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RETIREMENT AND THE EVOLUTION OF PENSION STRUCTURE

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ABSTRACT

Defined benefit pension plans have become considerably less common since the early 1980s, while defined contribution plans have spread. Previous research showed that defined benefit plans, with sharp incentives encouraging retirement after a certain point, contributed to the striking postwar decline in American retirement ages. In this paper we find that the absence of age-related incentives in defined contribution plans leads workers to retire almost two years later on average, compared to workers with defined benefit plans. Thus, the evolution of pension structure can help explain recent increases in employment among people in their 60s, after decades of decline.

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The typical employer-provided pension has changed dramatically in the last twenty years. The percentage of pensioned full-time employees with a 401(k) or other defined contribution (DC) plan rose from 40% in 1983 to 79% in 1998. The percentage covered by a defined benefit (DB) plan declined similarly, from 87% in 1983 to 44% in 1998.[1]

Pension wealth in traditional DB plans is a complicated function of earnings, tenure, and age. DB pension wealth typically accumulates slowly early in a job, accelerates or jumps after many years of tenure, and then ultimately slows down or declines if one stays in the job long enough. Therefore, DB pensions encourage workers to stay early on in order to gain access to large future pension accruals, and later to leave, after 25-30 years of tenure.[2] Earlier studies showed that DB pension plans influenced retirement behavior by as much or more than Social Security, and that the postwar spread of DB plans contributed to the striking decline in American retirement ages.[3] However, retirement ages leveled off in the early 1980s and employment at older ages has risen since then.[4] We argue that the shift in pension structure played a role in reversing the decades' long decline. DC pensions accumulate a lump sum which depends strictly on contributions and returns accumulated in a portable account, so the timing of pension wealth accruals is not tied to the timing of retirement as in DB pensions.

Our goal in this study is to analyze how the decline in DB pension coverage has influenced retirement. Our approach is essentially quasi-experimental, comparing retirement responses to financial incentives in DB versus DC plans. In addition, we offer some further extensions to the literature on private pensions. We show that the measures of pension accrual that are crucial for understanding DB pension incentives do not meaningfully describe DC plans.

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[1] EBRI (1996) and authors' computations from the Survey of Consumer Finances.
[2] These age-related incentives were documented by Burkhauser (1979) and Kotlikoff and Wise (1985, 1987, 1989).
[3] Costa (1998) reported that labor force participation rates fell from 58% to less than 20% between 1930 and 1990 among men aged 65+ and from 82% to 67% between 1940 and 1990 among men aged 55-64.

We also employ new data from the nationally representative, longitudinal Health and Retirement Study. The HRS began in 1992, more recently than data used in earlier studies of DB pensions, and it offers descriptions of pension plans from employers.[5]

We hypothesize that retirement hazards will smooth out for workers with DC plans, compared to workers with DB plans. In theory, that might reduce the average retirement age, if DB plans generally constrain workers to retire later than they would otherwise; or it might raise it, if DB plans constrain workers to retire earlier. Our estimates show that the differences in pension wealth accrual significantly affect retirement. Simulations based on the estimates demonstrate that workers with DB plans retire almost two years *earlier*, on average, compared to workers with DC plans and holding other characteristics constant. Accounting for DC contributions that are voluntary and possibly endogenous does not affect the estimation results, nor does allowing retirement behavior to differ by pension type, which controls flexibly for other differences between DB and DC pensions.

The simulation results imply that the shift in pension structure will raise the median retirement age by about 10 months when comparing full-time employees with a pension in the cohort aged 53-57 in 1983 with the cohort aged 53-57 in 2015. Under different assumptions about those without a pension, this corresponds to a 9-12 month increase in the median retirement age of all full-time employees in those cohorts. This response stands in sharp contrast to the trend towards earlier retirement that slowed down in the early 1980s, and it can help explain recent increases in employment among people in their 60s.

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[4] These recent trends have been documented by Quinn (2000) and Genser (2001).

[5] Coile and Gruber (2000) used the same HRS data to analyze the impact of Social Security on retirement. In some of their specifications they included private pensions, but they summed together pension and Social Security incentives, and they measured financial incentives in DB and DC plans in the same way.

While our work builds on previous research that treats pension type as exogenous, we recognize that workers may sort into firms endogenously, based on pension characteristics or on other characteristics correlated with pensions. We argue that the shift in pension structure does not appear to be related to retirement preferences. Moreover, we find little evidence of sorting into pension type on observable worker and job characteristics.

The rest of this paper is organized as follows. In Section I, we outline how differences between DB and DC pensions influence retirement and why pension structure may have changed. In Section II we describe the data and show raw statistics on pensions and retirement. We present the estimation and simulation results in Section III and summarize our findings in Section IV.

I. PENSIONS AND RETIREMENT

In this section, we show how pension structure may influence retirement. Then, we discuss why pension structure may have changed and argue that these changes occurred for reasons that were unrelated to retirement preferences.

A. The impact of pensions on retirement

The retirement decision. Each period a worker decides whether to stay in a job or leave (retire).[6] He or she weighs the utility of retiring now or of staying and deciding next period whether to retire. The value of this decision V_t can be written as $V_t = V(R_t)$, where R_t equals one if the decision is to retire and zero if the decision is to stay in the job.

Suppose that the value of staying in the job this period is

$$V(0) = u^0(W_t) + \beta E(V_{t+1}) \qquad (1)$$

[6] This framework may apply to quits at any age, if leaving a job is irreversible. Similarly, older workers may choose to take another job rather than retiring completely. These extensions do not alter the qualitative impact of pensions.

the sum of utility from the wage W_t received this period and the discounted expected value of facing the retirement decision next period.[7] Suppose that the value of retiring is

$$V(1) = u^1(P_t)$$

which depends on pension wealth P_t and possibly other factors, such as utility from leisure or another job. The decision depends on how current and expected future compensation in the job compare to the value of retirement.

Pensions. A pension is a form of compensation deferred until a worker leaves his or her job and often conditioned on having reached a certain age and/or tenure before leaving. A key factor is the value of the pension as the retirement date changes:

- Delaying retirement may substantially raise long-term benefits, so pension wealth accrual is large at some future date, though small today. That raises V_{t+1}, V_{t+2}, … in (1), encouraging later retirement. This pattern arises in DB plans at younger ages.
- Delaying retirement may have little or no effect on future pension benefits. Then, the foregone income makes pension wealth accrual small or negative, encouraging immediate retirement. This pattern generally arises in DB plans after eligibility for early or full benefits.
- Future pension benefits may increase at a constant rate when retirement is delayed. This pattern occurs in DC plans, in which case the incentive to retire depends on factors like the employer contribution rate.[8]

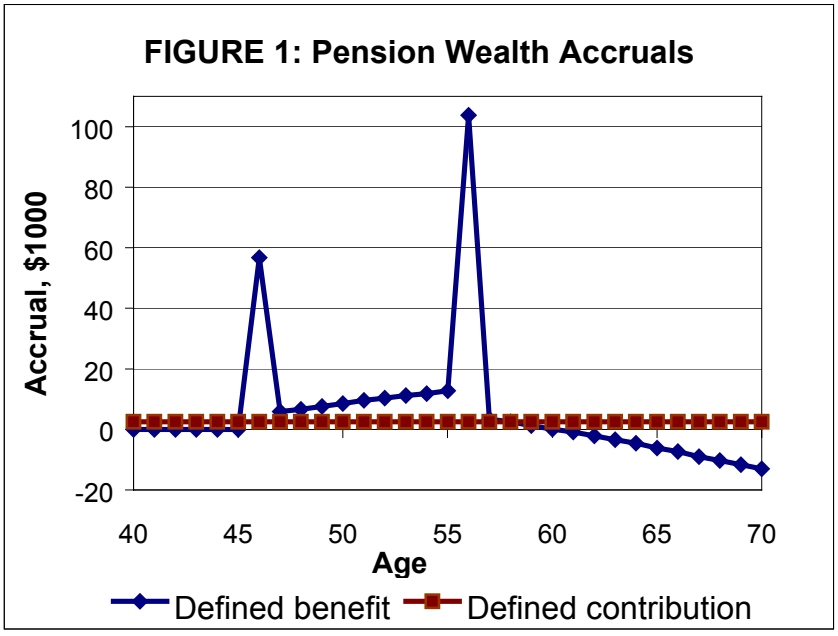
DB pension wealth accrual. A person who retires at age t has DB pension wealth equal to

$$P_t^{DB} = E\left[\sum_{s=t}^{T} \frac{1}{(1+r)^{s-t}} \delta_{s|t}\, p(q,t)\right] ,$$

[7] β reflects the rate of time preference and mortality risk, which is assumed fixed for simplicity.
[8] These distinctions between the path of DB and DC pension accruals were also noted by Quinn et al (1998).

or the expected discounted value of pension benefit flows p(q, t) received each period after the pension commences at age $q \geq t$.[9] A typical formula for p(q, t) involves a benefit that is proportional to the worker's final or average salary, with the proportion increasing in tenure. Benefits are discounted to time t by the age-conditional probability of survival δ and the interest rate r.

DB pension wealth accrual, defined as $\left[\frac{1}{1+r} P_{t+1}\right] - P_t$, indicates the gain in pension wealth if one works an additional year and then retires. Figure 1 shows pension wealth accrual in an actual DB plan as the retirement age t increases.[10]



Two or three key dates can cause sharp changes in P_t^{DB}. Pension wealth is zero until the vesting date, when a worker becomes eligible to receive a future pension. The maximum

[9] A person who quits may not be eligible to receive benefits immediately, but it is almost always optimal to begin receiving benefits as soon as one is eligible.

vesting date is now 5-7 years but was 10 years in the plan shown in Figure 1. Pension wealth then accrues gradually as the future benefit rises with earnings growth, tenure, and the approach of retirement. Pension wealth accrual generally spikes again if the plan offers an early retirement date (ERD), when a worker can leave the job and first receive a reduced benefit, or at the normal retirement date (NRD), when a worker qualifies for the full benefit. The spike in Figure 1 results from a discrete jump in the pension benefit at the ERD. Accruals are negative following the NRD because current benefits are foregone and future benefits are often flat. In Figure 1 the penalty for receiving early benefits is mild, so accruals turn negative after the ERD.[11]

It is clear that a single year's pension accrual does not capture the full value of postponing retirement. Stock and Wise (1990a) developed an "option value" approach that reflects the increment to utility from postponing retirement and gaining access to distant accruals. Estimation of their model requires numerous functional form and distributional assumptions, however. Coile and Gruber (2000), in their analysis of Social Security incentives, introduced a simpler measure of the "peak value" of pension wealth accrual $\left[\frac{1}{(1+r)^{m-t}} P_m\right] - P_t$, where pension wealth reaches its discounted maximum in future year m. They argued that peak value isolates the key incentives influencing retirement while imposing fewer assumptions.[12] Although peak value does not fully capture the effect of the number of years until the peak, we find that the results are not sensitive to normalizing by years to peak.

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[10] The pension accruals in Figure 1 were computed from sample HRS plans that were slightly modified to protect anonymity. Following the literature, our calculations assume a 3% real discount rate, average mortality probabilities by age and gender, and a terminal age of 120.

[11] The maximum vesting period was reduced in 1989; most workers in our sample had already passed the vesting date before it was reduced, and the shorter vesting date is incorporated in plans of workers who had not. 1986 legislation that eliminated the use of age-related limits on maximum pension benefits is also reflected in the plans in our sample; tenure-related limits are still permitted (see, for example, Mitchell 1999, Table 15) and generate negative accruals like those shown in Figure 1.

DC pension wealth accrual. DC plans function very differently. DC pension wealth is the market value of current assets.[13] The gain to DC pension wealth each period is the return on the initial balance plus this year's contributions from the employee and employer. While contributions to a 401(k) are voluntary, they are mandatory in other DC plans.[14]

An additional year of work has no effect on pension wealth if contributions are zero and raises pension wealth if contributions are positive. Therefore, DC pension wealth never reaches a peak, and the peak-value measure is not meaningful. This is apparent in the pension accruals shown in Figure 1 from a typical DC plan. Only a portion of DC pension accruals constitute an incentive to delay retirement. Employer contributions will cease at retirement, and access to a tax-deferred savings vehicle will diminish or cease. In contrast, existing assets will generate returns regardless of retirement.

There are, nonetheless, two potentially important dates in DC pension wealth accrual. First, some DC plans have vesting dates of up to five years, though a majority vest within 0-2 years (Mitchell 1999). Second, 401(k) funds can be withdrawn without a penalty beginning at age 59½; we will test for an age-59½ effect on retirement.

Another important point is that voluntary contributions may replace other personal saving and thus depend on retirement intentions – an important point because voluntary contributions generate some, though not all, of the cross-sectional variation in pension accrual. Therefore, we try omitting a measure of voluntary contributions from DC pension wealth when we estimate the impact of pensions on retirement.

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[12] Samwick (2000) demonstrated that controlling separately for earnings, as we do, captures the key difference between the option value and peak value measures.

[13] To be precise, DC pension wealth should also include the present value of future tax relief. We will follow the literature in omitting this component, since DB pension wealth is also tax-deferred.

[14] Other types of DC plans are money purchase plans, profit sharing plans, target benefit plans, simplified employee pensions, and employee stock ownership plans.

Lastly, as we noted earlier, most existing research on 401(k) plans examined their impact on personal saving.[15] This debate is not relevant for our paper. Differences in pension structure can influence retirement whether or not they alter savings rates.

B. Summary of key differences [16]

DC pension wealth accrues smoothly. We hypothesize that retirement hazards will smooth out for workers with DC plans, compared to workers with DB plans who experience swings in pension accruals. This could lead to earlier retirement under DC plans, if DB plans have generally constrained workers to retire later than they would otherwise in order to gain access to the peaks in pension wealth accrual, or it might lead to later retirement, if DB plans have constrained workers to retire early, when accruals drop off or turn negative. We will be able to distinguish which through simulations based on our estimation results.

DC pension wealth includes voluntary contributions. Since these may be determined endogenously with retirement plans, we examine whether voluntary contributions affect estimates of the influence of DC pensions.

DC plans are typically not annuitized. By insuring against lifespan uncertainty, a DB plan with actuarially equivalent present value is worth more than a DC plan to a risk-averse individual lacking a bequest motive.[17] Workers with DC plans may therefore save more or retire later. While we lack sufficient information on annuitization options in DC plans in order to identify the direct impact on retirement, we allow for distinct effects on retirement of different types of pension wealth in order to capture differences like these.

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[15] See, for example, Poterba, Venti, and Wise (1996) and Engen, Gale, and Scholz (1996).
[16] Friedberg and Owyang (2002a) describe these and other differences between DB and DC pensions in more detail.
[17] Less than 20% of DC plans allow annuitization after retirement (Brown, Mitchell, Poterba, and Warshawsky 1999).

DB and DC pensions have different risk characteristics. The DB rate of return depends on earnings growth before retirement and on inflation after retirement. The DC rate of return depends on portfolio choices and yields, and differences between expected and realized rates of return may alter retirement plans.[18] Again, we allow different effects of different types of pension wealth to capture distinctions like these. We also try a specification that includes a control for people who invested their DC plans mostly in stocks, although this is potentially endogenous with retirement plans.

DC pensions have shorter vesting periods. Taking a new job may have become more attractive to older workers, since new jobs are now more likely to offer a DC instead of a DB pension, and quick vesting in DC plans raises effective compensation for people who expect to retire fully a few years later. Thus, we distinguish in the empirical analysis between people who leave their pensioned job for another job and those who retire fully.

C. What determines the structure of pensions?

In Lazear's theory of deferred compensation, DB pensions solve a contracting problem between workers and firms (see, for example, Lazear 1986). Firms cannot perfectly monitor workers but want to deter shirking. Deferred pension accruals, as well as a rising wage profile, induce workers to devote optimal effort so that they do not lose their jobs. A similar motive for deferred compensation arises if workers require firm-specific training or hiring is costly for other reasons. At some point, however, rising wages exceed marginal productivity of older workers. DB pension provisions help encourage retirement at an appropriate age.

While various elements of these theories have found support in explaining the use of DB pensions, they offer little insight about the use of DC pensions or about their increasing

[18] For example, workers who invested their DC assets in equities may have earned unexpectedly high returns in the

prevalence. Most explanations for the shift in pension structure focus on regulatory changes, which have had several effects. A series of laws enacted since 1974 tightened DB funding standards, enhanced workers' claims to DB pension wealth after leaving a job, restricted the use of pensions in compensating highly-paid employees, and extended tax breaks for DC contributions. The new rules raised the cost of administering pensions, but early evidence yields mixed conclusions about its impact. Ippolito (1995) reported estimates from the Hay-Huggins Company (1990) indicating that only very small DB plans grew relatively more expensive to administer; for larger firms, average costs of DB and 401(k) plans rose at similar rates. Kruse (1995) concluded that rising administrative costs might explain some but not all of the decline in DB pensions during 1980-86. Clark and McDermed (1990) argued, further, that some of the restrictions limited the usefulness of DB pensions in providing optimal long-term incentives. Nevertheless, it is apparent from Figure 1 that DB plans can still be designed to deliver pension wealth in a highly nonlinear fashion.

Friedberg and Owyang (2002b) offered another explanation for the decline in DB coverage. Building on Lazear's theory, they examined reasons why the value of long-term jobs might have declined. Their explanation emphasizes the nature of long-term jobs held by prime-age workers, rather than retirement incentives of older workers. That focus is consistent with the more rapid change in pension structure among younger workers; with an overall decline in average job tenure; and with evidence of structural change in the economy involving workers of all ages – for example, the rate of decline in the use of DB plans has varied across industries, and workers (who typically move when they are young) have shifted from jobs typically covered by DB plans to jobs typically covered by DC plans.[19]

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late 1990s and then chosen to retire early. Coronado and Perozek (2001) found evidence of this in the HRS.

[19] Clark and McDermed (1990), Gustman and Steinmeier (1992), Ippolito (1995), Kruse (1995), Papke (1999).

In sum, both the regulatory and contracting explanations for the shift in pension structure appear to have little to do with retirement incentives. If anything, the move away from DB plans may have increased firms' use of temporary early retirement inducements.[20]

We recognize nonetheless that pensions and retirement may be endogenously determined. A firm's choice of pension structure may be influenced by factors correlated with the average age and retirement preferences of workers. However, we do not believe it is feasible to estimate the determinants of pension design. Filer and Honig (1998), for example, failed to find convincing exclusion restrictions when allowing for endogenous DB pension design.[21] Nevertheless, we address some concerns about endogenous sorting. We control for observable worker and job characteristics (e.g., firm size, industry, unionization, job tenure) that are correlated with pension type; none influence the estimated effect of pension characteristics on retirement. Also, we show that older workers with different pensions types are quite similar on other key dimensions like earnings and wealth, along which one might expect observable differences if workers were sorting by retirement preferences or related characteristics.

II. DATA

A. The Health and Retirement Study

The Health and Retirement Study (HRS) is a detailed longitudinal survey of over 7,600 households with a member born between 1931 and 1941. The HRS began in 1992 and surveys people every two years. We use data from the first four waves.[22] The HRS reports unprecedented detail about household and job characteristics as people age. For people who said

[20] Lumsdaine, Stock, and Wise (1990), Brown (1999).

[21] They estimated a joint model of the DB early retirement date faced by a worker, along with the worker's actual retirement age. They used macroeconomic variables (unemployment, inflation) at the hiring date to identify the impact of the pension retirement age on retirement. These variables did not have a statistically significant impact on the pension, however, so the estimation was essentially identified from nonlinear functional form.

they had a pension and gave permission, the HRS contacted employers to get information about the pension. The HRS also obtained Social Security earnings records for those who gave permission. The HRS pension and Social Security data are available on a restricted basis, together with a program to compute private pension wealth at all ages. We have written a similar program to compute approximate Social Security wealth.[23]

Gustman and Steinmeier (1999) studied the quality of the pension data. In the first wave, 65% of workers who reported a pension in their current job were matched to their pension data.[24] Match failures arose either when someone refused permission to the HRS to contact their employer, or when the employer did not respond to HRS queries. Gustman and Steinmeier found that some variables significantly affect the probability of a match, but that they have relatively little explanatory power.[25] In our judgment we lack sufficient information to impute missing pension data or control for selection due to match failure.

For people who say they have a pension, we use employer data to determine whether they have only DB plans, only DC plans, or else both types or combined plans. We classify people as having a DB plan if their employer offers one, since participation is rarely voluntary. We classify them as having a DC plan if their employer offers one and they participate in it. We focus on participation rather than eligibility because the HRS did not contact employers of people who said they had no pension, so we miss some people who are eligible but did not

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[22] Third and fourth wave data are from the early releases.

[23] We use earnings records and current rules to compute the present value of Social Security benefits, but we do not compute dependent and survivor benefits.

[24] Since the match rate for earlier pensions was only 35%, we do not focus on exit from earlier jobs. If DB pensions encouraged some HRS respondents to leave their main job before they were first observed 1992, sample selection would bias our estimates downward.

[25] In a probit estimating the likelihood of getting pension data, the pseudo R-squared was 0.1164. The likelihood of a match rose with education, firm size, the value of self-reported pension assets, and working in a non-manufacturing firm, and fell with personal assets and earnings.

participate.[26] This might bias the results if, for example, people who intend to retire later do not contribute to their 401(k); we address some concerns about endogenous participation by estimating a specification that omits a measure of voluntary DC contributions.

Employers reported the plan parameters that determine DB pension wealth.[27] DC plan balances were not reported by employers, so the HRS imputed DC pension wealth from data on employer contributions, match rates, and compulsory and voluntary employee contributions. Gustman and Steinmeier recommended using these imputed values rather than self-reported plan balances, since respondents made frequent reporting errors. Still, because imputed values tend to overstate DC pension wealth when plans allow voluntary contributions, they proposed a correction for this which we try as well.[28]

B. Characteristics of workers and pensions

Table 1 compares full-time employees with different types of pensions in the first wave in 1992.[29] We focus on those who appear in columns (1), (2), and (3); these are 1,528 people who have a DB and/or a DC plan in which they participate, and for whom the HRS obtained private and public pension data. Among them, 62% have only DB plans, 20% have only DC plans, and 18% have both types or a combination plan.[30]

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[26] Using different data, Poterba, Venti, and Wise (1995) estimated the effect of 401(k) *eligibility*, rather than the endogenous effect of 401(k) participation, on saving. We could do something similar if we limited the sample to workers with a DB plan and compared those who are additionally eligible or not for a DC plan; Webb (2002) used the HRS to analyze saving in this way. However, we would not learn a great deal about retirement, since our results are driven by the presence or absence of a DB plan, not a DC plan.

[27] In calculating the present value of future DB pension wealth, we modified the HRS program to discount DB pension wealth by age-specific survival probabilities.

[28] The correction is based on regressing the ratio of self-reported to employer-reported values on the log of the employer-reported value and its square.

[29] We will refer to our sample of full-time employees as "workers" in the rest of the paper for ease of exposition. Additional sample selection criteria are mentioned in the notes to Table 1.

[30] This sample is considerably larger than in earlier pension studies. Most researchers used data on one or a few firms, while Samwick (1998) used a sample of 520 employees from the 1983 SCF. The proportions with different types of pension plans differ from Gustman and Steinmeier (1999) because of our focus on DC participation, rather than eligibility, as described earlier.

People with different types of pensions are quite similar, except in three dimensions; we control for these differences in the regressions, and they do not influence the estimated effect of pension incentives on retirement. First, people with only a DC plan have average job tenure of 14 years, compared to 18-19 for others. This difference is related to the recent spread of DC plans in new jobs. Second, 55% of individuals with stand-alone DB plans are employed in professional or related services or public administration, compared with 29-33% of those with DC or combined plans. Third, pension wealth differs systematically across plans. People with combined plans have the highest pension wealth, with a median of $345,156 if they retire at age 65 – higher than the sum of the median stand-alone DB plan and the median stand-alone DC plan. In contrast, non-pension wealth is similar across pension type, with median financial assets lying in the range of $22,000-26,300. We would not expect to find this similarity if workers select into pension types based on differences in retirement preferences, which should also lead to differences in life-cycle saving behavior.

In other dimensions as well, people with different pension types are otherwise similar. Median earnings across pension type lie in the range of $30-33,000. Education and occupation differ, but not by a great deal. People who attended college comprise 52% of those with DB plans only, 49% with DC plans, and 57% with combination plans, while skilled workers (in management, professional, or technical jobs) comprise 40%, 44%, and 42%, respectively.

Another 1,527 people reported having a pension but were not matched to their private pension or Social Security data. They are slightly less educated and more likely to be in blue collar jobs. 1,332 people reported having no pension. They are even less skilled and are substantially poorer. We omit both groups from the analysis because we do not feel confident explaining who has a pension or pension data.

Pension characteristics are reported in Tables 2 and 3. In these tables, and in our regressions, we convert the data on individuals in columns (1)-(3) of Table 1 into person-age cells, so each observation represents an individual at a given age.[31]

As expected, DC pension accruals are very smooth. In Table 2 the median of pension accruals for men is consistently around $4-5,000, regardless of retirement age, or around $3-4,000 when an estimate of voluntary contributions is excluded. Women with DC plans have lower levels of voluntary and mandatory contributions.

In contrast, the median DB pension accrual is highest at age 54, when the early retirement date is reached in many plans. Median accruals turn rapidly negative after age 61, when many plans begin to pass their normal retirement date. Women with DB plans experience positive pension accrual at later ages because of shorter job tenure and longer life-expectancy. Patterns of accrual in the DB and DC components of combined plans resemble those of stand-alone plans. Lastly, it is worth emphasizing the considerable variation in the pattern of DB pension accruals across the sample, as indicated by the 25th and 75th percentile values of pension accruals shown in Table 3.

Table 4 shows the proportion of the sample from columns (1)-(3) of Table 1, at each age, who voluntarily leave their 1992 job and retire by 1998. Altogether, 39% of those in our sample leave their job. Workers with a DB or combined plans exit at higher rates than workers with only a DC plan. At ages 55-59, 4.4% with a DB plan and 5.2% with a combined plan leave their job each year, on average, compared to 2.2% with a DC plan. At ages 60-62 the statistics were 11.8% with a DB plan, 8.7% with a combined plan, and 6.3% with a DC plan. This key distinction across pension types emerges in the estimation results below.

[31] We exclude observations of people aged 51 and 52 for ease of computation. Few retire or reach key swings in pension accrual at those ages.

III. ESTIMATING THE IMPACT OF PENSIONS ON RETIREMENT

Descriptive statistics confirm that both pension wealth accruals and job exit vary with pension type. This section reports estimates of the effect of pension accruals on retirement, controlling for pension wealth and other characteristics.

A. Estimation strategy

We have chosen a straightforward estimation approach. This has the advantages that we avoid strong assumptions about the functional form of utility, and that the source of identifying variation from pension incentives is clear. We pool observations on full-time employees with pensions at each age between the years 1992 and 1998.[32] In most of our specifications, our left-hand side variable is a binary indicator for whether a worker leaves a pensioned job voluntarily (not due to layoff or plant closure) from one age to the next and fully retires.[33] We focus later on exits to another job. We estimate probits with Huber-White standard errors adjusted for person-level clustering and use the HRS-provided person-level analysis weights.[34]

On the right-hand side, our key variable is the peak value measure of pension accrual (discounted peak minus current pension wealth, or zero if past the peak), introduced by Coile and Gruber (2000). Although they did not, we test for a nonlinear effect of peak value, and we add an indicator for being at or older than the peak, since peak value is set to zero after accruals turn negative. We allow separate effects of peak value in DB plans and in the DB component of combined plans. Similarly, we allow separate effects of pension wealth from DB, DC, and combined plans, in case differences in pension structure (such as the annuitization of DB pension

[32] Again, we will refer to full-time employees as "workers". Additional sample selection criteria are mentioned in the notes to Table 5.

[33] In contrast to our annual approach, Gustman and Steinmeier (1999) tracked employment changes and pension accruals by wave (i.e., over two years), which introduces some imprecision since pension accruals can varyannually.

wealth) imply different response to the same value of pension wealth. Furthermore, we include separate dummy variables for each pension type, in case other pension characteristics are related to retirement. We normalize pension variables by earnings.[35] We experiment with indicators for being at the early or normal DB retirement dates, in case such institutional details matter, and add indicators for employers matching employee contributions to DC plans, since that discourages retirement, and for employers offering a temporary early retirement "window plan".

We control for a variety of other influences on retirement, including earnings, Social Security peak value and wealth, on-the-job and post-retirement health insurance coverage, and non-pension financial assets and home ownership. We control for employer size, industry, unionization, occupation, education, and tenure, which are potentially correlated with pension structure. In addition, we include dummies for recent hospitalizations, gender, marital status, race, and age.

B. Estimation results

Table 5 reports marginal effects from probit estimates for several specifications. The dependent variable is whether a person voluntarily leaves his or her 1992 job and retires at a particular age, so a positive coefficient indicates a higher probability. The basic specification in 5.1 follows the literature by including pension wealth and a measure of pension accrual. The specification in 5.2 adds dummies for being at or past the age of peak pension wealth (when peak value is zero) and the pension's normal retirement date. Our preferred specification in 5.3 adds a quadratic in peak value.

We find that both private and public pension accruals influence retirement. In all three

[34] Coile and Gruber (2000) also estimated probits on annual retirement hazards. They found that results from a Cox proportional hazards model were virtually identical.

specifications, peak value is significant at the 5% level for workers with DB plans and also for workers with combined plans. Peak value has a larger effect in combined plans, but the differences across pension type are not statistically significant. In specification 5.2, holding all other variables constant, having the mean DB (combined) peak value instead of a peak value of zero reduces the annual retirement hazard by 1.1 (3.6) percentage points for ages 55-59, or a 20% (36%) reduction compared to the observed hazard. The quadratic terms in peak value are significant in specification 5.3, and allowing for nonlinear effects actually increases the overall effect of peak value, both at the center of the distribution and at the first and third quartiles. Now, having the mean DB (combined) peak value reduces the retirement hazard by 1.7 (3.8) percentage points for ages 55-59, or a 29% (37%) reduction compared to the observed hazard.[36] It should be noted that we control for tenure, age, and earnings, which are key determinants of peak value, so the estimated effect of peak value does not reflect their impact on retirement.

Peak value is not economically meaningful after pension wealth peaks, so it is set to zero. Therefore, we added dummy variables in 5.2 and 5.3 to capture the disincentive effect of declining pension wealth. Being at or older than the DB peak raises the retirement hazard by 1.21 percentage points in 5.3, but the estimate fall a little short of statistical significance, and it is far from significant for combined plans.

We also experimented with controls for being at the DB pension's early or normal retirement date. The results indicate that institutional factors sometimes affect retirement. In estimates that are not shown, we found no spike in quits at the early retirement date (ERD) when

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[35] The "option-value" measure of pension accrual in Samwick (1998) implicitly weighs pension income by earnings. We also control for earnings separately.

[36] Cubic terms in peak value are not statistically significant. We tried normalizing peak value by years to peak, but the resulting coefficients are insignificant, as peak value and years to peak are highly correlated. This shows that peak value captures the key pension incentives.

reduced pension benefits are first available. The ERD generally occurs early, often around age 55, when we observe few retirements. On the other hand, being at the normal retirement date (NRD) significantly raises quits among DB people; it lowers quits among combined people, though not significantly. The lack of significance among combined people may arise in part because the NRD tends to occur later in combined plans, and fewer people in our sample have reached the later NRD. The NRD is 60 or younger in 35% of stand-alone DB plans, compared to 21% of combined plans. One reason is the greater proportion of stand-alone DB plans in professional services and public administration; these plans have an earlier average NRD. Nevertheless, controlling for industry did not affect the estimation results. Taken together, these findings suggest that institutional factors and social norms involving the NRD play a role for people with stand-alone DB plans, which tend to have an earlier NRD.

To continue, we allowed the effect of pension wealth to vary by pension type. We find a significant and positive, though economically quite small, effect of DB wealth on DB people and, in 5.1, of DC wealth on combined people. Coefficients on the other pension wealth variables have similar magnitudes but are not statistically significant.[37] Samwick (1998) and Coile and Gruber (2000) also found weak effects of pension wealth. The results suggest that differences in other pension characteristics which we are not controlling for directly (the lack of annuitization in DC pensions, for example) do not significantly affect retirement.

Other pension characteristics which we control for do not have a major impact. Notably, the dummies for pension type are not small but they are far from significant, so the impact of pension type is captured primarily by the differences in accrual and wealth patterns. Indicators for employers matching employee contributions to DC plans or offering early retirement

"window" plans are not statistically significant. We tried other specifications that did not yield significant results and are not shown. For example, we found no evidence of a spike in retirement for DC people at ages 59 and 60, when 401(k) withdrawals no longer suffer tax penalties, or of other pension-related differences in retirement by age.[38] Retirement hazards of people who report investing their DC plan partly or mostly in stocks were not significantly different; this variable was not included in our main specification because portfolio choice is potentially endogenous. A measure of subjective life expectancy was not significant and did not alter the estimated effect of DB plans, although annuitization makes DB pensions more valuable to those who are risk-averse and lack a strong bequest motive.

As with private pensions, Social Security incentives significantly affect retirement. Social Security peak value reduces the retirement hazard by 1-2 percentage points for people in their late 50s, evaluated at the sample means; the impact is similar to peak value of private pension plans.[39] Although we allowed the effect of Social Security accruals to vary by private pension type, the responses are very similar – suggesting that people with DC plans react in the same way when faced with DB-type incentives as people with DB plans react.

It is important to note that industry, unionization, job tenure, and firm size do not significantly influence retirement, though they are related to pension type. Leaving these variables out of the regression also has little effect on the pension estimates. Briefly, other control variables have the same qualitative impact on retirement found in a great deal of previous research. The retirement hazard rises with age, especially after 60. Higher financial assets are

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[37] Adjusting DC pension wealth for the tendency to overestimate pension wealth in plans that allow voluntary contributions, using the method proposed by Gustman and Steinmeier (1999) and discussed earlier, leads to larger but still insignificant coefficients.

[38] Thus, allowing for distinct age dummies by pension type does not alter the estimated effect of peak value. A spike in DB retirements at age 55 is the only significant difference by age; it is apparently related to the importance of the NRD in stand-alone DB plans, mentioned earlier.

[39] Coile and Gruber (2000) found responses of a similar magnitude to Social Security.

associated with significantly earlier retirement, so that a 10% increase in financial assets raises the hazard by about 0.6 percentage points. People with zero financial assets tend to retire earlier too, an anomalous result found in other research using the same data.[40] Higher earnings lead to highly significant, though small, delays in retirement; an additional $10,000 in earnings reduces the hazard by about 0.25 percentage points.[41] When an employer provides health insurance for workers but not retirees, a worker is about a percentage point less likely to retire. People with more education are less likely to retire. Many of the other variables fall short of statistical significance, but the estimates should grow more precise as the sample ages and more individuals retire.[42]

In sum, the estimates demonstrate that differences in pension accrual patterns alter retirement, as we hypothesized. Sharp spikes in DB pension accruals influence the timing of retirement, compared to smooth DC accruals. We discuss some additional specifications next and then analyze whether the shift in pension structure led to earlier or later retirement.

C. Additional specifications

This section reviews additional results shown in Table 6. We build on specification 5.3 and try using a different discount rate, excluding voluntary DC contributions, estimating the impact of pensions on people taking a new job, and separating the sample by gender.

In 6.1 we experiment with a discount rate of 5%, rather than 3%, in case people behave impatiently. As Samwick (2000) pointed out, observed patterns of aggregate saving and wealth holdings are consistent with a relatively high discount rate. In this case, a high discount rate

[40] Friedberg (2003). Omitting the wealth variables from the specification, based on the argument that they are endogenously determined with retirement, does not alter the estimated effect of the pension variables.
[41] We tried including a measure of recent earnings growth in order to capture the shape of the earnings profile; it did not have a significant effect.

reduces the present value of future pension accruals and hence the age of peak value. Since we observe low retirement hazards at younger ages, this reduces the magnitude of the peak value variables, and it increases those of the pension type and past-the-peak variables. Thus, using a higher discount rate does not increase the explanatory power of the pension accrual variables.

Another concern is that voluntary DC contributions are endogenously determined with retirement. Since the HRS does not distinguish between voluntary and compulsory contributions, we tried subtracting all employee contributions from pension wealth when plan rules allow for voluntary contributions. In the resulting estimates in 6.2, DB pension variables continue to have a similar effect, whether or not someone has voluntary contributions in a DC plan. Thus, later retirement by workers with DC plans is not explained by endogenous voluntary contributions; we see, as before, that it is explained by the absence of DB pension accruals.

In this sample, 73% of quits result in retirement. In 6.3, the dependent variable is defined as a job change, and retirements are now excluded. The pension variables are insignificant for this sample, suggesting that a fuller understanding of job changes must await an investigation of the new jobs taken by those who quit.[43]

Lastly, retirement patterns differ somewhat for men and women in estimates that are not shown. The influence of peak value has a similar magnitude by gender, but it has greater statistical significance for women. Pension wealth tends to have smaller effects for women. Women react more strongly to the DB normal retirement date, which accounts for its significance in the earlier regressions. Building on the explanation offered earlier, these differences seem to arise because DB plans in some sectors (especially professional services and public administration) have an earlier average NRD which is more likely to have been reached,

[42] Recent hospitalization does not significantly affect retirement. Including self-reported disability instead significantly raises the retirement hazard, but this variable may be correlated with unobserved retirement preferences.

and women are more likely to work in those sectors. Lastly, simply having a DB or combined plan leads women to retire earlier. Obviously, career paths of men and women clearly differ along many dimensions – only some of which are captured by differences in pension wealth – and warrant future investigation.

D. The aggregate impact of the decline in DB plans

Since DB pensions encourage people to work until a certain date and then to retire, the shift towards DC pensions may lead to either earlier or later retirement. We use simulations, based on our preferred specification in 5.3, to understand the impact of pension structure on retirement. We also compare our simulation results to recent trends in retirement.

Figure 2 shows predicted labor force participation rates at each age for workers in our sample who have DB pensions.[44] It compares the predicted participation rate when workers have their own DB pensions to predictions if they instead had a typical DC plan. Differences in the underlying predicted retirement hazards arise entirely because of differences in pension characteristics.[45]

Forecasted participation rates begin to diverge after age 55 as some DB plans reach their early or normal retirement dates, though retirement hazards remain low (under 5% per year) for both pension types until around age 60. At that point, retirement of workers with DB plans accelerates, as many pass their peak pension value. The difference in retirement hazards by pension type exceeds 5 percentage points at ages 62 and up, resulting in a substantial difference

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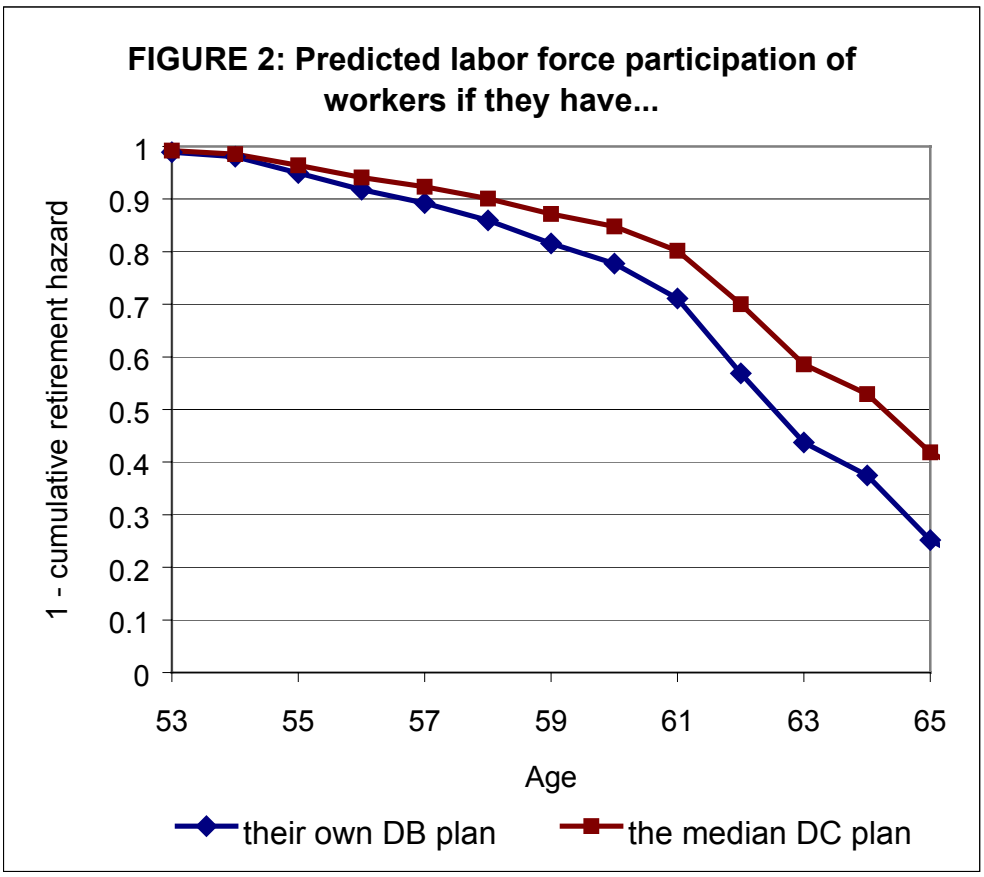
[43] The HRS has not collected pension data from new employers.

[44] Recall that these are predicted participation rates for people who are in pensioned full-time jobs at ages 51-61 and will either stay in their pensioned jobs or retire fully.

[45] To characterize the typical DC plan, we use median pension wealth at age 53, augmented with the median of pension wealth accrual at each subsequent age. We chose to allow other pension characteristics to differ as well, on the assumption that a change in pension type typically involves a change in pension wealth, etc.; however, pension wealth has a very small effect on the retirement hazards. Other right-hand side variables are assigned their mean values.

in cumulative labor force participation. The median retirement age is 62 years and 6 months for workers with DB plans, versus 64 years and 3 months if instead they have DC plans, a difference of 21 months. We tried a similar exercise for workers with combined DB and DC plans. Predicted retirement hazards for workers with combined plans yield a median retirement age of 62 years and 8 months, versus 63 years and 9 months if they only retain their DC plans.



We are also interested in understanding the impact on aggregate retirement patterns of the recent shift in pension structure. However, there is no consistent data source that reports past changes in pension structure, and of course we must make inferences about future changes. We will therefore rely on information from a few data sets. For older workers (i.e., full-time employees) in the 1980s, we use employer-reported data on pensions from the Survey of

Consumer Finances (SCF) Pension Provider Supplement in 1983, and for younger workers in the 1990s, we use individual-reported data from the 1995 SCF.[46] That allows us to establish trends in pension coverage starting with workers who were aged 53-57 in 1983 and finishing with workers who were aged 33-37 in 1995 and will be 53-57 in 2015.[47] To determine pension coverage of workers aged 53-57 at an intermediate date, we try both employer-reported data from the 1992 HRS and individual-reported data from the 1995 SCF. Using the former yields a small past decline in DB pension coverage and a large future decline, while using the latter yields a larger past decline and smaller future decline.

The resulting predictions are shown in Table 7.[48] We assume no further change in DB coverage as workers aged 33-37 in 1995 get older, nor any change in typical DB pension provisions.[49] Our data sources imply a 41.3 percentage point decline in DB pension coverage among all workers aged 53-57 between 1983 and 2015, from 64.0% to 22.7%, and a 44.9 percentage point decline among pensioned workers. This implies a 10 month increase in the median retirement age of *pensioned* workers aged 53-57 over this period; or, equivalently, an increase in the predicted employment rate of pensioned workers from 59% to 65% at age 62 and from 31% to 45% at age 65. Based on data from the 1992 HRS, that 10 month increase consists of a gain of 1 month between 1983 and 1992 and 9 months between 1992 and 2015. Based instead on data from the 1995 SCF, it consists of a gain of 7 months between 1983 and 1995 and 3 months between 1995 and 2015. These forecasts follow directly from the simulation results

[46] The SCF has surveyed a cross-section of households every three years since 1983. In 1983 the SCF also collected pension data from the employers of respondents. While employer-reported data is more accurate, as Gustman and Steinmeier (1999) noted, there is no source for younger workers in the 1990s. We use the 1995 instead of 1998 data because it is closer in time to the HRS data in 1992.

[47] We chose those age groups in order to observe long-term trends in pension structure because those aged 53-57 are representative of older workers but have not yet begun retiring in large numbers, and those aged 33-37 are representative of younger workers but have already settled into relatively long-term jobs.

[48] Again, these are predicted participation rates for people are in full-time jobs at ages 51-61.

[49] Detailed evidence in Mitchell (1999) shows only minor changes during the 1990s.

discussed above. Since having a DB plan reduces the median retirement age by about 21 months, then, if DB coverage fell by 20 percentage points, that suggests an increase in the median retirement age of about 4 ½ months.

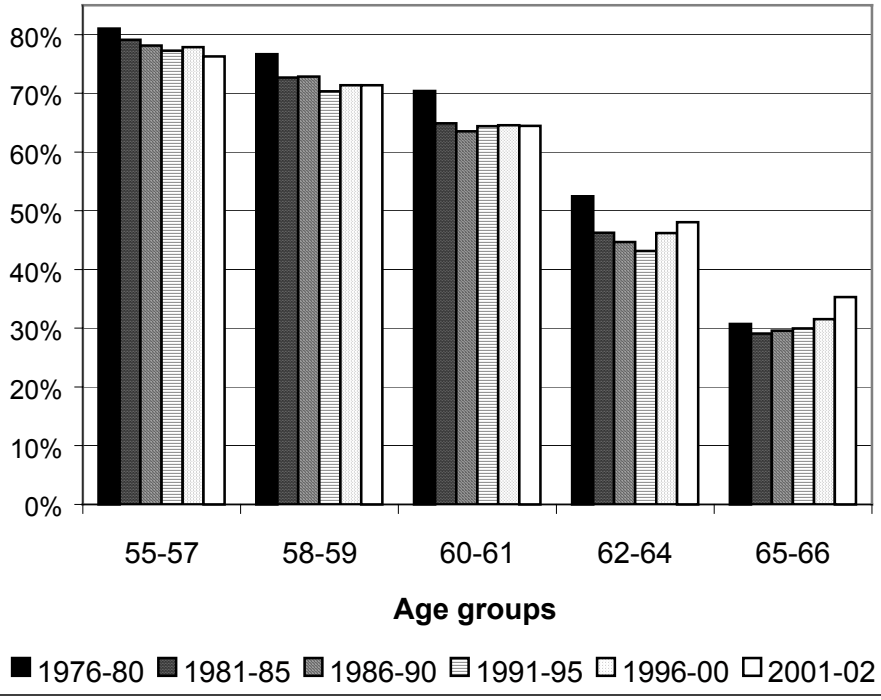
In order to make projections for all workers in full-time jobs at ages 51-61, we have to take into account that, as DB pension coverage drops, some workers gain DC pensions and others have no pension.[50] We have to make some assumption about retirement behavior among those with no pension, even though our estimates do not offer any guidance about them. We report predictions under two possible assumptions. One is that the increased numbers without a pension will behave like workers with no pension in the 1992 HRS who are retiring later, on average, than workers with DB or DC plans; this assumption yields a jump of 13 months in the median retirement age of all workers aged 53-57 between 1983 and 2015, consisting of 3 (7) months early on and 10 (6) months later, based on the 1992 HRS (1995 SCF) data. The overall increase in the median retirement age of 13 months corresponds to a gain in the predicted employment rate from 61% to 67% at age 62 and from 37% to 50% at age 65. Another assumption is that they will behave like workers with DC plans, or alternatively that they will get a DC plan as they age; this assumption yields a jump in the median retirement age of all workers aged 53-57 of roughly 9 months, consisting of a little under 2 (6) months early on and a little under 8 (4) months later. The increase in the median retirement age of 9 months corresponds to a gain in predicted employment from 64% to 71% at age 62 and from 38% to 52% at age 65.

It is important to keep in mind that we cannot directly test how our simulated retirement rates match data reported in other sources, which do not distinguish the sample that was in full-

[50] Overall pension coverage in 1995 was lower for workers aged 33-37 than for workers aged 53-57. This probably reflects both an age effect that disappears as the cohort grows older and a time effect due to trends in pension coverage. We infer this because there was also an age differential in pension coverage in 1983, though it was smaller, and because pension coverage of older workers also fell between 1983 and 1995, though by less.

time jobs at ages 51-61. Nevertheless, we can observe general trends in employment rates, which are shown in Figure 3 for older men in the Current Population Survey.[51] We would expect to see increases in employment rates at ages when DB plans typically induced retirement; at ages 62-63, average accruals in DB plans in our HRS sample turned negative, according to Table 2. This is what Figure 3 shows, with the employment rate at ages 62-64 rising from 44.7% in the late 1980s and 43.2% in the early 1990s to 46.2% in the late 1990s and 48.1% in the early 2000s. Increases of a similar magnitude occurred for men aged 65-66. In order to control crudely for aggregate trends, we might contrast those increases with slight declines in employment observed for men in their late 50s.

FIGURE 3: Employment rate, men



[51] We focus on men because of major secular increases in labor supply of older women since the 1980s. Employment rates are computed using the basic monthly weights from March CPSs. Using multiplicative adjustment factors that account for changes in the employment series due to the 1994 redesign yields almost the same results (Povlika and Miller 1998).

In sum, major changes in pension structure can be expected to raise the median retirement age of pensioned workers by 10 months, and the median retirement age of all workers by 9-13 months, when comparing the cohort aged 53-57 in 1983 with the cohort aged 53-57 in 2015. This response stands in sharp contrast to the trend towards earlier retirement that ceased in the early 1980s, and it can help explain increases in employment rates among people in their 60s since then.

IV. CONCLUSIONS

While an extensive literature has analyzed the savings effects of DC pensions, we focus on retirement. We have found substantial changes in retirement patterns resulting from the spread of 401(k) and other DC plans in place of DB plans. These changes arise because of major differences in the accrual of pension wealth – pension wealth in DC plans accrues smoothly, while pension wealth in traditional DB plans spikes sharply at older ages and turns negative afterwards. While we expected to find smoother retirement rates for workers with DC plans compared to workers with DB plans, this does not allow us to predict *a priori* whether that would reduce the average retirement age, if DB plans constrain workers to retire later than they would otherwise; or raise the average retirement age, if DB plans constrain workers to retire earlier.

Our estimates show that workers with DC plans are retiring significantly later. Retirement patterns begin to diverge at around age 55 and accelerate around age 60, when most workers with DB plans begin to experience negative accruals. While endogenous selection into jobs with different pensions remains a concern, we find that older workers with different types of pensions are quite similar in their observable characteristics, and controlling for variables that may relate to selection does not alter the estimation results.

Thus, we conclude that the spread of DC pensions helps explain why employment rates have recently risen among people in their 60s, after decades of decline. Our results suggest that these trends will continue, as younger workers who increasingly have DC pensions approach retirement.

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TABLE 1
Characteristics of workers, 1992

	(1) DB only	(2) DC only	(3) Combined, DB and DC	(1)-(3)	(4) DC-eligible nonparticipants	(5) Has pension, no data	(1)-(5)	(6) No pension
N	948	304	276	1528	47	1527	3102	1332
mean birthyear	1937	1936	1937	1937	1936	1937	1937	1936
female	0.45	0.42	0.37	0.43	0.47	0.42	0.43	0.50
married	0.76	0.77	0.76	0.76	0.82	0.73	0.75	0.67
poor health	0.07	0.07	0.07	0.07	0.01	0.07	0.07	0.10
education								
< high school	0.11	0.15	0.07	0.11	0.09	0.16	0.13	0.28
completed HS	0.37	0.36	0.36	0.37	0.42	0.39	0.38	0.42
some college	0.52	0.49	0.57	0.52	0.49	0.45	0.49	0.30
occupation								
unskilled	0.37	0.31	0.32	0.33	0.30	0.39	0.36	0.54
semi-skilled	0.23	0.25	0.26	0.25	0.30	0.25	0.25	0.26
skilled	0.40	0.44	0.42	0.43	0.40	0.36	0.39	0.21
industry								
agric,mining, construction	0.04	0.07	0.03	0.04	0.08	0.07	0.06	0.10
manuf, trsprt	0.32	0.29	0.44	0.33	0.19	0.38	0.35	0.24
prof services, public admin	0.55	0.33	0.29	0.46	0.54	0.32	0.39	0.23
trade, non-prof services	0.09	0.31	0.24	0.17	0.19	0.24	0.20	0.43
mean job tenure	19	14	18	18	10	16	17	8
median earnings	32,000	30,000	33,000	31,500	28,000	29,000	30,000	15,500
owns home	0.90	0.87	0.89	0.89	0.80	0.86	0.87	0.73
median financial assets	22,000	25,500	26,300	23,100	25,000	22,000	23,000	5,000
pension wealth at age 65								
25% quartile	89,920	49,109	160,354	-	-	-	-	-
median	203,949	102,298	345,156	-	-	-	-	-
75% quartile	384,378	230,946	647,207	-	-	-	-	-

Data: Health and Retirement Study, wave 1, 1992.
Sample: People who in 1992 were aged 51-61, worked at least 30 hours per week, were not self-employed, were in households containing a financial respondent; and who were observed in wave 2 and did not leave their jobs involuntarily by wave 2.
Notes: The estimates use person-level analysis weights. Those in column (4) told the HRS they had a pension but had zero DC assets and no DB pension. Those in column (5) said they had a pension, but the HRS was unable to obtain data on their pension or Social Security. Those in column (6) said they had no pension. Skilled occupations include management, professional, and technical jobs; semi-skilled include clerical and sales; and unskilled include all others.

TABLE 2
Median of pension wealth accruals, as the retirement age changes

Retirement age:	DB only Total	DC only Total	DC only Excluding voluntary contributions	Combination Total	Combination DB component	Combination DC component
Men						
53	6,381	4,811	3,114	12,276	6,079	4,353
54	8,734	4,763	3,164	20,955	14,387	4,707
55	5,416	5,110	3,052	13,321	7,101	4,870
56	5,275	5,542	3,474	13,882	7,137	5,069
57	4,748	5,522	3,580	14,031	6,083	5,175
58	4,764	5,017	3,696	13,652	6,362	5,317
59	4,595	5,755	3,848	12,690	6,407	5,471
60	2,849	5,856	3,981	10,280	3,578	5,612
61	2,614	5,972	4,086	8,683	3,020	5,745
62	137	5,901	4,109	7,258	1,127	5,865
63	-798	5,973	3,982	6,622	-104	5,747
64	-1,527	5,932	4,040	5,988	-1,273	5,572
65	-3,267	5,612	3,745	2,483	-3,237	5,174
66	-4,086	5,263	3,627	1,111	-4,372	4,909
Women						
53	5,155	1,903	1,443	8,834	4,920	2,114
54	5,714	2,007	1,522	8,314	5,814	2,285
55	5,449	2,115	1,763	7,409	4,045	2,408
56	5,716	2,192	1,922	8,537	4,092	2,933
57	6,147	2,392	1,940	8,277	4,755	2,636
58	6,540	2,843	1,980	9,274	4,791	2,743
59	5,956	2,946	2,136	9,923	5,556	2,760
60	3,853	2,991	2,204	6,570	3,670	2,644
61	3,656	3,174	2,290	6,336	3,340	2,824
62	2,661	3,293	2,360	5,388	2,261	2,703
63	1,927	3,385	2,358	5,520	2,201	2,908
64	1,074	3,472	2,394	5,437	1,939	2,907
65	424	3,552	2,463	3,702	604	2,960
66	-186	3,532	2,486	3,179	216	2,865

Data: Health and Retirement Study.
Sample: Person-age observations of individuals from the sample appearing in columns (1)-(3) of Table 1, excluding observations below the age of 53 and excluding job exits that were involuntary or that were to another job, rather than to full retirement; this yields the same sample as that used in the estimation results in Table 5.
Notes: Pension wealth is defined as the value of the pension if workers leave their jobs at each particular age. Pension wealth accrual is the discounted change in pension wealth gained by working one more period and then leaving.

TABLE 3
More statistics on pension wealth accrual

Quartile values	DB 25%	DB 75%	DC 25%	DC 75%	Combination 25%	Combination 75%
Retirement age:						
Men						
53	2,083	14,454	3,017	10,413	6,592	20,767
54	1,724	21,191	2,777	9,829	9,577	60,340
55	2,094	12,173	3,224	10,260	7,387	20,811
56	1,913	10,953	3,440	10,676	6,597	22,800
57	1,349	10,342	2,988	10,411	7,614	24,154
58	789	9,868	2,790	11,138	7,123	23,062
59	239	10,236	2,892	10,703	6,403	27,330
60	-622	6,690	2,884	10,914	5,341	18,608
61	-1,686	6,911	3,075	11,256	3,576	17,973
62	-2,783	3,909	3,159	10,591	3,012	15,455
63	-4,716	2,915	2,971	10,727	1,654	13,950
64	-6,521	2,660	3,188	10,661	449	12,905
65	-9,008	369	3,000	9,625	-1,721	7,288
66	-10,959	-39	2,875	9,343	-3,050	5,624
Women						
53	1,917	11,056	1,265	3,547	4,521	16,820
54	1,417	14,174	1,244	4,049	6,415	17,629
55	1,998	9,670	1,324	4,195	4,090	13,454
56	2,060	10,253	1,371	4,941	4,553	15,124
57	2,333	10,886	1,487	5,340	4,528	16,767
58	2,454	11,225	1,673	5,525	4,616	14,672
59	2,349	12,285	1602	6,431	4,832	15,503
60	1,486	7,269	1,718	5,995	3,580	12,525
61	1,298	7,426	1,886	6,226	3,673	12,206
62	821	5,149	1,909	6,341	3,431	9,299
63	129	4,209	1,859	6,670	3,265	8,798
64	-204	4,235	1,921	6,644	2,883	8,759
65	-1,571	1,708	1,958	6,967	1,738	6,702
66	-2,779	1,187	1,919	6,698	959	5,488

See Table 2 notes.

TABLE 4
Annual retirement hazard rates, 1992-1998

	(1) DB only	(2) DC only	(3) Combined, DB and DC	(1)-(3)	(4) DC-eligible nonpar-ticipants	(5) Has pension, no data	(1)-(5)	(6) No pension
Men								
53	2%	0%	0%	1%	0%	2%	1%	2%
54	1	0	2	1	0	1	1	0
55	3	1	6	3	0	3	3	2
56	4	1	6	4	0	4	4	1
57	5	1	3	4	0	2	3	2
58	3	6	7	5	0	3	4	0
59	6	2	9	6	5	5	5	4
60	5	3	6	5	0	7	6	3
61	11	7	9	10	17	5	7	2
62	27	15	11	22	0	18	20	14
63	23	31	22	25	0	16	21	9
64	19	0	10	13	0	8	10	7
65	24	19	48	26	0	19	22	15
66	18	0	0	12	0	0	6	4
Total	37	25	33	34	8	25	30	16
Women								
53	3%	0%	0%	2%	0%	1%	1%	0%
54	2	1	1	2	0	0	1	0
55	6	0	5	5	0	1	3	0
56	5	2	5	4	0	1	3	1
57	3	1	4	3	5	1	2	1
58	3	3	5	3	5	2	3	0
59	7	3	2	5	0	3	4	1
60	7	2	6	6	12	6	6	2
61	9	5	7	8	0	6	7	4
62	15	12	18	15	36	14	15	8
63	20	10	9	16	7	14	15	12
64	13	8	27	14	0	22	17	2
65	29	20	21	25	48	27	27	7
66	21	28	32	24	0	38	29	5
Total	40	19	25	26	39	16	23	9

Sample: Same as Table 1.
Details: Retirement hazard rates are computed as the percentage who are working at one birthday and have left their pensioned job and retired fully by the next birthday. The sample excludes quits by people who take another job, as well as involuntary job exits due to layoff or plant closure.

TABLE 5-A
Regression results:
Coefficient estimates on pension variables

Dependent variable: leaves one's job	5.1	5.2	5.3
Pension variables:			
has a: DB plan	0.0131	0.0090	0.0114
	(0.0121)	(0.0124)	(0.0124)
combined plan	0.0213	0.0254	0.0324
	(0.0223)	(0.0232)	(0.0251)
peak value / earnings: DB plan	-0.0084**	-0.0068**	-0.0106**
	(0.0034)	(0.0034)	(0.0044)
DB portion of combined plan	-0.0163**	-0.0171**	-0.0284**
	(0.0076)	(0.0078)	(0.0110)
(peak value / earnings)^2: DB plan	-	-	0.0008**
			(0.0004)
DB portion of combined plan	-	-	0.0041*
			(0.0022)
at or older than peak value: DB plan	-	0.0140	0.0121
		(0.0100)	(0.0098)
combined plan	-	0.0096	0.0060
		(0.0211)	(0.0200)
at normal retirement date: DB plan	-	0.0227**	0.0221**
		(0.0133)	(0.0132)
combined plan	-	-0.0230	-0.0234
		(0.0118)	(0.0115)
pension wealth / earnings:	0.00315**	0.00270**	0.00259**
DB plan	(0.00101)	(0.00106)	(0.00107)
DB (combined plan)	0.00151	0.00105	0.00073
	(0.00265)	(0.00294)	(0.00293)
DC plan	0.00085	0.00084	0.00086
	(0.00192)	(0.00192)	(0.00192)
DC (combined plan)	0.00282*	0.00252	0.00253
	(0.00156)	(0.00158)	(0.00159)
DC, employer matches own contributions	0.0031	0.0032	0.0037
	(0.0072)	(0.0072)	(0.0072)
early-out incentive offered	0.0087	0.0094	0.0096
	(0.0106)	(0.0107)	(0.0108)

TABLE 5-B
Regression results:
Coefficient estimates on pension variables

Dependent variable: leaves one's job	5.1	5.2	5.3
Other financial variables:			
earnings / 10,000	-0.0024**	-0.0024**	-0.0025**
	(0.0011)	(0.0011)	(0.0011)
Social Security peak value / earnings:			
private pension is DB only	-0.0146**	-0.0140**	-0.0140**
	(0.0049)	(0.0050)	(0.0050)
private pension is DC only	-0.0197**	-0.0202**	-0.0206**
	(0.0090)	(0.0091)	(0.0091)
private pension is combined	-0.0166*	-0.0170**	-0.0173**
	(0.0087)	(0.0087)	(0.0087)
at or older than peak value: Social Security	-	0.0028	0.0029
		(0.0101)	(0.0102)
Social Security wealth / earnings	-0.00117	-0.00112	-0.00118
	(0.00132)	(0.00135)	(0.00136)
log financial assets	0.0061**	0.0061**	0.0061**
	(0.0014)	(0.0014)	(0.0014)
financial assets = 0	0.0923**	0.0917**	0.0918**
	(0.0416)	(0.0415)	(0.0415)
not a homeowner	-0.0020	-0.0010	-0.0012
	(0.0067)	(0.0067)	(0.0067)
Log likelihood per observation	-0.198	-0.198	-0.197

Sample: Person-age observations of individuals from the sample appearing in columns (1)-(3) of Table 1, through 1998 or until they retire, who are aged 53 and over, and who did not exit their job involuntarily or exit to another job. N = 7965.

Details: The table reports estimated marginal effects from probits, computed at sample means of the right-hand side variables, and, in parentheses, Huber-White standard errors adjusted for person-level clustering. The dependent variable is an indicator for leaving one's job and retiring from one age to the next between 1992 and 1998. The estimates use person-level analysis weights. Significance at the 90% (*) and 95% (**) levels are indicated.

TABLE 5-C
Regression results:
Coefficient estimates on other variables

Dependent variable: leaves one's job	5.3
Other independent variables:	
industry: agriculture, mining, construction	-0.0095 (0.0091)
manufacturing, transport	-0.0037 (0.0057)
professional services, public admin	-0.0057 (0.0081)
firm size: 100-500 employees	0.0077 (0.0101)
>500 employees	0.0044 (0.0054)
tenure: joined employer 1974-85	-0.0024 (0.0051)
joined employer 1986+	-0.0063 (0.0067)
occupation: admin, professional, technical	0.0006 (0.0070)
sales, clerical	0.0048 (0.0074)
union member	0.0043 (0.0051)
has pay and promotion responsibility	0.0102 (0.0067)
health insurance: provided by employer	-0.0091 (0.0078)
employer plan provided to retirees	0.0101* (0.0053)
privately purchased	0.0042 (0.0067)
from Medicare or VA	0.0733** (0.0486)
from Medicaid or other public source	0.0232** (0.0115)
hospitalized: once in last year	-0.0028 (0.0067)
twice or more in last year	0.0036 (0.0126)
education: high-school diploma at least	-0.0037 (0.0079)
more than 12 years schooling	-0.0167** (0.0058)
demographic characteristics: female	0.0017 (0.0111)
married	-0.0093 (0.0098)
married female	0.0121 (0.0131)
black	-0.0021 (0.0064)
hispanic	-0.0009 (0.0103)

age: 54	-0.0062 (0.0152)	61	0.0775** (0.0323)
55	0.0382** (0.0233)	62	0.1800** (0.0503)
56	0.0392** (0.0234)	63	0.2193** (0.0610)
57	0.0218 (0.0201)	64	0.1245** (0.0536)
58	0.0334* (0.0230)	65	0.2572** (0.0795)
59	0.0455** (0.0253)	66	0.1770** (0.0834)
60	0.0325* (0.0230)	67+	0.0433 (0.0848)

TABLE 6-A
Regression results, additional specifications:
Coefficient estimates on pension variables

Dependent variable: leaves one's job	6.1 5% discount rate	6.2 excludes voluntary DC contributions	6.3 Dependent variable: takes a new job
Pension variables:			
has a: DB plan	0.0113	0.0112	0.0016
	(0.0104)	(0.0132)	(0.0105)
combined plan, only voluntary contributions in DC plan	-	0.0714*	-
		(0.0519)	
combined plan	0.0422**	0.0243	-0.0114
	(0.0252)	(0.0284)	(0.0109)
peak value / earnings: DB plan	-0.0086**	-0.0102**	0.0049
	(0.0038)	(0.0045)	(0.0056)
DB portion of combined plan, only voluntary contrib. in DC plan	-	-0.0323*	-
		(0.0166)	
DB portion of combined plan	-0.0253**	-0.0148	0.0177
	(0.0104)	(0.0258)	(0.0140)
(peak value / earnings)^2: DB plan	0.0007	0.0008*	-0.0011
	(0.0004)	(0.0004)	(0.0011)
DB portion of combined plan, only voluntary contrib. in DC plan	-	0.0045*	-
		(0.0027)	
DB portion of combined plan	0.0059**	-0.0004	-0.0059
	(0.0021)	(0.0090)	(0.0047)
at or older than peak value: DB plan	0.0242**	0.0129	-0.0087
	(0.0124)	(0.0101)	(0.0068)
combined plan, only voluntary contributions in DC plan	-	0.0142	-
		(0.0283)	
combined plan	0.0110	0.0058	0.0139
	(0.0182)	(0.0374)	(0.0246)
at normal retirement date: DB plan	0.0215**	0.0223*	0.0028
	(0.0119)	(0.0134)	(0.0116)
combined plan, only voluntary contributions in DC plan	-	-0.0366**	-
		(0.0049)	
combined plan	-0.0243*	-0.0086	(collinear w/ other variables)
	(0.0071)	(0.0252)	
pension wealth / earnings:	0.00330**	0.00299**	-0.00030
DB plan	(0.00085)	(0.00111)	(0.00105)
DB (combined plan), only voluntary contrib. in DC plan	-	0.00063	-
		(0.00393)	

DB (combined plan)	0.00042	0.00216	0.00242
	(0.00294)	(0.00474)	(0.00254)
DC plan	0.00217*	0.00077	-0.00054
	(0.00117)	(0.00357)	(0.00171)
DC (combined plan)	0.00143	0.00170	0.00021
	(0.00114)	(0.00479)	(0.00133)
DC, employer matches own	-0.0030	0.0060	0.0087
contributions	(0.0060)	(0.0078)	(0.0066)
early-out incentive offered	0.0163*	0.0128	0.0117
	(0.0104)	(0.0117)	(0.0097)

TABLE 6-B
Regression results, additional specifications:
Coefficient estimates on pension variables

Dependent variable: leaves one's job	6.1 5% discount rate	6.2 excludes voluntary DC contributions	6.3 Dependent variable: takes a new job
Other financial variables:			
earnings / 10,000	-0.0017*	-0.0018	-0.0005
	(0.0010)	(0.0012)	(0.0009)
Social Security peak difference / earnings:			
private pension is DB only	-0.0104**	-0.0148**	0.0003
	(0.0042)	(0.0051)	(0.0022)
private pension is DC only	-0.0151*	-0.0230**	-0.0001
	(0.0081)	(0.0100)	(0.0050)
private pension is combined	-0.0173**	-0.0213**	-0.0031
	(0.0083)	(0.0094)	(0.0055)
at or older than peak value:	0.0035	0.0037	-0.0029
Social Security	(0.0090)	(0.0105)	(0.0085)
Social Security wealth / earnings	-0.00107	-0.00100	-0.00086
	(0.00114)	(0.00139)	(0.00093)
log financial assets	0.0052**	0.0043**	-0.0000
	(0.0012)	(0.0014)	(0.0011)
financial assets = 0	0.0691**	0.0565**	-0.0041
	(0.0365)	(0.0331)	(0.0107)
not a homeowner	0.0003	-0.0015	-0.0083*
	(0.0060)	(0.0071)	(0.0046)
Log likelihood per observation	-0.172	-0.201	-0.113
Number of observations	7962	7635	7254

See Table 5 notes.
Details: In 6.1, the discount rate used to compute DB pension wealth was set at 5% instead of 3%. In 6.2, DC pension wealth excludes an estimate of voluntary contributions, as described in the text; consequently, we chose to distinguish in the estimation between combined plans with a DC component that only has voluntary contributions and other combined plans. In 6.3, the sample excludes exits to full retirement and includes exits to another job.

TABLE 7
Predicted changes in retirement

Change in retirement attributable to past change in pension structure

	Workers aged: 53-57 in 1983	Workers aged: 53-57 in 1992	Workers aged: 53-57 in 1983	Workers aged: 53-57 in 1995
data source	SCF	HRS	SCF	SCF
respondents	employers	employers	employers	workers
actual pension structure				
% DB, combined	64.0	55.4	64.0	38.5
% DC only	12.0	13.6	12.0	32.4
% no pension	24.0	31.1	24.0	29.2
predicted change in median retirement age:				
over the time period:	1983-1992		1983-1995	
among workers with a pension:	+1 months		+7 months	
among all workers, if those with no pension behave like:				
those with no pension today	+3 months		+7 months	
those with a DC plan today	+2 months		+6 months	

Change in retirement attributable to future change in pension structure

	Workers aged: 53-57 in 1992	Workers aged: 33-37 in 1995	Workers aged: 53-57 in 1995	Workers aged: 33-37 in 1995
data source	HRS	SCF	SCF	SCF
respondents	employers	workers	workers	workers
actual pension structure				
% DB, combined	55.4	22.7	38.5	22.7
% DC only	13.6	35.0	32.4	35.0
% no pension	31.1	42.3	29.2	42.3
predicted change in median retirement age:				
over the time period	1992-2015		1995-2015	
among workers with a pension:	+9 months		+3 months	
among all workers, if those with no pension behave like:				
those with no pension today	+10 months		+6 months	
those with a DC plan today	+8 months		+4 months	

Predictions based on simulation results from specification 5.3 and on the observed decline in DB pension coverage. See text for more details.