

# Not Your Father's Pension Plan: The Rise of 401(k) and Other Defined Contribution Plans

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**T**he number of workers with a 401(k) plan grew from 7.1 million in 1983 to 38.9 million by 1993. The rapid diffusion of this new type of pension plan underscores a broader change in pension structure. Your father's pension plan was designed to give him a fixed income after retirement, but only if he stayed with his employer for 20 or 30 years; if he left early, he ended up with little or nothing. In contrast, your 401(k) or thrift plan is portable; the money accumulated in the account belongs to you when you leave your job, perhaps after a vesting period of a year or two. Consequently, the rise in 401(k) plans may have important implications for job tenure and worker mobility.

Your father's pension plan is called a *defined benefit* pension because the benefit—the money paid out of the pension—is set in advance by a formula that depends on salary and tenure. Employers fund defined benefit pensions by saving money over time, but the amount that they save does not determine the benefit that is paid out. The 401(k) and thrift plans that have become more common today are examples of *defined contribution* pensions. In these plans, the contribution—the money going into the pension—is set in advance, while the final value of the pension is uncertain and depends on the rate of return earned by accumulated contributions.

Pensions can be quite valuable, often worth \$200,000 or more in present value at retirement

for a worker who has stayed long enough with an employer. Moreover, different types of pensions can have important effects on job mobility, retirement, and saving decisions of workers.

## TRENDS IN PENSION COVERAGE

Over the last 20 years, defined contribution (DC) plans have supplanted defined benefit (DB) plans as the typical pension for many workers. Figures 1 through 3 highlight trends in pension coverage from 1983 through 1998.<sup>1</sup> Figure 1 shows that overall pension coverage declined from 67 percent of full-time employees in 1983 to 58 percent in 1998; it also shows trends in the percentage of full-time workers with a DB or DC plan. Figures 2 and 3 show the distribution of workers across pension type in 1983 and in 1998. In 1983, 40 percent of workers with a pension had only a DB plan, while 45 percent had both a DB and DC plan and only 15 percent had a DC plan. Figure 3 shows the dramatic decline in DB pension coverage: 20 percent had only a DB plan and 20 percent had both types, while 59 percent had only a DC plan.

In the rest of this article, we will describe how DB and DC pensions affect incentives of workers and employers. First, we discuss how pensions work and why they exist. Next, we describe the differences between DB and DC pensions, which are also enumerated in Table 1, and we analyze the impact of these differences on workers' incentives to stay in a job. Because of these incentive effects, the switch from DB to DC pensions may alter job tenure, worker mobility, and retirement patterns. Later, we discuss other differences between DB and DC pensions in administrative control and in the distribution of interest rate risk and other risks. These differences may influence saving behavior, stock market participation, and post-retirement consumption patterns.

## HOW DO PENSIONS WORK?

### The Structure of DB Pensions

A worker who qualifies for a DB pension will get an income flow until his death. The annual benefit is typically a proportion of either the worker's

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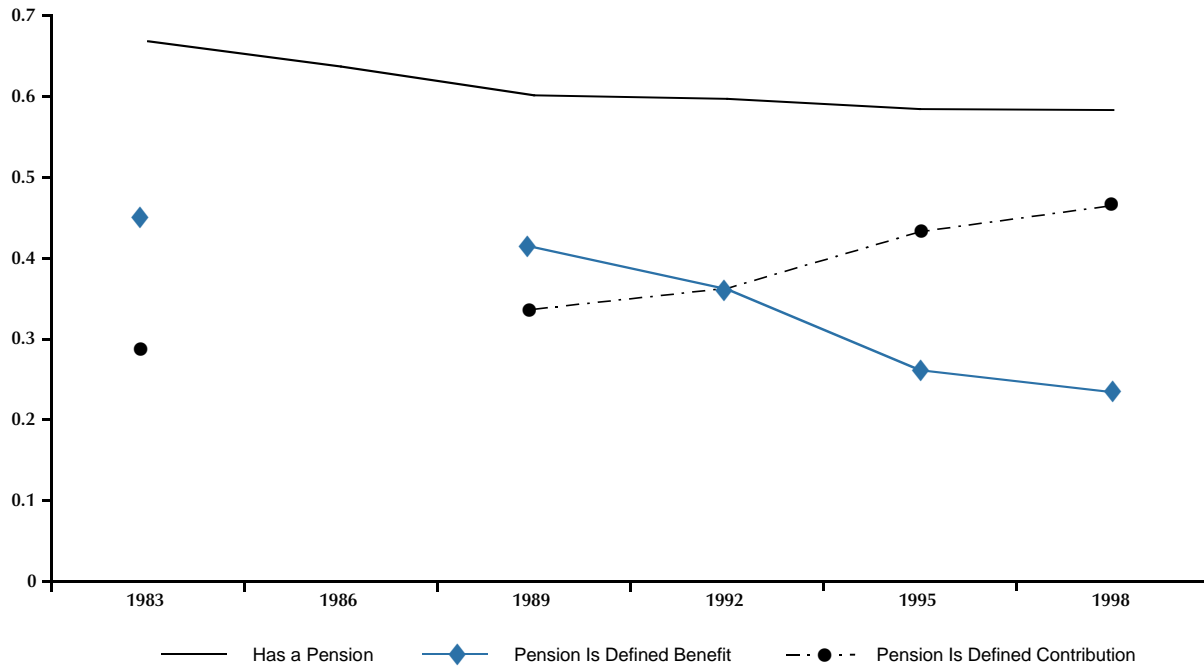
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<sup>1</sup> Pension statistics are reported by individuals in the Survey of Consumer Finances, which is computed for employees working 35 or more hours per week and weighted so that they are nationally representative. The SCF took place every three years from 1983 on, but the questions in 1986 were not asked in the same way, and the 1986 sample is not nationally representative.

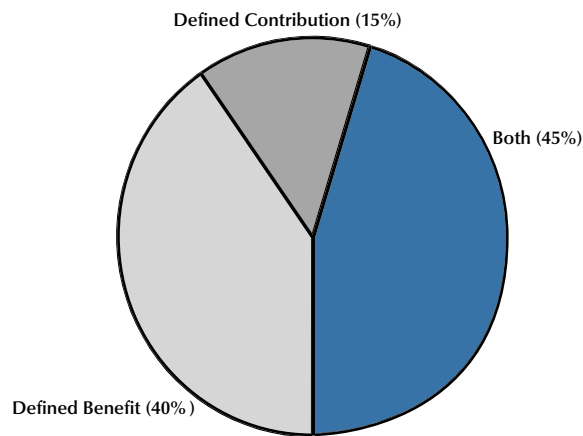
**Figure 1**

**Full-Time Employees**



**Figure 2**

**1983 Pension Structure for U.S. Labor Force Full-Time Employees**



NOTE: Includes only those individuals that specified pension type.

**Figure 3**

**1998 Pension Structure for U.S. Labor Force Full-Time Employees**

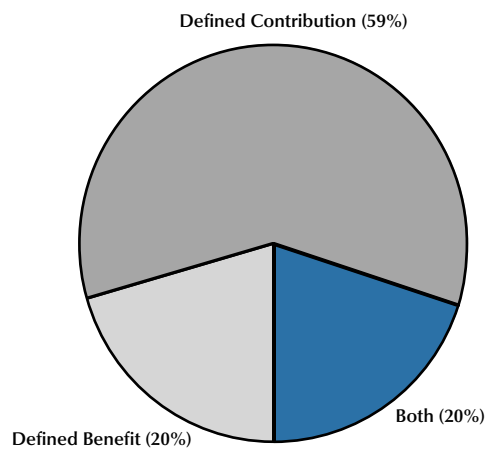
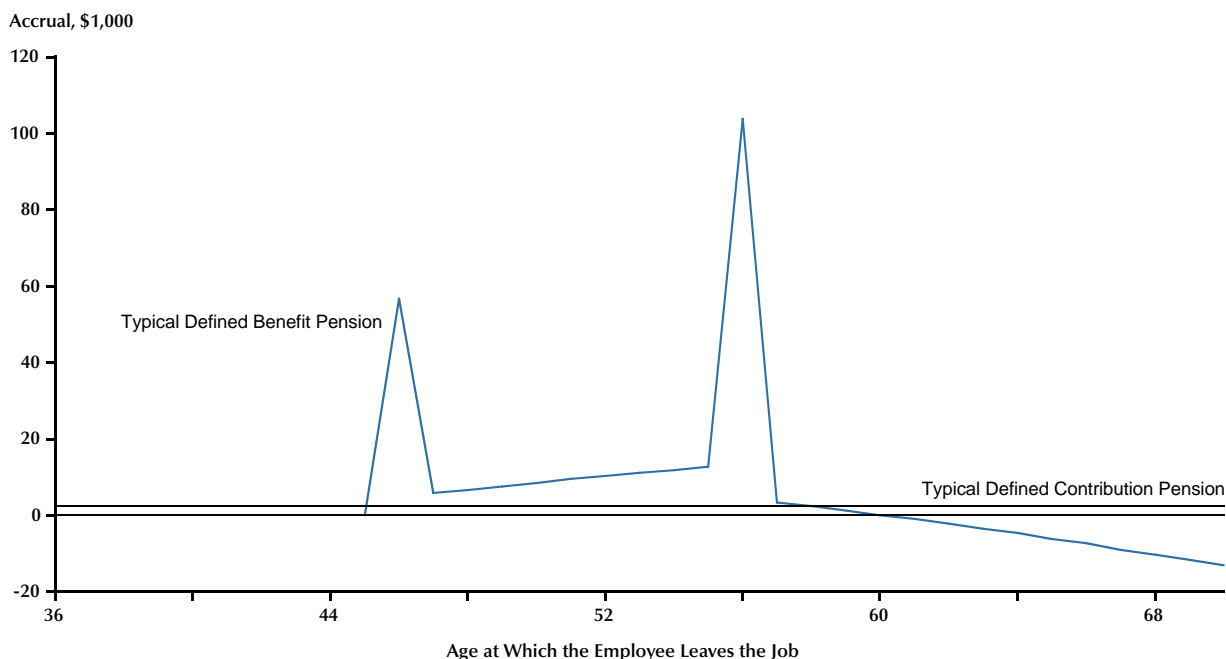


Figure 4

## Accrual of Pension Wealth



average or final salary, with the proportion increasing with tenure. We can summarize the flow in present value terms: Pension wealth  $P_t$  is defined as the real present value of the worker's expected future pension benefits, actuarially discounted to incorporate uncertainty over the lifespan, if the job ends at time  $t$ . Pension wealth accrual is the change in pension wealth,

$$\frac{1}{1+\delta}P_{t+1} - P_t,$$

discounted at rate  $0 < \delta < 1$  if the employee works one additional year and then leaves.

The path of DB pension wealth accrual is characterized by occasional sharp spikes. Figure 4 shows pension wealth accrual in a typical DB pension plan.<sup>2</sup> The first spike, in this case worth about \$60,000, occurs when the worker vests, that is, becomes eligible for future benefits. Maximum vesting dates of 10 to 15 years were established in 1974 and have since been lowered to 5 to 7 years. While vesting yields a claim to some future benefits, pension wealth continues to rise as the worker gains tenure.

Another spike, worth over \$100,000, occurs when the worker reaches the plan's early retirement date (ERD), often at ages 55 to 60 with at least 20

years on the job. At the ERD a retiree can first begin to receive cash benefits. The early benefit is generally smaller than the full benefit available at the normal retirement date (NRD); if it is significantly smaller, then another spike in pension wealth occurs at the NRD. Frequently, though, the penalty for retiring early is small, as is the case in Figure 4. After the ERD or NRD, pension accruals swing around and turn negative because the worker gets little or no further increase in the benefit level but forgoes income by not retiring.

### The Structure of DC Pensions

DC pensions are very simple: Funds go into an account, the worker can choose among a limited number of investment options, and the pension is portable after vesting. Therefore, workers can take

<sup>2</sup> These pension plans are based on information in the Health and Retirement Study (HRS) and have been slightly altered, as described in Friedberg and Webb (2000), to protect confidentiality. The HRS is a nationally representative study of households with at least one member aged 50 to 62 in 1992. The HRS obtained detailed information about pension plans directly from employers of survey respondents. Earlier DB plans were similar or had even sharper spikes; these patterns were documented in a series of papers by Kotlikoff and Wise (1985, 1987, 1989) and Stock and Wise (1990a, 1990b).

their accumulated funds with them when they leave their job. DC pension wealth after vesting is simply

$$(1) \quad P_t^{DC} = P_{t-1}^{DC}(1 + r_t) + c_t,$$

where  $r_t$  is the rate of return earned on assets accumulated through the previous period and  $c_t$  is this period's contribution. Most DC pensions have vesting periods that are either immediate or less than two years.<sup>3</sup> Contributions are tax-deductible (as are a firm's contributions to fund a DB pension), and returns accumulate tax-free. Withdrawals from DC pensions, like DB pension benefits, are taxable.

The smooth path of DC pension wealth accrual shown in Figure 4 stands in stark contrast to the path of DB accrual. These differences directly affect incentives to stay in a job. DC pension accruals are largely age-neutral. Compared with a portable DC plan, a DB plan tends to reduce worker mobility for many years after a worker starts a job. Later on, it encourages retirement when pension accruals turn negative, whereas DC pension accruals remain positive and steady.

While the expected rate of return on DC pension wealth in Figure 4 is assumed to be constant, unpredictable changes in the actual return will shift the realized path of pension wealth accrual. For example, the sharp downturn in the financial markets in 2000-01 has reduced the value of DC pensions invested in stocks.<sup>4</sup> This interest rate risk introduces a new element of uncertainty as workers plan for retirement, so the widespread adoption of DC pensions may increase the volatility of retirement rates.

## WHY DO PENSIONS EXIST?

Why is part of compensation deferred in the form of a pension? Individuals should prefer cash up front, if all else is equal; pensions exist because all else is not equal. The current theory of pensions was developed in a series of papers summarized in Lazear (1986), when DB pensions were the norm. In Lazear's view, DB pensions alter the incentives for long-term employment. We extend the theory to explain the choice between DB and DC pensions. DC pensions do not offer the same incentives for long-term employment, so they must serve an additional purpose perhaps by encouraging long-term saving. Thus, we focus on the incentives for long-term employment and for long-term saving.

## A Stylized View of Pensions

A simplified version of DB pension wealth takes the following form:

$$(2) \quad P_t^{DB} = \begin{cases} 0 & \text{if } t < T \\ \bar{P} & \text{if } t \geq T \end{cases}$$

A worker gets a fixed payment  $\bar{P}$  if she stays in the job until some future date  $T$ .<sup>5</sup> DB pensions impose a risk on workers—that their job could end before time  $T$  and they would then lose their pension. Portable DC pensions do not impose this severance risk, so DB pensions must be more valuable, at least in expectation, for risk-averse workers to accept them. Thus,  $\bar{P}$  can be written as

$$(3) \quad \bar{P} = E_0[P_T^{DC}] + \pi,$$

where  $P_T^{DC}$  is the value of a DC pension at the same future period  $T$ ,  $E_0[\cdot]$  denotes the expectation at the outset of employment, and  $\pi > 0$  is a premium associated with an enduring employment relationship, explained later.

Workers will only accept a DB pension if expected tenure, as well as the DB premium  $\pi$ , are high, relative to the interest rate risk implicit in DC plans. Some evidence on the size of this premium is available from the Health and Retirement Study, a longitudinal survey with detailed pension data for people aged 50 to 62 in 1992. We can use this information to compare DB and DC pension wealth if a worker retires at age 65. As defined earlier and detailed in Friedberg and Webb (2000), DB pension wealth is the present actuarially discounted value of expected future benefits (assuming a 3 percent discount rate and age- and gender-specific survival probabilities), and DC pension wealth is the estimated plan balance. For full-time employees in 1992, median pension wealth was \$192,006 for workers with a DB plan and \$99,105 for workers with a DC plan. Future workers will have somewhat higher DC pension wealth, as they spend more time in jobs with DC plans. Still, this gives an idea about the relative value of typical DB and DC pensions.

<sup>3</sup> From 30 to 35 percent of DC plans vest immediately and another 20 percent vest in two years or less, while most DB pensions take five years to vest, according to Mitchell (1999).

<sup>4</sup> See, for example, Cray (2001).

<sup>5</sup> In fact, before 1974, many DB pensions vested only at the NRD, according to Ippolito (1988).

## **The Value of Long-Term Employment**

Lazear viewed pensions as a component of an implicit contract. Employers avoid explicit long-term contracts in order to preserve their flexibility, but they may nonetheless wish to encourage workers to stay or to devote greater effort to their job. Several possible explanations lie behind the “implicit contract” theory of pensions.

One reason an employer might encourage longer tenure is linked to the cost of searching for new workers. If searching for a new hire is costly, the decision of whether to search depends on a worker’s expected tenure. Also, the relative ease or difficulty of transferring human capital investments can affect the firm’s desire to have longer tenured workers. If human capital investments do not easily transfer to other workers or to other jobs, the sooner a worker is expected to leave, the more reluctant the employer will be to train that worker. The expectation of longer tenure then raises the rate of job training and results in higher productivity and profits, which the employer can share with the worker in the form of a DB pension.

Alternatively, in an efficiency wage framework, deferred compensation encourages workers to devote greater effort to their jobs. In some jobs it is difficult or costly for employers to monitor workers, who may shirk their responsibilities. Employers may find it useful in such cases to pay an “efficiency wage,” which is higher than the prevailing wage in other jobs. This policy deters shirking, since a worker will lose her high-wage job if shirking is detected. Deferred compensation, in the form of a pension for instance, can also function as an efficiency wage, since a worker who shirks may lose her job before qualifying for that pension.

## **Pensions and the Incentive to Retire**

The most common form of deferred compensation is the implicit promise of future wage increases, which also encourages longer tenure. If a fixed amount of wages are to be paid over some duration, wages can be structured to rise over time by paying a worker less than her marginal product early on and more than her marginal product later.

However, two problems arise with this element of an implicit long-term contract. First, it encourages workers to stay on *too* long. An aging worker will choose to retire when her marginal utility of leisure, which probably increases with age, exceeds her wage; the rising wage profile therefore leads her to

retire later than the efficient date. Second, the rising wage profile creates an incentive for employers to violate the implicit long-term contract by firing workers, since employers will receive the benefits of the increased productivity sooner than workers. This credibility problem undermines the implicit contract; workers will not agree to a rising wage profile if they anticipate getting fired when their wages rise.

DB pensions help resolve both of these problems. A DB pension encourages the worker to retire at the “right” age, since the real value of her pension accruals turns negative after a certain point. And that condition, in turn, reduces the incentive of employers to fire older workers, which helps maintain the credibility necessary for the implicit contract. Again in this case, the employer may wish to fire a worker before the major spikes in pension wealth accrual. But, as argued above, that undermines the implicit long-term contract that promised workers a pay-off for long tenure. Furthermore, age discrimination laws and union rules make it difficult to fire older workers systematically.

## **Evidence for the “Implicit Contract” Theory of Pensions**

Several pieces of evidence support the notion that DB pensions function as an implicit contract. For example, workers in jobs with DB pensions are less likely to leave their job. Among workers aged 30 to 54 in the 1998 Survey of Consumer Finances, those with a DB pension had average tenure of 12.5 years, compared with 10.1 for workers with a DC pension. The difference of 24 percent is statistically significant.

In addition, pensions are correlated with the timing of retirement. Using detailed data from both particular firms and national surveys, previous researchers have shown that workers tend to delay retirement until they reach the major spikes in DB pension wealth accrual at the early and normal retirement dates. The evidence suggests that DB pensions affect the timing of retirement by as much or more than Social Security (Stock and Wise, 1990a, 1990b; Samwick, 1998). The spread of DB pensions in the 1950s and 1960s coincided with a substantial decline in the average retirement age (Lumsdaine and Wise 1994). The median retirement age is now age 62, so a significant fraction of workers retire before they are even eligible to receive Social Security benefits. Much of this early retirement may be attributable to DB pensions.



Table 1

## Summary of Pension Characteristics

|  | Defined benefit                               | Defined contribution |
|--|---|----------------------|
| <b>Key pension characteristics</b>     |   |                      |
| Determined in advance                  | Pension benefit                               | Pension contribution |
| Encourages longer tenure               | Yes   | No                   |
| Encourages optimal retirement          | Yes   | No                   |
| Encourages long-term saving            | Yes   | Yes                  |
| Contributions are tax-deferred         | Yes   | Yes                  |
| <b>Differences during employment</b>   |   |                      |
| <b>Pension design</b>                  |   |                      |
| Median vesting period                  | 5 years                                       | 0-2 years            |
| Timing of pension wealth accruals      | Most of pension wealth accrues late in career | Smooth accrual       |
| Portable                               | No  | Yes                  |
| <b>Administrative control</b>          |   |                      |
| Controls investment of assets          | Firm  | Worker, firm*        |
| Can borrow against assets <sup>†</sup> | —   | Worker               |
| Bears costs of administration          | Firm  | Worker, firm         |
| Bears costs of regulatory compliance   | Firm  | Firm                 |
| <b>Risk</b>                            |   |                      |
| Interest rate risk                     | Firm  | Worker               |
| Underfunding risk                      | — <sup>†</sup>                                | Worker <sup>‡</sup>  |
| Risk of early severance                | Worker  | —                    |
| <b>Differences after employment</b>    |   |                      |
| <b>Pension design</b>                  |   |                      |
| Form of pension benefit                | Annuity                                       | Lump sum             |
| Bequeathable                           | No <sup>§</sup>                               | Yes <sup>¶</sup>     |
| <b>Administrative control</b>          |   |                      |
| Controls investment of assets          | Firm  | Worker               |
| Bears costs of administration          | Firm  | Worker               |
| Bears costs of regulatory compliance   | Firm  | Worker <sup>#</sup>  |
| <b>Risk</b>                            |   |                      |
| Interest rate risk                     | Firm  | Worker               |
| Lifespan risk                          | Firm  | Worker               |

NOTE: \*Employers choose which investment options to offer, usually including investment in company stock and several different mutual funds.

<sup>†</sup>Government regulations constrain both underfunding and overfunding of DB pensions by firms.

<sup>‡</sup>Contributions to 401(k) plans are voluntary and hence are subject to underfunding risk, but contributions to other types of DC plans are mandatory. Workers can withdraw DC assets in case of financial hardship or when separated from the firm; if they do so before age 59 1/2, they owe a 10 percent penalty to the government. Some firms allow 50 percent of worker contributions to the 401(k) (up to \$50,000) to be used as collateral for loans with a term of no more than 5 to 10 years.

<sup>§</sup>Many DB pensions allow retirees a choice between a larger annual benefit payable until the retiree dies, or a smaller annual benefit payable until both the retiree and his or her spouse die.

<sup>¶</sup>Individuals are required to make regular withdrawals of assets from their DC plans beginning at age 70. If they do not, they or their heirs face tax penalties, limiting the extent to which DC assets can be saved for a bequest.

<sup>#</sup>As mentioned previously, individuals owe penalties for withdrawing funds when too young or too old.

Table 2

**Rates of Pension Coverage and Job Training: Regression Results by Industry**

| Independent variables              | Dependent variables among those with a pension |                              |                              |
|------------------------------------|--|------------------------------|------------------------------|
|                                    | % in industry with a pension                   | % in industry with a DB plan | % in industry with a DC plan |
| % in industry who got job training | 1.17 (0.28)                                    | 0.792 (0.192)                | -0.560 (0.195)               |
| Constant                           | -0.056 (0.122)                                 | 0.208 (0.083)                | 0.894 (0.085)                |
| Adjusted R <sup>2</sup>            | 0.733  | 0.728                        | 0.548                        |

NOTE: Standard errors are in parentheses. The sample includes seven one-digit industries (agriculture, mining/construction, manufacturing, retail/wholesale trade, finance/real estate/insurance/business and repair services, transportation/communication/other services, and public administration). Training rates are from the January 1991 Current Population Survey and are weighted to make them nationally representative; the national mean is 0.426 (0.002). Pension coverage rates, from the 1992 Survey of Consumer Finances, are also weighted.

In a similar vein, recent research by Friedberg and Webb (2000) shows that workers with DC plans are retiring later than workers with DB plans because of the differences in pension wealth accrual. The resulting change in the average retirement age is almost two years, controlling for other factors.

Other pieces of evidence are also consistent with the implicit contract theory of pensions. For example, DB pension coverage is more common in industries with high rates of job training. Recall that one reason for employers to encourage longer tenure is to gain more rewards from training their employees. Data on job training rates, aggregated for seven broad industrial sectors, can be matched to pension coverage rates in the 1992 Survey of Consumer Finances.<sup>6</sup> Regression results in Table 2 suggest a link. Industries with high training rates have more pension coverage; a 10 percent higher training rate is associated with an 11.7 percent higher pension coverage rate. Moreover, industries with high training rates also have significantly more DB and less DC coverage. A 10 percent higher training rate is associated with 7.9 percent higher DB coverage and 5.6 percent lower DC coverage, among those with pensions.

Most of the evidence which we have discussed here involves correlations between pension coverage and other variables (tenure, retirement, job training). The correlations do not prove causation, however. DB pensions might cause workers to stay in a job longer when young and retire early when old, for example; or employers might offer DB pensions to attract workers who want to do those things, along the lines suggested in the sorting model of Salop and

Salop (1976). In either case, though, DB pensions help employers achieve the desired length of tenure.

### ***Pensions and Personal Saving***

The discussion above explains the purpose of DB pensions, but not necessarily DC pensions, which have little effect on tenure. Besides functioning as an implicit contract, deferred compensation obviously alters the path of consumption and saving for workers who face borrowing constraints. This should make pensions less appealing, according to conventional economic theory. However, recent research based on psychological evidence suggests that pensions may help workers save for retirement.

This notion is implicitly tested in most of the existing research on 401(k) plans, which seeks to determine whether people who save in 401(k) plans save more altogether. Conventional theory suggests a small positive response is likely, and a negative response is possible, because people would shuffle their assets and thereby gain a tax break that reduces their need to save. However, comparisons between people whose employers offer 401(k) plans and people whose employers do not suggests that 401(k) eligibility leads to substantial increases in saving.<sup>7</sup>

The magnitude of this response is difficult to

<sup>6</sup> The January 1991 Current Population Survey asked respondents, "Since you obtained your present job, did you take any training to improve your skills?" More information about these data is reported in the notes for Table 2.

<sup>7</sup> Poterba, Venti, and Wise (1995, 1998) and Webb (2001) found similar results in different data sets that covered different time periods. Engen, Gale, and Scholz (1994, 1996) argued, however, that 401(k) savers would have saved more in any case.

explain if people are fully rational. The evidence may be explained if people are irrationally impatient and have trouble saving. Workers with a self-control problem will be better off if they are compelled to save for retirement. Pensions do this, and workers accept them because they recognize their inability to control *their spending*.

This theoretical explanation is supported by extensive psychological evidence and by recent economic analysis in Laibson, Repetto, and Tobacman (1998). These authors used simulation models to show that people who recognize their self-control problems will use 401(k)-like plans to make wealth available to themselves in the future. According to their results, 401(k) plans always raise aggregate private saving because of their tax advantages. Their additional value as a means to commit to a long-term saving plan provides an extra boost of 17 to 60 percent to the aggregate saving rate, if people have self-control problems.<sup>8</sup>

Although the savings debate has focused on 401(k) plans, DB pensions also allow workers to commit to a long-term saving plan. Indeed, earlier evidence suggests that people with DB pensions saved more altogether, as people with 401(k) plans now do. Diamond and Hausman (1984) found that the elasticity of wealth with respect to pension income was  $-0.141$ , implying far less than a dollar-for-dollar offset. They also found that Social Security benefits reduced private wealth by less than dollar-for-dollar. Dicks-Mireaux and King (1983) found the same patterns for private and public pensions in Canadian data. Other researchers have suggested that workers prefer rising wage profiles, perhaps because it helps them save (Loewenstein and Sicherman, 1991; Frank and Hutchens, 1993).

It is important to note that 401(k) plans in particular do not entirely solve the self-control problem, since contributions are voluntary and workers can borrow against their 401(k) assets under some circumstances. Other DC pension plans require mandatory contributions.<sup>9</sup> However, any DC pension may be liquidated when a worker changes jobs, subject to a 10 percent penalty before age 59  $\frac{1}{2}$ . These factors raise the risk that some workers will underfund their retirement saving. Chang (1996) found that 401(k) cash-out rates tend to be lower for older workers and for workers with higher balances. Poterba, Venti, and Wise (1999) estimated that cash-outs will reduce the aggregate value of 401(k) assets for workers at age 65 by about 5 percent.

## Summary

The existence of pensions and other forms of deferred compensation is puzzling. Pensions constrain workers to save, whether they wish to or not. Existing pension theory suggests that the constraint is accepted because pensions encourage long-term employment, raising productivity and thus overall compensation. Considerable evidence supports this explanation for DB pensions, but the theory fails to account for the use of portable DC pensions.

Therefore, we have proposed a supplementary explanation—that workers value pensions as a vehicle for long-term saving. This explanation is linked to recent economic research that builds on extensive psychological evidence, and it is supported by findings that 401(k) plans, DB pensions, and Social Security all tend to raise personal saving.

## POTENTIAL EXPLANATIONS FOR THE EVOLUTION OF PENSION STRUCTURE

A number of factors, both legal and economic, may explain the shift from DB to DC pensions. Legislative changes since 1974 have expanded the flexibility and preferential tax treatment of DC pensions but, at the same time, have boosted the costs of administering pension plans. For example, the government has set increasingly tight standards for maximum benefits, vesting, and eligibility in all types of pension plans, as well as funding requirements in DB plans.<sup>10</sup> Ippolito (1995) reported estimates from the Hay-Huggins Company (1990) that the average administrative costs of DB and 401(k)

<sup>8</sup> The range of increase depends on the particular features of the 401(k). These figures assume a value of one for the rate of relative risk aversion, though saving responds less to the 401(k) if risk aversion is higher. The authors argued that the most careful set of studies support a value of one or less.

<sup>9</sup> In a money purchase plan, the employer's annual contribution is determined by a specific formula, usually either a dollar amount or a percentage of salary. A target benefit plan is designed to provide a specific benefit level, but the benefit is not guaranteed. In a simplified employee pension, the employer contributes to the employee's individual retirement account. The employer distributes its own shares to employees in an employee stock ownership plan, while employees receive an option to purchase shares at a specified price in a stock purchase plan.

<sup>10</sup> Clark and McDermed (1990) provided a detailed explanation of these legal changes, which began with the Employee Retirement Income Security Act (ERISA). Using data for 1980-86, Kruse (1995) found that firms generally offered DC plans alongside existing DB plans, rather than terminating DB plans. Using later data from 1985-92, Papke (1999) found some replacement of both DB and other types of DC plans by 401(k) plans.



plans generally rose at similar rates, although very small DB plans grew relatively more expensive.

While legislative changes can account for some of the shift from DB to DC pensions, they cannot explain other patterns—for example, different rates of diffusion of DC pensions across industries and the movement of workers from types of firms with relatively high rates of DB coverage to types with high rates of DC coverage. A series of papers by Clark and McDermed (1990), Gustman and Steinmeier (1992), Ippolito (1995), and Kruse (1995) showed (i) that DB pensions remain more prevalent in large firms, industries such as manufacturing, and unionized jobs but (ii) that the proportion of workers in such jobs has declined.

Therefore, we are seeking explanations based on the economic theory of pensions outlined previously. DB pensions lose their appeal when the value of long-term employment declines. As with other recent labor market trends, such a change may be rooted in the diffusion of information technologies over the last 20-odd years.<sup>11</sup> Technological change is a leading explanation for the growing demand for skilled workers and consequent rise in earnings inequality between skilled and unskilled workers. It would not be surprising if rapid shifts in skill requirements associated with new technologies have also reduced the value of long-term employment.

In Friedberg and Owyang (2001) we explore this idea. An increasing pace of skill-biased technological change tends to raise the volatility of demand for particular skills. This change will in turn lower the expected duration of employment, and both workers and employers will gain less from the use of DB pensions.

In addition, factors such as technological change that have reduced relative earnings of unskilled workers may also explain their loss of pension coverage. Figure 1 shows the declining rate of pension coverage for all workers; Bloom and Freeman (1992) and Even and MacPherson (2000) have shown that coverage fell substantially more for workers with less education. Thus, it will be important to explore how changes in technology have affected both the level and structure of pension coverage.

## OTHER IMPLICATIONS OF THE EVOLUTION OF PENSION STRUCTURE

Other differences between DB and DC pensions, besides those involving portability, are summarized

in Table 1. Firms manage DB pension assets and as a consequence bear most of the resulting risks, except the risk of early severance. In contrast, workers manage DC pension assets and bear most of the risks. These differences could have important effects not only on job mobility, but also on consumption and saving before and after retirement and on stock market participation.

### **Additional Differences Between Pensions During Employment**

Many aspects of administrative control and consequent risk are borne by firms when pensions are DB and are borne by workers when pensions are DC. Firms control how DB pension assets are invested and consequently bear the risk of uncertain interest rates, which may leave pensions underfunded or overfunded. Government regulations instituted since 1974 tightly restrict funding of DB pension obligations, however, and thus reduce the extent to which firms can smooth these risks over time.

Workers control how DC pension assets are invested among several options—generally mutual funds and company stock—which employers choose to offer. Consequently, workers bear the risk of uncertain rates of return. Underfunding is a greater possibility, as some employers allow workers to borrow against DC pensions in case of financial need.

Lastly, firms bear all the administrative and regulatory costs of DB pensions but also bear much of the costs of DC pensions. Workers incur costs to the extent that they actively manage their DC pension assets.

### **Additional Differences Between Pensions Post-Employment**

The primary difference post-employment is that DB pension benefits are paid out as an annuity, while DC pension assets are transferred as a lump sum to workers. Consequently, firms bear the risk of the uncertain lifespan of workers who receive DB pensions, while workers bear this risk when they receive DC pensions.

Post-employment, the administrative control and consequent interest rate risk of each pension type generally remain the same as during employment. However, the burden of administrative and

<sup>11</sup> For example, the personal computer was launched by IBM in 1981.

regulatory costs of DC pensions shift from firms to workers upon retirement.

### **Implications for Consumption and Saving**

Consumption and saving patterns are likely to differ for workers with different types of pensions. Workers with DC pensions bear interest rate and lifespan risk, and because individuals are risk-averse, this should induce additional precautionary saving. Similarly, they should be slower to deplete their wealth after retirement. All that, however, depends on individuals making consumption and saving choices rationally. Self-control problems of the type described earlier may be abetted by the lump-sum payout at separation from DC pensions. In order to encourage the preservation of DC pension assets, withdrawals before age 59  $\frac{1}{2}$  suffer a 10 percent penalty, as we noted earlier.

### **Implications for Public Policy**

Because DC pensions are paid as a lump sum, elderly with DC pensions are more likely to outlive their assets, compared with elderly with DB pensions. This will be exacerbated if self-control problems lead to overconsumption after receiving the lump sum. As a result, the spread of DC pensions may increase take-up of means-tested public programs like Supplemental Security Income (which offers cash benefits), Medicaid (which pays for long-term care), and food stamps.

Medicaid rules dealing with annuitized versus unannuitized wealth may further encourage retirees with DC pensions to spend down their assets.<sup>12</sup> Medicaid only pays for long-term care when income and assets are low enough. Both must be extremely low for single people to qualify. However, the spouse of a married person who qualifies may retain \$2,000 in monthly income, \$20,000 in assets, and 50 percent of assets between \$20,000 and \$180,000. Annuitized DB pension wealth is treated as income, while unannuitized DC pension wealth is treated as an asset. Since the asset limit is relatively stricter than the income limit, DC pension wealth is subject to a relatively high implicit tax, in case one spouse applies to Medicaid to pay for long-term care.

### **Implications for Financial Markets**

DC pension plans that do not involve employee stock ownership or stock options give workers some choices over their investment strategy. Thus, pension

structure will influence financial markets if firms and workers make different portfolio choices. A growing body of financial research suggests that, even if investors are fully rational, the process by which information diffuses affects both rates of return and volatility in financial markets. For example, a simple model of herding laid out in Banerjee (1992) suggests that investors who have little or no private information rationally follow the behavior of others, which may be highly misleading. Learning models can also lead to herding, as noted in Smith and Sørensen (2000). Individual investors may be more subject to these types of “informational cascades” than institutional investors like pension funds. Another class of models analyzes specific deviations from rationality to which small investors may be more prone; these may explain the equity-premium and other long-standing puzzles involving financial markets.<sup>13</sup>

## **CONCLUSIONS**

In this article, we have reviewed a variety of causes and consequences of the choice of pension structure. It is not surprising, therefore, that the evolution of pensions over the last 20 years has begun to influence many aspects of working and saving. While the spread of defined benefit (DB) pensions in the 1950s and 1960s contributed to the decline in the average retirement age, retirement ages have stabilized in the 1980s and 1990s as defined contribution (DC) pensions have taken hold. Meanwhile, workers at younger ages are changing jobs more frequently.

Although it is too early to tell, post-retirement consumption patterns may also shift. If people correctly evaluate the increased risk of outliving their DC pension resources, they may slow down their consumption and save more. However, access to their entire pension wealth upon retirement may lead some to hasten consumption, ultimately worsening the problems of poverty among widows and the oldest old and increasing the fiscal drain on income support programs for the elderly.

As the age structure of the labor force continues to shift, it will be important to understand the impli-

<sup>12</sup> Medicaid's treatment of DB and DC pension wealth is detailed in Webb (2001).

<sup>13</sup> See, for example, Barberis, Huang, and Santos (1999) and Barberis and Huang (2000). These articles analyze the financial implications of loss aversion and mental accounting, described in Rabin and Thaler (2001).

cations of the ongoing changes in pensions. Future research in this area promises new insights not only about the role of pensions, but more broadly about the behavior of workers and firms in an era of changing expectations and new technologies.

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