

# *How defined contribution plans and 401(k)s affect employer pension costs*

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## Abstract

We investigate the pension choices made by over 700 firms between 1981 and 1998 when DC plans expanded and overtook DB plans. Their average pension contribution per employee dropped in real terms from \$2,140 in 1981 to \$1,404 in 1998. At the same time, the share of their pension contributions attributed to defined contribution plans was 23% in 1981 and increased to 68% in 1998. By analyzing pension plan data from the IRS Form 5500 and finances of the plan's sponsoring employer from COMPUSTAT with a fixed-effects ordinary least squares model and a simultaneous model, we find that a 10% increase in the use of defined contribution plans (including 401(k) plans) reduces employer pension costs per worker by 1.7–3.5%. This suggests firms use DCs and 401(k)s to lower pension costs. Lower administrative expenses may also explain the popularity of DC plans. Although measuring a firm's pension cost per worker may be a crude way to judge a firm's commitment to pensions, this study suggests that firms that provide both a traditional defined benefit and a defined contribution plan are the most committed because they spend the most on pensions. Further research, especially case studies, is vital to understand employers' commitment to employment-based pension plans.

**Key words:** Pensions, defined benefit, defined contributions, 401(k)

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## Introduction: the shift to defined contribution pension plans

Though it is well known that 401(k)s began to be adopted by firms in 1981 and expanded rapidly, understanding why employers choose a particular plan design helps predict whether defined benefit (DB) plans are dinosaurs and whether defined contribution (DC) plans, and 401(k)s in particular, are the pension plans of the future.<sup>1</sup>

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<sup>1</sup> Defined benefit plans (DB) pay an annuity based, typically, on years of service and pay. The employers bear all the investment risk, and 'longevity' risk – the risk that the retired worker or beneficiary outlives her or his projected life expectancy. The worker bears the important risk of leaving an employer before

The 1980s and 1990s was a period of great pension upheaval: the share of workers covered by a 401(k) plan jumped from 19% in 1984 to 65% in 1998. In contrast, the share of pension-covered workers with only a DB plan fell from 76% in 1986 to approximately 20% in 1998 (Employee Benefits Research Institute, 1997: 83,116; US Department of Labor, 2000: 2). One explanation is that firms were accommodating both increasingly mobile workers who want individual portable pensions and ‘new-economy flexible production processes that values mobile workers’. This view is expressed as follows: ‘The old defined benefit plan is one that many workers and employers no longer support given the exigencies of modern labor and capital markets’ (Schieber, Dunn, and Wray, 1998: 282). On the other hand, the explanation could be simpler: ‘An additional explanation for DC plans’ popularity is that they are often perceived as less expensive than the defined benefit alternative’ (Mitchell and Schieber, 1998: 9). This study aims to identify how employer contributions change when DCs replace DBs.

Coincident with the relative aggregate growth in DCs and 401(k)s is the little-known drop in US employer expenditures for all pension types by 22% between 1978 and 1998 (Medoff and Calabrese, 2001: 134). This is during a time when the number of active workers in DB assets fell by 23%, while DC active participants grew one and a half times; the number of DB plans fell by two thirds and DC plans grew 78%; and DB assets only tripled, while DC assets grew tenfold (Munnell and Soto, 2004: 78). Obvious questions arise: Have all firms cut back or just some, while others are increasing their pension contributions per worker? And, if some firms are reducing pension contributions and others are not, why? Did the shift in pension design have any role? Almost all studies of pension choice depend on surveys of workers or analyses of broad industry trends. Observing workers often leads to inferences that workers are choosing their preferred type of pension; yet, firms, especially in non-unionized settings, are the primary movers in constructing the types of pension plans offered. Broad industry trends tell us almost nothing about employer motivations. This is the first study that examines the pension choices of a large number of individual firms for a long period of time. The National Academy’s project on retirement savings recognized the importance of firm-level data to explain changes in pension structure (Parsons, 1996).

We assume firm’s pension policy is motivated to a large extent by pension expenses. After the introduction, the second section reviews the literature on firm pension arrangements and the third section describes our unique panel data set of firms. The fourth section describes the pension choices of the large firms in the sample over the 18-year period. The fifth section emphasizes how the unique features of 401(k) plans may cause an employer’s pension costs to fall as the firm’s share of pension contributions attributed to 401(k) plans rises, and the following section discusses our

vesting. The worker bears inflation risk. DB costs vary according to plan generosity, demographics, and portfolio earnings. Defined contribution plans shift risks. The employer establishes an account and contributes a steady stream of income. The worker uses the money for retirement, and thus the worker bears the longevity, inflation, and investment risk. However, the DC account is portable. There is considerable debate about which plans pose more risks to workers (Samwick and Skinner, 1997). 401(k)s are special DC plans. Allowed in 1978, but implemented in 1981, they allow workers to make pre-tax contributions into an account maintained by the employer; employer contributions are discretionary.

regression strategy. The seventh section reports the results of the fixed effect models of how DCs and 401(k) plans affect a firm's pension expenditures. In the eighth section, simultaneous regression models consider that in the late 1990s the financial market boom coupled with relatively high interest rates helped firms reduce DB pension expenses. In the ninth section we explore the idea that firms prefer DCs and 401(k)s because of their relatively low direct administrative costs. Finally, we summarize our findings and propose future research.

### **Previous studies on pension choice**

Many studies seek to explain the shift from DB to DC plans. Gustman and Steinmeir (1992) found that approximately half of the change could be explained by shifts away from industrial sectors with high propensities to have defined benefit plans, i.e. manufacturing and other unionized sectors. The other half was explained by employers making different pension choices and by new employers adopting DC plans.

Ippolito (1995) confirms that half of the shift towards DC plans can be explained by industry shifts and adds another fundamental reason for the adoption of 401(k)s. He posits that firms are choosing 401(k) plans because only in 401(k) plans do workers make voluntary, pre-tax contributions. Ippolito surmises that knowing which workers contribute to their 401(k)s can help firms screen for high productivity workers. The argument is that firms can discover which employees have 'high discount' rates by examining who avoids contributing to the 401(k) plan (Ippolito, 1997). He argues that workers who prefer immediate gratification are likely to be poor performers on the job. Ippolito (1995, 1997) used cross-section comparisons of firms by the type of plan they offer (excluding firms that offered both plans) to infer there must be a productivity reason for the apparent change in firm pension choices. A drawback to Ippolito's work is that excluding firms that offer both types of plans prevents comparing the minority of firms that offer only one type to the majority that offer two or more kinds of pension plans.

Papke (1996) improves on Ippolito's study by using a panel of firms for two end years, 1985 and 1992. She refutes Ippolito by concluding that DCs were substitutes for DBs because firms adopting DCs were more likely than other firms to have terminated DB plans. Specifically, she finds that adding a DC plan substantially increases the probability that the firm will terminate a DB plan. She uses an ordinary least squares regression to explain the change in the number of DB plans offered by the firm between 1985 and 1992. Controlling for firm employment in 1985, the number of 401(k)s and DCs, and industry, Papke concludes that the probability that a DB plan will be dropped is about 18% and increases to 35% and 40% when a 401(k) or DC plan is adopted. Papke warns, rightly, that she can not make claims about what is happening to participants and whether the DC plan is better than the DB plan. Papke does not analyze which firms are likely to make the switch or why.

Olsen and VanDerhei (1997) interpret the trends differently. They find many firms keep and improve their DB plans. We adopt their method of using an employer's actual expenditures on pensions as a proxy for an employer's preference for types of pension plans and their proxy for a firm's preferences for DC pensions: the share of

all pension contributions going to DC plans. Like Vanderhei and Olsen, we improve on previous work by observing actual firms, not plans. Unlike other studies that infer pension trends by using different groups of firms in different years our panel data set, which covers 18 years (1981–1998), links the same firm to their pension choices over time. And, because we link plan finances to firms we can control for a firms' financial condition to help in explaining firms' pension contributions.

During the period between 1981 and 1998 most firms added DC plans, and DB and DC combinations became the predominant pension arrangement. The puzzle is deciphering the firms' intentions. Firms adding DC plans could have been supplementing their DB programs or adding DC plans merely to phase out their DB plans. We find evidence that DC plans were used as both supplements and complements to DB plans (which include cash balance plans but the Form 5500 did not distinguish cash balance plans until 1999). We also find support that firms use DCs and 401(k)s to lower their overall pension contributions per worker.

### Data

The data set includes 727 firms that continuously filed IRS Form 5500 reports for each pension plan they sponsored from 1981 through 1998 and which also kept the same employer identification (EIN) number for all these years. This means that companies sponsoring pensions that went bankrupt or merged into other firms or for any other reason changed EINs were dropped from the sample.

We also only consider firms that sponsor single employer plans (not part of a multi-employer pension plan) and have at least 100 participants in each of their pension plans. Consequently, our sample consists of mostly large firms. The average number of total pension participants in the 727 firms is larger than the average of all the firms in the Form 5500 database. In 1998, the sample had, on average, 11,607 participants whereas all firms had an average of 1,332 participants. (The main difference between the sample and the population of firms is size, but the comparisons along other dimensions are available from the authors.)

Although, 727 firms constitutes a substantial sample of firms, it is a subset of over 26,140 firms that provided information on their pension plans in 1981. (Firms must annually file an IRS Form 5500 for each pension plan they sponsor.) To be in our sample firms had to file a Form 5500 continuously for 18 years and keep the same employer identification (EIN) number. Therefore, there is certainly survivor bias in our sample. This bias is, however, particularly useful in answering crucial questions about employer pension policy. Large and continuously operating firms are often trendsetters in employee benefits (especially for firms in the same industry).

Another challenge in constructing the sample was to describe a firm's pension costs, the degree of unionization, and the number of pension participants when a firm sponsored more than one plan and most workers were likely to be in several plans. We aggregated the plans by using the weighted average of the characteristics in order to describe a firm's DB situation and DC situation (similar to Olsen and VanDerhei's approach). This method of aggregation is based on the strong assumption that a firm's policy towards its largest pension plan and group of workers – say, the rank

and file, hourly workers – characterizes its policy and stance towards all of its plans. Based on one of the author's extensive pension consulting and trustee experience, this assumption seems reasonable. Appendix 1 describes why we conclude this does not significantly change the results.

We also use the number of active participants in the largest plan as the number of a firm's pension participants. Since the data do not identify which workers are in multiple plans, this is a good compromise for the estimations described below. Next, we describe the sample firms' pension choices.

### **Which firms choose DC plans and when do they choose them?**

There was a great upheaval in pension arrangements between 1981 and 1998. Starting in 1981 (enabling legislation was passed in 1978) an ever-growing number of firms adopted individual-based 401(k) plans, which made employee pension account contributions convenient and the employers' contributions optional. At the same time, DB plans became more regulated and more expensive to administer (Hustead, 1998). We confirm in the penultimate section that the employers' 401(k) administration costs are much lower than DBs', and the administration cost gap is widening. If these changes accompanied a great upheaval in pension norms during this time period, then our panel of large, continuously pension-providing firms is uniquely qualified to answer questions about what kinds of firms change their pension policies, and, just as important, which do not.

The practice of these firms offering only a DB plan dramatically decreased between the 1980s and the 1990s. The share of firms that sponsored only DB plans dropped from 44% in 1981 to 11% in 1998, while the share of firms providing a combination of DB and DC plans increased. In 1981, 42% of firms provided only DB's and approximately 42% provided both type of plans. However, in 1998, that share rose to 71%. At the same time, the share of firms that provided only DC plans changed little, increasing slightly from 14% to 17%. At first glance, this supports the claim that DCs, most of which are 401(k)s, are complements of, and not substitutes for, DB plans. Named after the tax code that allows employers the option to contribute to a worker's tax-preferred account, 401(k)s offer automatic payroll deduction for workers who want to save. The fact that employers are not required to contribute distinguishes them from other DC plans. Between 1988 and 1998, the share in DC assets that were in 401(k) plans ranged from 63% to 88%.

In other words, the predominant trend during this period was for firms to offer both DB and DC plans by adding DC plans. And, note, in this sample, DB plans are not dinosaurs: 86% of firms that kept their EIN numbers for 18 years surprisingly had a DB plan in 1998. The firms in our sample are relatively large and DB plans are more prevalent in large firms (US Department of Labor, 2000: 2–3).

In contrast, examining Department of Labor data for the entire population of plan participants, including those in small, large, and new firms, the number of DB participants decreased by 1% to 23.3 million in 1996, while the number of DC participants increased by 5% to 44.6 million. Among workers with pensions, 49% are in DB plans and 83% are in DCs (many are in both). Pension trends are usually

discussed in terms of workers covered by type of plan and not about firms making choices about plan type. Our panel data set gives us the advantage of being able to actually identify the firms that made certain pension choices over the years. This is the first study able to link a firm's pension contributions and other specific firm and plan characteristics with 12 possible plan choices that firms could make during 1981 to 1998. These choices range from keeping the same pension plan structure to dropping and adding a DB or DC plan. See Table 1.

### *Firms with low pension contributions*

First we consider the pension choices of firms that rank near the bottom of pension contributions per worker. The largest group of employers, 215, which we refer to as Case 1 in Table 1, consists of firms that sponsored only DB plans in 1981, kept their DB plans, and adopted a DC sometime during the 18-year period, are among those with the lowest pension contributions. These firms include PepsiCo, Northwest Airlines, and Bank One. (In contrast, as we will see below, firms that sponsored both DB and DC plans consistently throughout the 18 years are the top contributors.) In addition, the firms that sponsored only one kind of plan contributed less than other firms (Cases 2, 3, 4, 5) in 1981, but not in 1998. McDonald Corp. and IBM are among the largest firms in this group.

The 38 firms (Case 6) with the lowest average contribution we designate as 'terminators'. The firms in this small group (Case 6) dropped their traditional DB plan to adopt a DC plan. The behavior of outright substituting DCs for DBs is presumed to be widespread, but that perception may be wrong. Indeed, Papke (1996) showed that, if a firm dropped a DB plan, it was likely to replace it with a DC plan. But, in our sample, the behavior is not widespread – only 38 firms did so – nor would we expect it to be. Terminating a plan is a drastic and expensive act (Mittelstaedt, 1989). Therefore, our study does not concentrate on terminators, but rather on firms that may use a variety of pension plan choices to reduce pension costs.

### *Firms with high pension contributions*

Firms with the highest average pension contribution levels, \$2,118 per participant, sponsored both DB and DC plans at the beginning of the period and maintained that combination structure throughout the 18-year period (Cases 7 and 8).<sup>2</sup> AT&T, GM, and Sears are among the firms that sponsored both DB and DC plans in 1981 and stayed that way through 1998 (Case 7). This group is probably larger because 140 employers reported a combination structure in 1981 and reported dropping a DB or DC plan sometime during the period but had a combination structure in 1998

<sup>2</sup> The firms that changed their pension structure from a DC and DB combination to something else were likely to be non-union, much less likely to be in the service sector, and more likely to be in retail. (Remember the sample sizes are small and that most firms that started out in 1981 having a DB and DC combination kept the combination.) The other main difference is that the firms that sponsor only DB plans because they had dropped their DC plans, had more turnover than the ones that kept their DC plans. This may mean that turnover does not matter to a firm when making a pension structure choice or that firms experiencing high turnover want to limit it by offering a DB plan. (Data on the employee turnover assumptions are available from the authors.)

Table 1. *Changes in pension choices and employer contributions of 727 firms during 1981–1998*

1981–1998: 12 Cases	Number of firms	1998 contribution*	Rank in 1998	1981 contribution*	Rank in 1981
<b>ADOPTORS OF DCs AND EXPERIMENTORS</b>					
1. Were DB only in 1981 and changed during 1981–1998 by keeping the DB and adopting a DC during 1981–1998	215	\$1,649	6	\$2,177	5
2. Were DB only in 1981 and changed during 1981–1998 by switching back to DB only after making some change	27	\$1,140	11	\$2,079	6
3. Were DB&DC in 1981 and changed during 1981–1998 by dropping their DC and keeping their DB during 1981–1998	16	\$854.1	12	\$2,813	4
4. Were DC only in 1981 and changed during 1981–1998 by switching back to DC only after making some changes	8	\$1,176.4	10	\$1,219	11
5. <b>MAINTAINED DC</b> Were DC only in 1981 and stayed through 1998	55	\$1,405.0	8	\$1,745	9
6. <b>TERMINATORS</b> Were DB only in 1981 and dropped DB and replaced it with a DC	38	\$1,204	9	\$1,851	7
<b>MAINTAINED BOTH DB AND DC:</b>					
7. Were DB&DC in 1981 and stayed DB&DC through 1998	114	\$2,118	1	\$4,275	1
8. Were DB&DC in 1981 and changed during 1981–1998 and switched back to DB&DC	154	\$2,036	2	\$4,096	2
9. <b>MAINTAINED DB ONLY</b> Were DB only in 1981 and stayed DB only through 1998	39	\$1,917	3	\$1,398	10
<b>ADOPTED DB</b>					
10. Were DC only in 1981 and changed during 1981–1998 by adopting a DB	3	\$1,776	5	\$420	12
11. Was DC only in 1981 and adopted a DB during 1981–1998	35	\$1,539	7	\$1,752	8
12. <b>DROPPED DB</b> Were DB&DC in 1981 and dropped DB and kept DC during 1981–1998	23	\$1,797	4	\$3,661	3
Total and weighted average	727	\$1,407		\$2,170	

Note: \* Average employer contribution per worker in 1998 dollars.



(Case 8), for example the Deluxe Corporation and DuPont. These top contributors rank second with \$2,036 per participant. (We presume that many of these firms misfiled one year and probably provided both DB and DCs throughout the entire period.) The average pension contribution for employers that provide only a DB plan (Case 9) improved quite a bit, this group ranked tenth in 1981 and third in 1998.

### *What distinguishes firms with high average pension contributions?*

A pattern clearly emerges and the pattern is surprising. We expected that whether firms sponsored only a DC plan or only a DB plan would distinguish firms from each other. In fact, it is whether a firm *adopts* a DC plan anytime during this period that explains the relative level of pension contributions. Thus, we surmise, as Vanderhei and Olsen did, that the more emphasis a firm places on DC plans, the lower its total pension contributions will be. Therefore, we proceed with the methodology explained in the section following the discussion of 401(k)s.

### **Unique features of 401(k)s and how they lower firm pension contributions**

Our model describing how pension plan arrangements affect pension expenditures recognizes Ippolito's argument that 401(k)s are special types of DC plans. 401(k)s do not require employer contributions. Although they were designed to be a convenient way in which firms could help employees divert pay into semi-liquid savings accounts, both employers and workers often refer to them as retirement plans.<sup>3</sup>

Perhaps, the 401(k) revolution came about – they became popular in 1981 – because employers could no longer justify paying significant amounts for pensions but were reluctant to eliminate pensions altogether. With 401(k)s employers can redirect the burden of financing retirement to the individual employee.<sup>4</sup> Sixty six per cent of all contributions made to 401(k)s are from employees compared to less than 1% in DB plans (US Department of Labor, 2000: 9).<sup>5</sup> Firms that emphasize their 401(k) plans over their other plans may be the firms that are reducing their pension contributions.

401(k)s can affect employer pension contributions four ways. First, if workers' perceptions favor DC plans over DB plans, employers can get more 'bang' out of their pension contributions to 401(k)s. The equity market's late 1990s boom contributed to workers' desire to own stocks directly. Compounding this desire is human psychology; when equity values are high, people tend to 'over value' the equity

<sup>3</sup> 401(k)s are not pension plans, they can be spent before retirement – 92% of employers allowed borrowing from the 401(k) (Hewitt, 2000) and most employees cash out their 401(k)s when changing jobs (Bassett, Fleming, and Rodrigues, 1998). In addition, a host of usual pension regulations do not apply: for instance rights of spousal claims on 401(k)s, vesting, funding, and fiduciary liability.

<sup>4</sup> There is an obvious problem of 401(k)s' impact on financial security, since 401(k) contributions are increasingly being invested in stocks. Shiller (2000: 217) writes, something was 'lost in the transition' from defined benefit plans to defined contribution plans. He argues that defined benefit plans are risk-managing institutions for pensioners, which are especially important for low-income pensioners, and employers are now telling workers 'choose your investments (for the pension contributions) and take your chances'.

<sup>5</sup> Of course, the true incidence of pension contributions depends on the ability of the employer to pass the cost of pensions on to the employee in the form of reduced compensation in other areas.



market (Shiller, 2000). Also, DC plans have more allure if workers feel their job is insecure.

Second, the DC administrative costs are falling fast because of competition and productivity improvements in the industry (Hustead, 1998), whereas DB plan administration has become more complicated (Twinney, 1997) and DB plans can not take advantage of on-line services (Glenn, 1999), an increasingly valued pension plan and cost effective plan feature. Firms also do not pay most of 401(k) administrative costs. In 1998, the Department of Labor recognized, 'A substantial portion of 401(k) plan fees and expenses are charged against the account balances of the plan participants and the trend is increasing' (US Department of Labor, 1998: 4), and six years later the SEC issued a controversial white paper criticizing high and hidden 401(k) money management fees paid by workers (Walsh, 2004).

Third, employers can also contribute their own stock to their employees' 401(k)s (they can also do so in DB plans with limitations and approval from the PBGC and the Treasury Department), which is often cheaper for the firm than contributing actual cash.

Last, employer matches are not required, so employers can administratively set up a plan, and, since the employee contributions are netted from the paycheck, the worker may credit the employer with providing a retirement plan.

### Methodology and regression strategy

We explain changes in employer pension contributions per participant with a multiple regression analysis – a generalized least squares fixed effects model – by controlling for factors that may independently affect pension costs and focusing on this study's variable of interest, the firm's structure of pension offerings.<sup>6</sup> We proxy for firm choice with the share of DC expenses of all pension expenses. We also control for the financial condition of the firms, the level of unionization, size of the firm, and industry membership.

Fixed effect models control for the heterogeneity across firms with regard to wages and, in particular, total compensation. We corrected for the possible time-series effects on the error terms with a SAS routine called TSCSREG. We needed to use variables that change over time or else the fixed effects model has a difficult time specifying the parameter, so we could not use industry dummies. However, industry membership is important in pension choices, so we adjusted some of the financial variables for industry membership.

Ideally, we would have used the funded status of the firm's DB plans to control for limitations on a firm's DB contributions but we can not since we include DC plans in the regression and DCs do not have a 'funded status'. We solve this problem in part by accounting for the phenomenon that many firms stopped or dramatically decreased their contributions to their DB plans during the financial market boom of the

<sup>6</sup> Fixed effect techniques are valuable because they control for the individual factors that determine firms' compensation levels. However, union levels and industry membership are certainly important factors in those decisions. We estimated regressions using industry dummies and found similar results as the fixed effects models. In these regressions also the 401(k) share was a significant factor in determining a lower level of pension contributions per participant.

1990s. We recognize that employer pension contributions per participant are to some degree dependent on contributions to DB plans, in part influenced by the DB funding ratio – the ratio of assets to liabilities. When the funded ratio is high because pension asset earnings are sky high, then employer pension contributions will fall, and the explanation of pension spending dips will differ from the hypothesis that firms use DC plans to strategically reduce pension expenses. Therefore, in the sixth section we include a predicted value of the DB funded ratio in a second stage regression explaining employer pension contributions. The results are similar and support our hypothesis.

In the regressions using all the firms discussed in Table 1 we use a dummy variable for the year 1987 to proxy for the regulatory changes, named OBRA87, TRA86, and PPA87.<sup>7</sup> These regulations were intended to significantly hamper firms' ability to fund 'newer' DB pension plans. Therefore, we expect employer pension contributions to be negatively affected by these regulations.

Another factor affecting employer pension contributions is the rate of return on the fund assets. We use the return on equities (the S&P 500) to proxy for boosts in DB plans' rates of return, which allowed many firms to slow or stop contributions to DB plans (especially, if workers and firms did not improve the generosity of DB pension benefits). Moreover, since regulations in the 1980s did not inhibit firms from terminating their DB plans to use the 'excess' assets for corporate finance purposes, they would not have been discouraged in making excess contributions (1989 legislation taxing the surplus virtually stopped this behavior) when their plans had high asset-to-liability ratios. (The means of the variables are in the Appendix.)

### *Results for fixed effects model*

The first regression reports the results for more than 700 public and privately held firms. The second regression reports the results for only public firms (see Table 2). In both regressions our major variable of interest, DC share of total pension plan costs, is significant and negative. This implies that firms that emphasize DC plans are those firms with a low pension contribution per participant. There are a number of ways to explain this result. Many DB sponsors took advantage of the favorable returns in the financial markets in the 1990s to stop or lower employer contributions to their DB plan. If these firms maintained contributions to their DC plans, the DC share would rise and the pension costs would fall. However, some firms lowered DB contributions and expanded their DC efforts, while other firms used the gains in the DB assets to increase the generosity of the DB plans. (We explore this further below.) In either case, the DB contributions fell, the DC share rose, but overall pension contributions did not necessarily decrease.

Moreover, our interpretation that DC plans are used, in part, to lower over-all employer pension contributions is supported by the cross tabulations in Table 1.

<sup>7</sup> We did not control for the Retirement Protection Act of 1994 (RPA), which boosted PBGC premiums for under-funded DB plans. (This legislation also coincided with SEC regulations on minimum funding, which would also put upward pressure on pension contributions.) However, it was aimed at the small number of under funded DB plans.

Table 2. *How the share of DC costs to total pension costs affects employers' pension contributions*

(Dependent variable: pension contributions per active participant 1998 dollars)

Independent variables	All firms	With financial data
DC employer costs/total pension costs	−8.91*** (0.634)	−8.53*** (1.216)
Unionization – percent firm participants are in a collectively bargained plan	−310.1 (173.7)	−46.18 (318.8)
The passage of the OBRA (1987)	0.79 (45.5)	96.98 (98.4)
The S&P 500 index value	5.05** (168.5)	−1.37 (373.4)
Plan age (weighted average of all the plans a firm sponsors)	−17.8*** (2.9)	−34.3*** (6.3)
Plan participants (natural Log)	−1019.5*** (39.9)	−1971.3*** (81.3)
Capital availability (premium over industry average)	N/a	1.21 (0.98)
Debt–equity ratio	N/a	0.06* (0.03)
<i>N</i>	13,064	5,506
Adjusted R-squared	0.65	0.54

Notes: \* = 90% confidence level 0.05, \*\* = 95% confidence level 0.025, and \*\*\* = 99% confidence level 0.005.

Source: All firms from 1981 to 1998.

Firms that had both DB and DC plans before 1981 maintained relatively high pension contributions throughout the 1980s and 1990s. However, firms that adopted a DC plan in that time period did not.

In the regression including public and privately held firms, unionization has an insignificant effect on employer pension contributions. This may seem surprising, since union workers have higher coverage rates and better pensions than non-union workers. Also unions emphasize pension and other employee benefits in collective bargaining, thus tending to boost employee benefits for all workers in a firm. However, union workers are also among the lowest paid workers in a firm. These forces may counteract each other.

Pension legislation in 1987, which generally limited DB pension contributions, did not inhibit pension contributions as expected.

The results on the annual rate of return of the S&P 500, which proxies for the rate of return of plan assets, are worrisome. Munnell (1987) infers, using aggregate cross-section data, that firms are 'target savers' because DB pension asset growth falls when equity returns rise – high returns mean firms can contribute less and still meet saving targets. Munnell and Soto (2004) also found that, in the absence of the stock market boom and the regulatory and legislative changes, the employer contribution to its pension plan would have been 50% higher during 1982–2001. We find equity

returns have a positive and significant effect on pension contributions. Equity returns, boosts pension contributions by employers when financial conditions are not controlled for. The effect is not trivial; a 1% change in returns boosts contributions by \$5.04. Again, this belies the view that employers are target savers and is worrisome if it means pension contributions will fall in bear markets. Workers and firms either do not have savings targets or could miss them. (These findings are similar for the 401(k) sample.)

Larger plans elicit fewer contributions per participant. In the first regression, a 1% increase in plan participants reduces contributions by \$10.20 and by \$19.70 in the public firm regression. The finding that firm size is associated with decreases in pension contribution per participant is unexpected because smaller firms usually have less generous employee benefits. Larger firms tend to have better benefits because they have the advantage of economies of scale.

The weighted average age of the pension plans sponsored by the employer has insignificant effect in both the first regression and the second. Older plans, surprisingly, require fewer contributions; perhaps their mature funding status overwhelms the tendency for older plans to have older (and more expensive) participants.

The public firms sample controls for financial performance and yields similar results. Controlling for financial condition is important because firms in poor financial shape reportedly weather a dip in sales, liquidity, and capitalization by reducing DB pension contributions or DC matches. Even with these controls, the share of DC pension costs has a significant and negative effect on pension contributions. Unionization has insignificant effects on pension contributions.

In order to assess the relative financial strength of a company we adjusted capital availability for each company in each year and subtracted it from the capital availability for the industry in that year.<sup>8</sup> Capital availability is cash from operations, less dividends and capital expenditures scaled by sales. This directly measures a firm's ability to generate internal cash flow. (Profitability, although an appealing proxy for firm health, is endogenous. Firms can boost profits by lowering DB funding.<sup>9</sup>) The ratio of long-term debt to total equity proxies for the closeness to binding covenant constraints. As a result, we would expect an inverse relationship between the debt–equity ratio and the cash commitment to the pension fund.<sup>10</sup> Despite the effort,

<sup>8</sup> We do not have any industry controls in the fixed effect regressions.

<sup>9</sup> Profitability is a logically appealing proxy for firm health and was used in a number of studies including Francis and Reiter (1987). However, Francis and Reiter note that a firm has a range of flexibility when funding its DB pension plan and this flexibility is the driver behind contribution decisions and thus they argue that capital availability is a more direct measure of a firm's ability to fund its pension plan. Myers and Majluf (1984) argue that firms use their pension plan as a preferential storage device for internal sources of funds, so that profits would be higher sometimes if pension contributions were lower. Firms prefer to use internal rather than external sources of funds for future investment projects due to the negative signaling associated with new equity and debt issues. As a result, firms use the pension fund as a means of building financial slack. Profitability may proxy for a wide range of effects, whereas capital availability directly proxies for a firm's ability to make contributions to its pension plan beyond its current needs for reinvestment in the business.

<sup>10</sup> Restrictive debt covenants are written to protect investors from wealth expropriation by owners or managers. Most covenants restrict the firm's ability to dispose of assets, pay dividends, and issue additional debt. This accounting arrangement leads firms to shift accounting numbers away from the prescribed limits in order to avoid the implicit and explicit costs associated with technical default.

the capital availability has no significant role in explaining variability in pension funding, but the effect of the debt–equity ratio is slightly positive.

In sum, for all public and private firms, the share of employer pension contributions going to DC plans in 1981 is 23% and in 1998 is 68%. But the average changes obscure the variation in firm behavior. Regression analysis helps us distinguish between firms. We explore what determines the amount a firm will spend on pensions. We find that the maturity of the plan is correlated with more pension expense, as well as whether the firm has a lower debt ratio. We are most interested in the finding that a firm increasing its share of pension contribution being spent on DC plans by 10% decreases pension expenditures by 3.5%. It is not unreasonable to assert that the 190% increase in the overall share of firms' pension contributions in DC-type plans over this 18-year period could have helped induce the 53% decrease in average pension contributions per worker.

The DC share of total pension costs is also correlated with decreases in pension contributions when the financial condition of the firm is controlled for. The elasticity is slightly smaller; increasing the share of DC contribution by 1% decreases contributions by 0.17%.

Next, we turn to the results of the regressions isolating the effect of the 401(k) share of pension expense on overall levels of pension expenditures.

### **Results for the fixed effects models of 401(k)s employer pension policies**

Below we examine the pension plan choices of 792 firms (the original 727 and those that we have information for from 1988) for 11 years (1988–1998.) We need to begin the sample in 1988 because the Form 5500 did not identify 401(k)s specifically until 1988, and compare their pension plan choices in 1998. In 1988, about one third of firms (29%) offer only 401(k) plans. Approximately 46% offer both 401(k) and other non-401(k) plans, and 26% do not have a 401(k) but have a DB and or non-401(k) DC plans. In 1998 the shares were not much different. See Table 3.

The main lessons we draw from the trends in 401(k) sponsorship is that, in our sample of large firms, the overall percentage of firms sponsoring only 401(k)s has not changed much in recent years. The Department of Labor reports similar trends for all firms; the share of 401(k) plans that are sponsored by firms with only 401(k) plans in 1988 is 16.6% and in 1996 is 17.1% (US Department of Labor, 2000: 47; US Department of Labor, 1999: 50).

We use the same controls as in the DC regressions and create a 401(k) share variable (The means of the variables used in these regressions are in Appendix 2). The effect is calculated for all public and private firms. Increasing the share of 401(k) contributions by 10% decreases contributions by 2.7% (evaluated at the mean contribution per participant of \$1,918 for the regression reported in Table 4).

The 401(k) share of total pension costs also decreases contributions when we control for the financial condition of the firm. The effect revealed in the second regression reported in Table 5 for public firms, increasing the share of 401(k) contributions by 10% decreases contributions by 3.5% when the financial condition of the firm is taken into account. Please refer to Table 4 for the results of these regressions. Unlike

Table 3. *Number of firms by 401(k) status*

	Total number of firms	401(k) only	401(k) and others	Do not have a 401(k)
1988	792	28.9 %	45.6 %	25.5 %
1989	792	31.2 %	44.2 %	24.6 %
1990	792	20.8 %	55.2 %	24.0 %
1991	792	20.0 %	56.1 %	23.9 %
1992	792	33.5 %	46.3 %	20.2 %
1993	792	28.4 %	48.0 %	23.6 %
1994	792	29.8 %	48.4 %	21.8 %
1995	792	29.5 %	49.4 %	21.1 %
1996	792	34.3 %	41.9 %	23.7 %
1997	792	31.2 %	48.9 %	19.9 %
1998	792	32.4 %	49.0 %	18.6 %

Source: Sample of firms from 1988 by 401(k) status.

in the DC regressions, where collectively bargained plans had insignificant effects, unionization is associated with lower contributions when financial controls are not used. However, the effect is insignificant when controls are used; perhaps, this finding is the result of unionized firms being more likely to be in financially troubled industries during this 11-year period.

The significant coefficients on the level of the S&P500 are oddly positive as they were in the first set of regressions. When returns are high, pension contributions increase, rather than decrease, as we would expect from the behavior of target savers. Large firms have relatively lower pension contributions, which is a similar to the conclusion reached in the analysis of all DC plans.<sup>11</sup>

### Pension contributions and simultaneous regressions

One of the most dramatic developments in the US and UK in the 1990s was that the combination of high interest rates and high rates of returns in financial markets both increased defined benefit pension assets and reduced calculated future liabilities. Not only did funded ratios soar, inducing substantial numbers of firms from having to make defined benefit contributions, but defined benefits plans became a 'profit center' as DB surplus augmented the corporate bottom line. But not all firms did this. For our purposes, this would create an increase in the DC share of pension contributions and a decrease in pension contributions per participant.

<sup>11</sup> Non-fixed effects regressions that use industry dummies revealed similar results as the fixed effects models reported above. Similar to the results described above, the DC share effect on pension contributions was significantly negative; but the old and large plan sponsors elicit higher pension contributions. By controlling financial conditions, firms in manufacturing, transportation, and construction industries contribute more. The non-fixed effects regression results confirmed the fixed effects model findings that the 401(k) share of pension contributions significantly lowers pension contributions per participant. Equity returns and union have no effect on contributions. Manufacturing firms' pension contributions were higher than those in the service industry. These results are available upon request.

Table 4. *How the share of 401(k) costs to total pension costs affects contributions per active pension participant*

(Dependent variable: pension contributions per active participant 1998 dollars)

Independent variables	Coefficient standard error	Coefficient standard deviation
	All firms	Public firms
Share of 401(k) costs to total pension costs	-11.91*** (0.96)	-13.97*** (1.401)
Unionization – percent participants are in a CB plan	-537.3** (181.2)	-349.87 (294.8)
The S&P 500 index value	8.76*** (232.0)	7.42* (362.3)
The age of the oldest plan	-2.78 (5.2)	3.81 (8.2)
Number of participants	-1,879.5*** (69.9)	-1,835.55*** (101.7)
Capital availability	N/a	0.50 (1.9)
Debt–equity ratio	N/a	-1.81 (5.2)
<i>N</i>	8,698	3,401
Adj. R-squared	0.61	0.60

Notes: \* = 90 % confidence level, \*\* = 95 % confidence level, and \*\*\* = 99 % confidence level.  
Source: Sample of firms from 1988 by 401(k) status.

We maintain that this move is a retreat from a pension commitment, since firms that increased pension benefits or kept their actuarial rates of interest at reasonable levels (in a Fidelity survey, the median interest rate used to project fund earnings for corporations was 9%, while for union and public plans it was a much lower, 8% – Ruffel and Adams, 2002) would not have taken a pension holiday and their defined benefit plans would be in good financial shape. However, the correlation we glean from a decline in pension contributions and a rise in DC and 401(k) share can not be interpreted to mean that firms use DC plans – especially 401(k)s – to reduce pension commitments. Therefore, we must control for the pension holiday phenomenon causing the link between DC share and lower contributions per participant.

Our econometric strategy takes into account that the level of DB funding, measured by the funded ratio, partly explains pension contributions per participant and that the funded ratio itself is determined endogenously by several factors. We estimate the funded ratio in the first stage regression and then we regress pension contributions per participant, using the estimated funded ratio and other variables described above. Our sample size is much smaller, approximately 100 firms, because we can only use firms that have had both DB and DC plans.

The first stage models the funded ratio as being determined by several factors. First, we control for the stock market returns and expect that the higher the returns,



the larger the funded ratio (which would lower pension contributions). Federal regulations imposed in the late 1980s (described above) limit the tax deductibility of pension contributions in well-funded DB plans and they suppress the funded ratio. The larger the projected returns on assets, the lower the liabilities and the higher the funded ratio. We expect older plans will have higher costs because, typically, retirees cost more than current workers. Unionization, *cet. par.*, will lower the funded ratio for two reasons: unions bargain for increased liabilities when funded ratios are healthy (the firms resist less) and many union plans have flat benefit formulas, which, for technical reasons, reduce funded ratios. A larger plan may have lower funding ratios because the large firm can ‘self insure’ for future shortfalls or may have higher ratios because it can afford pension contributions. We also take into account that firms with lower debt and more capital availability will contribute relatively more to their pensions. (This sample is smaller because we can only evaluate public companies.)

In short, we find evidence confirming the hypothesis that, even after taking into account the possibility of funding holidays from DB plans, the DC and 401(k) share of pension contributions has a strong negative effect on pension contributions. Unionization, has a significant and positive effect on pension expense, implying that collective bargaining increases pension expenses (even when we do not control for participants’ overall compensation). The elasticity evaluated at the mean is that a 1% increase in the DC share of pension contributions is associated with a 1.6% decrease in pension contributions per participant. Please see the results in Table 5 (the means are in Table 3).

The results are similar for the regressions controlling for financial condition of the firm in Table 5. Yet, the sample size is only 69 firms. Three variables are significant, the variable of interest, the DC share of pension expenditures, as well as unionization, and, for the first same time, the funded ratio. The DC share result is consistent with our hypothesis that an emphasis on DCs lowers pension contributions. The elasticity is a 0.7% decrease in pension contributions per participant.

Unionization, again increases pension expenses. However, the result for the funded ratio is the opposite of that of the commonplace argument. A higher funded ratio is associated with more pension contributions per participant. This makes sense if firms that shave their funded ratios are also those that are in financial stress and do not have profits to shelter in tax favored accounts.

The simultaneous regression on 401(k) sample from 1988 through 1998 presents similar results, although the sample size is small. The results are available upon request.

### **Administration costs for DB and DC plans**

A strong argument challenging our hypothesis is that firms choose DC plans because this type of plan is a more efficient way to deliver pension promises. The administrative cost of DB plans far exceed, the argument goes, the costs of a DC and 401(k) because these plan types do not require such high costs as actuaries and PBGC premium costs. We used our data to explore this argument and find that indeed the administrative costs, after controlling for variables besides plan type that would affect costs, are much lower for 401(k)s and DC plans, which weakens our hypothesis. But,

Table 5. Two stage least squared regression results in the sample of firms with both DB and DC plans

(Dependent variable: Pension contributions per active participant 1998 dollars)

Independent variables	Coefficient standard error	Coefficient standard deviation
	All firms	Public firms
Share of 401(k) costs to total pension costs	−37.92*** (830.08)	−38.46*** (401.13)
Funded ratio	674.52 (507.95)	3,036.02*** (778.51)
The S&P 500 index value	3.45 (681.03)	−20.52** (873.26)
Unionization	681.88*** (204.33)	1,567.28*** (343.1)
Number of participants	−164.72*** (55.85)	0.89 (74.43)
Capital availability	N/a	1.82 (1.19)
Debt–equity ratio	N/a	0.09** (0.04)
<i>N</i>	1,831	1,248
Adj. R-squared	0.16	0.10

Notes: \* = 90 % confidence level, \*\* = 95 % confidence level, and \*\*\* = 99 % confidence level.  
Source: All firms from 1981–1998.

because we have a time series, we note that the administrative cost advantage grows over time. This trend and a 1998 Department of Labor report (US Department of Labor, 1998) showing that firms are shifting administrative costs of 401(k)s directly to workers would also explain the attraction of these plans to employers which strengthens our argument that DC plans help firms off load pension expenses.

The detailed findings of our administrative costs estimations are discussed below. In a method similar to Mitchell and Andrews (1980) and Ghilarducci and Terry (1999), a cross-section analysis of the administrative costs of over 17,400 plans in 1989 shows that the size of plans lower costs because of economies of scale and a high ratio of retirees to current participants raises costs – it is more expensive to ‘cut a check’ than collect contributions. A 401(k) plan radically reduces administrative expenses. A shift to a 401(k) plan (the variable is a dummy for 401(k) plan) reduces administrative costs by 3 %. In 1998, the elasticities are more pronounced. A 401(k) reduces administrative costs by 25 % and a shift to a DB plan increases administrative costs by 21 %. Interestingly, the effect DB plans have on costs have been relatively stable; but, the effect 401(k)s have in lowering employer costs is growing stronger. Please see Table 6 and Appendix 2. Bateman and Mitchell (2004) also found in a cross section of Australian superannuation plans that DB plans have one-third higher reported expenses than DC plans, even after controlling for plan size.

Table 6. *The effects of plan type on pension administration costs*

Independent variables	Coefficient standard error	Coefficient standard deviation
	1998	1989
Ratio of retirees to total participants	100.95*** (3.9)	34.86*** (1.60)
Unionization	4.59 (4.29)	0.59 (2.63)
Number of participants	-11.57*** (1.30)	-10.05*** (0.85)
Dummy of 401(k) plan	-41.48*** (6.51)	-11.03*** (3.08)
Dummy of DB plan	101.89*** (6.18)	54.83*** (2.63)
<i>N</i>	11,377	17,454
Adj. R-squared	0.19	0.08

Notes: \* = 90 % confidence level, \*\* = 95 % confidence level, and \*\*\* = 99 % confidence level.  
Source: All firms from 1981–1998.

### Conclusion

No set of regressions can prove that firms – after taking into account their firm-specific behavior, unionization, size, and other factors – use 401(k)s and other individual-based pension accounts to pull back from pension funding. These results are meant to add to an understanding of why firms use DC plans in the context of other evidence, such as the reported motivations of firms using 401(k)s to shift the pension burden to employees, the decline in internal labor markets (Osterman, 1999), and the ‘irrational’ attraction of workers to individual accounts – the editor of an influential industry magazine bluntly states, ‘It’s ironic that employees seem to prefer the new species of retirement plan, although it might not be good for them’ (Clowes, 2004: 10). Proof in social science research requires reasonable convergence of evidence, like that in a trial. Circumstantial evidence, the nature of what we have here, must be consistent with a reasonable ‘narrative’ – a logical reasoned argument that something should affect something else – and a preponderance of anecdotal stories that some firms act the way the narrative describes.

We conclude that there is some evidence that DC (which include 401(k) plans have had a depressive effect on contributions. The amount employers contribute to pension plans is lower the larger the DC share of the employers’ total pension costs. This finding supports our hypothesis that firms can use DC and 401(k) plans to reduce pension expenditures. This study only focuses on employer contributions per active participant and does not evaluate the other sources of income workers may have (for a good review see Mitchell, Hammond, and Rappaport, 1999). We do not examine if worker contributions are making up for the shortfall, nor do we control for changes in wages or health care expenditures, which would test for an equalizing differential.

We also do not have data on the few bold firms that might have stopped providing pensions altogether. Our hypothesis is supported by both the fixed effect model and simultaneous regression model. Compared to the simultaneous model that takes into account how high DB funded ratios can cause pension contributions to fall, the fixed effect models include more firms and isolate the unique relationship between firms' choices to spend relatively more on DC plans and their total pension contributions. This study adds to the larger debate on the role of government, employers, and workers in providing retirement income security. More research is needed involving case studies of firms, surveys of employers, consultants, and more years of observation.

For example, we need to know if cash balance plans are cheaper than DB plans. Cash balance plans have gained popularity since the late 1990s. However, whether a DB plan was a cash balance plan was not so designated on the Form 5500 until 1999. Clark and Schieber (2004) found that employers tend to make restitutions for the benefits that senior employees lose in cash balance conversions – which suggest that cash balance plans may not be motivated primarily by employers' efforts to save costs, in contrast to motivations for the adoptions of 401(k) plans. The growing popularity of DC plans seems to have had a depressive effect on employers' pension costs, in addition to perhaps pleasing workers and accommodating employer's changing 'personnel' needs.

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### Appendix 1: The aggregation method

In order to support our aggregation method, we examined 12 of the largest companies in our sample from the various types of pension policy history. Only three had separate plans for management and hourly workers. Of those that had separate plans, the level of the contributions per participant was much higher in the management plan, but the pattern of contributions were very similar. (To separate and identify the rank and file and management plans, we used the name of the plan, the number of participants, and union status of the plan.) The patterns of contributions have similar characteristics. For most companies, pension contributions were high in the 1980s and fell precipitously in the early 1990s – a period of recession and of rapid increases in health insurance costs. The pension contribution rates characteristically soared in the late 1990s, but not to the 1980s levels. Also, real wages, for most male workers, actually fell during this period.

### Appendix 2

Table A2.1. Means for regressions for DC share (in 1998 dollars)

Variables	All firms		Public firms	
	<i>N</i>	Mean, standard deviation	<i>N</i>	Mean, standard deviation
Employer contributions (real)	13,064	\$2,195 (2,689.2)	5,506	\$2,354 (3,483.6)
DC employer costs/total pension costs	13,064	0.51 (0.4)	5,506	0.49 (0.4)
Collectively bargained plans	13,064	0.53 (0.5)	5,506	0.67 (0.5)
Annual rate of return on S&P 500	13,064	0.16 (0.1)	5,506	0.15 (0.1)
Natural log of plan participants	13,064	8.07 (1.5)	5,506	8.71 (1.4)
Plan age		23.3 (11.6)	5,506	22.0 (11.1)
Capital availability relative to the industry			5,506	−0.08 (42.1)
Debt–equity ratio			5,506	−3.22 (1,222.1)

Table A2.2. Means for 401(k) regressions (in 1998 dollars)

Variables	All firms		Public firms	
	<i>N</i>	Mean standard deviation	<i>N</i>	Mean standard deviation
Employer contributions (real)	8,698	\$1,918 (3,150)	3,401	\$1,996 (2,911)
401(k) employer costs/total pension costs	8,698	0.43 (0.42)	3,401	0.50 (0.40)
Collectively bargained plans	8,698	0.23 (0.34)	3,401	0.25 (0.32)
Return on S&P 500	8,698	0.18 (0.11)	3,401	0.17 (0.12)
Natural log of plan participants	8,698	8.13 (1.5)	3,401	8.85 (1.4)
Plan age	8,698	24.6 (11.8)	3,401	23.86 (11.3)
Capital availability			3,401	-0.15 (18.4)
Debt-equity ratio			3,401	-0.03 (7.9)