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CHAPTER 6

Defined Contribution Plans: Enhancing or Replacing Defined Benefit Plan Assets?

ISSUES SURROUNDING DEFINED CONTRIBUTION GROWTH

The impressive growth of the defined benefit system over the past 35 years and its promised continued growth for the foreseeable future is a testament to the time it takes for a government shock—in this case, restructuring of the tax system—to take its full toll on equilibrium. It is also a testament to the phenomenal popularity of the defined benefit pension plan form: plans paying annuities beginning at retirement age which are proportional to final wage (and substantially inflation indexed during retirement). Defined benefit plans have formed the cornerstone of the private pension system in the United States since its inception; and, even now, approximately 80 percent of all pension plan participants are solely or primarily covered by these types of plans.

Notwithstanding the dominance of the defined benefit form, there has been an impressive parallel growth in defined contribution plans. Rather than promising wage-indexed annuities at retirement, defined contribution plans are much like tax-exempt savings accounts. Contributions are made by the firm into these accounts each year; the accounts usually hold diversified portfolios managed by the plan fiduciary (though they are sometimes concentrated in the firm's own stock). Once vested, workers own the value of the account (even if they leave) and usually take the lump sum value of the account upon retirement.

While the majority of this growth has been concentrated in secondary plans—that is, second plans to primary defined benefit plans—reasonable suspicions about ultimate defined contribution substitution surround these data. Are defined contribution-only plans—that is, defined contribution plans not accompanied by defined benefit plans—

TABLE 6–1 Establishment of Defined Contribution Plans

Period of Plan Establishment	Percent New Plans that Are Defined Contribution (Percent × 100)			Percent 1981 Plans Established (Percent × 100)
	All DC Plans	Primary	Secondary	
Prior to 1960	35.3	16.4	18.9	48.3
1960–1967	36.0	12.6	23.4	19.6
1968–1974	52.9	14.2	38.7	15.1
1975–1981	77.8	18.9	58.9	17.0
				100.0

All data are weighted by plan participants in 1981. The data is based on a cross section of plans from the Form 5500 annual pension plan reports. These plans are arranged by establishment date. The number of participants in each plan in 1981 is assumed to be proportionally related to the number of participants at the date of creation. Statistics are based on pension plans that have at least 100 participants (i. e., Form 5000-C's are not included in the data).

replacing defined benefit plans as the primary plan? And are defined contribution secondary plans slowly reducing the benefits of primary defined benefit plans, perhaps ultimately to replace them after a long adjustment process?

These questions are important for the purpose of projecting the size and character of the private pension system. If defined contribution growth is supplemental to defined benefit growth, the asset projections made in Chapter 5 are considerable underestimates of the size of the system in the year 2000. If defined contribution growth is largely a reflection of substitution for defined plans, projections of defined contribution growth on top of defined benefit growth will lead to considerable double-counting of asset growth.

The data shown in Table 6–1 demonstrate the basic parameters of defined contribution growth. The data is a composite recreation of the establishment pattern of defined contribution plans, drawn from a cross section of pension plans for the year 1981. That is, the establishment date of all plans existing in 1981 is reported; so is the number of participants. By arraying these plans in order of date of establishment, a pseudo time series of plan creation can be constructed. For the purpose of this exercise, plans are weighted by participants in the plan in 1981.

By arraying the data in this way, it is possible to create a measure of the frequency of defined benefit creation over time. For example, in Table 6–1 the data show that 35.3 percent of all plans (weighted by participants) created prior to 1960 were defined contribution. The same rate of establishment was maintained over the period 1960–1967 (36.0 percent). But fully 52.9 percent of participants in plans created during

the period 1968–1974 were enrolled in defined contribution plans; 77.8 percent of participants in plans created after ERISA were enrolled in defined contribution plans.

Clearly, new plan formation has been dominated by defined contribution plans over the last 15-year period. This pattern, however, is somewhat misleading because most large firms in 1981 had established their pension plans prior to 1968. That is, in the last column of the table, it is shown that plans accounting for 48.3 percent of all 1981 participants were formed prior to 1960. Only 17 percent of 1981 participants were in plans created after 1975. Thus, the highest frequency of defined contribution creation was affiliated with generally smaller firms. Moreover, if small firms are more likely to turn over than large firms and also have a higher likelihood of defined contribution formation, any pseudo time series of the type created here will show an apparent shift toward defined contribution plans over time. Nevertheless, by 1981, fully 18 percent of all participants were in defined contributions only plans (DC-only) and 33 percent of all participants had a defined contribution secondary plans (DC-secondary).

ARE DEFINED CONTRIBUTION PLANS DISPLACING DEFINED BENEFIT GROWTH?

The data described above can be used to mount a prima facie case that defined contribution plans are the dominant plans of the future, and that the growth evinced in the table implies the ultimate downfall of defined benefit plans. Reports of widespread terminations surrounding the enactment of ERISA in 1974 provided the basis for some initial speculation on this point. The recent rash of voluntary sufficient terminations—so-called terminations for reversion—replaced oftentimes by defined contribution plans, have reinforced this presumption. In this section, the data that surround the termination issue and the theory that lies behind the presumed superiority of defined benefit plans are reviewed and discussed. It is concluded that while defined contribution plans indeed have emerged as important features in the private pension system, there is no compelling evidence that they will replace defined benefit plans as the premier feature of the system.

A Closer Look at Conventional Termination Statistics

It is most natural to discuss the increase in terminations over the past 10 years in two parts. This is because most policy discussions of terminations are dichotomized into ERISA regulatory problems and, of late, "terminations for reversion."

Impact of ERISA. Consider the popular view that the enactment of ERISA through its regulatory cost impact has encouraged termina-

TABLE 6–2 Defined Benefit Plan Terminations 1950–1984

(1)	(2)	(3) Terminations	(4)	(5)	(6) Qualifications	(7)
Year	Number of Plans per Year	Average Plan Size	Percent of Covered Workers Affected per Year (Percent × 100)	Number of Plans per Year	Average Plan Size	Percent of Covered Workers Affected per Year (Percent × 100)
1950–1954	96	55	.04	—	—	—
1955–1959	199	55	.09	3,602	143	3.20
1960–1964	336	52	.09	5,502	96	2.60
1965–1969	522	47	.10	11,299	73	3.30
1970–1974	1,706	36	.20	27,176	35	3.30
1975–1979	5,140	23	.36	10,509	102	2.90
1980–1984	5,175	48	.74	23,239	80	5.10

Actual data for the four years 1980–1983 are averaged to project the 1984 experience.

SOURCE: Hay Associates, *Pre-ERISA Plan Termination Benefit Losses*, Report submitted to the U.S. Department of Labor, 1979; and Pension Benefit Guaranty Corporation, *Analysis of Single Employer Defined Benefit Plan Terminations*, annual.

tions of defined benefit plans. The rationale for this expectation is discussed in a subsequent section. First, consider Internal Revenue Service termination and qualification data that are often cited to support this notion; in particular, note that the number of unweighted plans terminating sharply increased after ERISA and the number of qualifications decreased. Some of these statistics are shown in Table 6–2.

It is important first to understand that not all terminations or plan creations are recorded with the IRS; hence, the data are not intended to represent fully accurate counts on the *absolute* level of such activity, nor are the termination and qualification data equally distorted by omissions. But most pension policy experts accept the accuracy of the data to gauge overall trends in pension creations and terminations. With this caveat in mind, the IRS data are now addressed for the purpose of discerning apparent trends.

The (annual) number of terminating plans and new qualifying plans during a series of five-year intervals are shown in columns 2 and 5 of the table. Indeed, compared to the pre-ERISA period (1970–1974) the number of plan terminations virtually tripled during the post-ERISA period 1975–1979 (from 1,706 terminations to 5,140), and the number of new qualifying plans fell by over 60 percent (27,176 qualifications per year to 10,509). But closer examination of the data suggests that these statistics are somewhat misleading.

First, the dramatic increase in plan terminations began prior to ERISA. During the pre-ERISA period 1970–1974 the number of terminations more than tripled compared to the previous five-year period 1965–1969, an unprecedented increase during the post-war period. Second, once the data are weighted (by participants), the ERISA impact

falls by an order of magnitude. Column 3 presents data describing the average plan size for terminations; column 4 describes the termination rate: the percentage of the pension-covered work force affected by terminations. The post-ERISA participant-weighted plan termination rate was 80 percent higher than the 1970–1974 termination rate (.36 percent per year versus .20 percent) but not 200 percent higher as the unweighted data suggest. Moreover, the weighted rate of new qualifications (see column 7) fell by only 12 percent (from 3.3 percent to 2.9 percent), not 60 percent as suggested by the unweighted data.

Even if higher rates of terminations (lower rates of qualifications) occurred during the post-ERISA period, other factors could have caused the termination activity independent of ERISA. A premier candidate is the dramatic reduction in stock market value during the early 1970s. In Chapter 4, it was shown that the average funding ratio for defined benefit plans fell precipitously from 1972 to 1974[1]—largely the result of poor portfolio performance. It is easy to imagine some firms discovering during this period that the cost of the defined benefit plan (because of higher contributions necessitated by reductions in asset market values) exceeded their expectations, and reacted by terminating the contract.

Regardless of the cause of the increase in the termination rate after the enactment of ERISA, the absolute percentages involved are small. Prior to 1970 approximately .5 percent of participants were involved in a termination each five-year period (multiply numbers in column 4 in the table by 5). After 1970 this rate increased dramatically but remained below 2 percent. These numbers do not support the notion that a dramatic shift is occurring in the popularity of defined benefit plans at least as a result of ERISA.

Termination for reversion. The attention to terminations during the post-ERISA period has continued, but recently the emphasis has switched from ERISA-induced terminations to "terminations for reversion." That is, one way of interpreting historical data is that terminations occur because of the *downside* of market performance; that is, low funding ratios cause terminations. Yet they now appear to be occurring on the *upside* as well! Terminations have reached historical highs during the most recent five-year period, a period marked by relatively high funding ratios.[2] The rationale for termination has therefore switched: it is not necessarily attributable to fear of regulatory impact nor to sudden (perhaps unexpected) contribution burdens attributable to poor portfolio performance. Rather, it is seen as a means to access

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[1]Consider Table 4–2; real funding ratios fell from 86 percent to 53 percent from 1972 to 1974.

[2]The last accurate snapshot available is for 1981. The economic funding ratio in that year was .77 (see Table 4–2). Market indexes have improved markedly during the interval 1981–1984.

TABLE 6–3 PBGC Terminations by Type

Plan and Sponsor Status	*Plans*	*Participants (in Thousands)*
Sufficient terminations		
Ongoing firms	1,126	429
Failed firms	360	101
Total	1,486	530
Insufficient terminations		
Ongoing firms	64	47
Failed firms	112	85
Total	176	132
Grand Total	1,662	662

SOURCE: PBGC Case Processing Tape. Data based on terminations occurring between 1979 and mid-1983. Numbers summarize terminations of plans with at least 100 participants.

so-called excess assets in the pension plan. In terms of the earlier discussion about the true nature of pension liabilities (see Chapter 3), the excess is simply the difference between pension assets and terminated pension liabilities.

If firms find it optimal to access these funds, a lagged impact of ERISA could now be showing in the data because funding ratios (in a termination sense) have increased markedly owing to improved stock market performance (relative to the early and mid-1970s) and higher nominal interest rates (compare terminated funding ratios in 1978 and 1981 in Table 4–2). The IRS termination data in Table 6–2 show that over the most recent five-year interval, the termination rate has doubled again from the historical highs of the post-ERISA period. What is different about the data in this period is that the qualification rate is also markedly higher, suggesting that terminations are either attributable to failed firms being replaced by new firms with new plans, or that firms are terminating old defined benefit plans, (DB plans), recreating new DB plans in their place. Fortunately, better data are available from 1979 onward from the Pension Benefit Guaranty Corporation (PBGC), which permits a closer examination of the latest termination concern.

Table 6–3 presents the distribution of terminations from 1979 through mid-1983 of large pension plans with 100 or more participants, obtained from the PBGC Case Processing System Tape.[3] "Sufficient terminations" require no PBGC transfer; "insufficient terminations" require at least some PBGC transfer. The number of participants affected by terminations in these categories is also shown. The data show that

[3]The terminated plans with 100 or more participants account for 65 percent of participants in terminated plans.

TABLE 6–4 Pension Plan Terminations by Year

Year of Termination	Participants in Terminated Plans: Sufficient (in Thousands)	Participants in Terminated Plans: Insufficient (in Thousands)
1979	39	19
1980	43	34
1981	87	43
1982	151	42
Total	320	138

SOURCE: See Table 6–3.

64 percent of participants in terminated plans were in ongoing firms that had "sufficient" plans.

The trends in termination of "sufficient" and "insufficient" large plans of ongoing firms processed by PBGC since 1978 are shown in Table 6–4. What is noteworthy is that the numbers show a strong upward trend. But the termination growth is far greater in "sufficient" plans. For example, in 1979 only 39,000 participants were in terminated sufficient plans with at least 100 participants; in 1982, 151,000 participants were affected.

For comparison, consider the termination history in failed firms. While some upward trend is also evident, it is far less impressive. In 1979 and 1982, the numbers of participants in failed firms were 19,000 and 42,000. Thus, over the three-year period, participants in terminations in failed firms in 1982 were somewhat more than double those in 1979; participants in terminations of sufficient plans for ongoing firms in 1982 were almost quadruple those in 1979: voluntary terminations for ongoing firms were increasing at a much faster rate than involuntary terminations in failed firms.

According to the statistics in the PBGC data base, 47 percent of the participants were in sufficient terminated plans whose sponsor intended to establish a new plan (usually defined contribution or profit sharing) in its place (see Table 6–5).[4] An unknown portion of the remaining 53 percent of participants who did not receive a new plan or for whom information was not available may have already been covered by a second plan. It is not known whether, in the case of participants receiving a new plan, the new plan was as generous as the old, or in the case of participants already covered by a second plan, the second plan was enhanced as a result of the termination.

In short, there appears to be a strong indication that the number of sufficient plan terminations is increasing, perhaps being replaced by

[4]If the number of terminated plans for which no information is available on successor plan status were excluded from the base, the percentage of participants given a new plan increases to 71 percent.

TABLE 6–5 New Plan Formation after Termination in Ongoing Firms

Type of New Plan		*Participants (Percent × 100)*
No new plans		20
Unknown		33
New plans adopted	1	
DB-plan		
DC-plan	27	
Unknown	19	47
Total		100

SOURCE: See Table 6–3.

defined contribution plans. Again, however, a relatively small number of participants are affected. The numbers in Table 6–4 suggest that fewer than 1 percent of all participants in defined benefit pension plans in the United States were affected by sufficient terminations during the four-year period 1979–1982.

The story told by either IRS or PBGC termination data is the same. Terminations have been historically numerous since 1970, but the numbers of participants affected are relatively small. This is not to say that the post-1970 termination experience does not warrant study and continued monitoring. But at the same time, the data do not warrant a conclusion that defined benefit plans, as a whole, are experiencing a basic restructuring. But final conclusions cannot be based on these data alone. The case for healthy defined benefit growth can be built by appeal to theoretical arguments and exploitation of more complete population pension plan data.

Theoretical Considerations

Attributes of DB plans. The dominance of defined benefit plans (DB plans) did not emerge by accident. To people who believe in the efficiency of competition in markets, the pervasive adoption of defined benefit plan varieties signals their superior economic traits over defined contribution plans. If they were not superior, they would not have evolved as the premier form of pension plan. Two of these traits are particularly important.

First, DB plans offer annuities, not lump sum options. As discussed in Chapter 2, this feature distinguishes the defined benefit form from virtually all DC plans.[5] By offering a lump sum-annuity option to retirees, a selectivity problem is created: those who expect earlier death choose lump sums; those who exhibit indications of unusual longevity

[5]Based on a Department of Labor sample of 700 pension plan descriptions, 98 percent of defined contribution plans offer lump sum options.

choose annuities. The overrepresentation of superlongevity prospects makes the annuity value uneconomic to retirees with average longevity prospects. But if they accept the lump sum option instead, additional problems arise because retirees will protect against outliving their lump sums, and hence collectively will forgo considerable retiree consumption as a group (on average they will die with part of the lump sum intact). DB plans avoid these problems by requiring workers to sign up early for annuities; fair annuity prices can be given and the law of large numbers is exploited to permit consumption by the group to equal the full value of the groups' collective pension value.

Second, and perhaps more importantly, DB plans offer individuals the opportunity to spread risk over their working lives, rather than to concentrate risk at retirement. That is, saving for retirement involves risk. Even if individuals hold a diversified portfolio in their defined contribution account, it is possible that in their year of planned retirement, their portfolio could lose substantial value simply because of random shocks to stock, bond, and other securities' values. For example, the funding ratio data in Table 4–5 suggest that asset values in presumably diversified pension portfolios were approximately 40 percent lower in 1974 compared to 1972; this must have been a shock to DC-only retirees in 1974. Presumably, workers do not want to face this kind of risk at a point in life where there is little opportunity to recoup sudden wealth losses.

While market risk ultimately must be borne by someone at some time, it is easy to imagine a more efficient way in which this risk can be absorbed. One effective way is to establish a defined benefit plan. In a DB plan, regardless of the particular performance of each worker's implicit savings with the firm, the firm guarantees that at the point of retirement, the worker will have a pension indexed to his wage; even after retirement, he can look forward to significant inflation indexing. How then is the risk absorbed? This is the eloquence of defined benefit plans.

Recall from Chapter 3 that in a DB plan, the worker pays for the increment in his pension value each year in the firm. That is, he deposits an amount equal to the pension annuity discounted by the long-term interest rate. The long-term interest rate is the best guess of what the inflation rate and real return (and risk premium) will be on this deposit. One way the worker can reduce risk is to invest exclusively in short-term notes; but in so doing, he ensures that his long-term rate of return will be void of any risk premium. How can he effectively hold a riskier portfolio?

It is easy to work through the logic if we think the firm takes the deposit and actually buys long-term bonds with the deposits. If inflation falls relative to expectations, the firm experiences a capital gain; if

inflation increases, the firm experiences a loss. Since each worker cohort "bets" on the long-term interest rate each period, it is possible that by retirement, the gains and losses will wash. But if returns are serially correlated, it is also possible that a particular worker cohort could lose on the sum of their "bets" over time. It is almost surely true, however, that the net gain or loss over several cohorts will wash. That is, given the long-term horizon of the firm, it sees virtually no long-term risk; thus, it efficiently absorbs risk that may be very high to any particular cohort.

The annuity and risk-spreading features are endearing qualities of defined benefit plans. Given these advantages over defined contribution plans, it is hard to see how defined benefit plans, absent a restructuring of the operating characteristics of DC plans, will lose the allure they have had for the American worker for over 35 years. ERISA regulations could have caused a change in the relative cost of operating DB plans compared to DC plans, and hence stimulated a trend away from DB plans. But consideration of ERISA regulatory impact makes this argument unconvincing.

Much of ERISA regulation—including reporting and disclosure, vesting, and fiduciary regulations—apply equally to DC and DB plans. The critical difference is that DB plans are required to accept a federal insurance policy from the Pension Benefit Guaranty Corporation (PBGC) and are required to conform to minimum funding standards. First, consider the funding issue. No matter how stringent the funding requirements are for DB plans, funding requirements in DC plans are 100 percent each year!

Second, consider the insurance issue. Take the extreme case. Consider a firm that has a zero chance of failing over the next 50 years. That is, suppose its insurance premium is paid with zero expected benefit. Next, suppose the current *proposed* PBGC premium of $7 is expected to triple (in real terms) to $21 per participant per year. If we ignore discounting, the average (real) pension annuity in the United States is roughly $120,000.[a] If the average tenure is 25 years, and the average retirement period 15 years, the lifetime PBGC premium (using the $21 rate) over all active and retirement years is $840. Is it reasonable to think that an assessment of .7 of 1 percent (= 840/120,000) of the value of the pension will lead to the demise of defined benefit plans?

DC plans as secondary plans. The above remarks suggest that there is little a priori expectation that defined benefit plans should be replaced by defined contribution plans. But there may be a reasonable expectation that DC plans can and will continue to *supplement* the

[a]That is, the average annuity is roughly $6,000 per year (see Chapter 1); the average annuity period is roughly 20 years.

basic DB plan structure. Recall the discussion of the basic infrastructure of pensions. In Chapter 2, it was argued that pension growth was due primarily to the tax shock that must have jolted the economy during the post–World War II period. Because of the new, high-marginal tax rate structure, the tax advantages of pensions became significant.

Consider, however, that while these tax advantages were high, older workers during the 1950s had likely accumulated considerable provisions for retirement. They may have purchased a house and other durable assets or accumulated sizable portfolios to finance their retirement. Simply put, older workers had already sacrificed considerable consumption to provide for retirement. Notwithstanding the new-found tax advantages of pensions, these workers must have been unwilling to sacrifice as large a portion of their wage as young workers who had not yet planned for retirement. Even young and middle-aged workers may have already made commitments to other long-term accumulations—such as house or life insurance purchases—which may have made them unwilling to suddenly switch large portions of their wages to the new pension vehicles.

It is easy to imagine that the optimal response to the shock would have been to opt for the introduction of defined benefit plans and perhaps to increase their generosity over time. But it is also plausible that the evolutionary adjustment to the shock could take the form of defined contribution plans. There are two reasons for this. First, increases in the generosity parameter of the defined benefit plan will award windfall gains to older workers. A gradual schedule of increases that could be reasonably expected by workers would have to be built into the plan. It would be simpler, and also would be strictly proportional to the worker's age, to start a defined contribution plan.

Second, given annuity expectations from two sources—social security and DB plans—workers may have wished to accept part of the gradual adjustment to higher pensions in the form of DC plans. Among other things, it could help them diversify against the risk of unexpected early departures from their firm, which would trigger real losses in their DB plans (see Chapter 3); DC plans are immune from the effects of early departure or firm failure.

No pretense is made here that the dynamics of the full adjustment to the tax shock are understood. The conjecture is made, however, that the growing popularity of defined contribution plans could easily be interpreted as a natural part of the overall evolution to a full-equilibrium pension-savings world. In this sense, it is easy to depict DC plan growth as more pension growth, not displacement of DB plan growth.

Empirical Considerations

The above discussion about DC plan growth relied on casual evidence and theoretical arguments. But additional analysis can be performed

which would permit us to test defined contribution growth hypotheses in a more systematic way. The purpose of this section is to subject secondary and primary DC plan growth to this type of scrutiny.

Secondary defined contribution plans. Most defined contribution plans are secondary. Annual report data for 1981 suggest that over 70 percent of assets in DC plans are in plans that are secondary to defined benefit plans. It is therefore natural to ask whether there is any evidence to suggest that secondary plan growth is coming at the expense of reduced emphasis on the primary DB plan.

First, consider that over 80 percent of the assets in DC secondary plans are in profit sharing or stock bonus plans. That is, the worker's secondary pension is heavily dependent on the actual (profit sharing) and/or anticipated (stock bonus) profit flow in the firm. Thus, on the face of it, secondary plans appear to be performing a different function than DB plans.[7] This fact alone suggests that secondary DC plans are not close substitutes for defined benefit plans.

A more direct test of this proposition is possible. If secondary DC plans are substitutes for DB plans—secondary DC plans are expected to gradually replace primary DB plans—then it follows that, other things constant, the generosity of the primary DB plan should be reduced by the creation of a second plan and, more importantly, the generosity should fall more noticeably as the DC plan ages (DC plan benefits accumulate proportionally to plan age).

From an empirical perspective, it is possible that firms which offer generous DB plans may also offer a second plan; that is, some firms may simply offer more pension benefits across-the-board, suggesting that DB plan generosity and secondary DC plan creation could be positively correlated. But the DC plan-age hypothesis is discriminating. Regardless of which firms create a secondary DC plan, if the plan is designed to gradually replace the primary DB plan, the aging of the DC plan should result in reductions to the generosity of the primary plan.

This hypothesis was tested using data from the Form 5500 annual pension reports. Defined benefit generosity was measured by the average annual pension paid to current retirees. This measure could be influenced by many factors. For example, new plans may start at lower levels of benefits; younger plans may appear less generous just because plans become more generous with age. The pension amount will also be influenced by the average age of retirement; firms with early retirement features will appear less generous because annual pensions will tend to be lower for early retirees. To accommodate these and other influences, numerous independent variables were included in the regression. These include age of plan, firm size, plan size, and many industry characteristics. In addition, a dummy variable denoting the presence

[7] A money purchase DC plan—a percentage-of-wage savings plan—is more akin to a DB plan (without the straight annuity feature).

TABLE 6–6 Impact of Secondary Plan on Generosity of Primary Plan

Independent Variables	*Coefficient*
Intercept	6.14
	(3.38)
Plan age (DB primary plan)	.024
	(6.55)
Plan age squared	−.00023
	(3.47)
Secondary DC plan	.056
	(1.68)
Age of secondary plans	−.0032
	(1.73)
Industry weekly wage (mean $147)	.0035
	(1.95)
Other variables[a]	X
R squared	.31
Number of defined benefit plans in sample	2,085

Dependent variable: Log of average annual pension paid in 1981 in a defined benefit plan.

[a]The regression also included all independent variables shown in Table 4–7 and additional variables to describe the educational, occupational, age, and sex distributions at the three-digit industry level.

SOURCE: U.S. Department of Labor, Annual Pension Plan Reports, 1981.

of a secondary DC plan was included as well as a variable denoting the age of the secondary plan, if one existed. The results are reported in Table 6–6.

Because of the large number of explanatory variables, only a selected number of coefficients are reported. For example, the results show that older plans award larger average benefits, and higher wage workers receive higher pension benefits. Of most interest, however, is the coefficient for the dummy variable representing the presence of a secondary DC plan and its age. The coefficient on the DC dummy variable is positive, suggesting that other things constant, secondary plans tend to be established in firms that already have somewhat more generous DB plans. More importantly, however, the coefficient on the age of the DC plans is negative.

This result suggests that, indeed, as secondary plans age (and hence accumulate more assets and benefits), the average annuity paid from the primary plan falls. Thus, the hypothesis that DC plans substitute for DB plans has found some verification in the data. But the coefficient is barely significantly different from zero at conventional levels; more importantly, the coefficient is quite small. For example, the results suggest that a secondary plan that is 20 years old in 1980 would reduce the primary pension generosity by approximately 6.1 percent (= the coefficient .0032 times 20 years). Given that most secondary defined contribution growth has occurred over the past 20 years, it is somewhat

TABLE 6–7 Percent of Participants with Defined Contribution Plan Coverage, 1947–1981

(1)	(2)	(3)
Year	*Participants with DC-Plan Primary Coverage (Percent × 100)*	*DB-Plan Participants with DC-plan Secondary Coverage[a] (Percent × 100)*
1947	18.6	5.7
1953	12.0	12.6
1960	12.2	20.6
1967	12.9	20.9
1974	14.6	23.7
1981	18.0	33.0

[a]The percent of participants with DC-plan primary coverage who also have secondary coverage was approximately 10 percent in 1981.

SOURCE: See Table 6–1.

perilous to extend these results much beyond 20 years. In general, however, it can be concluded from the data that while some evidence exists suggesting some substitution of the secondary DC plan for the primary DB plan, the degree of substitution is small. That is, the growth of secondary DC plans may ultimately slow the growth of DB plans, but the effect is so small that as a first order magnitude, it can be safely ignored.

Primary defined contribution plans. While the evidence suggests that secondary plans are truly providing a second tier of private pension benefits, the same cannot be said of the growth of defined contribution-only plans. By definition, growth of DC-only plans implies replacement of defined benefit plans as the primary form of benefit. Statistics describing this growth are presented in Table 6–7. These numbers are based on a cross-sectional observation of pension plans in 1981 and hence are a reflection of the pseudo time series statistics provided in Table 6–1. They describe the percentage of pension participants covered by secondary and primary DC plans during the period 1947–1981.

The numbers in the last column show the percent of participants in DB plans who also had secondary DC plan coverage from 1947 to 1981. In 1947, only 5.7 percent of DB plan participants also had secondary DC-plan coverage; by 1967, 20.9 percent had secondary coverage; by 1981, 33 percent. Similar numbers for DC only coverage are presented in column 2 in the table. Inspection of these data confirms the discussion of various termination data above.

In 1947, fully 18.6 percent of all participants in pension plans were covered primarily by a DC plan. But this percentage fell to 12 percent by 1954 and increased gradually to 12.9 percent in 1967. From 1967 to 1974 the DC share in primary plan coverage grew substantially to

14.6 percent. This result is consistent with our earlier finding that the termination rate in DB plans increased during the early 1970s. Again, consistent with earlier evidence, the rate of growth continued to increase at a somewhat accelerated pace through 1981 when it reached 18 percent.

A more complete analysis of DC only growth was also made. All primary plans were selected from the 1981 annual pension report data base; again, each was arranged by period of establishment (each period was seven years in length 1975–1981, 1968–1974, etc., except the first, which was open ended prior to 1947). The idea was to estimate the probability of whether a plan created in period i was defined benefit or defined contribution—recall secondary plans are not included in the analysis. Plan and industry characteristics were included to explain plan selection as well as market conditions at the time of plan creation (such as the average funding ratio for DB plans in the period and the average nominal long-term interest rate, both suggested by termination arguments made above).

The results, which are shown in Table 6–8, confirm some of the patterns in DC only growth suggested in Table 6–7 and implied by the termination findings above. In particular, during periods of high average (real) funding ratios in DB plans, the probability of the creation of a DC only plan falls. During periods of high nominal interest rates, the probability of DC only establishment increases. Equally important, and not apparent from the aggregate data shown above, the results suggest a negative drift in the probability of DC only formation, especially in large firms [see negative coefficients on the variables Period and Period (Firm > 10,000)]. But ERISA partially reverses this negative trend; apart from the effects of funding levels and interest rates, ERISA's impact is positive and highly significant, though quite small in magnitude. Specifically, the results suggest that as a result of ERISA, the probability that a new primary plan (unweighted) would be defined contribution during 1988 would be one-half of 1 percent higher than it otherwise would have been.[a]

Conclusions

Considering all the data together, there is confirmation in the results that DC plans have been growing with remarkable speed. At the same time, the data do not appear to support the notion that the dominance of defined benefit plans as the primary source of pension benefits in

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[a]The point estimate on the ERISA · Period interaction variable is .0024. Thus, two periods after ERISA (each period is 7 years long), the impact of ERISA on new DC-primary-plan formation is .0048 (= 2 × .0024). It is also noteworthy that DC-only formation is more likely to occur in high-growth industries.

TABLE 6–8 Probability of Defined Contribution-Only Formation

Independent variables	*Coefficient*	*Point estimate*
Intercept	.230	
	(.88)	
DB funding ratio during period	−.024	−.005
	(4.80)	
Long-term nominal interest rate during period	.474	.104
	(3.82)	
Period	−.025	−.005
	(7.14)	
Period · ERISA	.011	.0024
	(11.09)	
Period · Firm size < 250	.004	.0008
	(1.18)	
Period · Firm size (5,000–10,000)	−.005	−.001
	(1.50)	
Period · Firm size > 10,000	−.020	−.004
	(4.00)	
Union	−1.72	−.378
	(13.65)	
Industry growth during 1958–1981	.096	.021
	(2.59)	
Period of plan creation	.370	.081
	(2.17)	
Industry dummy variables	*X*	—
Number of observations	9,324	—
Number of positive observations	3,006	—
Log of likelihood	10,046	—

Sample includes all primary defined benefit and defined contribution plans in 1981 from the U.S. Department of Labor, Annual Pension Plan Reports. *Period* is a variable which equals one if establishment occurred prior to 1947 (a separate dummy was also included for this longer period, not reported), two if establishment occurred between 1947 and 1953, three during 1954–1960, etc. Industry growth is measured at the four-digit level using employment statistics as a measure of growth.

the United States is fundamentally threatened by the growth of defined contribution plans. Most DC-plan growth is affiliated with *secondary* plan coverage; there is little indication that the institution and development of these plans has led to any substantial reduction in the generosity of the primary defined benefit plan.

While DC plans as *primary* plans have become more popular during the 1970s, two important factors should be remembered. First, the percent of participants affected by the switch from DB-primary coverage to DC-primary coverage is quite small. Over the entire period 1967–1981, the percent of participants with DC-primary coverage increased from 12.9 percent to 18.0 percent, hardly a startling increase. Second, the data suggest that the DC-primary growth does not reflect a strong trend but instead reflects the influence of dramatic changes in funding

ratios due to poor stock market performance and unprecedented increases in nominal interest rates. Arguably, if inflation is reduced to pre-1965 levels on a consistent basis, stock market performance will return to some form of normalcy[8] and nominal interest rates will fall dramatically. If so, defined contribution share of primary funds could revert to pre-1970 levels.

DEFINED CONTRIBUTION ASSET PROJECTION

With some understanding of the growth of defined contribution plans and their role in the private pension system vis-à-vis defined benefit plans, it is now possible to attempt to add appropriate DC-plan asset growth to projections already made for DB plans in Chapter 5. Our findings suggest that projected secondary DC-plan asset growth can be added to DB-plan asset growth without double counting to any significant degree. But the potential spread of DC-only coverage cannot, of course, be included because, to the extent that DC-only coverage growth continues, it will come directly at the expense of DB-plan coverage. Since DB-plan growth has already been projected, accounting for DC-only growth in coverage would represent a strict double-count of asset projections. This does not mean that all asset growth in DC-only plans should be ignored.

There are two types of asset growth to consider. First, it takes many years for pension plans to fully mature. And it turns out that the rate of growth in assets is fastest at younger plan ages. Thus, to the extent that the ages of current DC plans—primary and secondary—are younger than DB plans, the relative asset share of DC plans will increase just because, on average, DC plans tend to be younger than DB plans and thus are maturing at a faster rate.

Second, DC-plan asset growth may also grow in importance as the DC plan coverage rate expands. Accounting for further DC only plan coverage would merely double count coverage already included in the DB plan projections. But accounting for further DC-secondary-plan growth—which the data suggests will occur without substantially affecting the size of primary defined benefit plans— is appropriate.

DC Asset Growth Due to Projected Maturity Effects

Since there is considerable variation in plan ages at a given time, the asset-maturing path for DB plans and DC plans can be estimated from cross-sectional data. Holding other things (including active partici-

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[8]It is well known that the stock market reacts negatively to unexpected inflation. See, for example, Eugene Fama and G. W. Schwert, "Asset Returns and Inflation," *Journal of Financial Economics* 5 (November 1977), pp. 115–46.

pants) constant, assets in the DB plan should grow as real benefits improve and the retiree annuity age ranks are filled. Assets in DC plans will grow as active employees acquire more service and as the plans become more generous. Available data suggest that neither type of plan fully matures until approximately 45 years old.[10]

Following a procedure outlined at the beginning of this chapter, the start dates can be recreated for all plans observed in 1981.[11] By applying the maturity functions to these plans, the size of each plan over time from the date of its creation to 1981 can be estimated. Real growth due to further maturing can be projected to the year 2000. By applying this procedure to each plan and adding up the "observed" assets in all plans in a given year, the growth of aggregate DC-plan and DB-plan assets can be recreated and projected.

DC-Plan Asset Growth Due to Spread of Secondary Plans

Estimates of the growth of secondary plan formation can also be made. In particular, it is possible to estimate the determinants of secondary DC-plan creation. This estimate is presented in Appendix 6–1. This equation can be used to project incremental plan creation for all DB plans that did not have a secondary plan in 1981. By assuming that new plans will on average be as generous as existing plans at full maturity and using the DC-plan maturity function to adjust the assets to their size in 1990 and the year 2000, the DC-asset growth attributable to secondary DC-plan formation can be estimated.[12]

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[10]Maturity functions are estimated from annual pension plan report tapes. Holding industry, firm, and plan characteristics, as well as actual plan participants, constant, the following equations are estimated (t-statistics on plan age variables are highly significant):

$$\text{DB Assets} = X \cdot \exp(.092\,PA - .00098\,PA^2),\ R^2 = .42,\ \text{Obs.} = 4247;$$
$$\text{DC Assets} = Y \cdot \exp(.081\,PA - .00086\,PA^2),\ R^2 = .44,\ \text{Obs.} = 5759,$$

where X and Y represent vectors of other variables and PA represents plan age. Taking the first derivative of these equations and setting the result equal to zero, the maturity age of these plans is found to be in the vicinity of 45 years.

[11]This procedure excises plans from firms that existed prior to 1981 but failed before the 1981 snapshot could be taken. But since most DC-plan assets are secondary to DB plans, firm failures are expected to bias DB-plan and DC-plan data in similar ways.

[12]For example, consider the projection of assets to the year 1990. First, depending on the characteristics of a particular DB plan (including its age, growth rate, etc.), an annual probability of secondary DC-plan creation can be found from Appendix 6–1. Such a probability (times nine years from 1981–1990) is derived for all DB plans in 1981 which did not already have a secondary plan. This probability is multiplied by the average assets per participant in secondary DC plans (approximately $7,500 in 1981) times the number of participants in the DB-only plan. Since the $7,500 average applies to the average maturity of existing DC-secondary plans (17 years), it is scaled down to 4.5 years (the average age of new plans created after 1981 until 1990) using the DC-maturity function (see note 10). The summation of these calculations is added to the 1990 DC-asset base. A similar procedure is used to project DC-asset growth for the year 2000.

TABLE 6–9 Share of Defined Contribution Assets, 1950–2000

(1) Year	(2) DC Assets ÷ DB Assets (Percent × 100)	(3) DC-Plan Share of Pension Assets	(4) DC-Plan Share of Pension[a] Liabilities
1950	13.2	11.6	9.0
1955	17.3	14.7	11.4
1960	21.9	18.0	14.1
1965	26.3	20.8	16.4
1970	30.6	23.4	18.6
1975	34.7	25.7	20.6
1980	38.6	27.8	22.4
1990	47.0*	32.0*	26.1*
2000	53.6*	34.9*	28.6*

*Denotes projected value.

[a]Numbers in this column are derived on the basis of a target funding ratio of .75 (see Chapter 4).

Data source through 1980: see notes to table 6–1. Projected values are discussed in text and related footnotes.

Total Growth

Applying the maturity factors to the DC plans and DB plans in the pseudo times series sample used above, and adding new DC-plan formation after 1981, the defined contribution asset base can be compared to the DB-plan asset base over the period 1950–2000. The results are listed in columns 2 and 3 of Table 6–9.

The numbers reflect the general flavor of results reported earlier in the chapter: a rapid escalation of the importance of DC plans in the pension plan asset universe. Consider the results in column 2. In 1950, assets held by defined contribution plans were only 13.2 percent as large as the DB-plan asset base; by 1970, they were 30.6 percent as important; and in 1980, 38.6 percent as large. The formation of more secondary plans and the maturing process alone will swell this number: in the year 2000, DC-plan assets will have $53.60 in assets for each $100 held by DB plans. In terms of total pension assets (see column 3), DC plans will increase their share of ownership from 27.8 percent in 1980 to 34.9 percent in the year 2000. This growth is attributable to the generally younger ages of DC plans that mature at a faster rate than older plans,[13] and, after 1980, to some moderate increase in new (secondary) DC-plan formation.[14]

[13]When weighted by active participants, the average age of a DB plan in 1981 is 18.9 years; the average for DB plans is 26.3.

[14]Plan formation after 1981 is responsible for approximately 2.6 percentage points out of the 34.9 percentage point share for DC plans in the year 2000.

Because defined benefit plans are not fully funded, the DC-plan share of pension liabilities is somewhat lower.[13] These numbers are presented in the last column in the table; in 1980 the DC-plan share of private pension liabilities was 22.4 percent; in the year 2000, it will grow to 28.6 percent.

CONCLUSION

This chapter explored one of the most dynamic aspects of the private pension system: supergrowth of defined contribution plans. Using 5500 annual pension reports in a way that creates a pseudo time series data base, the relative growth of defined contribution plans was analyzed. The data confirm the widespread belief that defined contribution plans are becoming a progressively more important element of the private pension plan system. Indeed, in 1980, assets in defined contribution plans represented approximately 28 percent of all private pension assets. Considering that defined benefit plans are only partly funded, this means that in 1980 approximately 22 percent of all accumulated private pension liabilities were incurred by defined contribution plans. In 1950, the DC-plan asset and liability shares were 11.6 and 9.0 percent.

Examination of the data, however, shows that most of this growth is attributable to the remarkable growth of secondary DC-plan creation. In 1950, only approximately 6 percent of participants in DB plans had a second plan. By 1981, 33 percent had secondary coverage. The data show that the growth of secondary DC plans does not appreciably reduce the benefit levels available in the primary plan.

Some evidence was uncovered to suggest that, after a relatively long period of constancy, DC-only plan coverage increased markedly after 1970. The data suggest that a portion of this increase was attributable to poor stock market performance in the early 1970s and the controversial "terminations for reversions" boom after 1979 (attributable to high interest rates). Since only a small portion of this change was attributed to ERISA itself, it is not clear that the DC-only spurt in the 1970s will continue or wane. In general, however, nothing in the data suggests that defined contribution plans are replacing defined benefit plans for the long run.

The growth of DC-plan assets is expected to exceed the growth of DB-plan assets. This projection is attributable to two factors: the maturity process itself [DC plans are younger and thus are generally in higher growth phases than older DB plans], and the expected creation

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[13] That is, the DC-plan share of liabilities is $1 - L_{DB}/L$ where L_{DB} are DB-plan liabilities and L are total pension liabilities. But since $L_{DB} = A_{DB}/F$, $A_{DC} = L_{DC}$ and $L = L_{DC} + L_{DB}$ where A_{DB} are assets in DB plans, F is the funding ratio, A_{DC} and L_{DC} are assets and liabilities in DC plans, it follows that the DC-plan share of liabilities is equal to $1 - 1/[(FA_{DC}/A_{DB}) + 1]$. The ratio A_{DC}/A_{DB} is found in column 3 of Table 6–9.

of even more secondary coverage over the long run. In the year 2000, it is estimated that DC-plan assets will account for 34.9 percent of all private pension plan assets; this is in comparison to 27.8 percent in 1980.

The single most important factor on which these projections are based is the continuation of the trust of workers in the integrity of defined benefit plan sponsors. The data and the theory suggest that there is no logical reason to believe that defined benefit plans will not continue to be the dominant type of pension plan in the United States. But recall that these contracts are written in nominal terms and the firm holds the legal right to terminate the plan at any time. If voluntary terminations become a larger problem and if there is an implicit contract between workers and firms that the firm will not terminate the plan, a large-scale reexamination of the pension contract will ensue. If workers begin to lose trust in the integrity of the *real* element of the defined benefit contract, we will observe either a rewriting of defined benefit contracts in real terms or a dramatic switch toward primary DC plans. This has no immediate implication for asset growth—but the relative proportions of DB-plan and DC-plan asset shares could be dramatically altered from the scenario depicted in Table 6–9.

Appendix 6–1
Determinants of Secondary Plan Coverage

The purpose of this appendix is to provide an estimate of the probability of secondary plan coverage. Approximately 33 percent of workers have secondary plan coverage, mostly workers who have a DB plan as their primary pension.[16] Why do some workers have secondary coverage while others do not? How has the pattern of coverage changed over time?

To answer these questions, the pseudo-longitudinal pension plan data base is used. That is, the 5500 data base can be used to determine the date of creation of pension plans and to identify secondary plan coverage.[17] This information can be used to determine the probability

[16]The probability that a worker who has a DC plan as his primary plan also having a secondary plan is approximately 10 percent.

[17]The 5500 form does not indicate secondary plan coverage as such. Each pension plan, however, is affiliated with a particular IRS-EIN number and a plan number. By applying certain axioms—for example, workers are never simultaneously covered by two DB plans—and taking advantage of auxiliary data—for example, numbers of participants in each plan—estimates of secondary coverage can be made. Hand checks of samples of these computer matches shows that the algorithm is a reliable indicator of secondary plan coverage.

of secondary DC-plan creation during a particular period (e.g., 1968–1974), given that a DB plan had already been created at the beginning of the period (e.g., 1968). In this way, the probability of secondary coverage, conditional on primary coverage in plans, can be evaluated over several pseudo time periods and across firm characteristics in each period.

The results of a logistic equation estimate of this probability relation are presented in Table 6–10. In the middle column, the coefficient (and t-values) are given. In the right column, the point estimates for each variable are given. For example, the intercept term refers to the probability of secondary plan creation during the period 1975–1981, given that a primary DB plan existed in 1975 (and did not already have a DC plan), the firm employed between 1,000 and 10,000 nonunion workers, industry growth was zero, and the firm was in the manufacturing industry. The results show that the conditional probability of creation for this DB-plan-covered group is 16.6 percent over the seven-year interval 1975–1981. In the pre-1947 period, the same probability for the same firm would have been 11.1 percentage points lower. During the period 1961–1967, the probability would have been only 3.9 percentage points lower. Thus, the data show a strong trend toward more secondary plan coverage over time. The results also show that the probability varies with size of firm, age of DB plan, industry, and industry growth.

To project future secondary plan coverage, we suppose that the post-ERISA probabilities of plan creation will prevail until the year 2000. The equation is applied to all DB only plans in 1981 that did not already have secondary DC plan coverage. The estimates suggest that 19.2 percent of these DB plans will create a secondary plan by the year 2000. This result is used in the text to generate estimates of additional assets expected to be held by these new plans.

TABLE 6–10 Determinants of Secondary Plan Creation (logistic equation)

Independent Variable	*Coefficient*	*Point Estimate*[a]
Intercept	−1.61	.166
	(2.91)	
Time period	−1.91	−.111
Earlier than 1947	(3.29)	
1947–1953	−1.98	−.114
	(3.53)	
1954–1960	−.58	−.033
	(5.27)	
1961–1967	−.72	−.039
	(8.01)	
1968–1974	−.39	−.021
	(4.87)	

TABLE 6–10 *(concluded)*

Independent Variable	*Coefficient*	*Point Estimate*[a]
Size of firm (workers)		
Fewer than 500	−.624	−.034
	(6.23)	
500–1,000	.437	.024
	(3.73)	
More than 10,000	.82	.045
	(4.55)	
Age of DB plan	.009	.00049
	(3.24)	
Unionization of participants	.0019	—
	(.03)	
Industry growth (four digit)		
1958–1981	−1.51	−.083
	(1.17)	
Current period	.63	.034
	(2.74)	
Last period	.20	.011
	(.83)	
Industry (two digit)		
Mining	.89	.048
	(5.93)	
Construction	.80	.044
	(2.58)	
Transportation	.70	.038
	(4.36)	
Communications and utilities	.41	.022
	(3.41)	
Wholesale trade	−.14	−.007
	(.38)	
Retail trade	−.21	−.011
	(.75)	
Finance, insurance, and real estate	.89	.048
	(9.88)	
Services	−.97	−.052
	(6.06)	
Other	−1.34	−.074
	(4.34)	
Number of observations	19,286	
Number of observations positive	1,126	
Log of likelihood	7873.1	

Dependent variable: one if secondary DC plan was created during period; zero otherwise. The numbers in parenthesis are t-statistics.

[a]The point estimate gives the increase in the dependent variable from an increase in the independent variable by one unit. This can be shown to be equal to $b_j P (1 - P)$ where b_j is the jth coefficient and P is the percentage of positive observations in the sample.

SOURCE: U.S. Department of Labor, Annual Pension Plan Reports, 1981, arranged in pseudo-longitudinal order. See Table 6–1 and surrounding discussion in text.