Insurance: Mathematics and Economics 58 (2014) 138–149

Contents lists available at ScienceDirect

Insurance: Mathematics and Economics

journal homepage: www.elsevier.com/locate/ime

Life insurance policy termination and survivorship[☆]

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HIGHLIGHTS

- We model the mortality of terminated contracts to understand lapses and survival.
- We find statistical evidence of mortality selection based on insurance company data.
- These results indicate a 50–50 chance of a positive loss when a policy terminates.

ARTICLE INFO

Article history:
Received August 2013
Accepted 22 June 2014
Available online 10 July 2014

Keywords:
Survivorship and persistency
Duration models
Gompertz models
Mortality selection
Financial cost of termination
GB2 models

ABSTRACT

There has been some work, e.g. Carriere (1998), Valdez (2000b), and Valdez (2001), leading to the development of statistical models in understanding the mortality pattern of terminated policies. However, there is a scant literature on the empirical evidence of the true nature of the relationship between survivorship and persistency in life insurance. When a life insurance contract terminates due to voluntary non-payment of premiums, there is a possible hidden cost resulting from mortality antiselection. This refers to the tendency of policyholders who are generally healthy to select against the insurance company by voluntarily terminating their policies. In this article, we explore the empirical results of the survival pattern of terminated policies, using a follow-up study of the mortality of those policies that terminated from a portfolio of life insurance contracts. The data has been obtained from a major insurer which traced the mortality of their policies withdrawn, for purposes of understanding the mortality antiselection, by obtaining their dates of death from the Social Security Administration office. Using a representative sample of this follow-up data, we modeled the time until a policy lapses and its subsequent mortality pattern. We find some evidence of mortality selection and we consequentially examined the financial cost of policy termination.

1. Introduction and literature

A life insurance contract is one very unique and complicated consumer product to put a price tag on. By the very nature of the product, its price has to be determined even before its actual underlying cost can be accurately assessed. Although actuaries responsibly predict the cost, it certainly can take several years before its ultimate price can indeed be determined. When determining a premium to assess for the product, the actuary makes its best estimate according to factors that directly affect the cost of the product including, but not limited to, the level and pattern of benefits, policy features and guarantees, expected returns on investments, and expenses. Some assumptions about mortality pattern and policy termination, together with the uncertainties and possible resulting variabilities associated with them, will additionally be required in the calculation of a premium. See Atkinson and Dallas (2000).

However, additional to this already complicated factors and assumptions is the consideration of the effect of policyholder behavior. One school of thought asserts that buyers of insurance products behave or react differently in the presence of insurance coverage. See Kunreuther et al. (2013). Whether consumers act rational or not in the presence of insurance, it is a widely accepted perception that there is an asymmetry of information in the insurance market. Under several circumstances, the insurer does not often have

☆ The authors acknowledge the Janet and Mark L. Goldenson Actuarial Research Center of the University of Connecticut for the funding support to complete this project. Specifically, Ushani Dias received a summer research grant to assist in the completion of this work.

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http://dx.doi.org/10.1016/j.insmatheco.2014.06.011
0167-6687/

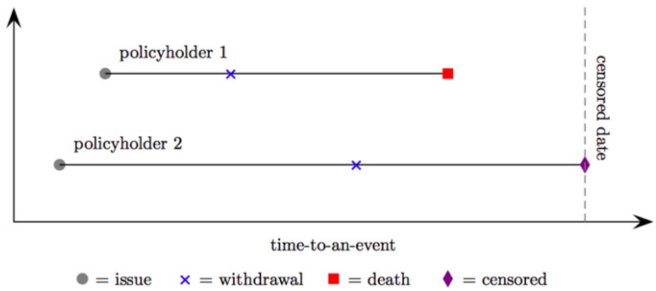

Fig. 1. Illustrative diagram of the observed times until withdrawal and death.

all the available information to accurately underwrite the level of risks of potential policyholders. Nevertheless, the insurer relies on the pooling of risks based on the assumption that there will be a large enough number of homogeneous risks so that the expected aggregate cost of insurance can be determined with reduced variability. The presence of asymmetric information has the potential to distort this homogeneity within the group and the resulting tendency is the pooling of more risks considered "worse" than the average risk. See, for example, the illustration of Bluhm (1992) in the case of health insurance policies. Several undesirable consequences of policyholder behavior may be mitigated so long as the insurer practices prudent risk management.

In this paper, we focus on policy termination together with understanding the survivorship pattern resulting from terminated policies. Our observable data is an extract from a real life data of a portfolio of terminated life insurance policies from an undisclosed insurance carrier which tracked the mortality dates of these policies from the US Social Security Administration office. The primary purpose of obtaining such information is to first understand the relationship between policy termination and mortality, and later, more importantly, to assess the financial implication of this relationship in the design, pricing and risk management of insurance products. These terminated policies are as of a fixed date, hereby undisclosed to preserve some level of confidentiality. The recorded death date information is also as of this same fixed date which is then considered the censoring date used in our model calibration. Our data file also recorded period around 1920s as the year with the earliest policy issue date in the portfolio. On the aggregate, we have observations totaling to 65,435 terminated single life policies, discarding joint life policies for purposes of our analysis. This set of observations that we use for model calibration in this paper is only a random sub-sample from the insurer's portfolio used in their analysis.

The type of observations in our empirical data is vividly illustrated in Fig. 1. According to this figure, we observe two distinctly classified policyholders, herewith labeled policyholders 1 and 2, where in both cases, we observe the times when each withdraw their policy out of the insurance company. Policyholder 1 dies before the end of the observation period and therefore we can observe its time from withdrawal until time of death. On the other hand, policyholder 2 is still alive at the end of the observation period and is therefore clearly considered a right-censored observation.

Given a policy is issued at a fixed and known age, denote this by z, we are interested in estimating the probability distribution of the time-until-withdrawal and the time-until-death from issue. Denote these times to events, respectively, by the random variates T_w and T_d, and define the difference as $T_{wd} = T_d - T_w$. Our data file allows us to observe T_w and the conditional random variate $T_{wd}|T_w$, or effectively $T_d|T_w$ since $(T_{wd}|T_w) = (T_d|T_w) - T_w$. For notation purposes, we can express $T^*_{wd} = T_{wd}|T_w$ and $T_{d|w} = T_d|T_w$. Notice that because not all policies were followed up until their times of death, censoring is therefore present and the observable T_d is therefore calculated as of the censoring date, as previously explained, and a censoring variable is recorded for each of the policies in the portfolio. These are indeed called right-censored observations which are typical in mortality studies. See, for example, Elandt-Johnson and Johnson (1980). Of our entire observations, we found that we have a total of 61,889 right-censored observations. Slightly over 5% of our observations are deaths, something not atypical of mortality follow-up studies.

Understanding, recognizing and measuring the relationship between policy termination and survivorship in a life insurance portfolio can be of considerable importance to actuaries with pricing, reserving and risk management responsibilities. This interconnection between termination and survivorship is something called in the insurance literature as mortality selection. This selection roughly produces an unbalanced mixture of low and high mortality risks which could have a spiraling effect on the insurer's portfolio of policies. Policyholders who terminate their policies are believed to have better mortality risks than those who remain; these policyholders are able to seek coverage elsewhere at possibly better premium rates. On the other hand, those who remain will have the effect of a worse mortality pattern than would have been originally anticipated creating a circumvolved early death claims. See the monograph published by Munich RE on how life insurance companies may combat such selection; see Donnelly (2011).

The extent of the probable damage caused by mortality selection will vary according to the nature and type of the life insurance product. For instance, in a traditional whole life insurance, the consequences could range from low to unmanageably high. Possible factors that contribute to this extent include the permanent long term nature of the commitment where the periodic payment of the premium is fixed at issue; policy alteration may be possible but within contractual constraints. Furthermore, this relationship may be more important in the life settlement business which as of late has turned into a multi-billion dollar industry. With life settlements, life insurance contract holders have the option of selling their policies to third party investors in the capital market, in lieu of terminating their policies. Such an arrangement has the potential financial attractiveness both to the policyholder and the investor. See, for example, Doherty et al. (2002) and Vadiveloo (2005). In this type of market, the investors would be interested in the survivorship patterns of these potentially terminating policies. The typical pricing approach for life settlement policies is to assume that the insured lives will have impaired mortality. This is a contrast to the mortality selection you would expect from a portfolio of ordinary life insurance policies. Finally, the recognition of the relationship between termination and survivorship is probably more importantly pronounced in lapse-supported products, something more common in Canada introduced in the early 1980s. See Tullis and Polkinghorn (1992). Pricing for lapse-supported products is very sensitive to the assumption of the proportions of policyholders terminating their policies; these are policies that provide long term commitments without the attraction of a cash surrender value at policy termination.

It is an unfortunate situation that there is a scant research work published in the literature about the true nature of the relationship between policy termination and survivorship. This is not to say that researchers and practitioners do not recognize its relevance, indeed far from it. In practice, the common method is to select average mortality and lapse rates, on the "aggregate" as Jones (1998) points out, applied to a class of contracts and policyholders. The aggregation, of course to the extent it is measurable, may vary according to the heterogeneous characteristics of the policyholders within a portfolio. Mortality impairment in subsequent periods is then reflected through the use of excess lapse rates for renewed policies. See also Dukes and MacDonald (1980). This approach is quite commonplace and recommended in reserving guidelines for