Assessing the Profitability of Insurance Contracts subject to Swiss Solvency Test Capital Requirements

Paul Huber[1]

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1 Objective

This document illustrates how to calculate economic return on capital for insurance contracts subject to Swiss Solvency Test (SST) capital requirements using the cashflow approach. This approach ensures consistency across multiple valuation standards, provides built-in controls to improve accuracy, and avoids unnecessary circularities in the calculations. It also provides a financial market interpretation of the cost of capital rate used to determine risk margins and can be readily adapted to accommodate other capital or liquidity constraints, such as rating agency capital requirements or statutory capital restrictions. The cashflow approach highlights that an insurer's accounting policy is not relevant for assessing economic value, but its dividend restrictions and investment policy are. Insurers can leverage their investment position through investing funds backing insurance contracts and the value of this leverage to shareholders improves profitability, all else remaining equal. However, taking investment risk also increases tax frictions on the marginal additional capital requirements accompanying this risk.

The cashflow approach is illustrated by way of a simplified example. Section 2 introduces the cashflow approach assuming no investment risk is taken by the insurer. The valuation assumptions for the simplified example are first outlined and then used to determine the total amount of investments needed to support the contract. This information is then used to construct a cashflow statement, which is used as the basis for assessing profitability. The cashflow statement is also used in section 3 to construct balance sheets and income statements based on economic, SST, Solvency II, and statutory accounting standards. This confirms the accuracy of the calculations and illustrates that the accounting standard merely determines how quickly earning are released; the more conservative the accounting standard, the slower earnings are released and the higher the return on

[1] Contact information for correspondence: paul_huber@swissre.com. This paper was prepared by the author in his personal capacity. The opinions expressed in this paper are my own and do not necessarily reflect the view of Swiss Re.

equity. Furthermore, this comparison demonstrates that the 6% cost of capital rate used in SST and Solvency II are not comparable and neither are comparable with an insurers equity cost of capital. Section 4 extends the example to show the impact of taking investment risk. This explains how insurers can improve profitability, and leverage return on equity, by taking investment risk.

2 Cashflow approach to valuation

2.1 Valuation assumptions

This section describes the insurance contract used to illustrate the cashflow approach to valuation. The underwriting assumptions are shown in the table below. Expenses include commission of 10% of premiums, administrative expenses of 1% of claims, and investment expenses of 0.05% of investments. These cashflows are assumed to occur at the end of the year. Initial statutory, or tax, reserves are set to ensure zero profit at inception and then amortized in-line with nominal claims outstanding. The tax rate is assumed to be 20%.

Capital requirements are based on achieving a target SST ratio of 200%. SST risk capital, based on 99% one-year expected shortfall, is assumed to be 12% of discounted claims. For simplicity, this is assumed to apply to both first year and run-off capital requirements used to determine the SST market value margin (although allocated run-off capital requirements are typically higher than initial capital requirements due to less diversification in run-off). The market value margin is based on a pre-tax cost of capital rate of 6% per annum. It is assumed that the insurer does not take additional investment risk, it only replicates the insurance liability.

	Cashflows (end-of-year)			Balance sheet values (year-end)	
Year	**Premiums**	**Claims**	**Expenses**	**Tax reserve**	**SST capital**
0	100		-10.00	90.000	10.292
1		-33	-0.33	55.465	6.333
2		-18	-0.18	36.628	4.174
3		-11	-0.11	25.116	2.855
4		-8	-0.08	16.744	1.899
5		-5	-0.05	11.512	1.305
6		-4	-0.04	7.326	0.830
7		-3	-0.03	4.186	0.475
8		-2	-0.02	2.093	0.237
9		-1	-0.01	1.047	0.119
10		-1	-0.01		

The valuation rates are shown in the table below, which are used to derive discount factors for valuing cashflows. Risk-free discount factors after investment expenses incorporate a negative 5 basis point spread and are used to calculate the total investment requirement. Subordinated debt is included to illustrate both the flexibility and the precision of the cashflow approach. When assessing the profitability of insurance contracts, post-tax frictional capital costs are assumed to be 500 basis points, reflecting the return over risk-free that shareholders require to incentivise them to commit equity capital to the insurer. This rate is the subject of much discussion and controversy. From a finance theory perspective, it does not represent a risk premium as the underlying insurance risk is idiosyncratic and can be diversified by shareholders. This rate rather represents a charge for financial frictions (other than tax) covering agency costs, financial distress costs, and costs associated with potential regulatory restrictions on capital repatriation (see Bergesio et al 2019). The weighted average capital cost discount factor assumes that 25% of underwriting capital is backed by subordinated debt, charged at the after-tax subordinate debt rate, and the balance by equity capital, charged at the risk-free rate plus frictional cost spread. This means that the frictional tax cost on the risk-free return on economic capital only applies to equity capital; it does not apply to capital backed by subordinate debt, as interest expenses are tax deductible.

	Spot rates (basis points)			Discount factors				
Year	**Risk-free**	**Sub-debt spread (pre-tax)**	**Frictional cost**	**Risk-free**	**Risk-free (after expenses)**	**Sub-debt (post-tax)**	**Frictional costs**	**Weighted average capital cost**
0				1.000	1.000	1.000	1.000	1.000
1	1	300	500	1.000	1.000	0.976	0.952	0.958
2	1	300	500	1.000	1.001	0.954	0.907	0.918
3	2	300	500	0.999	1.001	0.931	0.863	0.880
4	5	300	500	0.998	1.000	0.908	0.821	0.842
5	10	300	500	0.995	0.998	0.885	0.780	0.805
6	15	300	500	0.991	0.994	0.861	0.740	0.768
7	20	300	500	0.986	0.990	0.838	0.701	0.733
8	25	300	500	0.980	0.984	0.814	0.664	0.698
9	30	300	500	0.973	0.978	0.791	0.628	0.665
10	35	300	500	0.966	0.970	0.768	0.594	0.633

2.2 Investment requirement based on SST

These assumptions are first used to determine the investments needed to maintain a 200% target SST ratio. This calculation is illustrated in the table below based on the following steps:

a. The best estimate value of the liabilities equals the value of the outstanding net underwriting cashflows discounted at risk-free rates. This calculation initially excludes investment expenses as the total investment amount has not yet been determined.

b. The SST market value margin equals 6% of the value of the outstanding run-off capital requirements (not including the current year) discounted at risk-free rates.

c. The target SST capital requirement is 200% of current year SST risk capital.

d. The investment cashflows before investment expenses equal the investment requirement before investment expenses (equal to the sum of the previous three elements, namely best estimate liability, market value margin, target capital requirement) at the start of the year accumulated at the risk-free forward rate, minus, the corresponding asset requirement at the end of the year.

e. The total asset requirement is then equal to the present value of the outstanding investment cashflows before investment expenses discounted at risk-free rates after investment expenses.

Year	Best estimate liability (pre-investment expenses)	Market value margin	Target SST capital requirement	Investment cashflows (pre-investment expenses)	SST 200% investment requirement
0	86.625	1.092	20.584		108.451
1	53.304	0.712	12.666	41.630	66.778
2	35.129	0.461	8.348	22.750	44.000
3	24.033	0.290	5.711	13.921	30.075
4	15.987	0.177	3.799	10.114	19.988
5	10.985	0.099	2.610	6.328	13.710
6	6.989	0.049	1.661	5.050	8.708
7	3.994	0.021	0.949	3.778	4.969
8	1.998	0.007	0.475	2.514	2.482
9	1.002	0.000	0.238	1.257	1.241
10				1.250	

2.3 Cashflow statement

The above inputs are then used to construct a cashflow statement for the contract, which is illustrated in the table below. This is calculated based on the following steps:

a. Underwriting cashflows, commission, and administrative expenses are derived from the inputs.

b. Investment expenses are 0.05% of the investment requirement at the start of the year.

c. Tax is 20% of statutory income, which is equal to premiums plus investment income less claims, expenses, and change in statutory reserves. The tax calculation initially excludes interest expenses, as the subordinate debt amounts have not yet been determined.

d. The investment cashflow at inception is minus the initial required investments. Investment cashflows in subsequent years equal the required investments at the start of the year accumulated at the projected forward rate of return on the investments less the required investments at the end of the year (or investment income plus release of investment requirements). In this case, the return on investments is the risk-free forward rate.

e. Capital cashflows are the residual, ensuring the cashflow statement balances. The capital cashflows need to be funded by equity or subordinate debt, negative amounts are akin to dividends or subordinate debt payments and positive amounts to capital contributions or the proceeds from subordinate debt issuance.

Year	Underwriting cashflows	Other expenses	Investment expenses	Tax cashflows	Investment cashflows	Capital cashflows
0	100	-10.000		0.000	-108.451	18.451
1	-33	-0.330	-0.054	-0.232	41.684	-8.068
2	-18	-0.180	-0.033	-0.126	22.784	-4.444
3	-11	-0.110	-0.022	-0.079	13.943	-2.732
4	-8	-0.080	-0.015	-0.064	10.129	-1.970
5	-5	-0.050	-0.010	-0.047	6.338	-1.232
6	-4	-0.040	-0.007	-0.039	5.057	-0.971
7	-3	-0.030	-0.004	-0.030	3.783	-0.719
8	-2	-0.020	-0.002	-0.020	2.517	-0.474
9	-1	-0.010	-0.001	-0.011	1.258	-0.237
10	-1	-0.010	-0.001	-0.009	1.251	-0.231

2.4 Assessing economic profit

The internal rate of return of the capital cashflows shown in the above cashflow statement is 5.1%. To determine whether this is attractive it needs to be compared against the weighted average capital cost for this contract. This is achieved by decomposing the capital cashflows into a risk-free return, capital costs, principal amounts, and economic profit. This decomposition illustrated in the table below and calculated based on the following steps:

a. In total, principal amounts (subordinate debt and equity) equal the outstanding capital cashflows discounted at the weighted average cost of capital rate. This ensures that enough margin is

reserved to cover the interest expense on the subordinate debt and equity capital costs. Of the total principal, 25% is assumed to be funded by subordinated debt and the balance by equity.

b. The after-tax subordinate debt interest expense is equal to the forward after-tax subordinate debt rate multiplied by the principal amount of subordinate debt outstanding at the start of the year.

c. The risk-free return and frictional cost equal the forward risk-free and frictional cost spread rates multiplied by the outstanding equity capital at the start of the year.

d. Economic profit is the residual; negative values indicate a profit or payment to shareholders.

Year	Capital cashflows	Sub-debt (interest)	Sub-debt (principal)	Risk-free return	Frictional cost	Equity capital	Economic profit
0	18.451		4.693			14.079	-0.320
1	-8.068	-0.113	-1.812	-0.001	-0.704	-5.437	
2	-4.444	-0.069	-0.986	-0.001	-0.432	-2.957	
3	-2.732	-0.046	-0.600	-0.002	-0.284	-1.799	
4	-1.970	-0.033	-0.434	-0.005	-0.194	-1.303	
5	-1.232	-0.023	-0.268	-0.008	-0.129	-0.804	
6	-0.971	-0.016	-0.215	-0.007	-0.089	-0.644	
7	-0.719	-0.011	-0.161	-0.006	-0.057	-0.484	
8	-0.474	-0.006	-0.108	-0.004	-0.032	-0.324	
9	-0.237	-0.003	-0.054	-0.002	-0.016	-0.161	
10	-0.231	-0.002	-0.055	-0.001	-0.008	-0.165	

This decomposition implies that the 5.1% weighted average return on capital should be compared against a weighted average cost of capital of 4.4% (the internal rate of return on the capital cashflows excluding economic profit), which is comprised of a 2.5% after-tax subordinate debt cost and a 5.1% cost of equity capital. As a result, the economic profit of 0.320 corresponds to a 0.7% return on capital profit margin.

For comparison, the table below shows how the economic profit calculation would typically be presented. These values are determined by discounting at risk-free rates the relevant cashflows shown in the cashflow statement. Capital costs are the sum of frictional costs discounted at the risk-free rate and the difference between the market value and risk-free discounted value of the subordinated debt cashflows. This means that capital costs equal the difference between the initial capital requirement of 18.771 and the cost of replicating the subsequent capital cashflows (or their risk-free discounted value) of 21.021.

While this appears to be a more straightforward method of calculating economic profit, the problem is that an iterative approach is needed to calculate investment expenses, tax, and capital costs, as the investment and capital amounts are not known. In addition, there are no checks to ensure that tax and capital costs have been properly accounted for.

Premiums	100.000
Claims	-85.768
Expenses	-11.008
Taxation (before interest expenses)	-0.654
Economic earnings	2.570
Capital costs (post-tax)	-2.250
Economic profit	0.320

3 Alternative accounting statements

The above cashflow statement can be used to compute financial statements for any accounting standard. This allows contracts to be assessed from multiple accounting perspectives on a consistent basis (reflecting the same underlying capital requirement). The financial statements also provide a check on the results, as they need to balance and the change in equity balances from one year to the next need to equal earnings plus cashflows to shareholders. This highlights that the 6% cost of capital rate used in SST is not equivalent to either the 6% rate used in Solvency II nor the cost of equity capital spread over risk-free (see Huber and Kinrade 2018).

3.1 Economic financial statements

The economic financial statements are provided in the tables below. Following the Solvency II approach, deferred tax balances equal the tax rate multiplied by the difference between the statutory reserves and best estimate liabilities plus capital cost margin, where the capital cost margin is reported on a before-tax basis (divided by one minus the tax rate). Double tax balances are equal to the present value of tax on risk-free investment returns on statutory capital, or the difference between total investments and statutory reserves. An alternative, more intuitive, representation would be to calculate a total tax liability based on the present value of expected future tax payments and calculate the frictional capital cost margin on an after-tax basis.

In the economic income statement, interest expenses are shown pre-tax and tax is reduced by these expenses. This confirms that initial economic earnings equal economic profit and subsequent earnings equal frictional costs plus the risk-free return on equity capital.

Economic balance sheet

Year	Investments	Best-estimate liability	Deferred tax	Double tax	Capital cost margin	Subordinate debt	Economic equity
0	108.451	-86.775	-0.082	-0.009	-2.813	-4.693	-14.079
1	66.778	-53.400	-0.055	-0.009	-1.792	-2.881	-8.642
2	44.000	-35.192	-0.054	-0.009	-1.166	-1.895	-5.685
3	30.075	-24.074	-0.058	-0.008	-0.755	-1.295	-3.886
4	19.988	-16.012	-0.051	-0.007	-0.474	-0.861	-2.582
5	13.710	-11.000	-0.044	-0.005	-0.289	-0.593	-1.778
6	8.708	-6.998	-0.033	-0.003	-0.162	-0.378	-1.134
7	4.969	-3.998	-0.021	-0.002	-0.081	-0.216	-0.649
8	2.482	-2.000	-0.012	-0.001	-0.035	-0.109	-0.326
9	1.241	-1.003	-0.006	0.000	-0.012	-0.055	-0.165
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Economic income statement

Year	Client cashflows	Expenses	Reserve release	Investment income	Interest expense	Tax	Economic earnings
0	100.000	-10.000	-89.680			0.000	0.320
1	-33.000	-0.384	34.424	0.011	-0.141	-0.204	0.705
2	-18.000	-0.213	18.835	0.007	-0.087	-0.109	0.433
3	-11.000	-0.132	11.526	0.018	-0.058	-0.068	0.287
4	-8.000	-0.095	8.349	0.042	-0.041	-0.056	0.200
5	-5.000	-0.060	5.206	0.060	-0.028	-0.041	0.137
6	-4.000	-0.047	4.143	0.055	-0.020	-0.035	0.096
7	-3.000	-0.034	3.093	0.044	-0.013	-0.027	0.062
8	-2.000	-0.022	2.055	0.030	-0.008	-0.019	0.036
9	-1.000	-0.011	1.026	0.017	-0.004	-0.010	0.019
10	-1.000	-0.011	1.021	0.010	-0.002	-0.009	0.010

3.2 SST financial statements

The following tables show the SST financial statements. Subordinate debt plus SST equity capital equals 200% of SST risk capital. Also, from the first year onwards, SST earnings before interest expenses and tax equal the risk-free return on total capital (200% of SST risk capital at the start of the year) plus 6% of SST risk capital at the end of the year. This is because SST capital is calculated before-tax, and the SST market value margin does not cover current year capital costs and is based on minimum, rather than target, capital requirements. As a result, the total earnings of 2.305 are released more quickly in the SST income statement and even become negative in the later years as

SST does not reserve for tax costs. This indicates that SST is less conservative than economic for this simplified example; a frictional capital cost spread of only 24 basis points would equate initial economic and SST capital.

SST balance sheet

Year	Investments	Best-estimate liability	Market value margin	Subordinate debt	SST equity
0	108.451	-86.775	-1.092	-4.693	-15.891
1	66.778	-53.400	-0.712	-2.881	-9.786
2	44.000	-35.192	-0.461	-1.895	-6.453
3	30.075	-24.074	-0.290	-1.295	-4.416
4	19.988	-16.012	-0.177	-0.861	-2.938
5	13.710	-11.000	-0.099	-0.593	-2.018
6	8.708	-6.998	-0.049	-0.378	-1.283
7	4.969	-3.998	-0.021	-0.216	-0.733
8	2.482	-2.000	-0.007	-0.109	-0.366
9	1.241	-1.003	0.000	-0.055	-0.183
10					

SST income statement

Year	Client cashflows	Expenses	Reserve release	Investment income	Interest expense	Tax	SST earnings
0	100.000	-10.000	-87.867			0.000	2.133
1	-33.000	-0.384	33.755	0.011	-0.141	-0.204	0.037
2	-18.000	-0.213	18.458	0.007	-0.087	-0.109	0.056
3	-11.000	-0.132	11.289	0.018	-0.058	-0.068	0.049
4	-8.000	-0.095	8.175	0.042	-0.041	-0.056	0.026
5	-5.000	-0.060	5.090	0.060	-0.028	-0.041	0.020
6	-4.000	-0.047	4.052	0.055	-0.020	-0.035	0.005
7	-3.000	-0.034	3.028	0.044	-0.013	-0.027	-0.004
8	-2.000	-0.022	2.013	0.030	-0.008	-0.019	-0.006
9	-1.000	-0.011	1.004	0.017	-0.004	-0.010	-0.003
10	-1.000	-0.011	1.003	0.010	-0.002	-0.009	-0.009

3.3 Solvency II financial statements

The next set of tables show comparable Solvency II financial statements. For simplicity is has been assumed that the Solvency II solvency capital requirement is equal to the SST risk capital requirement (SST is typically higher as it is based on 99% expected shortfall, while Solvency II is

based on 99.5% value at risk). The Solvency II risk margin is also based on a 6% cost of capital rate on minimum capital requirements, but it allows for current year capital costs. Solvency II allows for deferred tax based on the difference between statutory reserves, and the best estimate liability value plus the risk margin. Solvency II equity is the balancing item.

Solvency II balance sheet

Year	Investments	Best-estimate liability	Deferred tax	Risk margin	Subordinate debt	Solvency II equity
0	108.451	-86.775	-0.303	-1.709	-4.693	-14.971
1	66.778	-53.400	-0.195	-1.092	-2.881	-9.211
2	44.000	-35.192	-0.145	-0.712	-1.895	-6.057
3	30.075	-24.074	-0.116	-0.462	-1.295	-4.128
4	19.988	-16.012	-0.088	-0.291	-0.861	-2.736
5	13.710	-11.000	-0.067	-0.177	-0.593	-1.873
6	8.708	-6.998	-0.046	-0.099	-0.378	-1.187
7	4.969	-3.998	-0.028	-0.050	-0.216	-0.676
8	2.482	-2.000	-0.014	-0.021	-0.109	-0.338
9	1.241	-1.003	-0.007	-0.007	-0.055	-0.169
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Solvency II income statement

Year	Client cashflows	Expenses	Reserve release	Investment income	Interest expense	Tax	Solvency II earnings
0	100.000	-10.000	-88.787			0.000	1.213
1	-33.000	-0.384	34.101	0.011	-0.141	-0.204	0.383
2	-18.000	-0.213	18.638	0.007	-0.087	-0.109	0.236
3	-11.000	-0.132	11.397	0.018	-0.058	-0.068	0.157
4	-8.000	-0.095	8.260	0.042	-0.041	-0.056	0.111
5	-5.000	-0.060	5.147	0.060	-0.028	-0.041	0.078
6	-4.000	-0.047	4.102	0.055	-0.020	-0.035	0.055
7	-3.000	-0.034	3.067	0.044	-0.013	-0.027	0.036
8	-2.000	-0.022	2.040	0.030	-0.008	-0.019	0.021
9	-1.000	-0.011	1.018	0.017	-0.004	-0.010	0.011
10	-1.000	-0.011	1.017	0.010	-0.002	-0.009	0.006

Note that from the first year onwards, Solvency II earnings before interest expenses equal the risk-free return on total capital, plus 4.8% (6% multiplied by one minus the tax rate) of the solvency capital requirement at the start of the year accumulated to the end of the year, less tax on the risk-free return on investments in excess of statutory reserves. This means that the 6% Solvency II

capital cost rate is not comparable to either the 6% SST capital cost rate nor the equity cost of capital of insurers (for this example, a 255 basis point economic frictional capital cost would equate initial economic and Solvency II capital). While total earnings are also 2.305, they are released more slowly in the Solvency II income statement than SST, but more quickly than economic.

3.4 Statutory financial statements

The next set of tables show the statutory financial statements. For simplicity, it is assumed that investments are held at market value. Statutory equity is the balancing item.

Statutory balance sheet

Year	Investments	Statutory reserves	Subordinated debt	Statutory equity
0	108.451	-90.000	-4.693	-13.758
1	66.778	-55.465	-2.881	-8.432
2	44.000	-36.628	-1.895	-5.478
3	30.075	-25.116	-1.295	-3.663
4	19.988	-16.744	-0.861	-2.383
5	13.710	-11.512	-0.593	-1.605
6	8.708	-7.326	-0.378	-1.004
7	4.969	-4.186	-0.216	-0.566
8	2.482	-2.093	-0.109	-0.280
9	1.241	-1.047	-0.055	-0.139
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Statutory income statement

Year	Client cashflows	Expenses	Reserve release	Investment income	Interest expense	Tax	Statutory earnings
0	100.000	-10.000	-90.000			0.000	0.000
1	-33.000	-0.384	34.535	0.011	-0.141	-0.204	0.816
2	-18.000	-0.213	18.837	0.007	-0.087	-0.109	0.435
3	-11.000	-0.132	11.512	0.018	-0.058	-0.068	0.272
4	-8.000	-0.095	8.372	0.042	-0.041	-0.056	0.223
5	-5.000	-0.060	5.233	0.060	-0.028	-0.041	0.163
6	-4.000	-0.047	4.186	0.055	-0.020	-0.035	0.139
7	-3.000	-0.034	3.140	0.044	-0.013	-0.027	0.108
8	-2.000	-0.022	2.093	0.030	-0.008	-0.019	0.074
9	-1.000	-0.011	1.047	0.017	-0.004	-0.010	0.039
10	-1.000	-0.011	1.047	0.010	-0.002	-0.009	0.035

Total statutory earnings are also 2.305, but are released more slowly than economic, Solvency II, and SST earnings. A consequence of this is that statutory equity is lower, as the dividends or capital contributions are independent of the accounting standard. As a result, the more conservative the accounting standard, the slower the release of earnings, and the higher the reported return on equity. In this example, the average return on equity for the statutory accounts (sum of projected statutory equity divided by sum of projected statutory earnings) is 6.2%, compared to 5.9% for the economic accounts, 5.2% for SST, and 5.6% for Solvency II. However, this is irrelevant for assessing profitability, as the shareholder cashflows (capital contributions and dividends) are always the same; meaning that constraints on dividend policy are more important determinants of profitability.

4 Impact of taking investment risk

This section illustrates the impact of taking investment risk on profitability. In principle, taking investment risk should not impact economic profitability; the cost of capital should increase to offset the additional expected investment return to compensate shareholders for the additional financial market risk taken.

However, there are two considerations that may impact profitability. Firstly, taking additional risk may increase capital requirements, which increases tax costs on the risk-free return on equity capital. Shareholders need to be compensated for this tax cost to ensure they are indifferent between taking investment risk via an insurance company or directly in financial markets. Secondly, shareholders would incur funding costs on the insurance liabilities if they invested in a comparable leveraged investment vehicle. These costs would correspond to the value shareholders derive from their option to default if investment losses exceed the available equity capital. As insurance markets are competitive, insurers are motivated to credit these costs to policyholders.

As a result, liability funding costs should depend on the level security provided to policyholders. If the liabilities are unsecured then they should be comparable to the senior debt spreads of the insurer. To the extent that they are collateralised or protected by regulation, for example via tied-asset requirements, then they should reflect secured funding costs (for example the cost of repurchase agreements). This is appropriate as shareholders would incur the cost of forced investment liquidations by supervisors to eliminate investment risk if minimum capital requirements were not met. Moreover, it ensures symmetry between insurance and reinsurance contract valuation as the liability funding credits correspond to allowing for credit risk on reinsurance contracts.

An alternative justification for such a funding credit, used in IFRS 17 (which does not allow for own credit risk), is that it reflects a margin for the illiquidity of insurance liabilities, which depends on the stability of the underlying insurance cashflows. It is typically assumed that if the insurance cashflows are highly predictable then the illiquidity margin should be comparable to equivalent margins derived from corporate bond spreads. The main difficulty with this justification is that illiquidity margins are independent of the level of security provided to policyholders. However, if the insurance liabilities were effectively secured then the investment illiquidity risk would be borne by shareholders and the leverage would have less value.

4.1 Additional valuation assumptions

To illustrate the impact of taking investment risk on profitability, the example in section 2 is extended by assuming that the insurer invests in a portfolio of corporate bonds with benchmark spot rate spreads shown in the table below. The marginal additional SST risk capital requirement for taking this risk is assumed to be 3% of total investments, and these additional capital requirements are assumed to be backed by equity capital only. The table also shows liability funding cost spreads and corresponding after-tax funding cost discount factors (as interest expenses are tax deductible).

	Spot rates (basis points)			Discount factors	
Year	**Risk-free**	**Funding cost spread**	**Benchmark spread**	**Funding cost (post-tax)**	**Investment return**
0				1.000	1.000
1	1	35	150	0.997	0.985
2	1	38	155	0.994	0.970
3	2	41	160	0.990	0.953
4	5	44	165	0.984	0.935
5	10	47	170	0.978	0.915
6	15	50	175	0.969	0.893
7	20	53	180	0.960	0.871
8	25	56	185	0.950	0.847
9	30	59	190	0.938	0.822
10	35	62	195	0.926	0.797

4.2 Cashflow statement including investment risk

Based on these assumptions, the revised cashflow statement is provided below. Compared to the cashflow statement in section 2.3, the investment amounts have been scaled-up by 6% (reflecting the 3% marginal increase in SST risk capital and 200% SST capital ratio target) and the investment and tax cashflows reflect the higher investment returns. Investment expenses have not been

increased despite the higher investment volumes, as the benchmark investment return is assumed to be after the additional investment expenses. This means that economic profit on investment activities is measured by comparing actual against benchmark investment returns less total investment expenses minus investment expenses allocated to insurance contracts. As before, the capital cashflows are the balancing item.

Year	Underwriting cashflows	Other expenses	Investment expenses	Tax cashflows	Investment cashflows	Capital cashflows
0	100	-10.000		0.000	-115.373	25.373
1	-33	-0.330	-0.054	-0.579	46.076	-12.113
2	-18	-0.180	-0.033	-0.354	25.375	-6.808
3	-11	-0.110	-0.022	-0.239	15.629	-4.258
4	-8	-0.080	-0.015	-0.180	11.352	-3.077
5	-5	-0.050	-0.010	-0.128	7.147	-1.959
6	-4	-0.040	-0.007	-0.098	5.671	-1.527
7	-3	-0.030	-0.004	-0.069	4.219	-1.115
8	-2	-0.020	-0.002	-0.044	2.794	-0.728
9	-1	-0.010	-0.001	-0.023	1.399	-0.365
10	-1	-0.010	-0.001	-0.016	1.362	-0.336

4.3 Impact of investment risk on economic profit

To determine whether the internal rate of return on the capital cashflows shown in the previous table of 9.7% is attractive, it needs to be compared against the weighted average capital cost taking financial market risk into account. This is calculated by firstly separating the capital cashflows into investment and underwriting capital cashflows.

The investment capital cashflows are shown in the table below and equal the sum of:

a. Principal or equity capital cashflows, which are the change in marginal additional equity capital requirements supporting investment risk (or 6% of total investments).

b. Risk-free return on outstanding equity capital at the start of the year.

c. Market risk premium, or compensation to shareholders for investment risk, which equals the difference between the benchmark and replicating portfolio (assumed to be risk-free) return on total investments. This premium is after-tax, as the investment risk that shareholders are effectively exposed to is reduced due to tax (alternatively, the replicating portfolio for tax on the market risk premium is a fraction, the tax rate, of the investment portfolio).

d. Liability funding costs, which equal the forward after-tax funding cost spread over risk-free multiplied by the funding provided by policyholders. Policyholder funding equals the value of claims less premiums discounted at the liability funding cost rate, subject to a maximum of zero. This means that liability funding credits only apply to insurance liabilities; if the contract were an asset, then its value would instead allow for credit default or lapse risk. The impact of this on economic profit is equivalent to valuing the client cashflows at the after-tax funding cost rate.

Year	Investment capital cashflows	Risk-free (investment capital)	Market risk premium (post-tax)	Liability funding cost	Equity (investment)
0	6.922				6.922
1	-3.809	-0.001	-1.384	0.236	-2.660
2	-2.193	0.000	-0.909	0.170	-1.454
3	-1.400	-0.001	-0.637	0.127	-0.889
4	-1.014	-0.003	-0.461	0.093	-0.644
5	-0.663	-0.004	-0.323	0.065	-0.401
6	-0.509	-0.004	-0.233	0.047	-0.319
7	-0.365	-0.003	-0.156	0.032	-0.239
8	-0.234	-0.002	-0.093	0.019	-0.159
9	-0.119	-0.001	-0.049	0.010	-0.079
10	-0.100	-0.001	-0.025	0.005	-0.079

The underwriting capital cashflows are then equal to the total minus investment capital cashflows. These cashflows are decomposed in the table below into a risk-free return, capital costs, principal amounts, and economic profit, using the approach in section 2.4.

Year	Underwriting capital cashflows	Sub-debt (interest)	Sub-debt (principal)	Risk-free return	Frictional cost	Equity (underwriting)	Economic profit
0	18.451		4.869			14.607	-1.026
1	-8.304	-0.117	-1.864	-0.001	-0.730	-5.591	
2	-4.614	-0.072	-1.023	-0.001	-0.451	-3.068	
3	-2.858	-0.048	-0.628	-0.002	-0.297	-1.883	
4	-2.063	-0.034	-0.455	-0.006	-0.203	-1.365	
5	-1.296	-0.024	-0.282	-0.008	-0.135	-0.846	
6	-1.018	-0.017	-0.225	-0.007	-0.093	-0.676	
7	-0.750	-0.011	-0.169	-0.006	-0.059	-0.506	
8	-0.493	-0.006	-0.112	-0.004	-0.034	-0.337	
9	-0.247	-0.003	-0.056	-0.002	-0.017	-0.168	
10	-0.236	-0.002	-0.056	-0.001	-0.008	-0.169	

As a result, the 9.7% return on capital should be compared against a weighted average cost of capital of 8.0%, which is comprised of a 2.5% after-tax subordinate debt cost and 9.2% equity capital cost after investment risk. The equity capital cost for investment activities is 17.7%, reflecting the benchmark return on marginal capital requirements supporting investment risk, and the equity capital cost for underwriting activities is 5.1%. The 1.8% profit margin corresponds to economic profit of 1.026. This highlights the adjustments needed when comparing the equity cost of capital with the frictional capital cost rate (see Huber and Kinrade 2018).

In this example, taking investment risk improves profitability as the value of the liability funding margin to shareholders more than compensates for the additional tax costs on the marginal additional capital requirements. This outcome depends on several factors; for example, if the risk-free rate was assumed to be 2%, and all other assumptions remained unchanged, then the additional tax cost would exceed the liability funding margin.

In conclusion, this paper provides a robust and flexible framework for assessing the economic profitability of insurance contracts and for understanding the circumstances in which taking investment risk improves profitability, as opposed to merely increasing return on equity by leveraging investment returns.

Literature

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