A Study of Incidence Experience for Taiwan Life Insurance

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ABSTRACT

Mortality improvement has been a popular topic in insurance business and the life expectancy of human being is likely to prolong in the near future. The life expectancy of people in Taiwan has increased significantly since the end of World War II, and becomes even more noticeable after the National Health Insurance (NHI) was enforced in 1995. However, even though every Taiwan people owns 3 insurance policies on average, about half populations in Taiwan do not purchase any life insurance products. It is still unknown whether the population of purchasing insurance products would have similar mortality profiles as those do not purchase. Because often there are not enough data of incidence experience, sometime we need to rely on population life tables. Thus, we want to explore if the mortality rates of population with insurance policy differ significantly from those without insurance policy.

Table 1. Summary of Insurance Policy

Type	No. of Policy
Term Life	4,268,921
Endowment	24,132,752
Whole Life	22,610,097

In this paper, we will study the incidence data from Taiwan Life insurance companies, for the years 1972~2007 (26 years of data). The data were collected via Taiwan Insurance Institute (TII) and cover all life insurance companies in Taiwan. There are three types of insurance policies included in the study: Term life, Endowment, and Whole life. The numbers of policies are summarized in Table 1, and the endowment is the most popular, which is quite unique. The empirical study will be separated into two parts: one is to check if there are factors which are mortality

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related, and the other is to compare the mortality rates from population table and experience table. We shall introduce the major findings according to this order.

Because the Taiwan population is around 23 millions and the yearly mortality rates would have large fluctuations, the data are partitioned into 5-year and 5-age groups with the highest age group 80+ (ages 80 and over). We found that there are four factors which are related to the mortality rates: Medical Exam, Repayment of Principal, Company Size, and Benefit Amount. As expected, the mortality rates with medical exam are smaller (the male data as a demonstration, as seen in Figure 1). Because the nature of principal repayment is similar to annuity, i.e., payment upon survival, it is not surprise to see the mortality rates are smaller for policies with repayment of principal. The differences are less obvious for the whole life.

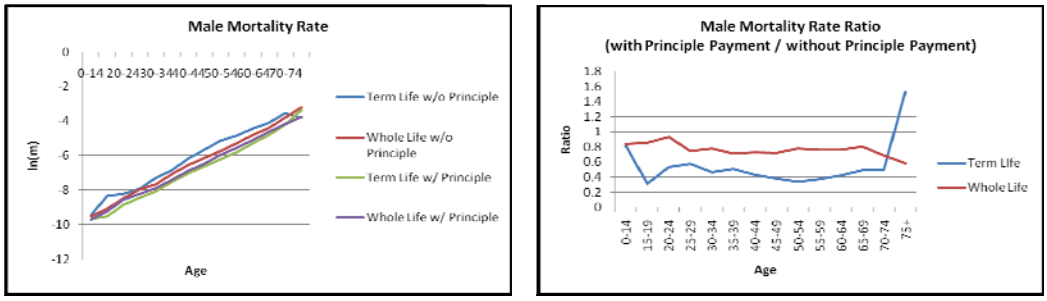

Figure 1. The Mortality Comparison (Male, Principal Repayment)

Table 2. Summary of Company Size

Gender	Company Size	Term Life	Endowment	Whole Life
Male	Large size Company	1,584,231	11,352,337	9,560,227
	Middle size Company	239,357	654,538	1,721,926
Female	Large size Company	2,165,901	10,952,936	9,160,791
	Middle size Company	223,935	712,346	1,745,610

We summarize the policies according the company size (large size vs. middle size) in Table 2. We can see that the whole life policies have much larger market share for the middle size companies. The overall mortality comparisons for the company size are in Figure 2. The mortality rates of middle size companies are generally

smaller in all age groups. It might be that the middle size companies are less tolerant in loss and thus are more risk-sensitive.

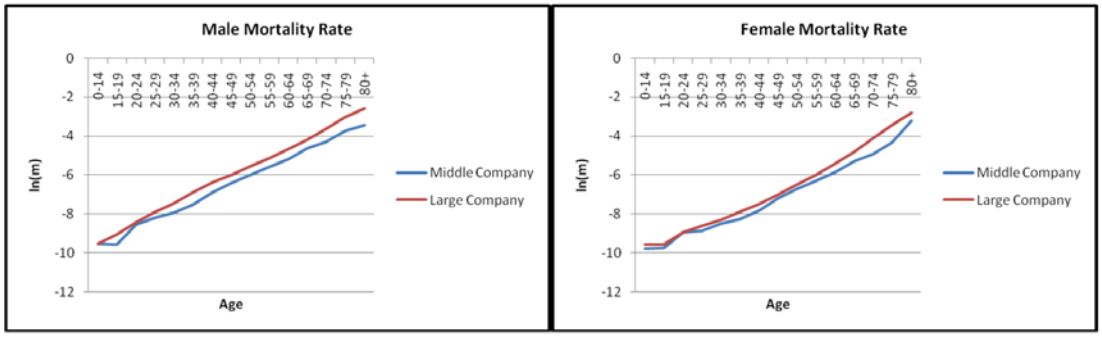

Figure 2. The Mortality Comparison (Company Size)

The benefit amounts are divided into three categories: less than $0.5 million NT dollars, $0.5~1.0 million NT dollars, and more than $1 million NT dollars. For the term life insurance, the policies with benefit amount less than 0.5 million NT dollars have the smallest mortality rates, while those with benefit amount more than 1.0 millions NT dollars have the largest mortality rates (Figure 3). The patterns reverse for the endowment insurance, the mortality rates are the smallest for benefit amount more than 1.0 million NT dollars. This is an important finding since it might imply that insurance companies should adopt different mortality rates of pricing according to the benefit amounts in order to avoid biased selection. We can use this information to further differentiate mortality risk (Term Life) and seek a better solution in handling longevity risk (Endowment).

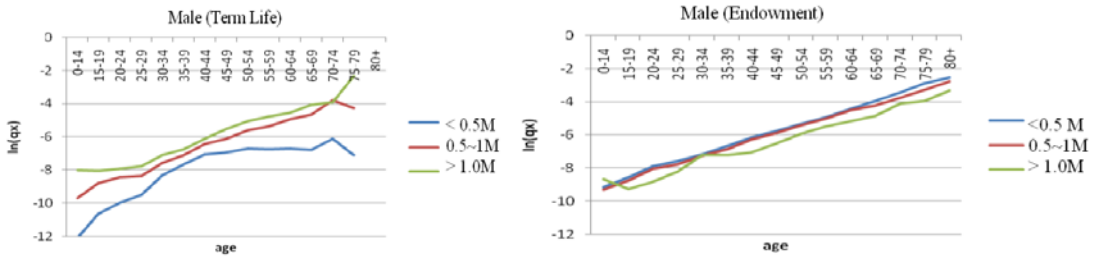

Figure 3. The Mortality Comparison (Male, Benefit Amount)

We use the Lee-Carter model to compare the mortality rates from population table with those from experience table. The Lee-Carter model was proposed by Lee

and Carter (1992) and the central mortality rate $m_{x,t}$ is supposed to follow the following equation

$$\ln\left(m_{x,t}\right) = \alpha_x + \beta_x \kappa_t + \varepsilon_{x,t},$$

where the parameter α_x describes the average age-specific mortality, κ_t represents the general mortality level, and the decline in mortality at age x is captured by β_x.

The coefficients α_x and β_x have similar values for the whole Taiwan population and the people purchasing insurance products. However, the mortality improvement over time, which can be expressed in terms of κ_t, behave quite different between these two groups. As shown in Figure 4, the slope of κ_t is steeper for the people purchasing insurance products and this indicates that they have much obvious mortality improvement. Because the life industry only has less than 40 years of history in Taiwan (started in 1970's), sometimes relying on the population data to develop experienced rates is unavoidable. However, based on our findings, this must be handled with care since the mortality improvement is likely to be different. If the annuity table is constructed via the population data, the premiums will be under-estimated.

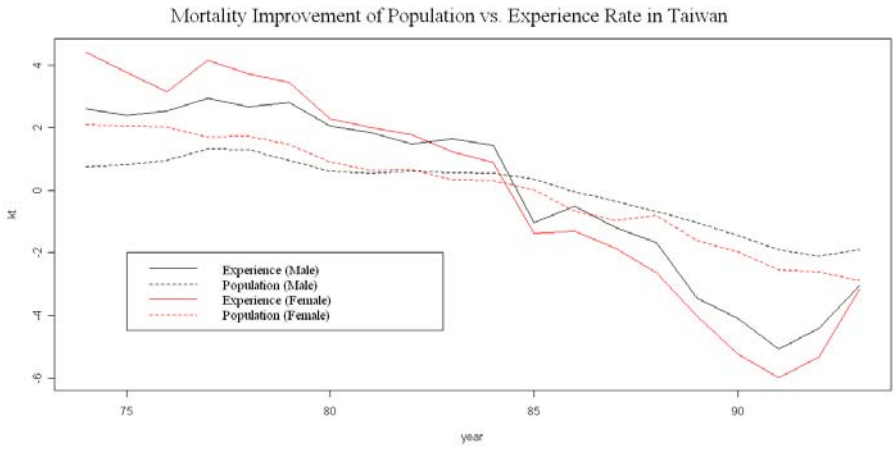

Figure 4. Mortality Improvement of Population vs. Experience