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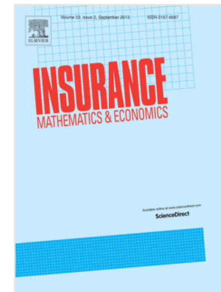

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PII: S0167-6687(14)00067-5
DOI: http://dx.doi.org/10.1016/j.insmatheco.2014.06.005
Reference: INSUMA 1952

To appear in: *Insurance: Mathematics and Economics*

Received date: September 2013
Revised date: June 2014
Accepted date: 4 June 2014

Please cite this article as: Melnikov, A., Tong, S., Quantile hedging on equity-linked life insurance contracts with transaction costs. *Insurance: Mathematics and Economics* (2014), http://dx.doi.org/10.1016/j.insmatheco.2014.06.005

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ACCEPTED MANUSCRIPT

Quantile Hedging on Equity-Linked Life Insurance Contracts with Transaction Costs

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Abstract

This paper analyzes the application of quantile hedging on equity-linked life insurance contracts in the presence of transaction costs. Following the time-based replication strategy, we present the explicit expressions for the present values of expected hedging errors and transaction costs. The results are derived by using the adjusted hedging volatility $\bar{\sigma}$ proposed by Leland. Furthermore, the estimated values of expected hedging errors, transaction costs and total costs are obtained from a simulation approach for comparison. Finally, the costs of maturity guarantee for equity-linked life insurance contracts inclusive of transaction costs are discussed.

Keywords: Quantile hedging; Equity-linked life insurance; Transaction costs; Adjusted hedging volatility.

Introduction

Equity-linked life insurance products have been issued by insurance companies for decades and become increasingly popular these years. These products include equity-index annuities, variable annuities and segregated funds, etc. As a type of investment linked products, the benefit of equity-linked life insurance contracts is stochastic. It mainly depends on the performance of investment in financial market such as stocks, foreign currencies, and some insurance-type events of the contract owners, such as death or survival to a certain date. In case of some poor investment performance, equity-linked life insurance products usually come with guarantees at maturity, which make such products more attractive than the traditional ones. Hardy (2003) gave comprehensive introduction on all kinds of investment guarantees in equity-linked life insurance, by taking into account the convergence of financial and insurance market.

Hedging strategies have been commonly used to price equity-linked life insurance contracts since first papers Brennan & Schwartz (1976, 1979) and Boyle & Schwartz (1977). They applied option pricing method to replicate the payoff of the contracts. Later on, Bacinello & Ortu (1993) and Aase & Person

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