

Securitisation of Non-Life Insurance Working Party

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Lessons from Sub-Prime Sub-Group

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1. INTRODUCTION

The crisis in the sub-prime mortgage market and the wide reaching effect that the securitisation of residential mortgages has had on the wider insurance and banking industries has brought sharp focus to the desirability or otherwise of securitised loans as an asset.

We do not seek to provide a detailed analysis of the sub-prime crisis as there are a number of papers that do that, in particular the Bank of England Financial Stability reports.

Instead we seek:

- Firstly, to consider the lessons of the Sub-Prime crisis and the role played by mortgage backed securities and to apply these to catastrophe bonds,
- Secondly to consider the wider lessons of the resulting credit crunch and to apply these more widely than simply securitisation to the non-life insurance industry and to actuarial work within it.

We finish with a futuristic scenario of how a similar event to the sub-prime crisis could impact non-life insurance if insurance securitisation continues to develop in complexity along lines similar to mortgage backed securities.

This paper is one of a series of stand-alone but complementary papers produced by the GIRO 2008 Securitisation of Non-Life Insurance Working Party.

The other papers cover:

- a **History of Securitisation** to date including a review of predictions made in prior GIRO papers,
- a quantitative and qualitative review of the **Zero-Beta** quality often claimed for catastrophe bonds,
- a review of the important topic of **Basis Risk** within non-life insurance linked securitisations including an example spreadsheet,
- a review of **Regulatory Regimes** (particularly capital regime) treatment of non-life insurance linked securitisation,
- a review of the securitisation possibilities for **Other Non-Life Risks and Assets** other than purely catastrophe bonds.

2. IMPLICATIONS OF SUB-PRIME FOR CATASTROPHE BONDS

Introduction

In this section we aim to consider some of the issues that arose with mortgage backed securitisation and in particular the securitisation of sub-prime retail mortgages. For each of these issues we then consider its applicability to catastrophe bonds.

Correlations

There is a large variance in the attributes of risks that can be securitised compared to traditional corporate bonds. Corporate bondholders have a large equity cushion before they incur losses. In addition, losses on bonds issued by one corporation will have an impact on the likely performance of other bonds for the same corporation but are less likely to affect other corporations. For the sub-prime market investors could buy bonds with a wide range of originators but once the markets began to fall the diversification benefits of differing providers were swamped by the large systemic actions from both the inability of borrowers to continue payments on similar products and the falling value of house prices as repossession rates increased significantly.

Further, many of the security ratings assumed a wide degree of geographic diversification in US house prices whereas, in practice, house price falls proved to be highly correlated across regions.

Finally, these investments were highlighted as providing an additional benefit of diversification from mainstream asset classes, however, subprime bond losses were associated as both cause and effect with the downturn in the mainstream economy (see below for further comment on this) so that the associated diversification benefits did not materialise.

Hence all of the three forms of diversification assumed (between providers/products; between geographic regions; with mainstream asset classes) proved to be significantly over-stated.

We now consider each of these in turn in the context of catastrophe bonds.

The development of catastrophe models and equally importantly of standardised way of geo-coding and describing insured properties, have for some time permitted insurers and reinsurers to accumulate and manage exposure coming from different cedants as well as from geographical regions exposed to the same peril. This understanding of diversification should be tempered by issues with the standards of data quality in some territories.

On the second point, diversification and correlation between different catastrophe perils and regions is based on detailed seismological and meteorological understanding as well as many years of data including negative correlations e.g. the opposite effect of ENSO (El Nino Southern Oscillation) on Pacific Typhoons and Atlantic Hurricanes and positive correlations e.g. the possibility of late season Atlantic hurricane transitioning into European Extra-tropical cyclones. Again this optimism should be partly tempered by gaps in the scientific understanding particularly about issues such as the propensity for clustering of hurricanes and extra tropical cyclones

and about whether a clustering or seismic gap model (where large earthquakes occur at periodic intervals due to stress build up that is then reduced by the quake) applies for earthquakes.

Finally, economic shocks cannot cause natural catastrophes although there is the possibility of causation the other way around, with a sufficiently severe natural catastrophe leading to knock-on financial market impacts (particularly on an already vulnerable financial market). Examples include: the impact of the April 1906 San Francisco earthquake on the “Panic of 1907” stock market crash; the impact of the October 1987 “Great Storm” on market logistics and possibly exacerbating the market reaction on the following “Black Monday”; the knock-on effects of the January 1995 Kobe earthquake on an already weak Japanese stock market (and its direct involvement in the fall of Barings bank).

Feedback

One of the key issues with the securitisation of residential mortgages (and particularly the securitisation of sub-prime mortgages) was how it led to an asset bubble with self-reinforcing behaviour and trends and with the rise in securitisation eventually leading to behaviour which directly harmed the value of the assets being securitised.

Initially there appeared to be a virtuous upward spiral.

Home sales rose. In turn this led to appreciation in house prices. Normally this would be expected to choke off the market as houses became unaffordable. Instead the ease with which the loans could be repackaged and sold on, often in their entirety, both in the primary and synthesised markets, gave lenders the possibility to expand their product offerings and lending markets while at the same time having very limited incentive to enforce strict underwriting conditions. As a result, loans were offered to individuals who would previously have been unable to secure credit (“sub-prime” loans). Loans based on 100%+ of property value and on higher multiples of salaries were allowed. Products such as teaser loans (deliberately low introductory interest rates) were introduced so counteracting the affordability issue. This in turn increased the demand for property and increased property values resulting in ever increasing levels of finance being requested. Further, the rise in house prices reduced modelled credit risk on the mortgage backed securities. Householders in difficulties seemed to have no incentive to default as they could borrow more (based on increased house prices) and even if they did default there appeared to be no credit risk as the house could be sold for more than the original loan value. And so the virtuous circle continued.

Things changed into a vicious downward spiral as the economy turned down, housing prices reached unsustainable levels and the boom in house building in response to the virtuous upward spiral came on tap. Home sales and prices fell. As individuals reached the end of teaser and other fixed rates, they found that their house was worth less than the loan value and had an incentive simply to return the keys to the lender in the post (so called “jingle-mail”). As defaults increased, lending standards tightened which led to buyers being priced out of the market and further falls in house prices. The resulting losses on sub-prime securitisations led to a

drying up of securitisation as a source of liquidity for banks and a further fall in lending and house prices.

This is different and much more fundamental than, for example, the unexpected correlations seen between providers and geographical areas as described for catastrophe bonds above where a single underlying cause turned out to affect a variety of classes which were previously seen as largely diversified. It even goes beyond a simple correlation on losses between sub-prime securities and mainstream investments. Here the correlations feed on themselves in a loop or spiral and the phrase “feedback” would be more appropriate.

There are fundamental differences between loan securitisation and catastrophe bonds which make it difficult to imagine the same type of feedback loop for catastrophe bonds, with securitisation of the risks actually increasing catastrophic losses.

In the extreme, the provision of additional reinsurance capacity could give incentives for people to live in high risk areas such as on floodplains or near earthquake faults. The lack of insurance, however, only prevents additional building if insurance is required by mortgage providers or government legislation. In California for example, neither requirement holds and the take up of residential earthquake insurance is very low. Perhaps the forms of catastrophe bonds most likely to lead to additional exposure are those backing governmental disaster funds (such as those purchased by the Hawaii Hurricane Relief Fund, Joint Florida Underwriting Association, Taiwanese Residential Insurance Earthquake Pool and the Mexican government’s fund for natural disasters (“FONDEN”)) as they could remove the government’s fiscal incentive to prevent building in hazard prone areas.

Even if the provision of catastrophe bonds did increase exposures to a loss it would not affect the frequency of losses and further there seems no possibility of a feedback loop occurring with the additional exposures from a loss causing further future losses.

Misalignment of interests

In the securitisation of sub-prime there was a fundamental misalignment of interest between the three main parties involved: borrower; originating bank; investor in mortgage backed security.

The provision of 100% loans led to moral hazard and, as described above, in times of economic difficulty alongside falling property prices the borrower had an incentive to simply return the keys. Again, as described above, the lender, having securitised 100% of its exposure, had no reason to modify its lending policies to prevent this happening.

For conventional insurance the equivalent three parties are: policyholder, broker/agent/cover-holder and insurer. Insurers have, for many years, dealt with ensuring that all interests are aligned. The insurer has an incentive to maintain underwriting controls through extensive use of self insured retentions. Agents are encouraged to seek out and put forward only good risks via the use of profit commissions rather than volume-adjusted commissions and delegation of underwriting authority (“giving the pen away”) is only allowed under very strict criteria.

The dangers of delegating authority are well recognised and any agencies with delegated authority are generally monitored extremely closely by the underlying insurer.

Catastrophe bonds introduce a further relationship with the insurer now taking on more of the agent role and the investor assuming ultimate underwriting risk. There are, however, a number of features of catastrophe bonds (at least as currently developed) that mitigate the misalignment of interest. They do not assume full insurance risk, only the catastrophe part so that insurers still have to control attritional and large claims. Catastrophe layers (including those securitised) are structured with the originating insurer accepting a self insured retention as well the possibility that extreme claims could exceed the cover provided. Both these measures maintain the interest of the insurer in managing the loss with securitisations often acting as the top layers of catastrophe programmes. Lower down, more exposed layers are covered conventionally by professional reinsurers who are used to ensuring long-term alignment of interest.

Complexity

The homogeneity of mortgage type risks facilitated the development of re-packaging allowing issuers to structure the deals so as to transform the least attractive and riskiest parts of their mortgage portfolios into a form of mortgage backed securities apparently suitable for a wide variety of investors. In addition, there may have been a misalignment of interest with advisors benefitting from the wider appeal (and hence increased marketability) as a result of re-structuring and re-packaging risk a number of times over.

The apparent similarity between the various packaged risks allowed a significant secondary market to develop in which synthesised loan products from multiple original sources were packaged and sold on to investors. The array of financial instruments available such as mortgage backed securities, credit default swaps and collateralised debt obligations, as well as combinations and derivatives of these, led to basic credit risk being packaged into both complex structures and complex re-packaging routes.

Investors did not appear to be concerned that the origins of the risks could not be easily traced and instead were content that the underlying risks were residential mortgages sourced from a variety of lenders. The least attractive and riskiest parts of mortgage portfolios were sold onto investors in this way with relative ease. Investors did not recognise the extent to which these complex products contained the less desirable risks.

The re-packaging complexity obscured the fact that the deals, while including multi-year, multi-provider and multi-location exposure, did not repackage and spread the systemic risks of US home equity and the underlying exposure to default risk (in economic downturn) and remortgage/switching risk.

Two results of this complexity were that:

- In some cases, rather than achieving the initial aim of financial innovation to spread risk and transfer it to those best able to manage it, the risk is instead concentrated on those least able to understand it.

- In other cases the risk ended up back with the banks that had sought to diversify it in the first place, either because a bank invested in the risk on the asset side of their balance sheet or because as an issuer, in stressed conditions some of the complex guarantees given on the facilities issued led to off-balance sheet risk returning to its balance sheet.

The lack of clarity and transparency of the underlying risks has a clear analogy with the London Market Excess of Loss (LMX) Spiral. As with mortgage linked securities, LMX spiral losses ultimately were left with those least able to understand it and those who thought they had transferred it.

To date, in contrast to mortgage linked securities, the structure of most catastrophe bonds has been comparatively straightforward. Although multi-year deals are issued there is clear separation of risk between accident years and a much more transparent and effective diversification of perils/territories accepted by the issuers through to the investors in insurance linked securities.

The use of collateralised debt obligation (CDO) technology in catastrophe bonds which began in 2007 is perhaps the first step to a more complex structure. The most notable to date is the bond issued by the hedge fund/asset manager Nephila who themselves accept catastrophe risk from a variety of sources. Similar deals are in the 2008 pipeline and are seen as the next step for catastrophe bonds by enabling risk to be tranching so as to appeal to differing sets of investors. It will be interesting to see if the issues with sub-prime crisis lead to these developments stalling or simply to a requirement for detailed and clear disclosure of the risks being repackaged.

A greater concern with catastrophe bonds is that the risks they cover are inherently less understood by investors, such as institutional investors managing retail funds, than mortgage backed securities. Mortgage backed securitisation relates to credit risk which is something banks and institutions are used to measuring, understanding and trading. Catastrophe bonds require institutional investors to have a high level of specialist expertise in (to the investment markets at least) an esoteric area of risk. This was a point made in April 2008 by the Financial Industry Regulatory Authority (the largest non-governmental regulator for US Securities firms) when it issued an "investor alert" to retail investors on the risks of them (or more likely institutions investing on their behalf) "speculating" in "bets" on Catastrophe Bonds and Other Event-Linked Securities".

Liquidity

One of the key impacts of the sub-prime crisis was the liquidity impact on banks when the ability to issue mortgage backed securities dried up. Many banks had relied on a deliberate mismatch of using short term wholesale assets (i.e. securitisations) to fund longer term retail liabilities (mortgages) (the most extreme case being Northern Rock) and therefore had severe difficulties when the credit crunch withdrew the sources of short term funding.

Interestingly, for catastrophe bonds the reverse is true. Issuers of catastrophe bonds have one year liabilities (due to the annually renewable nature of non-life insurance) but use securitisation as a way of obtaining fixed reinsurance terms for say a 3-year future period as an alternative to the one-year only reinsurance available

conventionally which, although matching their liabilities, can make planning and original price setting very difficult due to significant over correction in reinsurance prices following a catastrophic loss.

For this reason, if anyone is carrying the liquidity risk for catastrophe bonds it is the investors rather than the issuers. The bonds, however, have a limited (although improving) secondary market and are not in themselves easily traded and must be considered as a relatively illiquid asset. Losses against these bonds therefore can result only in a limited loss in their liquidity. They can however have a knock on effect elsewhere for the investors as they must compensate for the losses resulting from triggered catastrophe bonds elsewhere in their investment portfolios. There is, however, little correlation between the liquidity of the other investments and performance of the catastrophe bonds except to the extent that the most serious natural catastrophes could cause an economic downturn (e.g. the Kobe Earthquake).

The liquidity risk in using catastrophe bonds also has wider implications for investors. The credit crunch has resulted in some investors having to divest non core assets to create greater liquidity and has driven some of the recent secondary market in catastrophe bonds. There is therefore some risk for investors in holding a relatively illiquid non-core asset class. In addition, since special purpose vehicles ("SPVs") generally invest in cash, there is the need to consider whether sufficient premium is offered to compensate the investor for tying up a liquid asset within a relatively illiquid bond. The balance between the liquidity of the SPV investment and the zero beta attraction come into play in weighing up what a suitable SPV investment approach is. Investment by the SPV in more liquid assets risks the insurance linked security losing the zero beta advantage of the catastrophe bond within an investment portfolio.

Mark to market

Marking to model price is less reliable than marking to market price as it relies on the accuracy of the assumptions in the model. However, for assets that have no liquid market, marking to a theoretical price may be the only method of accounting for the asset. This is the case for many types of catastrophe bonds, most notably those with indemnity and modelled loss triggers.

Mark to model methods for mortgage backed securities were open to both manipulation and unintended mis-valuation due to the complexity of the products. This was evident from the large re-valuations of assets by banks. In addition, the ability to audit the models was limited due to the complexity, range of assumptions considered reasonable and lack of comparable benchmarks available.

Whilst valuation of catastrophe bonds is currently only possible by marking to models, liquid secondary markets in catastrophe bonds are growing and various catastrophic loss indices, together with options and futures trading on these indices, are being developed. Both of these give the potential for a price based on market valuations. This may offer the possibility of more transparent valuations of such securitisations going forward.

Interestingly, if a sufficiently liquid market in catastrophe bonds and futures were to develop, it could permit true market-based valuation of conventional catastrophe insurance liabilities when International Financial Reporting Standards are introduced for insurance.

Over-reliance on rating agencies

One key issue identified in the fall-out from sub-prime losses was over reliance on the rating agencies by investors who did not seek to understand the risks sufficiently through their own due diligence. Further, a number of commentators have identified conflicts of interest for rating agencies. For example, the rating agencies' desire to maintain or increase market share may have caused a reduction in the conservatism with which they assessed the securitised loans and a resistance to disclosing in detail the limitations of their models and assessments.

The Securities Exchange Commission ("SEC") is currently undertaking an on-site examination of the largest credit rating agencies. At the time of writing the results have not been published but we understand that there is considerable focus on how credit rating agencies responded to the increased volumes of deals brought to them for assessment, the increased complexity of the structured products and the change in underlying backing securities from plain vanilla to more difficult to assess loan packages. It will be interesting to see how well the SEC believes that the rating agencies have adapted their models and rating approaches to this changing environment and, more particularly, how they have disclosed the limitations of their rating approach and models to the users of their ratings for the securitisations under consideration. Investors may not have had sufficient information available to them to recognise that the change in characteristics was not being modelled or otherwise sufficiently considered within the rating work and that there was a need for greater in depth analysis.

The frequency with which securitised loans have been downgraded in the recent past is an indicator that there may have been issues with the original rating and that part of the cause for such significant downgrading lies in deficiencies in the original rating procedures for these fast evolving structures. By February 2008, Moodys had downgraded 54% of its 2006 and 40% of its 2007 tranches. Similarly, Standard and Poors ("S&P") had downgraded 45% of its 2005-2007 tranches by March 2008 and the equivalent figure for 2006 tranches for Fitch is 34%.

In addition, the continued good performance of the investments for a number of years contributed to errors or deficiencies occurring from due diligence exceptions being masked and hence not identified in retrospect by investors. When investment performance faltered the deficiencies became much more apparent.

Over-reliance on agencies is a large potential issue for catastrophe bonds as there is a reliance not only on rating agencies (as for sub-prime securitisation) but also on the catastrophe modelling firms.

Use of black-box models

A related factor in the securitisation of loans is the use of complex black-box models by those designing, rating, selling, and in some cases buying these products. Many of these models have now been subject to severe recalibration.

Catastrophe models are open to the same criticisms and the same risk of recalibration as the models used for loan securitisation. Whilst core assumptions are based on meteorological and seismological assessments which draw on data over periods actually matching some of the return periods quoted, e.g. assessments that

earthquakes of a certain magnitude have a 1 in 100 year return period often draw on say 500 years of data, there has to be a significant question on the reliability and interpretation of such data in that it is a relatively immature science. In addition, there are many subjective assumptions and judgement calls in the model design and use.

Following any major event, modelling firms adjust and refine their models in the light of that event and the areas in which their existing models proved to be a good or bad predictor of actual losses. An example of this is the re-calibrations of catastrophe models following the 2004 and 2005 hurricanes (including the adjustments for demand surge). While it could be expected that re-calibrations may well be larger for events such as a New Madrid Earthquake or a New York Hurricane (which have not been tested by actual events of any magnitude since catastrophe models were first produced), the extent of those recalibrations is likely to be much less than has been seen in as adjustments applied to mortgage backed security and other credit based models following the sub-prime crisis. By way of example, Katrina resulted in around a 50% hike in severity and 20% hike in frequency as compared to the several fold adjustments to calibration following on from the sub-prime crisis for credit based models.

Reaction to losses

Sub-prime bonds were a sub-set of the residential mortgage backed securities asset class. These bonds were structured in a manner that provided varying levels of security and associated risk/return profiles in order to cater for multiple risk appetites. The ratings given by rating agencies and the impression given by issuers that the ratings were comparable to those provided for traditional corporate bonds led to the assumption that the performance, including the default profile, would be similar whilst giving the additional benefit of diversification to an asset portfolio.

Research on losses from all types of securitisations shows a number of losses on investor grade bonds even prior to the sub-prime crisis. The consistent feature of chronicled losses is that the losses are often not due primarily to the underlying risks. The causes tend to be other external issues mainly related to some level of fraud. These are:-

- fraudulent intent (e.g. National Century Financial enterprises where funds for securitisation purposes were diverted to other uses),
- misrepresentation of the actual assets (e.g. Towers Healthcare Funding Corporation where the value of receivables placed within the securitisation structure was significantly overstated),
- misrepresentation of the expected performance of assets (particularly subprime debts even prior to 2007). An example is the specialty finance companies in the mid '00s who misrepresented subprime delinquent loans by misclassifying certain cash receipts and further disguising statistics by debt re-aging practices,
- misrepresentation of the securitisation structure.

The reaction to the significant emerging losses from sub-prime was a sharp move in investor sentiment. This was shown by:-

- the sharp revaluation in these assets relative to traditional corporate bonds
- the non-acceptance of retail mortgage backed securities and associated assets as a collateral for further borrowing at almost any value
- the contagion of fear that spread to other asset classes that potentially could be affected by the events in the retail mortgage backed securities
- the consequent declines in asset values of credit linked securities.

The first major insurance-linked public cat bond default was triggered by Katrina. The Kamp Re catastrophe bond was launched just weeks before Katrina by Swiss Re to protect Zurich Financial Services from net losses on US Hurricane and Earthquake claims exceeding \$1bn. The response to this loss was very different from the investors' reaction to the sub-prime losses against mortgage backed securities. Whilst the sophisticated investor base helped, it was also clear that the investors could see the natural event unfolding and could understand the potential for it to trigger default of the Kamp Re bond. The adjustments to the bond value, status and interest payout rate were transparent and followed the lines given in the prospectus well. Indeed, some investors have expressed surprise that it took so long to call on the bond's collateral. The main cause for this was the indemnity nature of the underlying reinsurance asset which lengthened the time required for the loss to be established as compared with a bond defined by parametric or industry index triggers. Investors also fully expect the option to extend the bond's maturity by 36 months to be exercised and accept the need for this. Although the Kamp Re bond's passage has been smooth there are warnings from commentators that, as the investor base widens so does the potential for disputes. This would arise from the existence of investors who do not understand reinsurance well and hence have not understood the true implications of catastrophe bonds from a risk perspective.

Even with Kamp Re there will be a number of investment managers under pressure for not fully understanding the risks that they took on. Over the last nine years there has been a marked change in the make up of investors in insurance linked securities. In 1999 they comprised over 50% insurers and reinsurers whilst today these groups represent less than 10%. By contrast nearly half the bonds are now taken up by dedicated funds as compared to around 5% in 1999.

It is possible to contrast the investor and rating agency reaction to the emergence of a severe natural catastrophe with their reaction to emergence of a longer tailed loss potential through aggregation of losses by consideration of the Avelon Re insurance linked bonds. These are linked to liability losses which include bodily injury claims which is still relatively unusual in the insurance linked security context. The bond structure centres around a third loss energy cover and was placed in three tranches A-C with C having the lowest attachment point being excess of US\$300m with a maximum single event contribution of US\$150m. As with Kamp Re, the trigger was indemnity based, which has delayed the recognition of the potential for loss to some extent and makes the likelihood of applying the option to extend the maturity date more likely. Hurricane Katrina and the UK Buncefield explosions had already resulted in erosion of much of the underlying aggregate retention and all three classes of notes had previously been placed on a watch negative by S&P and Fitch. In July 2007, the New York steam pipe explosion put the bond under further pressure.

Due to the fact that the trigger is based on indemnity value and the fact that the issuer wrote excess business, it has taken some time to establish that the risk potential is material. Nearly nine months after this third industry loss, the tranche C bond was downgraded by S&P from CCC- to CC and by Fitch to C. Over its remaining life, the bond will pay a reduced coupon of LIBOR plus 10bp. As with Kamp Re, the investors seem comfortable with the process to date. In practice, the bond has not actually defaulted although it is at risk and commentators believe that whilst the maturity date will be extended by the maximum permitted under the contract, the bond will eventually be repaid at par.

Due to the natural peril diversification afforded by territory in catastrophe bonds the likelihood of wholesale default is extremely low. It is interesting, however, to speculate how the catastrophe bond market might react if a very large Florida windstorm (say a 1 in 100 year loss twice as expensive as Katrina) caused all bonds exposed to that peril to default in full. In practice the traditional reinsurance market would harden very significantly and almost certainly attract opportunistic capital (just as it did post Hurricane Andrew, World Trade Centre and particularly Katrina/Rita/Wilma) with some of that capital flowing to catastrophe bonds as an alternative to seemingly overpriced reinsurance. History suggests that investors would be attracted by the significant margins over LIBOR available. In fact, it has been losses which have acted as a spur (not an impediment) to the development of catastrophe bonds with Andrew and Katrina representing pivotal movements in first the invention and secondly the widespread use of catastrophe bonds.

Further, the most extreme reaction to losses on mortgage backed securities has been on the highest rated layers where the risk was supposedly notional and the credit cliff was not recognised. Catastrophe bonds, although at the top end of most cedants' reinsurance programmes where risk of a loss is low, are still recognised as being high risk in investment terms (typically of junk-bond status). Whilst restricting the universe of possible investors, this should also temper the reaction of them to a loss.

Conclusion

At one extreme, you can argue that all securitised products are tarred with the same brush as sub-prime residential mortgage backed securities.

At the other extreme you can argue that there are marked differences between securitised retail mortgage backed securities and catastrophe bonds and that the crisis resulting from sub-prime actually makes non-life insurance linked securities more attractive to investors. There is indeed evidence that investor interest in insurance linked securities has increased since the sub-prime bubble burst (with the slowdown in total size if not volume of deals in 2008 year to date being due to a lack of supply and not to a lack of demand). The true picture is likely to be somewhere in between.

On the one hand, for catastrophe bonds some of the main failings of the sub-prime securitisation market are eliminated or at least mitigated. For example: more and better understood diversification within the class and lesser correlation with mainstream asset classes; lower chance of contagion/feedback loops; reduced and better managed misalignment of interest between involved parties; more transparent

structuring resulting in a greater chance of a positive reaction to losses emerging. It is these points, particularly those relating to the diversification/correlation/contagion, that have dominated the initial positive robustness of the catastrophe bond market to the sub-prime securitisation losses.

However, in the longer run the sub-prime crisis and the role played by securitisation does raise challenges for the catastrophe bond market, particularly over complexity of risk, the role of rating agencies and catastrophe modelling firms, and the use of black-box models.

3. LESSONS OF THE CREDIT CRUNCH FOR NON-LIFE INSURANCE

The lessons arising for the banking and finance industry from the events of the sub-prime crisis and wider resulting credit crunch can be used to give analogous lessons for the non-life insurers (wider than simply securitisation) and for actuaries working in that market.

We have used direct quotes (in *“italics”* and marked [SSG]) taken from an influential March 2008 paper “Observations on Risk Management Practices during the Recent Market Turbulence” produced for the Financial Stability Forum of the Bank for International Settlements by the Senior Supervisors Group (“SSG”). This group comprises: the French Banking Commission, German Federal Financial Supervisory Authority, Swiss Federal Banking Commission, UK Financial Services Authority (FSA) and US: Board of Governors of the Federal Reserve System; Federal Reserve Bank of New York; Office of the Controller of the Currency & Securities and Exchange Commission (SEC).

3.1. Soft-market lessons

One of the issues with the credit crunch was that it came after a prolonged period of economic stability with low inflation, low interest rates and rising house prices. Many of those involved in the market did not remember the last property crash in the 1980s and the high interest rates at that time and even more experienced members of the financial community seem to have been convinced that we were in a new dawn of stability.

Analogously the insurance industry is faced with potentially the worst possible economic conditions for non-life insurance claims due to stagflation (with high inflation in fuel and food prices combined with slow economic growth due to a slump in asset pricing). At the same time many market participants are convinced that things will not happen the same way again and that the worst excesses of the down-cycle will be avoided.

In fact, many of the lessons of the SSG paper have direct analogies with behaviour that has proved particularly risky in previous insurance soft markets.

- *“Firms that experienced material unexpected losses in relevant business lines typically appeared to have been under pressure over the short term either to expand business aggressively or to defend a market leadership position”.* [SSG] In a soft non-life insurance market, rapid expansion, moving into new lines of business or following (or even leading) a market down so as to avoid losing market share are the riskiest of all behaviours.
- *“Firms also noted that mortgage underwriting standards had deteriorated. An increasing portion of mortgages were being underwritten without verifying the borrower's source of income for repayment ('stated income' loans); in addition mortgages were often underwritten based upon initial "teaser" rates rather than a rate consistent with bearing the obligation to maturity. Undeclared and*

undocumented second loans also served to increase borrower's payments relative to their income and decreased borrower's equity positions in the home." [SSG]. The importance of monitoring weakening terms and conditions in a soft non-life insurance market is well understood although the pressure put upon rates means that the underwriting discipline required can be difficult to maintain.

- *"Some firms found that they could not syndicate their holdings of leveraged loans because of reduced investor appetite for those assets and they could not cancel their commitments to fund these loans"* [SSG]. As mentioned above, a key risk for many financial market companies was liquidity risk, particularly a mismatch between using short term wholesale assets to fund longer term retail liabilities which gave them difficulties when the credit crunch withdrew the sources of short term funding. One analogous risk for non-life insurers in a soft market is writing multi-year risks and protecting them with annual losses occurring reinsurance. If the reinsurance market hardens, then the insurer is left with a number of years of underpriced direct exposure (typically the reinsurance market hardens before the direct market) which either have to be run net or reinsured at prohibitive terms.
- *"Firms cited the usefulness of revisiting simple notional limits to highlight potential concentrations of risk. These measures are devoid of assumptions and give management a simpler perspective on the potential scale of the risks"* [SSG]. In a non-life insurance market now dominated by use of catastrophe models and management of exposure via 1 in 100 year or 1 in 250 year Probable Maximum Loss (PML); insurers should not lose sight of also being aware of their Maximum Foreseeable Loss (MFL) or even better their total aggregate exposures. In addition such assessments should be carried out on a gross basis not just a net basis.
- *"In a period of quickly shifting market developments, the timely provision of accurate information to senior management was critical to a firm's ability to respond rapidly"* [SSG]. One of the issues in past non-life insurance soft markets was the time it took before companies realised the difficulties they were in, particularly on long tailed business where a number of years business may have been written at ever decreasing rates before an earlier year started to deteriorate. In the forthcoming soft market actuaries will have a key role to play in providing quick management information in areas such as: actual versus expected claims experience; claims frequency and severity trends; rate monitoring; new business volumes and relative rate adequacy.

3.2. Future risk management issues

Other lessons from the SSG paper relate less to previous soft markets, but more to the “brave new world” the non-life insurance market is entering of ICAS, Solvency II, and Enterprise Risk Management.

In many ways we are following in the pioneering risk management footsteps of the banking industry and it would be useful to attempt to learn from their mistakes.

- *“Some firms relied too passively on external views of credit risk from rating agencies and pricing services to determine values of their exposures” [SSG]. In their “Financial Risk Outlook 2006” the FSA commented “in the aftermath of Hurricanes Katrina, Rita and Wilma in Autumn 2005, it became apparent that some firms may rely too much on the output of their catastrophe models without proper consideration of the inputs”. The 2006 GIRO Catastrophe Modelling Working Party paper was prepared explicitly to enable non-life insurance actuaries to deal with some of these concerns and assist them in seeing catastrophe models as a developing tool and not, in themselves, the answer.*
- *“Because these and other innovative products had been created during the prior period of more benign market conditions, banks and security firms had not observed how such products would behave during a significant market downturn” [SSG]. This has two implications for non-life insurers. The clearest analogy is: How reliable are ICAS models for new lines of business, especially ones an insurer has written only in a hard market? More generally, most insurers now base their planned loss ratios on prior years’ reserved loss ratios over say the last five years, adjusted for a constant rate of claims inflation and for rating changes. Given that the last five years have seen very benign claims conditions across many classes and that the next two to three years may see (as described above) very adverse economic conditions, are insurers factoring this sufficiently into their loss picks?*
- *“Managers at better performing firms ... balanced the use of quantitative rigour with qualitative analysis”. “Firms that experienced more significant problems ... tended to apply a ‘mechanical’ risk management approach, accepting the estimates of their primary risk systems without challenges based on other tools and expert judgement”. “[The] dependence on historical data makes it unlikely that a VAR-based measure could ever capture severe market shocks that exceed recent or historical experience, highlighting the importance of supplementing VAR with other measures”. [SSG]. Many non-life insurers’ capital assessments could be seen as the use of two black-box models: an ICA model which is in turn heavily dependent on the output of catastrophe models. Actuaries need to subject ICA models to challenge by other disciplines in the company (such as underwriters), carry out scenario tests and consider the possibility of Black Swans.*
- *“Among the risks that were missed or misestimated was ... correlation risk”. “Firms that avoided significant losses have additional risk measures that reflect differences in assumed levels of correlations between market variables in benign versus stressed market conditions” [SSG]. In building ICA models*

actuaries need to consider carefully correlations between supposedly uncorrelated classes and between assets and liabilities as well as the extent to which financial contagion can affect liabilities (for example in lines such as E&O and D&O) as well as leading to an increase in fraudulent claims. Actuaries need to stress test their correlation assumptions and to consider the possibility of needing to use copulas to describe the possibility of correlations between classes (as well as with assets) being much higher in the tail of the claims distribution.

- *“Firms cited difficulties that arose from their dependency on net measures of risk or measures of risk that rely on certain assumptions about correlation, market liquidity and other factors that may not be true in a given event“. “The available credit index instruments introduced significant basis risk. This basis risk - that is, the risk inherent in the imperfect correlation between the underlying cash position and the hedge instrument weakened the effectiveness of the hedging strategy.” [SSG]. Banks assumed that their hedging strategies would work perfectly and concentrated on net rather than gross exposures when assessing their trading position. Insurers need to be careful of considering basis risk on reinsurance when assessing their exposures particularly in the tail and including the risk of reinsurers themselves being in financial difficulty in the extreme events and therefore unable or unwilling to pay.*
- *“An issue for a number of firms is whether compensation and other incentives have been sufficiently well designed to achieve an appropriate balance between risk appetite and risk controls, between short-run and longer-run performance and between individual or local business unit goals and firm-wide objectives” [SSG]. This can be a challenge also for non-life insurers where many lines are: either catastrophe exposed, so that distinguishing good underwriting performance and risk management from luck can be difficult; or long-tailed, so that true performance is not known for a number of years. The appropriate use of well designed internal reinsurance can prevent conflicts between local business goals and corporate aims such as the over purchase of low security external reinsurance to protect individual accounts.*

3.3. Questions for future accounting/solvency regime

Some of the issues in the sub-prime crisis raise questions about the direction of insurance solvency and accounting regimes.

- The requirement to “mark to market” caused market players to take action which only in turn exacerbated the crisis. What are the implications for the market-based approach to both assets and liabilities that insurance accounting is taking under IFRS?
- Does the sub-prime crisis raise questions over the idea of allowing banks (and under Solvency II) insurers to set their capital based on their own internal models rather than a more prescriptive approach?
- A number of commentators and regulators are considering the extent to which capital and solvency regimes can be adjusted to be countercyclical rather than pro-cyclical for example having to raise more capital when loan growth rises. Can Solvency II be similarly adapted to help dampen the insurance cycle (in contrast to capital measures based on premiums which simply deepened it by reducing capital requirements in a soft market)?

4. A FUTURISTIC SCENARIO

By way of a conclusion and drawing on many of the issues arising from sub-prime securitisation and the issues around the credit crisis as discussed in this paper, we offer the following futuristic scenario of how development of the non-life insurance linked securitisation market could lead to an analogous type of insurance market crunch.

The maturing of the insurance linked securities market

- Non-life insurance linked securitisation develops to the securitisation of liability risks – in particular to the securitisation of Errors & Omissions (E&O) and Directors and Officers (D&O) insurance, which are seen as more amenable to securitisation due to their “claims made” (as opposed to losses occurring) triggers.
- These bonds are seen by investors as attractive and adding a new source of diversification and “alpha”, including institutional investors looking after retail funds.
- The liability insurance linked securities become increasingly complex – including such features as: “top and drop” layers; aggregate cover; reinsurance and retrocession cover including cover of other liability insurance linked securities and of companies investing in those securities; use of CDO type technology to tranche securities; the use of class action index triggers for some D&O bonds.
- Capital requirements for the bonds are signed off by rating agencies using work produced by accountants and actuaries expanding on their ICAS models. In addition, in some cases accountants and actuaries are involved in the actual evaluation of claims to the bond at some future date after the bond’s cover periods expire.

Opportunities for insurers

- The ubiquity of this market and the introduction of mark-to-market accounting under International Financial Reporting Standards (IFRS) means that insurers increasingly use the yields on insurance linked securities to evaluate their conventional insurance liabilities.
- Looking to diversify their exposure but lacking the security rating to access liability business directly, many property insurers and reinsurers (including specialist side-cars) become significant purchasers of the liability insurance linked securities.
- Looking for new classes of business to write and supported by the ability to reduce or even remove their exposure entirely using securitisation, conventional insurers begin insuring the previously self-insured lower layers and inner aggregates of the professional indemnity insurance of the big accountants and actuaries.

Social, economic and legal drivers

- The continuing evolution of legal framework and litigious environment in the UK towards that of the US includes the introduction and partial acceptability of contingency fees and the permissibility of shareholder class actions.
- Enterprising insurers extend traditional solicitors professional indemnity cover to offer a form of insurance for solicitors operating on a contingency fee basis, covering the risk that the courts rule the level of contingency fee agreed to be unacceptable. They securitise this product (seen as very difficult to insure given the experiences with some high profile After the Event insurance failures) so as to remove any actual underwriting risk to themselves simply fronting the risk for a small ceding commission
- The availability of this product encourages smaller solicitors to move to operating on a contingency basis and to looking for opportunities to run class actions on behalf of small investors.
- As this market becomes more competitive insurers begin to offer multi-year deals while retaining their annual securitisation funding of their exposures. On a one-year time horizon the securitisations are seen as a perfect hedge and so the net liability risk to companies is seen as nil.
- The resulting rise in compensation culture and class action payouts acts as a brake on economic growth. A number of companies suffer a fall in share price and the resulting shareholder class actions lead to a rise in D&O claims.

The downside and feedback loop

- These claims begin to impact some of the liability insurance linked securities. Due to the complexity of the securities, striking layers considered (and signed off by accountants and actuaries) these have often been rated as “AAA” or better. Investors in these securities begin to sue the advisory companies, which only leads to further liability insurance linked security losses due to a rise in E&O claims.
- D&O claims (and insurance linked security losses) arise from class actions against companies and institutional investors found to have invested in loss making assets.
- Disputes arise over valuation of the IBNR at the valuation date of some securities leading to further suits (and further E&O claims and liability insurance linked security losses).
- In contrast, due to basis risk, some of the index-based D&O securities do not respond despite the issuers suffering direct losses, leaving those insurers with exposures on their balance sheet that they had assumed were fully reinsured.
- The secondary spreads even on unaffected bonds widen significantly causing mark-to-market losses for investors including insurers.
- D&O and E&O Insurers are also forced to increase the value of their liabilities under mark-to-market rules.

Loss in confidence

- As investor appetite for liability insurance linked securities completely dries up, insurers offering multi-year policies are left to run those liabilities (which are marked to market as a loss at inception) net on their books
- A wave of insurer and reinsurer insolvencies and downgrades occur due to this series of adverse claim factors.
- This in turn leads to a further wave of D&O claims against the insurers themselves and further liability insurance linked security losses.
- Even insurers not affected by any of the above suffer capital hits (and in some case actual losses) due to downgrades (and in some cases failures) of their reinsurers.
- Eventually there is a public and political backlash against the compensation culture, the role played by contingency fees and the resulting damage to the London market insurance industry. This leads to legal changes eliminating contingency fees and class actions, striking out spurious claims and reducing payouts.
- Ironically this only leads to one last spiral of liability insurance linked security losses (and the resulting knock on effects) from the new forms of cover given to solicitors.

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Trading Risk

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