

**The Rise in Defined Contribution Pension Plans
And The Stock Market Boom**

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1. Introduction

The last two decades have witnessed a material change in the way Americans save for retirement. The enactment of Employee Retirement Security Act (ERISA) in 1974 popularized the defined contribution pension plans and transformed the American retirement system. The popularity of defined contribution plans got a strong fillip in 1982 with the introduction of 401(k) accounts. The value of assets in private sector defined contribution plans increased from \$104 billion in 1978 to \$ 2.5 trillion in 2000¹.

The trend towards defined contribution pension plans is not limited to the U.S. Defined contribution plans in private sector are already dominant in countries like Hungary, Denmark, Thailand, Australia, Switzerland and Spain. Some countries, notably Singapore and Malaysia, have gone further and adopted defined contribution plans for public-sector pensions as well.

Changing composition of pension plans has been a matter of academic and policy debate for a long period. Especially, the surge in defined contribution plans has attracted theorists to trace its causes and to forecast its effects. Analysts have warned about the individual employees' inability to bear the greater risks or their lack of expertise in making investment decisions entailed by defined contribution plans. Significant concerns have also been expressed about excessively conservative investments by 401(k) participants, especially women². However, these concerns have been allayed by empirical studies showing that the average and median pension benefits are higher for defined contribution plans than for defined benefit plans³.

¹ U. S. Department of Labor data

² Mary Rowland, 1995

³ Samwick and Skinner, 2001

Many alternative explanations have been theorized for the rise in defined contribution plans. The earlier research on the topic has focused on three main explanations for growing popularity of defined contribution plans. The first explanation is based on changes in regulation, as the increased regulation contributed to unpopularity of defined benefit plans⁴. The second explanation is the relative shift in concentration of work force from large, unionized firms that tend to favor defined benefit plans, to smaller service firms that tend to favor defined contribution plans⁵. The third explanation, advanced by Friedberg and Owyang (2002), is the acceptance of defined contribution plans by employees as a vehicle for savings.

Surprisingly, the alternative reasons given for the growth in defined contribution plans do not emphasize the choice over investment destinations provided by these plans. This becomes especially important with the increase in superior returns that can be attained by exercising such a choice. Empirical data suggests that the surge in defined contribution pension plans has meant a greater portion of plan assets invested in equity. Not coincidentally, this era also witnessed the periods of unprecedented booms in US stock markets. The combined effect of the two trends has been a self-fulfilling cycle: the astronomical returns generated by the “go-go” markets attracted investors and speculators alike, and the increase in money flowing to equity securities pushed equity valuations to even higher levels. Some analysts have argued that shifting investment decisions to individuals may imply an increase in “hot” money, causing higher market volatility as individuals chase performance, have shorter time horizons and are more prone to panic.

In this paper we examine the factors influencing individuals’ choice of defined contribution plans insofar as it is driven by capital market variables. Especially, we argue that

⁴ Clark and McDermed, 1990

⁵ Beller and Lawrence, 1992

disproportionately high returns from equity in the last two decades have contributed to the growth in defined contribution plans, since these plans allow individuals to control the investment destination of their savings. However, we do not argue that the attraction of equity has been a singularly dominant factor in the rise of defined contribution plans. Instead, we believe that emphasis on equity investment is an important factor that has been hitherto under-emphasized. We believe that understanding the relationship between defined contribution plan assets and stock market returns and volatility has important consequences not only for regulations related to retirement savings, but also for understanding stock market performance.

2. Factors Affecting Trends in Pension

2.1 Incentives for long-term employment and savings

The basic structure of a pension plan involves deferring compensation and consumption. Rationally individuals should prefer compensation up front, or at best be financially neutral if the compensation is constant in present value terms. Why then do the pensions exist? A series of papers have examined this issue and have attributed the evolution of pension structure to the incentives for long-term employment and long-term savings.

The traditional defined benefit pensions have been explained as a vehicle for employers to incentivize long-term employment without entering into a rigid employment contract⁶. This, however, does not fully explain the emergence of defined contribution plans, which are portable and hence not tied to the tenure of employment with a single employer. The existence of defined

⁶ See, for example, Lazear (1986)

contribution plans has been explained using psychological theories: pension plans force individuals to save and hence are accepted by workers who recognize their inability to control their spending⁷.

The move towards defined contribution plans is consistent with the increase in job-turnover, especially over the last two decades. The shift towards defined contribution plans has been supported, no doubt, by the favorable legislative changes and tax benefits. However, favorable legislation does not fully account for the rise of defined contribution plans and especially the concentration of defined contribution assets in corporate equities.

2.2. Attractive returns from equity investments

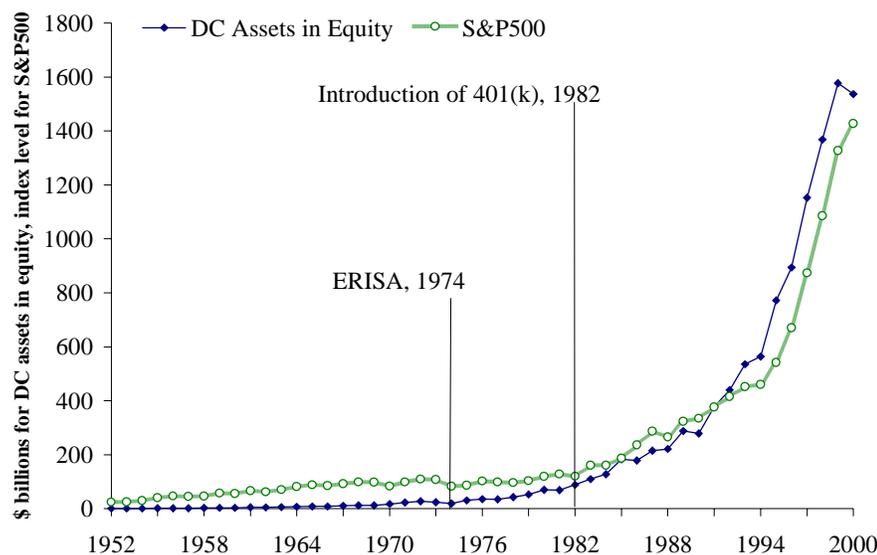
One explanation for the growth in defined contribution plans is the greater degree of control over investment decisions. The value of this control has increased with boom in equity returns. The individuals, in turn, have increasingly opted for defined contribution plans and directed their investments into corporate equities. Thus, the rising level of defined contribution assets has gone hand in hand with the rise in equity valuations over the last two decades. Also, as more and more of defined contribution assets get allocated to equities, stock market performance has a profound effect on the value of total defined contribution assets.

This explanation draws support from the increasing level of defined contribution assets in equity. In particular, the growth in defined contribution plan assets in equity has been meteoric over the last two decades and has paralleled the rising equity valuations, as observed in

⁷ Friedberg and Owyang, 2002

Figure 2.1. A TIAA-CREF study⁸ shows that the stock of equity assets in defined contribution plans increased from 44% in 1987 to 60% in 1996. A similar conclusion was reached by an EBRI study⁹, suggesting that 72% of balances in its 401(k) participants' database were invested in equity securities. One of the earliest evidence of correlation between equity market returns and popularity of defined contribution plans comes from the stock market crash of 1929. Whereas prior to the crash 10,000 firms had defined contribution plans, only 300 plans remained in place at the end of the Great Depression¹⁰.

Figure 2.1: Defined contribution plan assets invested in equity and equity market valuations



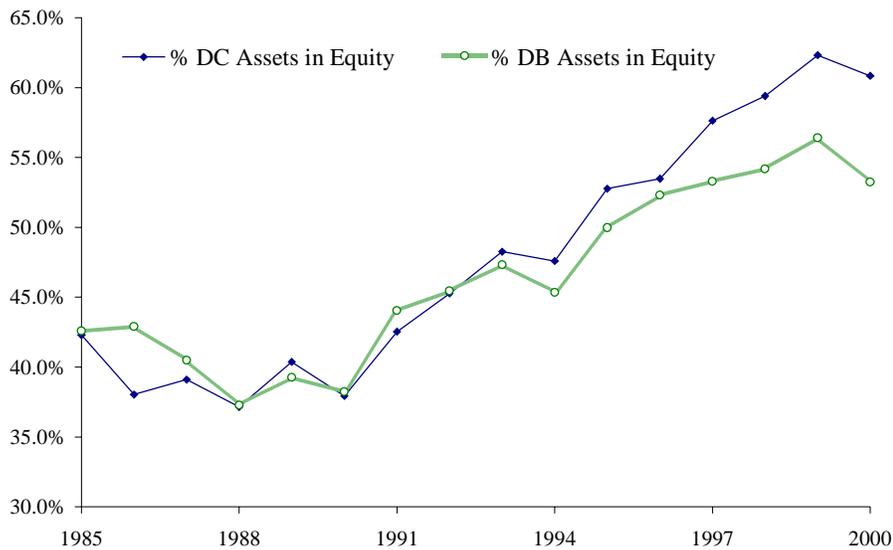
⁸ TIAA-CREF, "Portfolio Choice in Retirement Accounts," January 1998

⁹ Employee Benefit Research Institute, "Issue Brief," February 2001

¹⁰ The Economist, May 15, 1999

A second, and more important trend supporting our hypothesis is shown in Figure 2.2. As the figure shows, the proportion of defined contribution assets invested in equity has outpaced the proportion of defined benefit assets in equity. This lends credence to the hypothesis that directing investment to equity has been a motivation behind the choice of defined contribution plans.

Figure 2.2: Equity exposure of defined contribution and defined benefit pension assets



While defined contribution plans do offer employees greater participation in directing their investments, these plans also effectively shift the risk of investment performance onto individuals. With the preference for putting pension assets in equity, the performance of defined contribution assets is subject to equity market volatility. Increases in stock market volatility will increase the risk and reduce the attractiveness of equity investments for rational, risk-averse

individuals. Since we argue that the ability to put greater investment in equity has been a significant contributor to the growth in defined contribution plans, higher stock market volatility then should reduce the attractiveness of these plans.

2.3 Rising per capita income

A second economic variable causing the rise in retirement savings in general, and defined contribution assets in particular, can be the rise in per capita income levels.

Economic theory suggests that increases in income may have two contradictory effects on savings. Increases in income will increase individuals' ability to save leading to higher savings. However, the savings proportion may decline, since with higher salary a smaller proportion of savings will suffice to generate a desired level of post-retirement income, *ceteris paribus*. Furthermore, increases in salary may fuel expectations of even higher salaries in future, thus reducing the need and tendency to save.

2.5 Permanent income effect

An alternative explanation of the income effect on savings is given by the permanent income hypothesis. In contrast with the Keynesian theory, which suggests current consumption is highly correlated with current disposable income, the permanent income hypothesis suggests that the consumption is related to (an expected) permanent income and is therefore non-cyclical. This implies that individuals will save in periods when current income is above permanent income and dissave in periods when current income is below permanent income. Then, the increasing savings over the last fifteen years can be explained only by postulating that the consumers

believed the rise in earnings to be temporary and not a reflection of a proportional rise in permanent income.

Campbell (1987) provided an alternative interpretation of the permanent income hypothesis arguing that people save when they rationally expect their permanent income to decline; they save “for a rainy day.” This would imply that over the last fifteen years not only did the consumers believe that the rise in permanent income was less than the rise in current income levels, but they in fact expected the permanent income to fall!

2.4 Interest rate effect

Finally, the growth in defined contribution assets may be related to the levels of interest rates, though the theoretical explanation for interest rate effect is ambiguous. In theory, higher interest rates increase returns from savings and investment, thus increasing both the flows and the overall levels of saving. However, rise in interest rates may also have a counter-effect on savings, since higher interest rates imply the need for lower amounts of saving to generate a required future level of assets.

3. Empirical Evidence on the Growth of Defined Contribution Plans

To understand the factors influencing emergence of defined contribution plans and to test aforementioned hypotheses, we developed a statistical model. Because linear models are easy to interpret and are likely to give good estimates of the average effects, we focus on linear regression. The model takes as inputs: the performance of stock market including returns and

volatility, indicator of per capita income and a proxy for risk free interest rates. The data has been taken from the Federal Reserve Board, Bureau of Labor Statistics and Bureau of Economic Analysis. The Federal Reserve database separates amounts for defined contribution and defined benefit plan assets in its quarterly release Z.1, starting 1985. Correspondingly, the period 1985-2000 has been used for our analysis. The model is presented in Table 3.1

Table 3.1: Model definition

$$DC = b_0 + b_1 * EQTY + b_2 * VLTY + b_3 * INCM + b_4 * RATE$$

Variable Definition:

DC = Growth in Defined Contribution plan assets, in %

EQTY = Equity returns, represented by continuously compounded annual returns from S&P500, in %

VLTY = Stock market volatility, standard deviation of continuously compounded returns from S&P500, in %

INCM = Per capita income, growth in current dollars per capita disposable personal income, in%

RATE = Risk free interest rate, represented by 10 year Treasury bond rate (nominal), in %

To represent stock market performance and volatility, data for Standard & Poor's S&P 500 index has been used. Per Capita Income is extracted from the National Income and Product Accounts. 10-yr T-bond rate, as reported in Federal Reserve's H.15 release has been used as the risk free rate. The data set used for regression is appended as Exhibit 1, the regression results are given in Table 3.2.

Table 3.2: Model results

$DC = 10.0 + 0.3 * EQTY - 0.9 * VLTY - 0.6 * INCM + 0.6 * RATE$
t-stat (1.6) (5.6) (-1.5) (-0.8) (0.7)
std error (6.1) (0.1) (0.6) (0.8) (0.9)
$R^2 = 84.9\%$
$F = 14.0$

Predictably, the most significant and the most predictive variable relates to equity market performance (EQTY). Further, the signs of coefficients for EQTY and VLTY support the intuition: growth in defined contribution assets accelerates with higher equity valuations, but gets dampened by the volatility in equity markets. However, the coefficient for volatility is not statistically significant. This suggests relative neutrality to stock market volatility of the individual penchant for directing retirement assets into equity. However, it remains to be seen

how pension asset investors will respond should the returns from equity turn southward for a prolonged period.

The model also suggests that defined contribution savings decreased as the per capita income rose. This is related in part to prolonged economic boom periods witnessed after mid-1980s where the expectation of sustained rise in income increased present consumption. However, the predictive power of this relationship is limited, as the coefficient is not statistically significant.

To test the robustness of our regression, we also developed models for the level of defined contribution plan assets and the annual flows into defined contribution plans. These models and their results are appended as Exhibit 2 and Exhibit 3 respectively. The regression for the level of defined contribution assets conforms to the relationships inferred above, though it may be a spurious regression. The model for annual flows into defined contribution plans is much less predictive. Thus, whereas capital market variables are less potent in predicting annual flows into defined contribution plans, these variables have a significant relation with the overall level and growth defined contribution assets. This is understandable, since the level of pension plan assets depends on both the net new inflow of money and the performance of the existing plan assets. The latter is much highly correlated with equity market performance, given the increasing concentration of pension assets into corporate equities.

As an additional test of relationship between equity markets and defined contribution plans, we ran correlation between the two for two different periods: pre-401(k) and post-401(k). Over 1952-1982, the correlation between level of defined contribution assets invested in equity with the average level of S&P500 index was 0.78. Post 1982, however, the correlation was 0.99.

This further underlies the strong role of equity investments in fueling the growth of defined contribution pension plans.

4. Summary

The defined contribution pension plans have grown manifold in the last two decades. This growth started as a result of a series of legislative changes: enactment of ERISA in 1974, introduction of 401(k) in 1982 and favorable tax treatment. The defined contribution plans aptly suited a generation much less prone to work with a single employer for the entire career. However, another very important factor behind popularity of defined contribution pension plans was the control it offered to individuals over destination of their investments. The attractiveness of this control increased as the equity markets witnessed long bull runs and superior returns.

Statistical analysis of growth in defined contribution assets over the last two decades confirms this intuition, suggesting that investment returns are an important determinant for the popularity of defined contribution type pension plans. While the relationship has held true during bull markets, rising equity returns leading to rising defined contribution plan assets, it remains to be seen how the relationship holds should the stock market returns remain less than spectacular for a somewhat prolonged period.

Exhibit 1: Data set used for the model in Table 3.1 and Table 3.2

Years	DC	EQTY	VLTY	INCM	RATE
1986	8.61	28.83	8.03	4.74	7.78
1987	17.37	43.26	8.44	5.10	8.59
1988	8.26	8.66	8.86	7.48	8.96
1989	19.85	43.93	6.34	6.03	8.45
1990	3.06	(14.89)	4.40	5.80	8.61
1991	20.88	35.73	7.05	2.84	8.14
1992	9.41	1.06	3.31	4.87	7.67
1993	14.09	3.75	2.90	2.46	6.59
1994	6.80	(3.51)	2.10	3.40	7.37
1995	23.58	44.18	5.59	3.74	6.88
1996	14.30	26.48	6.25	3.49	6.71
1997	19.60	31.99	8.53	3.85	6.61
1998	15.20	34.59	7.64	5.26	5.58
1999	9.87	24.61	7.52	2.94	5.87
2000	(0.21)	(19.54)	4.12	4.98	5.94

Sources: Federal Reserve Board, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis

Notes:

DC = Growth in Defined Contribution plan assets, in %

EQTY = Equity returns, represented by continuously compounded annual returns from S&P500, in %

VLTY = Stock market volatility, standard deviation of continuously compounded returns from S&P500, in %

INCM = Per capita income, growth in current dollars per capita disposable personal income reported by the Bureau of Economic Analysis, in %

RATE = Risk free interest rate, represented by 10 year Treasury bond rate (nominal), in %

Exhibit 2: Model for level of defined contribution pension assets

$$DC = b_0 + b_1 * EQTY + b_2 * VLTY + b_3 * INCM + b_4 * RATE$$

Variable Definition:

DC = Value of assets in Defined Contribution plans, in \$ billions

EQTY = Equity market performance, annual average of daily closing level for S&P500

VLTY = Stock market volatility, standard deviation of continuously compounded returns from S&P500, in %

INCM = Per capita income, per capita disposable personal income reported by the Bureau of Economic Analysis, in current \$

RATE = Proxy for interest rate, represented by the annual average level of Merrill Lynch Bond Index

Model Results

$$DC = -570.0 + 0.8 * EQTY + 21.9 * VLTY + 0.0 * INCM + 2.4 * RATE$$

t-stat	(-1.4)	(5.9)	(2.1)	(0.2)	(2.7)
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std error	(412.0)	(0.1)	(10.4)	(0.0)	(0.9)
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$R^2 = 99.3\%$

F = 378.1

Exhibit 2 (continued): Model for level of defined contribution pension assets**Data Set**

Years	DC	EQTY	VLTY	INCM	RATE
1985	430.94	186.91	5.39	12,941	216.46
1986	468.03	236.39	8.03	13,555	250.84
1987	549.35	287.00	8.44	14,246	256.19
1988	594.73	265.88	8.86	15,312	275.96
1989	712.80	323.05	6.34	16,235	315.05
1990	734.62	334.63	4.40	17,176	341.42
1991	887.98	379.49	7.05	17,664	396.53
1992	971.55	412.45	3.31	18,524	426.99
1993	1108.40	451.61	2.90	18,979	474.43
1994	1183.81	460.42	2.10	19,624	458.13
1995	1462.92	541.72	5.59	20,358	546.23
1996	1672.07	670.49	6.25	21,069	562.14
1997	1999.78	873.43	8.53	21,881	617.21
1998	2303.70	1085.50	7.64	23,031	675.56
1999	2531.03	1327.33	7.52	23,708	661.87
2000	2525.68	1427.22	4.12	24,889	739.61

Sources: Federal Reserve Board, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis

Exhibit 3: Model for annual flows in defined contribution pension plans

$$DC = b_0 + b_1 * EQTY + b_2 * VLTY + b_3 * INCM + b_4 * RATE$$

Variable Definition:

DC = Net annual flow in Defined Contribution plan assets, \$ billions

EQTY = Equity returns, represented by continuously compounded annual returns from S&P500, in %

VLTY = Stock market volatility, standard deviation of continuously compounded returns from S&P500, in %

INCM = Per capita income, growth in current dollars per capita disposable personal income reported by the Bureau of Economic Analysis, in %

RATE = Risk free interest rate, represented by 10 year Treasury bond rate (nominal), in %

Model Results

$$DC = 60.8 + 0.1 * EQTY - 2.6 * VLTY - 1.2 * INCM + 0.5 * RATE$$

t-stat	(2.7)	(0.6)	(-1.2)	(-0.4)	(0.1)
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std error	(22.5)	(0.2)	(2.2)	(3.2)	(3.4)
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$R^2 = 22.1\%$

F = 0.7

Exhibit 3 (continued): Model for annual flows in defined contribution pension plans

Data Set

Years	DC	EQTY	VLTY	INCM	RATE
1986	24.92	28.83	8.03	4.74	7.78
1987	42.13	43.26	8.44	5.10	8.59
1988	46.72	8.66	8.86	7.48	8.96
1989	38.71	43.93	6.34	6.03	8.45
1990	32.24	(14.89)	4.40	5.80	8.61
1991	66.30	35.73	7.05	2.84	8.14
1992	56.65	1.06	3.31	4.87	7.67
1993	56.18	3.75	2.90	2.46	6.59
1994	45.80	(3.51)	2.10	3.40	7.37
1995	59.42	44.18	5.59	3.74	6.88
1996	45.24	26.48	6.25	3.49	6.71
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1999	35.48	24.61	7.52	2.94	5.87
2000	53.63	(19.54)	4.12	4.98	5.94

Sources: Federal Reserve Board, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis

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