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Subprime Financial Crises and the Effects in the Catastrophe Bonds Market*

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Catastrophe bonds (CAT bonds) are often said to be 'zero-beta' investments (Litzenberger *et al.*, 1996). Their structure attempts to isolate investors from market-related risks and expose them only to event risk. As a result, these securities are considered to be a valuable new source of diversification for investors. This short article summarises the recent work by Carayannopoulos and Perez (2015) that examines this argument in the context of the 2008–2009 subprime financial crisis. Research on CAT bonds has focused mainly on their pricing (see, for example, Lane and Mahul (2008) and Braun (2011)). In contrast, relatively little research has focused on the relation of CAT bonds with the rest of the market and the claim that they are zero-beta instruments. The recent research of Carayannopoulos and Perez investigates the correlation of CAT bond returns with other asset classes and analyses their dynamic hedge ratios. They use a multivariate generalised autoregressive conditional heteroscedasticity (MGARCH) approach to study the behaviour of the relationship between CAT bonds and each of the stock, corporate and government bond markets for the period from January 2002 to October 2013.

The structure of catastrophe bonds

Global catastrophe insured losses have grown significantly over time. Although global losses of less than USD 10 billion per year were experienced during the 1970s and early 1980s, losses of more than USD 30 billion per year have often been experienced since the early 1990s. This increasing trend has continued since the year 2000, even after adjusting for inflation. Global economic catastrophe losses over USD 200 billion were observed in 2005, 2008, 2010, 2011 and 2012, and global catastrophe insured losses have experienced a similar pattern (see Guy Carpenter, 2012).

Given the dramatic increase in global economic and insured catastrophe losses, insurance markets have looked for innovative solutions to the problem of risk financing. In this context, CAT bonds have emerged as the predominant alternative risk-financing tool. Since its development in the early 1990s, the market for CAT bonds has grown steadily over the years and has provided a significant source of risk capital to insurers and reinsurers. It constitutes a mechanism that allows insurance and reinsurance companies to transfer natural disaster risk and meet the funding demands of mega-catastrophes.

The typical structure of a CAT bond is as follows. The insurance or reinsurance company, usually referred to as the sponsor, that wants to transfer the risk of a natural catastrophe does not issue the bond directly to the capital markets. Instead, it forms a reinsurance agreement with a special purpose vehicle (SPV) that is usually located offshore. Subsequently, the SPV issues the bond to the capital markets. Proceeds of the bond are placed

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in a collateral trust account and used to purchase high-quality assets such as short-term treasuries or AAA-rated corporate securities, in accordance with conditions stipulated in the offering documents. The vast majority of CAT bonds use a total return swap (TRS) to convert the fixed returns on the collateral securities into floating returns based on a widely accepted index, most commonly the London interbank offered rate (LIBOR). The bond's interest and principal payments are contingent upon the insured catastrophic event occurring. On the occurrence of the event, proceeds are released from the SPV to help the insurer pay claims arising from the event. In the majority of cases, investors' principal is fully at risk. Depending on the insurer's losses due to the occurrence of the insured event, investors could potentially lose the entire principal in the SPV. In return, investors receive a floating rate on their investment, most commonly LIBOR plus a risk premium. If the event does not occur during the life of the bond, they also receive the invested principal at maturity.

The role of the TRS is to immunise investors from collateral asset value fluctuations (mark-to-market) and eliminate the likelihood of default risk. Thus, this structure allows investors to gain exposure solely to the risk of the underlying peril. Since the TRS counterparty assumes the risk of movements in interest rates and the mark-to-market risk to the value of the collateral assets, the SPV, and ultimately the investors, are insulated from any investment-related risk. As a result, the CAT bond asset class should provide great diversification benefits to investors. On each interest payment date, the TRS counterparty guarantees investors a stream of LIBOR-based investment returns irrespective of the actual investment return earned on the collateral assets.

CAT bonds asset class as a source of diversification

Given the significant influence of the subprime financial crisis on the CAT bond market and the spike in correlations with other asset classes, the question still remains whether CAT bonds still constitute a good source of diversification. The recent work by Carayannopoulos and Perez analyses this question.

Their analysis is based on the construction of hedge ratios between their market proxy and three different investment opportunities: CAT bonds, corporate bonds and government bonds. Since the hedge ratios are estimated by the ratio of the covariance with the market and the variance of the market, they can be interpreted as time-varying betas. Their proxy for the market is the Standard & Poor's 500 (S&P 500) index return. Carayannopoulos and Perez estimate the variances and covariances of each one of the test assets with the market using an MGARCH model. Betas for CAT bonds are found to be very close to zero until the collapse of Lehman Brothers. They start to increase around September 2008, reaching a maximum value of 0.014 in January 2010 and coming back to close to zero at the end of the sample period. However, the economic significance of these betas is questionable even at the maximum value.

Carayannopoulos and Perez cannot deny the economic importance of the effect of the financial crisis on the corporate bond market. During the period from the end of 2008 until the end of 2009, the hedge ratio became positive with a maximum value of 0.13 observed in September 2008. Results are not as clear for the government bond market. They can still observe the effect of the financial crisis with a big jump on hedge ratio from –0.17 on September 2008 to zero on October 2008.

However the evolution of the government bond beta seems to be much more complicated and unstable. Overall, the relative change of CAT bonds hedge ratios during the financial crisis is extremely small compared with that of other financial assets. Thus, Carayannopoulos and Perez conclude that CAT bonds constitute an asset class that provides superior diversification opportunities to prudent investors.

Finally, as an additional test, they compare the hedge ratios between CAT bond and corporate bond returns. This analysis is interesting in the sense that an investor may introduce CAT bonds in a diversified portfolio consisting of corporate bonds in order to hedge the negative impact of the financial crisis. The expectation is that, if CAT bonds are a good hedging instrument relative to government bonds, then their hedge ratios should not be significantly affected by the crisis. The behaviour of hedge ratios confirms their results; hedge ratios for CAT bonds are very close

to zero during all sample periods, and they are not significantly affected by the crisis. Government bond hedge ratios drop significantly after September 2008 and remain low until the end of the crisis. Carayannopoulos and Perez conclude that the CAT bond market is a useful source of diversification in the context of a corporate bond portfolio.

Conclusion

Carayannopoulos and Perez's main findings are threefold. First, their results imply that CAT bonds were not zero-beta assets during the financial crisis. The dynamic correlation coefficients of CAT bonds with the market and the corresponding hedge ratios are statistically significant during the crisis. They argue that weaknesses associated with both the structure of CAT bond trust accounts and the composition of the assets used as collateral in the trust accounts are the main drivers of these results. Assets used as collateral in these trust accounts proved to be of lesser than expected quality and, furthermore, counterparties in swap agreements put in place in an effort to immunise collateral asset returns from market fluctuations were exposed to considerable credit risk or even defaulted during the crisis.

Second, Carayannopoulos and Perez find evidence that the effects of the financial crisis on CAT bonds disappear by the beginning of 2011, as the correlations with the market return to their statistically insignificant pre-crisis levels. These results may imply that the new and improved collateral structures created for CAT bonds issued after 2009 have been perceived as effective by market participants. These new structures attempt to enhance the credit quality of the collateral asset and include limits to the type of assets permitted in the collateral account, and constant monitoring and reporting of the collateral account balance.

Finally, and more importantly, an analysis of estimated hedge ratios of CAT bonds and other assets provides evidence that, despite the impact of the financial crisis on them, CAT bonds are still a valuable source of diversification and an asset class that should not be ignored by investors. Furthermore, steps taken after the crisis to improve the structure of the CAT bonds and further isolate investors from market risks have probably improved the diversification benefits of this asset class even further. To what extent, however, would be the subject of further research in the context of future events that could put pressure on and increase systematic risk in the financial markets.

References

Braun, A. (2011) 'Pricing catastrophe swaps: A contingent claims approach', *Insurance: Mathematics and Economics* 49(3): 520–536, http://econpapers.repec.org/article/eeeinsuma/v_3a49_3ay_3a2011_3ai_3a3_3ap_3a520-536.htm

Guy Carpenter (2012) *Catastrophes, Cold Spots and Capital. Navigating for Success in a Transitioning Market*, Renewal Report.

Lane, M.N. and Mahul, O. (2008) *Catastrophe Risk Pricing: An Empirical Analysis*, Working Paper No. 4765, Washington, DC: The World Bank, http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-4765

Litzenberger, R.H., Beaglehole, D.R. and Reynolds, C.E. (1996) 'Assessing catastrophe reinsurance-linked securities as a new asset class', *Journal of Portfolio Management* 23(special issue): 76–86.