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INSIDE

FRONT

COVER

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PAGE

The Pension
Forum

Volume 12, Number 1 December 2000

PENSION FORUM TABLE OF CONTENTS

Page

Actuarial Aspects of Cash Balance Plans for The Society of Actuaries

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The Pension

Forum

Volume 12, Number 1 December 2000

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF FIGURES

Page

OTHER ARTICLES

BLANK

PAPER

SECTION 1: INTRODUCTION

The purpose of this study is to provide the actuarial profession with a review of the actuarial aspects of cash balance retirement plans and original actuarial research regarding the design and valuation of such plans. **Cash balance plans** present design and valuation issues not found in traditional retirement plans. Real world cash balance issues include:

- The choice of appropriate **interest credit rates**[1] and related valuation assumptions;
- The valuation of fixed minimum interest credit rates;
- The valuation of interest credit rates tied to equity returns; and
- The valuation of qualified plan rollovers into a cash balance plan

There are real risks associated with each of these issues. There may be disagreement on the extent to which they should be considered when determining a cash balance plan's **actuarial liability** and cost. Actuaries will increasingly be asked to address and measure the costs and risks associated with cash balance plans, both in plan design and ongoing valuation.

This report discusses cash balance plan features and methods to measure the associated risks.

What is a cash balance plan?

This report is intended primarily for actuaries familiar with cash balance plans; however, we have provided the following short general description. A cash balance plan is a type of defined benefit (DB) plan that has many of the characteristics of a defined contribution (DC) plan. Cash balance plans have notional accounts for each active participant that are credited with a contribution credit each year (such as 3% of pay) as well as a defined interest credit (either a flat rate or tied to a type of investment, such as 52-week Treasuries). The participants usually do not contribute to the accounts. At termination of employment or retirement, the account balance can usually be paid either as a lump sum or converted to an annuity based on conversion factors described in the plan document. The basic benefit formula is almost always expressed in terms of a lump sum and most benefits are paid in the form of a lump sum rather than an annuity.

Unlike a DC plan, the plan sponsor bears the investment risk, rather than the plan participants. For example, if the supporting trust fund assets earn less than assumed investment return, it is the employer who must make up the shortfall. By the same token, any trust fund gains above the assumed investment return rate are used by the employer to reduce future costs. Because of investment returns different from the interest credit rate, assets of the fund are not likely to equal the sum of the account balances plus retiree reserves.

As with other DB plans, cash balance plans are insured by the Pension Benefit Guaranty Corporation (PBGC) and provide a benefit that is expected to increase every year.

While cash balance plans are not new, their popularity in recent years has brought forth new features that make these plans increasingly complex. Consequently, the way that these plans are analyzed needs to be reevaluated. This study looks at features of cash balance plans that demonstrate the variety of ways that employers have expanded on the original concepts. It also considers the actuarial implications of these features.

Scope of Study

This report covers a wide range of cash balance actuarial issues. In some cases we have given suggestions on how to factor risks into valuations, such as the use of Monte Carlo simulations to determine the risks associated with minimum interest credit rates. In other cases we have simply noted issues which need to be addressed.

This study does not address IRS qualification issues or set actuarial standards of practice. However, it is intended to cause the reader to consider new issues particular to cash balance plans.

The study is divided into seven sections and five appendices. A short summary of each remaining section follows.

Section 2: Concepts addresses four basic ways cash balance plans differ from traditional retirement plans. It touches on the impact of **leverage,** plan design, and PBGC issues. This is part of the foundation for the rest of the study. In this report, the phrase *anticipated leverage* is used to describe the excess of the assumed rate of investment return on plan assets over the assumed cash balance plan interest credit rate.

Section 3: Embedded Features defines the term **embedded feature** and discusses a variety of embedded features which exist in cash balance plans and how they are valued. These include the use of equity based interest credit rates. Monte Carlo simulation is used to assess the risk associated with various embedded features.

Section 4: Discussion of Funding Methods and Funding Levels introduces the concept of account balance funding ratios (ratio of the plan's actuarial liability to the sum of the account balances). It goes on to define different attribution rules for the **Projected Unit Credit (PUC)** funding method and to compare the results of such valuations for selected sample lives.

Section 5: Plan Termination Concepts and Concerns provides background on plan termination rules as they apply to cash balance plans. The PBGC has not set final policy on what it guarantees for cash balance plans. While this section raises more questions than it answers, it will hopefully help indicate issues requiring additional discussion.

Section 6: FASB Statement No. 87 and Cash Balance Plans provides a summary of the valuation assumptions used by actuaries for FAS 87 as found in our survey (see Appendix B).

Section 7: Actuarial Disclosure Issues discusses assumptions that are unique to cash balance plans, and what actuaries are currently disclosing. This section does not cover issues related to disclosure to plan participants.

Appendix A: Definition of Terms defines certain terms used in and associated with cash balance plans.

Appendix B: Survey of Cash Balance Plans discusses the results of a survey on the design and valuation of thirty-nine cash balance plans. Actuaries may find it helpful to see how their plans compare to those found in our survey.

Appendix C: Projected Unit Credit Variations/Sample Lives contains spreadsheets with the sample life calculations used in our study and details of the various PUC attribution rules.

Appendix D: Monte Carlo Methodology describes the methodology we followed for our Monte Carlo simulation used to assess risk.

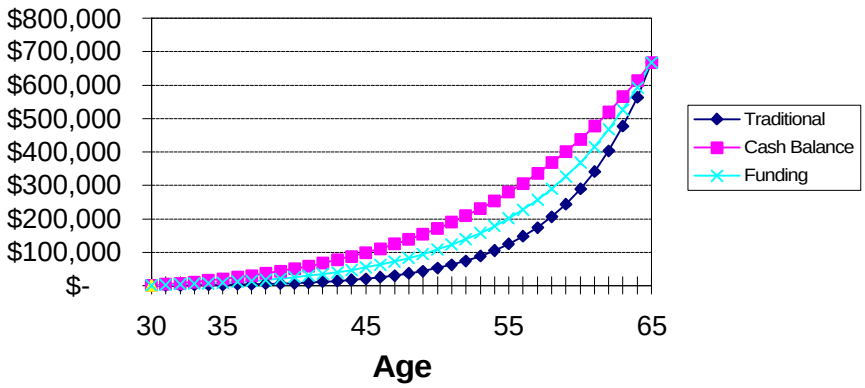
Appendix E: Citations contains references we used in our study.

SECTION 2: CONCEPTS

Concept #1: Typically, a cash balance plan's active actuarial liability is less than the sum of the account balances.

In a cash balance plan, anticipated interest leveraging allows the actuarial liability to be less than the sum of the account balances. The following graph compares this to a traditional plan for the same age 65 funding target:

Figure 2.1
Funding vs. Benefit Accruals



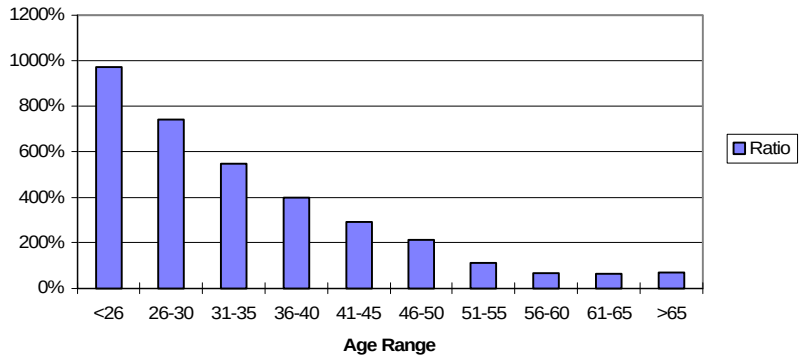
The Traditional line represents the present value of the accrued benefit in a typical final-average-pay plan (using ongoing plan assumptions)[2] from the time an employee is hired at age 30 until retirement at age 65. The cash balance line represents the notional cash balance account. The Funding line, which is the same for both plans, represents the actuarial liability using some simplifying methods and assumptions. It should be noted that in a cash balance plan a loss tends to occur when employees quit and take their lump sums, and a gain tends to occur when an employee continues employment. This is the reverse of what tends to happen in a traditional final-average-pay plan.

Concept #2: In comparison to accruals of a final-average-pay plan, cost equivalent cash balance plans provide smaller benefit accruals at ages 55-65 and larger benefit accruals below age 55 than a traditional defined benefit plan of similar cost.

This concept was well described in an article by Steve J. Kopp and Lawrence Sher [5]. The following graph examines the ratios of the value of benefits in a traditional 1% final five-year average pay plan with a 3.95% cash balance plan from that study. For example, this graph shows that employees quitting at ages 36-40 are expected to get a

benefit from this cash balance plan that is four times the expected benefit from the traditional plan. As was described in [5], both plans produced the same average benefit payment when all employees are considered; however, some get more and some get less compared to a traditional plan. Although only the last three age groups get less under a cash balance plan than under a traditional plan (ratio under 100%), they represent the largest individual benefit values.

Figure 2.2
Ratio of Cash Balance to Traditional Benefit*



** Values from article by Steve Kopp & Lawrence Sher [5].*

Concept #3: Embedded Features can change the present value of a Cash Balance benefit.

Certain plan features raise issues on how to value a benefit or control risk. Switching the basis for the interest credit rate from 52-week Treasuries to an equity basis will change the volatility and value of the cash balance benefit. The actuarial present value of the cash balance benefit depends partly on the expected future interest credit rate and the expected return on plan assets. These two important assumptions and their relationship are obviously important for the actuarial valuation. Some analysis has been done in the related area of pricing equity-based annuities [1].

Other types of embedded features, such as subsidized annuity conversions and 401(k) plan transfers, present other types of risks. When such provisions exist, the risk level changes. It is unclear how the actuary should reflect these risks in calculating the present value of benefits for an ongoing plan. Section 3 delves further into the concept of embedded features.

Concept #4: Cash balance plans raise several distinct plan termination and PBGC issues.

Ongoing funding targets for cash balance plans often produce active life actuarial liabilities below the level of the account balances. Due to interest leveraging (the difference between the riskier return on plan assets and the less risky rate credited to cash balance accounts), it can be reasonably argued that this is appropriate for an ongoing plan. Consider a plan with only active participants that is frozen with ABO = Assets < Account Balances. The plan will not have the assets in trust to immediately pay out the account balance. However, if frozen, it is expected to have sufficient assets when the payments come due at termination of employment (or a later date if restricted by the plan). The difference between account balances and **accumulated benefit obligation (ABO)** is due to the leverage anticipated in the future. However, this leads to a situation where cash balance plans of bankrupt companies are less likely to terminate as a standard termination than a traditional final average salary-based defined benefit plan if the test is based on the immediate availability of account balances. Said differently, the leverage that makes a cash balance plan an efficient use of employer contributions to an ongoing plan creates funding issues should all benefits come due immediately.

Cash balance plans are not alone in presenting risk to PBGC. However, there are some unresolved issues that are unique to cash balance plans, such as whether PBGC will guarantee interest credit rates based on equities. Section 5 covers issues about Cash Balance plan terminations.

SECTION 3: EMBEDDED FEATURES - DEFINITION, ASSUMPTIONS, METHODS AND RISKS

Depending on market conditions, some plan features present significant risks which may not be recognized if the plan is valued using standard actuarial valuation methods. For the purpose of this study, the broad term **embedded feature** is used to refer to such features. This section discusses each of the following embedded features:

- Interest credits tied to equity indices with employee choice;
- Equity indexed deferred annuities;
- Minimum interest guarantees;
- Subsidized Annuity options;
- Acceptance of 401(k) transfer or rollover amounts which may be converted to annuities;
- Tax Sheltered Annuity (TSA) **match credits;**
- Establishment of floor benefits; and
- Non traditional normal retirement ages.

This is followed by a discussion of measurements of leverage risk and asset matching. The riskiness of each embedded feature will vary from plan to plan depending on specific plan provisions.

Interest Credits Tied To Equity Indices With Employee Choice

There are a few plans that currently allow employees to select the basis for their interest credits. This includes plans that allow employees to elect to use an equity index. None of these plans actively participated in our survey. Most of these plan designs are too new for us to determine the assumptions and methods used to fund these plans. The next subsection titled “Equity Indexed Deferred Annuities” should be read in connection with this section since it provides some discussion of what insurance companies have done in similar situations to mitigate risks.

One key issue is setting an interest credit rate assumption when there is employee choice. For example, one plan in our survey allows transfers from 401(k) accounts and provides the same 11 investment options as exist in the 401(k) plan. For this plan, the initial interest credit rate assumption could be based on the same average investment mix as under the existing 401(k) plan. This assumption could be changed once sufficient experience on employee elections is gathered.

Assume that employees elect a 50/50 equity/fixed income mix for their interest credits. If the pension plan has a 70/30 mix in assets, assumptions could be set as shown in Figure 3.1, resulting in anticipated leverage of 0.6%. However, there are still some questions to ask. Given employee choice, is it valid to assume that no leveraging will be realized? Should the fact that employees have the ability to change to a 70/30 mix mean that the interest credit rate should be assumed to equal expected investment returns? If cash balance accounts are not re-balanced, should it be assumed that an initial 60/40 mix

might go to 70/30? If employees elect a higher equity mix than the plan sponsor is willing to accept, should anticipated leverage be negative? What if the plan only permits employee choice for five years and reverts to a low fixed rate (such as 4%) unless the plan is amended?

Assume employee election of indexes and actual trust fund investments are as shown Figure 3.1.

Figure 3.1
Real Rates of Return

Investment Class	Real Rate of Return within Investment Class	Employee selection of index by Class times Real Return	Actual Investment Mix times Real Return
Equity	5%	50% x 5%	70% x 5%
Fixed	2%	50% x 2%	30% x 2%
Total Real Rate of Return		3.5%	4.1%

Based on Figure 3.1, the appropriate leverage anticipated would be 0.6%. Should actuaries adjust the assumed interest credit rate if the employee equity/fixed selection changes by 5% or 10%? How should investment expenses be reflected? What historical time frames should be looked at to estimate future real rates of return?

The risks of this embedded feature are:

- Change in employee choice of index;
- Negative return/reduction in accrued benefit;
- Expected leverage not realized; and
- Legal unknowns because these designs are so new.

Equity Indexed Deferred Annuities

While equity based cash balance plans are new, insurance companies have been offering equity indexed deferred annuity contracts for some time. While these annuities are not an existing embedded feature, we thought it was appropriate to include them under the topic of equity indices. The American Academy of Actuaries published a report in 1997 that included discussion of design, investments and reserving of these deferred annuities [1]. An example of a contract design is:

After seven years the contract will provide a return equal to the greater of (1) 80% of the return on the S&P 500, or (2) 3% interest on 90% of the principal.

To avoid an investment mismatch, assets may be invested in a combination of (1) zero coupon bonds to provide the minimum 3% benefits (for example, face amount equals $90\% \times 1.03^7 = 110.69\%$ of the purchase price), and (2) seven year call options with a strike price of 113.36% (1+10.69% / 80%) of the purchase price. The zero coupon bonds hedge the floor guarantee and the call options provide the equity return in excess of the strike price. If stocks earn more than 13.36%, 80% of the equity return will be credited. Insurers may deliberately mismatch some of these investments; however, the actuary plays a large role in monitoring the matching of assets and liabilities. This funding approach is complicated by early surrender values and death benefits.

The reserves may be based on discounted values of the minimum benefit and the discounted value of the call options.

Some of this could translate into future cash balance plan design; however, it seems that it would provide an investment design that is more attractive to employees at the loss of some or all leverage that would reduce employer cost. Asset mismatching and risk may be weighed differently by a plan sponsor than by an insurance company.

The following are considerations in managing risks for any type of equity based interest credit:

- Limiting the time period over which a guarantee is provided;
- Providing penalties for early withdrawals; and
- Matching assets to liabilities.

Minimum Interest Guarantees

Some plans provide a minimum annual interest credit. This is an embedded feature because even though the minimum may be below the current and assumed interest credit rate, it does have some cost. The most common minimum found in our survey was 4% per year.

Should a plan that bases interest credits on 52-week Treasuries be valued using the same assumptions as a plan that is identical except that it also provides a minimum rate of 4%? What if the minimum is 6%? In this section we look at surveys of existing plans and measurements of risk.

The common method of recognizing these minimum rates would be to lower anticipated leverage by raising the assumed interest credit rate relative to the valuation interest rate. One method to estimate the cost of a minimum interest credit rate is a Monte Carlo simulation, described under the heading “Measurement of Leverage Risk” at the end of this Section. Some plans with a minimum interest credit rate also had a maximum interest credit rate. The maximum offsets some or all of the cost of the minimum rate embedded feature. This effect could also be estimated by Monte Carlo methods.

There were eight plans in our survey that had a minimum interest credit rate and provided a complete set of actuarial assumptions. The survey looked at the average interest credit rate and investment return assumption for plans with the same core index compared to the assumption used by each of the eight plans with minimum rates. In Figure 3.2, the column, "Difference in Anticipated Leverage," equals:

1) the plan's investment return assumption minus interest credit assumption, less

2) the average investment return assumption minus the interest credit assumption for the other plans with the same interest credit basis but no minimums.

Not every plan that had a minimum interest credit rate anticipated a lesser amount of leverage (as would have been indicated by a negative in the last column of Figure 3.2).

Figure 3.2
Effect of Minimum Guarantees on Anticipated Leverage

Interest Credit Basis	Fixed Guarantee	Assumed Credit Rate in Valuation	Number of "other" plans	Average Assumed Credit Rate among other plans [3]	Difference in Anticipated Leverage vs. other plans
6 Month Treasuries	4% min	6%	2	2	N/A
52-week Treasuries	4% min	7%	10	10	.50% [4]
52-week Treasuries	6.5% min	6.50%	10	10	-2.00%
52-week Treasuries + 1%	5% min	7%	10	10	-1.00%
30-year Treasuries – 1%	4% min	6%	6	6	1.19%
	7.5% max	7%	6	6	-0.81%
30-year Treasuries + 0.5%	5%min [5]	4%	2	2	3.50%
CPI	4% min	5.50%	2	2	1.00%
CPI	4% min 5% max	4% min	4% min	4% min	4% min

The second plan on this chart used 52-week T-bills with a 4% minimum. The anticipated leverage rate is 0.5% lower than the average of plans that used 52-week T-bills without a minimum. Because a 4% minimum is not very high and the investment mixes are not known, the 0.5% difference seems to be reasonable. This compares to the next plan that has the same 52-week index, a higher 6.5% minimum and a 2% difference in the anticipated leverage rate. The fifth plan actually anticipates 1.19% higher than average leverage but this was probably related to the fact that the index was reduced by 1% and had a 7.5% maximum.

Some plans used a 7%-9% rate on starting account balances to provide an extra transition benefit or to compensate for using a similar rate when converting the original accrued annuity to the original account balance. A few plans used an ongoing fixed rate that was (or is likely to be) higher than the **417(e) rate** or the **GATT rate**. This leads to a discussion of **IRS Notice 96-8** and whether a **whipsaw** problem is created. For the

purpose of this study our concern about whipsaws focuses on whether the benefit expected to be paid is the benefit that is valued.

All of the above dealt with annual minimum guarantees. One plan that provided an equity index for interest credits provided a cumulative 0% guarantee. A cumulative guarantee tends to be much less expensive than an annual guarantee since the risk decreases as interest becomes a larger percentage of the account balance. This can be a low cost feature. It needs to be realized that this will allow account balances to decline from one year to the next. We have seen similar types of guarantees (usually at 3%) on Tax Sheltered Annuities (TSA) long term fixed income accounts. As interest rates rose in the early 1980s, these TSAs provided negative annual returns dropping the account values to the minimum balance and creating policyholder concerns.

Subsidized Annuity Options

A subsidized annuity conversion basis may be an embedded feature. For this report, subsidized is defined as providing a benefit greater than the 417(e) basis. For example, consider a plan that provides annuities based on a fixed 6% interest basis. Some years this may be a rate higher than the 417(e) rate and the plan may provide for a whipsaw treatment of lump sums in those years. If the actuarial valuation assumes lump sum payments, some estimate needs to be made of the impact of the potential whipsaws.

Partly because of the guidance under IRS Notice 96-8, many cash balance plans convert to annuities based on 417(e) rates. Because these rates are tied to conservative fixed income rates, the safest thing to assume is usually a lump sum form of payment. In this situation, whenever a participant elects an annuity, leveraging is likely to continue (a net gain may or may not occur). However, some plans use a higher fixed interest rate and at least five of the 39 plans surveyed used fixed annuity conversion factors that did not vary by age. One plan in the survey had an interest rate for annuity conversions as high as 8%. Assume that a plan uses a fixed 8% rate for annuity conversions and the GATT rate is 5.5% and the same mortality table is used. Figure 3.3 shows when it is most conservative to value an annuity or a lump sum for this plan. We have shown two sets of results because not every plan recognizes the need to provide a whipsaw benefit.

Figure 3.3
Lump Sum vs. Annuity - Conservative Assumption

Valuation Interest Assumption:	>8%	8%	5.50%	<5.5%
Assuming No Whipsaw [6]	Lump Sum	Either LS or Annuity	Annuity	Annuity
Whipsaw	Lump Sum	Lump Sum	Either	Annuity

While most surveyed plans assumed 100% of participants take a lump sum, some did assume 10% to 30% would take annuities.

Regarding whipsaws, the purpose of our study is not to discuss the legal issues connected with the whipsaw effect. Some plans do pay higher benefits because of whipsaw treatment of certain plan provisions. Other similar plans (including those designed prior to IRS Notice 96-8) just pay the account balance. While there may be a risk that IRS or DOL might find that a whipsaw should exist where none was paid, this type of risk is beyond the scope of this study.

Transfer or Rollover Amounts which may be Converted To Annuities

Only two plans in the survey allow transfers from a 401(k) plan to a cash balance plan. One of these plans allows transfers to an active employee account balance while the other plan requires immediate annuitization. Either is an embedded feature since the liabilities that will be transferred are unknown and often only valued after the transfer takes place.

Assume that the actuarial valuation report and plan document had the following statement that is intended to control risk:

> *Once 401(k) funds are transferred into the plan, they become a part of the vested accrued benefit and as such cannot be eliminated by plan amendment. However, the plan may be amended at any time to eliminate the ability to accept future 401(k) transfers.*

The question arises as to whether the actuary should anticipate future transfers, especially if minimum interest credits or subsidized annuity factors are involved. At worst, losses would be recognized when funds are transferred. More likely, gains will be recognized when transfers occur if GATT rates are used for annuity purchases. Based on a very small sample, it appears that future transfers are not being anticipated and current plan design tries to avoid future actuarial losses.

One surveyed plan allows transfers to convert to immediate annuities at GATT rates. Since GATT rates are tied to recent 30-year Treasuries and RPA Current Liabilities are based on 105% of a four-year average of 30-year Treasuries, this leads to a situation where transfers reduce the amount of the unfunded Current Liability. It is likely to be a gain under the regular valuation but may generate additional PBGC variable premiums because of the low rate used for this purpose.

Based on the above, risk controls for this embedded feature include:

- Selection of market related annuity conversion factors;
- Ability of the plan/employer to discontinue future transfers; and
- Limitations on the rights to transfer funds.

Because there is no information on how subsidized 401(k) transfers might be valued, we suggest one possible approach. Assume that a particular transfer subsidy adds 10% to the value of the 401(k) transfer. Assume also that 5% of all eligible 401(k) money is actually transferred and not paid directly from the 401(k) plan. This results in a subsidy

of 0.5% of the value of the 401(k) accounts. Based on these assumptions and current 401(k) account balances and contribution data, adjustments can be made to the defined benefit plan's actuarial liability and normal cost. Exactly how this would be done would depend on the funding method. In addition, we expect most plans would try to find a way to avoid the subsidy and the extra liabilities as discussed in the prior three bullet points.

Tax Sheltered Annuity (TSA) Match Credits

Some hospital plans provide a cash balance match based on employee TSA (403(b)) deferrals. Plan valuation requires an assumption of the level of future TSA contributions. At least two of the plans surveyed had this feature, and assumed that an individual's prior year's deferral percentage would continue fixed until termination of employment. From the actuarial valuation report of a third plan, we could not tell the assumption used for future TSA deferrals or matches. One risk is that TSA savings will increase. The ability to end this feature prospectively may be the best method of controlling risk. It should also be pointed out that the same types of cost risks to the employer exist where the TSA match does not involve a cash balance plan.

Establishment of Floor Benefits

A few of the cash balance plans established a traditional final-average-pay floor benefit. One plan actually provided the greater of the old plan or the cash balance plan to employees who were participants at the date of transition. This is like a traditional plan that provides the greater of a final-average-pay formula or a fixed dollar rate and simply values the greater of the two benefits. As long as both benefits are being tested and valued, there is no special funding requirement.

One interesting note relates to a benefit "mismatch" using the PUC attribution rule under the **Annuity Accrual Method** (described in detail in Section 4). Under this funding method, the proportion of a future benefit, projected with a salary scale, attributed to each year of service is based on a projection of future benefits without a salary scale. Consider a plan that provides the greater of a cash balance benefit or a final-average-pay benefit. Assuming a salary scale, the final-average-pay accrued benefit would be the greater after some age X. Assuming no future salary increases, the final-average-pay accrued benefit would not exceed the cash balance accrued benefit until some later age, X+Y. Under this PUC method, the normal cost at ages between X and X+Y will be the present value of a percentage of the final-average-pay benefit where the percentage is based on the ratio of the current and projected cash balance benefits. A similar situation can exist in a traditional plan with a fixed dollar benefit minimum.

Normal Retirement Age

In a cash balance plan, from the employee's perspective there may be no material significance to normal retirement age, since the basic benefit is communicated as a lump sum and not as an annuity. However, from a compliance perspective, selection of normal retirement age can be material. One feature of some newer cash balance plans is to define normal retirement age as the earlier of age 65 or five years of vesting service. It raises questions on whether a plan can avoid a whipsaw while guaranteeing an interest

credit higher than the 417(e) rate by only projecting to current age (i.e. normal retirement). While acceleration of retirement eligibility may help with some compliance issues, it is likely that an actuarial valuation will assume that the average employee will retire far beyond the normal retirement age. This issue is primarily a regulatory issue.

Measurement of Leverage Risk

In this report the word leverage is used to define the difference between the rate of return on the trust fund assets and the interest credit rate. This difference is because the employer is generally taking more risk by investing in assets different from the basis for the cash balance interest credit. We have measured the risk by looking at levels of leverage over periods of time using Monte Carlo simulations. Details of the assumptions and methods used are in Appendix D. We looked at the effect of (1) changing investment mix, (2) selection of interest credit basis, (3) adding a minimum interest credit rate and (4) changing the period of historical performance being examined.

We looked at six different situations. The first five were based on returns from 1926 - 1998. The 20-year median leverage results were as follows:

	Cash Balance Interest Credit Basis	**Trust Fund Investment Mix (Equity/Fixed)**	**Median Leverage after 20 years**
Figure 3.4	Long-Term Treasuries [7]	70%/30%	4.85%
Figure 3.5	Long-Term Treasuries	50%/50%	3.78%
Figure 3.6	50% S&P + (50% LT Gov., Income only)	70%/30%	1.68%
Figure 3.7	50% S&P + (50% LT Gov., Income only); minimum	70%/30%	0.47%
Figure 3.8	Long-Term Treasuries, minimum annual return = 6%	70%/30%	3.09%
Figure 3.9	Same as 3.4 except based on experience from 1979 - 1998 vs. 1926 - 1998.	Same as 3.4 except based on experience from 1979 - 1998 vs. 1926 - 1998.	6.59%

Each figure (3.4 – 3.9) shows the risk that the leverage implicit in the assumptions may not be met over a 1 to 20 year period.

Of particular significance is the impact of providing a minimum rate of return on the long-term median leverage result. Figure 3.4 shows a median expected leverage of 4.85% after 20 years. Adding a 6% minimum, shown in Figure 3.8, reduces the median expected leverage from 4.85% to 3.09% after 20 years. This is comparable to an average increase in the annual interest credit rate of 1.76%. The lower 3.09% rate was heavily influenced by the use of returns back to 1926. Long-term Treasury income rates were below 6% in 1926-69, 1972, and 1998.

All six figures use the same scale. From this it can be seen that while the equity based interest credits (Figures 3.6 and 3.7) have the lowest level of leveraging, they also have the lowest level of variation.

Figure 3.4

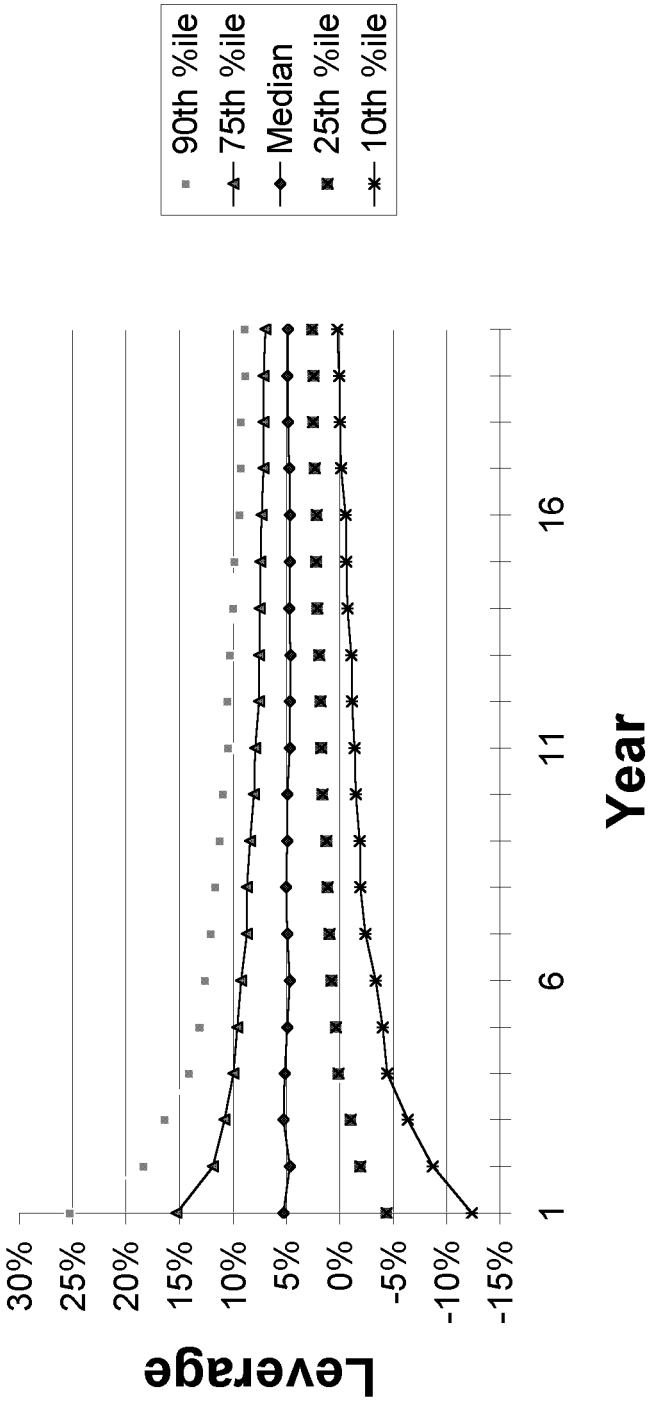
Expected Leverage

Experience from 1926-1998

Investment Mix: 70% S&P 500 and 30% Long Term Government Bonds Total Return

Cash Balance Interest Credit Basis: Long Term Government Bonds Income Return

(Longterm Median: 4.85%)



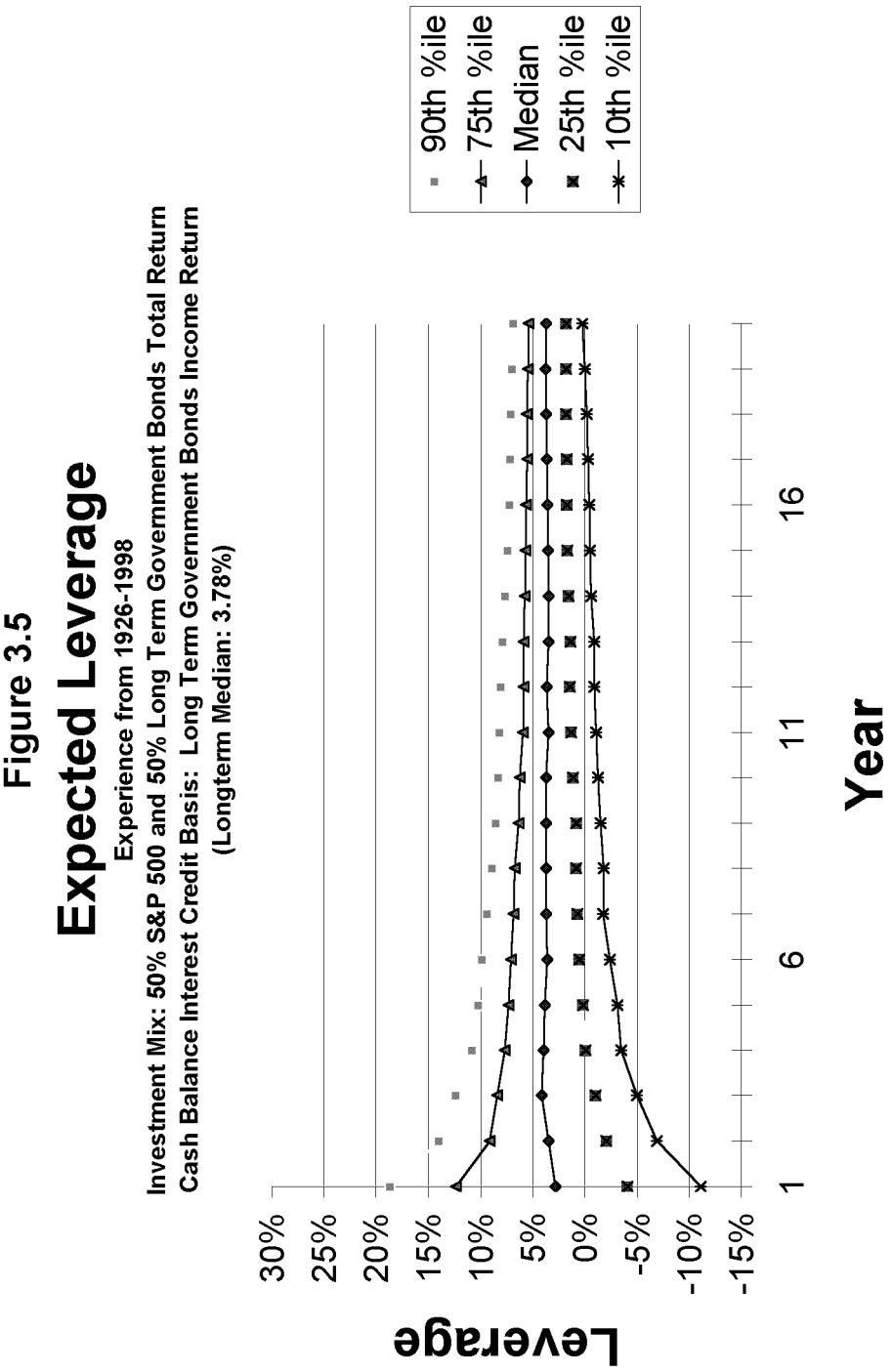
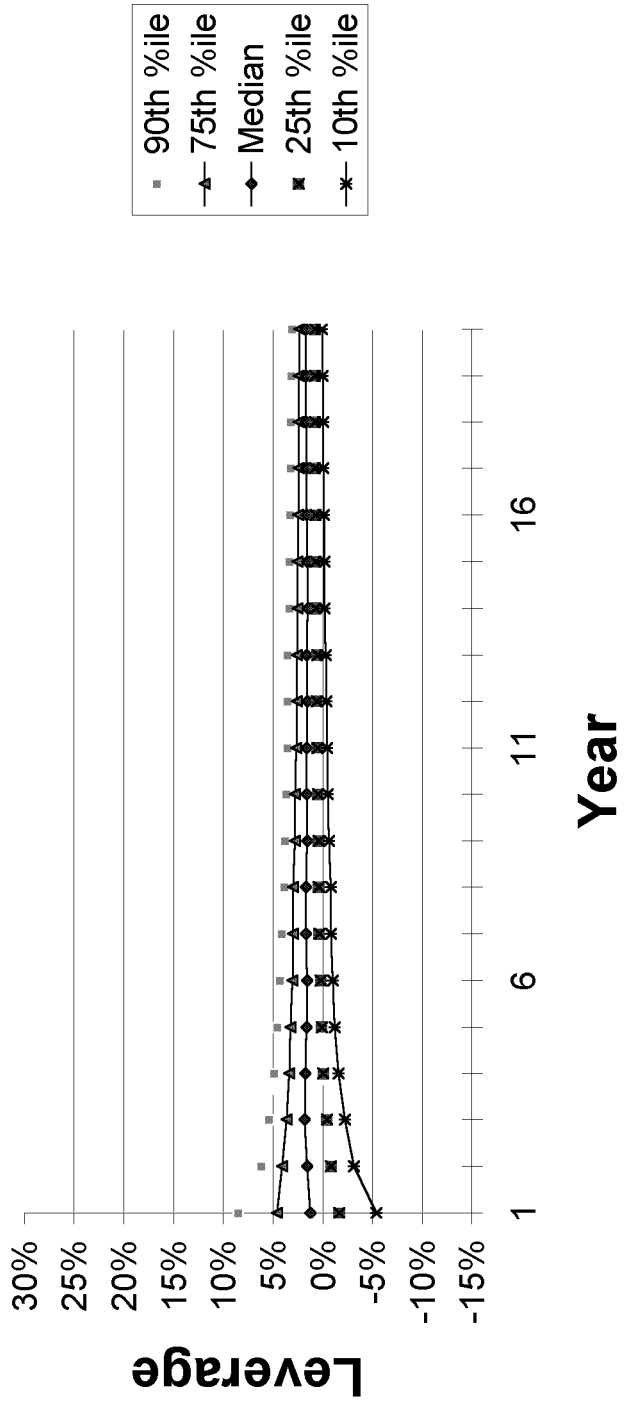


Figure 3.5
Expected Leverage
Experience from 1926-1998
Investment Mix: 50% S&P 500 and 50% Long Term Government Bonds Total Return
Cash Balance Interest Credit Basis: Long Term Government Bonds Income Return
(Longterm Median: 3.78%)
90th %ile
75th %ile
Median
25th %ile
10th %ile
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
-15%
Leverage
1
6
11
16
Year

Figure 3.6

Expected Leverage

Experience from 1926-1998
Investment Mix: 70% S&P 500 and 30% Long Term Government Bonds Total Return
Cash Balance Interest Credit Basis: 50% S&P 500 and 50% Long Term Government Bonds Income Return
(Longterm Median: 1.68%)



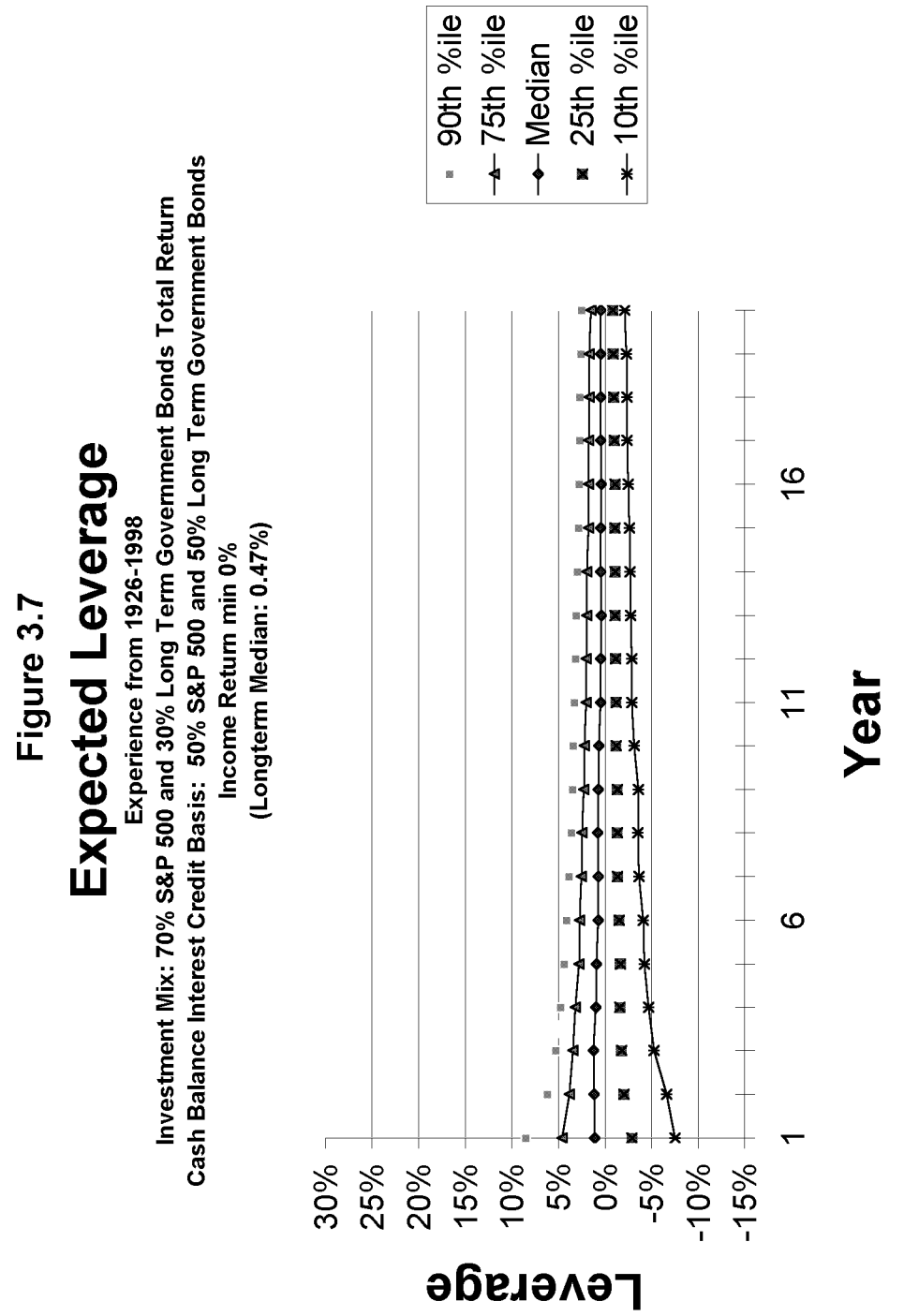
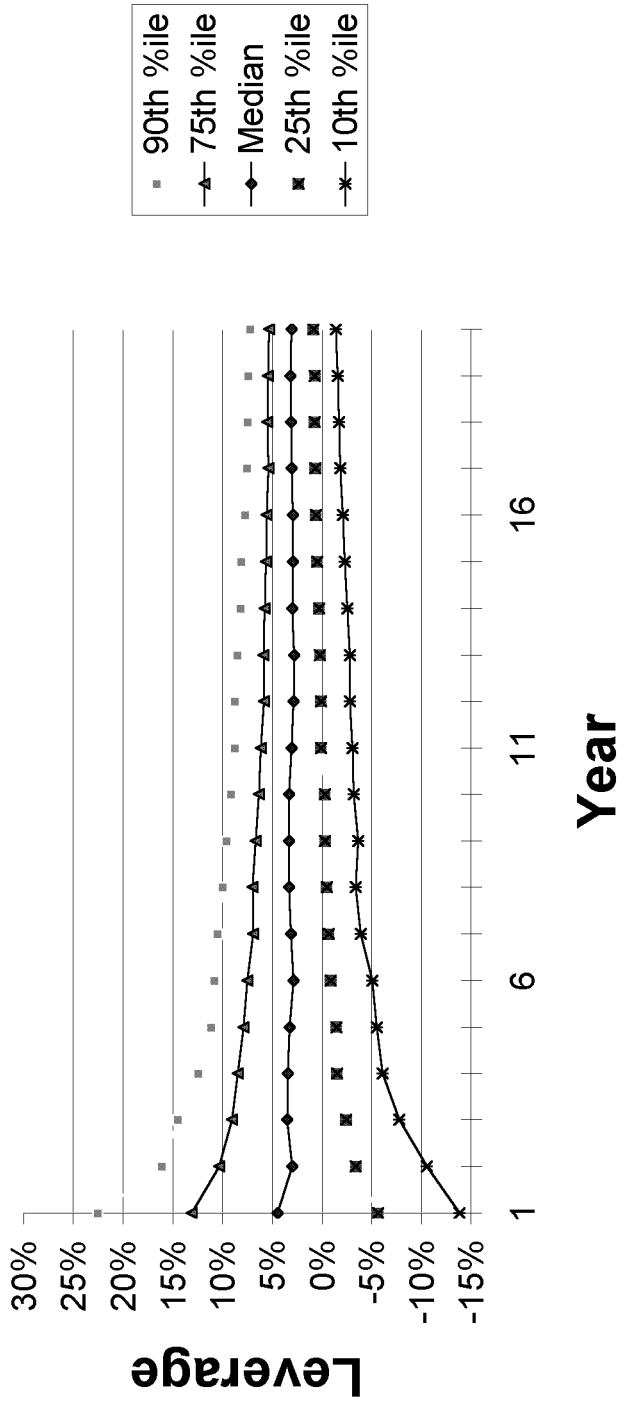


Figure 3.7
Expected Leverage
Experience from 1926-1998
Investment Mix: 70% S&P 500 and 30% Long Term Government Bonds Total Return
Cash Balance Interest Credit Basis: 50% S&P 500 and 50% Long Term Government Bonds
Income Return min 0%
(Longterm Median: 0.47%)
90th %ile
75th %ile
Median
25th %ile
10th %ile
Leverage
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
-15%
1
6
11
16
Year

Figure 3.8

Expected Leverage

Experience from 1926-1998
Investment Mix: 70% S&P 500 and 30% Long Term Government Bonds Total Return
Cash Balance Interest Credit Basis: Long Term Government Bonds Income Return, min. 6%
(Longterm Median: 3.09%)



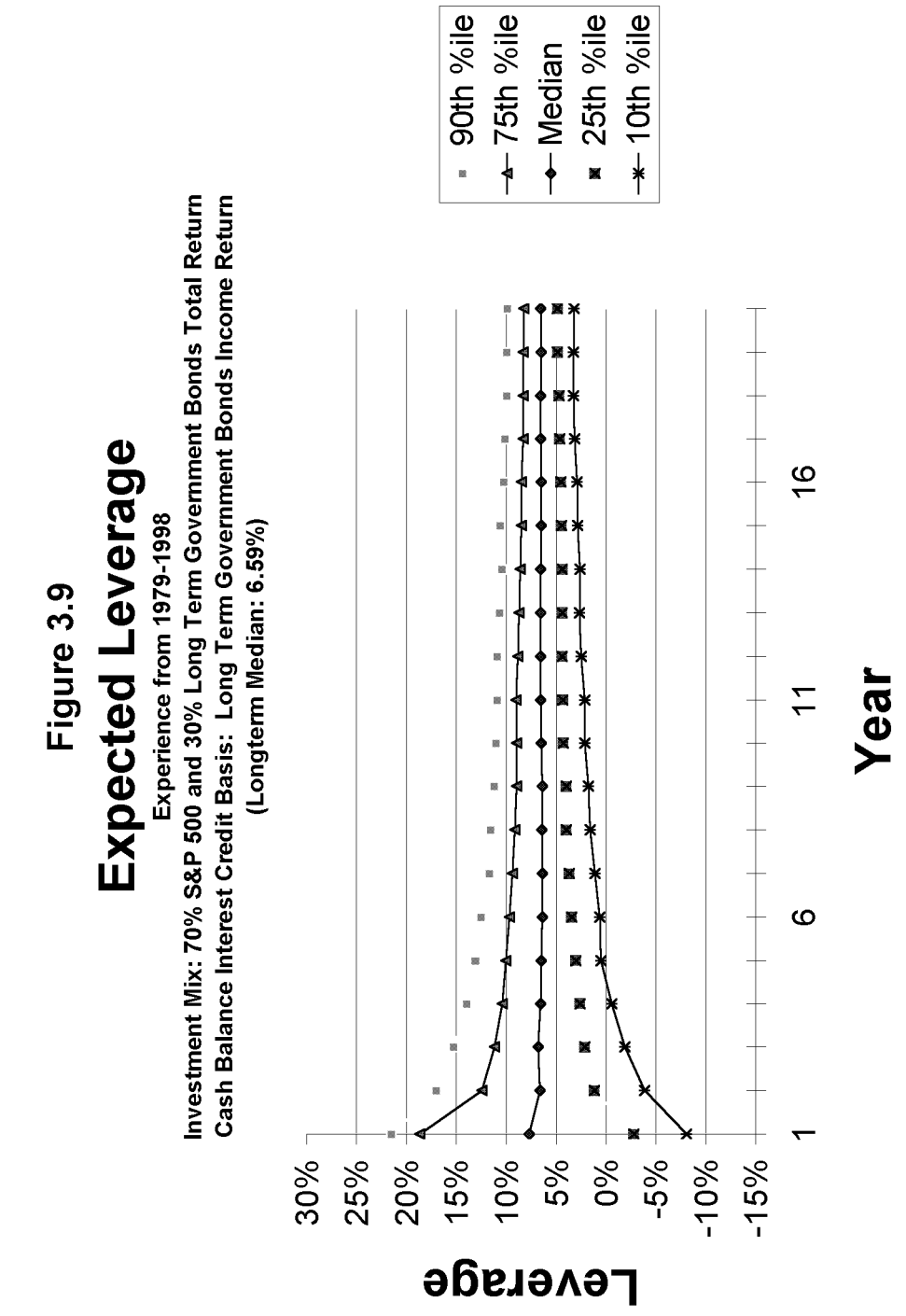


Figure 3.9
Expected Leverage
Experience from 1979-1998
Investment Mix: 70% S&P 500 and 30% Long Term Government Bonds Total Return
Cash Balance Interest Credit Basis: Long Term Government Bonds Income Return
(Longterm Median: 6.59%)
90th %ile
75th %ile
Median
25th %ile
10th %ile
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
-15%
Leverage
1
6
11
16
Year

Risk Measurement and Asset Matching

The concept of the efficient frontier has been part of pension modeling for many years. This is often graphed with Total Return on the Y-axis and Risk on the X-axis. The efficient frontier is usually expressed as an increasing curve that flattens out as risk increases as shown in Figure 3.10 below. Investment portfolio mixes that fall along this curve provided the highest level of return for a given amount of risk. Portfolios that fall below this line do not provide the most efficient mix of assets.

In a cash balance setting, we are looking for a different type of efficient frontier. We want to find the investment mix that maximizes leverage for a stated amount of risk. A plan that uses 52-week Treasuries for interest credits obtains a relatively risk free situation by investing in short term investments. The sponsor may choose not to invest in this fashion in order to obtain some positive leveraging. Similarly, interest credits might be based on 50% of the S&P and 50% of short term Treasuries. This plan can also have relatively no risk and no leverage if it is invested in the same 50%/50% manner. Any deviation away from a 50%/50% mix, in either direction, will increase risk and affect leveraging. A 60%/40% mix will, on average, create positive leverage while a 40%/60% mix will, on average, create negative leverage. An equity interest credit basis with matching investments can be risk free but minimizes the opportunity for leveraging.

Figure 3.11 shows what the cash balance efficient frontier for leveraging purposes might look like. It plots the same six efficient portfolios from Figure 3.10 and assumes interest credits mimic the investment returns of portfolio C. Based on this revised efficient frontier, we would never invest using portfolios A or B. Portfolio C offers no risk or leverage. Portfolios D - F offer increasing amounts of risk and positive leverage.

In our example, we assumed that interest credits would be tied to a portfolio that falls on the efficient frontier. This would not necessarily be the case.

One of the difficulties is that some cash balance plans use interest credits based only on income (dividends and interest) rather than total returns. Investments that would reproduce interest credits based on 30-year Treasury income would not be 30-year Treasury investments because of market appreciation or depreciation risks not reflected in the interest credits.

Figure 3.10
Efficient Frontier

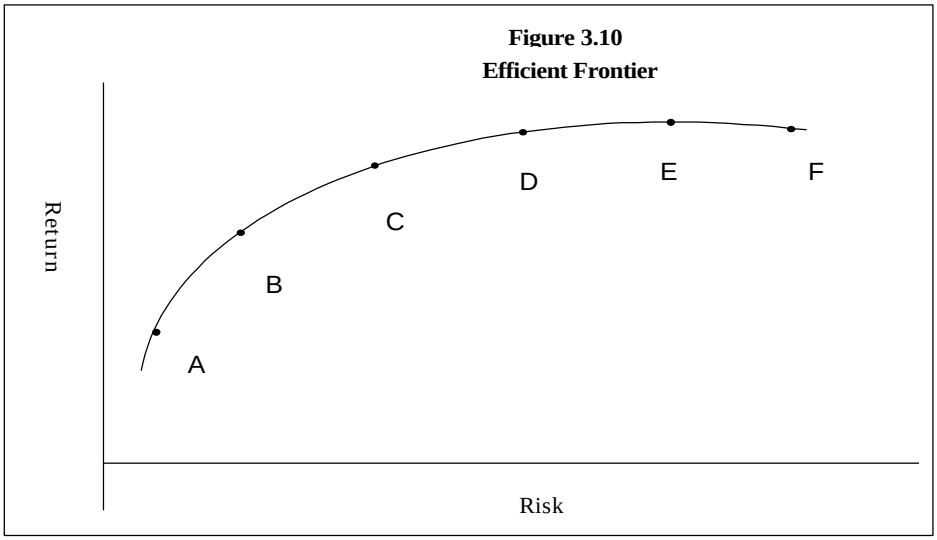
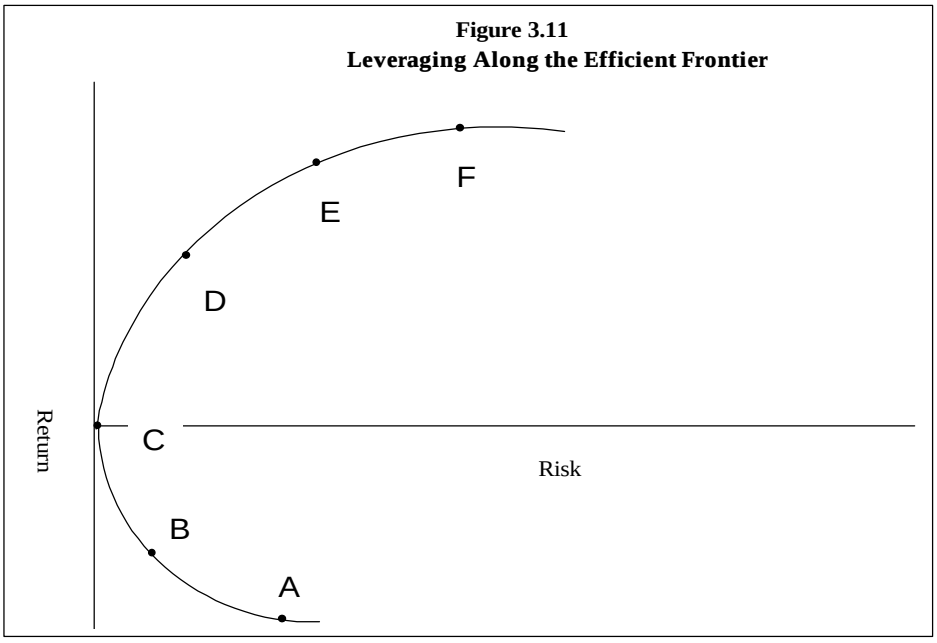


Figure 3.11
Leveraging Along the Efficient Frontier



SECTION 4: DISCUSSION OF FUNDING METHODS AND FUNDING TARGETS

It has long been recognized that cash balance plans do not have the same funding characteristics as traditional plans, due to the fact that most cash balance plans tend to front-load the benefit accruals. In a traditional plan, higher turnover leads to lower cost. In a cash balance plan, which pays immediate lump sums, a higher turnover rate shortens the time for anticipated leveraging and may actually increase plan cost. The extent to which a cash balance plan reacts to various assumption changes depends on a number of factors, including:

- Anticipated leverage;
- Availability of immediate lump sum payments;
- Degree of front or back-loading in cash balance formula; and
- The funding method selected.

To examine the impact of some of these variables, we created sample life valuations. We started with a fairly simple cash balance plan, 4% **pay credit rate** for the first ten years and 5% thereafter, with interest credits assumed at 6%. The valuation interest rate assumed is 8%. It is important to note that the benefit formula selected can have a material impact on the level of the actuarial liability under different funding methods. The next two parts of this section, Account Balance Funding Ratios and Funding Methods, describe how we will compare different funding methods and define the methods used.

Account Balance Funding Ratios

One method used to compare the level of funding is the ratio of the active actuarial liability to the active lump sum account balance, which does not depend on the turnover assumption used. This ratio is referred to in the report as the **Account Balance Funding Ratio**. A ratio of 80% means that the plan is only funding to a target of 80% of the account balance and leaves the difference to (1) anticipated leverage, (2) anticipated forfeitures for those not yet vested, and (3) future normal costs. It does not mean that plan funding is at 80% of the target. In many plans, the account balance will equal the plan termination liability and the Account Balance Funding Ratio represents a percentage of the termination liability. However, the active life termination liabilities may be different from the associated account balances.

Similar ratios compare the normal cost to the expected dollar amount of the pay credits for the coming year[8]. We have called this the **Normal Cost Ratio**. It is often expected that this ratio will be below the Account Balance Funding Ratio since younger employees have more weight in the determination of the normal cost versus the actuarial liability. The Normal Cost Ratio is usually easier to measure than the Account Balance Funding Ratio since transition issues and inactive liabilities are less likely to complicate the calculation.

In our survey a rough estimate of the average Normal Cost Ratio for 15 plans came out to be 66% (41% minimum and 100% maximum). A similar ratio based on the annual increase in Current Liability was 78%. The difference between 66% (or 78%) and 100% of the pay credits was created mostly by anticipated leveraging and to a lesser degree by anticipated forfeitures.

Detailed survey results appear in Appendix B.

Funding Methods

In Figure 4.1, the Account Balance Funding Ratios are graphed for the five different funding methods listed below. We have also graphed the Normal Cost Ratio and normal cost as a percentage of pay. All of these are based on the sample plan described above. Appendix C provides a more detailed description of each of the following funding methods and assumptions used.

PUC Service Prorate Method (PUC S/P):

A simple Service Prorate was the most common method found in our survey. Under this method an equal amount of the cash balance benefit is associated with each year of service and an employee's normal cost is affected by changes in age. For example, if an employee hired at age 25 is projected to get a $100,000 lump sum at age 65, $2,500 is associated with each year of service ($100,000/40 years). Obviously, $2,500 discounted back to age 25 will create a smaller normal cost at age 25 than $2,500 discounted back to age 40 to create the age 40 normal cost.

There are many variations of the Service Prorate. One variation assigns the transition (opening) account balance plus interest to past service. Future pay credits plus interest on future pay credits are prorated from the date of transition.

PUC Annuity Accrual Method (PUC Ann):

Another method is to allocate the normal cost in proportion to the annuity being earned each year. In a final-average-pay plan which has an accrual rate of 2% per year for the first ten years and 1% per year for additional years above ten, the attribution pattern during the first ten years would be twice that for years after ten. This attribution pattern is developed without regard to future salary increases. Because the cash balance benefit is a lump sum with an unknown level of future interest credits and unknown future annuity value, this creates a question on how to determine the equivalent annuity benefit. However, the valuation should have an assumption concerning future interest credits and future annuity conversion factors. Using this as a basis, each year's projected account balance can be projected forward to normal retirement age with interest only (no salary scale is used as noted in the final-average-pay example above) to produce an annuity to be used for attribution purposes. From this an allocation of normal cost can be determined. See Appendix C for a numerical example and some further discussion. It should be noted that this method front-loads cost and was not used by any of the plans we surveyed. This method and the Entry Age Normal method may be very conservative if the cash balance pay credit rate increases sharply by age/service (see Figure 4.1). This method may require a complicated computer program when the benefit is defined by comparing multiple benefit formulas, including non-cash balance formulas.

PUC Pay Credit Method (PUC PC):
Another method is to allocate the normal cost in proportion to the pay credit rate associated with each year. This can be looked at as a weighting of service under the Service Prorate Method. While this sounds similar to the prior method, the result is very different. Since the weights do not recognize salary increases and interest credits, the Pay Credit Method is not similar to PUC funding of a final average formula.

In the Appendix C illustration, an employee earns a pay credit rate of 4% for the first ten years and 5% thereafter. The actuarial liability under this method after 5 years for a decrement at 15 years equals 20%/65% times the present value of that benefit.

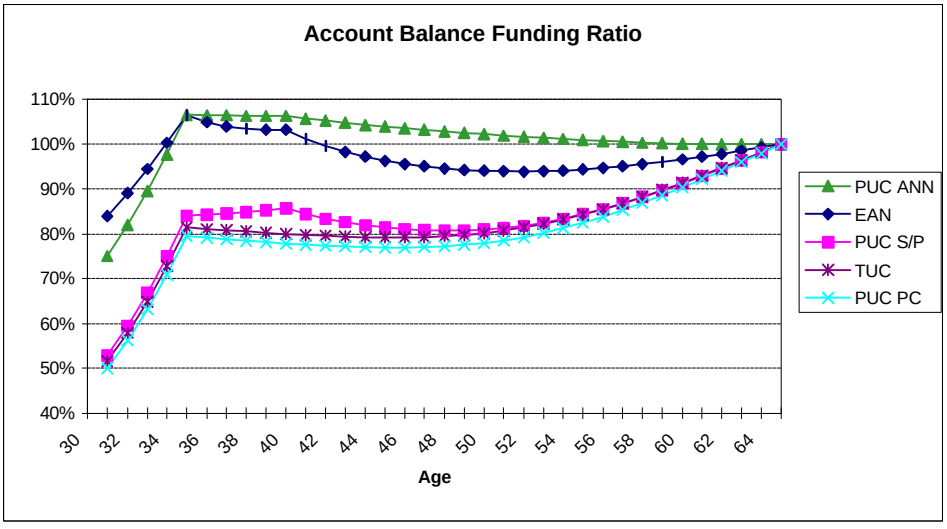
Traditional Unit Credit Method (TUC):

Under the Traditional Unit Credit Method the actuarial liability is the ABO, which is basically the existing account balance projected at the assumed interest credit rate to the expected payment date and then discounted back at the assumed investment return rate.

Comparison of Funding Methods

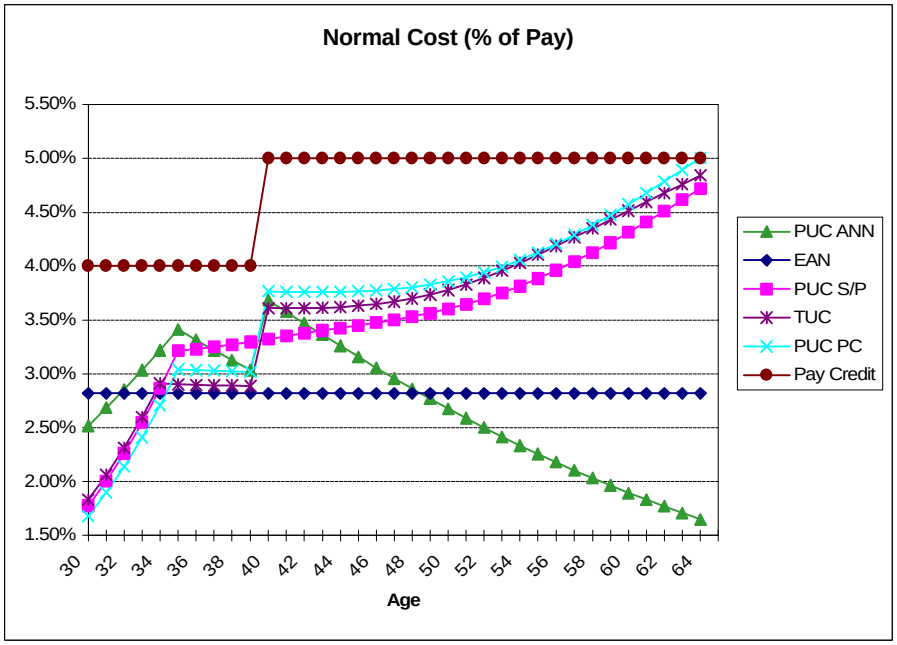
On the following graphs, Entry Age Normal Funding is abbreviated as EAN and the notional cash balance pay credit rate is abbreviated as Pay Credit. Figure 4.1 shows the actuarial liability as a percent of the account balance under five different funding methods. Figure 4.2 shows the normal cost as a percent of pay under five different funding methods as well as the actual pay credit rate. Figure 4.3 shows each normal cost as a percent of the pay credit. The significance is the impact of anticipated leveraging and the choice of funding method.

Figure 4.1
Account Balance Funding Ratio from Entry Age to Retirement Age



Why does Figure 4.1 look the way it does? It tracks one employee from age 30 through age 65. The plan is assumed to have five-year vesting, which accounts for the steep curve during the first five years when the employer's cost is discounted for anticipated forfeitures. In four of the methods there is a bump at age 40 when the pay credit increases from 4% to 5% (this is best seen in Figure 4.2). Three of the funding methods never get to 100% until age 65 primarily because of anticipated leveraging. The exact shape depends on many factors including the pay credit structure, salary assumptions, interest assumptions and the funding method.

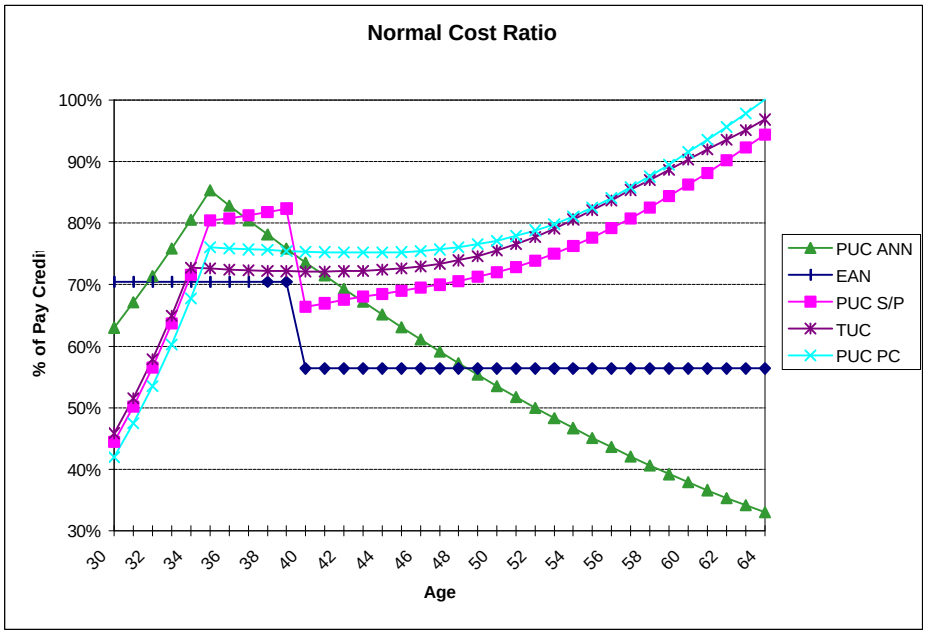
Figure 4.2
Normal Cost as a Percentage of Payroll



The top line in Figure 4.2 represents the nominal pay credit rate for a sample employee throughout his potential career and is not a normal cost rate. The EAN normal cost is a fixed percentage. The four other normal cost lines react to vesting and three of these react to changes in the pay credit rate. It is interesting to note how low the normal cost gets at age 65 under the PUC Annuity Accrual method. Few employees actually work 35 years to get to this situation.

Figure 4.3 shows the normal cost ratio for each method, which can be determined by dividing the normal cost by the pay credit rate.

Figure 4.3
Normal Cost Ratio from Entry Age to Retirement Age



In some plans, the PUC Pay Credit Method produces lower actuarial liabilities than the Traditional Unit Credit method. Is this a problem? Question #9 from the *1999 Enrolled Actuaries Meeting Gray Book* made some points that are relevant to this discussion. It noted that variations of "project and prorate" methods were acceptable to the IRS as long as the actuarial liability was no less than the present value of accrued benefits. It also noted the significance of some transition benefits.

It has been pointed out in the past that ABO can be greater than the **Projected Benefit Obligation (PBO)** using the Service Prorate Method if the salary scale is less than the interest credit rate. If this were to occur, the relationships between the TUC and PUC S/P lines on our graphs would change. About a third of the plans in the survey indicated that the PBO is equal to the ABO for purposes of meeting financial accounting standards (FAS); and the rest had a PBO higher than the ABO.

Impact of Turnover on Funding Levels

Figure 4.4 compares the actuarial liabilities using either a T-3 or T-7 turnover table[9]. For an employee hired at age 30, the Account Balance Funding Ratio at age 40 under Entry Age Normal Funding would be 103% using T-7 and 97% using T-3. As stated above, this occurs due to a change in the working lifetime available for leveraging. In a traditional defined benefit plan the lower turnover table would have produced the equivalent

of a higher target. Entry Age Normal and four different unit credit funding methods are used. The results are for an employee age 40, hired at age 30, using the plan provisions and assumptions described in Appendix C.

Figure 4.4
Effect of Turnover on Account Balance Funding Ratio
4% to 5% Pay Credit, 2% Anticipated Leverage

	Entry Age Normal	PUC Annuity Method	PUC Service Prorate	TUC Method	PUC Pay Credit Method
T-7	103%	106%	86%	80%	78%
T-3	97%	108%	79%	73%	70%

This shows that the PUC Pay Credit method can produce the lowest level of funding. Some actuaries put a minimum on the liability equal to the TUC result just as under FAS when the PBO is not allowed to be less than the ABO.

Other Observations

Are any of the above too low a level of funding? What is a reasonable attribution method to allocate normal cost? Does the answer depend on the cash balance credit formula? One guide is Regulation 1.412(c)(3)-1(e)(3), which requires that the allocation between past and future service benefits for career average pay plans "must be reasonable." Paragraph 40 of FAS 87 has us look to the formula to determine how to attribute benefits to each year of service. All of the funding methods get to 100% funding at age 65 but so does terminal funding which generally is not appropriate since it provides neither (1) protection to the participant offered by prefunding in a trust nor (2) a charge to the employer while benefits are being earned. Both of these factors may need to be met to provide an adequate funding method. However, it is expected that actuaries will differ on the amount of protection needed.

The degree of anticipated leverage and the pay credit rate structure may have an important influence on what is or is not reasonable. We looked at how such variations impacted the Account Balance Funding Ratio. To do this we changed the degree of anticipated leverage or the pay credit rate structure in our sample life calculations. Figure 4.5 shows the Account Balance Funding Ratios for a plan that has a fixed (6%) pay credit at all ages and assumes that interest credits will be 2% less than the investment return of the fund (i.e. 2% anticipated leverage). Figure 4.6 shows what happens when the anticipated leverage is reduced to 0%, thus increasing the Account Balance Funding Ratios. Figure 4.7 shows the Account Balance Funding Ratios for a plan that has a pay credit that increases every four years from 2% to 10% of pay and assumes 2% leverage. All three of these figures assume that the benefit is paid as a lump sum at time of termination of employment. Figure 4.8 modifies Figure 4.4 by assuming that the payment of the lump sum is deferred until age 65.

Figure 4.5
Account Balance Funding Ratio
Flat 6% Pay Credit, 2% Anticipated Leverage

	Entry Age Normal	PUC Annuity Method	PUC Service Prorate	TUC Method	PUC Pay Credit Method
T-7	90%	103%	78%	80%[10]	78%
T-3	83%	104%	70%	73%	70%

Figure 4.6
Account Balance Funding Ratio
Flat 6% Pay Credits, No Anticipated Leverage

	Entry Age Normal	PUC Annuity Method	PUC Service Prorate	TUC Method	PUC Pay Credit Method
T-7	110%	134%	97%	100%	97%
T-3	105%	148%	96%	100%	96%

Many plans have pay credits that increase substantially as age and/or service increase. Using either Entry Age Normal or a PUC Service Prorate Method will tend to increase the Account Balance Funding Ratio because the plan is more back-loaded than a plan that provides flat cash balance pay credits. The normal cost under these methods might even exceed the pay credits depending on the extent of back-loading and the demographics. A PUC Annuity Accrual method would be less affected. Because it would be very difficult to explain why the plan's normal cost is higher than the notional pay credits, the Entry Age Normal or PUC Service Prorate methods might not be selected.

Figure 4.7
Account Balance Funding Ratio
2% to 10% Pay Credit, 2% Anticipated Leverage

	Entry Age Normal	PUC Annuity Method	PUC Service Prorate	TUC Method	PUC Pay Credit Method
T-7	160%	115%	114%	80%	77%
T-3	162%	121%	117%	73%	69%

All of the above assumed that the lump sum would be paid immediately at termination of employment. Some cash balance plans may make employees wait until age 55 or 65 to get a lump sum, or even require that the benefit be annuitized. All of these extend the potential period over which anticipated leveraging could occur and lower the Account Balance Funding Ratio.

Figure 4.8 contains examples where an employee must wait until age 65 to receive the lump sum benefit. This sample employee is again age 40 and was hired at age 30 using the same basis as from Figure 4.4 (T-7) except for the age at which the lump sum is paid. Comparing this with the plan that assumes immediate lump sum payments produces the following result:

Figure 4.8
Account Balance Funding Ratio
4% to 5% Pay Credit, 2% Anticipated Leverage, T-7 Turnover

	Entry Age Normal	PUC Annuity Method	PUC Service Prorate	TUC Method	PUC Pay Credit Method
Immediate Lump Sum	103%	106%	86%	80%	78%
Lump Sum at Age 65	92%	87%	68%	50%	61%

If an employee must wait until age 65 to receive a lump sum, the lower Account Balance Funding Ratio may be justified. From a consulting perspective, the employer needs to understand the cost associated with lowering the age at which lump sums can be paid.

Effect of Transition Benefits on Funding

While any of the above PUC methods can fund benefits by expected termination of employment, the presence of a transition benefit can impact on the funding decision. Of the plans surveyed, 37 out of 39 had traditional plan formulas that were converted to starting account balances. Many of the starting (transition) account balances were materially different from what they would have been had the plan always been a cash balance plan. Is the Service Prorate method appropriate for these plans? At least three of the surveyed plans made adjustments to the PUC attribution method. Each was similar in that they kept the transition benefit attributed to past service.

Since plan sponsors provide such a wide variety of transitions, it is difficult to generalize. Examples based on survey responses are as follows.

1. The prior plan accrued benefit is converted to a starting account balance simply protecting the old accrued benefit. No other transition rules applied. Many such plans continue to use a simple PUC Service Prorate Method. However, others treat past accruals associated with the initial account conversion differently from future cash balance accruals. These actuaries modify the PUC Service Prorate by always keeping the initial balance as past service liability and prorating the future **pay credits** with service starting from the date of transition. This way the prior benefit does not contribute to the normal cost.

2. The plan described above but the initial starting balance is based on an 8% interest rate (higher than the 417(e) rate). There may be a **wearaway** problem for some number of years. Should the normal cost be zero for these years? The actuary should

be valuing lump sum payments higher than the account balance for decrements during the wearaway period. However, the PUC attribution method and assumed future 417(e) rate should also be considered as a way of managing the risk of these extra liabilities.

3. The old formula is continued as a minimum for some (or all) employees either for a limited period of time (three to five years) or forever. In this case, a portion of the normal cost is still associated with the prior plan formula. Attribution rules should again be examined; however, the added risk is that the amount of time that the benefit under the old formula will be larger than the cash balance benefit may depend on the level of future interest credits and 417(e) rates. This would have to be measured on a case-by-case basis and often may not be significant.

4. Extra temporary pay credits are given for some or all employees in the plan at transition. For example, 3% additional pay credits would be given over the next five years for all employees age 50 or older at transition. If a pure Service Prorate Method were used, it may not measure any front-loading for this benefit. Our survey found plans with this type of provision using a five-year attribution rule on this portion of the benefit.

5. This plan has the following features:

- Pay credits that increase with age and service (about 3% to 4% per year);
- Some special transition credits that ended after 10 years; and
- Retention of Final-average-pay formula for some older employees at transition.

In this plan the actuary assumed that for a new hire, the simple Service Prorate rule would apply. Then to reflect the fact that the starting account balance should perhaps have a different attribution rule, the actuary modified the rule by assuming the starting account balance is always past service liability. To accomplish this the actuary split the projected benefit into two parts: the protected transition account balance and the projected benefit derived from post transition benefit credits. Only the second portion was prorated based on service and the service for this purpose starts from the date of transition. Where cash balance benefit credits did not continue until normal retirement, the Service Prorate was also limited to ten years. In other words, the special ten-year transition credit had a third attribution rule. Finally, for employees expected to receive the final-average-pay benefit, a traditional attribution rule was used.

Summary

While it can be assumed that all of the assumptions and methods found in our survey would fund benefits if given enough time, each funding method will create a different set of Account Balance Funding Ratios. From an employee or PBGC perspective, it may be desirable for the active actuarial liability to equal or exceed the sum of the account balances. However, in an ongoing plan, the anticipated leverage can be realized. Actuaries need to be aware of how plan design, assumptions, and methods interact.

SECTION 5: PLAN TERMINATION CONCEPTS AND CONCERNS

The Fallacy of Perpetuity

Actuarial valuations and Schedule B's are almost always focused on the plans being ongoing; however, all plans must provide for what will happen when they terminate. There are some cash balance specific issues, involving both standard and distress terminations, that have not yet been resolved. PBGC rules on distress terminations of cash balance plans have not yet been established. Questions to ask include:

1. Do cash balance plans tend to be funded at the level of the termination liability?
2. What must be provided if the plan terminates as a standard termination?
3. What does PBGC guarantee?

This section explains what is already known and discusses these issues.

Do Cash Balance Plans Tend to be Funded at the Level of the Termination Liability?

For both traditional and cash balance plans, the amount of liability depends on whether the plan is being measured on an on-going or termination basis. For example, on-going valuations are likely to use a higher interest rate and a salary projection.

When a traditional plan is terminated, liabilities may exceed the ongoing plan liabilities. In addition, traditional plans may present other funding challenges at termination such as (i) flat dollar or career average pay plans with frequent past service updates and (ii) plans with shutdown benefits.

When a cash balance plan is terminated, the lump sum account balance may become available immediately. This total loss of anticipated leverage increases liabilities. If a plan can be frozen and not terminated this increase can usually be avoided.

Every plan will terminate eventually. If plan termination liabilities are greater than ongoing actuarial liabilities, the probability of a standard termination is reduced. If the following conditions were met, a cash balance plan could not terminate as a standard termination without additional funding:

1. The plan were funded to the level of 100% of the actuarial liability;
2. Account balances exceed the actuarial liability; and
3. Plan termination liabilities equal account balances.

Does this mean that cash balance plans are more likely to end up at the PBGC than traditional plans? Traditional final-average-pay plans often have higher plan termination liabilities than ongoing liabilities due to factors that may include the use of a lower interest assumption or special termination benefits. However, in a final-average-pay plan the funding for future pay increases offsets some or all of this cost.

Recent investment returns of 20% per year and surplus assets at the time of conversion to a cash balance plan make it likely that cash balance plans can have enough assets to cover all lump sum benefits. Interestingly, 53% of the plans surveyed were at the ERISA Full Funding Limit. However, it seems that when interest leveraging is anticipated (interest assumption higher than interest credit assumption), plan funding will trend toward assets equal to 100% of the actuarial liability and, in the long-term view, the PBGC may bear a greater risk of taking over the plan. This risk may involve more administrative problems than actual liabilities since the PBGC should be able to earn some of the anticipated leverage that the employer did not have the time to enjoy.

What does PBGC Guarantee?

At first one might realize that there is a conflict between the PBGC's concern to have plans funded on a termination basis and most employers' desire to fund on an ongoing basis recognizing future leverage. However, there is also an internal conflict between PBGC's missions of (1) encouraging the continuation and maintenance of private pension plans and (2) protecting pension benefits in ongoing plans.

It should be understood that the PBGC had trusteed only five cash balance plans by the end of 1998. How to apply many of the PBGC's guaranteed benefit rules to traditional cash balance plans has yet to be decided. However, one long-standing PBGC rule is that they only guarantee annuities at retirement and not lump sums. PBGC pays lump sums only in a limited number of situations (mostly those under $5,000). PBGC does pay annuities at ages below 55 where a plan has a provision such as normal retirement after 30 years of service at any age. PBGC would likely continue annuity payments to an existing cash balance plan annuitant regardless of age; however, it is not clear whether PBGC would provide annuities beginning at any age.

In the earliest cash balance plans, the lump sum account balance was divided by a person's life expectancy to provide a variable annuity that would increase both before and after retirement based on inflation credits. Because the PBGC does not guarantee cost of living adjustments, the inflation credits might not have been guaranteed in these original plans. However, almost all current cash balance plans now have future interest credits built into the definition of the accrued annuity benefit. Therefore, it seems likely that PBGC will guarantee an annuity based on the current account balance plus future interest credits.

Assume that a terminated participant age 40 has a vested cash balance account of $10,000. The plan credits interest based on 1-year Treasury Constant Maturities (at prior December rate) and annuitizes based on GATT interest and mortality (at prior December rate). These interest rates for December 1998 would be 4.52% and 5.06% respectively. For January 1999, PBGC would discount the value of annuities at 5.3% for the first 20 years and 5.25% thereafter. PBGC might value the annuity by bringing the $10,000 account forward (interest only) at 4.52% for 25 years[11] and annuitize at 5.06%. This would produce an annuity at age 65 of $219.27/month. Discounting back for interest and no mortality at PBGC rates produces a present value of $8,195. If the plan provided

immediate lump sums of $10,000, the guaranteed benefit (PBGC Priority Category 4) would be worth $8,195 and the remaining $1,805 might be a Priority Category 5 or 6 benefit for which the PBGC could try to recover from the employer. However, the missing $1,805 might not exist as any type of liability because the PBGC does not pay lump sums above $5,000.

Other problems for the PBGC actuaries arise from this example:

1. How should death benefits be valued?

2. Is the plan sufficient if the $1,805 is not a benefit liability and plan assets fall between the $8,195 and $10,000 levels discussed above?

3. Does the PBGC take over the plan (assuming the employer is bankrupt) if assets fall between $8,195 and $10,000? If not, what gets paid?

4. Should assumed retirement age (XRA) be equal to current age?

5. What should the PBGC do if the value of the annuity is more than the cash balance lump sum?

6. What rate should be credited for interest after the PBGC takes over the plan?

The last two points are particularly relevant to this study. The fifth point is PBGC's version of the whipsaw. Even plans that follow IRS Notice 96-8 to avoid the whipsaw in an ongoing plan can encounter this problem on termination. Had the interest credit in the prior example been 1% higher, the annuity would have increased and the present value would have been over $10,000. Will the PBGC really assess, against the plan sponsor, an unfunded benefit liability claim that is greater than the unfunded account balance?

Should PBGC Set the Interest Credit Rate, Ending the Use of the Plan's Index? Can the Rules be Changed to Allow the Plan Document to Provide for this at Plan Termination (even on a standard termination)?

The issue about what rate should be credited for interest after the PBGC takes over the plan is very important. In our example, should the rate be fixed at 4.52% or should it be allowed to float? Allowing it to float also has some administrative complexities for the PBGC. What if the rate is based on the S&P index? What if the prior year's S&P index increased 20%? Or 0%? If employees get to choose the index while the plan is ongoing, will they be allowed to choose the index after PBGC trustees the plan? Should PBGC simply set (freeze) the rate to that used to value the benefits at time of termination (such as 5.3% and 5.25% in our example)?

The PBGC might look for guidance at how the FDIC deals with interest rates on certificates of deposit when the depository institution fails [6]. The precedent would reset

the interest credit to the lesser of the credit rate in effect at the time of plan termination or the PBGC's valuation interest rate.

PBGC's practice is to issue benefit statements showing fixed annuity benefits[12]. It does not show lump sums (>$5,000) because it does not generally pay lump sums. Even if the IRS allows a cash balance benefit to be definitely determinable with future annuities that float, PBGC might be uncomfortable showing lump sum types of benefit statements with estimated future annuity benefits. How important is it that PBGC be able to set the annuity at date of plan termination vs. letting the lump sum and annuity float?

Other Observations

Some have suggested that cash balance plans be allowed to have a provision that would apply only at plan termination. This would allow the terminating plan to set future interest credits at a fixed rate, such as 5%. The effect would be to establish fixed dollar annuity benefits at plan termination commencing at any retirement age. For existing plans, this conflicts with the IRS concept that the interest credit rate cannot be changed for current account balances.

Even if a plan is sufficient by PBGC's terms, how is it possible to buy a deferred annuity if the interest credit is tied to the S&P index? Can the annuity option be limited to an immediate annuity?

If money is transferred from a 401(k) plan to a cash balance account or used to purchase an annuity from a cash balance plan, are there any special issues? How would PBGC's phase-in rules apply? What priority category is this in? Is it in Priority Category 1 (voluntary contributions) even if not exactly in a separate account? Note that money in a 401(k) plan is not guaranteed by PBGC and that, while Priority Category 1 is a relatively safe category, it is not guaranteed by PBGC.

Should employees be told they lose the ability to get a lump sum if PBGC ever trustees the plan?

Current Liability and PBGC Variable Premiums

The Current Liability is used for many purposes including Full Funding Limit calculations, additional funding requirements and PBGC variable premiums. Generally, cash balance plans have converted account balances to annuities when determining Current Liability. Assuming the plan uses the GATT conversion basis and the Current Liability interest rate is higher[13], this produces a smaller Current Liability than would be produced by assuming a lump sum form of payment. To the extent that PBGC variable premiums are based on Current Liability, consider the following:

- Would the Current Liability be better valued if the form of payment were assumed to be a lump sum? Or does the fact that PBGC does not guarantee lump sums mean that the annuity form is more appropriate?

- Should the rules to determine the PBGC variable premium be changed so that adjustments of the Current Liability to the PBGC interest rate basis could be ignored, and the current account balance (plus any whipsaw) be used for these participants? Is this too complicated? Should it be optional?

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SECTION 6: FASB STATEMENT NO. 87 AND CASH BALANCE PLANS

This section looks at special FAS 87 issues that apply to cash balance plans based on responses to FAS related questions in the survey. Below is a list of relevant points followed by some survey facts and observations related to embedded features. The first four points were discussed at the April 1993 Society meeting in San Diego [3].

1. The **vested benefit obligation (VBO)** can be measured as either an immediate termination benefit or a benefit at separation. The immediate benefit would be the cash balance account and the other measure would likely be a smaller value factoring in interest leveraging. Also see point 6.

2. In a cash balance plan there is no single, generally accepted attribution method under unit credit. A service proration would likely be acceptable. Alternatively, an annuity accrual proration method might also be acceptable. This second method is what we have referred to as the PUC Annuity Accrual Method.

3. If ad-hoc interest credits are applied, the full expense may need to be fully recognized in that year for FAS purposes.

4. In converting to a cash balance plan some plans use a higher interest rate than the GATT 30-year treasury rate. This results in protected benefits issues. For a period of years many employees may not accrue any benefits. A *curtailment*, under FAS 88, is the elimination of accruals for some or all years. Some thought should be given to curtailment accounting.

5. Paragraph 169 of FAS 87 requires that the *substantive plan* be valued. For a cash balance plan, this means that if an employer plans to provide future *bonus* interest credits, this should be taken into account when determining current PBO and ABO. One way to reflect this is by raising the assumed interest credit rate. None of the plans surveyed indicated that future plan amendments were included as part of the substantive plan, with the possible exception of the plan for California part-time teachers. They assume that the valuation interest rate and interest credit rate are equal. This seems intended to make the plan act like a money purchase plan through special interest credits. The California plan is not subject to FAS 87.

6. For many years there has been discussion whether the ABO and VBO should equal the account balances or should be a lesser amount based on discounts for anticipated leverage and non-vested terminations. The Emerging Issues Task Force Statement 88-1 allows the VBO to be measured on either basis. One large actuarial firm has a formal preference to discount the ABO and VBO. Based on our research (see survey in Appendix B), discounting is almost always done. If plan assets are less than the ABO, FAS 87 may require employers to create a *minimum liability* for the shortfall. If the account balance were used, minimum liability issues are more likely to arise.

7. In eight out of 27 plans that provided this information, the ABO equaled the PBO. For the other 19, the combination of the attribution rule, plan provisions, and assumptions produced a PBO greater than the ABO.

8. Because of the prevalence of lump sum payments, some smaller cash balance plans need to consider whether a settlement occurs during the normal operation of the plan. This occurs when the lump sum payments exceed the sum of the service cost plus the interest cost.

Survey Results

It is common that the funding valuation interest assumption would be higher than the FAS discount rate and lower than the FAS expected return on plan assets. Most plans used the same assumption for future interest credits for funding and FAS. The following is from Figure B.3.

Figure 6.1
Average FAS Assumptions

Funding Investment Assumption	Funding Interest Credit Assumption	FAS Credit Assumption	FAS Discount Rate	FAS Return on Plan Assets
8.42%	6.05%	5.93%	7.27%	9.24%

We found that in 23 of 28 plans the interest credit assumption was the same for both funding and FAS purposes. The average amount of anticipated leverage was as follows:

Figure 6.2
Anticipated Leverage

	Leverage in Rates
Valuation Basis	2.22%
FAS Discount Basis	1.20%
FAS Expected Return Basis	3.17%

Paragraph 44 of FAS 87 defines the *discount rate* as the rate at which the pension benefits could be effectively settled. FAS suggests that PBGC rates and yields on high quality fixed income investments could be used. The average 1.20% anticipated leverage shown above generally reflects the difference in rates between different qualities of fixed income investments. Is a 1.20% spread appropriate? The table below shows the spread between the December Moody's AA Corporate Bond Yield and 30-Year Treasuries rates for the last three years.

Figure 6.3
Spread Between AA Bond Yields and 30-Year Treasuries Rates

	Dec-97	Dec-98	Dec-99
Moody's AA Corporate Bond Yields	6.98%	6.65%	7.90%
30-Year Treasury Rates	5.99%	5.06%	6.35%
Difference	0.99%	1.59%	1.55%

Treatment of Embedded Features for FAS Purposes

401(k) Transfers: Consider a plan that allows 401(k) transfers to purchase immediate annuities. Assume the annuity conversion is at GATT rates and the discount rate is higher than the GATT rate. If such purchases are only recognized when they occur, the amendment generates no past service base and gains are realized as annuities are purchased.

Stochastic Valuations: Some embedded features like minimum interest credits and equity indexing may be best measured by stochastic valuations; however, like regular funding valuations, the FAS valuations are all done as deterministic models. There were no special comments received in the survey that related to risk under FAS valuation methods that did not also relate to the regular valuation, except that the PBO was not allowed to be less than the ABO.

Anticipated FAS Leverage for Equity Interest Crediting: If a cash balance plan used an equity index for interest credits, would negative leveraging be anticipated for FAS (discount rate less interest credit assumption)? Discount rates may be based on insurance company annuity contracts. It may be possible to argue that an indexed annuity could be found with limited negative leverage. One informal discussion indicated that this argument might not succeed until such a market is established. We leave this as an open issue.

Subsidized Annuities: Some plans with subsidized annuity features appeared to assume that future GATT rates will be high enough to avoid projected potential whipsaw issues, allowing the actuary to value the projected account balance by assuming it will equal the lump sum.

SECTION 7: ACTUARIAL DISCLOSURE ISSUES

This section contains a discussion of disclosure for actuarial valuation reporting. It does not consider participant statement disclosures. Our comments focus on identifying issues related to the types of items that might be disclosed.

Disclosure of Future Cash Balance Interest Credit Assumption

Most cash balance plans tie their interest credit to an index rate. If employees get to select the index, an issue develops as to how this would be used to set the assumption for future credits and how it would be disclosed. For example, consider account balances tracked in separate sub-accounts for each investment option on an employee-by-employee basis. Further, the equity fund index is assumed to equal 9% and the money market fund index is assumed to equal 4.5%. Would the assumed future interest credit be based on a re-balancing at the end of each year? Would future contribution credits be allocated in the same proportion as the current account balance?

Form of Payment Valued

Many actuaries stated that the form of payment valued was an immediate lump sum at termination of employment. For current liability purposes, the form valued must be an annuity. Some consideration should be given to stating the form of payment valued for all purposes.

Annuity Conversion Factors

If lump sum payments are valued and annuity conversions are based on GATT factors, there may not need to be an assumption for future GATT factors. However, there may be a need to use assumed future GATT factors for current liability purposes. If a plan uses a fixed factor or a fixed set of factors, it may be acceptable to include this in the summary of plan provisions, as it is not an assumption.

Future Match Credits

Some plans provided credits tied to matching 403(b) deferrals. The level of future matches needs to be disclosed to know what benefits were valued. This may best be expressed as the level of future employee deferrals as percentage of salary, since the level of match may vary by age or service.

PUC Funding Method

Since there is a variety of attribution rules available under the PUC funding method, how detailed of a disclosure is appropriate?

Level of Funding

Is it important to disclose the sum of the account balances in order to identify the amount of leverage that is anticipated? In plans with both cash balance and traditional formulas in place, how would this work? We recognize that many actuaries already state that the liabilities at plan termination are not the same as in an ongoing plan. We also recognize that leverage might be anticipated. Given the relatively low Account

Balance Funding Ratios in some plans and the fact that readers might assume that the account balances are equal to the actuarial liability, does this make disclosure of this number in the actuarial valuation report important? Is this any different than other termination liabilities in traditional plans?

FAS Disclosure

ASOP #2 discusses recommendations for actuarial communications for FAS 87 and 88. Part of the concern was that FAS 87 paragraph 18 says: "The accumulated benefit obligation and the vested benefit obligation provide information about the obligation the employer would have if the plan were discontinued." IASB had concerns that plan termination liabilities can be very different and the results might be misinterpreted. We have a similar concern that some readers will incorrectly assume that (1) the actuarial liability or ABO equals the sum of the account balances and (2) in plans with a whipsaw feature the account balance equals the immediate lump sum. This is another reason to think about disclosing the account balances or some other measure of termination liability.

Other Possible Disclosure Items:

1. Should a statement be included about the likelihood that the employer would need to continue contributions to the plan if the plan were frozen? Even if 100% funded, this can be an issue if the actuarial liability is less than the ABO. Examples of when this can sometimes occur include: (1) when using the PUC pay credit method, (2) when using a Service Prorate method with a wearaway problem and (3) when the salary scale is smaller than the interest credit assumption.

2. Should the basis for conversion to an initial account balance be disclosed? Given that the current account balance includes this amount, it can be argued that this information is not required. However, should it be included in the summary of plan provisions at least when the cash balance feature is new and protected accrued benefits may be present?

3. Should actuaries consider disclosing the impact of a 1% change in the interest credit assumption similar to the FAS 106 disclosure of the effect of changing the medical inflation assumption by 1%?

4. Should actuaries disclose: (1) embedded features in the plan provisions; (2) investment mix of plan assets; (3) approach to arrive at the assumed real rate of return on investments and interest credits; and (4) adjustments (if any) to the interest assumption to reflect the risk associated with embedded features?

APPENDIX A

DEFINITION OF TERMS

Following are definitions of terms used in this study. Most of the terms have specific meaning related to cash balance plans. Many are in common use but have no single, formal definition.

417(e) rates – This refers to the interest rates contained in section 417 of the Internal Revenue Code. This section specifies the interest and mortality rates to be used to convert between lump sum and annuity forms of payment in qualified defined benefit plans. This is also referred to as GATT rates.

Account Balance – A notional value used to communicate to a participant the value of his accumulated benefit under the plan.

Accumulated Benefit Obligation or ABO – This is a term used in FAS 87. It is an ongoing measure of liabilities based on current accrued benefits, current service and current salary levels.

Account Balance Funding Ratio – The ratio of a plan's actuarial liability to the sum of the account balances, or immediate lump sum liability if higher.

Actuarial Liability – Defined by the Actuarial Standards Board as "that portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of pension plan benefits and expenses that is not provided for by future Normal Cost."

Annuity Accrual Method – A Projected Unit Credit method under which normal cost and actuarial accrued liability is allocated based on the relative weights of the annuity associated with the cash balance account. Projecting the account balance forward to age 65 with no mortality or salary scale usually develops the annuity.

Cash Balance Plan – A defined benefit pension plan with notional accounts. The benefit is initially defined as the account lump sum comprised of contribution credits and interest credits. Note: some of the original cash balance plans were more like career average pay plans with pre and post termination COLA provisions. The benefit accrual was like the contribution credit and the COLA was like the interest credit.

Embedded Feature – A cash balance plan provision whose consequence depends on market conditions or future employee elections, and may be difficult to recognize using standard actuarial valuation methods.

GATT Rate – This is a common name for the 417(e) rate. See definition above.

Interest Credit – The dollar amount added to the participants' account balances as a result of the passage of time. Equals the prior account balance times the interest credit rate.

Interest Credit Rate – The basis used to determine the interest credit to be added to a cash balance account. This may be tied to an external index such as the yield on 30-year Treasuries.

IRS Notice 96-8 – This is an IRS notice issued in 1996. It contains safe-harbor rules for cash balance interest credits that can be used without creating a whipsaw effect.

Leverage – For cash balance plans, leverage is defined as the excess of the investment return rate on the plan's assets over the interest credit rate. The actual rate of return on plan assets is expected to be higher than the interest credit rate because the plan can adopt a higher level of risk on its investments than can be reflected in the interest credit rate. This difference can produce an actuarial liability less than the sum of the account balances.

Match Credit – The dollar amount of employer provided contribution credits added to a participant's account and linked to a separate employee contribution. The employee contributions being matched may be contributed to a separate plan, such as a 403(b) plan.

Normal Cost Ratio – The ratio of a plan's normal cost to the expected dollar amount of pay credits for the coming year.

Pay Credit – The dollar amount added to a participant's account balance for benefit accrual purposes. Equals pay credit rate times compensation.

Pay Credit Rate – The contribution credit to be added to a participant's account balance, expressed as a percentage of compensation.

Pay Credit Method – A Projected Unit Credit method where normal cost and actuarial accrued liability are allocated based on a weighting of the pay credit rates.

Projected Benefit Obligation or PBO – This is a term used in FAS 87. It is an ongoing measure of liabilities based on current service and projected salary levels. See FAS 87 for more details.

Projected Unit Credit or PUC – This is a type of actuarial funding method. Future salary levels and benefits are projected and then prorated to each year of service using an attribution rule.

Service Prorate Method – A Projected Unit Credit method where normal cost and actuarial accrued liability are allocated based on a simple service proration where no year of service has more weighting than another.

Traditional Unit Credit or TUC – This is a type of actuarial funding method. The actuarial liability is based on the current accrued benefit. The normal cost is based on the value of the benefit expected to be earned in the coming year.

Vested Benefit Obligation or VBO – This is a term used in FAS 87. It is an ongoing measure of liabilities based on current vested accrued benefits. It is the vested portion of the ABO.

Whipsaw – The need to pay a lump sum greater than the account balance due to the need to project the account balance forward and annuitize at rates different than the 417(e) basis for discounting back.

Wearway – This is a situation where the accrued benefit (expressed as either an annuity or lump sum) may not benefit from additional benefit accruals for some period of time due to the protected benefit being higher than the basic cash balance formula. This sometimes happens at or shortly after transition from a traditional plan to a cash balance plan. Reasons for this occurring include (1) using interest rates higher than current lump sum rates to establish opening account balances or (2) a decline in GATT lump sum interest rates after plan conversion.

APPENDIX B

SURVEY OF CASH BALANCE PLANS

We surveyed the actuarial aspects of the design and valuation of 39 large cash balance plans. This appendix has four parts: (1) description of the survey process, (2) survey of plan features, (3) survey of funding methods and assumptions, and (4) detailed results on pay and interest credits. As is indicated below, not every plan provided complete information. For example, not all plans provided information on FAS assumptions. In addition, not all surveyed items applied to all plans (e.g., FAS 87 did not apply to one governmental employer). Therefore, some survey topics will not cover all 39 plans.

Part 1: Survey Process

The Society of Actuaries provided us with a list of about 80 cash balance plans. Initially, we asked plan sponsors to provide information in the form of plan documents and actuarial reports. From these sources we obtained the types of information shown in this survey. Some plan sponsors did not respond, chose not to participate, or responded to specific questions but chose not to provide copies of valuation reports or plan documents. In seven cases we relied on information from 5500 filings or employee communication material. As a result, these seven plans do not have FAS or certain other assumption information in this survey. In most cases we followed up on our request with phone calls to the plan's actuary to discuss issues such as transition benefits and complicated pay credit provisions.

Part 2: Survey of Plan Features

The design of features varied widely. Below is a summary of some of the findings followed by a longer description of the more interesting individual plan features we found.

Number of plans surveyed: 39

Median number of participants covered = 7,991
(49% had over 10,000 and 10% had fewer than 1,000)

As of 1/1/99, average period since cash
balance feature adopted: 6.17 years
(Minimum = <1 year, Maximum = 14 years)

Average cash balance interest credit for 1998 = 5.90%

Number with pay credit that is:

Constant % over career =	13
Based on service only =	10
Based on age only =	6
Based on age and service =	10
Total =	39

Integrated with Social Security (also included in above numbers) = 12
Three plans frozen — no current pay credits (prior pay credit schedule included in above)

Figure B.1
Range of Pay Credits as a % of pay ($40,000[14] pay in 1999)

Employee Age	Employee's Service (years)	Minimum Credit Rate	Median Credit Rate	Maximum Credit Rate	Standard Deviation
25	5	1.00%	3.00%	7.00%	1.5%
35	10	1.00%	4.00%	8.35%	1.6%
45	15	1.00%	5.00%	11.35%	2.0%
55	20	1.00%	6.19%	14.35%	2.6%
65	25	1.00%	6.50%	15.35%	3.0%

Percent with unlimited lump sums at any age = 69% (27 out of 39)

All but two converted from a traditional plan

Percent with special transitional benefits[15] = 51% (20 out of 39)

Embedded features found:

Subsidized option benefit forms	7 out of 39
Accept DC plan transfers for conversion to an annuity	2 out of 39
Interest credits tied to equity index	1 out of 39
403(b) (tax sheltered annuity) match credit	3 out of 39
Other match credit	1 out of 39
Interest Credit > IRS Notice 96-8 safe harbors	6 out of 39
Potential whipsaw (all causes)	12 out of 39

Interesting Plan Features

The following four features were found in one plan that was converted to a cash balance plan in 1998.

1. *Investment Options:* Investment credits are based on the investment gains or losses of the same or similar funds available through the company's 401(k) plan. There are 11 different funds ranging from a money market fund to an equity fund. Employees get to elect from these options.

2. *401(k) Transfers:* Employees were allowed (and encouraged) to transfer most of their current 401(k) account balance into the cash balance plan. This appeared to be a one-time option. The same investment options were allowed.

3. *Investment Guarantee:* Because of the possibility of negative returns, there is a minimum guarantee that the lump sum will not be less than the sum of (1) the 1998 starting account balance, (2) any 1998 401(k) plan transfers and (3) future employer pay credits. Over time, the value of this guarantee would diminish.

4. *Transition Benefit:* There is a transition benefit where certain older or long service employees have the old plan formula continue until 2003.

In other plans the following features were found:

- Employees are allowed to make contributions to their account balances. Those that made employee contributions were given additional employer provided pay credits. Employees were able to start or stop making employee contributions at any time. The additional pay credits were not called a match but that is effectively what they were.

- Ongoing 401(k) plan transfers: One plan placed an interesting limitation on transfers. An employee could only transfer the account balance at time of retirement if used to purchase an immediate annuity and this was only allowed if the total benefit (including the cash balance account and 401(k) account) were used to buy an annuity. Annuity option factors were based on GATT rates. This is discussed in more detail in Section 3 of the report.

- Several had minimum and/or maximum interest credit rates.

- One plan based the pay credits on a target benefit plan type of approach.

- One plan provided an ongoing minimum, floor, final-average-pay benefit.

- 16 plans provided annuity conversion rates tied to GATT or PBGC (417(e)) rates. 14 plans used fixed annuity conversion factors, including 5 that used fixed factors that

did not vary by age. Two plans used floating rates that were not based on 417(e) rates. The basis for seven plans was either not provided or was not yet established.

- One plan limited the lump sum payment to one times pay. The excess was paid as an annuity unless the remaining lump sum was less than $30,000 in which case the excess could also be paid as a lump sum.

- Some of the plans for hospital employees had a TSA match.

- Some plans give extra cash balance pay or interest credits for participants at transition. Some credits were temporary while others were permanent.

- Some plans covered multiple employee groups, some of whom had cash balance benefits while others did not.

- The plan for California part-time teachers required pre-tax employee contributions (414(h) pick up feature).

- One plan has a loan feature.

- Of the plans that were integrated with Social Security, most provided an extra pay credit on compensation in excess of one-third to one-half of the Social Security Wage Base.

- A few plans did not convert their pre-cash balance traditional benefit to a starting account balance. They simply add a prospective account balance to the prior plan annuity. One plan restricted the lump sum to the cash balance portion of the plan thus requiring the pre-cash balance portion to be paid as an annuity.

Part 3: Survey of Funding Methods and Assumptions

Most plans were funded anticipating interest leverage. We estimated that anticipated leverage resulted in current actuarial liabilities being 20% to 30% less than the current account balances.

One plan did not anticipate any leverage in funding. In this plan the normal cost was determined as the current pay credits. The funding method was described as Traditional Unit Credit with a 6.5% interest assumption and 6.5% interest credit assumption. Interest on account balances is credited using 30-year T-Bill rates but excess earnings are used to provide extra ad-hoc interest credits when a sufficient surplus is generated.

The following summarizes some of the survey results:

Number of plans surveyed:	38
Number of plans covered by ERISA:	37 of 38

Funding method:

Projected Unit Credit	74% (28 out of 38)
Traditional Unit Credit	8% (3 out of 38)
Entry Age Normal	11% (4 out of 38)
Aggregate	5% (2 out of 38)
Frozen Initial Liability	3% (1 out of 38)

Variations of Projected Unit Credit (see Section 4 and Appendix C for a description of funding methods). Note: 6 of the 28 plans using PUC did not specify details

Single Service Prorate	73% (16 out of 22)
Multiple Service Prorates	5% (1 out of 22)
Pay Credit Method	23% (5 out of 22)
Annuity Accrual Method	0% (0 out of 22)

Average valuation interest rate = (Min. = 6%, Max. = 9%)	8.29%
Average salary scale =	5.23%

This survey provided information on the relationship of the salary assumption to the interest credit assumption in 36 plans. The salary assumption was higher in 6 plans, equal in 3 plans and lower in 27 plans.

Another area of focus was the interest credit assumption. For instance, if a plan granted cash balance interest credits based on 30-year Treasury rates, what did the actuary assume the future rate would be on 30-year Treasuries? We asked for this information on both an IRS funding valuation basis and a FAS basis. On average, the assumed interest credit rate was 2.22% less than the funding valuation interest assumption and 1.20% less than the FAS 87 discount rate. However, because plans are not equally generous with their interest credits, we broke the results down into categories based on which index they used. We focused on the ultimate rate a new employee would receive, thus ignoring any other rates that might be applied to transition benefits.

The following table shows the assumed rate of future interest credits. Because some plans use 52-week Treasuries while others used 52-week Treasuries plus an adjustment (e.g., +1%), we added a *core rate* column. The core rate is the assumed interest credit with that adjustment removed. For a plan that assumes a future interest credit of 6%

based on 52-week Treasuries plus 1%, the core rate assumption will be 5%. All of the numbers in the next two charts are assumptions and not actual interest credits or actual investment returns.

Figure B.2
Future Cash Balance Interest Credit Assumption

Basis for Interest Credit	Number of Plans	Average Core Rate	Minimum Credit	Maxium Credit	Average Valuation Interest Credit
All plans	38	5.85%	4.00%	7.15%	6.07%
30-year Treasuries	8	6.39%	5.75%	7.00%	6.33%
52-week Treasuries	13	5.87%	5.00%	7.00%	6.17%
Other	17	5.59%	4.00%	7.15%	5.87%

Figure B.3
Average Assumptions (excludes plans that did not provide all five assumptions)

Basis for Interest Credit	Number of Plans	Average Funding Valuation Interest	Funding Valuation Interest Credit	FAS 87 Discount Rate	FAS 87 Rate of Return	FAS 87 Interest Credit
All plans	28	8.42%	6.05%	7.27%	9.24%	5.93%
30-year Treasuries	7	8.43%	6.30%	7.44%	9.75%	6.19%
52-week Treasuries	11	8.34%	6.02%	7.23%	9.05%	5.98%
Other	10	8.51%	5.90%	7.20%	9.10%	5.70%

Turnover Assumptions

Given the significant impact of turnover on cost, information was also collected on turnover assumptions. In some cases, there were different assumptions for different groups of employees within a plan. While select turnover rates were used for many plans, to simplify our report, select turnover rates were ignored and only ultimate turnover assumptions for males were summarized. Following is the average ultimate turnover assumption at ages 25, 40, and 55.

Figure B.4
Average Ultimate Turnover Rates of 26 plans

Age	Probability
25	12.18%
40	6.00%
55	2.39%

Many plans included select turnover rates. Generally, the lowest cost estimate is produced using high select turnover prior to vesting (maximizing forfeitures) and low turnover thereafter (maximizing anticipated leveraging).

Part 4: Pay and Interest Credits Charts

The following charts show some of the individual features and assumptions used. Individual plans are not identified nor are they in the same order in each figure. Figure B.5 shows the average pay credit for five different combinations of age and service for someone earning $40,000 in 1999. The results are sorted from highest to lowest, based on the simple sum of the five pay credit rates shown. Note that Figures B.5 and B.6 focus on the benefits offered to a new employee, without prior transition benefits. Employees in the plan at the time of transition may have higher benefits. In addition, certain other benefits such as TSA matches and minimum final-average-pay formulas were not included in Figure B.5. Figure B.6 shows the basis for providing interest credits and the assumptions used to value them.

Figure B.5
Survey of Pay Credits at Various Age/Service combinations:

Age:	25	35	45	55	65
Years of Service:	5	10	15	20	25
Plan Rank by Pay Credit					
1	6.35%	8.35%	11.35%	14.35%	15.35%
2	7.00%	7.00%	7.00%	7.00%	7.00%
3	3.00%	4.25%	6.50%	10.00%	10.00%
4	4.50%	5.50%	6.50%	7.50%	8.50%
5	3.00%	4.50%	6.00%	9.00%	9.00%
6	5.25%	5.25%	7.00%	7.00%	7.00%
7	3.00%	4.00%	5.00%	7.80%	11.60%
8	6.25%	6.25%	6.25%	6.25%	6.25%
9	6.00%	6.00%	6.00%	6.00%	6.00%
10	3.00%	4.00%	6.00%	7.00%	9.00%
11	4.00%	5.00%	6.00%	7.00%	7.00%
12	2.00%	3.00%	6.00%	8.00%	10.00%
13	1.70%	2.70%	4.60%	8.00%	10.70%
14	3.30%	3.30%	7.00%	7.00%	7.00%
15	4.00%	5.00%	6.00%	6.00%	6.00%
16	3.29%	3.99%	4.99%	6.19%	7.58%
17	3.23%	4.23%	5.23%	6.23%	6.73%
18	2.50%	4.00%	6.00%	6.50%	6.50%
19	2.50%	3.75%	5.00%	6.25%	7.92%
20	5.00%	5.00%	5.00%	5.00%	5.00%
21	3.00%	3.00%	4.00%	5.60%	7.20%
22	3.00%	4.00%	4.00%	5.00%	5.00%
23	4.00%	4.00%	4.00%	4.00%	4.00%
24	4.00%	4.00%	4.00%	4.00%	4.00%
25	4.00%	4.00%	4.00%	4.00%	4.00%
26	3.00%	3.00%	4.00%	4.00%	4.00%
27	2.00%	2.50%	3.50%	4.00%	5.00%
28	3.30%	3.30%	3.30%	3.30%	3.30%
29	2.00%	2.50%	3.00%	4.00%	4.00%
30	2.00%	2.50%	3.00%	3.00%	3.00%
31	1.35%	1.84%	2.45%	3.31%	4.53%
32	2.00%	2.00%	2.00%	2.00%	2.00%
33	1.00%	1.00%	1.00%	1.00%	1.00%
34	1.00%	1.00%	1.00%	1.00%	1.00%
Average =	3.37%	3.93%	4.90%	5.77%	6.36%

Figure B.6
Anticipated Leverage by Index

Core Interest Credit Basis	Margin +/-	Minimum	Maximum	Valuation Interest Assumption	Interest Credit Assumption	Anticipated Leverage
30-yr Treas.				9.00%	6.11%	2.89%
30-yr Treas.	-1.0%	4.0%	7.5%	9.00%	6.00%	3.00%
30-yr Treas.				8.50%	6.50%	2.00%
30-yr Treas.				8.50%	5.75%	2.75%
30-yr Treas.				8.00%	6.75%	1.25%
30-yr Treas.			6.0%	8.00%	6.00%	2.00%
30-yr Treas.	0.5%	5.0%		8.00%	7.00%	1.00%
30-yr Treas.				6.50%	6.50%	0.00%
52-wk Treas.		5.0%	12.0%	9.00%	7.00%	2.00%
52-wk Treas.				9.00%	6.50%	2.50%
52-wk Treas.				8.75%	5.50%	3.25%
52-wk Treas.	1.0%	5.0%		8.50%	7.00%	1.50%
52-wk Treas.				8.50%	6.00%	2.50%
52-wk Treas.				8.50%	6.00%	2.50%
52-wk Treas.	1.0%			8.50%	6.00%	2.50%
52-wk Treas.				8.25%	6.00%	2.25%
52-wk Treas.				8.25%	5.00%	3.25%
52-wk Treas.				8.00%	6.50%	1.50%
52-wk Treas.		6.5%		7.00%	6.50%	0.50%
52-wk Treas.	1.0%			9.00%	6.25%	2.75%
52-wk Treas.	1.0%			8.00%	6.00%	2.00%
6% fixed				9.00%	6.00%	3.00%
6-month Treas.			GATT	8.60%	4.50%	4.10%
6-month Treas.		4.0%	6.0%	8.50%	6.00%	2.50%
CPI		4.0%		9.00%	4.00%	5.00%
CPI		4.0%	5.0%	8.00%	5.50%	2.50%
CPI				9.00%	7.00%	2.00%
CPI				7.00%	6.00%	1.00%
Five-yr. Treas				9.00%	6.08%	2.92%
Five-yr. Treas				8.50%	6.00%	2.50%
Five-yr. Treas	1.0%			8.50%	7.00%	1.50%
Fixed 4%				9.00%	4.00%	5.00%
Fixed 6.5%				6.50%	6.50%	0.00%
Fixed 7%				8.00%	7.00%	1.00%
Set annually, 3% min.		3.0%		9.00%	7.00%	2.00%
Set annually, 4% min		4.0%		6.00%	6.00%	0.00%

APPENDIX C

PROJECTED UNIT CREDIT VARIATIONS/SAMPLE LIVES

There are several ways to allocate normal cost using the Projected Unit Credit actuarial cost method. This appendix contains an illustration of four unit credit attribution methods. The charts at the end of this Appendix begin with the development of the basic benefit and present values (Figure C.1). This is followed by separate pages calculating normal cost and actuarial liabilities for each unit credit attribution method (Figures C.2 – C.5). The sample life illustration assumes the following and is the basis for the charts in Section 4 of the report.

- Interest Assumption 8%
- Salary Scale = 5.5%
- T-7 turnover with five-year vesting (a variation was also done using T-3 for the Figures in Section 4)
- Cash balance interest credit rate = 6% (credited at end of year on BOY balance)
- Cash balance pay credit rate = 4% of pay for first ten years and 5% thereafter (other variations were also done for some Figures in Section 4)
- Benefit paid as a lump sum at termination of employment (a variation was also done assuming payments delayed until age 65 for Table 8 in Section 4)
- Assume that the plan annuitizes at GATT rates and the valuation assumes that the future GATT interest rate will be 6.5%. The assumed age 65 GATT annuity factor is therefore 10.246.
- Assume that an employee joins the plan at age 30 with a salary of $30,000

Based on the above the following can be derived:

Service Prorate Method: Figure C.1 shows that the projected account balance at age 65 will be $330,381. Ignoring for a moment the cost of vesting and death benefits, the present value of providing this age 65 lump sum benefit is discounted back at 8% for 35 years (0.06763) and for preretirement mortality and turnover (0.14517). This equals $3,244. Under a Service Prorate method, the first year's normal cost for the retirement decrement is $1/35^{th}$ of this amount or $93. For all decrements the total first year normal cost is $533. See Figure C.2. It is interesting to note that the retirement decrement accounted for 17.4% ($93/$533) of the first year's normal cost and to note the ratio under other funding methods.

Annuity Accrual Method: Next, consider allocating normal cost based on some type of annuity attribution rule. If a final-average-pay plan gave 1% for the first 20 years and 0% thereafter, the normal cost attribution rule would be weighted as level for 20 years and zero thereafter, without looking at salary scales, mortality or other decrements. However, for a cash balance plan the annuity attributable to each year (at each attribution age from 30 to 64 in our example) would be:

Pay credit rate at attribution age times current salary times [(1+ assumed interest credit rate) ^ (age 65 - attribution age)]/annuity factor at age 65

If this is calculated at every age it is apparent that some terms do not change. Therefore the relative attribution amount can be thought of as:

Pay credit rate at attribution age times [(1+ assumed interest credit rate) ^ (age 65 - attribution age)]

While this is a good simplification, it may not work in real life when there are non-cash balance transition or minimum benefits.

In Figure C.3 we calculated both of the attribution formulas italicized above. Using the first method, the annuity values for the first two years are $900 and $849, both payable at age 65 and both based on a $30,000 salary. The difference of 6% ($900/$849–1) is tied to the assumed interest credit rate. To determine the portion of the first year's normal cost for the retirement benefit, the $3,244 present value shown above (in the Service Prorate method) is multiplied by the ratio of $900 to the sum of all annuity credits ($15,536 = annuity equivalent of projected age 65 account balance with no salary increases). Still ignoring for a moment the cost of vesting and death benefits, the first year's normal cost for the retirement decrement is $188 ($3,244 x $900/$15,536). For all decrements the total first year normal cost is $756. See Figure C.3. The retirement decrement accounted for 24.9% ($188/$756) of the first year's normal cost.

The annuity method will tend to increase the back-loading of normal cost (higher in later years) relative to the Service Prorate method if the following occurs:

- The plan has contribution credits that increase with age and/or service;
- Salary increases are higher than expected; and
- The assumed interest credit assumption (6% in our example) is reduced.

Some variations that might be questioned include:

- Using interest and mortality to bring the balance forward instead of interest only, when determining the attribution percentage when using the Annuity Accrual Method.

- Using the valuation interest rate (8% in our example) instead of the assumed interest credit assumption (6%) to bring the balance forward when determining the attribution percentage when using the Annuity Accrual Method.

Pay Credit Method: This method simply weights the service based on the pay credit rates. In this example the pay credit rate was 4% for ten years and 5% thereafter. To determine the portion of the first year's normal cost for the retirement benefit, the $3,244 present value shown above is multiplied times the ratio of the first year's credit to all credits until age 65 (4%/(4% x 10 + 5% x 25) = 4/165). Still ignoring for a moment the cost of vesting and death benefits, the first year's normal cost for the retirement decrement is $79. For all decrements the total first year normal cost is $198. If the pay credit rate does not vary by age or service, this method is the same as the Service Prorate method. See Figure C.4. The retirement decrement accounted for 39.9% ($79/$198) of the first year's normal cost

Traditional Unit Credit Method: Under this method the actuarial liability equals the current account balance discounted for anticipated leverage and the normal cost is equal to the current year's pay credit also discounted for anticipated leverage (Figure C.5).

It is worth noting that the cause of decrement (e.g., death, retirement or quit) is not significant since the benefit paid is not dependent on the cause. Figure C.5 was designed to make this point. We recognize that actual plan design might not allow such simplification. For example, death benefits might be paid if death occurs before vesting.

Other Thoughts:

1. There is an issue that arises concerning the determination of the annuity used in the attribution rule under the PUC Annuity Accrual method. Often annuities are determined at age 65 (normal retirement age). What if a valuation assumes that some participants work beyond age 65? Is it appropriate in the attribution ratio to include annuities payable at different ages? This can also lead to a discussion that if age 65 has no significance to the participant, can actuaries value annuities payable at the age of decrement for normal cost attribution purposes?

2. Another important issue concerns how starting account balances should be factored into the PUC attribution rules when transitioning from a traditional Defined Benefit formula. This is a particular concern when the conversion rate was aggressive (high interest rate) and protected annuity benefits may apply for a few years.

All Column references are at age (x) unless indicated

Selected Formulas for Figure C.1 -Sample Life PVB & EAN Projection

Column	***Description/Formula***
1	Age (x)
6	Cash Balance Account at Age = Col. 6 (x–1) + Col. 7 (x–1) + Col. 8 (x–1)
7	Cash Balance Pay Credit = Col. 4 * Col. 5
8	Cash Balance Interest Credit = 6% * Col. 6
16	PVB – Retirement = Col. 6 * Col. 10 * Col. 14 * Col. 15
17	PVB – Turnover = Col. 6 * Col. 9 * Col. 14 * Col. 15; if Col. 2$5; 0 otherwise.
18	PVB – Death = Col. 6 * Col. 11 * Col. 14 * Col. 15
19	PV Salary at Entry = Col. 4 * Col. 14 * Col. 15
20	If Active PVB in Year of Decrement = (Sum of Col.'s 16 to 18 from Age x to 65) * [1/ (Col. 14 (x) * Col. 15 (x))]
21	EAN Normal Cost = 2.82% * Col. 4 (2.82% developed at bottom of Col. 18 at Entry Age)
22	EAN Act. Liability = Col. 20 - 2.82% * (Sum of Col. 19 from Age x to 65) * [1/ (Col. 14 (x) * Col. 15 (x))]

Selected Formulas for Figure C.2 - PUC Service Prorate Method

Note: Fig 1: Col. 16 (x) refers to Column 16 of Figure C.1, at age (x)

Column	***Description/Formula***
2	PUC NC at Entry – Retirement = (Fig 1: Col. 16) * (1/Col. 1 (x))
3	PUC NC at Entry – Turnover = (Fig 1: Col. 17) * (1/Col. 1 (x))
4	PUC NC at Entry – Death = (Fig 1: Col. 18) * (1/Col. 1 (x))
5	Current PUC NC – Retirement = (Sum of Col. 2 from x to 65) * {1/ (Fig 1: Col. 14 (x) * Fig 1: Col. 15 (x)}
6	Current PUC NC – Turnover = Same as 5 but uses (Sum of Col.3 from x to 65)
7	Current PUC NC – Death = Same as 5 but uses (Sum of Col. 4 from x to 65)
9	Current PUC AL – Retirement = Col. 5 * Col. 1
10	Current PUC AL – Turnover = Col. 6 * Col. 1
11	Current PUC AL – Death = Col. 7 * Col. 1

Selected Formulas for Figure C.3 - PUC Annuity Accrual Method

Column	***Description/Formula***
1	EOY Annuity at Age 65 from Deposit = Fig. 1: Col. 4 (30) * Fig. 1 : Col. 5 (x) * (1.06 (65 – (x)) /ä65(12)) Note: ä65(12) is based on 6.5% GATT Mortality and is the Assumed Annuity Conversion Basis.
2	Weighted Service Attribution (NC Payments) = Col. 1 (x) / Col. 1 (64)
5	PUC NC at Entry Age – Retirement = Fig. 1 Col. 16 (x) * Col. 2 (30)/(Sum of Col. 2 from 30 to x–1)
6	PUC NC at Entry Age – Turnover = Same as 5 but uses Fig. 1 Col. 17 (x)
7	PUC NC at Entry Age – Death = Same as 5 but uses Fig. 1 Col. 18 (x)
8	Current PUC NC – Retirement = Sum of Col. 5 from x to 65 * 1/(Fig. 1 Col. 14 (x) * Fig. 1 Col. 15 (x)) * [Col. 2 (x)/Col. 2 (30)]
9	Current PUC NC – Turnover = Same as 8 but uses Sum of Col. 6 from x to 65
10	Current PUC NC – Death = Same as 8 but uses Sum of Col. 7 from x to 65
12	Current PUC AL – Retirement = Sum of Col. 5 from x to 65 * 1/(Fig. 1 Col. 14 (x) * Fig. 1 Col. 15 (x)) * [Sum of Col. 2 from 30 to (x-1)/Col. 2 (30)]
13	Current PUC AL – Turnover = Same as 12 but uses Sum of Col. 6 from x to 65
14	Current PUC AL – Turnover = Same as 12 but uses Sum of Col. 7 from x to 65

Selected Formulas for Figure C.4 - PUC Pay Credit Method

Column	***Description/Formula***
2	Weighted Service Attribution (NC Payments) = Col. 1 (x)/Col. 1 (30)
3	PUC NC at Entry Age – Retirement = Fig. 1 Col. 16 (x) * Col. 2 (30)/(Sum of Col. 2 from 30 to x–1)
4	PUC NC at Entry Age – Turnover = Same as 5 but uses Fig. 1 Col. 17 (x)
5	PUC NC at Entry Age – Death = Same as 5 but uses Fig. 1 Col. 18 (x)
6	Current PUC NC – Retirement = Sum of Col. 3 from x to 65 * 1/(Fig. 1 Col. 14 (x) * Fig. 1 Col. 15 (x)) * Col. 2 (x)
7	Current PUC NC – Turnover = Same as 6 but uses Sum of Col. 4 from x to 65
8	Current PUC NC – Death = Same as 6 but uses Sum of Col. 5 from x to 65
9	Current PUC AL – Retirement = Col. 6 (x) * Sum of Col. 2 from 30 to (x-1)/Col. 2 (x)
10	Current PUC AL – Turnover = Same as 9 but uses Col. 7 instead of Col. 6
11	Current PUC AL – Death = Same as 9 but uses Col. 8 instead of Col. 6

Selected Formulas for Figure C.5 - Traditional Unit Credit Method

Column	***Description/Formula***
8	TUC NC = Col. 1 (x) * {SumProduct of Col. 4-7 from (x+1) to 65}/ [Col. 3 (x) * Col. 6 (x) * Col. 7(x)]
9	TUC AL = Col. 2 (x) * {SumProduct of Col. 4-7 from (x) to 65}/ [Col. 3 (x) * Col. 6 (x) * Col. 7(x)]

Note: SumProduct is a Microsoft Excel function

Figure C.1 - Sample Life PVB & EAN Projection - Page 1 of 2

Val. Interest rate = 8.0%
Inflation rate = 3.5% Cash Balance Interest Credit Assumptio 6.0%
Salary Scale = 5.5%

1	2	3	4	5	6	7	8	9	10	11
Current Age	Years of Service	Salary Scale	Salary	Pay Credit Rate	BOY Cash Balance Account	EOY Cash Balance Pay Credit	EOY Cash Balance Interest Credit	Turnover T7	Retirement Rates	Mortality 83GAM m
30	0	6%	$ 30,000	4%	0	1,200	0	0.0930		0.0006
31	1	6%	$ 31,650	4%	1,200	1,266	72	0.0921		0.0006
32	2	6%	$ 33,391	4%	2,538	1,336	152	0.0910		0.0007
33	3	6%	$ 35,227	4%	4,026	1,409	242	0.0898		0.0007
34	4	6%	$ 37,165	4%	5,677	1,487	341	0.0885		0.0008
35	5	6%	$ 39,209	4%	7,504	1,568	450	0.0871		0.0009
36	6	6%	$ 41,365	4%	9,522	1,655	571	0.0855		0.0009
37	7	6%	$ 43,640	4%	11,748	1,746	705	0.0837		0.0010
38	8	6%	$ 46,041	4%	14,199	1,842	852	0.0818		0.0010
39	9	6%	$ 48,573	4%	16,892	1,943	1,014	0.0798		0.0011
40	10	6%	$ 51,244	5%	19,849	2,562	1,191	0.0775		0.0012
41	11	6%	$ 54,063	5%	23,602	2,703	1,416	0.0752		0.0014
42	12	6%	$ 57,036	5%	27,721	2,852	1,663	0.0726		0.0015
43	13	6%	$ 60,173	5%	32,236	3,009	1,934	0.0698		0.0017
44	14	6%	$ 63,483	5%	37,179	3,174	2,231	0.0668		0.0019
45	15	6%	$ 66,974	5%	42,584	3,349	2,555	0.0635		0.0022
46	16	6%	$ 70,658	5%	48,488	3,533	2,909	0.0601		0.0025
47	17	6%	$ 74,544	5%	54,930	3,727	3,296	0.0562		0.0028
48	18	6%	$ 78,644	5%	61,953	3,932	3,717	0.0520		0.0031
49	19	6%	$ 82,969	5%	69,602	4,148	4,176	0.0473		0.0035
50	20	6%	$ 87,533	5%	77,927	4,377	4,676	0.0422		0.0039
51	21	6%	$ 92,347	5%	86,979	4,617	5,219	0.0368		0.0043
52	22	6%	$ 97,426	5%	96,815	4,871	5,809	0.0312		0.0048
53	23	6%	$ 102,785	5%	107,495	5,139	6,450	0.0257		0.0052
54	24	6%	$ 108,438	5%	119,084	5,422	7,145	0.0203		0.0057
55	25	6%	$ 114,402	5%	131,651	5,720	7,899	0.0155		0.0061
56	26	6%	$ 120,694	5%	145,270	6,035	8,716	0.0112		0.0066
57	27	6%	$ 127,332	5%	160,021	6,367	9,601	0.0077		0.0071
58	28	6%	$ 134,335	5%	175,989	6,717	10,559	0.0049		0.0077
59	29	6%	$ 141,724	5%	193,265	7,086	11,596	0.0029		0.0084
60	30	6%	$ 149,519	5%	211,948	7,476	12,717	0.0015		0.0092
61	31	6%	$ 157,742	5%	232,140	7,887	13,928	0.0006		0.0101
62	32	6%	$ 166,418	5%	253,956	8,321	15,237	0.0002		0.0111
63	33	6%	$ 175,571	5%	277,514	8,779	16,651	0.0000		0.0124
64	34	6%	$ 185,227	5%	302,943	9,261	18,177	0.0000		0.0139
65	35		$ 195,415		330,381			0.0000	1.0000	

Figure C.1 - Sample Life PVB & EAN Projection - Page 2 of 2

12	13	14	15	At Entry Age 16	At Entry Age 17	At Entry Age 18	At Entry Age 19	At Current Age 20	At Current Age 21	At Current Age 22
disabled ax	1px	tp30	0.08 vt	PVB Ret	PVB Turnover	PVB Death	PV Future Salary at Entry	If active PVB in year of decrement	EAN Normal Cost	EAN Act. Liability
14.9866	0.9064	1.0000	1.0000	-	-	-	30,000	8,150	845	-
14.9328	0.9073	0.9064	0.9259	-	-	1	26,561	9,711	892	1,007
14.8760	0.9083	0.8223	0.8573	-	-	1	23,541	11,559	941	2,260
14.8159	0.9094	0.7469	0.7938	-	-	2	20,888	13,742	993	3,804
14.7525	0.9107	0.6793	0.7350	-	-	2	18,557	16,315	1,047	5,692
14.6855	0.9121	0.6186	0.6806	-	275	3	16,508	19,343	1,105	7,987
14.6149	0.9136	0.5642	0.6302	-	289	3	14,708	22,123	1,166	9,985
14.5403	0.9153	0.5155	0.5835	-	296	3	13,127	25,179	1,230	12,208
14.4614	0.9171	0.4719	0.5403	-	296	4	11,737	28,536	1,297	14,682
14.3781	0.9191	0.4328	0.5002	-	292	4	10,515	32,217	1,369	17,432
14.2904	0.9212	0.3978	0.4632	-	284	5	9,441	36,251	1,444	20,486
14.1980	0.9235	0.3664	0.4289	-	279	5	8,496	40,666	1,523	23,876
14.1008	0.9259	0.3384	0.3971	-	270	6	7,664	45,446	1,607	27,593
13.9988	0.9285	0.3133	0.3677	-	259	6	6,932	50,614	1,696	31,664
13.8919	0.9313	0.2909	0.3405	-	246	7	6,288	56,191	1,789	36,121
13.7799	0.9343	0.2709	0.3152	-	231	8	5,720	62,200	1,887	41,001
13.6630	0.9375	0.2531	0.2919	-	215	9	5,221	68,667	1,991	46,343
13.5410	0.9410	0.2373	0.2703	-	198	10	4,781	75,614	2,101	52,189
13.4138	0.9449	0.2233	0.2502	-	180	11	4,395	83,064	2,216	58,590
13.2815	0.9492	0.2110	0.2317	-	161	12	4,056	91,039	2,338	65,598
13.1437	0.9538	0.2003	0.2145	-	141	13	3,761	99,563	2,467	73,274
13.0002	0.9589	0.1910	0.1987	-	122	14	3,504	108,658	2,602	81,686
12.8507	0.9640	0.1832	0.1839	-	102	16	3,282	118,356	2,745	90,907
12.6949	0.9691	0.1766	0.1703	-	83	17	3,091	128,693	2,896	101,017
12.5324	0.9740	0.1711	0.1577	-	65	18	2,926	139,717	3,056	112,103
12.3630	0.9784	0.1667	0.1460	-	50	20	2,784	151,489	3,224	124,258
12.1862	0.9821	0.1631	0.1352	-	36	21	2,661	164,082	3,401	137,580
12.0018	0.9851	0.1601	0.1252	-	25	23	2,553	177,578	3,588	152,176
11.8095	0.9873	0.1578	0.1159	-	16	25	2,457	192,070	3,785	168,156
11.6092	0.9887	0.1558	0.1073	-	9	27	2,369	207,659	3,994	185,640
11.4010	0.9894	0.1540	0.0994	-	5	30	2,289	224,448	4,213	204,760
11.1849	0.9893	0.1524	0.0920	-	2	33	2,212	242,549	4,445	225,657
10.9610	0.9887	0.1508	0.0852	-	0	36	2,138	262,074	4,689	248,486
10.7297	0.9876	0.1491	0.0789	-	-	40	2,065	283,140	4,947	273,420
10.4913	0.9861	0.1472	0.0730	-	-	45	1,992	305,868	5,219	300,648
10.2465	0.0000	0.1452	0.0676	3,244		-		330,381		330,381
		PV at Entry Age =		3,244	4,427	479	289,220			
		Total PV at Entry Age =				8,150				
		Entry Age Normal Cost =				2.8%		(8,150/289,220)		

Figure C.2 - PUC Service Prorate Method

		1	2	3	4	5	6	7	8	9	10	11	12
Current Age	Yrs. of Service	# of past Normal Cost Payments	PUC NC at Entry Retirement	PUC NC at Entry Turnover	PUC NC at Entry Death	Current PUC NC Retirement	Current PUC NC Turnover	Current PUC NC Death	Current PUC NC Total	Current PUC AL Retirement	Current PUC AL Turnover	Current PUC AL Death	Current PUC AL Total
30	-	-				93	417	24	533	-	-	-	-
31	1	1	-	-	1	110	497	28	635	110	497	28	635
32	2	2	-	-	1	131	591	33	755	263	1,183	65	1,511
33	3	3	-	-	1	156	703	38	897	469	2,109	113	2,691
34	4	4	-	-	1	186	835	44	1,064	742	3,339	175	4,257
35	5	5	-	55	1	220	990	51	1,261	1,101	4,950	253	6,304
36	6	6	-	48	1	261	1,018	58	1,337	1,564	6,106	350	8,020
37	7	7	-	42	0	308	1,043	67	1,418	2,157	7,298	471	9,926
38	8	8	-	37	0	364	1,064	77	1,505	2,908	8,515	620	12,043
39	9	9	-	32	0	428	1,082	89	1,600	3,853	9,742	801	14,396
40	10	10	-	28	0	503	1,096	102	1,701	5,030	10,960	1,021	17,012
41	11	11	-	25	0	590	1,104	117	1,811	6,487	12,149	1,285	19,922
42	12	12	-	23	0	690	1,103	133	1,926	8,276	13,237	1,598	23,112
43	13	13	-	20	0	804	1,091	151	2,047	10,458	14,185	1,966	26,609
44	14	14	-	18	1	936	1,068	171	2,175	13,100	14,951	2,394	30,445
45	15	15	-	15	1	1,085	1,033	192	2,310	16,277	15,493	2,885	34,655
46	16	16	-	13	1	1,254	985	215	2,455	20,070	15,767	3,443	39,280
47	17	17	-	12	1	1,445	926	239	2,610	24,566	15,735	4,067	44,369
48	18	18	-	10	1	1,659	854	264	2,777	29,854	15,369	4,757	49,979
49	19	19	-	8	1	1,896	771	290	2,957	36,020	14,656	5,504	56,180
50	20	20	-	7	1	2,157	680	315	3,153	43,142	13,608	6,300	63,050
51	21	21	-	6	1	2,442	584	339	3,366	51,291	12,264	7,128	70,682
52	22	22	-	5	1	2,751	486	362	3,599	60,522	10,692	7,967	79,181
53	23	23	-	4	1	3,082	391	382	3,855	70,886	8,982	8,792	88,659
54	24	24	-	3	1	3,435	302	399	4,135	82,429	7,236	9,574	99,239
55	25	25	-	2	1	3,808	222	411	4,442	95,209	5,560	10,279	111,048
56	26	26	-	1	1	4,204	155	418	4,778	109,301	4,042	10,874	124,218
57	27	27	-	1	1	4,623	102	419	5,144	124,815	2,750	11,320	138,885
58	28	28	-	1	1	5,068	62	413	5,543	141,902	1,722	11,571	155,195
59	29	29	-	0	1	5,544	33	399	5,976	160,762	966	11,570	173,298
60	30	30	-	0	1	6,055	15	375	6,445	181,656	463	11,243	193,361
61	31	31	-	0	1	6,610	6	338	6,954	204,905	172	10,492	215,569
62	32	32	-	0	1	7,216	1	287	7,504	230,897	39	9,190	240,125
63	33	33	-	-	1	7,882	-	217	8,099	260,096	-	7,167	267,264
64	34	34	-	-	1	8,619	-	124	8,743	293,047	-	4,201	297,249
65	35	35	93	-	-				-	330,381	-	-	330,381

Figure C.3 - PUC Annuity Accrual Method

Accumulate CB at: 6%
Annuitize CB at: 7% GATT Mortality
Annuity Factor at age 65 = 10.246 Any factor would produce same result.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Current Age	Yrs. of Service	EOY Annuity at age 65 from Deposit	Wgt. Service Attribution (NC payments)	Alternative Method (Pay credit rate + int. to age 65)	Alternative Weighted Service Attribution	PUC NC at Entry Age Retirement	PUC NC at Entry Age Turnover	PUC NC at Entry Age Death	Current PUC NC Retirement	Current PUC NC Turnover	Current PUC NC Death	Current PUC NC Total	Current PUC AL Retirement	Current PUC AL Turnover	Current PUC AL Death	Current PUC AL Total
30	-	$ 900	5.801	30.7%	5.801				188	531	37	756				-
31	1	$ 849	5.472	29.0%	5.472	-	-	1	211	597	41	850	224	633	44	901
32	2	$ 801	5.163	27.4%	5.163	-	-	1	237	671	45	954	518	1,465	99	2,082
33	3	$ 756	4.870	25.8%	4.870	-	-	1	266	753	50	1,069	898	2,540	169	3,607
34	4	$ 713	4.595	24.4%	4.595	-	-	1	298	843	55	1,196	1,383	3,909	256	5,548
35	5	$ 673	4.335	23.0%	4.335	-	62	1	334	943	61	1,337	1,993	5,636	363	7,992
36	6	$ 635	4.089	21.7%	4.089	-	56	1	373	932	67	1,371	2,755	6,888	492	10,135
37	7	$ 599	3.858	20.4%	3.858	-	50	1	416	916	73	1,405	3,697	8,151	649	12,497
38	8	$ 565	3.640	19.3%	3.640	-	45	1	463	897	80	1,439	4,853	9,407	837	15,097
39	9	$ 533	3.433	18.2%	3.433	-	40	1	514	873	87	1,474	6,259	10,635	1,060	17,955
40	10	$ 628	4.049	21.5%	4.049	-	36	1	712	1,057	118	1,887	7,958	11,810	1,324	21,092
41	11	$ 593	3.820	20.2%	3.820	-	33	1	787	1,016	129	1,932	10,165	13,118	1,660	24,943
42	12	$ 559	3.604	19.1%	3.604	-	30	1	869	970	139	1,978	12,809	14,295	2,051	29,154
43	13	$ 528	3.400	18.0%	3.400	-	26	1	956	917	150	2,023	15,954	15,300	2,501	33,755
44	14	$ 498	3.207	17.0%	3.207	-	24	1	1,049	858	161	2,068	19,668	16,090	3,016	38,774
45	15	$ 469	3.026	16.0%	3.026	-	21	1	1,148	794	172	2,114	24,025	16,622	3,596	44,243
46	16	$ 443	2.854	15.1%	2.854	-	19	1	1,252	725	183	2,159	29,099	16,855	4,243	50,197
47	17	$ 418	2.693	14.3%	2.693	-	17	1	1,360	652	193	2,205	34,965	16,754	4,954	56,673
48	18	$ 394	2.540	13.5%	2.540	-	15	1	1,473	576	202	2,251	41,692	16,294	5,725	63,711
49	19	$ 372	2.397	12.7%	2.397	-	13	1	1,588	498	211	2,297	49,338	15,471	6,545	71,353
50	20	$ 351	2.261	12.0%	2.261	-	11	1	1,705	421	218	2,343	57,947	14,300	7,399	79,647
51	21	$ 331	2.133	11.3%	2.133	-	9	1	1,821	346	223	2,390	67,542	12,831	8,269	88,642
52	22	$ 312	2.012	10.7%	2.012	-	7	1	1,935	276	226	2,437	78,126	11,137	9,130	98,394
53	23	$ 295	1.898	10.1%	1.898	-	6	1	2,045	212	227	2,485	89,694	9,315	9,954	108,962
54	24	$ 278	1.791	9.5%	1.791	-	4	1	2,150	157	225	2,533	102,233	7,473	10,708	120,414
55	25	$ 262	1.689	9.0%	1.689	-	3	1	2,249	111	221	2,581	115,744	5,717	11,360	132,822
56	26	$ 247	1.594	8.4%	1.594	-	2	1	2,342	74	214	2,630	130,249	4,139	11,875	146,264
57	27	$ 233	1.504	8.0%	1.504	-	2	1	2,430	47	204	2,680	145,803	2,805	12,217	160,825
58	28	$ 220	1.419	7.5%	1.419	-	1	2	2,513	27	191	2,731	162,506	1,749	12,344	176,599
59	29	$ 208	1.338	7.1%	1.338	-	1	2	2,593	14	175	2,783	180,506	978	12,202	193,685
60	30	$ 196	1.262	6.7%	1.262	-	0	2	2,672	6	157	2,835	199,999	467	11,725	212,191
61	31	$ 185	1.191	6.3%	1.191	-	0	2	2,752	2	135	2,889	221,236	173	10,822	232,231
62	32	$ 174	1.124	6.0%	1.124	-	0	2	2,834	0	109	2,943	244,513	39	9,379	253,930
63	33	$ 164	1.060	5.6%	1.060	-	-	2	2,921	-	78	2,999	270,184	-	7,239	277,423
64	34	$ 155	1.000	5.3%	1.000	-	-	3	3,013	-	42	3,055	298,653	-	4,201	302,855
65	35		-		-	188						-	330,381	-	-	330,381
	sum =	$ 15,536		5.306398494												

Figure C.4 - PUC Pay Credit Method

		1	2	3	4	5	6	7	8	9	10	11	12	13
Current Age	Years of Service	Pay Credit	Weighted Service Attribution (NC payments)	PUC NC at Entry Age Retirement	PUC NC at Entry Age Turnover	PUC NC at Entry Age Death	Current PUC NC Retirement	Current PUC NC Turnover	Current PUC NC Death	Current PUC NC Total	Current PUC AL Retirement	Current PUC AL Turnover	Current PUC AL Death	Current PUC AL Total
30	-	4%	1.00				79	404	21	504				
31	1	4%	1.00	-	-	1	94	482	26	601	94	482	26	601
32	2	4%	1.00	-	-	1	112	573	30	715	223	1,147	59	1,429
33	3	4%	1.00	-	-	1	133	682	34	849	398	2,045	102	2,546
34	4	4%	1.00	-	-	1	157	810	39	1,007	630	3,239	157	4,026
35	5	4%	1.00	-	55	1	187	960	45	1,192	934	4,801	227	5,961
36	6	4%	1.00	-	48	1	221	982	52	1,256	1,327	5,894	313	7,533
37	7	4%	1.00	-	42	0	261	1,001	60	1,322	1,830	7,006	419	9,255
38	8	4%	1.00	-	37	0	308	1,015	69	1,392	2,468	8,121	550	11,139
39	9	4%	1.00	-	32	0	363	1,024	79	1,466	3,269	9,219	710	13,198
40	10	5%	1.25	-	28	0	534	1,285	113	1,931	4,268	10,277	902	15,447
41	11	5%	1.25	-	25	0	625	1,281	129	2,035	5,629	11,525	1,157	18,311
42	12	5%	1.25	-	22	0	732	1,267	146	2,145	7,315	12,671	1,461	21,447
43	13	5%	1.25	-	19	0	853	1,243	165	2,262	9,386	13,677	1,820	24,883
44	14	5%	1.25	-	16	0	992	1,208	187	2,387	11,909	14,501	2,239	28,650
45	15	5%	1.25	-	14	0	1,151	1,161	209	2,522	14,961	15,099	2,723	32,784
46	16	5%	1.25	-	12	1	1,330	1,102	234	2,666	18,625	15,429	3,274	37,328
47	17	5%	1.25	-	11	1	1,533	1,030	260	2,822	22,990	15,450	3,894	42,333
48	18	5%	1.25	-	9	1	1,759	946	286	2,991	28,145	15,133	4,579	47,858
49	19	5%	1.25	-	8	1	2,011	851	313	3,175	34,181	14,466	5,325	53,973
50	20	5%	1.25	-	6	1	2,288	748	340	3,376	41,181	13,460	6,121	60,762
51	21	5%	1.25	-	5	1	2,590	640	366	3,596	49,218	12,152	6,951	68,322
52	22	5%	1.25	-	4	1	2,918	531	390	3,838	58,355	10,610	7,796	76,761
53	23	5%	1.25	-	3	1	3,269	425	411	4,105	68,644	8,924	8,629	86,198
54	24	5%	1.25	-	2	1	3,643	327	428	4,398	80,139	7,199	9,421	96,759
55	25	5%	1.25	-	2	1	4,039	241	441	4,721	92,901	5,536	10,140	108,577
56	26	5%	1.25	-	1	1	4,459	168	448	5,074	107,008	4,028	10,751	121,787
57	27	5%	1.25	-	1	1	4,903	110	449	5,461	122,574	2,742	11,213	136,530
58	28	5%	1.25	-	0	1	5,375	66	442	5,883	139,752	1,719	11,482	152,952
59	29	5%	1.25	-	0	1	5,879	36	426	6,341	158,746	965	11,499	171,210
60	30	5%	1.25	-	0	1	6,422	17	400	6,838	179,821	463	11,191	191,474
61	31	5%	1.25	-	0	1	7,010	6	361	7,377	203,302	172	10,457	213,932
62	32	5%	1.25	-	0	1	7,653	1	306	7,960	229,585	39	9,171	238,794
63	33	5%	1.25	-	-	1	8,359	-	231	8,590	259,141	-	7,160	266,301
64	34	5%	1.25	-	-	1	9,141	-	131	9,273	292,525	-	4,201	296,726
65	35			79	-	-				-	330,381			330,381

Figure C.5 - Traditional Unit Credit

		1	2	3	4	5	6	7	8	9
Current Age	Years of Service	Pay Credit	Cash Balance Account	${}_tp_{30}$	${}_tp_{30-t+1}p_{30}$	Vesting	Val Rate v^t	Interest Credit Rate $(1+i)^t$	TUC NC	TUC AL
30	-	$ 1,200	$ -	1.0000	0.0936	0%	1.0000	1.0000	550	-
31	1	$ 1,266	$ 1,200	0.9064	0.0840	0%	0.9259	1.0600	653	619
32	2	$ 1,336	$ 2,538	0.8223	0.0754	0%	0.8573	1.1236	773	1,469
33	3	$ 1,409	$ 4,026	0.7469	0.0676	0%	0.7938	1.1910	915	2,614
34	4	$ 1,487	$ 5,677	0.6793	0.0607	0%	0.7350	1.2625	1,081	4,130
35	5	$ 1,568	$ 7,504	0.6186	0.0544	100%	0.6806	1.3382	1,139	6,107
36	6	$ 1,655	$ 9,522	0.5642	0.0487	100%	0.6302	1.4185	1,199	7,722
37	7	$ 1,746	$ 11,748	0.5155	0.0437	100%	0.5835	1.5036	1,263	9,493
38	8	$ 1,842	$ 14,199	0.4719	0.0391	100%	0.5403	1.5938	1,330	11,433
39	9	$ 1,943	$ 16,892	0.4328	0.0350	100%	0.5002	1.6895	1,402	13,556
40	10	$ 2,562	$ 19,849	0.3978	0.0313	100%	0.4632	1.7908	1,848	15,878
41	11	$ 2,703	$ 23,602	0.3664	0.0280	100%	0.4289	1.8983	1,949	18,825
42	12	$ 2,852	$ 27,721	0.3384	0.0251	100%	0.3971	2.0122	2,057	22,053
43	13	$ 3,009	$ 32,236	0.3133	0.0224	100%	0.3677	2.1329	2,173	25,592
44	14	$ 3,174	$ 37,179	0.2909	0.0200	100%	0.3405	2.2609	2,298	29,472
45	15	$ 3,349	$ 42,584	0.2709	0.0178	100%	0.3152	2.3966	2,432	33,730
46	16	$ 3,533	$ 48,488	0.2531	0.0158	100%	0.2919	2.5404	2,578	38,408
47	17	$ 3,727	$ 54,930	0.2373	0.0140	100%	0.2703	2.6928	2,735	43,556
48	18	$ 3,932	$ 61,953	0.2233	0.0123	100%	0.2502	2.8543	2,908	49,232
49	19	$ 4,148	$ 69,602	0.2110	0.0107	100%	0.2317	3.0256	3,097	55,505
50	20	$ 4,377	$ 77,927	0.2003	0.0092	100%	0.2145	3.2071	3,306	62,454
51	21	$ 4,617	$ 86,979	0.1910	0.0079	100%	0.1987	3.3996	3,535	70,173
52	22	$ 4,871	$ 96,815	0.1832	0.0066	100%	0.1839	3.6035	3,788	78,764
53	23	$ 5,139	$ 107,495	0.1766	0.0054	100%	0.1703	3.8197	4,065	88,341
54	24	$ 5,422	$ 119,084	0.1711	0.0045	100%	0.1577	4.0489	4,367	99,023
55	25	$ 5,720	$ 131,651	0.1667	0.0036	100%	0.1460	4.2919	4,696	110,935
56	26	$ 6,035	$ 145,270	0.1631	0.0029	100%	0.1352	4.5494	5,052	124,206
57	27	$ 6,367	$ 160,021	0.1601	0.0024	100%	0.1252	4.8223	5,434	138,970
58	28	$ 6,717	$ 175,989	0.1578	0.0020	100%	0.1159	5.1117	5,845	155,365
59	29	$ 7,086	$ 193,265	0.1558	0.0018	100%	0.1073	5.4184	6,283	173,540
60	30	$ 7,476	$ 211,948	0.1540	0.0016	100%	0.0994	5.7435	6,751	193,655
61	31	$ 7,887	$ 232,140	0.1524	0.0016	100%	0.0920	6.0881	7,251	215,887
62	32	$ 8,321	$ 253,956	0.1508	0.0017	100%	0.0852	6.4534	7,784	240,437
63	33	$ 8,779	$ 277,514	0.1491	0.0018	100%	0.0789	6.8406	8,354	267,526
64	34	$ 9,261	$ 302,943	0.1472	0.0020	100%	0.0730	7.2510	8,964	297,411
65	35		$ 330,381	0.1452	0.1452	100%	0.0676	7.6861		330,381

APPENDIX D

MONTE CARLO METHODOLOGY

Figures 3.4 - 3.9 represent the results of our Monte Carlo simulation of the difference between the expected fund investment results and the assumed interest credit rate. We ran one thousand 20-year simulations. In each, we were calculating the average amount of leverage over 1 to 20 year periods.

Investment experience from 1926-1998 was used in all but one of the graphs, which used experience from 1979-1998. The basic investment data used for the period 1979-1998 is shown in columns (a) - (c) below. Column (d) is defined below.

Year	(a) S&P 500 TR %Total Return	(b) LT Gov Total Return	(c) LT Gov Income	(d) Leverage
1979	18.44%	-1.23%	8.86%	3.68%
1980	32.42%	-3.95%	9.97%	11.54%
1981	-4.91%	1.86%	11.55%	-14.43%
1982	21.41%	40.36%	13.50%	13.59%
1983	22.51%	0.65%	10.38%	5.57%
1984	6.27%	15.48%	11.74%	-2.71%
1985	32.16%	30.97%	11.25%	20.55%
1986	18.47%	24.53%	8.98%	11.31%
1987	5.23%	-2.71%	7.92%	-5.07%
1988	16.81%	9.67%	8.97%	5.70%
1989	31.49%	18.11%	8.81%	18.67%
1990	-3.17%	6.18%	8.19%	-8.56%
1991	30.55%	19.30%	8.22%	18.95%
1992	7.67%	8.05%	7.26%	0.52%
1993	9.99%	18.24%	7.17%	5.29%
1994	1.31%	-7.77%	6.59%	-8.01%
1995	37.43%	31.67%	7.60%	28.10%
1996	23.07%	-0.93%	6.18%	9.69%
1997	33.36%	15.85%	6.64%	21.47%
1998	28.58%	13.06%	5.83%	18.10%
Average 1979 - 1998	18.45%	11.87%	8.78%	7.70%
Average 1926 - 1998	13.17%	5.70%	5.20%	5.73%

Both (a) and (b) are assumed to be representative of asset classes used for investments and (c) is assumed to be the interest credit basis. The return in column (c) is income only and does not include any appreciation or depreciation. The leverage in column (d) is {.7 x (a) + .3 x (b)} − (c) and was used for Figure 3.4. This assumed a 70/30 investment mix and interest credit tied to income on long-term government securities.

If the first three random years selected were 1980, 1985 and 1990, the average leveraged return was assumed to be [1.1154 x 1.2055 x (1–.0856)] ^ (1/3) –1 = 7.13%.

Generally, the median line starts near the median for the years being considered (e.g. 1926-1998) and trends downward toward the geometric mean. Changes in asset classes and historical time frames can materially change the results. Long-term government investment returns in (b) and (c) came from Ibbotson Associates [4]. This is used in lieu of 30-year Treasuries data, which could not be obtained back to 1926.

APPENDIX E

CITATIONS

[1] Claire, Donna R., et. al., 1998. *Report of the Equity Indexed Products Task Force, December 1998,* The American Academy of Actuaries.

[2] Coleman, Dennis. October, 1998. "The Cash Balance Pension Plan," *The Pension Forum*, Pension Section of the Society of Actuaries

[3] Grant, Dale and Sarli,Maria M., 1993. "Cash Balance Plans," *Record of the Society of Actuaries,* Volume 19, pages 319-342.

[4] Ibbotson Associates, 1999. *Stocks, Bonds, Bills, and Inflation 1999 Yearbook,* Chicago.

[5] Kopp, Steve J. and Sher, Lawrence J., October, 1998. "A Benefit Value Comparison of a Cash Balance Plan with a Traditional Final-average-pay Defined Benefit Plan", *The Pension Forum*, Pension Section of the Society of Actuaries.

[6] Via, Jr., J. William, Counsel, October 30, 1990. "Acquiring Depository Institution is Required to Honor Failed Depository Institution's Certificate of Deposit Interest Rate for 14 Days", *FDIC Advisory Opinions, FDIC-90-55.*

[7] 1999 Enrolled Actuaries Meeting, Grey Book, Question #9.

[8] IRS Notice 96-8.

FOOTNOTES

1) Items that are defined in Appendix A appear in bold type the first time that they are used.

2) Lump sum at IRS mandated **417(e) rates** are probably higher.

3) Only includes plans with the same core basis, but excludes those with a minimum.

4) Equals Plan's (9% interest – 7% Interest Credit) – other 52-week plans' (8.48% interest – 5.98% Interest Credit)

5) Incorporates the 0.5% margin.

6) Implies plan not relying on IRS Notice 96-8 and is paying lump sums equal to Account Balance.

7) Used in lieu of 30-year Treasuries since return information back to 1926 is not available on 30-year Treasuries [4].

8) For methods like Aggregate, this measure is not very useful. However, for the Traditional Unit Credit or the Current Liability, it provides a very interesting demonstration of anticipated leverage.

9) T-3 and T-7 refer to Crocker-Sarason turnover tables. T-3 has lower rates of turnover than T-7.

10) The TUC ratio would have been less than the Service Prorate ratio if the salary scale (5.5%) had been more than the Interest Credit Assumption (6%).

11) PBGC actually uses assumed retirement ages (XRAs) and not normal retirement age.

12) Usually deferred annuities

13) This statement ignores differences in mortality.

14) A pay level is used to help capture the integration found in some of the plans.

15) Benefit other than conversion of accrued benefit to lump sum starting Account Balance based on regular lump sum basis. Examples include continuing old formula for employees over age 55.

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PAPER

The OASDI from a Canadian Perspective

Review by Bernard Dussault of the 2000 Trustees Report on the OASDI

Introduction and Executive Summary

The production of reliable long-term financial projections on social security programs (SSP) such as the OASDI rest on the availability of three main items: input valuation data, methodology and assumptions. Therefore, the results of such projections make sense to the extent that the underlying ingredients do. This review of the 2000 Trustees report puts emphasis on the actuarial evaluation assumptions, methodology and results, though a short and last section is devoted to some policy-related suggestions.

Assumptions make general sense. However, an analysis of their internal consistency reveals that they are somewhat optimistic. Internal consistency procedures are suggested and an embryonic model is offered.

The valuation methodology needs to be described in a more layman language and in more detail, and the underlying basic approach might benefit from some revamping. A simple alternative formula is presented for examination of its appropriateness.

The analysis of the main results is incomplete as it only refers to the baby boomers. The projected aging of the population results mainly from sustained lower fertility rates (baby bust) and to a lesser extent to assumed sustained mortality declines. The baby boomers are not much involved in the aging process. The temporary demographic fluctuation they represent merely adds a slight contribution, from about 2010 to 2040, with a peak in about 2025, to the permanent aging process that was launched sometime ago by declining mortality rates and more importantly about 1990 when the baby busters started joining the labor force.

The 75-year actuarial deficit is a weak template for the solution of the financing issue caused by the projected population aging. More robust measures are required to address both the financial and social equity issues that lie ahead of the current and future cohorts of contributors to the OASDI. The 1997 reform to the Canada Pension Plan is presented as a template for such robust measures.

1. Assumptions

When one is asked to comment on a Trustees report, the first and easiest target area of discussion is normally assumptions because of their intrinsic nature. Indeed, no one knows the future. Fortunately, the effect of the wide range of possible ultimate assumptions is quite attenuated on the long run by:

- The fact that it is their relative rather than absolute value that really counts in the case of pension valuations (e.g. high absolute values of 20% and 24% for the inflation and investment return on assets, respectively have the same effect on the (cost) contribution rate of a pension plan as absolute values of 0% and 3.333%);

- Extreme values for a given ultimate assumption cannot be selected without also imputing a somewhat neutralizing extreme value to one or more of the other key ultimate assumptions involved in the valuation process. For example, it would not be reasonable to assume a high productivity rate of 5% without considering in parallel higher mortality declines and lower disability incidence rates, as healthier economic conditions are normally associated with healthier human beings.

Generally speaking, the process for selecting the assumptions for the Trustees reports is refined and sophisticated. And these are quite voluble in providing some rationale for the selection of the nominal value of assumptions. However, those reports would gain much in professional and scientific value if they would provide some rationale on the relationship or correlation between the various economic and demographic assumptions wherever such relationship can be proven to exist. Eventual research and development in that area might show that the effect of extreme case scenarios have a somewhat limited effect on valuation results. Moreover, in that sense, the selection of the traditional low, medium and high cost estimates could thereby possibly be done on a less arbitrary basis. Until this is done, it can only be concluded that the selection of assumptions lacks some internal consistency. The effect of such internal inconsistency is that the assumptions would tend to be somewhat optimistic for the following two main reasons:

- In reference to the second bullet above, assumed productivity levels (1.5%, 1.0% and 0.5% for the low, medium and high cost estimates, respectively) appear to be incommensurate with the assumed annual rates of decline in mortality (0.2%, 0.7% and 1.2%, respectively), as the recent 40-year experience for these two factors is 1.1% for productivity and about 1.15% for mortality declines. Besides, consistency would require that longevity improvements decrease, rather than increase, as productivity decreases.

- The report is totally silent about the critical point made in several instances by Robert Brown, e.g. in his Research Report "A Demographer's Review of the Assumptions Underlying the Trustees Report," published in 1995, to the effect that the projected rapid aging of the population over the next 30 years, and in particular the dramatic associated increase in age dependency ratios, is bound to increase inflation during that period, as consumption (or demand for goods, which will be reinforced by the higher retirement pension income applicable during the 21st century) will increase faster than production (or supply of goods).

Another example of correlating assumptions would be the demographic and the production (or economic growth) increases, the underlying theory being that annual variations in the amounts of products and services (or more simply in the national payroll or

employment earnings) would tend in the long run to parallel those in the total population. Canadian data for 1925 to 1995 show some striking evidence in that sense. It would be interesting to see how, on average in the long run, the projected annual U.S. population increase compares with the annual increases in total covered earnings projected for OASDI purposes. The report actually fails to examine and discuss the internal consistency of the increase in total covered earnings. This parameter, which essentially corresponds to the economic growth rate for a program covering most of the national payroll, results from compounding the average wage increase with the annual increase in participation to the plan. In turn, most of the annual increase in participation in the plan corresponds to the projected annual demographic increase, as constant proportions of contributors are usually assumed for the whole projection period and as additions to the population are usually assumed to participate to the program in unchanged proportions. However, the other factors could, but only temporarily, alter the projected increase in total covered earnings, and these are the degree of compliance with participation in the program and the changes in employment rates. The matter of compliance is not covered in the Report. It should. On the other hand, some changes in employment rates are explicitly assumed for the future in terms of some relatively small gradual decreases.

Several other relationships would also exist between the various economic and demographic assumptions involved in the valuation of a SSP. In that connection, an embryonic model of what a rationale could look like for the relationship between the three key ultimate economic assumptions (inflation, wage increase and interest) is presented. For simplicity, productivity (herein defined as the difference between the nominal increase in average wages and inflation) and real return on assets are identified hereafter using as an approximation the arithmetic basis rather than the theoretically correct geometric basis.

As projections for SSPs are for the long-term, assumptions have to be determined in a manner consistent with the automatic adjustments that appear to take place in the macroeconomy over the long run (e.g. 50 years or more). In that sense, the return on assets should normally be greater than the annual nominal increase in average wages, which in turn should be greater than inflation. Here is why. For the general case where the economy is projected to evolve on a wealthy basis, some productivity is presumed. For developed countries, productivity would usually be thought or hoped to be at least 1%. It would and could be higher for developing countries due to the room available for closing the gap between developed and developing economies. If inflation were assumed at 3%, then the annual nominal wage increase would be at least 4%. If the return on assets were assumed at 5%, still with inflation at 3%, real interest would be 2%, which is not inconsistent or unrealistic per se. However, in countries where income is taxed, the real interest would normally have to be at least equal to inflation grossed up for income taxes in order to account for the eroding effect of income taxes on investment income. With a marginal tax rate of 40%, this would mean that the nominal return should be assumed to be at least 5%, i.e. 3% divided by the complement of 40%. For a 50% marginal tax rate, the grossed up rate would be 6%. In other words, investment earnings are eroded by both inflation and income taxes and would normally be higher than the sum of those two factors. Under the above scenario, the absolute return on assets would accordingly have

to be higher than 6% for a presumed marginal tax rate of 50%. Return at 7%, wage increase at 4% and inflation 3% would accordingly be a sensible set of key economic assumptions. Coming back to the very starting point, which is inflation, the assumed ultimate level of inflation (3%) is irrelevant. Relevant relationships start out with productivity, and then progress on to the real return on assets and the others.

As a practical application of the above rationale, let us look at both the relevant experience data presented in the 2000 Trustees Report for 1960 to 1999 and the selected ultimate assumptions. The simple historical arithmetic average for inflation, wage increase and interest rate over that period is 4.4%, 5.5% and 7.3%, respectively. This means an average productivity rate of 1.1% and a real rate of return of 2.9%. In line with the above rationale, the real return would be associated with a marginal tax rate of 40%. Regarding the ultimate assumptions selected for the intermediate cost scenario in the Trustees Report, the starting point, ultimate inflation, is assumed at 3.3%. Then, ultimate wage increases are assumed at 4.3%, representing an underlying productivity rate of 1%. And finally, the ultimate nominal level of return on assets is assumed at 6.3%. This represents a real rate of return of 3% and an associated marginal tax rate of 48%.

There happens to be much correlation between the embryonic rationale described above, the actual 1960-1999 experience as well as the 2000 Trustees Report ultimate assumptions. There are several possible reasons for that. One could be pure coincidence. At another extreme, it would be that the above rationale is of great scientific reliability and that assumptions of the 2000 Trustees report have been selected using on a strict basis that above rationale. In any event, the main conclusions are that a rationale should be used for the selection of assumptions (which is likely actually the case) and that such rationale should be disclosed in the Report.

Let us now look at how the embryonic rationale correlate with the ultimate assumptions adopted for both the low and the high cost estimate. For the low cost estimate, ultimate assumptions are 2.3%, 3.8% and 6.0% for inflation, wage increase and interest, respectively. This means a productivity rate of 1.5% and a real rate of return of 3.7%, for an underlying marginal tax rate of 62% or a return premium of 1.4% assuming a marginal tax rate of 50% (2.3%/0.5 +1.4% = 6.0%). This is not lacking any reasonableness or common sense because in the long term productivity may well be at 1.5% (versus 1% for the intermediate cost estimate), as it has actually been on average over the last 60 to 70 years. Likewise, real return may well exceed to some extent inflation grossed up by a deemed marginal tax rate of 50%. However, this would be more easily expected for a fund invested in a diversified portfolio than for one exclusively constituted of government bonds. In that sense, it would appear that the low cost scenario is somewhat overly optimistic as long as investments will be restricted to government bonds and that life could hardly be better on average in the long run. For the high cost estimate, ultimate assumptions are 4.3%, 4.8% and 6.5% for inflation, wage increase and interest, respectively. This means a productivity rate of 0.5% and a real rate of return of 2.2%, for an underlying marginal tax rate of 34%. Again, these make sense, except that the real rate of return would appear to be unrealistically low considering the relatively low underlying marginal tax rate.

Still, one also has to investigate the correlation between productivity and real return on investments, in other words between the nominal the nominal wage increase and the nominal interest rate. If such correlation exists in the long term, then it should be documented and disclosed. The 1960-1999 experience shows a differential of about 1.75% between real return and productivity. The corresponding ultimate values assumed for the report are 2.2%, 2.0% and 1.7% for the low, intermediate and high cost scenarios, respectively. This implies a rationale whereby higher productivity would be associated with even higher returns on investments. This reflects an environment where productivity gains are shared less and less equally between workers and investors with increasing economic growth. In real life, this may well be the case. As an extreme case, wage increases could remain low or unchanged despite high real returns if most business profits would be reinvested rather than split to some extent between salary increases and investments. This might well be a driving factor in the 21st century consistent with the globalization of markets.

As a general conclusion of the above discussion of assumptions, it is fair to say that the assumptions of the 2000 Trustees Report make sense but that they tend to be somewhat optimistic. Moreover, the rationale presented for their selection, although refined and sophisticated, should go beyond a mere justification based on observed past experience. In that sense, past economic and demographic experience should be investigated further in order to deal appropriately with the correlation between various assumptions. The selection of assumptions could then be made, taking into account their internal consistency, on a more valid and explicit basis.

2. Methodology

- **Basic valuation approach**
  Because of the very large number of people and the long-term future involved in the valuation of SSP, macrosimulation is normally used as the projection approach. Contrary to microsimulation, which deals with individuals, macrosimulation deals with numbers of people by age, gender, and calendar year.

Despite their lesser complexity, macrosimulation models still present material challenges of their own, typical ones being numbers of people eligible to benefits, pattern of individual earnings over the contribution period, etc. The main drawback with macrosimulation, very rarely disclosed, is that the underlying mathematical projection approach is accurate (to the extent of the selected assumptions) only in connection with some inevitable implicit assumptions underlying the approach. For Canada's SSP's, the methodology is coded in ACTUCAN. The CPP model is used for the statutory valuation of the Canada Pension Plan purposes. ACTUCAN encompasses only one simple (and luckily sensible) implicit assumption where contributors dying before retirement are implicitly deemed, in respect of each calendar year until their death, having employment earnings equal to the average earnings of the birth-cohort to whom they belong. This is disclosed, but not demonstrated in the section on methodology of the actuarial reports on the CPP. The general projection approach used for the CPP does not rely whatsoever on numbers. Indeed, proportions rather

than numbers are explicitly projected. Total covered earnings and benefits are accordingly projected at once for each age-gender-year cohort. The basic general formula for the average initial retirement benefit factor BENFAC for any given age-gender-year cohort is:

BENFAC = ratio of
- The sum, for each year over the contributory period, of the products of the proportions of contributors by the average covered (pensionable, differing from contributory) employment earnings, to
- The contributory period.

Surprisingly enough, multiplying BENFAC by the benefit replacement rate (namely 25%), and by the population at the appropriate retirement age, produces the correct answer for the annual retirement benefit of the that age-gender year cohort before further adjustments can account for some social adequacy-related provisions of the CPP. This includes its three "drop-out" provisions that disregard some years of lowest earnings for benefit calculation purposes. One of the fundamental reasons for this mathematical accuracy is that eligibility for the CPP retirement pension rests simply on having contributed at least one year to the program. However, this correct answer needs further adjustment before it can be accounted for social adequacy-related provisions of the CPP.

Due to the progressive nature of the OASDI retirement benefit formula, microsimulation is used for the projection of benefits. However, microsimulated results need to be validated using the validated results of a parallel macrosimulation projection model. SSA valuation actuaries should examine whether that "BENFAC" mechanism could not be properly applied to the OASDI valuation approach, being well understood that a new series of adjustment factors would need to be developed to account for the OASDI's own social adequacy-related and other special provisions. That is crucial because other methods are more complex; because it is likely not possible to identify the hidden implicit assumptions they encompass; because, even worse, it is not possible to determine the extent of their inaccuracy. In any event, the Trustees reports should disclose these matters of fact.

- **Description**
  The Trustees reports would gain in professional and public credibility if the description of the valuation methodology were described in a more layman language and in more detail. One structural change that could help in that respect would be to fully segregate, as done in the actuarial reports on the CPP, the description of methodology from the description of assumptions.

- **Validation**
  Again, credibility would be gained if the SSA actuarial valuation team went through the exercise of backdating the actual start of the projection in order to verify that the valuation model replicates accurately results of the past. This would represent a major endeavor. Such algorithm was put in place about 10 years ago in the CPP ACTUCAN model and has so far proven to be a very helpful tool for methodology improvements and refinements purposes.

- **GDP, labor force participation rates and unemployment rates**
  The Trustees report is not clear regarding how the GDP, labor force participation (LBFPR) rates and unemployment rates are projected and used. This area of methodology description is commingled with a reference to proportions of contributors (PROCON) to the program. Either, but not both, of these two series of variables needs to be used for the simulation of employment earnings. As explicit approaches have to be preferred to implicit ones, an exclusive "PROCON" approach should be adopted. A LBFPR approach is implicit in that such rates, as well as unemployment rates, are available only on an instantaneous basis, while PROCON values are the accurate average annual values explicitly required for the proper simulation of employment earnings. LBRPR instantaneous values cannot be accurately converted to an annual basis. Therefore, the reports should be clearer regarding the exact and explicit or implicit role of the GDP, labor force participation rates and unemployment rates within the valuation process. Still, these parameters are not expressly required for the valuation process. Moreover, although the GDP is a nice concept, its measurements appear distorted and inaccurate. Indeed, as nothing gets produced within the controlled economy other than through the payment of salaries, why is it that GDP values always amount to about twice the total national payroll?

3. Presentation of results

The main reason given in the report for the large projected increase in the paygo rates over the next 30 years is the baby-boomers. But it must be understood that the baby-boomers merely correspond to a temporary demographic fluctuation. The projected ultimate aging of the population and the resulting ultimate paygo cost increases stem mainly, besides the less impacting projected longevity improvements, from the drop in fertility rates started in the late 1960s and their sustained low values assumed for the future. This should not come as a surprise as most populations of the world are aging, while baby boomers are strictly a North American phenomenon. The baby-boomers merely add a slight contribution, from about 2010 to 2040, with a peak around 2025, to the permanent aging process, measured using age dependency ratios, that was actually launched sometime ago by declining mortality rates and more importantly about 1990 when the baby-busters started joining the labor force. If it were not for the baby busters, the rise in age dependency ratios after 2010 would be practically negligible for these reasons listed in the following paragraph on page 80.

Fertility rates reached a peak of about 4 during the baby boomers years. Fertility rates have rapidly dropped below 2 after 1965, and are not assumed to exceed that level under intermediate assumptions. In that sense, 3 can reasonably be regarded as a standard fertility level. Boomers correspond to a temporary period of fertility at an average level of 3.5 (arithmetic mean of 3 and 4), i.e. exceeding by only 0.5 the standard level of 3. Busters correspond to a permanent fertility rate of 2 or less, i.e. a cut of at least 1 from the standard level of 3. Moreover, the effect of variations in fertility rates on age dependency ratios shrinks with increases in the fertility rates, which further reduces the effect of boomers on age dependency ratios. It would be convenient if one could eventually model historical population figures with a removal of the baby boomers (by assuming such a standard fertility rate of 3). Then one would see a very meager difference between the age dependency ratios of the " modeled without" and the "historical with" boomers populations, respectively, after 2010.

Due to legal requirements, the Trustees reports must include two rather distinct series of projections, i.e. short-range and long-range estimates. This is unduly confusing as the short-range estimates already encompassed by the long-range estimates presented in a given report for costing purposes should not be allowed to differ from a distinct set of short-range estimates presented in the same report for accounting or budgeting purposes.

In a related vein, the 75-year actuarial balance test is unduly misleading and somewhat useless except for the involved actuarial deficit calculation. Its estimate is interesting as it indicates that a level contribution rate of 14.3%, i.e. the present contribution rate of 12.4% plus the actuarial deficit of 1.9%, would prevent a depletion of the fund for the next 75 years. However, that level contribution rate would require a further material increase of about 4% at the expiration of that period, which would bring it close to 18%. The Trustees Report should accordingly disclose the projected pay-as-you-go rate that would apply for a certain number of years (one year would be minimal but valuable information) after the 75-year period. A good alternative to the 75-year actuarial balance test would consist of measuring the level contribution rate over a longer period, e.g. 100 years, that would support the payments of all expenditures over that period of time as well as the maintenance of a larger minimum contingency fund equivalent to a multiple of the current annual expenditure, such as four to six years. Any increase in the current target fund/benefit ratio of one would reduce accordingly the resulting ultimate contribution rate. That ultimate contribution rate would have the advantage of being practically good forever, except for the low and gradual effect of longevity improvements.

4. Intragenerational inequities, Intergenerational equity, Funding and Reform Opportunity

The report should build further on its good discussion of fund/benefit ratios by providing information on funding. For example, the fund/benefit ratio for a fully funded plan is about 30 times the current annual expenditure, i.e. about the arithmetic mean of the contributory and benefits periods.

Funding is an unavoidable subject matter in the financial valuation of a SSP, as the impact of the applicable financing approach, be it pure paygo or quasi paygo (partial funding), can be properly assessed and understood only in reference to the full funding approach. The least reason for referring to the full funding approach is that the readership ought to be clearly informed about the differences in terms of social rationale and financial impact between paygo financing generally applying to social pension plans and full funding imposed on private plans.

Equity and fairness issues are involved here and the public disclosure of their financial assessment in the Trustees reports should be a trivial requirement. Do actuaries have to be reminded that the rationale underlying the mathematics of actuarial funding is individual equity? Compared to private pensions plans, social pensions programs provide some legitimate social adequacy-related benefits that need not be financed on a pure intragenerational individual equity basis. But why should the transfer of any part of those legitimate intragenerational individual inequities to future generations be allowed? In other words, the unavoidable inequities induced by social adequacy measures should be allocated on an equitable basis from one generation to the next. Intergenerational inequities should be avoided. That objective cannot be met without funding.

All of this would mean that no SSP should be implemented on a basis other than full funding. This has not happened. Is it not amazing that funding easily looks inappropriate for a publicly sponsored national pension plan only until it would be privatized? Correcting the intergenerational inequities that have actually ensued would induce further but much lesser inequities. This does not mean that nothing should or could be done. There is an opportunity to attenuate the level of inequities that will anyway be carried indefinitely forward to future generations as long as those inequities are not fully corrected. Such opportunity was seized in Canada through the 1997 reform of the CPP. Benefits were reduced by about 10%. Future emerging cash flows will be invested in a diversified portfolio rather than exclusively in provincial securities. Contribution rate increases are accelerated until 2003, leading to a higher funding ratio, at which time a steady-state rate of 9.9% is envisioned for the rest of the 21st century. Without the reform, future generations were projected to contribute at a rate of about 12.5% after 2030. The CPP reform therefore represents a relative contribution rate reduction close to 20%.

In the Conclusion of their report, the Trustees “urge that the long-range deficits of the OASI and DI funds be addressed in a timely way”. However, more than the long-range deficits need to be addressed. As discussed above, in connection with the 1997 CPP reform, social equity would compel an increase in the OASDI contribution rate beyond the floor level represented by a mere addition of the actuarial deficit of 1.9% to the existing 12.4% contribution rate, for a total of 14.3%. That would no longer be a workable rate beyond year 2075. Simple arithmetic indicates that slightly higher rate of 14.7% might be workable practically for ever provided changes similar to those of the 1997 CPP reform, i.e. 10% benefit reductions and investments into a diversified portfolio, would also be introduced to the OASDI program.

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PAPER

PROCEDURE FOR PREPARING ARTICLES FOR THE PENSION FORUM

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