Linking Surrender Risk to Mortality Risk: Does the Systemic Health Shock Matter?

Research Proposal

The evidence of policyholders' health status being an influencing factor of the surrender of life insurance contracts has been recorded in the literature. For example, Doherty and Singer (2003a, 2003b) argue that the surrender rate of impaired policyholders is higher than that of normal policyholders on a competitive settlement market. Moreover, Sutherland and Drivanos (1999) summarize findings on financial hardship that families with a seriously ill member experienced in the United States[1] and they emphasize that the ill patient sells a life insurance policy to acquire needed cash for dealing with the financial hardship. Giacalone (2001) also points out that the demand of selling a life insurance policy by ill insureds, as an alternative to surrendering the policy, is a major factor on viatical settlement markets. In addition, many empirical papers on lapse determinants have found that policyholders' characteristics, for example age and gender, are important drivers for lapse rates, see Cerchiara et al. (2008), Milhaud et al. (2011), Eling and Kiesenbauer (2013), Fier and Liebenberg (2013) and Kim (2013), just to name a few.

However, the relationship between mortality risk and surrender risk is rarely modelled in the life insurance literature. A few literatures that we are aware of and model the relationship between the two types of risk are Jones (1998) and Gatzert et al. (2009). The two papers recognize the mortality heterogeneity of poliyholders and adopt a frailty factor as modelled in Vaupel et al. (1979) to measure each policyholder's risk level. By assuming the policyholder's surrender is a function of his risk level, Jones (1998) analyzes the effect on the cohort force of mortality under different assumptions on the relationship between the mortality risk level and the lapse rate. While, Gatzert et al. (2009) focus on asymmetric surrender decisions triggered by the secondary market, where only contracts of impaired policyholders are sold and kept on the market, and they analyze the effects of the adverse surrender behavior on the primary insurer's surrender profits. The two papers do consider the relationship between the health status and the surrender of policyholders, but rather in a deterministic way. First, the frailty factor is drawn from a given distribution function to specify different health states of policyholders in a portfolio. However, any changes in the policyholders' health states are not tracked in the two papers and also any changes in the policyholders' surrender decisions due to their

[1]The original findings on the financial hardship were publish in 1994 on the Journal of the American Medical Association.

health state changes are not taken into account. Second, in the paper of Gatzert et al. (2009), adverse surrender behaviors of impaired policyholders implicated by the secondary market are exogenously given, rather than being linked to an endogenous triggering factor.

In this paper, we take into account a systemic health shock which harms the public health and lasts for relatively long time. Hence, the health shock applies to all the policyholders in the pool and damages on their health last for a relatively long-time period.[2] One example of the systemic health shock is the smog, which is a severe air pollution and currently prevalent in Asia.[3] Starting from the beginning of 2013, the northern part of China was hit by severe smog incidents, which damaged rural residents' health and lead to higher mortality, see Zhou et al. (2015). The smog is still continuing and getting more intensive in China. Such positive relationship between the smog and the mortality during smog episodes in industrialized countries has also been recorded in some empirical studies, see e.g., Wichmann et al. (1989) in Germany, and Anderson et al. (1995) in United Kingdom. As the policyholders' normal health state switches to an impaired state due to a systemic health shock, we expect changes in the policyholders' surrender behaviors, which have effects on the contract valuation. However, the connection between the mortality and the surrender triggered by the systemic health shock, and the presumed reactions of the policyholders on the surrender have not attracted attention in the current life insurance literature.

We use a jump process to model a systemic health shock in this paper and construct a continuous Markov chain to track a representative policyholder's health state change. We adopt the intensity-based approach of modelling partially rational surrender of the policyholder in Li and Szimayer (2014) and propose two state-dependent surrender change scenarios in case of a systemic health shock. In the first scenario, a large demand of cash spent on necessary medical treatments and improving the policyholder's living conditions threatens his financial liquidity.[4] Consequently, the policyholder becomes hurry to access surrender values. It corresponds to the Emergency Fund Hypothesis, which has been investigated and confirmed in

[2]As long as the pool is large enough, a health shock which applies only to an individual policyholder and consequently influences the policyholder's surrender, similar as the stochastic feature of the policyholder's mortality intensity, does not have much influence on the contract value, see Li and Szimayer (2011). Hence, we focus on the health shock which applies to all policyholders in the pool in this paper.

[3]The smog also happened intensively worldwide in the 19th and 20th centuries, e.g., Belgium, United Kingdom, United States, Germany, Mexico, and Chile. In addition, other examples of the systemic health shock in history include slums in European cities, ca. 1800-1900, potato famine in Ireland beginning in 1845, black population in South Africa during Apartheid ca. 1955-1993, etc.

[4]We have talked about the financial hardship of ill patients in the beginning of the introduction, see Sutherland and Drivanos (1999). Here, we use a more general term, financial liquidity problem, to include policyholders who are not terminally ill but still need a large amount of cash to pay for necessary medical treatments.

many empirical studies on life insurance lapses, see Dar and Dodds (1989), Outreville (1990), Liebenberg et al. (2012), Fier and Liebenberg (2013), and Kim (2013), just to name a few. This means the policyholder surrenders his policy more likely for exogenous reasons after experiencing the health shock in the first scenario. In the second scenario, the policyholder becomes more sensitive in handling his assets after experiencing a systemic health shock. Since the insurance policy is also a part of the policyholder's assets, see Sutherland and Drivanos (1999), we consider that the policyholder becomes more careful in dealing with his insurance policy. Higher concentration on managing his insurance contract requires the policyholder to collect more financial information and improve evaluating skills, which leads to a higher surrender intensity. Based on the two presumed scenarios, we analyze the effects of the systemic health shock on the pricing of the policy, and further discuss the effects of an early default regulatory rule imposed by a regulator on the contract's fair value.