

Securitization of motor insurance loss rate risks

Taehan Bae^a, Changki Kim^{b,*}, Reginald J. Kulperger^a

^a Department of Statistical and Actuarial Sciences, University of Western Ontario, London, Ontario, Canada

^b Actuarial Studies, Australian School of Business, The University of New South Wales, Sydney, NSW 2052, Australia

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ABSTRACT

In an attempt to transfer the loss rate risks in motor insurance to the capital market, we use the tranche technique to hedge the motor insurance risks. This paper illustrates AXA and their securitization of French motor insurance in 2005 as an example. Though this application is new, this transaction is based on a concept similar to CDOs. Tranches of bonds are constructed on the basis of the expected loss ratio from motor insurance policy holders' groups. As a consequence we develop motor loss rate bonds using the structure of synthetic CDOs. The coupon payments of each tranche depend on the level of the loss rates of the underlying motor insurance pool. We show the integral formulas for the loss tranche contract where the loss distribution is modelled with discounted compound Poisson process. Esscher transform is chosen for a risk adjusted measure change and Fourier inversion method is used to calculate the price of the motor claim rate securities. The pricing methods of the tranches are illustrated, and possible suggestions to improve the pricing method and the design of these new securities follow.

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1. Introduction

For motor insurance providers, future claims cannot be completely predicted. This risk, the mismatch of actual claims from those anticipated, is a significant one and must be managed. While, conventional methods of reinsurance are the dominant tools used in the area, some innovative applications of securitization have been gradually introduced into the market. In 2005, AXA pioneered this strategy, selling EUR 200 million of bonds, as securitization of their motor insurance portfolio. Since the issue of the innovative motor insurance securities from AXA, motor securitization has been receiving considerable attention in the noncatastrophe business line.¹

Securitization transfers risks to the capital markets, where there is greater capacity to absorb these risks compared to the reinsurance market. This is done using tradeable financial securities that have no or very low correlation with the original risk itself. Motor insurance securitization also creates new investment opportunities, providing greater diversification to the traditional assets normally offered. Investors are given the freedom to choose among tranches of bonds with different risk ratings. Hence, there are alternative securities to cater for various investors who are then able to select the most comfortable level of risk exposure.

* Corresponding author. Tel.: +61 2 9385 2647; fax: +61 2 9385 1883.

E-mail addresses: tbae@uwo.ca (T. Bae), c.kim@unsw.edu.au (C. Kim), kulperger@stats.uwo.ca (R.J. Kulperger).

¹ For more detailed information and discussion see Deringer (2006), De Mey (2007), AXA Financial Protection (2005), and Towers Perrin Tillinghast (2006).

There are several motivating factors for the launch of a securitization of motor insurance portfolio risks. The issuer will gain an alternate source of financing, a channel of risk transfer and a method of capital management. Securitization allows the insurer to eliminate counterparty risk, which it would otherwise experience from the reinsurance market, by accessing traditional ABS (Asset backed securities) investors. Also, securitization will allow the insurer to access those tools that are used by banks for risk management. The transaction will optimise the insurer's business and balance sheet with respect to volume, pricing and terms. This motivated AXA to initiate such a securitization as it would establish a flexible structure enabling the transfer of liability risks.

In classical risk theory, loss processes are very often modelled with compound Poisson process where the time value of claim payments has been ignored. Delbaen and Haezendonck (1987), and Nilsen and Paulsen (1996) studied the effect of interest rate on the loss process. Furthermore, the study conducted by Jang and Kravavych (2004) considered no arbitrage premium calculation using the duality of the discounted loss process with the shot noise process and Esscher transform. Although there exists some similarity in the approach between this study and the paper by Jang and Kravavych (2004), we focus on calculation of no arbitrage price of a stop loss contract, aimed at selling insurance risks to the capital market.

The introduction of securitization of insurance risk has been proven to be an effective way to transfer the risks. For traditional life insurance, mortality bonds have been employed by Swiss RE in 2003. Lin and Cox (2005) discussed the securitization of longevity

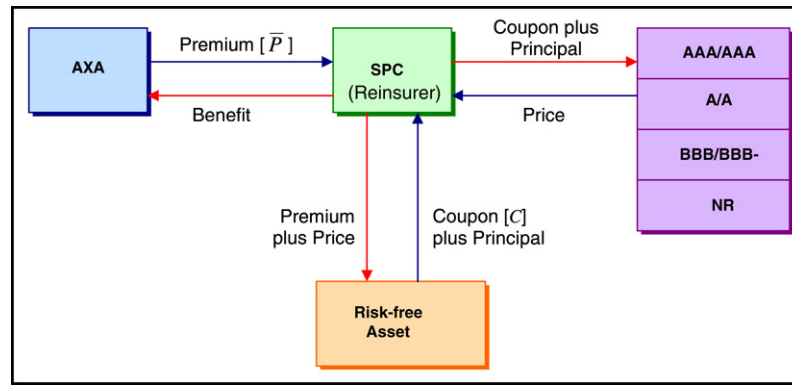


Fig. 1. Simplified structure of overall transaction.

Table 1

Features of notes issued in the AXA Motor Securitization.

	Equity Tranche	C Notes	B Notes	A Notes
Amount	Euro 33.7 million	Euro 27.0 million	Euro 67.3 million	Euro 105.7 million
Rating (S&P/Fitch)	NR	BBB/BBB-	A/A	AAA/AAA
Risk Transfer Thresholds ^a	Loss ratio trigger −3.5%	Loss ratio trigger 2.8 points of loss ratio	Loss ratio trigger +2.8%	Loss ratio trigger +9.8%
Tranche Size ^a	3.5 points of loss ratio [−3.5%; 0%]	2.8 points of loss ratio [0%; +2.8%]	7.0 points of loss ratio [+2.8%; +9.8%]	11.0 points of loss ratio [+9.8%; +20.8%]

Features are from AXA Financial Protection (2005).

^a 2005 thresholds = Loss ratio trigger.

risk in life annuity under the independent mortality assumption. In this paper, we consider the securitization of motor insurance losses with the assumption of Poisson claim arrivals and independent identically distributed claim payments. We introduce a process involved in calculation of the no arbitrage price of stop loss (or excess of loss) contract by means of the Esscher transform. Price of a stop loss contract under the compound Poisson distribution can be calculated using recursion, for example, using the Panjer recursion formula.² The numerical evaluation technique using Fourier transform and its inversion described in Dufresne et al. (2006) yields faster and more precise results than recursion with discretized claim size or Monte Carlo integration does.

We consider the structure of a synthetic collateralized debt obligations (CDOs) for the securitization of motor insurance loss rates. The details of various CDOs can be found in the study by Fabozzi and Goodman (2001), and Bluhm and Overbeck (2007). Investors have different preferences for risk. Consequently, in order to satisfy the need of the investors in the market and to create a greater demand, the security is partitioned into different tranches in accordance with the different risk levels assumed by the investors. We use the method of, the so-called, cash flow waterfall to decompose the security into tranches. This cash flow waterfall can be accomplished by distributing the realized loss to the equity tranche first and then to the senior tranches. We may refer the discussions in Finger (2002) and Hull and White (2004) on the pricing methods on CDOs.

Section 2 describes the AXA securitization process, and Section 3 presents the benefits of securitization. Section 4 describes the pricing models and Section 5 gives some numerical examples. Some concluding remarks are given in Section 6.

2. Characteristics of AXA motor insurance securitization

Prior to the discussion of the general motor insurance securitization we first consider the AXA motor securitization to

describe the essential characteristics of this system. The basic structure of AXA motor insurance securitization is illustrated in Fig. 1.

AXA takes reinsurance of its individual motor insurance portfolio through a Special Purpose Company (SPC). It pays a premium to the SPC for the reinsurance service. The SPC issues several bonds in three tranches rated by AAA/AAA, A/A, BBB/BBB- and non-rated (NR) tranche. The price is transferred to investors as coupon payments plus the principal.

The note holders are required to pay a price to the SPC in exchange for holding the bonds. The SPC invests the premium income received from AXA and the proceeds received from the note holders into a risk-free asset. From the risk-free asset, the SPC collects a coupon payment plus the principal. The SPC then transfers some of the benefit from this process to AXA. This contingent payment is measured by the difference between the real loss experienced and the expected loss, where the negative figure indicates there is no benefit to be received by AXA.

The securities are issued through private placement, meaning that the recipients have to be qualified investors. Together, they consist of three different tranches of four-year debt instruments. These notes are centralized around a predetermined loss ratio³ threshold trigger, which runs over each of the four years, treating each successive year as an independent period of cover. The trigger needs to be set such that ratings for each year can be reconfirmed by rating agencies such as S&P/Fitch, otherwise there is a possibility of early note redemption. The different tranches of the notes released by AXA, along with other essential features are depicted in Table 1.

We denote the value of the trigger by M%, due to the simplicity associated with the concept of tranche size and risk transfer thresholds. To illustrate this further, class B notes specified in Table 1 is considered. As seen clearly from the above tabulated features of the decomposed securities, B Notes are situated within the tranche from M + 2.8% to M + 9.8%. Hence, if the loss ratio

² See Bühlmann (1984), Gerber (1982) and Panjer (1981) for details.

³ Loss ratio is defined as covered losses divided by earned premiums in a given period.

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