

Risk Management of Corporate Pension viewed from Personal Finance

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Abstract

In this paper, corporate pension plans are considered from the viewpoint of balance sheets of individual members, instead of balance sheets of sponsoring companies as usually discussed. Stress testing, usually used as an ERM tool, is illustrated to be useful in considering personal lifetime balance sheets, because it shows clearly the consequence of company stock holdings and funding deficits upon participants of private pension plans.

Keyword:

Corporate pension, Personal Finance, DC, Company stock holding, Stress Testing

1. Introduction

This paper proposes a new approach to observe risks of corporate pensions that takes advantage of personal finance. My approach considers corporate pension plans in terms of balance sheets of individual members, instead of balance sheets of sponsoring companies as usually discussed.

The first reason of development of new approach is the prosperity of self-directed investment accounts such as U.S.401k plans to provide future retirement income. Prudent design and management of these accounts is necessary to avoid disastrous consequence of accounts and law suits, because many of holders of these accounts lacks knowledge about financial risk management which is sometimes difficult to handle even for sophisticated institutional investors. The second reason is the straightforwardness to discuss security of pension rights to defined benefit plans by using personal balance sheets of participants of the plan instead of balance sheets of sponsoring companies.

2. Personal balance sheet

Personal balance sheets are found in ordinary textbooks of personal finance and personal money management PC softwares. An example is shown in Table 1. Such kind of balance sheet is insufficient to solve corporate pension issues, because pension problem relates to future cash flows that are not mentioned in the above balance sheet. An example of pension problem is the company stock holdings of DC (Defined Contribution) plans¹. The effect of losing job and retirement allowance at a time, relates to future cash flow after job change and future cash flow of retirement benefits. Another example of pension problem is the result of pension deficit of DB (Defined Benefit) plan after bankruptcy of a sponsoring company. This issue also relates to future cash flow after job change and future cash flow of retirement benefit. Like a pension balance sheet familiar to pension actuaries, future cash flows can be taken to a balance sheet by calculating their present value. The problem is the determination of discount rate, because the surplus of a balance sheet is largely influenced by the discount rate. Generational Accounting deals with future cash flows, and it uses combination of multiple sets of discount rate and economic growth rate². The future cash flow of personal life is various and more complex than that of national population dealt in Generational Accounting. Therefore we assume discount rate to be 0 not to pile up complexity of future cash flow with the complexity of the estimation of discount rate. Zero discount rate will be especially supported in Japan because of its historical low interest rate.

¹ Company stock holding in DC is strictly regulated in Japan.

² Auerbach, Laurence, Kotlikoff, and Leibfritz(1998) perform generational accounting with 3 discount rates(3%,5%,and 7%) and 3 growth rates(1%,1.5%,and 2%).

Table 1. Example of a Personal Balance Sheet

Assets		
	Cash and Bank Accounts	
	Cash	
	Savings (yen)	
	Savings (dollar)	
	Other	
	Other Assets	
	Vehicles	
	Residence	
	Land	
	Other	
	Investments	
	Domestic stock	
	US stock	
	Japanese Government Bond	
	DC Company stock	
	DC stock index	
	DC US stock	
	Other	
Total Assets		
Liabilities		
	Current liabilities	
	Credit Cards	
	Car Loans	
	Mortgage	
	Other	
Total Liabilities		
Net Asset		
	Net Asset	

Under the 0 discount rate, the present value of future cash flows turns to be the accumulated amount of future cash flows. Thus we now have a balance sheet holding the expected amount of future cash flows shown in Table 2. We call this balance sheet as a “lifetime balance sheet”. We presume the present value of risk premium of risky assets to be 0 according to Jarvis, Southall, and Varnell(2001).

The total salary is assumed to be the amount after the deduction of tax and the social insurance premium, this means bonus to be assumed as the sum of tax and the social insurance premium. The already paid premium of DC is assumed to have distributed equally the company's own stock fund, the domestic stock market index fund, and United States stock fund. We use the life expectancy for the calculation of future cash flows of perpetual annuity. The handling of DB and DC is contrasted, because DB is listed in the accumulated amount of future cash flow, whereas DC is divided in investment and the accumulated amount of future cash flow.

Table 2. Example of a Lifetime Balance Sheet

Assets		
	Cash and Bank Accounts	
	Cash	
	Savings (yen)	
	Savings (dollar)	
	Other	
	Other Assets	
	Vehicles	
	Residence	
	Land	
	Other	
	Investments	
	Domestic stock	
	US stock	
	Japanese Government Bond	
	DC Company stock	
	DC stock index	
	DC US stock	
	Other	
	Accumulated amount of future cash inflow	
	Future salary	
	Retirement lump sum	
	Public Pension	
	Defined Benefit Corporate Pension	
	Expected amount of future increase of DC plan	
Total Assets		
Liabilities		
	Current liabilities	
	Credit Cards	
	Car Loans	
	Mortgage	
	Other	
	Accumulated amount of future cash outflow	
	Life expense	
	Re-building expense of residence	
	interest of loans	
	Other	
Total Liabilities		
Net Asset		
	Net Asset	

3. Stress testing

Our next step is the risk analysis of lifetime balance sheet. Various techniques are developed about the evaluation of the risk in the corporate Enterprise Risk Management (ERM). "Stress tests" are one of these tools. According to Nederlof (1996), there are various forms of stress testing. We adopt the form of "single, static shock scenarios". We observe the change of personal lifetime balance

sheets in the event of the bankruptcy, large stock price fall, and sudden currency appreciation. We do not deal with risks easily covered by insurance, such as longevity risk and mortality risk. We do not use stochastic analysis of bankruptcy because the forecast of bankruptcy of specific company is practically very difficult. VaR analysis of stock holding risk or currency risk is possible and may be useful. But our very simple approach is enough to evaluate the effect of company stock holding and funding deficit.

4. Numerical Examples

4.1 Lifetime balance sheet

We make a very simple example of lifetime balance sheet as Table 3. This is a balance sheet of a household consisting of the husband and the wife. The husband was born in April 2,1961, graduate at 25 years old and joins a company, served for 20 years. His average monthly salary so far is 300 thousand yen. His salary in the future is 500,000 yen on the average. The salary usually decreases from 60 years old, but in this simple example it does not decrease. It is assumed that the average salary at all periods from his joining a company to the retirement is 400,000 yen. His bonus is assumed as 3.6 months salary, and he is assumed to die at age of 80. The company provides retirement lump sum, DB Pension, and DC Pension. The wife was born April 2,1966, and she worked for the company for five years. She now retired, and she is a full-time housewife. Her average salary is 250,000 yen, and her life span will be 85. Thus she receives old age public pension . The amount of the expected benefit of public pension is calculated under the above-mentioned assumption. The amount of retirement allowance³ is calculated by 20-year average monthly salary before retirement multiplied by year of service and by 0.25. As the 20-year average salary before retirement is 500 thousand yen, the amount of retirement allowance is 5000 thousand yen, which are 500 multiplied by 40 years of service and by 0.25.

³ In Japan, retirement allowance is usually calculated based on final salary multiplied by number depending on years of serves. The above example is not realistic but easy to calculate.

Table 3. Numerical Example of a Lifetime Balance Sheet (10 thousand yen)

Assets		
	Cash and Bank Accounts	
	Cash	10
	Savings (yen)	100
	Savings (dollar)	100
	Other	0
	Other Assets	
	Vehicles	500
	Residence	1,000
	Land	2,000
	Other	0
	Investments	
	Domestic stock	100
	US stock	100
	Japanese Government Bond	100
	DC Company stock	100
	DC stock index	100
	DC US stock	100
	Other	0
	Accumulated amount of future cash inflow	
	Future salary	12,000
	Retirement lump sum	500
	Public Pension	6,807
	Defined Benefit Corporate Pension	2,000
	Expected amount of future increase of DC plan	1,000
Total Assets		26,617
Liabilities		
	Current liabilities	
	Credit Cards	20
	Car Loans	500
	Mortgage	2,500
	Other	0
	Accumulated amount of future cash outflow	
	Life expense	15,000
	Re-building expense of residence	1,000
	interest of loans	300
	Other	0
Total Liabilities		19,320
Net Asset		
	Net Asset	7,297

4.2 Stress test of bankruptcy

We now study the effect of bankruptcy of the sponsoring company to the balance sheet in above-mentioned Table 5. Bankruptcy may influence DC company stock, accumulated amount of future salary, retirement lump sum, public pension, DB pension, and expected amount of future increase of DC pension. Precisely, if the stock index includes the company stock, the stock index is

influenced by the bankruptcy, but we disregard this tiny influence.

The value of DC company stock is 0 after bankruptcy. The change of accumulated amount of future cash inflow depends upon the salary level of the person after getting a new job. Therefore we calculate 2 kinds of balance sheet, one is for salary level down to half, and another is for salary level unchanged. Further we divide each case into 2 cases according to the funding level⁴ of DB plan, 100% and 50%.

4.2.1 Case for Salary Decreased down to 50% after Job Change

This is the case of salary down to half after new employment.

The future salary decreases from 120,000 thousand yen to 60,000 thousand yen.

The retirement allowance is 0 from the bankrupted company.

The anticipated retirement allowance from the new company is 1,250 thousand yen, that is the result of new salary 250 multiplied 20 years of service and by 0.25.

As a DB pension, 20,000 thousand yen can be paid if the bankruptcy did not occur. At the time of bankruptcy, the pension right would be 10,000 thousand yen, which is 20,000 multiplied by 20 years of service so far divided by 40 years of services from beginning of employment to retirement. If the funding level is 100%, the pension right 10,000 is secured. But if the funding level is 50%, only 5,000 thousand yen is secured. Future portion of DB would decrease from 10,000 thousand yen to 5,000 thousand yen reflecting the salary reduction of 50%. Thus we estimate the accumulated amount of future DB benefit to be 15,000 thousand yen which is the sum of past portion (10,000) and future portion (5,000) in case of funding level 100%, and to be 10,000 thousand yen which is the sum of past portion (5,000) and future portion (5,000) in the case of funding level 50%.

Expected amount of future increase of DC would decrease from 10,000 thousand yen to 5,000 thousand yen according to the decrease of salary.

The most complicated work is the calculation of public pension benefit. The accumulated amount of public pension benefit decreases from 68,070 thousand yen to 58,590 thousand yen.

Thus we have Table4., where the decreased items are shown with * comparing with Table.3.

⁴ "Funding level" means market value of pension asset divided by roundup value of DB pension.

Table4. Salary Decreased down to 50% after Job Change (10 thousand yen)

		DB funding	
		100%	50%
Assets			
Cash and Bank Accounts			
	Cash	10	10
	Savings (yen)	100	100
	Savings (dollar)	100	100
	Other	0	0
Other Assets			
	Vehicles	500	500
	Residence	1,000	1,000
	Land	2,000	2,000
	Other	0	0
Investments			
	Domestic stock	100	100
	US stock	100	100
	Japanese Government Bond	100	100
	DC Company stock	0	0*
	DC stock index	100	100
	DC US stock	100	100
	Other	0	0
Accumulated amount of future cash inflow			
	Future salary	6,000	6,000*
	Retirement lump sum	125	125*
	Public Pension	5,859	5,859*
	Defined Benefit Corporate Pension	1,500	1,000*
	Expected amount of future increase of DC plan	500	500*
Total Assets		18,194	17,694
Liabilities			
Current liabilities			
	Credit Cards	20	20
	Car Loans	500	500
	Mortgage	2,500	2,500
	Other	0	0
Accumulated amount of future cash outflow			
	Life expense	15,000	15,000
	Re-building expense of residence	1,000	1,000
	interest of loans	300	300
	Other	0	0
Total Liabilities		19,320	19,320
Net Asset			
Net Asset		-1,126	-1,626

4.2.2 Case for Salary unchanged after new employment

This is the case of salary sustained after new employment.

The future salary is 120,000 thousand yen, the same number as in the Table.2. The retirement allowance is 0 form bankrupted company which the person was working. The anticipated retirement allowance is 2,500 thousand yen, that is the result of new salary 500 thousand yen multiplied by 20 years of service and by 0.25.

As a DB pension, at the time of bankruptcy, the pension right would be 10,000 thousand yen, which is 20,000 multiplied by 20 years of service so far divided by 40 years of services from

beginning of employment to retirement. If the funding level is 100%, the pension right 10,000 thousand yen are secured. But if the funding level is 50%, only 5,000 thousand yen are secured. Future portion of DB would be unchanged owing to the same level of salary. Thus we estimate the accumulated amount of future DB benefit to be 20,000 thousand yen which is the sum of past portion (10,000) and future portion (10,000) in case of funding level 100%, and to be 15,000 thousand yen which is the sum of past portion (10,000) and future portion (10,000).

Expected amount of future increase of DC and the accumulated amount of public pension benefit is unchanged owing to the same level of salary.

Thus we have Table 5. From both Table 4 and Table 5, we can grasp that the result of funding deficit of DB is same as that of company stock holding of DC. These balance sheets would be a good communication tool to advocate that the amortization of funding deficit is far more indispensable than the increase of benefit level. Comparing Table 5 with Table 4, company stock holding is less harmful to professionals whose salary level may be almost equal after job change.

Table5. Salary Unchanged after Job Change (10 thousand yen)

		DB funding	
		100%	50%
Assets			
Cash and Bank Accounts			
	Cash	10	10
	Savings (yen)	100	100
	Savings (dollar)	100	100
	Other	0	0
Other Assets			
	Vehicles	500	500
	Residence	1,000	1,000
	Land	2,000	2,000
	Other	0	0
Investments			
	Domestic stock	100	100
	US stock	100	100
	Japanese Government Bond	100	100
	DC Company stock	0	0*
	DC stock index	100	100
	DC US stock	100	100
	Other	0	0
Accumulated amount of future cash inflow			
	Future salary	12,000	12,000
	Retirement lump sum	250	250*
	Public Pension	6,807	6,807
	Defined Benefit Corporate Pension	2,000	1,500*
	Expected amount of future increase of DC plan	1,000	1,000
Total Assets		26,267	25,767
Liabilities			
Current liabilities			
	Credit Cards	20	20
	Car Loans	500	500
	Mortgage	2,500	2,500
	Other	0	0
Accumulated amount of future cash outflow			
	Life expense	15,000	15,000
	Re-building expense of residence	1,000	1,000
	interest of loans	300	300
	Other	0	0
Total Liabilities		19,320	19,320
Net Asset			
Net Asset		6,947	6,447

4.3 Stress test of stock price fall

Next Stress test is stock market fall. During recent 30 years, the lowest Nikkei Average of Tokyo Stock Market is 7607.88 yen recorded in April 28, 2003. We assume the current Nikkei Average to be 16,000 yen, and we assume the stock index to fall to 7607.88 yen in a very short time. As 7607.88 yen divided by 16,000 equals 48%, thus domestic stocks and DC stock index will fall from 100 to 48. The point drop of DC company stock depends on the beta value of this company stock. In an actual application we should measure the beta value, though we assume the beta to be one. As shown in Table 6., the DC company stock therefore falls from 100 to 48. The decrease of net asset is $(100-48) \times 3 = 156$. The value of Defined Benefit Plan 2000 is unchanged because pension fund or sponsoring

company absorbs the stock price fall. Many people think that DB is more reliable than DC under such a critical situation. In the selection problem of DB and DC, we might be able to execute more stable discussion by watching personal balance sheets as well as corporate balance sheets.

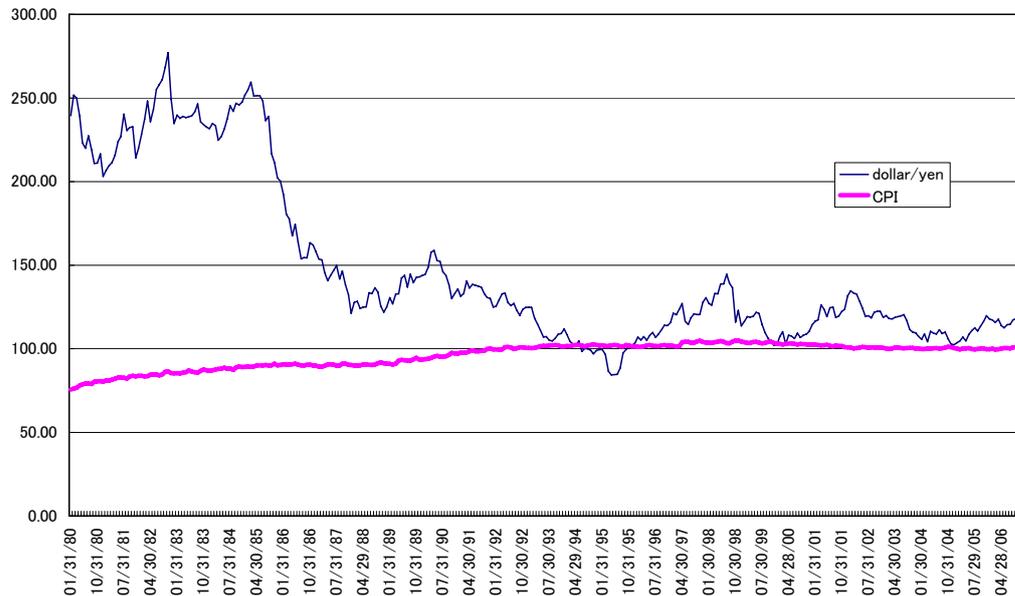
Table 6. Japanese Stock Price Fall (10 thousand yen)

Assets		
Cash and Bank Accounts		
	Cash	10
	Savings (yen)	100
	Savings (dollar)	100
	Other	0
Other Assets		
	Vehicles	500
	Residence	1,000
	Land	2,000
	Other	0
Investments		
	Domestic stock	48 *
	US stock	100
	Japanese Government Bond	100
	DC Company stock	48 *
	DC stock index	48 *
	DC US stock	100
	Other	0
Accumulated amount of future cash inflow		
	Future salary	12,000
	Retirement lump sum	500
	Public Pension	6,807
	Defined Benefit Corporate Pension	2,000
	Expected amount of future increase of DC plan	1,000
Total Assets		26,461
Liabilities		
Current liabilities		
	Credit Cards	20
	Car Loans	500
	Mortgage	2,500
	Other	0
Accumulated amount of future cash outflow		
	Life expense	15,000
	Re-building expense of residence	1,000
	interest of loans	300
	Other	0
Total Liabilities		19,320
Net Asset		
	Net Asset	7,141

4.4 Stress test of appreciation of the yen

Next stress test is currency appreciation - large increase of yen value. So far, the highest yen record is 79.75 yen per a dollar which observed at Tokyo market in April 19,1995.

Figure 1. Dollar/Yen rate and Consumer Price Index



We assume the current dollar/yen rate to be 120 yen, and we assume the yen to be hiked to 79.75 yen in a very short time. 79.75 divided by 120 equals 66%, therefore the value of dollar savings, US stock, and DC US stock should decrease from 100 to 66. The effect of exchange rate is various according to the company which the person works. As for expense, yen appreciation causes low price gasoline and low price overseas travel. From the data over 20 years plotted in Figure 1., consumer price index is stable regardless of dollar/yen rate. Government research tells that the portion of import and export in the total Gross Domestic Product is about 10%, and this low portion explains the stable CPI. Thus we do not touch the liability side of personal balance sheet now (see Table 7.), but the character of the company may be important in the practical application. If the company is export oriented company, the business will deteriorate. But if the company is import oriented, the business will be prosperous. Some people do not worry about company business performance, because their companies control their consolidated balance sheet to be currency neutral owing to the overseas business activities.

Table 7 shows the impact of yen hike, net asset decreasing from 7,297 to 7,201.

Table 7. Yen hiked to 79.75 yen (10 thousand yen)

Assets		
	Cash and Bank Accounts	
	Cash	10
	Savings (yen)	100
	Savings (dollar)	66 *
	Other	0
	Other Assets	
	Vehicles	500
	Residence	1,000
	Land	2,000
	Other	0
	Investments	
	Domestic stock	100
	US stock	66 *
	Japanese Government Bond	100
	DC Company stock	100
	DC stock index	100
	DC US stock	66 *
	Other	0
	Accumulated amount of future cash inflow	
	Future salary	12,000
	Retirement lump sum	500
	Public Pension	6,807
	Defined Benefit Corporate Pension	2,000
	Expected amount of future increase of DC plan	1,000
Total Assets		26,515
Liabilities		
	Current liabilities	
	Credit Cards	20
	Car Loans	500
	Mortgage	2,500
	Other	0
	Accumulated amount of future cash outflow	
	Life expense	15,000
	Re-building expense of residence	1,000
	interest of loans	300
	Other	0
Total Liabilities		19,320
Net Asset		
	Net Asset	7,195

5. Conclusions

Our analysis shows the following conclusions:

First, laborious part of this model is the calculation of the expected benefit of complicated public

pensions.

Second, skills are necessary to abbreviate the non-essential complexity of personal balance sheets which tend to be more and more complex reflecting the various life and work pattern of individuals. Well considered life model such as shown in Nakada and Arimori(2006) may be useful.

Third, the combination of personal lifetime balance sheet and stress testing provide clear view of the result of company stock holdings of DC, and the result of pension deficit of DB upon the bankruptcy of the sponsoring company, even if the premise of combination is very simple such as 0 discount rate. This combination may work as good communication tool for consultants, sponsoring company, trade union, and participants.

Fourth, company stock holdings of DC should be prohibited especially for low-income workers and non-professionals.

Fifth, in the event of bankruptcy, the underfunding of DB causes the same consequences as the company stock holding of DC. Trade union must negotiate firstly to erase pension deficit of DB instead of raising benefit level.

6. References

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