Basic Reinsurance Accounting—Selected Topics

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CAS Study Note

The purpose of this study note is to educate actuaries on certain basic reinsurance accounting topics that may be omitted in other syllabus readings. Specifically, this study note provides examples of how ceded reinsurance impacts an insurer's financial statements and key financial metrics.

Ceded Reinsurance Impact on Financial Statements

The book "Reinsurance Principles and Practices" by Connor Harrison lists the following six principal functions of reinsurance.

1. Increase large line capacity
2. Provide catastrophe protection
3. Stabilize loss experience
4. Provide surplus relief
5. Facilitate withdrawal from a market segment
6. Provide underwriting guidance

This paper will give an example of each of these types of reinsurance, and examine the impact to the ceding company on the following:

- Surplus
- Loss reserves
- Unearned Premiums
- Leverage ratios
- Income statement

The financial statements shown in the examples follow the SAP convention of offsetting ceded liabilities against gross liabilities.

1. Increase large line capacity

This example deals with the situation where a company is only willing to expose itself to a certain amount of loss per policy, but portions of its potential market demand greater coverage.

Beginning Assumptions (the "Without" column):

- XYZ insurance company writes homeowners insurance. It is unable or unwilling to write policies for homes with insured values over $500,000 without a suitable reinsurance program.
- XYZ writes $1 million of annual premium for this market, in a steady state with a level premium volume. The loss ratio is 75%. The only expense is commissions, which equal 20% of premium.
- Loss reserves = $750,000 and surplus = $1.5 million. Since XYZ is in a steady state, reserves and surplus are constant throughout the year.
- XYZ holds cash equal to 10% of gross loss reserves, agent balances equal to 10% of premium, and the remainder of its assets in bonds. The bonds and cash earn investment income at a rate of 5%.
- There are no income taxes.

Altered Assumptions (the "With" column):

- XYZ buys a "surplus share" pro rata reinsurance treaty that cedes premiums and losses for higher valued homes, with the ceding percentage for each policy equal to the excess of the home value over $500,000 divided by the total home value. (For example, for a home worth $625,000, the ceded percentage would be 125/625, or 20%.)
- This is the only reinsurance purchased by XYZ.
- The altered assumptions again reflect level premium volume and a steady state, in which XYZ has been writing identical business over a period of years.

- With access to the higher-value market, XYZ writes 40% more business and achieves $1.4 million in gross written premium. However under the treaties it cedes $300,000 of premium.
- The loss ratio remains 75% on both net and ceded business. However reserves increase relative to loss, because claims on more expensive properties take longer to develop.
- The expense ratio remains 20% of net written premium. The reinsurer pays a ceding commission to compensate for commissions on ceded business, so there is no net additional commission on ceded premium.
- Agent balances remain equal to 10% of premium, of which a portion, equal to the percent of premium ceded, is due to the reinsurer.
- We arbitrarily assume only a small increase in surplus, matching the increase in current year income.

Example 1			
XYZ Insurance Company			
Impact of Large Line Capacity Treaty			
Balance Sheet	Without	With	Difference
Assets			
Bonds	2,575	2,662	87
Cash	75	113	38
Agents Balances	100	140	40
Total	2,750	2,915	165
Liabilities			
Loss Reserves			
Gross	750	1,125	375
Ceded	0	300	300
Net	750	825	75
Unearned Premiums			
Gross	500	700	200
Ceded	0	150	150
Net	500	550	50
Ceded Agents Balances	0	30	30
Total	1,250	1,405	155
Surplus	1,500	1,510	10
Income Statement			
Earned Premium			
Gross	1,000	1,400	400
Ceded	0	300	300
Net	1,000	1,100	100
Incurred Losses			
Gross	750	1,050	300
Ceded	0	225	225
Net	750	825	75
Expenses	200	220	20
Underwriting Income	50	55	5
Investment Income	133	139	6
Total Income	183	194	11
Written Premiums			
Gross	1,000	1,400	400
Ceded	0	300	300
Net	1,000	1,100	100
Other Financial Statistics			
Gross WP/Surplus	67%	93%	26%
Net WP/Surplus	67%	73%	6%
Gross Loss Reserves/Surplus	50%	75%	25%
Net Loss Reserves/Surplus	50%	55%	5%
Ceded Reserves/Surplus	0%	30%	30%

Analysis of impact (from Exhibit 1)

- Surplus – We assumed no impact on surplus other than earnings on additional business opportunities. In reality, given the additional premium and reserves and reinsurance collectability risk, the ceding company may desire (or be forced to) hold more surplus to support these greater risks. Alternatively, it could decide to reduce volume to retain the same level of surplus relative to risk.
- Loss reserves – Both gross and net loss reserves increase, partly due to increased premium volume and partly due to the nature of new business being pursued, with slower development on larger claims.
- Unearned Premiums – increase, but remain the same in proportion to premium
- Leverage ratios – Net leverage ratios increase slightly because of the change in business model. Gross leverage ratios begin to differ materially from the net leverage ratios, and reinsurance leverage becomes important due to the purchase of reinsurance.
- Income statement – Little changed on a net basis, but over time the riskier book and changing cost of reinsurance may introduce greater volatility.

2. Provide Catastrophe Protection

This example deals with the situation where the company desires to reduce its potential loss from a catastrophic event.

Beginning Assumptions (the "Without" columns):

- ABC insurance company is in the same situation as XYZ insurance company in Exhibit 1, prior to the purchase of reinsurance. Hence, the "without" column in Exhibit 1 also applies to Exhibit 2, unless a catastrophe event occurs.
- If a cat event occurs, ABC incurs an additional $500,000 in loss, of which $50,000 is paid by the end of the year and the remainder is reserved.

Altered Assumptions (the "With" columns):

- ABC buys a catastrophe treaty on January 1st, for 5% of gross premium, that pays for losses from a single event in excess of 10% of premium. This premium is payable at the start of the year. *(Note that this assumption leaves zero ceded unearned at December 31st. Ceded unearned would be greater than zero if the ceded reinsurance policy term had not yet expired.)*
- This is the only reinsurance purchased by ABC.
- If a cat event occurs, ABC incurs an additional $500,000 in loss. This activates the cat treaty and the reinsurer assumes responsibility for the excess of event losses over 10% of premium, or $500,000 minus $100,000 = $400,000. Non-cat loss levels are unaffected by this event.
- Once again only 10% of the cat losses are paid by year-end, with the rest paid the following year. Note that the reinsurer does not begin paying until paid losses exceed 10% of premium, so the entire $400,000 of ceded loss is ceded reserve.
- The cat treaty has a mandatory reinstatement premium provision, with the reinstatement premium due once the cat treaty attachment is reached on a paid basis. This reinstatement premium charge is 2% of gross premium.
- The only surplus change is due to the change in underwriting results.

		No Cat Event			Cat Event		
Example 2							
ABC Insurance Company							
Impact of Cat Treaty							
Balance Sheet		No Cat Event			Cat Event		
		Without	With	Difference	Without	With	Difference
Assets							
Bonds		2,575	2,525	(50)	2,480	2,430	(50)
Cash		75	75	-	120	120	-
Agents Balances		100	100	-	100	100	-
Total		2,750	2,700	(50)	2,700	2,650	(50)
Liabilities							
Loss Reserves							
	Gross	750	750	-	1,200	1,200	-
	Ceded	0	0	-	0	400	400
	Net	750	750	-	1,200	800	(400)
Unearned Premiums							
	Gross	500	500	-	500	500	-
	Ceded	0	0	-	0	0	-
	Net	500	500	-	500	500	-
Ceded Agents Balances		0	0	-	0	20	20
Total		1,250	1,250	-	1,700	1,320	(380)
Surplus		1,500	1,450	(50)	1,000	1,330	330
Income Statement							
Earned Premium							
	Gross	1,000	1,000	-	1,000	1,000	-
	Ceded	0	50	50	0	70	70
	Net	1,000	950	(50)	1,000	930	(70)
Incurred Losses							
	Gross	750	750	-	1,250	1,250	-
	Ceded	0	0	-	0	400	400
	Net	750	750	-	1,250	850	(400)
Expenses		200	200	-	200	200	-
Underwriting Income		50	-	(50)	(450)	(120)	330
Investment Income		133	130	(3)	130	128	(3)
Total Income		183	130	(53)	(320)	8	328
Written Premiums							
	Gross	1,000	1,000	-	1,000	1,000	-
	Ceded	0	50	50	0	70	70
	Net	1,000	950	(50)	1,000	930	(70)
Other Financial Statistics							
Gross WP/Surplus		67%	69%	2%	100%	75%	-25%
Net WP/Surplus		67%	66%	-1%	100%	70%	-30%
Gross Loss Reserves/Surplu		50%	52%	2%	120%	90%	-30%
Net Loss Reserves/Surplus		50%	52%	2%	120%	60%	-60%
Ceded Reserves/Surplus		0%	0%	0%	0%	30%	30%

Analysis of impact (from Example 2)

- Surplus – Buying the cat reinsurance decreases surplus if no cat event occurs, due to the cost of reinsurance. But it can substantially mitigate the risk of significant drops in surplus if large cats occur. Note that the cost of the reinsurance in the event of a cat includes both the original premium and the reinstatement premium.
- Loss reserves – Net reserves are not impacted unless a covered cat event occurs. In that case, gross loss reserves can increase significantly for a relatively short period of time (i.e., the length of the cat payout pattern). Net reserves will return to normal levels sooner than gross reserves, as the retained portion of the cat is generally paid first before the ceded portion of the cat.
- Unearned Premiums – Little to no change (depending on the cat reinsurance policy term and accounting date), as cat reinsurance is normally a limited portion of total premium.
- Leverage ratios – If no cat event occurs, the biggest impact may be from reduced surplus in the denominator of many leverage ratios. If a cat does occur, then gross ratios and net ratios are significantly impacted without the reinsurance, while only the gross ratios are significantly impacted with the reinsurance (with the exception of ceded reinsurance leverage ratios). In general, ceded reinsurance leverage (i.e., ceded balances[1] as a percent of surplus) can be significantly impacted in the period after a major cat, prior to the runoff of the resulting cat loss reserves.
- Income statement – Investment income is reduced by purchasing reinsurance. But underwriting income is substantially protected, with the loss limited to the original ceded premium, plus the retention and reinstatement premium if a covered cat occurs. (This assumes that the cat stays within the maximum limit of the cat reinsurance program.)

3. **Stabilize loss experience**

This example deals with the situation where loss experience may fluctuate from year to year more than management desires. Management desire may in turn be driven by capital provider demands, or management may wish to simplify the capital management process (including the determination of shareholder dividends).

Beginning Assumptions (the "Without" columns):

- DEF insurance company is in the same situation as XYZ insurance company in Exhibit 1, prior to the purchase of reinsurance. The "normal losses without" column reflects a "normal" loss year with a loss ratio of 75%, as per Exhibit 1.
- However, this example also recognizes the possibility that a "high" loss year may occur, with a loss ratio of 125%. If a high loss year occurs, DEF incurs an additional $500,000 in loss, of which $50,000 is paid by the end of the year and the remainder is reserved.

Altered Assumptions (the "With" columns):

- DEF buys an aggregate excess of loss treaty for the entire book on January 1st, for 10% of gross premium, that returns 90% of losses above a loss ratio of 100%. The reinsurance premium is payable at the start of the year. *(Note that this assumption results in zero ceded unearned at December 31st. Ceded unearned would be greater than zero if the ceded reinsurance policy term had not yet expired.)*
- This is the only reinsurance purchased by DEF.
- In the high loss example, DEF incurs an additional $500,000 in loss for a loss ratio of 125%. This activates the aggregate excess treaty and the reinsurer assumes responsibility for 90% of losses above a loss ratio of 100%, or ($1,250,000 minus $1,000,000) * 90% = $225,000.

[1] Ceded balances are those balance sheet values arising from ceded reinsurance. In the above examples, they include ceded loss reserves and ceded unearned premiums. In a real-life example, they would also include reinsurance recoverables from amounts billed but not yet collected.

- Once again only 10% of the additional losses (over and above “normal” losses) are paid by year-end, with the rest paid the following year. Note that the reinsurer does not begin paying until paid losses exceed 100% of premium, so the entire $225,000 of ceded loss is ceded reserve.
- The only surplus change is due to the change in underwriting results.

Example 3							
DEF Insurance Company							
Impact of Aggregate Excess Treaty							
Balance Sheet		Normal Losses			High Losses		
		Without	With	Difference	Without	With	Difference
Assets							
Bonds		2,575	2,475	(100)	2,480	2,380	(100)
Cash		75	75	-	120	120	-
Agents Balances		100	100	-	100	100	-
Total		2,750	2,650	(100)	2,700	2,600	(100)
Liabilities							
Loss Reserves							
	Gross	750	750	-	1,200	1,200	-
	Ceded	0	0	-	0	225	225
	Net	750	750	-	1,200	975	(225)
Unearned Premiums							
	Gross	500	500	-	500	500	-
	Ceded	0	0	-	0	0	-
	Net	500	500	-	500	500	-
Ceded Agents Balances		0	0	-	0	0	-
Total		1,250	1,250	-	1,700	1,475	(225)
Surplus		1,500	1,400	(100)	1,000	1,125	125
Income Statement							
Earned Premium							
	Gross	1,000	1,000	-	1,000	1,000	-
	Ceded	0	100	100	0	100	100
	Net	1,000	900	(100)	1,000	900	(100)
Incurred Losses							
	Gross	750	750	-	1,250	1,250	-
	Ceded	0	0	-	0	225	225
	Net	750	750	-	1,250	1,025	(225)
Expenses		200	200	-	200	200	-
Underwriting Income		50	(50)	(100)	(450)	(325)	125
Investment Income		133	128	(5)	130	125	(5)
Total Income		183	78	(105)	(320)	(200)	120
Written Premiums							
	Gross	1,000	1,000	-	1,000	1,000	-
	Ceded	0	50	50	0	70	70
	Net	1,000	950	(50)	1,000	930	(70)
Other Financial Statistics							
Gross WP/Surplus		67%	71%	5%	100%	89%	-11%
Net WP/Surplus		67%	68%	1%	100%	83%	-17%
Gross Loss Reserves/Surplu		50%	54%	4%	120%	107%	-13%
Net Loss Reserves/Surplus		50%	54%	4%	120%	87%	-33%
Ceded Reserves/Surplus		0%	0%	0%	0%	20%	20%

Analysis of impact (from Example 3)

- Surplus – The expected value of surplus is lower after buying reinsurance, but with less period-to-period variation. The reduction is caused by the expected net cost of reinsurance. Note that while the ***expected*** impact of surplus is a reduction, the impact from year to year may vary between reductions and increases as gross losses are lower or higher than expected.
- Loss reserves – Stabilizing loss experience net of reinsurance generally translates into stabilizing net of reinsurance loss reserves. Gross reserves reflect the full volatility of year-to-year results, but net reserves should be smaller and more stable. (They may also be easier to estimate, as the situations that cause loss experience to fluctuate may also cause claim liability estimation to be more difficult.)
- Unearned Premiums – Reduced on a net basis due to the purchase of reinsurance, unless (as in our example) the reinsurance is purchased with a single effective date and the accounting date being used is the reinsurance expiration date.
- Leverage ratios – These ratios on a net basis should be more stable but slightly higher (due to reduced surplus), assuming there is a positive net cost of the reinsurance.
- Income statement – Underwriting results over time would be expected to be lower, due to the net cost of the reinsurance, and investment income would be lower. But the underwriting results from year-to-year should be more stable.

4. Provide surplus relief

This reinsurance deals with the situation where leverage ratios are higher than desired. Reinsurance is therefore purchased with the intent of reducing leverage ratios net of reinsurance.

Beginning Assumptions (the "Without" column):

- XYZ insurance company here is in the same situation as XYZ insurance company in Exhibit 1 prior to the purchase of reinsurance, except that it has fewer bonds and therefore only has $500,000 in surplus.

Altered Assumptions (the "With" column):

- XYZ buys reinsurance with a 50% quota share, in order to reduce its net premium to surplus and net reserves to surplus leverage ratios. This is a straight quota share, with 50% of premiums and losses ceded, with a ceding commission of 20% (consistent with the gross expense ratio).
- This is the only reinsurance purchased by XYZ.
- The altered assumptions once again reflect a steady state with consistent gross and ceded premium from year to year.
- The only surplus change is due to the change in underwriting and investment income during the year.

Example 4			
XYZ Insurance Company			
Impact of Quota Share Treaty			
Balance Sheet	Without	With	Difference
Assets			
Bonds	1,575	943	(632)
Cash	75	75	-
Agents Balances	100	100	-
Total	1,750	1,118	(632)
Liabilities			
Loss Reserves			
Gross	750	750	-
Ceded	0	375	375
Net	750	375	(375)
Unearned Premiums			
Gross	500	500	-
Ceded	0	250	250
Net	500	250	(250)
Ceded Agents Balances	0	50	50
Total	1,250	675	(575)
Surplus	500	443	(57)
Income Statement			
Earned Premium			
Gross	1,000	1,000	-
Ceded	0	500	500
Net	1,000	500	(500)
Incurred Losses			
Gross	750	750	-
Ceded	0	375	375
Net	750	375	(375)
Expenses	200	100	(100)
Underwriting Income	50	25	(25)
Investment Income	83	51	(32)
Total Income	133	76	(57)
Written Premiums			
Gross	1,000	1,000	-
Ceded	0	500	500
Net	1,000	500	(500)
Other Financial Statistics			
Gross WP/Surplus	200%	226%	26%
Net WP/Surplus	200%	113%	-87%
Gross Loss Reserves/Surplus	150%	169%	19%
Net Loss Reserves/Surplus	150%	85%	-65%
Ceded Reserves/Surplus	0%	141%	141%

Analysis of impact (from Example 4)

- Surplus – Liabilities decrease because half of the losses and unearned premium are ceded, but assets decrease because of the cost of the reinsurance. The net effect in our example is a small decline in surplus, since the ceded business was profitable. This quota share reinsurance would only increase surplus if the business was being written at a loss.
- Loss reserves – Net reserves are a fixed percentage of gross reserves.
- Unearned Premiums – Net reserves are a fixed percentage of gross reserves.
- Leverage ratios – Net leverage ratios are significantly improved, although ceded reinsurance leverage ratios are significantly increased. Hence, the insurer's solvency becomes more reliant on its reinsurers' solvency. Note that ceding half the gross business does not halve the net leverage ratios, due to the impact of the cession on surplus. While premiums and loss reserves drop in half, surplus does not stay constant. Hence, a cession of more than 50% would be required to obtain a 50% reduction in net premium and reserve ratios to surplus.
- Income statement – Underwriting income is cut in half, and investment income is significantly reduced.

5. Facilitate withdrawal from a market segment

This example deals with the situation where management wants to exit a market, and is not willing to wait until the runoff of existing obligations.

Beginning Assumptions (the "Beginning Balance" and "Without" columns):

- XYZ insurance company here is in the same situation as XYZ insurance company in Exhibit 1 except that it stopped writing new business at the beginning of the current year. The beginning balances come from Exhibit 1, "without" column.
- Written premium for the current year therefore drops to zero. XYZ continues to earn premium, and incur losses, on business written during the prior year.
- The accounting paradigm does not recognize Deferred Acquisition Costs, so XYZ incurs a zero expense ratio on runoff earned premium.
- XYZ earns investment income on the average of beginning and ending cash and bonds.
- All loss reserves as of the beginning of the year (for events occurring in earlier years) are closed and paid at the reserve amount before the end of the year.
- Half of all losses occurring during the year are paid by the end of the year.
- Surplus changes, during the year, only due to underwriting and investment income.

Altered Assumptions (the "With" column):

- XYZ buys prospective reinsurance on January 1st to cede 100% of the remaining unearned premium, and all losses occurring after the beginning of the year. A ceding commission is included to cover the commission portion of the unearned premium, which XYZ paid during the previous year.
- XYZ does not buy retroactive reinsurance. Once again all loss reserves as of the beginning of the year (for events occurring in earlier years) are closed and paid by XYZ at the reserve amount before the end of the year.
- Surplus changes, during the year, only due to underwriting and investment income.

Note: This example assumes withdrawal from all business. These results would need to be combined with results from ongoing businesses to see the combined balance sheet and income statement impact.

Example 5					
XYZ Insurance Company					
Impact of Prospective Reinsurance Treaty					
Balance Sheet		Beginning Balances:	Ending Balances Without:	Ending Balances With:	Difference
Assets					
Bonds		2,575	1,908	1,690	(218)
Cash		75	19	19	-
Agents Balances		100	-	-	-
Total		2,750	1,927	1,709	(218)
Liabilities					
Loss Reserves					
	Gross	750	188	188	-
	Ceded	0	0	188	188
	Net	750	188	-	(188)
Unearned Premiums					
	Gross	500	-	-	-
	Ceded	0	-	-	-
	Net	500	-	-	-
Ceded Agents Balances		0	-	-	-
Total		1,250	188	-	(188)
Surplus		1,500	1,739	1,709	(30)
Income Statement					
Earned Premium					
	Gross		500	500	-
	Ceded		0	500	500
	Net		500	-	(500)
Incurred Losses					
	Gross		375	375	-
	Ceded		0	375	375
	Net		375	-	(375)
Expenses			-	(100)	(100)
Underwriting Income			125	100	(25)
Investment Income			114	109	(5)
Total Income			239	209	(30)
Written Premiums					
	Gross		-	-	-
	Ceded		-	-	-
	Net		-	-	-
Other Financial Statistics					
Gross WP/Surplus			0%	0%	0%
Net WP/Surplus			0%	0%	0%
Gross Loss Reserves/Surplus			11%	11%	0%
Net Loss Reserves/Surplus			11%	0%	-11%
Ceded Reserves/Surplus			0%	11%	11%

Analysis of Impact (from Example 5)

- Surplus – Liabilities decline to zero as losses and unearned premium are ceded, but assets decrease because of the cost of the reinsurance. The net effect, once again, is a small decline in surplus, since the ceded business was profitable. However surplus will be less volatile if there are unexpectedly large or small losses during the runoff year.
- Loss reserves – Gross reserves are unchanged, but net reserves disappear, hence exposure to the volatility of net reserve estimates disappears.
- Unearned Premiums – Gross reserves disappear over the year as the business runs off. Net reserves disappear immediately when the unearned premium is ceded.
- Leverage ratios – Net leverage ratios are zero, hence the only remaining insurance risk is reinsurance collectability risk. Hence, surplus that was supporting the runoff business should now be free to support existing or new business, subject to supporting the residual reinsurance collectability risk.
- Income statement – Underwriting results reflect a profit because the ceding commission offsets expenses which were paid the previous year. This profit is slightly smaller than if the business had not been ceded. However the risk in the results is now greatly reduced (and limited to the risk in reinsurance collectability and in investment results).

6. Provide underwriting guidance

This reinsurance function arises in the situation where management wishes to enter a new market, or believes that it must be in one market to support another of its markets, but does not feel comfortable with its expertise in that new market. It therefore heavily reinsures its writings in that new market, relying on the reinsurer's expertise in pricing and underwriting that market correctly.

No numeric example will be provided for this situation. It is conceptually equivalent to Exhibit 1 wherein reinsurance creates new business opportunities for the insurer. The impact on surplus and income will depend on the profitability and volume (after reinsurance cessions) of the new business.