THE VALUE OF LIABILITIES IS EQUAL TO THE COST OF ASSETS NEEDED TO OFFSET THEM

John C. Burville

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BIOGRAPHY:

John Burville is a Principal and Consulting Actuary with Tillinghast, a Towers Perrin company, in their Bermuda office. Prior to joining Tillinghast in 1986, he was Vice President of AIRCO (Bermuda), a subsidiary of AIG. He has a Ph.D. and first class honors degree in mathematics from Leicester University in England. Mr. Burville became a Fellow of the Institute of Actuaries in 1975, until 1986 most of his actuarial career on life insurance and reinsurance, since that time has been involved with P&C Insurance consulting in Bermuda. He became a member of the American Academy of Actuaries in 1977.

ABSTRACT:

Current accounting techniques for P&C Insurance companies do not represent the real values for assets and liabilities. Discounting is now a major issue, which has been brought more to the fore with the Tax Reform Act of 1986. Apart from some special situations* unpaid liabilities are represented at their undiscounted value.

Cash flow techniques are becoming recognized as realistic methods of valuation. Methods which use a discount rate to determine the value of liabilities can be enhanced by establishing a model portfolio of assets which match the projected liability cash flow. The value of the unpaid liabilities can then be measured as the market value of the model assets.

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*Some medical malpractice reserves are discounted, as are workers' compensation pension cases.

THE VALUE OF LIABILITIES IS EQUAL TO THE COST OF ASSETS NEEDED TO OFFSET THEM

Accounting rules for insurance companies reflect hypothetical values for assets[1] and liabilities. There are many reasons for this posture. However, with the prevalence of computerized information, techniques which were considered impractical ten years ago are now very possible. For instance, a company can now determine the market value of held quoted assets monthly, if not daily. Consequently, the market value of assets can be easily estimated.

For the most part, liabilities have been accounted for on an undiscounted basis. No credit is given for future investment income. Discounting of the liabilities to recognize investment income before a loss is finally settled, has been a strongly debated issue for the industry. The most recent resolution to this debate was the requirement to discount for the calculation of taxable income (Tax Reform Act of 1986).

This paper presents the view that the real value of the insurance liabilities is equal to the market value, or current

cost, of assets needed to offset those liabilities.

Example:

In a simplified form, a liability for $5 million to be paid in exactly five years' time, has a value equal to the cost of a five year zero coupon bond (plus credit risk costs) with the same maturity date as the liability.

This example can be extended for each estimate of liability payments each year. This example may seem simple but this basic offset of values is often ignored. Indeed, some reinsurers of financial reinsurance products use this method to price a portfolio transfer.

This form of matching would be considered immunization. If the liability cash flow was as predicted, then the assets selected to match the cash flow would precisely offset the liabilities and therefore, the liabilities would be met regardless of any changes in the interest rates. Durational concepts are not relevant if cash flows are matched. However, they can be important for investment strategies which do not precisely match assets and liabilities. It will be demonstrated here that a fairly precise match of cash flows is possible.

Depending on the purpose of a valuation, (Statutory, GAAP, management, or acquisition) an alternative view of the value of the assets and liabilities will exist. This paper presents

methods to enhance both the management perspective, as well as provide meaningful insight into the value of a company for acquisition purposes.

It is not the intent here to discuss the features of asset/liability management, but more that the creation of a model portfolio by comparing cash flows can provide insight into the real value of the predicted liabilities. Cash flow techniques are recognized as a realistic alternative view for valuation purposes.

Selection of a model portfolio is dependent on the available assets, as well as the predicted liability cash flow. The intent of the model portfolio is to match the cash flows of assets and liabilities.

The development of asset/liability management techniques are hampered by the effects of the variance in liabilities. In order to develop the discussion, it is necessary, initially, to assume that the actuarial estimates for unpaid losses and payment patterns are correct and will not change. The section on variance in the liability assumptions will discuss the impact of changing reserve and payment pattern estimates.

There will be five parts to this discussion:

Valuation Treatment of Assets Versus Liabilities
Cash Flow Comparison
Selection of Model Portfolio
Variance in the Liability Assumptions
Market Value

This paper does not recommend a corporate investment policy of matching assets and liabilities. Such a strategy is not always appropriate. Alternative investment strategies are available which provide a greater benefit than a straightforward matched strategy. Nevertheless, a model asset portfolio which is matched to the liability cash flow can provide insight into the value of the liabilities, as well as the benefits of the investment strategy selected.

VALUATION TREATMENT OF ASSETS VERSUS LIABILITIES

Discounting is the technique which estimates the credit for accumulation of investment income during the period that unpaid liabilities are settled. Common techniques use the estimates of unpaid losses, a payout pattern and a discount rate. Many authors have discussed various methods of determining the discount rate based upon either a company's own assets, or possibly, yields on treasury bonds, municipal bonds, or some

other alternative form of investment.

All these methods may be appropriate, depending on the circumstances of the guarantor of the liabilities.

The amounts of liabilities, and assets as well as the nature of the assets should be determined by the corporate philosophy of the insurer.

Casualty loss reserve estimates are not precise. A company may select a value from within a range (although the company should be consistent in this selection process from year to year). Therefore, some companies can take a conservative posture and others an optimistic posture on the amounts of liabilities.

Equally well, companies can have opposing postures on the assets and their use of the investable reserve funds. Corporate investment policy which requires only AAA rated bonds and a minimal amount of surplus in equities is far more conservative than a company which invests in "junk bonds". Of course, the latter company needs to establish a greater MSVR (Mandatory Security Valuation Reserve).

These opposing views on both the liabilities and the assets create differing values for the liabilities and therefore, the

company. Discounting the liabilities at different rates of discount has the same effect and reflects two corporate views of the potential investment earnings from reserves.

To illustrate these opposing views liabilities will be valued using investments with credit ratings from treasuries to "junk bonds". Obviously, liabilities valued by comparison with a matched model portfolio using "junk bonds" has a lower value than using treasuries.

CASH FLOW COMPARISON

In their discussions to R. W. Sturgis[2], Rothman and Deutsch[3] proposed the use of cash flows. R. W. Sturgis[3] reconsidered the arguments presented in the discussions and presented a reconciliation of the comparison of present value of earnings versus present value of cash flows.

The technique proposed herein attempts to reduce the reliance on a discount rate assumption. This alternative approach for the value of liability cash flows, which relieves the use of a discount assumption, is to establish a model portfolio of assets which precisely matches the liability outflows (net of tax and investment costs). Assets should be nominally selected which

produce a similar cash flow to the liabilities. If, however, settlements are skewed during the year, then the cash flows should be estimated on a more frequent basis than yearly.

It may not be possible to find assets which closely match the timing of the liability payments. Consequently, consideration must be given to an adjustment for mismatch. J. S. Bradley[4] presents a method for calculating this amount by offsetting cash flows.

Exhibit A contains five samples of matching the same liabilities with various alternative types of assets. In this instance, assets have been found which match the cash flow, except that in some years the assets mature earlier than mid-year, and in others later than mid-year. The mismatch adjustment included in these exhibits is in respect of this difference in timing of loss payments and asset payments during each year.

In this manner, an estimate of the value of the liabilities is determined as the cost (market value) of the model portfolio of assets which offsets the liability cash flow, plus a cost for any mismatch of cash flows. The assets valued, are those assets which provide a cash flow as close to the liabilities as is possible in practice. Obviously, no discount rate assumption is needed for determining the market value of the assets.

Although the mismatch portion of the reserve needs interest assumptions, the relative impact of these assumptions are much less than with a standard discounting technique. The use of interest assumptions is only needed for timing differences between the model portfolio and the liability cash flow. In the following example, the amount of mismatch reserve is less than 1% of the estimated value of the liabilities. Obviously, the extent of the mismatch reserve will be dependent on the availability of assets to match the projected liability cash flow. If liabilities extend out beyond 12 years, there will be a shortage of assets maturing in the later years. However, as asset/liability management techniques become increasingly used, a market should develop for suitable securities.

SELECTION OF MODEL PORTFOLIO

There are many alternative methods for selecting a model portfolio with which to value the liability cash flow. In Exhibit A (sheets 1 - 5) five types of selections are shown. The first four use fixed interest bearing bonds, the fifth uses zero coupon bonds (stripped treasuries, for example). The first four examples illustrate the costs using fixed-interest bonds of different quality (treasuries versus high grade corporate bonds

versus other corporate bonds versus "junk bonds"). Sheets 1 and 5, however, illustrate the difference in cost between zero coupon bonds and fixed interest bonds (both treasuries).

It has been assumed that all loss payments occur at mid-year. If this is not the case, then maturity dates of the asset selections should reflect this. The maturity dates should be as close to the expected liability as possible.

With sufficiently large liability cash flow payments, several assets may be selected for a particular maturity year. In which case the timing of the liability cash flow for each year should be examined more closely.

To select a matched portfolio using fixed interest securities, the asset with the longest maturity date should be selected first to meet the cash flow at the latest duration. The reader will note in Exhibit A, sheet 1, allowance for one year's interest is made in the year 2000. In 1989, only six months' interest is included.

This selection method would not be appropriate if the liability cash flow increases dramatically in later years, or has years with no liability cash flows. In which case, zero coupon bonds could be used, or a mismatch reserve considered.

Leibowitz and Weinberger[5] refer to optimal cash flow matching. This is the selection of a least cost portfolio. Obviously, there are a variety of alternative portfolios which will be closely matched to the liability cash flow. The choice of the most appropriate portfolio, would depend on corporate philosophy, and investment policy. Within these guidelines there would always be a least cost portfolio.

In our example, it has been necessary to include a nominal reserve for mismatch. This is due to bonds maturing at times other than June 30. If the asset cash flow is in advance of the liability cash flow a reinvestment rate of 5% has been used. However, if the asset cash flow is after the liability cash flow, a borrowing rate of 10% has been used.

VARIANCE IN LIABILITY ESTIMATES

Property and casualty insurance liabilities can be considered as uncertain payments of cash in the future. The total amount of the payments is uncertain, as is the time when they will be made. The actuary's role is to use professional means and, where necessary, judgment in deriving estimates for the liabilities.

An insurance company maintains a surplus to ensure against adverse variation of losses. Consequently, in the valuation of a company, two views should be considered. The first is an expected scenario, and the second an adverse scenario.

When using cash flow techniques for valuation purposes, expected and adverse scenarios estimates should be made of both the unpaid liabilities, and the payment pattern. With these two assumptions, the methods presented in this paper can be applied, to derive a market value of liabilities for each of the two scenarios.

The method based on expected results is an estimation of the worth of the liabilities for a going concern. Whereas the results based upon adverse loss assumptions, is an indication of the ability of the company to settle its insurance liabilities, if it ceased writing business.

This paper will not present methods for estimating the adverse variation of losses. However, the reader is referred to the May 1988 Casualty Loss Reserve Seminar where several papers were written on this subject. In particular, the methods presented by A. Halpert and D. Oliver[6] provide a means of deriving a margin for adverse loss development as well as a methodology for estimating an adverse scenario payment pattern.

MARKET VALUE

The undiscounted liabilities used in the example in Exhibit A are $6,930, and indeed this value would be the balance sheet amount for statutory valuation purposes*. Nevertheless, it is clear from Exhibit A, that an undiscounted liability of $6,930 with the indicated cash flow stream, would have different market values depending on the types of investments selected. The appropriate selection of assets obviously is dependant on corporate philosophy and investment policy. Consequently, so is the value of the liabilities.

The table below summarizes the results of matching the sample liability cash flows with various types of assets.

Bond Types (all figures in $000's)	Market Cost	Equivalent Discount Rate	Mismatch Portion of Cost
U.S. Treasuries	$5,284	8.72%	($7)
Corporate (>=AA)	$5,295	8.65%	$44
Corporate (A)	$5,098	10.05%	($22)
"Junk Bonds" (<=BBB)	$4,710	13.16%	$15
Stripped Treasuries	$5,196	9.34%	($44)

*Except for reserves which are discounted on a statutory basis, such as some medical malpractice and workers' compensation pension cases.

Some of the mismatch portion of costs are positive and some negative. This represents the costs from borrowing or gains from reinvestment respectively. In view of the mismatch portion of the costs, the market value of the U.S. Treasuries is less than the market value of the high grade corporate bonds. The market value of treasuries versus high grade corporate bonds are extremely close.

The stripped treasuries produce a lower result than the corporate or the regular treasuries. This is because of the different yield curve between the two types of securities (interest bearing and zero coupon). Comparisons of yield curves between interest bearing and zero coupon are not straightforward, as interest bearing securities have cash payments during earlier years.

The market prices are as of September 30, 1988. However, for purposes of this exercise, the prices and equivalent discount rate have been assumed to be as at December 31, 1988.

The technique illustrated here provides a market value, or present value, without the variability resulting from selection of a discount rate. Furthermore, margins in the investment assumptions are easily reflected through investment selection (higher grade) or conservative assumptions in the liability estimates (ultimate losses and payment pattern).

This method of valuation has no implicit margins for adverse deviation of losses, early payment of losses, or investment income. Use of this method with a slower than actual payment pattern would create a value with an optimistic credit for future investment income.

If the purpose of the valuation is for acquisition, then margins are essential for both elements of adverse results. A risk margin for adverse deviation of losses is needed, as is a payment pattern assumption that is not slower than reality.

This paper has developed a method for generating a market value for the liabilities based on the market value of the model portfolio assets. The market value of the assets is a simple exercise. Readers will readily discern the comparison to P.D. Noris[7] where the term Market Value Surplus (MVS) is used. This represents the difference between the Market Value of Assets (MVA) and the Market Value of Liabilities (MVL). Algebraically this would be:

$$MVS = MVA - MVL$$

Quite simple!

By way of example, examine this simplified form of a balance sheet for an insurance entity:

Assets:

Fixed Interest Securities	8,000
Equities	800
Cash	300
Other Assets	1,500
Total Assets	$ 10,600
Liabilities:	
Loss and Loss Expense Reserves:	6,930
Other Liabilities	1,000
Total Liabilities	$ 7,930
Capital & Surplus	
Capital	1,000
Retained Earnings	1,670
Total Capital & Surplus	$ 2,670

The assets are presented at an amortized value, and equities are valued at cost.

The unpaid liabilities are the same as in Exhibit A, though the fixed interest bonds are of various types.

Assuming that the liabilities are as shown in the above model,

and, assuming that the company's investment policy is to invest reserve funds in treasuries (or strips), then the model gives a market value of $5,196 (using strips) for the liabilities.

On the asset side, assuming that the assets were purchased when interest rates were lower, then the market value may be less than the amortized value. Suppose, therefore, that the market value of the total assets is $9,800; then the MVS is $3,604 ($9,800 less $6,196), versus the balance sheet value of $2,670.

For an ongoing entity a margin may be necessary if the actual assets held do not reasonably match the maximum assumption payment pattern. The reason for this is that with the passage of time, if the assets do not reasonably match the payout of the liabilities, then there is additional liability if the market value of assets (initially equal to the market value of liabilities) diverges from the market value of the liabilities.

In the case of an acquisition, the buyer has the option to adjust the asset portfolio to match the liability model portfolio and, therefore, would not be so concerned with this divergence, unless market conditions prevented such a shift in assets.

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Asset/Liability Matched Portfolio
Bond Allocation Method

Exhibit A
Sheet 1

Fixed Interest Treasuries
(assumed annual interest payments)

Bond	Maturity Date	Coupon	Par Value	Market Price	Cash Flow in Year 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Estimated Liability Cash Flow					1200	1300	1100	850	750	500	400	300	200	130	100	100
U.S. Treasuries:																
	15-Aug-2000	8.625%	92	88	4	8	8	8	8	8	8	8	8	8	8	100
	15-May-99	8.500%	85	83	4	7	7	7	7	7	7	7	7	7	92	
	15-May-98	9.000%	105	106	5	9	9	9	9	9	9	9	9	115		
	15-May-97	8.500%	162	158	7	14	14	14	14	14	14	14	175			
	15-May-96	7.375%	244	225	9	18	18	18	18	18	18	262				
	15-Jul-95	8.875%	316	318	14	28	28	28	28	28	344					
	15-Jul-94	8.000%	385	374	15	31	31	31	31	416						
	15-Jul-93	7.250%	592	562	21	43	43	43	635							
	15-Jun-92	8.250%	639	634	26	53	53	692								
	15-Jun-91	7.875%	824	814	32	65	889									
	15-Jun-90	8.000%	948	944	38	1024										
	15-Jun-89	7.375%	988	984	1024											
Totals (Asset Cash Flow)				$5,291	1200	1300	1100	850	750	500	400	300	200	130	100	100
Offset (days) of asset payments (-ve indicates need to borrow)					14	13	13	13	-11	-10	-8	44	42	40	39	-46
Mismatch Adjustment (5% reinvestment, 10% borrowing)				-7	-2	-2	-2	-1	2	1	1	-2	-1	-1	-1	1
Total cost for assets and mismatch =				$5,284												

Note: (a) Par value of bonds and interest amounts have not been rounded.
(b) Mismatch adjustment is calculated assuming all interest payments take place annually.
(c) Offset days is the weighted difference between June 30, and the maturity date.

Asset/Liability Matched Portfolio
Bond Allocation Method

Exhibit A
Sheet 2

Fixed Interest Corporate Bonds Rated AA or better
(assumed annual interest payments)

Bond	Maturity Date	Coupon	Par Value	Market Price	Cash Flow in Year 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Estimated Liability Cash Flow					1200	1300	1100	850	750	500	400	300	200	130	100	100
Allocation of asset cash flow:																
Xerox	15-Oct-2000	9.625%	91	92	4	9	9	9	9	9	9	9	9	9	9	100
Philip Morris	15-Nov-99	6.000%	86	66	3	5	5	5	5	5	5	5	5	5	91	
Belgium	10-Jul-98	9.625%	106	107	5	10	10	10	10	10	10	10	10	116		
Norsk Hydro	09-Apr-97	8.250%	162	149	7	13	13	13	13	13	13	13	176			
Liberty Mutual	08-Jul-96	8.500%	242	235	10	21	21	21	21	21	21	262				
Aetna Life	11-Oct-95	9.500%	312	318	15	30	30	30	30	30	342					
Prudential	15-Jul-94	8.750%	379	379	17	33	33	33	33	412						
Sarah Lee	25-Aug-93	8.375%	580	588	24	49	49	49	629							
IBM O/S	01-Jun-92	8.625%	626	625	27	54	54	680								
Prudential	22-Jul-91	7.750%	813	794	32	63	876									
GMAC	15-Jul-90	8.250%	936	927	39	1013										
GMAC	07-Jul-89	8.250%	978	971	1018											
Totals (Asset Cash Flow)				$5,251	1200	1300	1100	850	750	500	400	300	200	130	100	100
Offset (days) of asset payments (-ve indicates need to borrow)					-9	-17	-23	15	-53	-20	-90	-9	63	-22	-135	-107
Mismatch Adjustment (5% reinvestment, 10% borrowing)				44	3	6	7	-2	11	3	10	1	-2	1	4	3
Total cost for assets and mismatch =				$5,295												

Note: (a) Par value of bonds and interest amounts have not been rounded to the value shown.
(b) Mismatch adjustment is calculated assuming all interest payments take place annually.
(c) Offset days is the weighted difference between June 30, and the maturity date.

Asset/Liability Matched Portfolio
Bond Allocation Method

Exhibit A
Sheet 3

Fixed Interest Corporate Bonds Rated A
(assumed annual interest payments)

Bond	Maturity Date	Coupon	Par Value	Market Price	Cash Flow in Year 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Estimated Liability Cash Flow					1200	1300	1100	850	750	500	400	300	200	130	100	100
Allocation of asset cash flow:																
Carolina Power	01-Jun-2000	8.375%	92	82	4	8	8	8	8	8	8	8	8	8	8	100
Pacific Gas	01-Jun-99	6.625%	87	67	3	6	6	6	6	6	6	6	6	6	92	
Michigan Gas	15-Jul-98	5.500%	110	79	3	6	6	6	6	6	6	6	6	117		
Michigan Gas	01-Jul-97	8.125%	167	148	7	14	14	14	14	14	14	14	180			
Gulf Power	01-Jun-96	7.625%	248	218	9	19	19	19	19	19	19	267				
Alabama Power	01-Sep-95	6.000%	328	264	10	20	20	20	20	20	348					
Alabama Power	01-May-94	4.875%	408	325	10	20	20	20	20	428						
Alabama Power	01-May-93	4.625%	629	519	15	29	29	29	658							
Alabama Power	01-Jun-92	4.375%	699	592	15	31	31	729								
Hawiian Elec	01-Apr-91	4.650%	907	815	21	42	949									
Alabama Power	01-Aug-90	5.000%	1,054	982	26	1107										
Alabama Power	01-May-89	4.875%	1,051	1029	1077											
Totals (Asset Cash Flow)				$5,120	1200	1300	1100	850	750	500	400	300	200	130	100	100
Offset (days) of asset payments (-ve indicates need to borrow)					56	-22	81	28	54	51	-53	27	1	-10	29	29
Mismatch Adjustment (5% reinvestment, 10% borrowing)				-22	-9	8	-12	-3	-6	-3	6	-1	-0	0	-0	-0
Total cost for assets and mismatch =				$5,098												

Note: (a) Par value of bonds and interest amounts have not been rounded to the value shown.
(b) Mismatch adjustment is calculated assuming all interest payments take place annually.
(c) Offset days is the weighted difference between June 30, and the maturity date.

Asset/Liability Matched Portfolio
Bond Allocation Method

Exhibit A
Sheet 4

Fixed Interest Corporate Bonds Rated BBB or worse
(assumed annual interest payments)

Bond	Maturity Date	Coupon	Par Value	Market Price	Cash Flow in Year 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Estimated Liability Cash Flow					1200	1300	1100	850	750	500	400	300	200	130	100	100
Allocation of asset cash flow:																
Price Comm	01-Sep-2000	14.625%	87	82	6	13	13	13	13	13	13	13	13	13	13	100
Gillette	01-Aug-99	13.875%	77	70	5	11	11	11	11	11	11	11	11	11	87	
PCPI Fund	01-Apr-98	15.500%	92	86	7	14	14	14	14	14	14	14	14	107		
Allegheny	01-Jun-97	10.000%	148	113	7	15	15	15	15	15	15	15	162			
Zeus Components	01-Jul-96	12.500%	220	197	14	28	28	28	28	28	28	248				
Wickes Cos	01-May-95	15.000%	278	293	21	42	42	42	42	42	320					
Magnatrek	01-Jun-94	11.875%	338	320	20	40	40	40	40	378						
UDC-Universal	01-Aug-93	12.250%	524	502	32	64	64	64	588							
Zale Corp	01-Jun-92	11.500%	560	558	32	64	64	624								
Castle Cooke	01-Sep-91	12.000%	723	724	43	87	810									
Gulf State	01-Jul-90	4.875%	880	803	21	923										
Amer Medical	15-Jul-89	9.000%	947	947	990											
Totals (Asset Cash Flow)				$4,695	1200	1300	1100	850	750	500	400	300	200	130	100	100
Offset (days) of asset payments (-ve indicates need to borrow)					-13	-2	-43	24	-19	28	49	1	24	65	-36	-63
Mismatch Adjustment (5% reinvestment, 10% borrowing)				15	4	1	13	-3	4	-2	-3	-0	-1	-1	1	2
Total cost for assets and mismatch =				$4,710												

Note: (a) Par value of bonds and interest amounts have not been rounded to the value shown.
(b) Mismatch adjustment is calculated assuming all interest payments take place annually.
(c) Offset days is the weighted difference between June 30, and the maturity date.

Asset/Liability Matched Portfolio
Bond Allocation Method

Exhibit A
Sheet 5

Zero Coupon or Stripped Treasuries
(assumed annual interest payments)

Bond	Maturity Date	Coupon	Par Value	Market Price	Cash Flow in Year 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Estimated Liability Cash Flow					1200	1300	1100	850	750	500	400	300	200	130	100	100
Stripped Treasuries:																
	15-May-2000	0%	100	36	0	0	0	0	0	0	0	0	0	0	0	100
	15-May-99	0%	100	37	0	0	0	0	0	0	0	0	0	0	100	
	15-May-98	0%	130	56	0	0	0	0	0	0	0	0	0	130		
	15-May-97	0%	200	95	0	0	0	0	0	0	0	0	200			
	15-May-96	0%	300	155	0	0	0	0	0	0	0	300				
	15-May-95	0%	400	228	0	0	0	0	0	0	400					
	15-May-94	0%	500	312	0	0	0	0	0	500						
	15-May-93	0%	750	511	0	0	0	0	750							
	15-May-92	0%	850	631	0	0	0	850								
	15-May-91	0%	1,100	889	0	0	1100									
	15-May-90	0%	1,300	1144	0	1300										
	15-May-89	0%	1,200	1147	1200											
Totals (Asset Cash Flow)				$5,240	1200	1300	1100	850	750	500	400	300	200	130	100	100
Offset (days) of asset payments (-ve indicates need to borrow)					46	46	46	46	46	46	46	46	46	46	46	46
Mismatch Adjustment (5% reinvestment, 10% borrowing)				-44	-8	-8	-7	-5	-5	-3	-3	-2	-1	-1	-1	-1
Total cost for assets and mismatch =				$5,196												

Note: (a) Par value of bonds have not been rounded.
(b) Mismatch adjustment is calculated assuming all interest payments take place annually.
(c) Offset days is the weighted difference between June 30, and the maturity date.