Appendix 2

CASH FLOW-BASED SURPLUS

Introduction

This appendix examines an insurance company's measure of surplus that is based directly on cash flows instead of traditional statutory or GAAP accounting concepts. The measure is called cash flow-based surplus (CFS) and is defined for a given scenario as the present value of asset cash flows less the present value of liability cash flows. This appendix describes how CFS should be calculated and how it may be interpreted and used.

Summary of Findings

- CFS can provide useful insight into the real financial strength of an insurance company. Because of the many assumptions inherent in developing CFS, it is more useful as a relative measure of financial strength than as an absolute measure of financial strength.

- CFS for a single economic scenario is not a good measure of a company's financial strength. However, CFS results over a broad range of scenarios provide a practical idea of a company's inherent financial strength.

- CFS is only meaningful if computed properly. In particular, interest rates used for discounting must be consistent with the scenario tested, and FIT must be properly reflected in both the cash flows and discount rates.

- If computed properly, CFS can be interpreted as:

  - The amount of cash that could be removed currently such that the remaining assets would be sufficient to mature all benefits on a true econominc basis (that is, ignoring statutory accounting conventions for assets and liabilities) under the assumed interest rate and experience scenario.

  - The present value of amounts removed over time such that the remaining assets can mature the benefits, given the same qualifications noted above. These amounts removed over time can be interpreted as shareholder dividends for a stock company, or perhaps contributions to permanent surplus for a mutual company.

- CFS does not recognize the financial strength (that is, earnings) associated with a company's future new business. For companies with a large amount of short-term business (for example, group term, health, and casualty lines), this is a serious shortcoming.

- The relationship of CFS to statutory surplus can provide useful information about solvency and can be a valuable tool for the valuation actuary preparing an actuarial opinion.

Definitions

CFS for a specified interest scenario is defined to be the excess of the present value of anticipated asset cash flows, derived from the existing assets, over the present value of anticipated liability cash flows. The present values of anticipated asset and liability cash flows will be referred to as the economic value of the assets (EVA) and the economic value of the liabilities (EVL), respectively. Thus, by definition,

$$(1)\quad CFS_i = (EVA)_i - (EVL)_i,$$

where i refers to the particular interest scenario for which $(EVA)_i$ and $(EVL)_i$ were calculated.

In subsequent sections, reference is made to a segregated surplus account, where the assets supporting the surplus are separated from the assets supporting the liabilities. The economic value of the surplus $(EVS)_i$, is defined consistent with the definitions of $(EVA)_i$ and $(EVL)_i$ and is equal to the present value of the anticipated cash flows from the assets in the surplus account for interest scenario i.

The cash inflows arising from the initial assets, normally consisting of interest payments and repayments of principal (rollover), should be reflected in the calculation of EVA. Conceptually, it is also necessary to reflect other forms of income related to the assets, such as call premiums and correspondent fees. The cash flows must realistically reflect the specified interest rate scenario.

All cash outflows associated with the company's contractual obligations and the expenses expected to be incurred in fulfilling such obligations should be reflected in the calculation of EVL. Additionally, it is necessary to reflect FIT payments, which can be material cash outflows in operating an insurance company.[1] Future renewal premiums that the policyholder is contractually obligated to pay should be used as a deduction from the liability cash flows. Again, the cash flows must realistically reflect the specified interest rate scenario.

Note that the definition of CFS relates only to the current in-force, or more specifically, the cash flows associated with currently booked assets and liabilities. Thus, it excludes the cash flows from future new business and hence the values associated with such new business.

Finally, note that CFS is not intended to represent a market value of the current in-force, as the discount rates used in the calculation of EVA and EVL reflect an assumed interest scenario rather than the discount rate an investor would currently choose to use in assessing the value of an operating company.

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[1] As described in a later section, EVL does not reflect the actual FIT payment. Instead, the FIT payment has to be reflected in both EVA and EVL.

Calculation of CFS

Determining the excess of the present value of asset cash flows over liability cash flows appears at first to be straightforward. It is not straightforward, however, as will soon be apparent. The mechanics of calculating CFS finally fell into place after a disciplined analysis of all of the cash flows associated with a simple insurance arrangement was developed. In order to appreciate the pitfalls of various straightforward approaches, and thus to understand fully the correct approach for calculating CFS, the straightforward approaches will be illustrated first. Then the correct methodology for calculating CSF will be presented to illustrate how it overcomes the various problems associated with the straightforward approaches.

Consider the cash flows associated with a simple insurance arrangement where the liability or outflow is a 4-year compound GIC with an interest guarantee of 13 percent. For simplicity, expenses are ignored. Thus, there is one cash outflow at the maturity of the ocntract. Assume that the premium for this GIC was invested in a 14 percent bond with annual coupons that matures when the liability matures. Assume further that net cash flows in renewal years are reinvested to mature when the liability matures. FIT equals 36.8 percent of earnings, defined as interest earned less interest credited. Finally, it is assumed that all earnings after tax are paid to shareholders each year.

The cash flows are summarized in Table A2-1. Detailed calculations are presented in the model output included later in this appendix. The "Earned-Credited" column, which equals earnings, is presented for reference purposes.

Earnings are not cash flows; however, earnings determine FIT and shareholder dividends, which are cash flows.

TABLE A2-1

Summary of Cash Flows
Annual Shareholder Dividend Paid

Year	Assets	Liability	Earnings: Earned-Credited	FIT	Shareholder Dividend
1	$ 140.00	—	$10.00	$ 3.68	$ 6.32
2	140.00	—	11.30	4.16	7.14
3	140.00	—	12.77	4.70	8.07
4	1,140.00	$1,630.47	14.43	5.31	9.12
PV-BFIT	$1,000.00	$ 965.37	x	$12.74	$21.89
PV-AFIT	$1,167.47	$1,161.53	x	$14.32	$24.59

At the bottom of the table, the present values of the various cash flows are shown on both a before- and an after-tax basis. Before-tax interest rates are 14 percent, and after-tax rates are 8.84 percent, which reflect a 36.8 percent tax rate. No present value is shown in the "Earnings" column, since, as noted, these are not cash flows.

With these present values, it should be easy to compute CFS. Table A2-2 shows the straightforward additions and subtractions.

TABLE A2-2

Development of CFS
Annual Shareholder Dividend Paid

	(1) Assets	(2) Liability	(3) FIT	(4) (1) - (2) - (3)	(5) Dividends
BFIT	$1,000.00	$ 965.37	$12.74	$21.89	$21.89
AFIT	1,167.47	1,161.53	14.32	-8.38	24.59

Assuming that shareholder dividends would be excluded, since they are not contractual obligations, the fourth column ought to be CFS. Note, though, that the after-tax result is nonsensical; since we are earning 14 percent and only crediting 13 percent, there should be inherent profits in this arrangement, and CFS should accordingly be positive. The result using before-tax discount rates makes more sense. The fact that the result equals the present value of shareholder dividends has intuitive appeal, since the cash flows that remain after all liabilities (including FIT payments) have been discharged would logically belong to the shareholders.

It was soon discovered, however, that the use of before-tax discount rates presents an unusual problem. If earnings are not distributed annually to shareholders, but rather retained in surplus and allowed to grow until payment at some future date, the value of CFS, as well as the present value of shareholder dividends, changes. The reason for this is that retained earnings grow at an after-tax rate; when retained earnings are paid out at a later date and discounted at a pretax rate, the resultant present value is different from the present value when they are paid out immediately (it is, in fact, lower). When pretax rates are used, therefore, the value of CFS chagnes under different shareholder dividend assumptions.

The analysis of different dividend assumptions also revealed that with after-tax discount rates, the present value of shareholder dividends will be the same whether earnings are paid out immediately or retained and paid out at some later date. Retained earnings, as previously noted, will grow at an after-tax rate in the surplus account. When the earnings plus accumulated interest are eventually paid out and discounted at the same after-tax rate, the value will be unaffected by the growth in the surplus account.

The fact that CFS (and the present value of shareholder dividends) using pretax rates varied depending on the dividend assumption, while the present value of shareholder dividends using after-tax rates remained constant, provided compelling evidence that after-tax discount rates should be used for calculating CFS. The problem was that the straightforward addition and subtraction of the cash flows using after-tax discount rates produced nonsensical results, and has been illustrated.

After some further work, a solution was found; in order to use adjusted-for-tax discount rates, it became apparent that it is also necessary to use adjusted-for-tax cash flows. The approach, basically, is to tax-effect the transactions that affect the tax liability on a current basis. For example, a coupon inflow of $140 each year is multiplied by the complement of the tax rate of 36.8 percent to yield a net after-tax inflow of $88.48. In effect, then, the $140 coupon is immediately reduced by an assumed tax payment of $51.52, and this payment must be regarded as a cash flow.

On the liability side, by crediting interest at 13 percent, there is a reduction in the tax liability associated with the coupon inflow on the asset side

by the amount of interest credited times 36.8 percent. In year 1, this is $130 x 0.368 = $47.84. Since the $51.52 on the asset side is treated as a cash payment or outflow, it is appropriate to treat this $47.84 as a cash inflow.

The adjusted-for-tax cash flows are thus as shown in Table A2-3.

TABLE A2-3

CFS Basis
Basic Cash Flows
Annual Shareholder Dividend Paid

Year	Assets	Liabilities
1	$ 88.48	$ (47.84)
2	88.48	(54.06)
3	88.48	(61.09)
4	88.48	(69.03)
	1,000.00	1,630.47
PV-AFIT	$1,000.00	$ 975.41

Note that this process produces the desirable result that the present value of the asset cash flows is equal to $1,000, which is the same as the statutory statement value of the asset. This was not the case in Table A2-2. CFS can now be computed as shown in Table A2-4.

TABLE A2-4

Development of CFS

	Present Values
Assets	$1,000.00
Liabilities	975.41
CFS	$ 24.59
Shareholder dividends	$ 24.59

Note also that, as desired, the value of CFS on this basis equals the present value, using after-tax discount rates, of shareholder dividends.

The tax adjustments made for the liability side appear a bit odd at first. It is interesting to note, though, that the FIT cash flows implicit in this overall methodology do net out to the actual FIT cash flow. This is illustrated in Table A2-5.

TABLE A2-5

Development of FIT Cash Flow
Annual Shareholder Dividend Paid

	Interest Earned		Interest Credited		FIT Cash
	(1)	(2)	(3)	(4)	Outflow
Year	Gross	FIT	Gross	FIT	(2) - (4)
1	$140.00	$51.52	$130.00	$47.48	$3.68
2	158.20	58.21	146.90	54.06	4.16
3	178.77	65.79	166.00	61.09	4.70
4	202.01	74.34	187.58	69.03	5.31

The FIT cash flow is implicitly recognized through the process of tax-effecting the cash flows that determine the tax liability.

In all of the examples presented thus far, a level interest rate environment has been presumed, and simple present value functions could be used to calculate the present value of future cash flows. When the future interest rate is assumed to change, the calculation of present vlues requires the accumulation of cash inflows and outflows forward to the end of the modeling period, reflecting the new money rate assumptions and reinvestment assumptions. It is also necessary to accumulate $1 invested immediately after time 0 to the end of the period, again properly reflecting new money rates, rollover rates, and reinvestment

assumptions. When the final inflow and outflow values are divided by the accumulated value of $1, present values are obtained that appropriately reflect the assumed interest scenario and the reinvestment assumption.[2]

The concept of CFS was developed with these simple GIC examples, but the concept was widely tested in a model developed to support the work of the Combination of Risks Task Force. The tests considered a wide variety of scenarios involving C-1, C-2, and C-3 risks.

Interpretation of CFS

As developed in the previous section, CFS is equal to the present value of shareholder dividends. This relationship, as noted previously, also follows logically from the intuitive notion that the shareholder interest is what is left over after payments of benefits to policyholders and payments of taxes to the federal government. For participating business, CFS can be thought of as thepresent value of the permanent contribution to surplus and/or the present value of additions to the current dividend scale.

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[2] This technique was described in somewhat greater detail in Richard M. Wenner The Actuary, February 1983. With Mr. Wenner's permission, a section of the report submitted to The Actuary illustrating the discounting process has been reproduced in Section 3 of Chapter 3.

A relatively simple proof of the equivalence of CFS and the present value of shareholder dividends is presented in attachment B. The relationships developed there also explain the origins of the problem with CFS computed with pretax cash flows and after-tax discount rates.

The more interesting property of CFS, which has application to risk quantification, is that it is equal to the amount of cash that may be removed from the beginning assets so that the remaining funds are just sufficient to mature benefits under the assumed interest and experience scenario used to compute CFS. Conceptually, this is the shareholder difidend that could be paid at the beginning of the insurance arrangement if there was certainty about the future cash flows. Given that there is uncertainty about future cash flows, analysis of CFS over a range of scenarios, where the cash flows are appropriately varied, could provde some insight into the level of risk associated with a particular book of business and under what conditions the risk would materialize.

The example illustrates the equivalence of CFS to cash. Assume that $24.59 (CFS from our previous example) of assets (in the assumed level interest environment, a dollar of assets equals a dollar of cash) has been removed from the simple GIC illustration. The CFS basis cash flows are presented in Table A2-6. In this case, the only effect is on the cash inflows associated with the assets; the cash outflows associated with the liabilities are the same as those presented in Table A2-3.

TABLE A2-6

CFS Basis Cash Flows
$24.59 Removed from Beginning Assets

Year	Assets	Liabilities
1	$ 86.30	$ (47.84)
2	86.30	(54.06)
3	86.30	(61.09)
4	86.30	(69.03)
	975.41	1,630.47
PV-AFIT	$ 975.41	$ 975.41

With the present value of inflows equal to the present value of outflows, CFS will be 0, thus confirming that CFS may be equated to cash.

When the cash flows for an insurance arrangement change as a result of risk, it should be apparent that the change in cash flows will produce a change in the value of CFS. The change in CFS can thus be thought of as the cash cost of risk.

Suppose, in our simple GIC example, that interest rates, instead of remaining level at 14 percent, increase to 14.4 percent, and that the liability matures at the end of 1 year by virtue of a policyholder election to exercise a discretionary withdrawal right. This is a classic example of mismatch risk. The CFS basis cash flows are presented in Table A2-7.

TABLE A2-7

CFS Basis Cash Flows
Mismatch Risk Illustration

Year	Assets	Liabilities
1	$ 88.48	$ (47.84)
2	88.48	1,130.00
3	88.48	-
4	88.48	-
	1,000.00	-
PV-AFIT	$ 991.83	$ 991.89

Present value computed at 9.101% = 14.4% (1 - 0.368).

CFS for the illustration in Table A2-7 is a negative: $.06 (991.83 - 991.89). thus, the cash cost of the mismatch risk produced by the change in interest rate and the change in the liability cash flow relative to expectations in the level interest case is $24.65; that is (0.06) - 24.59 = (24.65).

All of the examples considered thus far have assumed no beginning surplus. In many practical applications, it is likely that there will be beginning surplus. CFS is also useful in this case. If the surplus is held in a segregated account, the present value of the cash flows associated with the assets in the account simply yields the economic value of the surplus, $(EVS)_i$. CFS_i in this case includes only the asset cash flows associated with the assets backing the liabilities. Analysis of $CFS_i + (EVS)_i$ for various scenarios can provide useful insight into the overall risk management capability of the insurance company. For example, if CFS and EVS tend to move in the same direction, one may conclude that the company is particularly vulnerable, since the same risks that would produce product losses relative to expected would effectively reduce the economic value of surplus as well.

When surplus is not segregated, so that the asset cash flows used in computing CFS include the cash flows associated with surplus, CFS represents the economic value of the surplus plus the economic value of the assets and liabilities with respect to a given book of buiness. Analysis of CFS for different scenarios can still provide useful insight into the risk management capability of the insurance company, but it is not possible to associate clearly changes in CFS with product risks. Part of the change in CFS could be attributable to changes in the economic value of the surplus.

In the following example, it is assumed that $10 of cash is added to the beginning assets for the simple GIC example. The CFS basis cash flows are presented in Table A2-8.

TABLE A2-8

CFS Basis Cash Flows
$10 of Cash Added to Beginning Assets

Year	Assets	Liabilities
1	$ 89.36	$ (47.84)
2	89.36	(54.06)
3	89.36	(61.09)
4	89.36	(69.03)
	1,010.00	1,630.47
PV-AFIT	$1,010.00	$ 975.41

CFS is developed in Table A2-9.

TABLE A2-9

Development of CFS
$10 of Cash Added to Beginning Assets

	Present Values
Assets	$1,010.00
Liabilities	975.41
CFS	$ 34.59
Shareholder dividends	$ 34.59

The economic value of surplus in this case if $10, and CFS has increased by exactly this amount. It is worthy noting that this relationship would not hold if the straightforward approaches to discounting previously illustrated were used. The problem with beginning surplus is the same problem encountered with retained earnings; namely, surplus grows at an after-tax rate, and discounting at before-tax rates would produce a result that understates the economic value of surplus. After-tax discount rates again produce nonsensical results.

Model Output

A simple computer model was developed to keep track of the cash flows and calculate present values for the simple GIC insurance arrangement used in this appendix. The model output for the various examples used in the report is attached as exhibits. It is essentially self-explanatory. The only column that requires explanation is labeled "FIT Eff Liab" (section II, column 6). This is the tax credit on the current-year interest credit; for example, for year 1, 130.00 x 0.368 = 47.84. As has been explained, the practical effect of tax-effecting the

cash flows is to treat this amount as a cash inflow. Thus, the present value of these tax credits is deducted from the present value of the benefits in the summary section.

A summary of the exhibits follows (See Attachment A to this appendix.)

Example	Interest	Shareholder Dividend	Liability	Initial Surplus	EVA-BT less EVL-BT	CFS
A	Level	Annual	4-Year	None	21.89	24.59
B	Level	Final	4-Year	None	20.44	24.59
C	Level	Final	4-Year	-24.59	0.00	0.00
D	Level	Final	4-Year	10.00	28.75	34.59
E	To 14.4%	Annual	1-Year	None	0.68	-0.06
F	To 14.4%	Final	1-Year	None	-0.05	-0.06

Examples A and B are the base case for the two dividend policies. In Example C, initial assets equal to CFS are removed. The remaining assets are just sufficient to mature the liability, indicating that CFS may be equated to cash.

In Example D, $10.00 of cash is added to the surplus account, and CFS is increased by a like amount. Examples E and F illustrate how CFS may be used to quantify risk. It is assumed that interest rates increase to 14.4% and that the liability matures at the end of the first year. CFS is -0.06, indicating that the shareholders' interests were reduced by -24.65 (-0.06 - 24.59). If this amount of cash were added to initial assets, then CFS would be 24.59, as in the base case. Note that in Example E, where earnings after tax are paid out annually to shareholders, CFS-BT provides a very misleading indication of the cost of mismatch.

Uses of CFS

CFS has general application to the problem of risk analysis and quantification. It has the unique advantage that it does not require sophisticated statistical knowledge to understand and interpret results. Equating a given level of risk, expressed as a deviation from expected cash flows, to cash has an intuitive appeal that promotes understanding of the results.

Given the current level of concern with mismatch risk, where it is curently acknowledged that cash flow analysis is required to understand the risk exposure fully, CFS provides a discipline to quantatively compare different cash flow streams. Such a discipline should prove valuable to the valuation actuary preparing an actuarial opinion as to whether assets supporting valuation reserves for certain interest-sensitive products are adequate to mature contractual obligations and, if not, what increase in valuation reserves is necessary.

CFS also has potential application in the development of benchmark surplus formulas. By expressing the various risks assumed in terms of cash flow deviations, it is possible to understand how surplus requirements (expressed in terms of cash) vary with different levels and combinations of risk. Comparisons of CFS for various products, variations of the same product, or even different lines of business are easier to understand. Such understanding could lead ultimately to improved product design to control the risks assumed, as well as to improved pricing that more realistically reflects the risks assumed.

In any application of CFS, it must be understood that CFS addresses only the economics of the business without regard to statutory requirements. It is

possible, therefore, that in a particular application, CFS may be positive, but at some point over the period of the analysis, statutory surplus may be negative; that is, statutory assets may be less than statutory minimum valuation reserves. This can be particularly troublesome in developing benchmark surplus formulas, where the goal typically has been to establish a surplus level to ensure statutory solvency. Valuation actuaries who use CFS in support of actuarial opinion must be mindful of, and understand, the relationship between CFS and statutory surplus.

The relationship between CFS (developed to reflect assets supporting surplus) and statutory surplus can provide valuable insight into the real financial strength of an insurance company; this may prove to be a valuable management tool. For example, if CFS is consistently less than statutory surplus over a range of scenarios, this would be indicative of statutory losses in the years ahead and the need for prompt corrective action.

Perhaps the best advice regarding use of CFS is to try it. Cash flow analysis can provide real insight into the operation of an insurance company, and CFS has made it easier to understand the differences between cash flow streams. Like any new tool, experience in its use develops understanding and confidence. There is undoubtedly much more to understand about the use of CFS, given its limited use to date.

EXAMPLE A
BASE CASE: LEVEL INTEREST
EARNINGS PAID OUT ANNUALLY

ASSUMPTIONS			
Lapse Rate	Interest Rate initial	Interest Rate later	FIT Percentage
0.00	0.14	0.14	0.368
0.00			
0.00	Credited Rate	Chg in Assets	Earnings Paid Out
1.00	0.13	0.00	1

I. PRE-TAX CASH FLOWS

	SUMMARY OF OPERATIONS					OTHER CASH FLOWS				BALANCE SHEET			
years	Interest Earned initial	later	Interest Credited	FIT	FIT Eff Liab	Sh-Hldr Divids	Asset Rollover initial	later	Liability Csh Flws	Net Csh Flws	Asset Balance initial	later	Liability Balance	Surplus Balance
											1000.00		1000.00	0.00
1	140.00	0.00	130.00	3.68	6.32	6.32	0.00	0.00	0.00	130.00	1000.00	130.00	1130.00	0.00
2	140.00	18.20	146.90	4.16	7.14	7.14	0.00	0.00	0.00	146.90	1000.00	276.90	1276.90	0.00
3	140.00	38.77	166.00	4.70	8.07	8.07	0.00	0.00	0.00	166.00	1000.00	442.90	1442.90	0.00
4	140.00	62.01	187.58	5.31	9.12	9.12	1000.00	442.90	1630.47	-0.00	0.00	-0.00	-0.00	-0.00
Present Values:														
pre-tax	407.92	76.88	450.17	12.74	21.89	21.89	592.08	262.23	965.37	339.11				
post-tax	455.08	89.59	505.77	14.32	24.59	24.59	712.39	315.52	1161.53	372.14				

A. SUMMARY OF PRE-TAX PRESENT VALUES

			net
EVA-BT	592.08	407.92	1000.00
EVL-BT	965.37	12.74	978.11
CFS-BT			21.89
Shareholder Dividends			21.89

B. SUMMARY OF POST-TAX PRESENT VALU

			net
EVA-AT	712.39	455.08	1167.47
EVL-AT	1161.53	14.32	1175.85
CFS-AT			-8.38
Shareholder Dividends			24.59

II. TAX-AFFECTED CASH FLOWS

years	Interest Earned initial	later	Interest Credited	FIT	FIT Eff Liab	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	later	Liability Csh Flws	Net Csh Flws
1	88.48	0.00	82.16	3.68	-47.84	6.32	6.32	0.00	0.00	0.00	130.00
2	88.48	11.50	92.84	4.16	-54.06	7.14	7.14	0.00	0.00	0.00	146.90
3	88.48	24.50	104.91	4.70	-61.09	8.07	8.07	0.00	0.00	0.00	166.00
4	88.48	39.19	118.55	5.31	-69.03	9.12	9.12	1000.00	442.90	1630.47	-0.00
Present Values:											
post-tax	287.61	56.62	319.64	14.32	-186.12	24.59	24.59	712.39	315.52	1161.53	372.14

C. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA	712.39	287.61	1000.00
EVL	1161.53	-186.12	976.41
CFS			24.59
Shareholder Dividends			24.59

EXAMPLE B
BASE CASE: LEVEL INTEREST
EARNINGS RETAINED

ASSUMPTIONS			
Lapse Rate	Interest Rate initial	Interest Rate later	FIT Percentage
0.00	0.14	0.14	0.368
0.00			
0.00	Credited Rate	Chg in Assets	Earnings Paid Out
1.00	0.13	0.00	0

I. PRE-TAX CASH FLOWS

	SUMMARY OF OPERATIONS					OTHER CASH FLOWS					BALANCE SHEET			
years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws	Asset initial	Balance later	Liability Balance	Surplus Balance
											1000.00		1000.00	0.00
1	140.00	0.00	130.00	3.68	6.32	0.00	0.00	0.00	0.00	136.32	1000.00	136.32	1130.00	6.32
2	140.00	19.08	146.90	4.48	7.70	0.00	0.00	0.00	0.00	154.60	1000.00	290.92	1276.80	14.02
3	140.00	40.73	166.00	5.42	9.31	0.00	0.00	0.00	0.00	175.31	1000.00	466.23	1442.80	23.33
4	140.00	65.27	187.58	6.51	11.18	34.51	1000.00	466.23	1630.47	-0.00	0.00	-0.00	-0.00	-0.00
Present Values:														
pre-tax	407.92	80.82	450.17	14.19	24.38	30.44	592.08	276.04	965.37	356.87				
post-tax	455.08	94.19	505.77	16.01	27.49	24.59	712.39	332.14	1161.53	391.66				

A. SUMMARY OF PRE-TAX PRESENT VALUES

			net
EVA-BT	592.08	407.92	1000.00
EVL-BT	965.37	14.19	979.56
CFS-BT			20.44
Shareholder Dividends			20.44

B. SUMMARY OF POST-TAX PRESENT VALU

			net
EVA-AT	712.39	455.08	1167.47
EVL-AT	1161.53	16.01	1177.54
CFS-AT			-10.07
Shareholder Dividends			24.59

II. TAX-AFFECTED CASH FLOWS

	Interest Earned	Interest		FIT	Statutory	Sh-Hldr	Asset Rollover		Liability	Net
years	initial	later	Credited	Eff Liab	Earnings	Divids	initial	later	Csh Flws	Csh Flws
1	88.48	0.00	82.16	3.68	-47.84	6.32	0.00	0.00	0.00	136.32
2	88.48	12.06	92.84	4.48	-54.06	7.70	0.00	0.00	0.00	154.60
3	88.48	25.74	104.91	5.42	-61.09	9.31	0.00	0.00	0.00	175.31
4	88.48	41.25	118.55	6.51	-69.03	11.18	34.51	1000.00	466.23	1630.47	-0.00
Present Values:											
post-tax	287.61	59.53	319.64	16.01	-186.12	27.49	24.59	712.39	332.14	1161.53	391.66

C. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA	712.39	287 61	1000.00
EVL	1161.53	-186.12	975.41
CFS			24.59
Shareholder Dividends			24.59

EXAMPLE B
BASE CASE: LEVEL INTEREST
EARNINGS RETAINED

ASSUMPTIONS			
Lapse Rate	Interest Rate initial	Interest Rate later	FIT Percentage
0.00	0.14	0.14	0.368
0.00			
0.00	Credited Rate	Chg in Assets	Earnings Paid Out
1.00			
	0.13	0.00	0

I. PRE-TAX CASH FLOWS

	SUMMARY OF OPERATIONS					OTHER CASH FLOWS				BALANCE SHEET			
years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws	Asset Balance initial	Asset Balance later	Liability Balance	Surplus Balance
											1000.00		1000.00	0.00
1	140.00	0.00	130.00	3.68	6.32	0.00	0.00	0.00	0.00	136.32	1000.00	136.32	1130.00	6.32
2	140.00	19.08	146.90	4.48	7.70	0.00	0.00	0.00	0.00	154.60	1000.00	290.92	1276.90	14.02
3	140.00	40.73	166.00	5.42	9.31	0.00	0.00	0.00	0.00	175.31	1000.00	466.23	1442.80	23.33
4	140.00	65.27	187.58	6.51	11.18	34.51	1000.00	466.23	1630.47	-0.00	0.00	-0.00	-0.00	-0.00
Present Values:														
pre-tax	407.92	80.82	450.17	14.19	24.38	20.44	592.08	276.04	965.37	356.87				
post-tax	455.08	94.18	505.77	16.01	27.49	24.59	712.39	332.14	1161.53	391.66				

A. SUMMARY OF PRE-TAX PRESENT VALUES

			net
EVA-BT	592.08	407.92	1000.00
EVL-BT	965.37	14.19	979.56
CFS-BT			20.44
Shareholder Dividends			20.44

B. SUMMARY OF POST-TAX PRESENT VALU

			net
EVA-AT	712.39	455.08	1167.47
EVL-AT	1161.53	16.01	1177.54
CFS-AT			-10.07
Shareholder Dividends			24.59

II. TAX-AFFECTED CASH FLOWS

years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	FIT Eff Liab	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws
1	88.48	0.00	82.16	3.68	-47.84	6.32	0.00	0.00	0.00	0.00	136.32
2	88.48	12.06	92.84	4.48	-54.06	7.70	0.00	0.00	0.00	0.00	154.60
3	88.48	25.74	104.91	5.42	-61.09	9.31	0.00	0.00	0.00	0.00	175.31
4	88.48	41.25	118.55	6.51	-69.03	11.18	34.51	1000.00	466.23	1630.47	-0.00
Present Values:											
post-tax	287.61	59.53	319.64	16.01	-186.12	27.49	24.59	712.39	332.14	1161.53	391.66

C. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA	712.39	287.61	1000.00
EVL	1161.53	-186.12	975.41
CFS			24.59
Shareholder Dividends			24.59

EXAMPLE D
BASE CASE: LEVEL INTEREST
EARNINGS RETAINED
$10 CASH ADDED TO EX B

ASSUMPTIONS			
Lapse Rate	Interest Rate initial	Interest Rate later	FIT Percentage
0.00	0.14	0.14	0.368
0.00			
0.00	Credited Rate	Chg in Assets	Earnings Paid Out
1.00	0.13	10.00	0

I. PRE-TAX CASH FLOWS

	SUMMARY OF OPERATIONS					OTHER CASH FLOWS				BALANCE SHEET			
years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws	Asset Balance initial	Asset Balance later	Liability Balance	Surplus Balance
											1010.00		1000.00	10.00
1	141.40	0.00	130.00	4.20	7.20	0.00	0.00	0.00	0.00	137.20	1010.00	137.20	1130.00	17.20
2	141.40	19.21	146.90	5.04	8.66	0.00	0.00	0.00	0.00	155.56	1010.00	292.77	1276.90	25.87
3	141.40	40.98	166.00	6.03	10.36	0.00	0.00	0.00	0.00	178.36	1010.00	469.12	1442.80	36.23
4	141.40	65.68	187.58	7.18	12.32	48.55	1010.00	469.12	1630.47	-0.00	0.00	-0.00	-0.00	-0.00
Present Values:														
pre-tax	412.00	81.33	450.17	15.88	27.28	28.75	598.00	277.76	965.37	359.09				
post-tax	459.63	94.78	505.77	17.90	30.74	34.59	719.51	334.20	1161.53	384.10				

A. SUMMARY OF PRE-TAX PRESENT VALUES

			net
EVA-BT	598.00	412.00	1010.00
EVL-BT	965.37	15.88	981.25
CFS-BT			28.75
Shareholder Dividends			28.75

B. SUMMARY OF POST-TAX PRESENT VALU

			net
EVA-AT	719.51	459.63	1179.14
EVL-AT	1161.53	17.90	1179.44
CFS-AT			-0.29
Shareholder Dividends			34.59

II. TAX-AFFECTED CASH FLOWS

years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	FIT Eff Liab	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws
1	89.36	0.00	82.16	4.20	-47.84	7.20	0.00	0.00	0.00	0.00	137.20
2	89.36	12.14	92.84	5.04	-54.08	8.66	0.00	0.00	0.00	0.00	155.56
3	89.36	25.90	104.91	6.03	-61.09	10.36	0.00	0.00	0.00	0.00	176.36
4	89.36	41.51	118.55	7.18	-69.03	12.32	48.55	1010.00	469.12	1630.47	-0.00
Present Values:											
post-tax	290.49	59.90	319.64	17.90	-186.12	30.74	34.59	719.51	334.20	1161.53	384.10

C. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA	719.51	290.49	1010.00
EVL	1161.53	-186.12	975.41
CFS			34.59
Shareholder Dividends			34.59

EXAMPLE E
INTEREST RATES RISE TO 14.4%
EARNINGS PAID OUT ANNUALLY
ONE YEAR LIABILITY

ASSUMPTIONS

Lapse Rate	Interest Rate initial	Interest Rate later	FIT Percentage
1.00	0.14	0.144	0.368
0.00			
0.00	Credited Rate	Chg in Assets	Earnings Paid Out
0.00	0.13	0.00	1

I. PRE-TAX CASH FLOWS

	SUMMARY OF OPERATIONS					OTHER CASH FLOWS				BALANCE SHEET			
years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws	Asset Balance initial	Asset Balance later	Liability Balance	Surplus Balance
											1000.00		1000.00	0.00
1	140.00	0.00	130.00	3.68	6.32	6.32	0.00	0.00	1130.00	-1000.00	1000.00	-1000.00	0.00	0.00
2	140.00	-144.00	0.00	-1.47	-2.53	0.00	0.00	0.00	0.00	-2.53	1000.00	-1002.53	0.00	-2.53
3	140.00	-144.36	0.00	-1.61	-2.76	0.00	0.00	0.00	0.00	-2.76	1000.00	-1005.29	0.00	-5.29
4	140.00	-144.76	0.00	-1.75	-3.01	-6.30	1000.00	-1005.29	0.00	-0.00	0.00	-0.00	0.00	-0.00
Present Values:														
pre-tax	404.60	-290.97	113.64	-0.00	-0.01	0.68	583.84	-586.93	987.76	-877.90				
post-tax	452.58	-334.32	119.16	-0.34	-0.58	-0.06	705.81	-709.54	1035.74	-920.83				

A. SUMMARY OF PRE-TAX PRESENT VALUES

			net
EVA-BT	583.84	404.60	988.44
EVL-BT	987.76	-0.00	987.76
CFS-BT			0.68
Shareholder Dividends			0.68

B. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA-AT	705.81	452.56	1158.37
EVL-AT	1035.74	-0.34	1035.40
CFS-AT			122.97
Shareholder Dividends			-0.06

II. TAX-AFFECTED CASH FLOWS

years	Interest Earned initial	Interest Earned later	Interest Credited	FIT	FIT Eff Liab	Statutory Earnings	Sh-Hldr Divids	Asset Rollover initial	Asset Rollover later	Liability Csh Flws	Net Csh Flws
1	88.48	0.00	82.16	3.68	-47.84	6.32	6.32	0.00	0.00	1130.00	-1000.00
2	88.48	-91.01	0.00	-1.47	0.00	-2.53	0.00	0.00	0.00	0.00	-2.53
3	88.48	-91.24	0.00	-1.61	0.00	-2.76	0.00	0.00	0.00	0.00	-2.76
4	88.48	-91.49	0.00	-1.75	0.00	-3.01	-6.30	1000.00	-1005.29	0.00	-0.00
Present Values:											
post-tax	286.02	-211.29	75.31	-0.34	-43.85	-0.58	-0.06	705.81	-709.54	1035.74	-920.83

C. SUMMARY OF POST-TAX PRESENT VALUES

			net
EVA	705.81	286.02	991.83
EVL	1035.74	-43.85	991.89
CFS			-0.06
Shareholder Dividends			-0.06

ATTACHMENT B

CFS AND THE PRESENT VALUE OF SHAREHOLDER DIVIDENDS

A simple proof of the equivalence between CFS and the present value of shareholder dividends follows.

The cash inflows and outflows associated with an insurance arrangement may be grouped as follows:

Assets

- Cash inflows associated with original investment (A_O).
- Cash inflows associated with reinvestment (A_R).

Liabilities

- Cash outflows associated with benefits and associated expenses (B).
- oCash outflows associated with tax (FIT).

Dividends

- Cash outflows paid to owners (D).

Reinvestment

- Cash outflow, if net of above is positive (R_O).
- Cash inflow, if net of above is negative, so that borrowing is required (R_I).

Assume that reinvestment amounts are positive. Thus, reinvestment amounts represent outflows, and the corresponding future cash flows represent inflows.

For any given year,

(1) Amount reinvested = net cash flow.
$R_O = A_O + A_R - B - FIT - D.$

It follows that

(2) $D = A_O + A_R - R_O - B - FIT.$

Let the symbol PV(X) represent the present value of the cash flow X for all future years. Then formula 2 may be expanded as follows:

(3) $PV(D) = PV(A_O) + \left[PV(A_R) - PV(R_O)\right] - \left[PV(B) + PV(FIT)\right].$

If the discount rates used for present value purposes are consistent with the reinvestment assumptions, as explained in the report and the supplement, then the following relationship always holds:

(4) $PV(A_R) = RV(R_O).$

It follows that

(5) $PV(D) = PV(A_O) - \left[PV(B) + PV(FIT)\right]$

$= (EVA)_i - (EVL)_i$
$= CFS_i$

The relationship in formula 3, which includes reinvestment cash flows, will hold for any shareholder dividend policy and for any interest rate. The relationship in formula 5, however, holds only when the relationship in formula 4 is true. The equivalence between the present value of reinvestment cash flows and the cash reinvested holds only for the special case where interest rates remain level at the reinvestment rate. This explains why CFS computed with pretax discount rates was equal to the present value of shareholder dividends, whereas the equivalence did not hold for CFS computed with post-tax discount rates. On a post-tax basis, the required equivalence between the present value of reinvestment cash flows and the cash reinvested does not hold (unless the asset cash flows are tax-effected).

It is possible to illustrate the effect of considering reinvestment cash flows on the value of CFS. Table A2-10 shows the reinvestment cash flows associated with Example A used in the report, which assumes all earnings are immediately paid out as dividends.

TABLE A2-10

Reinvestment Cash Flows
Annual Shareholder Dividend Paid

Year	(Outflow) Net Cash Flow	(Inflow) Reinvestment Cash Flows	
		Interest	Principal
1	$130.00	$ 0.00	-
2	146.90	18.20	-
3	166.00	38.77	-
4	-	62.01	$442.90
PV-BFIT	$339.11	$76.88	$262.23
PV-AFIT	$372.14	$89.59	$315.52

At the time that an investment is made, the present value of future cash flows, computed at the reinvestment rate, by definition is equal to the cash invested. If these values are discounted to an earlier date, the equivalence will still hold. As can be seen from Table A2-11, this equivalence holds for present values computed at time 0 on a pretax basis—that is, the reinvestment rate—but not on a post-tax basis.

TABLE A2-11

Summary of Present Value of Reinvestment Cash Flows
Annual Shareholder Dividend

	BFIT Discount Rate	AFIT Discount Rate
Inflows		
Interest	$ 76.88	$ 89.59
Principal	262.23	315.52
Total	$ 339.11	$ 405.11
Outflows	$ 339.11	$ 372.14
Inflows-outflows	$ 0.00	$ 32.97

However, when the after-tax present value of the reinvestment cash flows is combined with the after-tax present value of the cash flows associated with the original assets and liabilities (see Table A2-2), the resultant present value is equal to the present value of shareholder dividends, as suggested from formula 3.

CFS-AT	("original" asset cash flows; Table A2-2)	$(8.38)
AFIT	(present value of "reinvestment" cash flows Table A2-11)	32.97
	Sum	$24.59
	CFS	$24.59

This demonstrates that CFS may be calculated without tax-effecting cash flows, provided that all reinvestment cash flows are taken into account.

Reinvestment cash flows are included in the model output for the various examples included in this appendix and it is easily demonstrated that by including reinvestment cash flows, it is possible to compute CFS without tax-effecting the cash flows.