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# Managing Risks in Defined Contribution Plans: What Does the Future Hold?

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***Abstract***

Traditional defined benefit pensions have been on the decline over time, as defined contribution (DC) plans increasingly supplant them. Despite their many appealing features including transparency and portability, DC plans often require participants to take an active role in deploying them to achieve their ultimate goal, namely, meeting retirement consumption needs. In the wake of the financial crisis and the continuing economic downturn, analysts and policymakers are asking whether, and how, DC pensions have weathered the storm and whether they should be overhauled in any systematic way. In particular workers and retirees now must contract with themselves, as well as employers, financial institutions, and governments, to try to secure long-term retirement financing. In this paper we outline key retirement risks confronting active and retired workers as well as sponsors and governments, along with financial market and policy responses. We conclude with a brief discussion of future challenges.

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# Managing Risks in Defined Contribution Plans: What Does the Future Hold?

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Traditional defined benefit (DB) pensions have become less and less popular over the last two decades in many countries; instead, they have been supplemented by, and in some cases replaced by, defined contribution (DC) plans. While DC plans have many appealing features including transparency and portability, they also require participants to take an active role in deploying them to achieve their ultimate purpose, namely, meeting retirement consumption needs. And, noting that participants sometimes have difficulty managing their retirement plans effectively, some critics have charged that DC plans are not up to the task. Accordingly, analysts and policymakers are now asking whether DC plans should be completely overhauled, so as to better meet national retirement objectives. In this paper we address these issues by evaluating the main retirement risks confronting participants in and sponsors of DC plans, and discussing how markets and regulators are responding to these. [1] We conclude with a discussion of some lessons and policy implications for the future of DC plan risk management.

This topic is of interest since pension assets represent millions of workers' retirement saving and are a key source of global financial capital. In 2009, worldwide retirement assets were estimated at US$24 trillion, projected to grow to more than $34 trillion in 2014 (see Figure 1). Pension assets represent a substantial portion of the world's wealth, equivalent to two-thirds of GDP on average for the nations depicted in Figure 2, and more than total national output, in some cases. The United States has the largest retirement asset pool with $16.5 trillion in 2010, of which $4.2 trillion was held in in employer-based defined contribution (DC) retirement plans

[1] This discussion draws on Mitchell (2010a, b).

(ICI 2010). Nevertheless pensions have not been immune to market shocks, suffering mightily with the recent sharp drop in equity markets (see Figure 3). In the US, for instance, in 2008 pensions assets fell by around 20%, coinciding unfortunately with the moment when the aging Baby Booomers begin to claim benefits (Moore 2010, Allianz 2010). Figure 4 shows that rates of return on pension fund assets were sharply negative in 2008 across a broad swath of OECD countries, a shock from which plan sponsors and participants are still recovering.

*Figures 1-4 here*

It is sometimes argued that market shocks have a more potent influence on retirement preparedness for those in DC plans compared to DB plans;[2] in the former, investment drops are immediately recorded on workers' and pensioners' accounts, whereas in a DB plan, a fall in assets values requires sponsors (and sometimes active workers) to make remedial contributions to fill the gap. Yet DB promises often cannot be met if sponsors close down their business with insufficient assets to cover pension promises. As Table 1 illustrates, with the notable exception of Japan and Canada, at least one-third and sometimes the bulk of retirement assets is now held in defined contribution plans in many large economies: some 43% or close to $10 trillion is managed in DC plan structures today. Further, industry projections estimate that DC assets will rise faster than DB plan assets in the future, including in Japan where DC plans now cover 3.5 million participants (in 2010), up from only 88,000 employees in 2001 (Nomura 2009; Nishiyama and Nakanishi, 2010). In other words, it seems clear that DC plans are here to stay and DB plans will continue to decline in coverage. For this reason it is crucial to focus on the question of how to best manage the risks particular to DC pensions. To this we turn next.

*Table 1 here*

[2] See Bosworth and Burtless (2010).

**Identifying Risks and Solutions**

In the discussion that follows, we classify key challenges facing the DC system into four which we label here *individual* risk, *institutional* risk, *country* risk, and *global* risk. In what follows, we first describe what we mean by each risk, and then in turn we identify some responses to these challenges.[3]

**Risks Confronting Individuals and their Families.** The conventional economic view of the lifecycle problem is that consumers will save and invest during youth and middle age, so as to have income and/or assets to live on during the later phase in life after labor market earnings cease. Pensions can play a very central role in this accumulation and later payout process, inasmuch as they represent deferred earnings dedicated to old-age consumption. (Buying a home and paying down one's home mortgage was once seen in the same spirit, prior to the housing bubble). And during the decumulation phase of life, the task is to draw down assets in an orderly manner, not too quickly, to avoid running out of money too soon.

In practice, of course, implementing the lifecycle model is fraught with problems. One reason is widespread financially illiteracy, combined with failure to plan and execute retirement saving plans. And since half the population will outlive its life expectancy, this increases the chances of running out of money in old age. For instance, in several recent surveys of US residents, we asked three financial literacy questions as follows (Lusardi and Mitchell 2007a,b, 2008; Lusardi et al. 2010):

> 1) Percentage calculation: If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease?
>
> 2) Lottery Division: If 5 people all have the winning number in the lottery and the prize is 2 million dollars, how much will each of them get?

[3] This risk classification was introduced by Mitchell (2010b).

3) Compound Interest: Let's say you have 200 dollars in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?

Results for a nationally representative sample of older US respondents appear in Table 2. On the one hand, almost 84% of the respondents – in their mid-50s at that time – could correctly compute the percentage question. More troubling was the fact that only slightly over half of the Boomers could accurately divide $2 million by 5. But most concerning is the fact that only 18% of this nationally representative sample of Americans in their 50's understood the principle of compound interest. Of those responding incorrectly, around two-fifths did a simple interest computation, whereas three-fifths either failed to answer at all, or responded with a clearly wrong answer. This is troubling in view of the fact that most people in their mid-'50s have had long and sometimes complex financial histories involving student loans, borrowing against credit cards, buying cars on time, and taking home mortgages. Since they fail at both simple numeracy and financial concepts, it is little wonder that their finances are not in order.

Our research also shows that financial literacy is a strong predictor of planning for retirement, saving for retirement, and succeeding in retirement (Lusardi and Mitchell 2007a). While more-educated people do perform better, still only 18% of these households on the verge of retirement are relatively successful at devising retirement plans and executing them at least some of the time. And those who succeed at retirement planning are also almost three times as wealthy as those who do not. In other research (Lusardi et al. 2010; Behrman et al. 2010), we address the critical and complex issue of reverse causality – i.e. whether financial literacy drives planning and wealth, or vice versa. Our work, along with that of Bernheim at al. (2001), confirms that financial literacy has a separate and powerful impact, suggesting that strengthening consumer knowledge of basic economics and financial could enhance retirement wellbeing.

Employers who offer DC pensions often play a role in helping combat participant illiteracy and inertia. To this end, some provide workers with retirement seminars, financial wellbeing calculators, and benefit estimators, seeking to enhance retirement planning and build pension saving (Clark et al. 2006). Workplace pension policies such as automatic enrollment and commitment saving programs have also made substantial inroads, with the goal of inducing workers to save more by defaulting them into DC pensions.[4] This usually also requires defaulting them into specific saving portfolios such as life-cycle funds, where the fund management gradually moves assets into less risky holdings as the worker ages. Evidence suggests that this approach can improve participant asset allocation patterns and is likely to enhance retirement accumulations over time (Mitchell et al. 2009), particularly for the low-age, women, and least financially literate.

Another source of risk facing participants in DC plans stems from uncertainty in labor income profiles. Even in good economic times, many people lose their jobs and experience periods without steady labor income (Mitchell et al. 2007). In fact, human capital risk is much more widespread than often appreciated, implying that relatively few workers end up with a smooth hump-shaped labor income profile so often assumed in economic modeling. For instance Mitchell and Turner (2010) cite evidence indicating that "real" workers' lifetime pay profiles turn out to be quite erratic due to periods of zero and low earnings. Thus only 14 percent of U.S. workers fit the classic profile; by contrast, the same fraction experienced sagging real earnings profiles in the middle years, another group had flat earnings profiles, and yet another experienced falling earnings after a fairly young age (c.f. Bosworth et al. 2000). Such patterns are critical for DC plans, where contributions depend on pay and are made only when people are employed;

[4] See for instance Thaler and Benartzi (2004).

furthermore early years tend to matter most, so compound interest can be earned over a longer period.

*Figure 5 here*

We turn next to the risk retirees must confront due to uncertainty over their future longevity. This becomes a key consideration for DC plan participants in countries such as the US, since here retirees are not required to buy lifelong income at the point of retirement, nor do most plan sponsors offer the option of an in-plan payout annuity. Instead, retirees are permitted to withdraw their entire pension accumulation (with tax consequences), they may take the money out gradually in a 'phased withdrawal' approach, or they may roll the money into a tax-qualified account and use that to purchase lifetime payout annuities. But in the US (as in many other countries), few retirees purchase payout products making it difficult to obtain longevity protection that previously had been afforded to DB plan participants.

In theory, payout annuities constitute an essential tool for retirement planning, since most retirees would benefit when they exchange a premium payment for an insurer's commitment to pay an income benefit until death.[5] This is still true even when taking into account the adverse selection that arises when people who buy payout annuities live longer than average. Yet people tend to underannuitize in part because they underestimate the chances of living to be very old and thus subject themselves unwittingly to "tail risk" of living well beyond their life expectancy (Brown et al. 1999, 2000, 2001, 2002). Over time, this risk is exacerbated by cohort-wide mortality improvement, which subjects retirees to the additional uncertainty of evolving life tables. A depiction of the uncertainty in longevity outcomes appears in Figure 6 (Dowd et al. 2007). Another concern is that confidence in the life industry has been shaken in the wake of

[5] See Dus et al. 2005; Horneff et al. 2007; 2009, 2010; Maurer et al. 2010.

insurance company problems with impaired assets and other market shocks; some insurers have also required government support due to depleted reserves.

*Figure 6 here*

What should be the responses to these important, and probably underestimated, sources of retirement risk in DC plans? Some critics contend that DC plans are not up to the job; for instance, Munnell and Sundén (2004) characterize them as "coming up short," since some workers save too little, make uninformed investment decisions, and borrow the money rather than saving it for old age. But such criticisms overlook the role of Social Security benefits in crowding out low-wage workers' need to save for retirement; furthermore, "leakage" from tax-qualified accounts is relatively small (Brady 2008). It is also true that DC plans enable people to work longer, whereas DB plans tend to penalize continued work past an early retirement age (Fields and Mitchell 1984). Yet relatively few people to date appear to be responding to market shocks by pushing back their retirement dates (Bosworth and Burtless, 2010; Goda et al. 2010; Gustman et al. 2010; Coile and Levine 2006). In part this is because relatively few older workers currently are directly exposed to equity with only the top ten percentile of the wealth distribution of older Americans holding as much as 20% of its assets in stocks (Gustman et al. 2010); equity-holding is miniscule among those in the bottom half of the wealth distribution. Among DC account holders there was some flight to safety during the turmoil (Tang and Mitchell 2010; Vanguard 2010), though the amounts transferred were not substantial and trading has apparently not altered participants' anticipated portfolio performance.

*Table 3 here*

**Pension System or Institutional Risks.** Next we consider institutional risk – that is, the possibility that the retirement system itself might fail. The sad reality is that the financial crisis

has brought into sharp contrast the extraordinarily poor condition of pensions all over the world, including the underfunding of the US corporate and public DB plans. While corporate plans often receive some government re-insurance, these governmental entities too often face financial problems of their own.

In the DC world, the market downturn has led some to suggest that 'naked' market exposure is too risky, and that guarantees must be embedded in workers' DC accounts. While this proposal has some appeal, guarantees are costly and the more generous the guarantee, the more expensive it becomes. In Japan, for example, the 401(k)-type model requires that at least one fund be principal guaranteed – that is, after 40 years, the member is sure to get back at least the money he put in (with a zero rate of return). While this is relatively easy and inexpensive to provide, guaranteeing a bond return is not; estimates are that it would cost 16-20% or more of annual contributions (Lachance and Mitchell, 2003; Lachance et al. 2003). Thus offering guaranteed funds on the DC plan menu may be attractive, but it will surely not be provided for free.

**National Risk Exposures.** We move next to a brief discussion of national factors influencing retirement risk management, particularly in the context of DC plans. Unfortunately national risks are often highly unpredictable, including political risk and the fact that future tax and transfer policy is highly uncertain. One need only recall Argentina's recent government takeover of national pension assets, which was justified by arguing that retirees would be 'safer' with government IOU's instead of volatile capital market assets. Another aspect of national risk has to do with the future of Social Security and retiree healthcare provision. In the US at least, anticipated healthcare costs including nursing home care are highly uncertain, depending on the as-yet unknown evolution of Medicare cost controls that must be undertaken to balance system

finances. Moreover, even if the mean costs are relatively constant, the fact is that such costs are very skewed, implying that a given retiree household could easily need around half a million dollars simply to fund old-age healthcare needs (Fronstin 2008; see Figure 7).

*Figure 7 here*

On top of this, the national Social Security system also faces insolvency in many countries. In the US, for instance, the estimated anticipated shortfall exceeds $15 trillion, an amount that undermines the system's long-term viability (see Figure 8). The last Presidential bipartisan Commission to Strengthen Social Security proposed that Social Security's financing problems could be remedied with one simple change, namely a reduction in the rate of growth of future benefits (Cogan and Mitchell, 2003). Under current rules, future benefits are slated to grow faster than prices, a major explanation for the system's projected cash flow shortfall. Nevertheless, this could be remedied by limiting benefit growth to inflation. In this case, no benefit cuts would be required in real terms, compared to current levels, and the system would return to solvency.[6] Unfortunately the Commission's proposals were reported out at the time when national attention had turned to other matters. Nevertheless, lack of action has not made matters better – indeed Medicare and Social Security shortfalls continue to grow and exacerbate budget deficits induced by the economic recession and the bailouts of the financial system.

**Global Risk Considerations.** Last but not least, we turn to the topic of global retirement risk, where it seems that relatively little can be done in the near-term to enhance retirement security and strengthen DC plans. It does appear that we needn't have worried that Baby Boomers would drive down equity markets and housing values by retiring and redeeming their assets, since the

[6] Indeed this would also allow some additional benefit enhancements for the lifetime low-wage workforce. In addition, the Commission was asked by the President to design voluntary personal accounts, which we also did in such a way that it left the system actuarially neutral; that is, it would not cost the system nor benefit it.

global asset meltdown happened even before the Boomers retired! The central problem with global risk management, of course, is that it is mostly non-diversifiable. In other words, spreading one's investments around the world for international diversification purposes does not seem as attractive today, for risk pooling purposes, as once touted. In the past, many nations simply spread global risk over time with pay-as-you-go Social Security systems that required young workers to pay for today's retirees beset by financial and economic shocks. But, unlike the past, future generations in most developed nations will be far smaller than in the past, so very few workers are available to support the long-lived elderly (Shoven and Schieber 1999). And as yet, there is no formal market where today's workers can "make a deal" to trade with those as yet unborn (Smetters 2004).

**Lessons and Implications for Defined Contribution Plan Risk Management**

As DB plans have declined in international popularity, and DC plans expanded, many new ideas have been implemented to enhance the resilience of the DC system. For instance, a large fraction of employers offering DC plans today provides automatic enrolment, which has been proven to increase workers' saving propensities substantially (Madrian and Shea 2001). Other new arrangements include commitment saving devices or techniques to foster desired changes in behavior, such as the Save More Tomorrow (Smart) plan devised by Thaler and Benartzi (2004).[7] Many analysts have also demonstrated that pension asset allocation patterns are sometimes swayed by seemingly irrelevant (or even welfare reducing) factors (c.f. Mitchell and Utkus, 2004). For instance, when employers make contributions in, employees tend to be much more likely to invest their own contributions in the same undiversified stock. Conversely, when a plan sponsor defaults workers into so-called "life cycle" or target maturity date funds,

[7] For other related ideas see Choi et al. (2002).

participants tend to stick with these. The result is that younger workers end up with professionally managed blended funds holding more equity for the young, and more fixed income for older workers; as Tang et al. (forthcoming) show, this enhances workers' asset allocation choices and expected performance.

One area where much remains to be done has to do with managing DC assets at retirement. To date, some three-quarters of DC pensions appear to be paid out as lump-sum cashouts instead of income annuities (McGill et al., 2004), a potentially problematic result if retirees then run short and outlive their resources. This could be countered by having employers offer annuities as a default option at retirement, rather than having lump sum payouts as the standard choice. Some countries such as Singapore have gone a step farther, requiring that older workers purchase deferred annuities to protect them against longevity risk (Fong et al. forthcoming). Nevertheless, at a recent US Department of Labor hearing seeking comments on the possibility of including annuities as US retirement plan defaults, it became clear that here many objections would need to be overcome before this could be implemented (Ebeling 2010).

It is also worth noting that all pension plans and those they cover will be forced to confront many other key challenges associated with political, demographic, and financial uncertainty in the near term. Political risk in the US is salient, due to the fact that US tax law is in flux – in fact, Congress has not determined exactly how this year's income as well as future years' inheritances will be taxed. Politicians have also been unable to deal effectively with looming insolvency in Social Security and Medicare, implying that workers and retirees cannot sensibly project what will be received from these sources, and hence how much they should save and withdraw from their pension assets. Demographic trends are also uncertain: declining fertility seems to be a given in most developed countries, with probably longer lifespans, though

increases in morbidity due to obesity could cut in the opposite direction. And if the future continues to be characterized by continued low returns and equity market volatility, this would likely make it much harder to build up retirement assets as well as to finance a long retirement period.

Financial markets may help in responding to these problems with a new range of innovative products that would allocate risk more efficiently across stakeholders (Mitchell et al. 2006). For example, innovative products for an aging population could include reverse mortgages, inflation-protected payout annuities, better long-term care insurance, survivor and mortality bonds, and mortality securitization. Nevertheless, these have been slow to find a market due to uncertainty regarding future mortality trends and information asymmetry in these markets. These shortcomings may offer a rationale for the public sector to seek ways to partner with private sector entities to develop better databases and do better risk management for an aging world.

**Conclusions**

Retirement security requires that workers find a successful, reliable, and resilient mechanism enabling them to save while young, and then to transfer that wealth to a future time when they need to draw the assets down as old-age income streams. But in the past, many retirement saving arrangements have proven risky and difficult to maintain, particularly as some of the key players, employers, financial institutions, and governments, have often failed to deliver on promises made. In particular, many defined benefit plans offered in the past by employers and governments are in demonstrable trouble, not only because they have retarded labor mobility, but also because they have fallen prey to underfunding, engaged in asset/liability

mismatching, and in some cases been intentionally manipulated to enrich a few at the expense of many.

By contrast, defined contribution pensions have firmly established themselves in many countries, and they now serve as the mainstay of retirement provision in Australia, Chile, and Singapore, to name a few success stories. DC plans in both developed and developing countries can offer an attractive framework within which workers contribute toward their own retirement future, while allowing the portability that a modern mobile workforce requires. DC plans also offer an opportunity for workers to tailor their own portfolios to their risk tolerances, with usually quite well-designed investment menus, along with the potential to pass on unspent assets to future generations. And from the employer perspective, DC are attractive in that they relieve management of the need to pay people benefits long after they have departed the active workforce, shifting both funding and longevity risk to the retiree's shoulders.

These positive aspects of DC plans do not alter the fact that they have yet to be proven as successful purveyors of secure retirement income. That is, in many instances, people are still saving too little to cover golden years, particularly when workers retire early. Moreover, participants still invest too much in their own company stock, fail to diversify, and in some cases, trade their holdings to their detriment. And most importantly, at retirement, many suffer from "lump sum illusion" and fail to protect against longevity risk, thinking (incorrectly) that a small nest egg will last for a lifetime. These shortcomings, when recognized, can and will be remedied.

**References**

Allianz. 2010. "Big and Getting Bigger: Despite Financial Crisis Global Retirement Market Expected to Grow to €36 Trillion Until 2020. https://www.allianz.com/static-resources/en/press/media/documents/demographic_pulse/dempulse_310_engl_final.pdf

Behrman, Jere, Olivia S. Mitchell, Cindy Soo, and David Bravo. 2010. "Financial Literacy, Schooling, and Wealth Accumulation." NBER Working Paper.

Bernheim, Douglas, Daniel M. Garrett and Dean Maki. 2001."Education and Saving: The Long-Term Effects of High School Financial Curriculum Mandates."*Journal of Public Economics*, 80(3), June, 435-465.

Bosworth, Barry and Gary Burtless. 2010. "Recessions, Wealth Destruction, and the Timing of Retirement. 12th Annual Joint Conference of the Retirement Research Consortium, Washington DC. August 5-6.

Bosworth, Barry, Gary Burtless, and C. Eugene Steuerle. 2000. "Lifetime Earnings Patterns, the Distribution of Future Social Security Benefits, and the Impact of Pension Reform." *Social Security Bulletin* 63 (4): 74–98.

Brady, Peter. 2008. "Can 401(k) Plans Provide Adequate Retirement Resources?" Washington, D.C.: Investment Company Institute. December.

Brown, Jeffrey, Olivia S. Mitchell, and James Poterba. 2002. "Mortality Risk, Inflation Risk, and Annuity Products." In *Innovations in Financing Retirement*. Zvi Bodie, Brett Hammond, and Olivia S. Mitchell, eds. Philadelphia, PA: University of Pennsylvania Press: 175-197.

Brown, Jeffrey, Olivia S. Mitchell, and James Poterba. 2000. "The Role of Real Annuities and Indexed Bonds in an Individual Accounts Retirement Program." In *Risk Aspects of Investment-Based Social Security Reform*. John Campbell and Martin Feldstein, eds. Chicago: University of Chicago Press: 321-360.

Brown, Jeffrey, Olivia S. Mitchell, James Poterba, and Mark Warshawsky. 2001. *The Role of Annuity Markets in Financing Retirement*. Cambridge, MA: MIT Press.

Brown, Jeffrey, Olivia S. Mitchell, James Poterba, and Mark Warshawsky. 1999. "Taxing Retirement Income: Nonqualified Annuities and Distributions from Qualified Accounts". *National Tax Journal*. LII,3. September: 563-592.

Choi, James, David Laibson, Brigitte Madrian, and Andrew Metrick. 2002. "Defined Contribution Pensions: Plan Rules, Participant Decisions, and the Path of Least Resistance." In James M. Poterba, ed., *Tax Policy and the Economy*, Vol. 16, Cambridge, MA: MIT Press: 67-113.

Clark, Robert, Madeleine d'Ambrosio, Ann McDermed, and Kshama Sawant. 2006. "Retirement Plans and Saving Decisions: The Role of Information and Education." *Journal of Pension Economics and Finance*. March: 45-67.

Cogan, John F. and Olivia S. Mitchell. 2003. "Perspectives from the President's Commission on Social Security Reform." *Journal of Economic Perspectives*. 17(2). Spring.

Coile, Courtney and Philip Levine. 2006. "Bulls, Bears, and Retirement Behavior." *Industrial and Labor Relations Review*. 59(3) Apr.: 408-429.

Dowd, Kevin, David Blake and Andrew J.G. Cairns. 2007. "The Myth of Methuselah and the Uncertainty of Death: The Mortality Fan Charts." Pensions Institute Working Paper. November.

Dus, Ivica, Raimond Maurer, and Olivia S. Mitchell. 2005. "Betting on Death and Capital Markets in Retirement: A Shortfall Risk Analysis of Life Annuities versus Phased Withdrawal Plans." *Financial Services Review*. (14):169-196.

Ebeling, Ashlea. 2010. "Anti-Annuity Sentiment Boils Over Before DOL Hearings." *Forbes*, Sept 14. http://blogs.forbes.com/ashleaebeling/2010/09/14/anti-annuity-sentiment-boils-over-before-dol-hearings/

Fields, Gary S. and Olivia S. Mitchell. *Retirement, Pensions, and Social Security*. Cambridge, Mass.: MIT Press, 1984.

Fong, Joelle H.Y. Olivia S. Mitchell, and Benedict S. K. Koh. *Forthcoming.* "Longevity Risk Management in Singapore's National Pension System." *Journal of Risk and Insurance.*

Fronstin, Paul, 2008. *Savings Needed to Fund Health Insurance and Health Care Expenses in Retirement*. EBRI Issue Brief No. 295. Washington, DC: Employee Benefit Research Institute.

Goda, Gopi Shah, John Shoven, Sita Nataraj Slavov. 2010. "Does Stock Market Performance Influence Retirement Expectations?" Presented at the 12th Annual Conference of the Retirement Research Consortium, Washington, DC.. August 5-6.

Gustman, Alan, Thomas L. Steinmeier, and Nahid Tabatabai. 2010. "What the Stock Market Decline Means for the Financial Security and Retirement Choices of the Near-Retirement Population." *Journal of Economic Perspectives*. 24(1) Winter: 161–182

Horneff, Wolfram, Raimond Maurer, Olivia S. Mitchell, and Michael Stamos. 2009. "Asset Allocation and Location over the Life Cycle with Survival-Contingent Payouts."*Journal of Banking and Finance*. (33) 9 September: 1688-1699.

Horneff, Wolfram J., Raimond H. Maurer, Olivia S. Mitchell, and Michael Z. Stamos. 2010. "Variable Payout Annuities and Dynamic Portfolio Choice in Retirement." *Journal of Pension Economics and Finance.* (9) April : 163-183.

Horneff, Wolfram, Raimond Maurer, Olivia S. Mitchell, and Ivica Dus. 2007. "Following the Rules: Integrating Asset Allocation and Annuitization in Retirement Portfolios. *Insurance: Mathematics and Economics.* 42: 396-408.

Investment Company Institute (ICI). 2010. *The U.S. Retirement Market*. Washington, D.C.: ICI. First Quarter. www.ici.org/pdf/fm-v19n3.pdf

Lachance, Marie-Eve and Olivia S. Mitchell. 2003 (b) "Understanding Individual Account Guarantees." *American Economic Review P&P*, May. 93(2): 257-260.

Lachance, Marie-Eve, Olivia S. Mitchell, and Kent Smetters. 2003. "Guaranteeing Defined Contribution Pensions: The Option to Buy Back a Defined Benefit Promise." *Journal of Risk and Insurance*. 70(1): 1-16.

Lusardi, Annamaria and Olivia S. Mitchell. 2007(a). "Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth." *Journal of Monetary Economics.* 54(1) January: 205-224.

Lusardi, Annamaria and Olivia S. Mitchell. 2007(b)."Financial Literacy and Retirement Preparedness. Evidence and Implications for Financial Education." *Business Economics*, January: 35-44.

Lusardi, Annamaria and Olivia S. Mitchell. 2008. "Planning and Financial Literacy: How Do Women Fare?" *American Economic Review P&P* 98: 2, 413–417.

Lusardi, Annamaria, Olivia S. Mitchell, and Vilsa Curto. 2010. "Financial Literacy among the Young: Evidence and Implications for Consumer Policy." *Journal of Consumer Affairs*. (44, 2): 358-380.

Madrian, Brigitte and Dennis Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics.* 116: 1149-1187.

Maurer, Raimond, Olivia S. Mitchell, and Ralph Rogalla. 2010. "The Effect of Uncertain Labor Income and Social Security on Lifecycle Portfolios." In Robert Clark and Olivia S. Mitchell, eds. *Reorienting Retirement Risk Management*. Oxford: OUP.

McGill, Daniel, Kyle Brown, John Haley and Sylvester Schieber. 2004. *Fundamentals of Private Pensions*, 8th edn. Oxford: Oxford University Press.

Mitchell, Olivia S. 2010(a). "Implications of the Financial Crisis for Long-run Retirement Security." Pension Research Council Working Paper. WP2010-02.

Mitchell, Olivia S. 2010(b). "Retirement Risk Management in Times of Turmoil." *Elder Law Journal*. 17(2) 439-460.

Mitchell, Olivia S., John Piggott, Michael Sherris, and Shaun Yow. 2006. "Financial Innovations for an Aging World." In *Demography and Financial Markets*, eds. C. Kent, A Park, D Rees. Reserve Bank of Australia/Australian Treasury: Report of the G-20 Meetings. Pegasus Press: 299-336.

Mitchell, Olivia S., James Poterba, Mark Warshawsky, and Jeffrey Brown. 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review*. December: 1299-1318.

Mitchell, Olivia S. and John Turner. 2010. "Human Capital Risk and Pension Outcomes." In Richard P. Hinz, Pablo Antolín, Rudolph Heinz, Juan Yermo, eds. *Evaluating the Financial Performance of Pension Funds*. Wash., DC: World Bank: 119-151.

Mitchell, Olivia S. and Stephen P. Utkus, eds. 2004. *Pension Design and Structure: New Lessons from Behavioral Finance*. Oxford, UK: Oxford University Press.

Mitchell, Olivia S., Gary Mottola, Steve Utkus, and Takeshi Yamaguchi. 2009. "Default, Framing and Spillover Effects: The Case of Lifecycle Funds in 401(k) Plans." NBER Working Paper 15108.

Mitchell, Olivia S. and Stephen Utkus. 2004, "Lessons from Behavioral Finance for Retirement Plan Design." In *Pension Design and Structure: New Lessons from Behavioral Finance*. eds. Olivia S. Mitchell and Stephen P. Utkus. Oxford, UK: Oxford University Press.

Moore, Rebecca. 2010. “Global Retirement Assets See Growth in 2009.” *Plan Sponsor.com*. June 25. www.plansponsor.com/Global_Retirement_Assets_See_Growth_in_2009.aspx

Munnell, Alicia H. and Annika Sundén, 2004. *Coming up Short: The Challenge of 401(k) Plans.* Washington, DC: Brookings Institution Press.

Nishiyama, Kengo and Hiroshi Nakanishi. 2010. “Underfunded Corporate Retirement Portfolios Could Have Big Consequences for the Market.” *Wall St Journal*. Sept 14. http://online.wsj.com/article/SB10001424052748703466704575489120297253054.html

Nomura, Akiko. 2009. “Proposal for Fundamentally Reforming Japan's Defined Contribution Pensions.” *Nomura Journal of Capital Markets*. 1(3) November 19.

OECD. 2010. *Pension Markets in Focus.* July, Issue 7. www.oecd.org/daf/pensions/pensionmarkets

Shoven, John and Sylvester Schieber. 1999. *The Real Deal: The History and Future of Social Security*. New Haven: Yale University Press.

Smetters, Kent A. 2004. "Trading with the Unborn: A New Perspective on Capital Income Taxation." Working Paper 066, University of Michigan, Michigan Retirement Research Center

Tang, Ning and Olivia S. Mitchell. 2010. “Trading Behavior of 401(k) Pension Plan Participants in Times of Financial Turmoil.” Pension Research Council Working Paper. Wharton School.

Tang, Ning, Olivia S. Mitchell, Gary Mottola, and Steve Utkus. *Forthcoming*. “The Efficiency of Sponsor and Participant Portfolio Choices in 401(k) Plans.” *Journal of Public Economics*.

Thaler, Richard and Shlomo Benartzi. 2004. “Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving.” *Journal of Political Economy*. 112(1): S164-S187, February.

Towers Watson. 2010. *The 2010 Global Pension Assets Study*. January. http://www.towerswatson.com/assets/pdf/966/GPAS2010.pdf

Vanguard. 2010. *Behavior of DC Plan Participants during Recent Market Volatility*. Valley Forge: The Vanguard Group.

Webb, Anthony and Natalia Zhivan. 2010. “How Much is Enough? The Distribution of Lifetime Health Care Costs.” CRR WP 2010-1, February.

## Figures and Tables

**Figure 1. Pension Assets as % of Total Global Pension Assets**
Source: Allianz (2010)

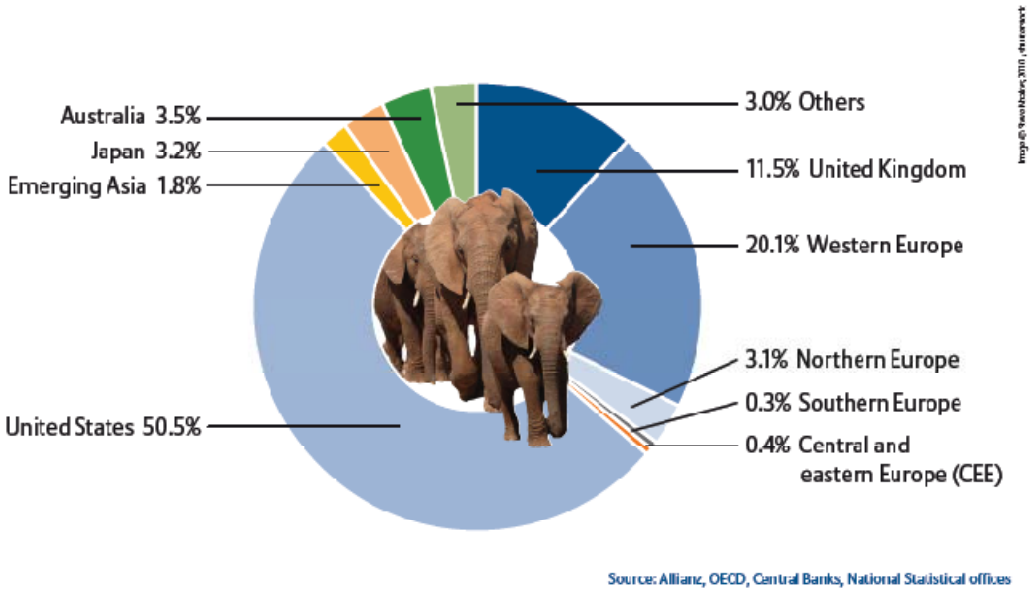


**Figure 2. Importance of Pension Assets Relative to GDP in selected OECD countries** (2009)
Source: OECD (2010).

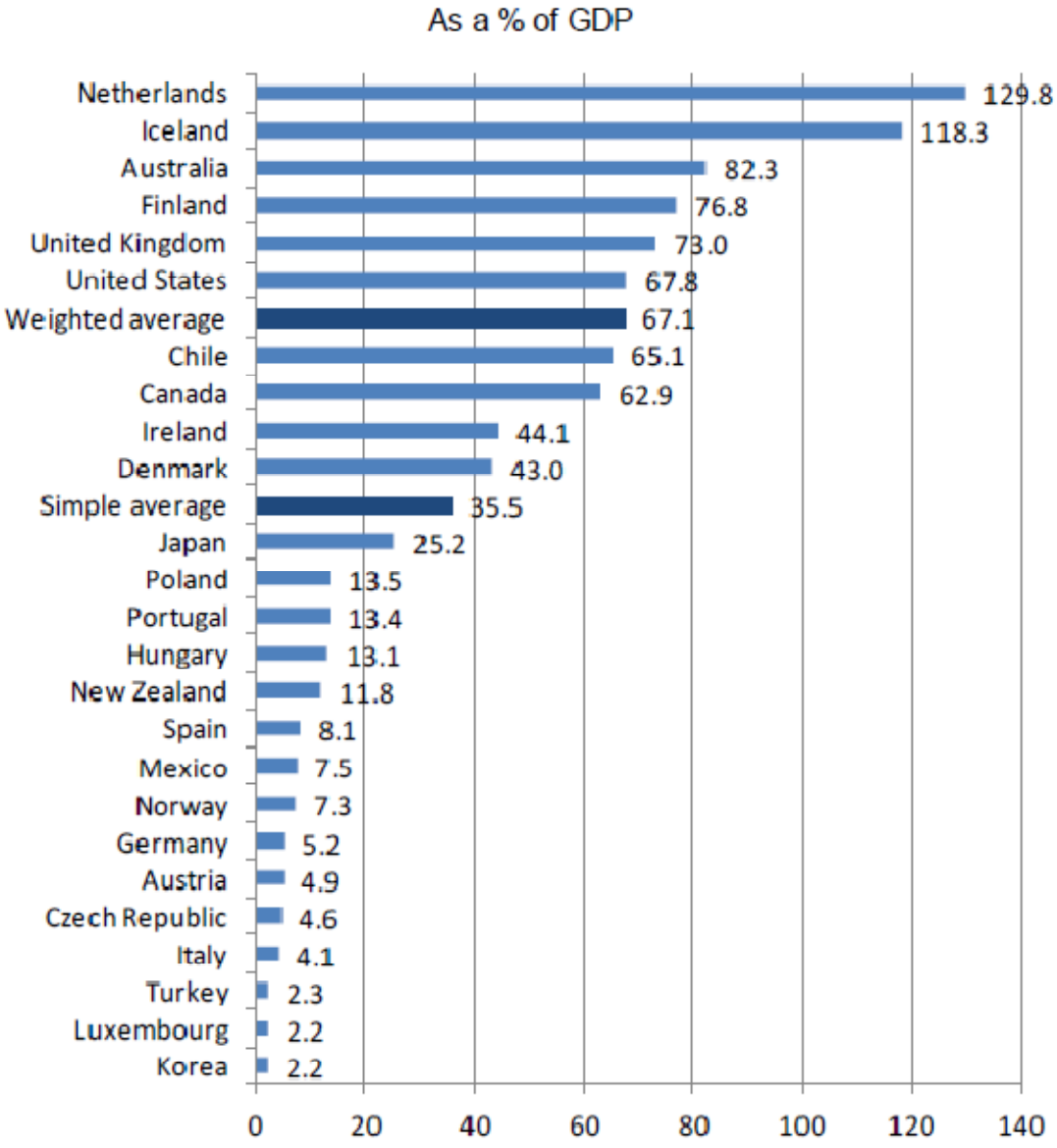


**Figure 3. US, European Monetary Union (EMU), and Emerging Markets Equity Market Performance** (1985-2010)
Source: Derived from Datastream

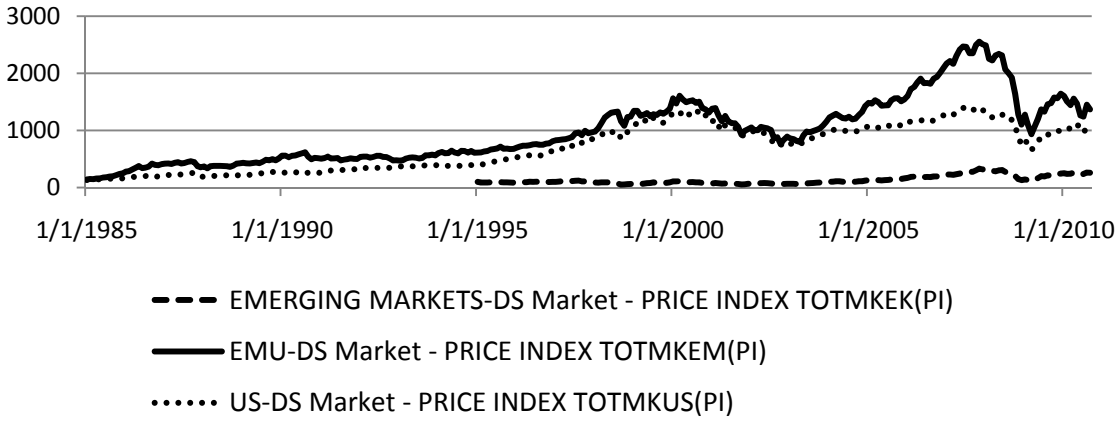
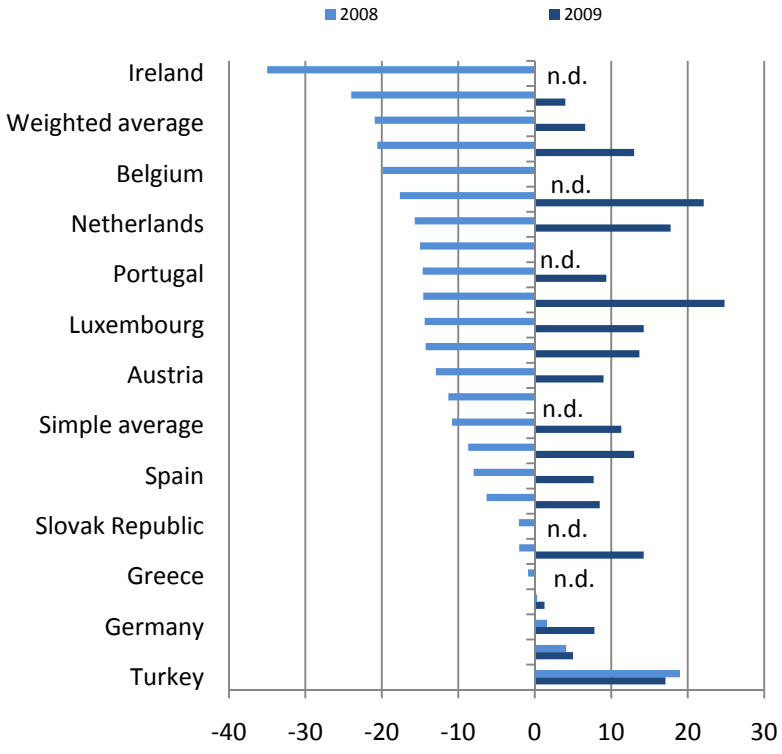


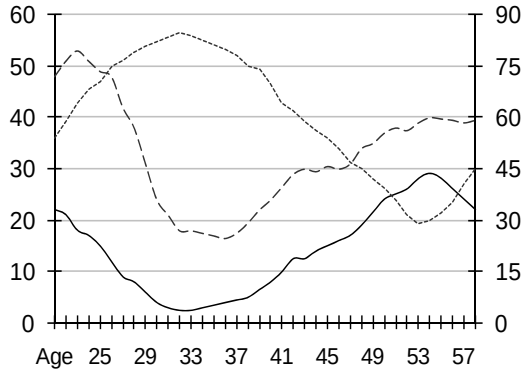

**Figure 4. Pension Returns in Selected OECD Countries** (2008-9)
Source: OECD (2010)



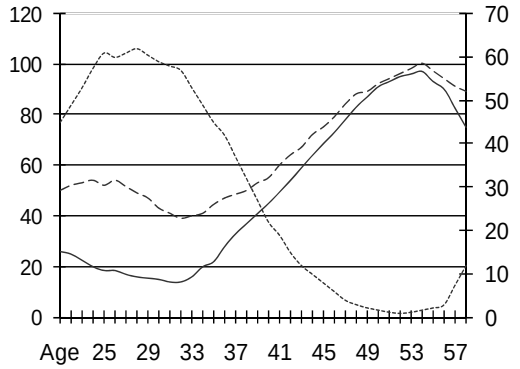

1. Estimated data including IRAs. 2009 data refer to the period January-June 2009.

**Figure 5. Patterns of Lifetime Earnings Excluding and Including Zero Earners**
Source: Derived by Mitchell and Turner (2010) from Bosworth, Burtless, and Steuerle (2000).
*Note:* Average earnings as a percentage of economy-wide average earnings on left scale; percentage of category with zero earnings in each year measured on right scale. Solid line refers to all workers including unemployed; dashed line refers to workers with positive earnings; and dotted line refers to percent of workers with zero earnings by age.

Panel A. Low-Income Workers with Rising Life-Cycle Earnings: With and without Zero Earners




Panel B. Middle-Income Workers with Rising Life-Cycle Earnings: With and without Zero Earners




Panel C. High-Income Workers with Rising Life-Cycle Earnings: With and without Zero Earners

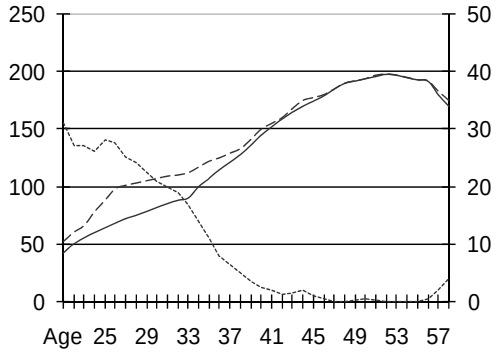


**Figure 6. Mortality Uncertainty**. Central 10% prediction interval for men currently age 85 with heaviest shading, surrounded by the 20%, 30%, …, 90% prediction intervals with progressively lighter shading.

Source: Dowd et al. (2007).

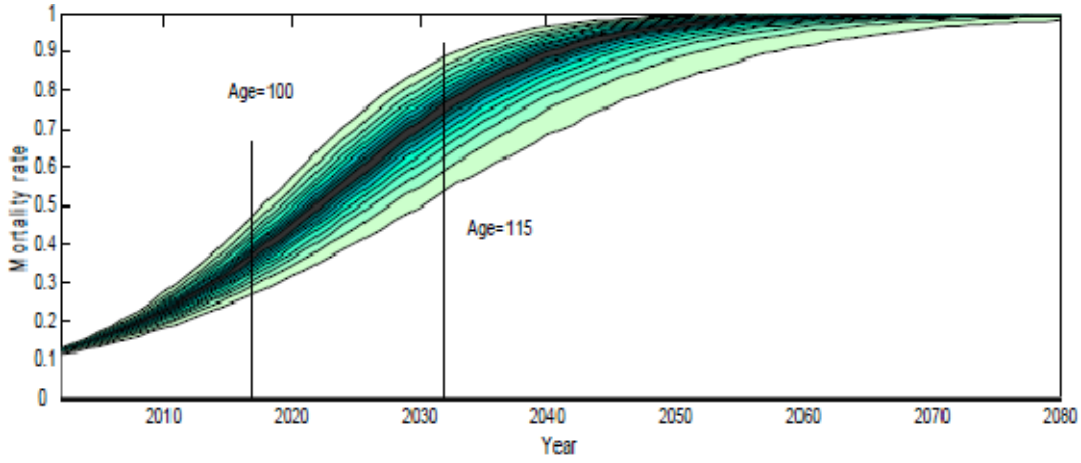


**Figure 7. Mean and 95th Percentile of Remaining Health Care Costs Including Nursing Home, by Age**
Source: Webb and Zhivan (2010).

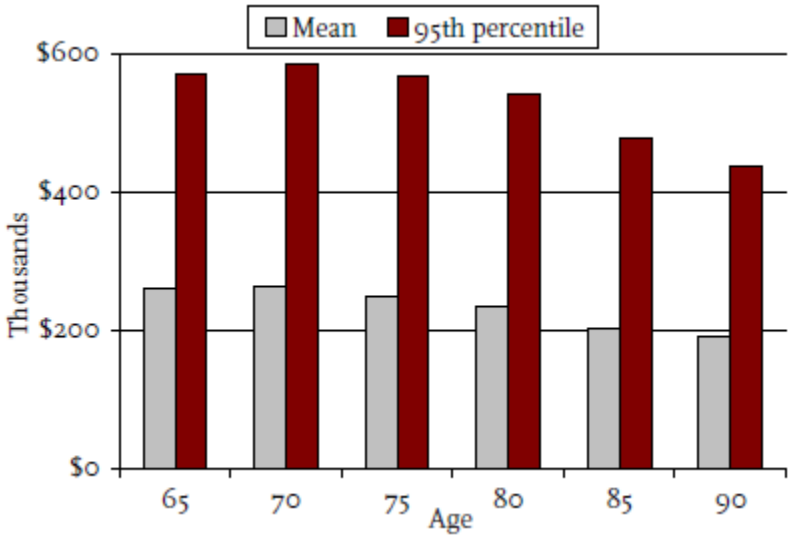



**Figure 8. Probability Distributions for US Social Security Shortfalls in the Next Century**
Source: CBO (2008).

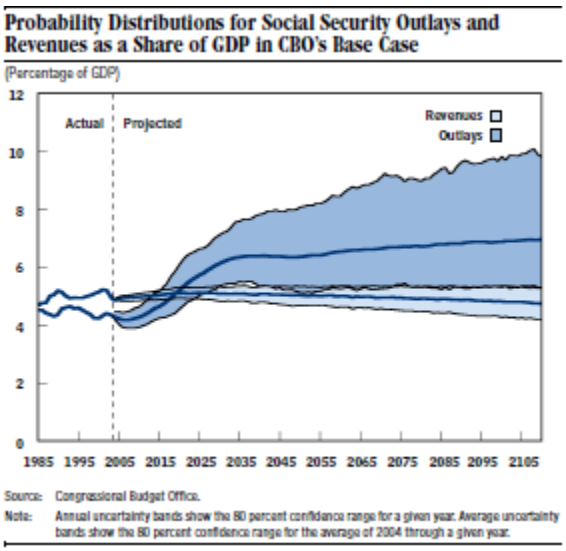


**Table 1. Pension Split in Certain Countries: Defined Contribution vs Defined Benefit**
Source: Towers Watson (2010); assets in US$ bn

| *Country* | Pension Assets (US$09) | DC % | DB % |
|---|---|---|---|
| ***Total*** | ***23,290*** | ***59*** | ***41*** |
| US (w IRA) | 13,196 | 55 | 45 |
| Japan | 3,152 | 1 | 99 |
| UK (wo Personal & Stkholder) | 1,791 | 39 | 61 |
| Canada | 1,213 | 3 | 97 |
| Australia | 996 | 82 | 18 |
| Netherlands | 990 | 8 | 92 |
| Switerland | 583 | 58 | 42 |
| German | 411 | 35 | 65 |
| Brazil | 392 | 66 | 34 |
| South Africa | 201 | 73 | 27 |
| France | 178 | 25 | 75 |
| Ireland | 102 | 39 | 61 |
| Hong Kong | 85 | 78 | 22 |

**Table 2. Financial Literacy Among Early Baby Boomers** (N = 1,984)
Source: Adapted from Lusardi and Mitchell (2009). *Note:* Early Baby Boomer sample surveyed in the Health and Retirement study weighted using household weights. Percentages may not sum to 100 due to missing data on a few respondents; values conditional on being asked the question.

| *Question Type* | **Correct (%)** | **Incorrect/Don't know (%)** |
|---|---|---|
| Percentage Calculation | 83.5 | 16.0 |
| Lottery Division | 55.9 | 43.1 |
| Compound Interest* | 17.8 | 81.7 |

**Table 3. Stock Market Exposure of Older US Households by Wealth Decile in the Health and Retirement Study**
Source: Gustman et al. (2010).

**Distribution of Assets by Wealth Decile in 2006 for Households with at Least One Member Born from 1948 to 1953**

| | *Average asset value for respondents in indicated total wealth percentiles* | | | | | | |
|---|---|---|---|---|---|---|---|
| *Sources of wealth* | *1–10* | *11–20* | *21–40* | *41–60* | *61–80* | *81–90* | *91–100* |
| Total Wealth ($1,000) | 51.7 | 135.3 | 587.4 | 1,086.2 | 1,807.8 | 1,421.4 | 2,573.9 |
| (Social Security Wealth + Pension Wealth)/Total Wealth (%) | 93.6 | 84.0 | 71.5 | 61.5 | 55.3 | 48.9 | 31.9 |
| Social Security Wealth/Total Wealth (%) | 89.9 | 78.3 | 57.9 | 40.6 | 28.4 | 19.0 | 11.1 |
| Total Pension Wealth/Total Wealth (%) | 3.7 | 5.8 | 13.6 | 20.9 | 26.9 | 29.9 | 20.8 |
| DC Pension Wealth/Total Wealth (%) | 1.4 | 2.8 | 5.0 | 6.4 | 7.6 | 9.3 | 9.4 |
| DB Pension Wealth/Total Wealth (%) | 2.3 | 3.0 | 8.6 | 14.5 | 19.2 | 20.6 | 11.4 |
| IRA Wealth/Total Wealth (%) | 1.0 | 1.1 | 3.0 | 4.6 | 6.8 | 6.9 | 9.0 |
| Net Housing Wealth/Total Wealth (%) | 5.8 | 9.5 | 17.8 | 22.5 | 23.0 | 23.4 | 22.4 |
| Wealth Held Directly in Stocks/ Total Wealth (%) | 0.2 | 0.2 | 1.1 | 1.6 | 2.5 | 5.4 | 9.6 |
| Total of Wealth Held in Stocks ($1,000) | 0.8 | 3.1 | 35.9 | 100.5 | 358.4 | 227.8 | 580.9 |
| **Total of Wealth in Stocks/ Total Wealth (%)** | **1.5** | **2.3** | **6.1** | **9.3** | **11.9** | **16.0** | **22.6** |

*Source:* Authors' calculations using data from the Health and Retirement Study (HRS).
*Notes:* Households with top and bottom 1% of total wealth are excluded. Values as of 2006 are reported in thousands of dollars. Wealth in stocks includes share of defined contribution accounts in stocks, share of IRA accounts in stocks, and direct stock holdings.