Duration Coinsurance

The use of reinsurance to manage ALM risk in emerging markets

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Introduction

In emerging markets like the Caribbean and Latin America, implementation of the concepts of Asset Liability Management (ALM) for insurance obligations are difficult due to the limitations of the financial markets in these regions.

In particular the scarcity of long term fixed income assets and the lack of an efficient equity market (e.g. lack of volume, or too much volatility), means that long term obligations cannot be managed in the same manner as in the large mature financial markets of North America or Europe.

Due to the dearth of matching assets, Insurers that reside and invest in these emerging financial markets must value their long-term obligations at very low discount rates. Though warranted, this conservatism represents a significant investment of capital, and inefficient use of resources. Also some of these insurance operations are small and resources are limited. Therefore there is a need to seek more efficient methods of investing capital.

This paper explores a reinsurance contract devised to allocate the ALM risk of long duration insurance contracts between the insurer that resides in an emerging market, and the reinsurers that have access to large efficient financial markets in North America or Europe.

In particular this paper introduces the concept of **duration tranches** for an insurance block of business. From which the term **duration coinsurance** is coined to describe a coinsurance agreement that transfers the risk of a duration tranche from the insurer to the reinsurer.

While the author is a practitioner in the Caribbean region, the concept is one that can be applied to other emerging markets, such as Latin America, India, China or wherever a free market economy is young and financial markets are inefficient and/or extremely volatile.

Objectives

This paper explores a new concept, which I have called, Duration Coinsurance. The objective of this reinsurance contract is to better align the ALM capabilities of the contract's parties to their investment capacity and/or expertise.

 An insurer in an emerging market is faced with either small or very volatile financial markets. In these regions the stock market comprise of mostly companies that are small cap growth companies. In the Caribbean and Latin America region there are small island economies or large economies in perennial recessions. And in the Pacific Rim the economic slowdown is ongoing. In these volatile markets neither borrowers nor lenders are willing to take a very long-term view. Therefore an insurer with very long-term liability exposure has the unenviable problem of securing assets to hedge its obligations.

In the more mature markets of North America and Europe, in which Reinsurance practice is well established, the financial markets are less volatile and long-term fixed income securities are available. For example there exists a liquid 30-year Treasury bond market in the United States.

The highly capitalized reinsurer that resides and invests in these mature financial markets is better able to secure the matching assets for insurance obligations of a very long-term nature.

Therefore the basic goal would be to cede to the reinsurer the liabilities associated with the much later durations of an insurance block, and for the insurer to maintain the short to medium term liabilities that can be better managed in the higher new money rate environment of an emerging market.

The Duration Tranche

The basic objective can only be achieved if there is agreement between the insurer and reinsurer of which risks are being transferred.

This requires a definition of the duration tranche.

The duration tranche is defined here as the projected or estimated liability cash flows of the base insurance contract (or block or cohort) for some particular contract durations (either by policy year or calendar year). For example the short-term duration tranche might encompass the policy year durations 0-10. Another duration tranche may consider the liability cash flows from calendar year durations 10-15.

The distinction between calendar year and policy year is key. Note that a policy year (0-10) duration tranche will diminish with the passage of time (5 years into the agreement only policy years 5-10 remain): whereas a calendar year (0-10) duration tranche obligation will remain constant (calendar years 0-10 at the start of every year of the contract).

The basic idea is that the insurer and reinsurer(s) will need to agree upon which duration tranche(s) their respective investment departments can best manage through their available financial markets.

In the example of an insurer resident in an emerging market, the short to medium term calendar year duration tranche may be the only one that can be properly matched by available assets. And as discussed above, the well- capitalized reinsurer in a developed market may be competent in finding matching assets for the obligations of the very long-term calendar year duration tranche.

The Duration Coinsurance Concept

Now the Duration Coinsurance concept can be defined with reference to the duration tranche.

In the case of one insurer and one reinsurer, the total liability obligation will be divided into two duration tranches. The two parties will agree upon a quota share of the base insurance contract premium that will be apportioned to pay for their respective obligations. A first year allowance may also be used to meet any expense requirements of the insurer.

The agreement may be either for calendar year duration or policy year duration. In the case whereby the insurer has assumed the early calendar years' duration tranche, the insurer will automatically recapture a year of the business each year until there will be no reinsured amounts. In this case a decreasing quota share percentage might be considered, but is not strictly necessary if the first year allowance is set accordingly.

Both the insurer and reinsurer will hold reserves, and the backing assets, to secure their duration tranche liability. At every anniversary the reinsurer will pay (receive) to (from) the insurer the decrease (increase) in its Present Value of its assumed Obligation (PVO). A decrease in the reinsurer's PVO implies risk recapture. An increase in the PVO implies additional risk have been ceded.

The contract will require an interest rate to calculate the change in the reinsurer's PVO. This interest rate will be derived from a recognizable index – for example 30-Year US Treasury Bond rate for the long-term duration tranche, or LIBOR for the short-term duration tranche – for the duration tranche that is ceded to the reinsurer. This interest rate is known as the **reference rate**.

The reference rate is on the one hand the pricing benchmark for the reinsurer; on the other hand it's the yield on the pseudo asset in which the insurer has invested to support the ceded liabilities.

The other risks of mortality and lapsation can also be transferred in this agreement. In the case of full transfer of these risks, the parties agree upon the mortality and lapse assumption in the reinsurer's PVO, and each year the reinsurer will pay to the insurer the amount of the release in PVO for the mortality and lapse components irrespective of actual experience.

The concept can be extended to as many tranches as there are reinsurers (or other insurers) that are willing to accept the liability risk, if a reinsurer has a perceived competence in investing at certain duration horizons. The insurer is willing to cede a duration tranche if that investment opportunity is not available in its home market, or that there is a perceived lack of competence in investing at these duration horizons.

ALM concept

The ALM concept of duration and partial duration matching is well documented in the Actuarial literature, and is in practice in most jurisdictions.

In fact the author sees the annual payment, due to the change in the reinsurer's PVO, from the reinsurer as a natural consequence of the rebalancing that is required to maintain a good match of its obligation. And likewise the insurer that receives this payment should have a ready strategy to invest the funds to keep its own asset liability match.

The duration coinsurance agreement works to create a greater focus on ALM and on duration matching. The insurer and reinsurers will seek to assume only those obligations for which they can find matching assets, or where there is a competence in managing any mismatch positions.

Indirectly the duration coinsurance agreement is creating a more secure asset liability match, therefore some of the PfAD for interest mismatch risk and/or required capital that would otherwise be held can be released.

In the case of the insurer resident in an emerging market, the C3 risk of the long duration asset can be relaxed, since this risk has been ceded to the reinsurer.

In this way both the insurer and reinsurer can operate in their comfort zone, whilst at the same time providing a more secure product for the insured.

The concept can naturally be extended to interest sensitive liability cash flows that require standard derivative instruments readily available in mature financial markets. But this paper will concentrate on fixed income assets backing a single premium immediate term certain annuity.

Duration Coinsurance Example

To demonstrate the value of a duration coinsurance agreement, consider a Single Premium Immediate Annuity, and specifically a 20-year Term Certain annuity. The single premium will remove any concern of how to apportion future premiums. Also the use of a non-contingent annuity will remove the lapse and mortality components. Hence the focus is squarely on the use of reinsurance to manage the mismatch risk.

In this example consider the following Product description:

- Premium Mode: Single Premium.

- Annuity income: Immediate and paid annually.

- Premium Load: 6% covers all expense cost, both acquisition and maintenance.

- The policy block pays 10,000 annual income.

The following are the pricing considerations:

- A flat pricing interest rate of 7% is used.

- The insurer bases the quote on a backing asset of an 8.50% 5-year PAR bond, since this is the predominant investment term in its financial market.

- The bond yield at maturity rollover is assumed to earn 1.0% lower; this results in a declining best estimate investment yield assumption.

- The reserve PfAD for interest is 0.75% off the best estimate investment yield; therefore the reserve interest rate is also a declining scale.

- The total MCCSR requirement is estimated to be 6% of the reserve. And required surplus held is 175% of MCCSR.

- The cost of capital or hurdle rate is 15%.

The reinsurer's specifics are:

- The reinsurer's share of the single premium is 33%

- The long-term asset available to the reinsurer (but not available in the insurer's financial market) is the 25-year PAR Bond (or MBS) that yields 7.0%.

- The reinsurer seeks a 0.25% spread as the cost for the duration coinsurance contract. Therefore the contract reference rate is 6.75%.

- The reinsurer agrees to invest for the liability obligations occurring after the 10th calendar year duration tranche (which means the reinsurance will fall off in 10 years).

- For analysis, effective duration is measured using a 7.0% discount rate.

Reinsurer's Obligation

The reinsurer is responsible for investing its portion of the premium to match the specific duration tranche. The reinsurer offers its investment capability at a cost, which is the spread, and contractually grants the insurer the reference rate as the yield.

At each year-end, the reinsurer pays the decrease in the present value of its duration tranche liability (PVO). In this example, its PVO starts with income payments 11-20: after one policy year, its PVO is based on income payments 12-20: and so on. Therefore the PVO decrease is divestment of a portion of the asset matched position, until after 10 years, the reinsurer is no longer involved.

The reinsurer's reserve is its PVO, and hence it pays both the interest earned (at the reference rate), and the year-to-year change in reserve to the insurer.

Insurer's Obligation

The insurer is obligated to invest its portion of the premium to match its own duration tranche. Hopefully this is the duration tranche that the insurer has competence with and is capable of managing. In this example it's the 0-10 calendar year duration tranche.

The insurer pays each year's annuity payment, and holds the actuarial reserve for the entire contract. The difference between the reserve with and without the duration coinsurance is the discount rates. Without reinsurance, the insurer uses its declining scale valuation interest rate as the discount. With reinsurance the reserve uses the reference rate as the discount rate on the portion of the liability that is obligated to the reinsurer for investing. The effect is a different pattern of reserves that hopefully releases reserve.

Basically the insurer has maintained the full liability, however it has two investment pools to back the liability. One pool is its own general fund, and the other is the reinsurer's asset pool accessed through the reinsurance contract.

SPIA Example – the numbers

Assumptions

I have created a policy year projection of the contract to demonstrate the reserve and required capital impact to the insurer of the reinsurance. In this way I demonstrate the cost of capital savings due to the duration coinsurance contract.

For the projection, I have assumed that the yield curve remains unchanged from year to year and hence the same investments are available each year. This means that the insurer's valuation interest rate remains unchanged from year to year, but maintains the declining scale at the point of each valuation due to the risk of reinvestment.

The insurer's valuation rate is a declining scale with each step being the length of the effective duration of the insurer's backing asset. Without reinsurance the effective duration is 4; therefore the valuation rate steps down every 4 years. With reinsurance the declining scale is applied to the un-ceded obligations, and the level reference rate is applied to the reinsured contract durations.

I also calculate the effective durations of the backing assets for both the insurer and the reinsurer. Again I demonstrate how the duration mismatch position has improved due to the duration coinsurance agreement. Without reinsurance the short-term asset is all that is available at the start of each year, so the mismatch position is evident. With reinsurance, a portion of the backing asset is invested in the longer assets of the reinsurer; therefore the overall duration match is improved.

Projection

Please refer to Appendix A for the policy year projection of the insurer's reserve with and without reinsurance.

The fourth column is the discount vector based on the insurer's declining valuation interest rate. The discount vector is applied to the payments to derive the reserve, in the fifth column, for each policy year. Required capital, the sixth column, is determined as a percentage of the reserve.

The difference between the discount vector with reinsurance, in the seventh column, and that in the fourth is that at the calendar year durations beyond 10 the discount is simply based on the reference rate in the contract. The hope is the reference rate is high enough that the long duration obligations have lower present value with reinsurance than without. In this example such is the case.

Therefore, the lower reserve and lower required capital will result in a savings in the amount of capital employed. The cost is evaluated at the hurdle rate, and is calculated by policy year until the end of the duration coinsurance contract and shown in the tenth column.

The eleventh column shows the portion of the assets, backing the insurer's reserve, which is invested with the reinsurer at the beginning of each year. The initial amount is 33% of the single premium; hence this is entered into the contract terms. The remaining columns show what amounts paid by the

reinsurer to the insurer at each year-end. These amounts consist of the agreed investment yield (reference rate) on the assets transferred and the unfolding of the reinsurer's obligation.

Please refer to Appendix B for the policy year effective durations for the liability and for both the insurer and reinsurer asset pools. The effective duration calculations (done at 7%, and a delta of 0.01%) illustrate the duration mismatch situation with and without reinsurance.

The insurer is assumed to have the same 5 year PAR bond available at the beginning of each year, therefore its general fund duration remains at 4 (the effective duration of the 5 year PAR bond) for the first 15 years and then grades down to zero as the contract unwinds (third column). This is the best duration match that's available to the insurer in its local financial markets.

However the annuity duration is initially 8 (second column). Now, consider the reinsurer. The reinsurer can source a 25 year PAR Bond (or MBS), which has an effective duration shown in the fourth column.

The duration coinsurance agreement apportions the base annuity contract into the insurer and reinsurer duration tranches, which have the effective durations of the fifth and sixth columns respectively.

Then finally the combined effective duration of the assets backing the insurer's liability with some portion "invested" with the reinsurer (seventh column).

Coinsurance versus YRT

In this example, I have shown a coinsurance agreement. By coinsurance I simply mean that the terms (namely, the reference rate) is set at the beginning and maintained throughout the duration of the contract. Therefore, the coinsurance arrangement envisages a buy and hold strategy for the reinsurer.

If however the reinsurer prefers an active strategy that is continually rebalanced, a Duration YRT agreement would be used. In the YRT contract, the reference rate would be set at the beginning of each year, based on what is then available to the reinsurer to hedge its liability obligation under the agreement. The concept otherwise is the same under either approach.

Currency Risk

The exchange of money between companies domicile in different regions of the globe means that the parties will need to consider the currency risk.

The party that assumes this risk must ensure that its benefit from the reinsurance agreement is more than either the cost of hedging or the loss due to reasonable fluctuations between the two currencies.

Summary of results

(1) The Insurer saves on the cost of capital required.
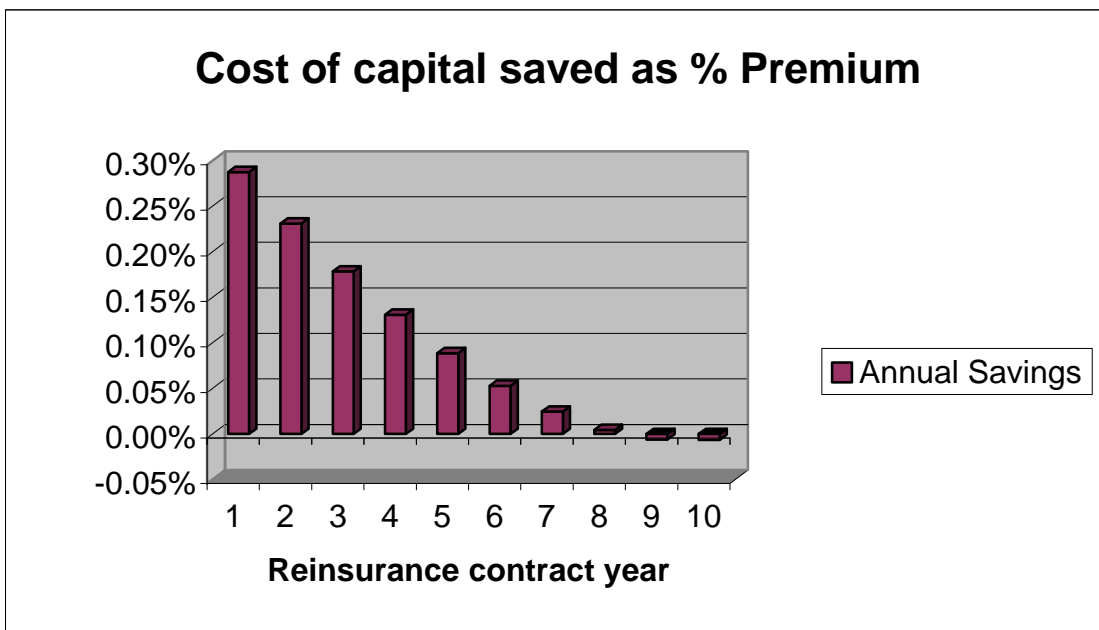
(2) The ALM mismatch position is much reduced.

Conclusion

This paper has explored a reinsurance agreement focused primarily on the Asset Liability mismatch position of insurers domiciled in developing markets.
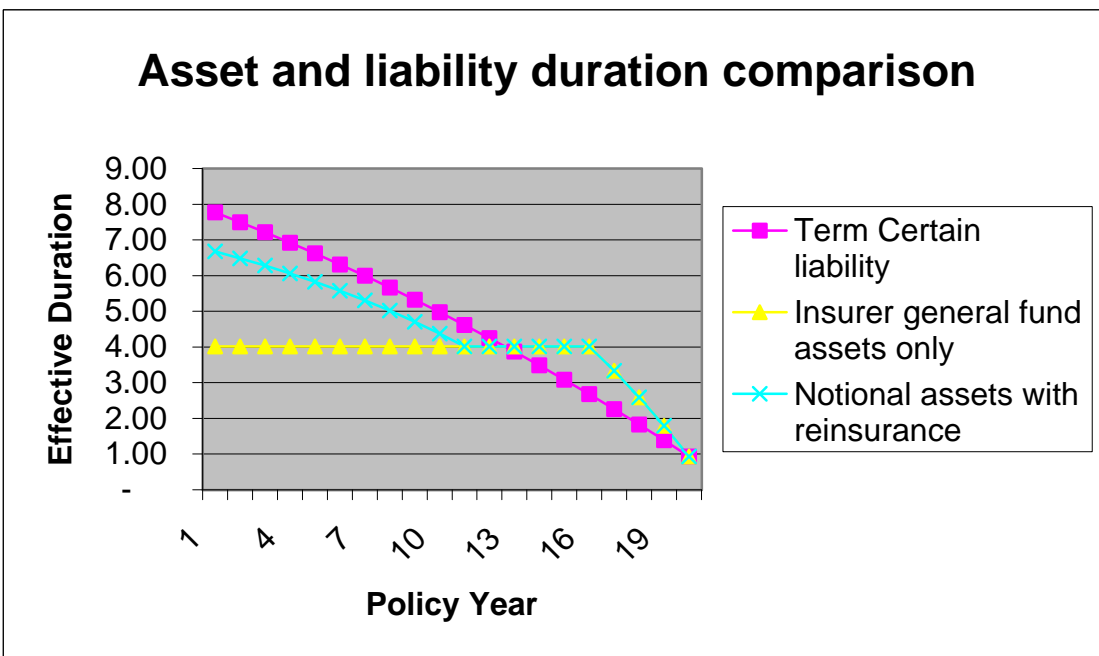
The financial markets of developing regions, like the Caribbean, Latin America and the Far East, are thin and/or volatile, and therefore long-term financial instruments are not as readily available as in North America or Europe.

The purpose of Duration Coinsurance is to create a reinsurance agreement that uses the broader financial asset pool of the reinsurer to support the insurer in its effort to better match its long-term obligations.

As demonstrated above, the result of duration coinsurance is two fold: (1) a reduction in reserve and capital requirements; and (2) a much improved Asset Liability duration match profile.

Whilst not considered in this paper, presumably this type of agreement should also reduce the risk based capital requirement factors of the insurer for two reasons: (1) the insurer's true C3 risk is much reduced due to the closer effective duration match of asset to liability, and (2) the C1 factor is also improved since a portion of assets are "backed" by a highly capitalized, likely AAA, multinational reinsurer, rather than invested in the debt of a small island nation or impoverished country.

There is however the added foreign currency risk which may render the agreement too costly or worse too risky. In the Caribbean, many of the small island nations have tied their currency to the United States dollar, and the largest industry (and foreign currency earner) is vacationers from the same United States. For this region, anyway, the foreign currency risk is manageable. In Latin America or Asia such may not be the case.

However, hopefully the discussion and analysis within demonstrates that this type of reinsurance is worth investigating for all insurers, domiciled in developing nations, which seek to fully utilize limited available capital and to better secure the obligations to their policyholders.

Appendix A: Policy year projection

Pol Year	End of Year Pmt	Valn Disc Rate	Present Value of 1	Beg.of yr. Insr.Resv. w/o Reins	Beg.of yr. Reqd.Cap. w/o Reins	Present Value w/ Reins	Beg.of yr. Insr.Resv. w/ Reins	Beg.of yr. Reqd.Cap. w/ Reins	Cost of Cap Saved	Asset with Reins	Pmt from 1. Cred Interest	Re to Ins 2. EOY Release
1	10000	7.75%	0.9281	108,012	11,341	0.9281	106,064	11,137	323	36,976	2,496	2,708
2	10000	7.75%	0.8613	104,920	11,017	0.8613	103,356	10,852	259	34,268	2,313	2,891
3	10000	7.75%	0.7994	101,674	10,676	0.7994	100,465	10,549	200	31,377	2,118	3,086
4	10000	7.75%	0.7419	98,265	10,318	0.7419	97,380	10,225	147	28,291	1,910	3,294
5	10000	6.75%	0.6950	94,686	9,942	0.6950	94,085	9,879	100	24,997	1,687	3,517
6	10000	6.75%	0.6510	90,928	9,547	0.6510	90,569	9,510	59	21,480	1,450	3,754
7	10000	6.75%	0.6099	86,982	9,133	0.6099	86,815	9,116	28	17,726	1,197	4,007
8	10000	6.75%	0.5713	82,838	8,698	0.5713	82,808	8,695	5	13,719	926	4,278
9	10000	5.75%	0.5402	78,488	8,241	0.5402	78,530	8,246	- 7	9,441	637	4,567
10	10000	5.75%	0.5109	73,919	7,762	0.5109	73,963	7,766	- 7	4,875	329	4,875
11	10000	5.75%	0.4831	69,089	7,254	0.4875	69,089	7,254	-	-	-	-
12	10000	5.75%	0.4568	63,980	6,718	0.4567	63,980	6,718	-	-	-	-
13	10000	5.00%	0.4351	58,578	6,151	0.4278	58,578	6,151	-	-	-	-
14	10000	5.00%	0.4143	52,865	5,551	0.4007	52,865	5,551	-	-	-	-
15	10000	5.00%	0.3946	46,766	4,910	0.3754	46,766	4,910	-	-	-	-
16	10000	5.00%	0.3758	40,256	4,227	0.3517	40,256	4,227	-	-	-	-
17	10000	5.00%	0.3579	33,306	3,497	0.3294	33,306	3,497	-	-	-	-
18	10000	5.00%	0.3409	25,888	2,718	0.3086	25,888	2,718	-	-	-	-
19	10000	5.00%	0.3246	17,894	1,879	0.2891	17,894	1,879	-	-	-	-
20	10000	5.00%	0.3092	9,281	974	0.2708	9,281	974	-	-	-	-

Appendix B: Policy year effective durations

Beg of Policy yr.	Base Ann Duration	Insurer Asset Durn	Reinsurer Asset Durn	NonReinsd Liab Durn	Reinsured Liab Durn	Combined Asst Durn
1	7.77	4.02	11.64	4.62	13.96	6.68
2	7.49	4.02	11.46	4.62	13.59	6.48
3	7.21	4.02	11.26	4.62	13.21	6.28
4	6.92	4.02	11.05	4.62	12.82	6.06
5	6.62	4.02	10.83	4.62	12.42	5.83
6	6.31	4.02	10.59	4.62	12.02	5.57
7	5.99	4.02	10.33	4.62	11.60	5.31
8	5.67	4.02	10.05	4.62	11.17	5.02
9	5.33	4.02	9.76	4.62	10.73	4.71
10	4.98	4.02	9.44	4.62	10.27	4.37
11	4.62	4.02	-	4.62	-	4.02
12	4.25	4.02	-	4.25	-	4.02
13	3.87	4.02	-	3.87	-	4.02
14	3.49	4.02	-	3.49	-	4.02
15	3.09	4.02	-	3.09	-	4.02
16	2.68	4.02	-	2.68	-	4.02
17	2.26	3.33	-	2.26	-	3.33
18	1.83	2.59	-	1.83	-	2.59
19	1.39	1.80	-	1.39	-	1.80
20	0.93	0.93	-	0.93	-	0.93