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MANAGING CAPITAL IN A SEA OF UNCERTAINTY: A GLOBAL VIEW OF CAPITAL AND ITS STRUCTURE UNDERPINNING CATASTROPHE RISK

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ABSTRACT

The paper begins by examining several alternatives for capital management available to a reinsurer; common equity, hybrid capital, retrocession by Quota Share or XOL covers, and cat bonds or sidecars. A real world procedure for choosing the optimum combination of these instruments is then outlined. In part 2, the impact of the global financial crisis on the availability of capital in different forms is discussed, and the competitive landscape reinsurers now face in the marketplace for capital is described. The paper closes by suggesting some future forms of underwriting capital.

INTRODUCTION

The global financial crisis has rapidly changed the landscape for reinsurance capital. Sophisticated reinsurers need to be able to access capital in both traditional and non-traditional markets, understanding the relative benefits and pricing of different methods of obtaining the capital needed to support their intended underwriting. With the common equity of many reinsurers trading below book value, merely relying on the stock market as a capital provider is no longer a viable strategy.

This paper describes a procedure for optimizing the balance sheet of a reinsurer given a universe of known capital alternatives and their pricing.

In the second section a practical overview of the capital marketplace as of mid -2009 is provided.

OPTIMIZATION OF REINSURANCE CAPITAL STRUCTURE

Types of Capital

For purposes of optimization, we look to forms of Underwriting Capital for reinsurers that are much broader than an accounting definition of capital. *Underwriting Capital is anything that allows a reinsurer to assume additional underwriting risk inwards.* Here we examine a reinsurer's choices between several sources of Underwriting Capital:[1]

- **Common Equity**
    - This is the one form of capital common to all reinsurers, and the most flexible, if often the most demanding. Whether it is expensive or cheap depends on the equity market's broad performance and the individual performance of the company's shares.
- **Senior Debt**
    - Senior Debt adds leverage to the returns but does not add to Underwriting Capital per se. This is because no rating agency or major regulator gives credit in

[1] This list is fairly broad but not exhaustive.

Underwriting Capital for senior debt, despite the fact that policyholder claims are senior to senior debt holders' claims. At typical pricing, Senior Debt will raise the mean of the outcomes, increase the variance of outcomes, and increase the probability of ruin. Because Senior Debt does not affect available Underwriting Capital, we will not discuss it further here.

- **Hybrid Capital: Preferred Equity or Subordinated Debt**

    - This is long term debt or non-participating preferred stock that has optionally- or mandatorily-deferrable coupon features, which activate in the event that the reinsurer has a financial problem. Depending on the exact terms typically most regulators and rating agencies consider it to be roughly halfway between equity and debt, and therefore the issuance of $1 of Hybrid Capital will add perhaps $0.50 to Underwriting Capital.[2] It will have the same impact on return streams as senior debt, but can leverage up returns on equity with moderate increases in volatility.

- **Retrocession by Quota Share**

    - QS retrocession is normally an annual contract providing for a ceding commission to cover the reinsurer's costs, and a profit commission to retain alignment. It can lower volatility and probability of ruin or can make allowances for additional growth and increase returns at similar levels of risk.

- **Retrocession by XOL purchase**

    - This normally moves the mean return lower, and lowers variance and probability of ruin.

- **CAT bonds or Sidecars**

    - Both CAT bonds and Sidecars are flexible structures that replicate traditional retrocession to a degree. Two features that are different are 1) Normally the risk is fully collateralized and 2) typically deals last for 2-3 years rather than one. CAT bonds also do not usually have reinstatement provisions. In general, we model typical sidecars as QS retrocession, and typical CAT bonds as XOL retrocession. One chooses these instead of traditional retro over 1) price, especially if the retrocession is deemed "cheap" and hence a multiyear deal is attractive or 2) to fully avoid credit risk.

    - Our DFA framework described herein, and the requirements of the various rating agencies and regulators, are built around one year simulations. Hence, for modeling purposes, the differences between the capital markets products and traditional retro largely disappear.

Choosing a Target and a Risk Measure

The first step in optimizing a portfolio is to choose a target metric and a risk measure. Most companies would formulate their optimization by saying we want to maximize some measure of success, subject to some constraint on risk.[3] Measures of success would include net income,

[2] See the rating agency frameworks referenced in the endnotes for a detailed perspective by agency. See also the Swiss Solvency Test reference.

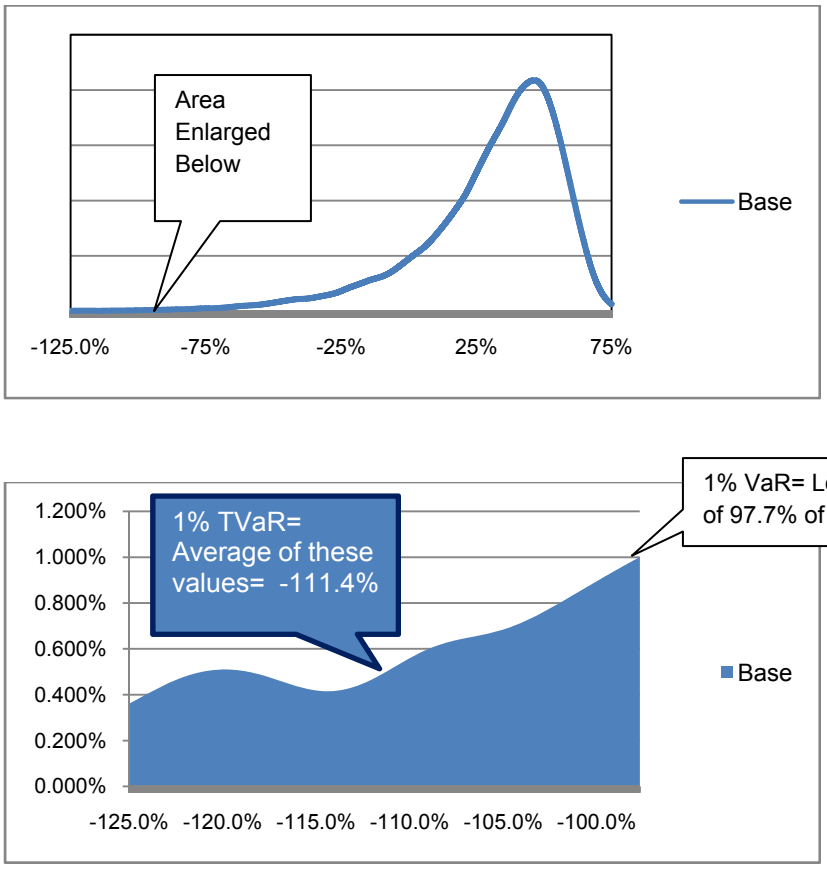
[3] One approach combines these two variables into one: the use of utility theory. This method combines all information about the shareholder's preferences for good and bad scenarios into one output, Expected

ROE, growth in book value per share, etc. Measures of risk might be a loss constraint ("we will lose money no more often than 10% of years") or a Value at Risk (VaR) for a year or for an event. Often these correspond to tests imposed by credit rating agencies, the de facto regulators of the global reinsurance market.

The well known AM Best BCAR model effectively is an event VaR on a portfolio of liabilities (coupled with a factor model for the assets and some other factors). Effectively, it takes the 100-year Per-occurrence (event) PML (or 99% Event VaR), twice, as a proxy for the worst year a reinsurer will have over many years.

Other rating agencies and regulators use annual aggregate Var or Tail VAR, (TVaR) measures. Tail VaR is the average of all outcomes that happen more rarely than a certain frequency, for example every 100 or 200 years. Figure 1 shows the difference between VaR and TVaR. Note that for the same percentile TVaR will always be ≥ VaR.

Figure 1: Difference between VaR and TVaR



Utility. The user then simply picks the portfolio with the maximum Expected Utility. The problems with this approach are that finding reasonable functional forms for the utility function, and calibrating them, are challenging tasks in the real world. I will not discuss this approach further in this paper.

Table 1: Different Frameworks and Risk Measures

Framework	Assets	Risk Measure	Percentile	Aggregate/Event
AM Best	Factor Model	VaR	1% (Storm)	Event x2
Fitch	In Simulation	TVaR	0.50%	Aggregate
Moody's	Factor Model	VaR	0.40%	Aggregate
S&P	Factor Model	VaR	0.40%	Aggregate
SST	In Simulation	TVaR	1.00%	Aggregate
Flagstone	In Simulation	TVaR	<35%, 1%	Aggregate

VaR effectively answers the question, “How often do we go broke?”. Because TVaR answers the question, “How often do we go broke, and on average how much does that cost the creditor or taxpayer?” it has generally been viewed as the superior measure when evaluating the risks to creditors and regulators. TVaR is the basis for solvency capital under Solvency II and the Swiss Solvency Test. These users apply it on an annual aggregate basis, and across the entire balance sheet of a firm, not just the liabilities. This approach is commonly called Dynamic Financial Analysis (DFA).
Because TVaR is the most popular overall, and the basis of our own DFA at Flagstone, I’ll show examples in this paper for a hypothetical firm that maximizes its mean ROE, while maintaining its compliance with a risk measure that states Underwriting Capital must be maintained at a level at least equal to 200-year (0.5%) TVaR. Underwriting Capital is here defined to be the book value of Common Shares outstanding plus 50% of any Hybrid Capital (Subordinated debt or Preferred Shares). This is a crude approximation of the available capital typically allowed in a rating agency/regulatory calculation of solvency. We assume Underwriting Capital of $1 billion.

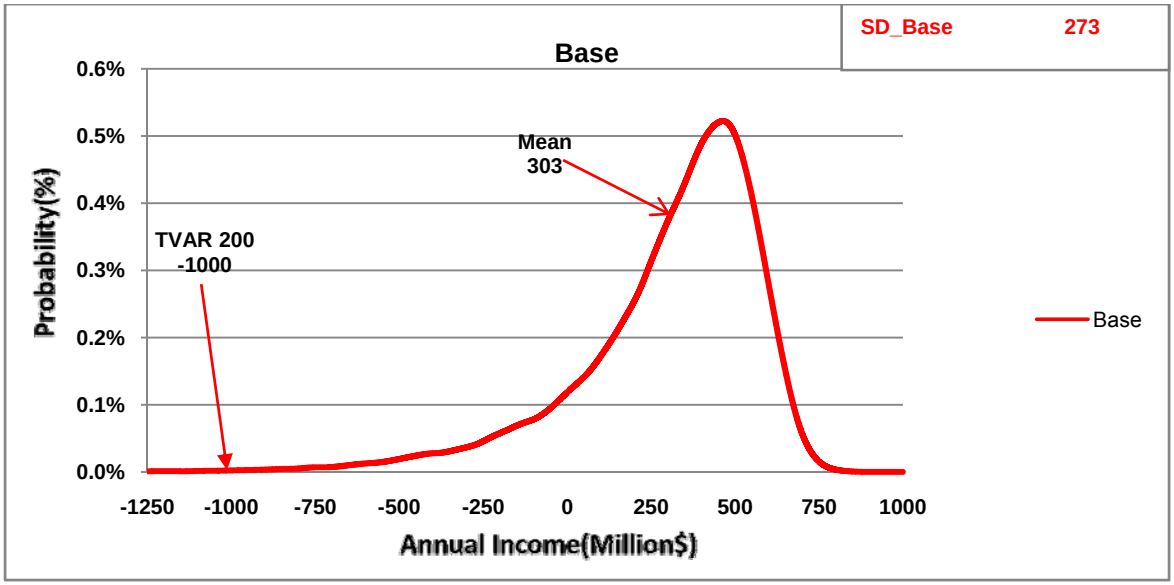
The conclusions would not change much if one used the VaR risk measure instead. Note that European Solvency II requirements broadly mirror the Swiss Solvency Test.

Note that the actual capital management must take into account all constraints, from internal risk measures, regulatory solvency tests, and rating agency tests. This presentation is therefore a simplified description of the process, and the process for any real company must take into account the regulatory environment it operates in, and which credit ratings agencies rate its claims-paying ability and debt, as well as internal descriptions of risk tolerance.

Baseline Firm

Figure 2 shows the distribution of Net Income for the baseline firm with $1 billion of Underwriting Capital, composed of all Common Equity. Note that it's 0.5% TVaR is $1 Billion (meaning it just complies with the requirement for the risk measure), and its mean Net Income is $303mln, with Standard Deviation $273mln. The ROE and its standard deviation are obviously 30.3% and 27.3%.

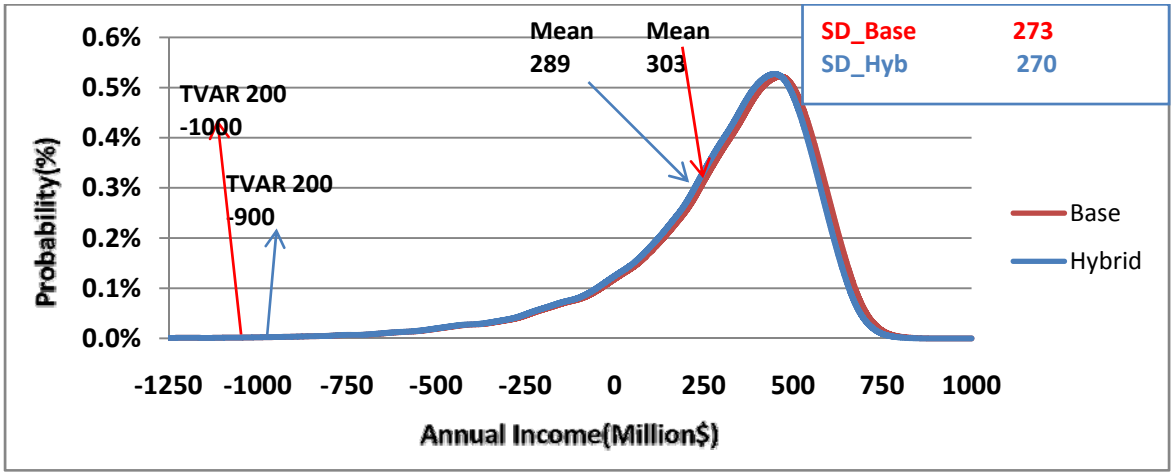
Figure 2: Baseline company - Annual Net Income



Baseline Firm with Hybrid Capital

Next we assume the same firm, but "dividend" $100 million of Common Equity, replacing it with a preferred share issuance of $200 million which pays 5% interest, and receives 50% rating agency equity credit. Underwriting Capital thus remains the same at $1 billion. Figure 3 shows the results.

Figure 3: Baseline Firm with Hybrid Capital - Annual Net Income

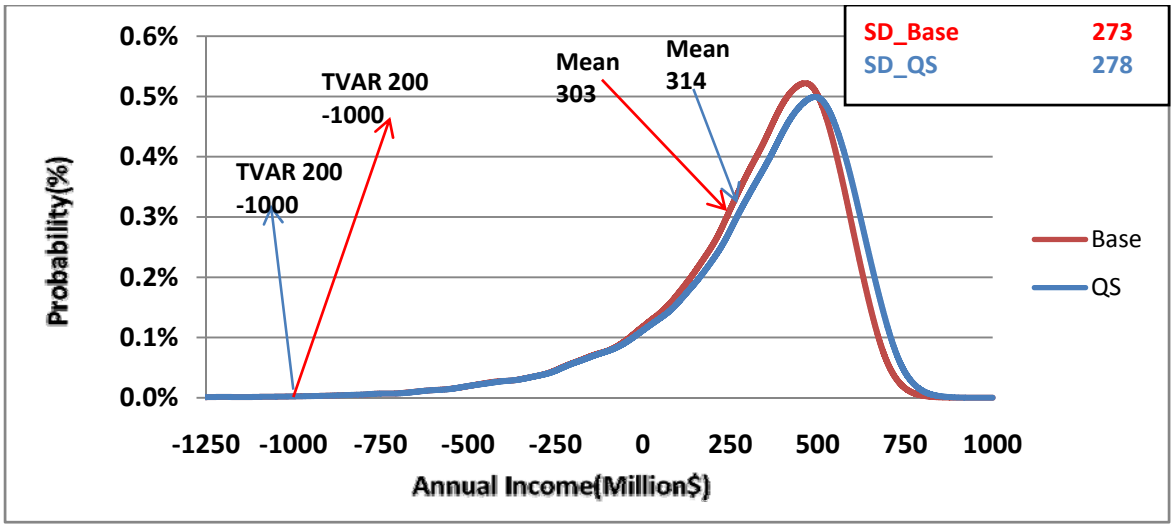


In this case, the Hybrid capital produces a mean return of $289 million on $900 million of Common, or 32.1%, versus the 30.3% without the Hybrid. Standard deviation of results, as a percentage of Common Equity, goes up from 27.3% to 30%. This is a common outcome with the application of financial leverage at market prices.

Baseline firm with 10% Quota Share

We return to our Baseline firm ($1 billion Underwriting Capital, all Common Equity). We assume it enters into a Quota Share retrocessional agreement with a ceding commission covering its costs, and a Profit Commission of 20%. This firm then scales up its gross underwritings until it once again only just meets the risk measure of 0.50% TVAR ≤ Underwriting Capital . Figure 4 shows the results.

Figure 4: Baseline Firm with Quota Share- Annual Net Income

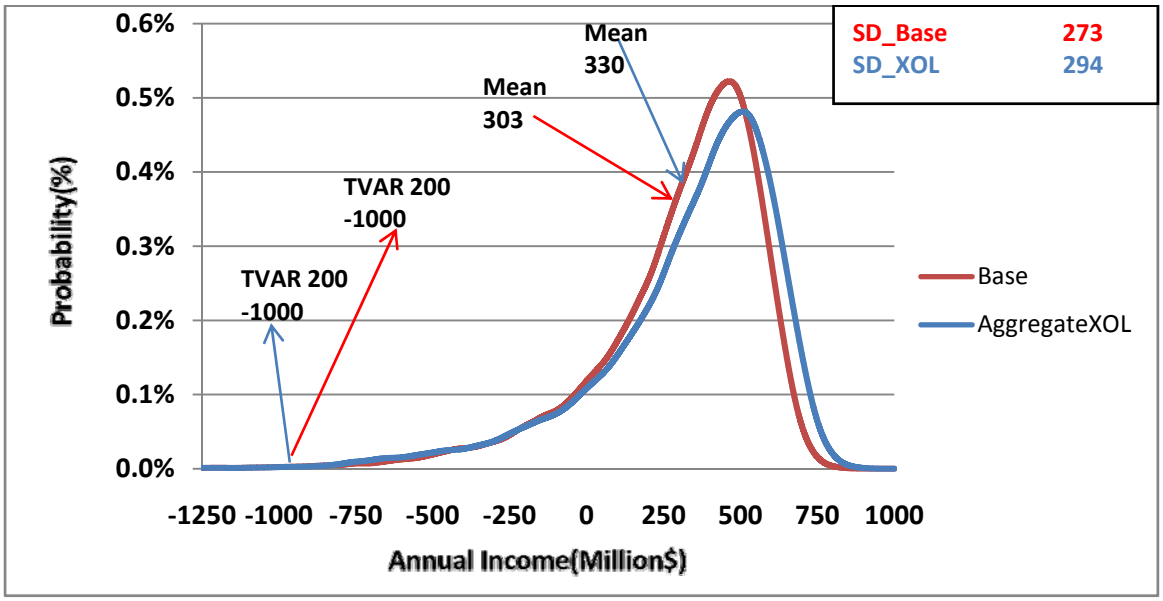


Perhaps not surprisingly, because the QS allows our reinsurer to participate 20% in the upside of new business without the downside, it improves our reinsurers economics by $11 million at the mean, or 1.1%. The impact on the Standard Deviation is more modest than in the Hybrid Capital case, even after adjusting for scale. For example, 32% quota share would match the ROE improvement of the Hybrid, but with only a 0.8% increase in Standard Deviation.

Baseline firm with XOL Retro

We return to our Baseline firm ($1 billion Underwriting Capital, all Common Stock). We assume it buys a retrocessional cover at the 5% probability level, covering half its losses from that point until the 1% probability level[4]. The cost of this purchase is estimated at 15% ROL. This firm then scales up its gross underwritings until it once again only just meets the risk measure of 0.50% TVAR ≤ Underwriting Capital. Figure 5 shows the results.

Figure 5: Baseline Firm with XOL Retro- Annual Net Income



Here we see a meaningful upwards shift in mean return (almost 3%), and a 2% increase in standard deviation. Because the TVaR test is driven by the parts of the probability distribution in which the XOL offers protection, the XOL enables a significant growth in gross premium and operating leverage. Of course, this relationship depends critically on the pricing of the XOL cover versus the inwards business written. In this case our assumptions imply a positive arbitrage. If the XOL cover were much more expensive, the purchase of XOL cover could lower the mean ROE.

Finding the optimum mix

If we assume (non-trivially) that we have the pricing space for all possible sources of Underwriting Capital defined, it is possible to use optimization methods or simulation to determine the optimum mix of Underwriting Capital. To do this one must also consider the practical constraints not modeled, such as the maximum amount of Gross-to Net spread desired, maximum Hybrid capital allowed by the Rating Agencies, and so on. A full optimization would also consider the tradeoffs between investment and liability risk- i.e., answers the question “how much risk should we take in the asset portfolio, given the opportunities or lack thereof in underwriting”.

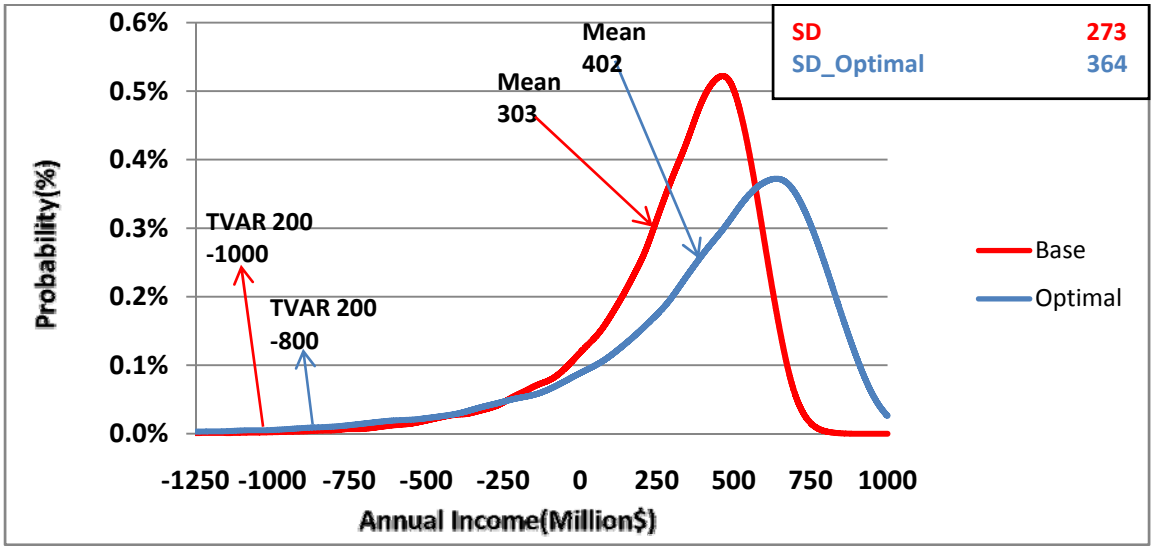
Here we assume the investment portfolio constant and tame. We assume Hybrid Capital credit is limited to 20% of Underwriting Capital (hence at most $400 million), producing $200 million Underwriting Capital, with $800 million Common Equity. We assume the maximum QS desired is 20%, and the maximum spend on XOL cover is 10% of gross premium. Any optimization problem exhibits strong connection between the constraints and the optimum produced; practitioners

[4] These percentiles are pre-scaling.

implementing these techniques should consider importantly the constraints and framework appropriate for them.

Figure 6 shows the Optimum Structure, along with the Baseline.

Figure 6: Baseline Firm with Optimum Structure- Annual Net Income



Note that the Optimum found is 20% Hybrid Capital and the balance Common Equity. Our optimum firm spends 10% of gross premium on XOL cover, and accepts an inwards QS of 20%. Compared to the baseline firm, we have improved expected Net Income by $99 million, while continuing to meet the risk measure. The reader will note that the Optimum structure also dominates all of the structures in Chart 3-6. The modeled mean ROE is 50%.

A second point of interest is that the Standard Deviation has risen from 27.3% to a somewhat breathtaking 45%. This tendency of an optimization of leveraging components versus tail risk, to push the belly of the distribution to be fatter, is a common feature. In the real world at Flagstone, we manage this by setting multiple constraints, in the tail and also in the belly.

As is often the case in optimization, the optimum is found at the limits imposed by the constraints; this means that setting the constraints reasonably is a critical task for this optimization. A real world manager might ask, “if I run a portfolio this dependent on purchase of retrocession, am I really comfortable with 20% Hybrid capital?”. This kind of what-if analysis generally means that several iterations of the optimizer are used. Thus, as with investment optimization, reinsurance capital structure optimization does not replace management judgment, but rather informs it.

This section provided an overview of the mechanics of optimization of the capital structure for a reinsurer. To make such a procedure a practical reality within a firm is no simple task, and the circumstances of a particular firm could impose consideration of other factors such as taxes and different regulatory constraints. The differing frameworks of the four main rating agencies also imply that the optimal use of Hybrid Capital and retrocession may be different for different participants.

In the second section we examine the particular challenges in the market place as of the time of writing, mid- 2009.

THE DYNAMICS OF THE MID-2009 MARKETPLACE FOR REINSURANCE CAPITAL

Asset Impairment

Due to the financial crisis of 2008, most reinsurers[5] have suffered a degree of asset impairment; many also found 2008 a difficult year on the liability side due to catastrophes. We are just starting to see reserves going up for subprime mortgages, Madoff, Stanford, Chinese wallboard, and other casualty risks. Thus it's reasonable to suggest that the amount of reinsurance capital available is 20-30% less in 2009 than at the end of 2007. At the same time, primary insurers have also suffered considerable balance sheet problems, and may require more reinsurance. This has the potential to create considerable tensions in the marketplace in the years to come.

An unusual degree of political importance, especially in the US

Several aspects of US politics are also of special interest at this time, and with the US at approximately 45% of the global reinsurance market, these matters should be of interest to global participants. First in magnitude is the likely massive reorganization of the health care system and health insurance in the USA with significant potential cost shifting to the Property and Casualty (Re)Insurance Sector. Second, the Democratic Party control of White House and Congress could result in a plaintiff-friendly swing in court decisions over time. A further new element on the landscape is the growing consideration by government bodies of nationalizing catastrophe risk cover. While the US government has thus far not accepted any plans relating to "bailouts" of state catastrophe pools, it seems likely that Florida, Texas, and Louisiana are depending on post-event protection as they approach the 2009 hurricane season.

Seized Capital Markets

As I write (July 2009) the average public reinsurance company is trading at 60-90% of its stated book value. Those for which their book values are seriously in question are trading lower still. At the same time, new issue spreads for corporate Senior Debt are higher than in decades, and the Hybrid/convertible market is effectively closed. These developments undermine one traditional feature of credit rating analysis of insurers/reinsurers: it has generally been assumed by analysts that being a public company was an advantage to a (re) insurer, as it allowed for swift access to capital markets after a catastrophe. This can no longer be taken for granted, for any reinsurer.

The CAT bond and sidecar market has shrunk considerably as well. There are at least three reasons for this:

- The main buyers were hedge funds, and hedge funds are impaired generally. Perhaps 50% of the fund assets from the beginning of 2009 have now been lost, either to redemptions or the markets.

- Purchases of rated CAT bond products could be financed 2x or 3x to 1, pre-September 2008. Prime brokers and at least one European reinsurer were in the business of providing these repo loans on diversified CAT bond portfolios. That lending capability is much reduced or gone completely, meaning that at the relatively modest returns versus LIBOR, CAT bonds may not reach the return target of a Hedge Fund anymore.

[5] I write this from the point of view of a reinsurer, but many of the same concepts could be applied to a large, risk bearing insurance company.

- CAT bond and sidecar products have to compete with many other asset classes for investors' attention. Many of those asset classes have cheapened considerably since 2008. An investor with risk appetite and cash has many choices which might look more attractive than CAT bonds.

The *good* news, from the point of the global reinsurer, is that a reinsurer can run its business without access to capital markets at all. One simply sizes one's book to one's capital, and optimizes relative to the underwriting and investment opportunities available and the availability and price of inwards cover. The *bad* news is that, if each reinsurer does this, there will be a considerable lack of capacity in markets. This may cause prices to rise (every reinsurers' dream!), but equally may add momentum to political efforts to nationalize some or all CAT risks. In the long run it is not politically healthy for the industry to operate with, for example, property rates in Florida at 5-7x actuarial loss expectations. The now-dwindling participation of the capital markets served to ease that tension between business and politics, especially in the peak zones.

Stand-by-Capital

In the past, there have been several transactions involving so called "Catastrophe Puts", which are private transactions which provide for an investor to earn a fee for standing by to invest in an insurer or reinsurer after a natural catastrophe of some certain size. Typically the investment would take place at the new book value, or a ratio thereof. The fees were modest, generally, because it was assumed that the capital; markets provided this capacity essentially for free. In the current environment, as mentioned above, no company has guaranteed access to capital in the capital markets, at least not at an attractive price; there should be demand for Catastrophe Put and other stand-by capital products.

Companies Going Private

There are a number of young reinsurance companies, in the Bermuda and Swiss marketplace especially, that were started by private equity interest in this decade, and which one might have expected to "go public" by now. Companies are delaying this move because of valuation, most of all, and because being public entails enormous compliance costs (Sarbanes-Oxley Act etc.) without a positive offset in terms of access to capital. There may even be public companies that see no better investment opportunity than their own shares at a big discount to book value, and choose to go private in this environment. The availability of the stand-by capital described above may facilitate this.

Merger and Acquisition Activity

It's a simple mathematical fact that when the governing risk measure is some VaR or TVaR measure, combining two adequately-capitalized firms with complementary books of business creates one better-than-adequately capitalized firm (as well as possible cost synergies). That excess capital can then be deployed in several ways, all friendly to the shareholder in an environment where market price is below book value. The merged company can:

- Buy back its shares
- Increase dividends

- Grow
- Pursue higher credit ratings
- Buy another company

In the author's opinion there is room for considerable consolidation in the global reinsurance space.

CONCLUSION

This paper first described Underwriting Capital and a number of alternative ways to raise it. The concepts of Target and Risk Measure were introduced and discussed. A process for evaluating the advantages of each form of UC relative to the Target and Risk Measure was then described, including an optimization scheme subject to constraints. The limitations of the analysis were also described, as well as possible features that any company-specific analysis might include.

The second section described the unusual circumstances of the financial markets in 2009, how reinsurers might adapt to those circumstances, and some opportunities created in product design for capital markets participants. It illustrates the application of DFA modeling the firm to a new set of circumstances, which imply changes to the model. This ability to manage the model is a key Enterprise Risk Management skill firms need to have in 2009 and beyond.

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