

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

Olivia S. Mitchell\*

The Wharton School of the University of Pennsylvania  
April 2011

## *Abstract*

Conventional defined benefit (DB) pensions have become less popular over the last two decades in the United States and around the world. Over this period 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 managing them to achieve their ultimate purpose, namely, meeting participants' consumption needs in retirement. 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. This paper evaluates the main retirement risks confronting participants in and sponsors of DC plans and discusses how markets and regulators are responding to those challenges.

\* International Foundation of Employee Benefit Plans Professor; Professor of Insurance/Risk Management and Business/Public Policy; Executive Director, Pension Research Council; Wharton School, University of Pennsylvania; [mitchelo@wharton.upenn.edu](mailto:mitchelo@wharton.upenn.edu). The author is solely responsible for all opinions and any errors contained herein. This paper is forthcoming in *Growing Old: Paying for Retirement and Institutional Money Management After the Financial Crisis*. Eds. Yasuyuki Fuchita, Richard J. Herring and Robert E. Litan. Brookings Institution Press. The author acknowledges research support from the Pension Research Council at the Wharton School and the Brookings/Nomura/Wharton Conference series. All rights reserved.

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

Olivia S. Mitchell

In many countries, traditional defined benefit (DB) pensions have become less popular over the last two decades, during which 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 managing them to achieve their ultimate purpose, namely, meeting participants' consumption needs in retirement. 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 in order to better meet national retirement objectives. This paper addresses these issues by evaluating the main retirement risks confronting participants in and sponsors of DC plans and by discussing how markets and regulators are responding to those.<sup>1</sup> We conclude with a brief mention of key 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 hopes; they also represent a key source of global financial capital. In 2009, worldwide retirement funds amounted to an estimated US\$24 trillion, projected to grow to more than \$34 trillion in 2014 (Allianz 2010); 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,

---

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

\$16.5 trillion in 2010, of which \$4.2 trillion was held in employer-based defined contribution (DC) retirement plans (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 2008 in the United States, for instance, pensions assets fell by more than 20 percent, coinciding unfortunately with the moment when the aging baby boomers began 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.

It is sometimes argued that market shocks have a more potent influence on retirement preparedness for those in DC plans than for those in DB plans.<sup>2</sup> That is because in the former investment drops are immediately recorded in workers' and pensioners' accounts, whereas in a DB plan, a drop in asset 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 businesses with insufficient assets to cover pension promises. As Table 1 illustrates, with the notable exception of retirement assets in Japan and Canada, at least one-third and sometimes the bulk of retirement assets in many large economies are now held in defined contribution plans: some 43 percent, 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 2009), up from only 88,000 participants in 2001 (Nomura 2009; Nishiyama and Nakanishi 2010). In other words, it seems clear that DC plans are here to stay and that DB plans will continue to decline in coverage. For that reason it is crucial to focus on the question of how best to manage the risks particular to DC pensions.

---

2. See Burtless (2008); for a related discussion see Bosworth and Burtless (2010).

## Identifying Risks and Solutions

It is useful to classify the key challenges facing the DC system into four types of risk: *individual risk*, *institutional risk*, *country risk*, and *global risk*. The following discussion first describes what is meant by each type of risk and then identifies some responses to each type.<sup>3</sup>

***Risks Confronting Individuals and Their Families.*** The conventional economic view of the life-cycle problem is that consumers will save and invest during youth and middle age in order to have income and/or assets to live on after labor market earnings cease. Pensions can play a very central role in the accumulation phase and later in the payout process, in that they represent deferred earnings dedicated to retirement consumption. (Buying a home and paying down one's home mortgage was once seen in the same light, prior to the collapse of the housing bubble). 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 life-cycle model is fraught with problems. One is widespread financial illiteracy, combined with failure to devise and execute retirement saving plans. Because half the population will outlive its life expectancy, there is a substantial chance that some retirees will run out of money in old age. For instance, several recent surveys asked U.S. residents three financial literacy questions (Lusardi and Mitchell 2007a, b; Lusardi and Mitchell 2008; Lusardi, Mitchell, and Curto 2010):

- 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?

---

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

- Lottery division: If five people all have the winning number in the lottery and the prize is \$2 million, how much will each of them get?
- Compound interest: Let's say you have \$200 in a savings account. The account earns 10 percent interest a year. How much would you have in the account at the end of two years?

Results for a nationally representative sample of older U.S. respondents appear in Table 2. On one hand, almost 84 percent of the respondents—in their mid-fifties at the 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 troubling was the fact that only 18 percent of this nationally representative sample of Americans in their fifties understands the principle of compound interest. Of those responding incorrectly, around two-fifths carried out a simple interest computation, whereas three-fifths either failed to answer at all or responded with a plainly incorrect answer. That is of concern because most people in their mid-fifties already have taken numerous financial actions, including taking out student loans, borrowing on credit cards, buying cars on time, and taking out home mortgages. Since this group does so poorly at both simple numeracy and financial concepts, it is little wonder that their retirement finances are not in order.

Research also shows that financial literacy is a strong predictor of planning for retirement and succeeding in accumulating retirement assets (Lusardi and Mitchell 2007a). Better-educated people do perform better, yet even so, only 18 percent of households on the verge of retirement are relatively successful at devising retirement plans and executing them (at least some of the time). Furthermore, those who succeed at retirement planning are almost three times as wealthy as those who do not. It is worth noting that these results are robust to tests for reverse causality

(Lusardi, Mitchell, and Curto 2010; Behrman and others 2010)—that is, to tests of whether financial literacy drives planning and wealth or vice versa. These findings, along with those in Bernheim, Garrett, and Maki (2001), confirm that financial literacy has an important and independent impact, suggesting that strengthening consumer knowledge of basic economics and finance could enhance retirement well-being.

Employers who offer DC pensions can and often do play a role in helping combat employee illiteracy and inertia regarding retirement saving. For instance, some firms provide workers with retirement seminars, financial well-being calculators, and benefit estimators to enhance retirement planning and build pension savings (Clark and others 2006). Workplace pension policies such as automatic enrollment and commitment saving programs also have made substantial inroads, inducing workers to save more by enrolling them by default into DC pension plans.<sup>4</sup> Such default plans require the employer to select prefabricated investment portfolios such as life-cycle or target maturity date funds, in which 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 enhance retirement accumulations over time, particularly for low-paid workers, women, and less financially literate participants (Mitchell and others 2009).

Another source of risk facing participants in DC plans stems from fluctuations in labor market earnings. Even in good economic times, people lose their jobs and experience periods without steady labor income, and human capital risk is widespread. Indeed the canonical smooth “hump-shaped” labor income profile so often assumed in economic modeling turns out to be relatively rare in practice. For instance, Mitchell and Turner (2010) cites evidence indicating that workers’ actual lifetime pay profiles turn out to be quite erratic due to periods of zero and low

---

4. See, for instance, Thaler and Benartzi (2004).

earnings. Only 14 percent of U.S. workers fit the classic hump-shaped profile; the same fraction had *sagging* real earnings in the middle years, another group had lifetime *flat* earnings, and yet another group had *declining earnings from a fairly young age* (compare Bosworth, Burtless, and Steuerle 2000). Such patterns are critical in DC plans, in which contributions depend on pay and are made only when people are employed. Furthermore, the early years tend to matter most, because savings can earn compound interest over a longer period.

We turn next to the risk that retirees confront due to uncertainty over longevity. That becomes a key consideration for DC plan participants in countries such as the United States, since retirees there are not required to buy lifelong income at the point of retirement and most plan sponsors do not offer the option of an in-plan payout annuity. Instead, retirees may withdraw their entire pension accumulation (with tax consequences), take the money out gradually in a phased withdrawal approach, or roll the money into a tax-qualified account and use that to purchase lifetime payout annuities. But in the United States (as in many other countries), few retirees purchase annuity payout products, reducing the longevity protection afforded to DB plan participants (Mitchell, Piggott, and Takayama, forthcoming 2011).

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.<sup>5</sup> That 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, partly because they underestimate the chances of living to a very old age and hence subject themselves to the "tail risk" of living well beyond their life expectancy (Brown and others 1999; Brown, Mitchell, and Poterba 2000; Brown and others 2001; Brown,

---

5. See Dus, Maurer, and Mitchell (2005); Horneff and others (2007, 2009, 2010); Maurer, Mitchell, and Rogalla (2010); and Mitchell and others (1999).

Mitchell, and Poterba 2002). Over time, that risk is exacerbated by cohort-wide mortality improvement, which imposes on retirees the additional uncertainty of evolving life tables (see Dowd, Blake, and Cairns 2007). Another factor retarding annuity market development is that confidence in the life insurance industry has been shaken in the wake of problems with impaired insurance company assets and other market shocks; in addition, some insurers have required government support due to depleted reserves.

In response to these important and often underestimated sources of retirement risk in DC plans, some critics contend that DC plans are simply not up to the job. For instance, Munnell and Sundén (2004) characterizes them as “coming up short,” since some workers save too little, make uninformed investment decisions, and borrow the money rather than save it for old age. Nevertheless, such criticisms overlook the role of government 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 also is true that DC plans enable labor mobility and delayed retirement, whereas DB plans tend to penalize continued work past an early retirement age (Fields and Mitchell 1984). Interestingly, relatively few people appear to have responded to recent macroeconomic shocks by pushing back their retirement dates (Bosworth and Burtless 2010; Goda, Shoven, and Slavov 2010; Gustman, Steinmeier, and Tabatabai 2010; Coile and Levine 2006). That may be because few older workers currently are directly exposed to equity: only those older Americans in the top decile of the wealth distribution hold as much as 20 percent of their assets in stocks (Gustman, Steinmeier, and Tabatabai 2010), and equity-holding is miniscule among those in the bottom half of the wealth distribution. Among DC account holders, there was a modest flight to safety during the financial turmoil of 2008-2009

(Tang and Mitchell 2010; Vanguard 2010), but the amounts transferred were not substantial and trading apparently has not altered participants' anticipated portfolio performance.

***Pension System Risks.*** Institutional risk—that is, the possibility that the retirement system itself might fail—is a second type of risk. The sad reality is that the financial crisis has brought into sharp focus the extraordinarily poor condition of pension systems all over the world, including the underfunding of U.S. corporate and public DB plans. Though corporate plans in the United States have the backing of a government reinsurance program, as do corporate plans in the United Kingdom, such government entities also often face financial problems of their own (Brown 2010).

In the DC world, the market downturn has led some to suggest that guarantees must be embedded in pension accounts so that workers are not too exposed to equity risk. While that proposal has some appeal, guarantees can be extremely costly, and the more generous the guarantee, the more expensive it becomes. Japan's 401(k)-type model requires that at least one fund be principal guaranteed; in that case, after forty years, the member is sure to get back at least the money that he or she put in (with a zero rate of return). While that type of guarantee is relatively inexpensive to provide, guaranteeing a bond return costs much more, from 16 percent to 20 percent or more of annual contributions (Lachance and Mitchell, 2003; Lachance, Mitchell, and Smetters 2003). Furthermore, if guarantees were to be offered in the DC context, it would be crucial to limit investors' portfolios so that people do not "game" the guarantee by investing only in extremely risky assets. In other words, including guaranteed products in DC plan menus may be attractive but guarantees cannot be provided for free.

***National Risk Exposures.*** National factors also influence retirement risk management. Unfortunately, national risks tend to be highly unpredictable; political risk, for example, means

that future tax and transfer policy is usually rather uncertain. One need only recall Argentina's recent government takeover of national pension assets, justified at the time by the suggestion that retirees would be "safer" with government IOUs instead of volatile capital market assets. Another aspect of national risk has to do with the future of government old-age (Social Security) and retiree healthcare provision. In the United States at least, anticipated healthcare costs, including nursing home care, are highly uncertain, depending on the as-yet unknown evolution of efforts to control Medicare costs, which must be controlled if system finances are to balance. Moreover, even if expected average health costs are relatively predictable, such costs are very skewed in practice, implying that any given household might need half a million dollars or more to pay for old-age healthcare needs (Fronstin 2008); see Figure 6.

The delicate state of many nations' old-age social security systems also is worth noting. In the United States, for instance, anticipated shortfalls exceed \$15 trillion (in expected present value), a sum large enough to substantially challenge the system's long-term viability (see Figure 7). That is because under existing law, future benefits will grow faster than prices and contribute to the system's projected cash flow shortfall. The 2001 President's Commission to Strengthen Social Security, a bipartisan group, proposed to rectify the problem by reducing the *growth rate of future benefits* while preserving benefits in current dollars (Cogan and Mitchell 2003). In that case, no benefit cuts would be required in real terms, compared to today's benefits, and the system would return to solvency.<sup>6</sup> Unfortunately, the commission's proposals were reported at a time when national attention had turned to other matters, and inaction—along with the recession and financial system bailouts—has exacerbated Medicare and Social Security shortfalls.

---

6. Indeed, that 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 designed in such a way that it left the system actuarially neutral; that is, it would not cost the system or benefit it.

**Global Risk Considerations.** Last but certainly not least is global retirement risk. Probably relatively little to enhance retirement security and strengthen DC plans with respect to global risk is feasible in the near term. It does appear that observers need not have worried that baby boomers would drive down equity markets and housing values by retiring and redeeming their assets, since the global asset meltdown happened before most boomers retired! The central problem with global risk management, of course, is that for the most part the risks cannot be diversified. In other words, for the purposes of risk pooling, diversifying one's portfolio with global investments seems less attractive today than in the past. Likewise, spreading risk across generations with pay-as-you-go social security systems also is dangerous in the face of global aging: if future generations are likely to be far smaller than previous ones, very few workers will be available to support the long-lived elderly (Shoven and Schieber 1999). An alternative approach might be to develop formal markets in which today's workers could "commit" to trade claims over consumption with those as yet unborn (Smetters 2004), but that is still a theoretical possibility as there is no effective market for such claims at present.

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

As DC plans have expanded and DB plans have declined around the world, many new ideas have emerged to enhance the resilience of the DC system. For instance, today many employers offering DC plans provide automatic enrollment, which is proven to increase substantially workers' propensity to save (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 in Thaler and Benartzi (2004).<sup>7</sup> Analysts also have demonstrated that pension asset allocation patterns can be swayed by surprising and even

---

7. For other related ideas see Choi and others (2002).

welfare-reducing factors (compare Mitchell and Utkus 2004). For instance, when employers make contributions in company stock—as occurred most notoriously in the case of Enron, which then went bankrupt—employees are more likely to invest their own contributions in the same undiversified stock. Conversely, if a plan sponsor defaults workers into so-called life-cycle or target maturity date funds, evidence shows that the employees remain in the funds for the long term; as a result, younger workers tend to end up with professionally managed blended funds holding more equity and older workers tend to hold more fixed income. As Tang and others (2010) show, that is likely to enhance workers’ asset allocation choices and expected performance.

One area in which much remains to be done is management of DC assets at and into retirement. Currently in the United States, around three-quarters of DC assets are paid out as lump-sum cashouts instead of income annuities (McGill and others 2004), a potentially problematic result if retirees end up outliving their resources. That tendency could be countered if employers offer annuities rather than lump-sum payouts as the default option at retirement. Singapore has gone a step further, requiring that older workers purchase deferred annuities to protect them against longevity risk (Fong, Mitchell, and Koh 2010). Nevertheless, when the U.S. Department of Labor recently sought comments on including annuities as defaults for 401(k) plans, numerous objections were lodged, making it clear that implementing a mandate here is unlikely in the short term (Ebeling 2010).

In the larger sphere, of course, pension plans and those that they cover must also confront other key challenges associated with political, demographic, and financial uncertainty in the near term. Political risk in the United States is salient, due to the fact that U.S. tax law is in flux—in fact, for the last several years, Congress has repeatedly debated how to overhaul the income and

estate tax system. Similarly, politicians thus far have not dealt with the looming insolvency in Social Security and Medicare, implying that workers and retirees cannot readily project what they can expect from those sources and hence how much they should save and withdraw from their pension assets. Demographic trends also are uncertain: declining fertility seems to be a given in most developed countries, along 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, that would likely make it much harder to build up retirement assets and 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 and others 2006). For example, 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, those products have been slow to find a market due to uncertainty regarding future mortality trends and information asymmetry in the markets. Those shortcomings may prompt public sector entities to find ways to partner with the private sector in order to develop better databases to facilitate better risk management for an aging world (Mitchell and others 2006).

## **Conclusions**

Retirement security requires that workers have access to successful, reliable, and resilient mechanisms that enable them to save while young and transfer that wealth to a future time when they need to draw the assets down in the form of reliable and predictable old-age income streams. But all too often in the past, retirement saving arrangements have proven risky and

difficult to maintain, particularly because some of the key players—employers, financial institutions, and governments—have failed to deliver on the promises that they made.

Indeed, many public and private defined benefit pensions are in serious trouble today, having fallen prey to underfunding, to asset/liability mismatching, and sometimes to strategic manipulation for purposes other than those intended. By contrast, defined contribution pensions have firmly established themselves as the mainstay of retirement provision in Australia, Chile, and Singapore, and they are growing in much of the rest of the world. DC plans have many positive features: they can offer an attractive framework for building a secure retirement while allowing the necessary labor mobility that a modern marketplace requires; they provide an opportunity for workers to tailor their own portfolios to their risk tolerance by using diverse investment menus; and they allow people to pass on unspent assets to future generations. And from the perspective of an employer, DC plans are attractive in that they relieve management of the need to continue paying people benefits long after they have departed the active workforce, shifting both funding and longevity risk to the retiree. DC plans are helping millions of workers invest their money and accumulate retirement assets.

There are nevertheless tasks remaining to ensure retirement security in the new financial environment. Many DC participants still save too little, fail to diversify and invest too much in their own company stock, and suffer from “lump-sum illusion” – believing that a relatively small nest egg will be sufficient to live on during their golden years. As a result, they may fail to annuitize at retirement, taking a chance instead that they will die before the money runs out. These remaining shortcomings in the DC model can be rectified, building on greater understanding of the role of behavior in household financial decisionmaking.

## 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](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 16542. Cambridge, Mass.: National Bureau of Economic Research.
- 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, no. 3 (June), pp. 435–65.
- Bosworth, Barry, and Gary Burtless. 2010. "Recessions, Wealth Destruction, and the Timing of Retirement." 12th Annual Joint Conference of the Retirement Research Consortium, Washington, 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, no. 4, pp. 74–98.
- Brady, Peter. 2008. "Can 401(k) Plans Provide Adequate Retirement Resources?" *ICI Report*. Washington: Investment Company Institute (December).
- Brown, Jeffrey R. 2010. *Private Markets and Public Insurance Programs*. Washington: American Enterprise Institute Press.
- Brown, Jeffrey, Olivia S. Mitchell, and James Poterba. 2002. "Mortality Risk, Inflation Risk, and Annuity Products." In *Innovations in Financing Retirement*, edited by Zvi Bodie, Brett Hammond, and Olivia S. Mitchell. Philadelphia: University of Pennsylvania Press, pp. 175–97.
- 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*, edited by John Campbell and Martin Feldstein. Chicago: University of Chicago Press, pp. 321–60.
- Brown, Jeffrey, Olivia S. Mitchell, and James Poterba. 1999. "Taxing Retirement Income: Nonqualified Annuities and Distributions from Qualified Accounts." *National Tax Journal* 52, no. 3 (September), pp. 563–92.
- Brown, Jeffrey, Olivia S. Mitchell, James Poterba and Mark Warshawsky. 2001. *The Role of Annuity Markets in Financing Retirement*. MIT Press.

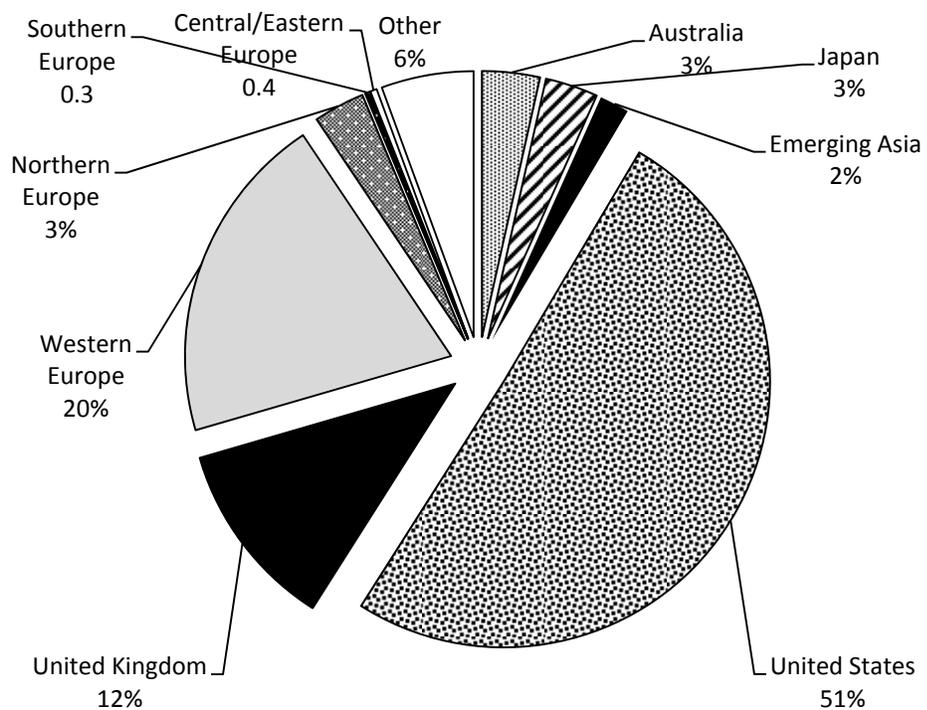
- Burtless, Gary. 2008. "Stock Market Fluctuations and Retiree Incomes: An Update." Brookings Institution ([www.brookings.edu/papers/2008/1031\\_market\\_burtless.aspx](http://www.brookings.edu/papers/2008/1031_market_burtless.aspx)).
- Choi, James, and others. 2002. "Defined Contribution Pensions: Plan Rules, Participant Decisions, and the Path of Least Resistance." In *Tax Policy and the Economy*, vol. 16, MIT Press. Edited by James M. Poterba, pp. 67–113.
- Clark, Robert, and others. 2006. "Retirement Plans and Saving Decisions: The Role of Information and Education." *Journal of Pension Economics and Finance* (March), pp. 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, no. 2 (Spring).
- Coile, Courtney, and Philip Levine. 2006. "Bulls, Bears, and Retirement Behavior." *Industrial and Labor Relations Review* 59, no. 3 (April), pp. 408–29.
- Congressional Budget Office (CBO). 2010. *CBO's 2010 Long-Term Projections for Social Security: Additional Information* ([www.cbo.gov/ftpdocs/119xx/doc11943/10-22-SocialSecurity\\_chartbook.pdf](http://www.cbo.gov/ftpdocs/119xx/doc11943/10-22-SocialSecurity_chartbook.pdf)).
- 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), pp. 169–96.
- Ebeling, Ashlea. 2010. "Anti-Annuity Sentiment Boils Over before DOL Hearings." *Forbes*, September 14.
- Fields, Gary S. and Olivia S. Mitchell. 1984. *Retirement, Pensions, and Social Security*. MIT Press.
- Fong, Joelle H. Y., Olivia S. Mitchell, and Benedict S. K. Koh. 2010. "Longevity Risk Management in Singapore's National Pension System." *Journal of Risk and Insurance* December. pp 1-21.
- Fronstin, Paul. 2008. *Savings Needed to Fund Health Insurance and Health Care Expenses in Retirement*. EBRI Issue Brief 295. Washington: Employee Benefit Research Institute.
- Goda, Gopi Shah, John Shoven, and Sita Nataraj Slavov. 2010. "Does Stock Market Performance Influence Retirement Expectations?" Paper presented at the 12th Annual Conference of the Retirement Research Consortium, Washington, 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, no. 1 (Winter), pp. 161–82.
- 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, pp. 396–408.
- Horneff, Wolfram, Raimond Maurer, Olivia S. Mitchell, and Michel Stamos. 2009. "Asset Allocation and Location over the Life Cycle with Survival-Contingent Payouts." *Journal of Banking and Finance* 33, no. 9 (September), pp. 1688–99.
- Horneff, Wolfram, Raimond Maurer, Olivia S. Mitchell, and Michel Stamos. 2010. "Variable Payout Annuities and Dynamic Portfolio Choice in Retirement." *Journal of Pension Economics and Finance* (9) April, pp. 163–83.
- Investment Company Institute (ICI). 2010. *The U.S. Retirement Market*. Washington. ([www.ici.org/pdf/fm-v19n3-a1.pdf](http://www.ici.org/pdf/fm-v19n3-a1.pdf))
- Lachance, Marie-Eve, and Olivia S. Mitchell. 2003. "Understanding Individual Account Guarantees." *American Economic Review Papers and Proceedings* 93, no. 2 (May), pp. 257–60.
- 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, no. 1, pp. 1–16.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2007a. "Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth." *Journal of Monetary Economics* 54, no. 1 (January), pp. 205–24.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2007b. "Financial Literacy and Retirement Preparedness. Evidence and Implications for Financial Education." *Business Economics*. (January), pp. 35–44.
- Lusardi, Annamaria, and Olivia S. Mitchell. 2008. "Planning and Financial Literacy: How Do Women Fare?" *American Economic Review P&P* 98, no. 2, pp. 413–17.
- 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, no. 2, pp. 358–80.
- Madrian, Brigitte, and Dennis Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics* 116 (4), pp. 1149–87.

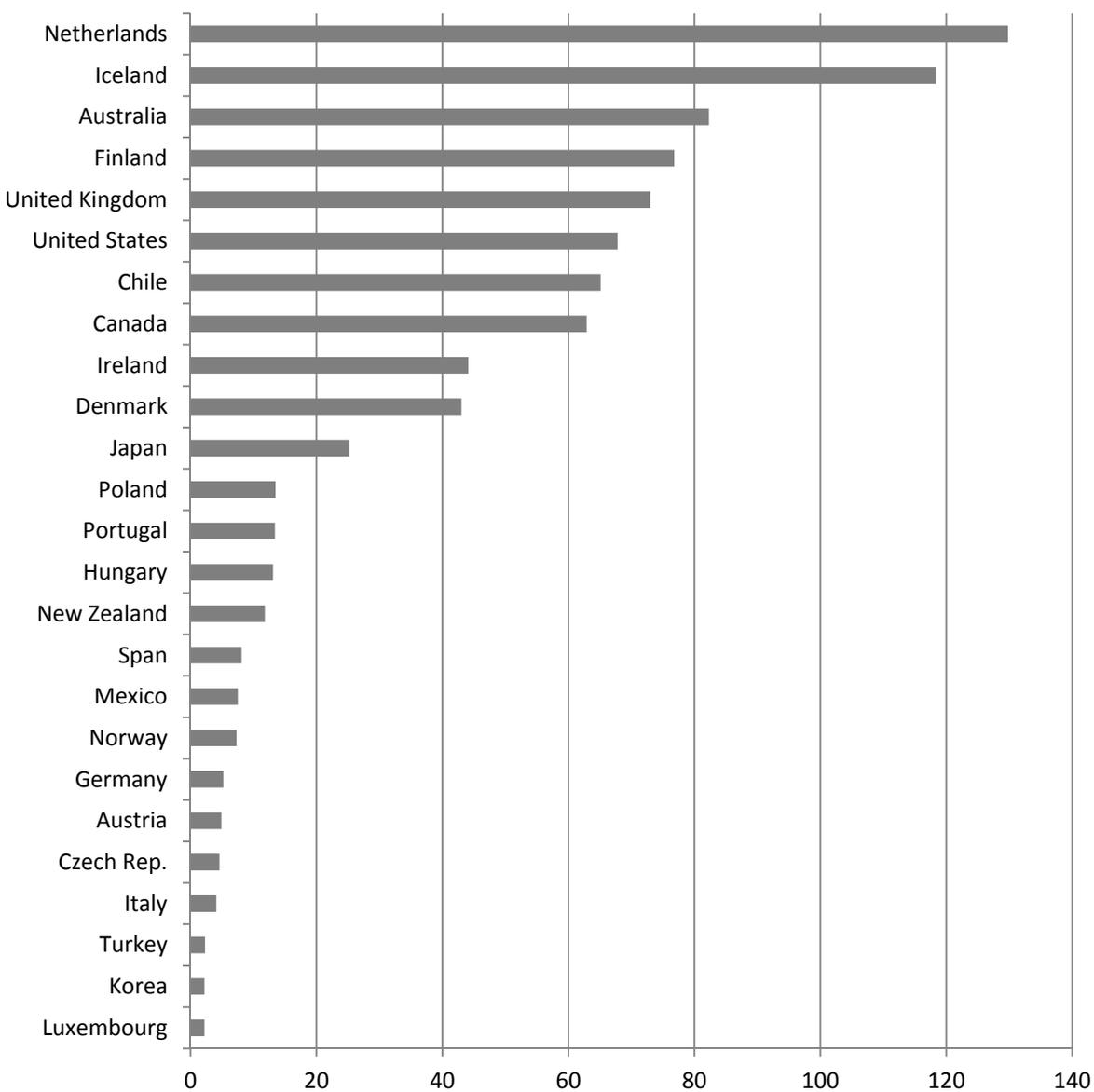
- Maurer, Raimond, Olivia S. Mitchell, and Ralph Rogalla. 2010. "The Effect of Uncertain Labor Income and Social Security on Lifecycle Portfolios." In *Reorienting Retirement Risk Management*. Oxford: Oxford University Press.
- McGill, Daniel, and others. 2004. *Fundamentals of Private Pensions*, 8th ed. Oxford University Press.
- Mitchell, Olivia S. 2010a. "Implications of the Financial Crisis for Long-Run Retirement Security." Pension Research Council Working Paper WP2010-02.
- Mitchell, Olivia S. 2010b. "Retirement Risk Management in Times of Turmoil." *Elder Law Journal* 17, no. 2, pp. 439–60.
- Mitchell, Olivia S., John Piggott, and Noriyuke Takayama. 2011. *Revisiting Retirement Payouts: Market Developments and Policy Issues*. Oxford: Oxford University Press.
- Mitchell, Olivia S., and John Turner. 2010. "Human Capital Risk and Pension Outcomes." In *Evaluating the Financial Performance of Pension Funds*. Edited by Richard P. Hinz and others, pp. 119–51. Washington: World Bank.
- Mitchell, Olivia S., James Poterba, and Mark J Warshawsky. 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review* **89**(5) (December), pp. 1299–1318.
- Mitchell, Olivia S., John Piggott, Michael Sherris, and Shaun Yow. "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, 2006: 299-336.
- 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. Cambridge, Mass.: National Bureau of Economic Research.
- 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*, edited by Olivia S. Mitchell and Stephen P. Utkus. Oxford University Press.
- Moore, Rebecca. 2010. "Global Retirement Assets See Growth in 2009." June 25 ([www.plansponsor.com/Global\\_Retirement\\_Assets\\_See\\_Growth\\_in\\_2009.aspx](http://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: Brookings.
- Nishiyama, Kengo, and Hiroshi Nakanishi. 2010. "Japan's Ticking Pension Time Bomb: Underfunded Corporate Retirement Portfolios Could Have Big Consequences for the Market." *Wall Street Journal*, September 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, no. 3 (November 19).
- OECD. 2010. *Pension Markets in Focus*. July ([www.oecd.org/daf/pensions/pensionmarkets](http://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. University of Pennsylvania, Wharton School.
- Tang, Ning, Olivia S. Mitchell, Gary Mottola, and Stephen Utkus. 2010 "The Efficiency of Sponsor and Participant Portfolio Choices in 401(k) Plans." *Journal of Public Economics*. 94, pp 1073-1085.
- Thaler, Richard, and Shlomo Benartzi. 2004. "Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving." *Journal of Political Economy* 112, no.1 (February), pp. S164-S187.
- Towers Watson. 2010. *The 2010 Global Pension Assets Study*. January [www.towerswatson.com/research/972](http://www.towerswatson.com/research/972)
- Vanguard Group. 2010. *Behavior of DC Plan Participants during Recent Market Volatility*. Valley Forge, Penn.
- Webb, Anthony, and Natalia Zhivan. 2010. "How Much Is Enough? The Distribution of Lifetime Health Care Costs." Center for Retirement Research WP 2010-1 (February).

**Figure 1. Pension Assets of Selected Countries as a Percentage of Total Global Pension Assets**

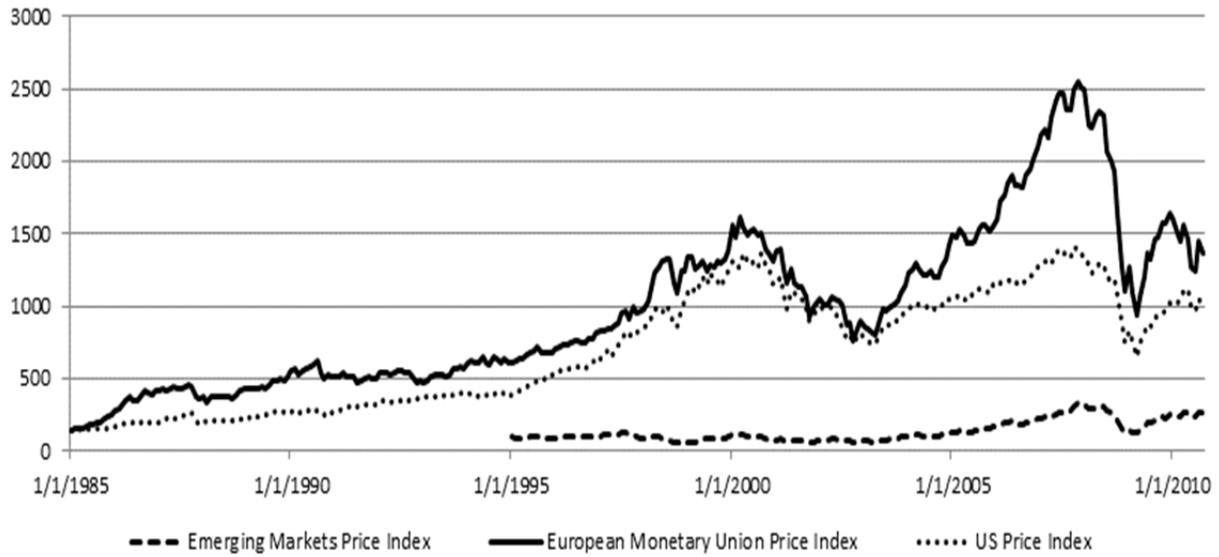


Source: Allianz (2010).

**Figure 2. Pension Assets as a Percentage of GDP in Selected OECD Countries, 2009**

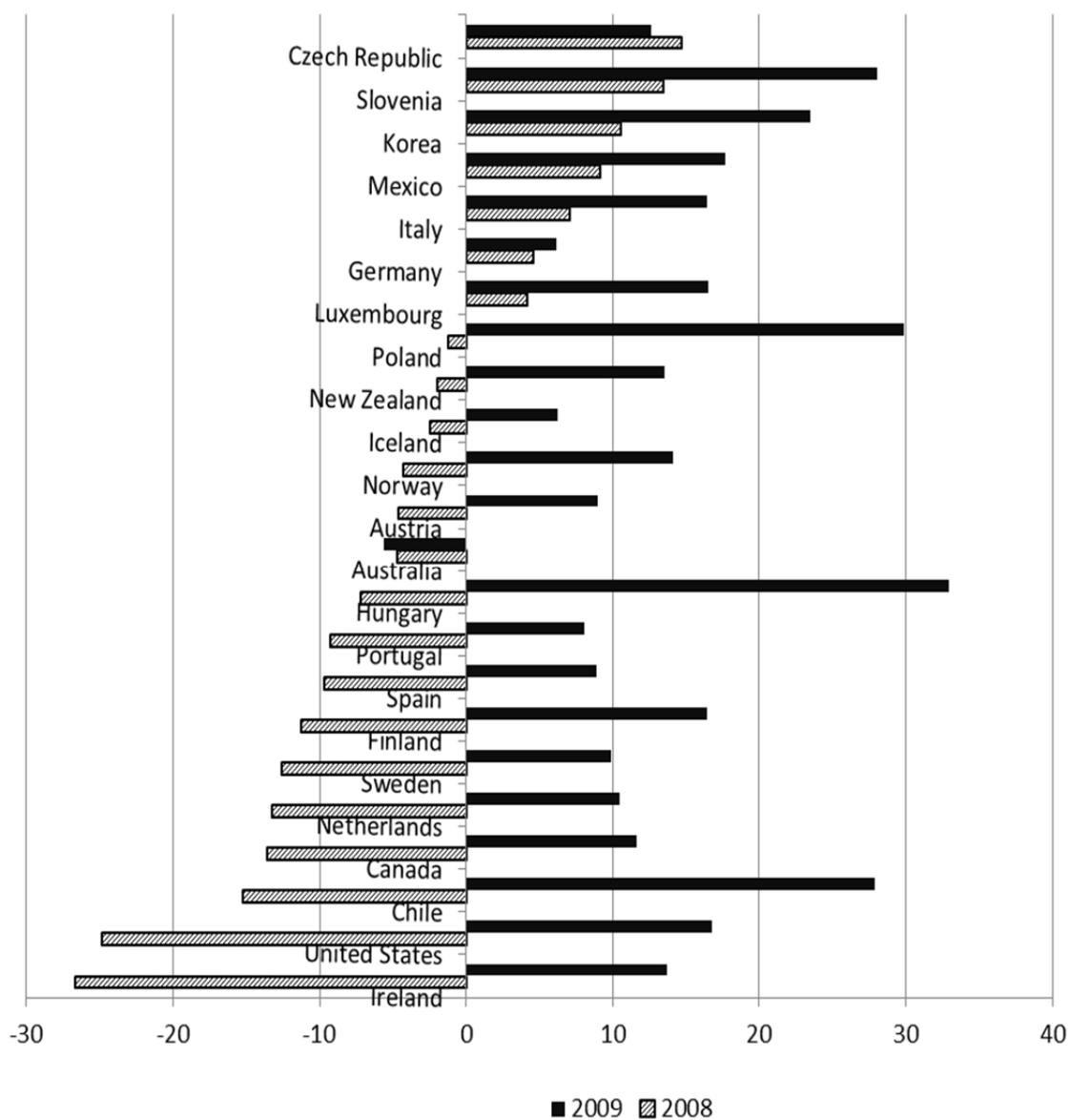
Source: Derived from OECD (2010).

**Figure 3. U.S., European Monetary Union (EMU), and Emerging Markets Equity Market Price Indexes, 1985–2010**



Source: Author's computations from Thompson Reuters Datastream  
(<http://online.thomsonreuters.com/datastream/>)

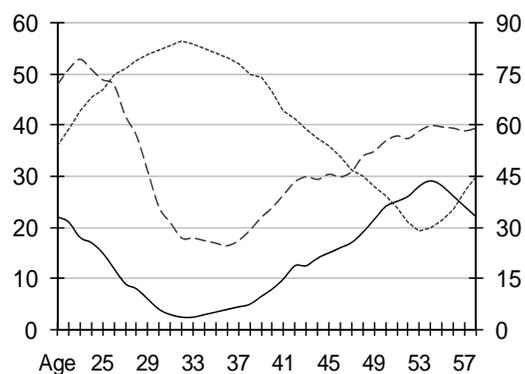
**Figure 4. Pension Returns in Selected OECD Countries, 2008–09<sup>a</sup>**



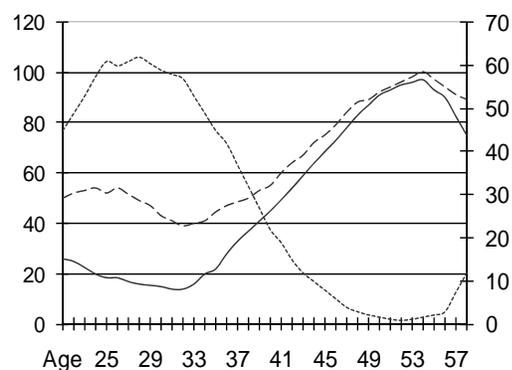
Source: OECD ([http://stats.oecd.org/Index.aspx?DatasetCode=PNNI\\_NEW](http://stats.oecd.org/Index.aspx?DatasetCode=PNNI_NEW))

**Figure 5. Patterns of Lifetime Earnings Excluding and Including Zero Earners<sup>a</sup>** Source: Source: Derived by Mitchell and Turner (2010) from Bosworth, Burtless, and Steuerle (2000).  
a. Average earnings as a percentage of economy-wide average earnings on left scale; percentage of individuals with zero earnings in each year measured on right scale.

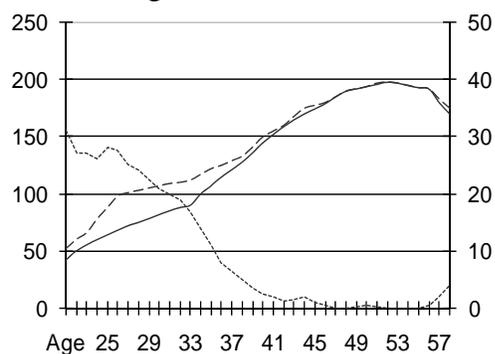
Panel A. Low-income workers with rising life-cycle earnings, with and without zero earners



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

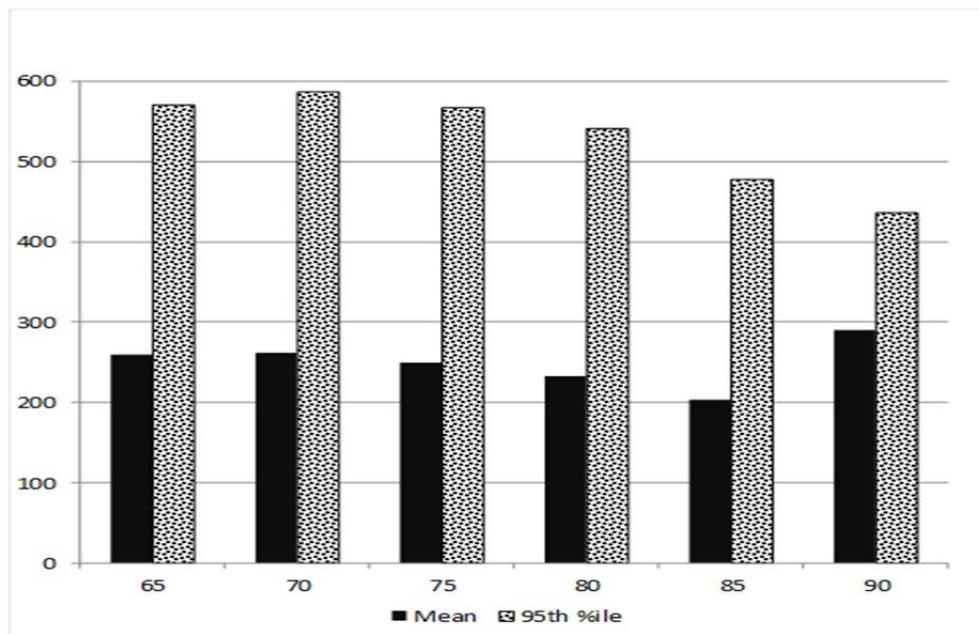


\_\_\_\_\_ All workers, including the unemployed.

----- Workers with positive earnings.

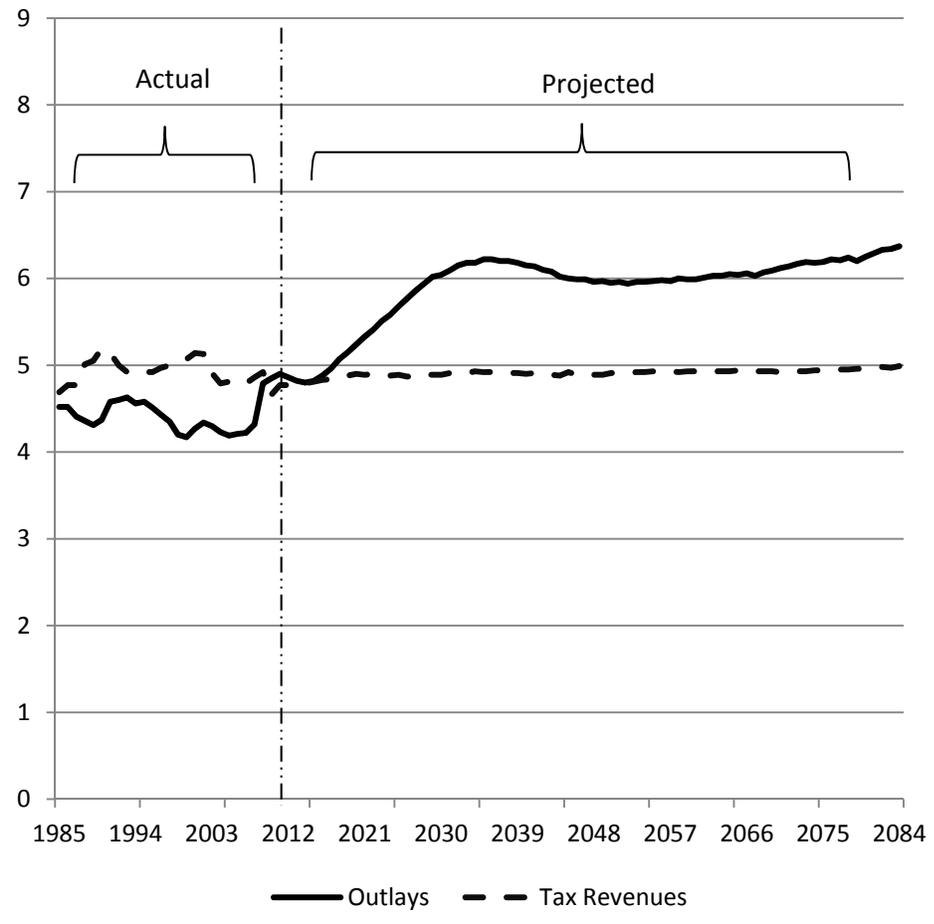
..... Workers with zero earnings.

**Figure 6. Mean and 95th Percentile of Remaining Health Care Costs Including Nursing Home, by Age**



Source: Webb and Zhivan (2010).

**Figure 7. Projected Social Security Tax Revenues and Outlays and System Shortfalls under Currently Scheduled Benefits**



Source: CBO (2010).

**Table 1. Split between Defined Contribution and Defined Benefit Pension Plans in Selected Countries**

Country	Pension Assets <sup>a</sup>	DC %	DB %
Total	23,290	59	41
US <sup>b</sup>	13,196	55	45
Japan	3,152	1	99
UK <sup>c</sup>	1,791	39	61
Canada	1,213	3	97
Australia	996	82	18
Netherlands	990	8	92
Switzerland	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

Source: Towers Watson (2010).

Notes:

- Assets in billions of 2009 U.S. dollars
- Includes Individual Retirement Accounts.
- Excludes Personal Pensions and Stakeholder Pensions

**Table 2. Financial Literacy among Early Baby Boomers<sup>a</sup>**

Question	% Correct	% Incorrect or don't know
Percentage calculation	83.5	16
Lottery division	55.9	43.1
Compound interest	17.8	81.7

Source: Adapted from Lusardi and Mitchell (2009).

- Early Baby Boomer sample (N = 1,984) 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.

**Table 3. Stock Market Exposure of Older U.S. Households by Wealth Decile in the Health and Retirement Study**

Source of wealth	<i>Average asset value for respondents in indicated total wealth percentile</i>						
	<i>1-10</i>	<i>11-20</i>	<i>21-40</i>	<i>41-60</i>	<i>61-80</i>	<i>81-90</i>	<i>91-100</i>
Total Wealth (\$000)	51.7	135.3	587.4	1086.2	1807.8	1421.4	2573.9
Wealth Held in Stocks/Total wealth (%)	1.5	2.3	6.1	9.3	11.9	16	22.6

Source: Derived from Gustman, Steinmeir, and Tabatai (2010).

Note: Households with top and bottom 1% of wealth are excluded. Wealth in stocks includes share of defined contribution accounts in stocks, share of IRA accounts in stocks, and direct stockholdings. Total wealth includes Social Security and pension wealth, IRA assets, and net housing wealth.