment advice, as well as financial education so they can accurately

assess the risk/return mix in their pension plans. A recent survey conducted of the TIAA-CREF participant pool suggest that most people in that sector appear to follow the standard rules for investing (Bodie and Crane, 1997).¹² On the other hand the group surveyed was better educated and more highly paid than on average, so questions remain about whether employees more generally would follow this tactic. A different approach is to ask whether employees tend to receive good advice from financial service firms and investment advisory services. Bodie (PRC Working Paper 2002-15) reviews a number of advice provider websites, and he concludes that a great deal of the information provided is logically flawed and sometimes even counterproductive. For example, he illustrates that the standard advice proffered is tilted toward risky investments, and it also offers little advice about protection against market declines. He concludes that more easy-to-understand advice and safer investment products are needed to simplify the complex task of investing for retirement.

Concern that DC participants might hold unbalanced investment portfolios in retirement plans is the focus of two studies that examine the role of employer stock. This issue has become especially important following the demise of Enron and other large employers. Mitchell and Utkus (PRC Working Paper 2002-4) explore why many DC plans became heavily concentrated in company stock, the result of a policy conflict between wanting workers to own the company and hence align their interests with the firm's, versus the more traditional need to hold a diversified retirement portfolio. One striking finding is that 401(k) plan participants tend to believe that their *own* firm's company stock is safer than *other* individual company stock, and also safer than a stock market index. The authors assemble a wide range of data on this topic and outline policy options for future plan design. In a related chapter, Ramaswamy (forthcoming) tackles the difficult issue of measuring the level of plan diversification when a worker holds a

great deal of his DC pension assets in his employer's stock. The diversification measure he develops computes how "close" the participant's portfolio is to the point on an efficient capital market frontier that would produce the same expected return. Ramaswamy's measure can be computed without knowing the expected returns to all the pension assets, and he shows that many common DC plan portfolios are so badly diversified that they would require very costly insurance to hedge these underlying risks.

The risk of nondiversification must be distinguished from general investment risk that arises from fluctuations in market returns. A person who elects an undiversified portfolio might forego larger returns even when the market returns as a whole does well. Recent research shows that peoples' DC portfolio choices follow the "path of least resistance," by passively opting for the enrollment and investment options suggested by their employers (Choi et al., forthcoming). Consequently, good plan design regarding automatic enrollment, investment choice, and financial education can have a powerful impact on influencing saving and portfolio choices. A similar point applies to national social security retirement systems. In the Swedish DC pension system, one-third of participants chose the "standard" fund in 2000, which was the fund assigned to those who did not elect any fund (Weaver, 2001). For this reason, the recent Commission to Strengthen Social Security (CSSS 2001) recommended that a standardized portfolio be offered for those who failed to elect a particular investment mix.

Another reason that investment risk in the DC system is of concern is that public and private pension systems may interact with each other, sometimes in complex ways. For example, Australia has for many years had both a national mandatory DC system and also a means-tested old-age benefit for the poor. The concern is that retirees have substantial flexibility in their pension investments and pension payouts, an interaction that opens the possibility of

strategic participant behavior. The potential for moral hazard in this circumstance is explored by Doyle and Piggott (forthcoming), who evaluate how participants perceive the cost versus the benefit of having a minimum pension benefit assured, versus a flat-rate benefit paid regardless of the value of assets in their personal account. They find that inflation-protected products have lots of value.

A different reason investment risk can arise results from confusion about how capital market risk should be assessed by pension policymakers. For example, when President Clinton proposed to invest the U.S. Social Security surplus in the stock market, government scorekeepers “scored” this plan using risky expected stock returns. The problem with this approach is that it does not explicitly discount for market risk, and as Smetters (2002) shows, this scoring method imposes a large actuarial unfunded liability on future generations. A similar problem arises with state-level pension systems and, to a lesser extent, private pension plans, as illustrated by Gold (forthcoming). The author also goes an important step further by pinpointing how actuarial standards can result in this costly bias. Concern over interference in valuing and investing pension assets has been highlighted by Iglesias and Palacios (2000), who emphasize how political factors may play an important role in reducing DB plan investment returns. To protect against this, several developed nations have recently restructured pension governance and investment options to limit the usage of pension monies for social projects that often earn low (or negative) real rates of return. Palacios (forthcoming) examines a range of “best practices,” and he contends that additional transparency, better reporting, and competitive market benchmarks can yield higher pension plan investment returns.

Global Developments in Retirement Risk Transfer

One approach to managing the investment risks that workers face in a defined-

contribution plan is to offer them some form of guarantee. A simple approach would promise a participant contributing to a DC plan that he would receive a minimum rate of return on his investments, or guarantee that the DC account would be of a minimum size when the worker attains retirement age. Lachance and Mitchell (PRC Working Paper 2002-5) estimate the actuarial cost of providing different types of DC plan guarantees, which they estimate using arbitrage pricing techniques. Though pension guarantees have been previously analyzed, this paper considers a wider range of guarantee structures and builds on methodology pioneered by Cox, Ingersoll and Ross (1985). This chapter confirms that many pension guarantees can be quite expensive. In addition, the authors also show that some potentially attractive guarantees might be more affordable. In particular, a “real principal” guarantee would return to a participant the real value of his contributions, a structure akin to that adopted in the new “Japanese 401(k)” plans (Clark and Mitchell, 2002). Since the guarantee is price indexed but the larger economy grows in real terms, this financial promise could be offered at fairly reasonable costs. On the other hand costs may be especially large if the plan guarantees a rate of return promised under a former DB social security system (Smetters, 2002).

DC plan guarantees are also offered in Germany, and are the subject of an examination by Maurer and Schlag (PRC Working Paper 2002-11). Under the recent German Retirement Saving Act, supplemental DC pensions were created to offset reductions in traditional DB state benefit promises. To qualify for a special tax status, providers of these supplemental DC products must ensure the nominal value of workers’ investments at retirement. The authors examine different ways in which providers can hedge such risks, as well as their associated costs. Alternative guarantees in Canadian “segregated funds” are examined by Vetzal, Forsyth, and Windcliff (forthcoming). Here a guarantee is provided after a specified time, on the initial

principal invested. These contracts include a reset provision that allows investors to lock in gains, as the value of the mutual fund increases; other features may also be included such as a death benefit paid off immediately on the investor's death. The authors describe hedging strategies that can be used by firms offering these contracts. Using numerical models they conclude that segregated contracts are quite expensive to offer, but that some of the risks can be reduced quite significantly using fairly simple active (or dynamic) hedging strategies.

Guarantees are quite prevalent in many pension plan systems around the world. For example, Chile was the first country to convert its complex DB system to one based on personal accounts. The Chilean system then guaranteed that each plan would yield a rate of return not too far from the average return and it also "tops up" personal accounts on retirement, so as to ensure that individual accounts are large enough to finance a benefit equal to approximately 75 percent of the minimum wage (Walliser, forthcoming). This guarantee produces a retirement benefit equal to about 25 percent of the average wage in the economy (Diamond and Vadés-Prieto, 1994). Walliser also surveys other mandatory retirement systems and groups them into two general types, and he further discusses economic rationales for and incentives created by these guarantees. Pension guarantees have also been offered in a wide range of voluntary DC plans, as discussed by Turner and Rajnes (forthcoming). These authors demonstrate that guarantees typically differ from those offered in mandatory system: that is, voluntary DC plans tend to offer a fixed nominal rate of return, while relative rate of return guarantee tend to be offered by mandatory plans. They argue that the more generous voluntary system guarantees are more likely to encourage plan participation.

While many may find attractive the provision of guarantees in pension plans, there remains the key issue of how to finance the costs of providing different guarantees. These

calculations are important because guarantees sometimes seem to be “free”; this is the case, for example, on government budget balance sheets that only report contemporaneous flows of revenues and costs, but ignore potential insurance liabilities down the road. Yet such guarantees can represent considerable risk to future taxpayers or, in the case of private sector, substantial risks for the party holding the short position of these contracts.

One of the most important diversification strategies for pension systems is to find investment vehicles whose returns are not highly correlated with the performance of the rest of the economy. For example, a worker who loses his or her job faces a second tragedy if the value of his pension plan also sharply decreases in value. Cummins and Lewis (forthcoming) investigate a new class of derivative securities whose returns are tied to events such as catastrophes and weather. They argue that these securities might be quite useful to institutional investors, such as a mutual fund, because of the low correlation of their returns with other financial investments. Moreover, these securities pay a rate of return that is often much higher than other low-correlation securities, such as government bonds. But Cummins and Lewis argue that some caution is in order: these markets are currently quite thin, and so this premium might reflect liquidity problems.

Additional issues pertinent to pension payouts are taken up in the study by Fliegelman, Milevsky, and Robinson (forthcoming). Their focus is whether and how insurers will be able to “make good” on promises to pay lifelong annuities. To this end, they propose that insurers can do several things, including offsetting mortality exposure via life insurance products and sensible product design. For example, they indicate that restricting investment options of plan participants can reduce volatility of returns and hence the value of the option granted to the contract holder. In addition, they recommend distributor and participant education as product complexity

increases. Finally they explore alternative financing mechanisms including reinsurance that might permit insurers to access product design and mortality expertise of reinsurers, though they also note that reinsurers have traditionally been less than willing to accept longevity risk unless it is priced very conservatively.

Conclusions

Ultimately, retirement income products that offer new promise for old-age income security must better handle the increased volatility resulting from capital market investment, along with longer-term trends in pension system design, that have prompted concerns regarding how effectively retirement systems can perform. Policymakers, academics, financial practitioners, and pension participants are engaged in an active search for innovative responses to the emerging global retirement environment.

This research shows that the pension market is far from exhausted. Indeed, more workers than ever before seek sensible pension designs to help them save during the accumulation phase, and also to help them manage pension payouts in retirement. Maintaining insurer financial integrity and profitability is essential, including protecting for the long-tailed nature of payout annuity contracts. In addition, more work remains to be done on how to better protect retiree minimum pension guarantees, ultimately the core concern of retirement plan designers.

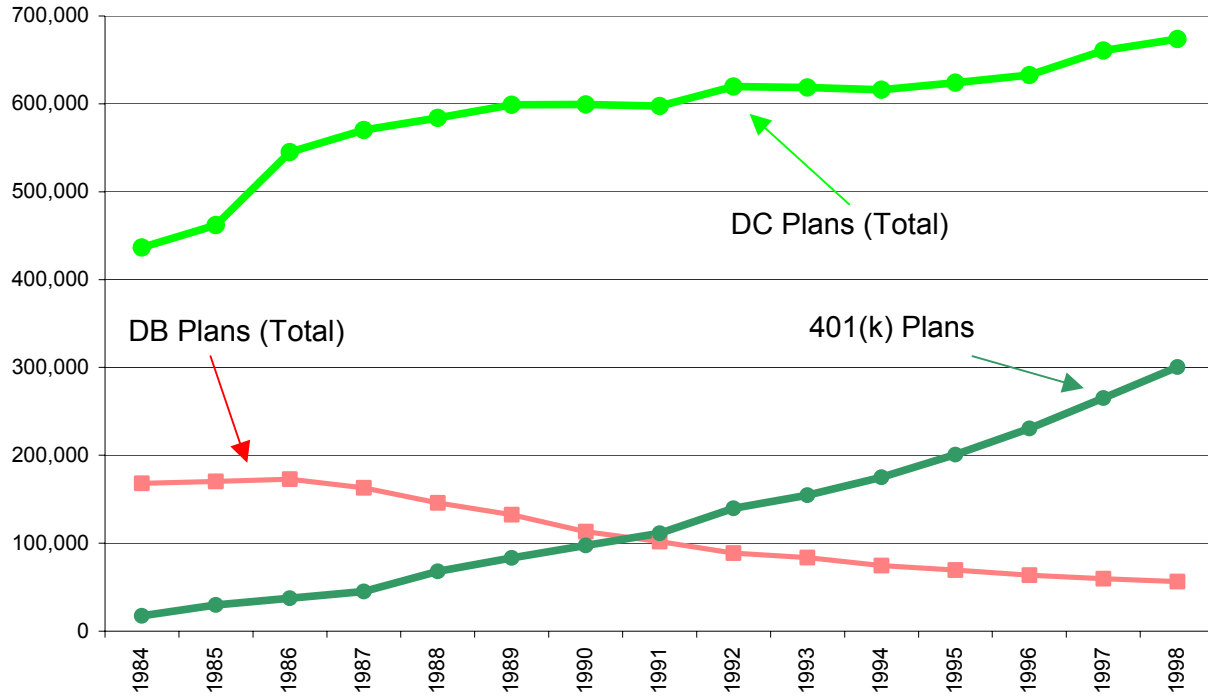
Table 1. Global Developments in Personal Account Retirement Systems

Country	Year personal accounts introduced	Voluntary participation choice?
Chile	1981	New workers must join new system; current workers may choose between systems
Switzerland	1985	No
U.K.	1986	Yes
Denmark	1990	No
Australia	1992	No
Colombia	1993	Yes, workers are allowed to switch back and forth every 3 years
Peru	1993	Yes
Argentina	1994	Yes
China	1995	No
Uruguay	1996	Employees > 40 can choose; those < 40 and new workers must join new system
Bolivia	1997	No
Mexico	1997	No
El Salvador	1998	All new & young workers must join new system. Older workers must remain with old system. Workers age 36-55 (men) /50 (women) may choose
Hungary	1998	No
Kazakhstan	1998	No
Sweden	1998	Workers born < 1938 stay in old system; those born > 1953 in new system; gradual transition from old to new system for others
Costa Rica	1999	
Poland	1999	Yes
Hong Kong	2000	No
Nicaragua	2000	
Dominican Republic	2001	
Croatia	2002	Yes

Source: Smetters and Park (in progress).

Figure 1. Trends in US Private Sector Pension Plans (number of plans by type)

Source: Authors' computations from data provided by the US Department of Labor, Pension and Welfare Benefits Administration (www.dol.gov).



References

- Bodie, Zvi. Forthcoming. "An Analysis of Investment Advice to Retirement Plan Participants." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- _____. 2001. "Financial Engineering and Social Security Reform." In *Risk Aspects of Social Security Reform*, eds. John Campbell and M. Feldstein. Chicago: Univ. of Chicago Press: 291-320.
- _____. 1995. "On the Risk of Stocks in the Long Run." *Financial Analysts Journal*, May/June: 18-22.
- Bodie, Zvi and Dwight B. Crane. 1997. "Personal Investing: Advice, Theory, and Evidence." *Financial Analysts Journal* 53: 13-23.
- Bodie, Zvi and Robert Merton. 1993, "Pension Benefit Guarantees in the United States: A Functional Analysis." In *The Future of Pensions in the United States*, ed. R. Schmitt. Pension Research Council. Philadelphia: University of Pennsylvania Press: 194-234.
- Bodie, Zvi, Brett Hammond, and Olivia S. Mitchell, eds. 2002. *Innovations in Financing Retirement*. Pension Research Council. Philadelphia: University of Pennsylvania Press.
- Brown, Jeffrey, Olivia S. Mitchell, James Poterba, and Mark Warshawsky. 2001. *The Role of Annuity Markets in Financing Retirement*. Cambridge: MIT Press.
- Campbell, John and Robert Shiller. 1998. "Stock Prices, Earnings and Expected Dividends." No. 858 in Cowles Foundation Discussion Papers from Cowles Foundation, Yale University.
- Campbell, John and Robert Shiller. 1998. "Valuation Ratios and the Long-Run Stock Market Outlook." *Journal of Portfolio Management* 24(2):11-26.
- Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick. Forthcoming. "Defined Contribution Pensions: Plan Rules, Participant Decisions and the Path of Least Resistance." *NBER Tax Policy and the Economy*. The MIT Press.
- Clark, Robert L. and Ann A. McDermed. 1990. *The Choice of Pension Plans in a Changing Regulatory Environment*. Washington, D.C.: AEI Press.
- Clark, Robert L. and Olivia S. Mitchell. 2002. "Strengthening Employment-Based Pensions in Japan." *Benefits Quarterly*, Second Quarter: 22-43.
- Clark, Robert L. and Sylvester J. Schieber. 2002. "Taking the Subsidy Out of Early Retirement: Converting to Hybrid Pensions." In *Innovations in Retirement Financing*, eds. Zvi Bodie, Brett Hammond, and Olivia S. Mitchell. Pension Research Council. Philadelphia: University of Pennsylvania Press: 149-174.
- Cogan, John, and Olivia S. Mitchell. 2002. "The Role of Economic Policy in Social Security Reform: Perspectives from the President's Commission." Pension Research Council Working Paper 2002-13. <prc.wharton.upenn.edu/prc.prc.html>.
- Commission to Strengthen Social Security (CSSS). 2001. *Strengthening Social Security and Creating Personal Wealth for All Americans: Final Report*. <www.csss.gov>.
- Congressional Budget Office. 1999. *Social Security Privatization: Experiences Abroad*. US

- Government Printing Office. Washington, D.C., January.
- Cox, John C., Jonathan E. Ingersoll Jr., Stephen A. Ross. 1985. "An Intertemporal General Equilibrium Model of Asset Prices." *Econometrica* 53(2): 363-384.
- Cummins, David and Christopher Lewis. Forthcoming. "Securitized Risk Instruments as Alternative Pension Fund Investments." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Diamond, Peter A. and Salvador Valdes-Prieto. 1994. "Social Security Reforms." In *The Chilean Economy: Policy Lessons and Challenges*, eds. Barry P. Bosworth, Rudiger Dornbusch, and Raúl Labán. Washington, D.C.: The Brookings Institution: 257-357.
- Doyle, Suzanne and John Piggott. Forthcoming. "Integrating Payouts: Annuity Design and Public Pension Benefits in Mandatory Defined Contribution Plans." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Fliegelman, Arthur, Moshe Milevsky, and Scott Robinson. Forthcoming. "Credit Implications of the Payout Annuity Market." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Goetzmann, William N. and Philippe Jorion. 1996. "Global Stock Markets in the Twentieth Century." *Journal of Finance* 54(3): 953-980
- Gold, Jeremy. Forthcoming. "Risk Transfer in Public Pension Plans." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Gustman, Alan S, Olivia S. Mitchell, and Thomas L. Steinmeier. 1994. "The Role of Pensions in the Labor Market." *Industrial and Labor Relations Review* 47 (3): 417-438.
- Iglesias, Augusto and Robert J. Palacios. 2000. "Managing Public Pension Reserves: Evidence from the International Experience." Pension Reform Primer, World Bank: Washington, DC.
- Lachance, Marie-Eve and Olivia S. Mitchell. Forthcoming. "Understanding Individual Account Guarantees." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Lofgren, Eric, Steven A. Nyce, and Sylvester J. Schieber. 2001. "Designing Total Reward Programs for Tight Labor Markets" Pension Research Council Working Paper 2001-17. <prc.wharton.upenn.edu/prc.html>.
- Lumsdaine, Robin and Olivia S. Mitchell. 1999. "New Developments in the Economics of Retirement". In *Handbook of Labor Economics*, eds. Orley Ashenfelter and David Card. Amsterdam: North Holland: 3261-3308.
- Marcus, Alan J. 1985. "Spinoff-Terminations and the Value of Pension Insurance." *Journal of Finance* 40 (3): 911-24.

- Marcus, Alan J. 1987. "Corporate Pension Policy and the Value of PBGC Insurance." In *Issues in Pension Economics*, eds. Zvi Bodie, John Shoven, and David Wise. Chicago: University of Chicago Press: 49-76.
- Maurer, Raimond and Christian Schlag. Forthcoming. "Money-Back Guarantees in Individual Account Pensions: Evidence from the German Pension Reform." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- McGill, Dan, Kyle Brown, John Haley, and Sylvester Scheiber. 1996. *Fundamentals of Private Pension Plans*. 7e. Pension Research Council. Philadelphia: University of Pennsylvania Press.
- Mitchell, Olivia S. 2000. "Developments in Pensions". *Handbook of Insurance*, ed. Georges Dionne. Boston: Kluwer Academic Publishers: 873-899.
- Mitchell, Olivia S. 1982. "Fringe Benefits and Labor Mobility." *Journal of Human Resources* 17(Spring): 286-298.
- Mitchell, Olivia S., David Blitzstein, Michael Gordon, and Judy Mazo, eds. Forthcoming. *Benefits for the Workplace of the Future*. Philadelphia: University of Pennsylvania Press.
- Mitchell, Olivia S., James M. Poterba, Mark J. Warshawsky, and Jeffrey R. Brown. 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review*, September: 1299-1318.
- Mitchell, Olivia S. and Hustead, Edwin, eds. 2000. *Pensions for the Public Sector*. Pension Research Council. Philadelphia: University of Pennsylvania Press.
- Mitchell, Olivia S. and Kent Smetters. Forthcoming. *The Pension Challenge: Risk Transfers and Retirement Income Security*. Philadelphia: Pension Research Council Press.
- Mitchell, Olivia S. and Stephen P. Utkus. Forthcoming. "The Role of Company Stock in Defined Contribution Plans." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Palacios, Robert. Forthcoming. "Securing Public Pension Promises through Funding." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Pennacchi, George G. 1999. "The Value of Guarantees on Pension Fund Returns." *Journal of Risk and Insurance* 66(2): 219-37.
- Pesando, James. 1982. "Investment Risk, Bankruptcy Risk, and Pension Reform in Canada." *Journal of Finance* 37(3): 741 - 49.
- Poterba, James M., Steven F. Venti, and David A. Wise. 2001. "The Transition to Personal Accounts and Increasing Retirement Wealth: Macro and Micro Evidence." NBER WP 8610, November.
- Ramaswamy, Krishna. Forthcoming. "Company Stock and Pension Plan Diversification." Mitchell, Olivia S. and Kent Smetters. In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia:

- Pension Research Council Press.
- Sass, Steven. 1997. *The Promise of Private Pensions: The First Hundred Years*. Cambridge: Harvard University Press.
- Schieber, Sylvester J. and John B. Shoven. 1999. *The Real Deal: The History and Future of Social Security*. New Haven: Yale University Press.
- Schwarz, Anita and Asli Demirguc-Kunt. 1999. "Taking Stock of Pensions around The World." World Bank (<http://www.worldbank.org/wbi/pensions/pdfpublications/schwarz.pdf>).
- Smetters, Kent. 2002. "Controlling the Costs of Minimum Benefit Guarantees in Public Pension Conversions." *The Journal of Pension Economics and Finance* 1(1), March: 9-34.
- Smetters, Kent and Cindy Park. In progress. *A Matter of Trust: Understanding Worldwide Social Security Reforms*. The Wharton School, University of Pennsylvania.
- Turner, John and David Rajnes. Forthcoming. "Retirement Guarantees in Voluntary Defined Contribution Plans." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Vetzal, Kenneth, Peter Forsyth, and Heath Windcliff. Forthcoming. "Hedging Segregated Fund Guarantees." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Walliser, Jan. Forthcoming. "Retirement Guarantees in Mandatory Defined Contribution Systems." In *The Pension Challenge: Risk Transfers and Retirement Income Security*, eds. Olivia S. Mitchell and Kent Smetters. Philadelphia: Pension Research Council Press.
- Weaver, Kent. 2001. "Reforming Social Security: Lessons from Abroad." Working Paper. Washington, D.C.: The Brookings Institution.
- World Bank. 1994. *Averting the Old-Age Crisis*. Washington, D.C.: The World Bank.

Endnotes:

¹ For a discussion of political risk in the case of the US Social Security system see Schieber and Shoven (2000) and Cogan and Mitchell (2002). Other countries are discussed in World Bank (1994).

² For a more extended discussion of US pension law and solvency issues the reader is referred to McGill et al. (1996); for more on annuities see Brown et al. (2001).

³ Many analysts have examined labor market impacts of DB plans; for reviews see Mitchell (1982) and Gustman et al. (1994).

⁴ DC plans did not technically replace existing DB plans in most cases; rather, existing workers are often allowed to contribute to new DC plans, and new companies now typically elect the DC form; for a review see Mitchell (2000).

⁵ Some DC firms do match a portion of employee contributions and then impose a vesting period similar to that in DB plans, before the matched contributions become the employee's personal property. In this case, some job lock still exists though it is less important relative to traditional DB plans.

⁶ The job-lock problem can also be addressed with a cash-balance DB plan that promises a fixed rate of return on contributions. Nevertheless these plans are costly to administer and typically do not give employees portfolio choice. Any employee seeking a relatively predictable rate of return could, of course, obtain it in a DC plan by investing in low-risk bonds.

⁷ Cash balance plans can also encourage continued work; see Clark and Schieber (2000).

⁸ While a few have done so, as in the case of Asian Provident Funds, these assets are often invested in fairly poor-performing assets. For a discussion of pension plans for governmental employees see Mitchell and Husted (2000).

⁹ For other risks we do not address here see Brown et al. (2000) and Bodie et al. (2002).

¹⁰ These include 1908-12, 1937, 1939, 1965-66 and 1968-73 (see Campbell and Shiller, 1998).

¹¹ Campbell and Shiller (1998) argue that the price-dividend ratio is a powerful predictor of future prices, contrary to the efficient market hypothesis. On these grounds, they forecast a 38 percent loss in the real value of stocks over the next decade.

¹² One important exception was that participants often failed to "tax minimize", which means they did not figure out a contribution and asset mix that would reduce lifetime taxes paid on retirement saving and dissaving.