The choice of trigger in an insurance linked security: The mortality risk case

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ABSTRACT

In 2003, Swiss Re introduced a mortality-based security designed to hedge excessive mortality changes for its life book of business. The concern was mortality risk, i.e., the risk of premature death. The mortality risk due to a pandemic is similar to the property risk associated with catastrophic events such as earthquakes and hurricanes and the security used to hedge the risk is similar to a CAT bond. This work looks at the incentives associated with insurance linked securities. It considers the trade-offs an insurer or reinsurer faces in selecting a hedging strategy. We compare index and indemnity-based hedging as alternative design choices and ask which is capable of creating the greater value for stakeholders. Additionally, we model an insurer or reinsurer that is subject to insolvency risk, which creates an incentive problem known as the judgment proof problem. The corporate manager is assumed to act in the interests of shareholders and so the judgment proof problem yields a conflict of interest between shareholders and other stakeholders. Given the fact that hedging may improve the situation, the analysis addresses what type of hedging tool would be best. We show that an indemnity-based security tends to worsen the situation, as it introduces an additional incentive problem. Index-based hedging, on the other hand, under certain conditions turns out to be beneficial and therefore dominates indemnity-based strategies. This result is further supported by showing that for the same sufficiently small strike price the current shareholder value is greater with the index-based security than the indemnity-based security.

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1. Introduction

The threat of SARS in 2003 and avian flu in 2004 subsequently have provided reminders that life insurers face correlated mortality risks on a large scale when pandemics occur. In December 2003, Swiss Re introduced a mortality-based security designed to hedge excessive mortality changes for its life book of business.1 The motivating concern was mortality risk, i.e., the risk of premature death. Mortality risk can be managed with the standard tools as long as there are no correlated mortality surprises. Such would not be the case with a recurrence of the 1918 flu or more generally with the occurrence of a new avian flu. The potential for pandemics introduces correlated risks on a large scale and so the potential for mortality surprises. The mortality risk due to a pandemic is similar to the property risk associated with catastrophic events such as earthquakes and hurricanes and the security used to hedge the risk is similar to a catastrophe (CAT) bond that pays the insurer or reinsurer when the option component of the bond is triggered by a catastrophe (Dubinsky and Laster, 2003). These instruments help hedge risk when the catastrophe generates correlated risks in the tails of the distribution.

The model constructed here is designed to analyze the potential usefulness of mortality-based securities in hedging risk. A publicly held and traded corporation with a book of life business is constructed or equivalently a portfolio of life risks. The corporation may be an insurer or reinsurer; it will be referred to as a reinsurer throughout this article. The organization is structured so that it faces mortality risk in addition to other risks such as credit and interest rate risk. Under these conditions, a reinsurer facing a capital constraint may find a mortality-based security to be a natural risk management tool and therefore turn to the capital markets to hedge the risk. It may also retrocede its book of business. The model employed here is sufficiently general to allow for both types of instruments to be considered. The focus, however, is highlighting

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A recent study by Guy Carpenter & Company (Guy Carpenter 2005), for instance identifies new risk capital in the amount of $915.3 million ($1.47 billion) that was provided through index-linked CAT bonds in 2004 (2003), while new indemnity-based transactions only amounted to $227.5 (260) million. Contrasting this, indemnity-based transactions in 1998 (1997) amounted to $846.1 ($431) million while index-based CAT bonds generated risk capital in the amount of $0 ($202 million).

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3 We refer to one of the risks as credit rather than default risk since the organization that is the object of analysis is not subject to default but rather owns a contract that is subject to default. The recently published version of (Cummins and Mahul, 2000), however, does not include the basis risk.

4 Insolvency risk is difficult to quantify for life reinsurers. One indication of the importance of insolvency risk is represented in the impairment due to catastrophe losses of eight reinsurers between 2000 and 2011, i.e., see (2012). Credit Risk of Property Catastrophe Reinsurers. Chicago, Illinois, AON Benfield. Another indication of its importance came in 2009 when Swiss Re found it necessary to seek an injection of capital from Berkshire Hathaway, i.e., see (2009), “Swiss Re seek injection from Berkshire Hathaway”. The Actuary Retrieved 01/16/2017, from http://www.theactuary.com/archive/old-articles/part-4/swiss-re-seeks-injection-from-berkshire-hathaway/.
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