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ASYMMETRIC INFORMATION IN LIFE INSURANCE: DIFFERENCE BETWEEN WHOLE LIFE AND TERM LIFE *

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Abstract

This paper provides empirical evidence consistent with the existence of adverse selection and moral hazard in the whole life and term life insurance market. We use life insurance companies' data to recognize adverse selection, moral hazard, and medical examination effects. Drawing on data from more than 1.3 million insurance policies in Japan, we find evidence that the mortality of the insured at policy inception is lower than that of the general public; with the selection of the insured via medical examination, we did not find adverse selection in new whole life and term life insurance risks. In the case of automatic renewal of term life policies where insurance companies set the price using the same regulated mortality table as that of optional renewal term life policies, the effectiveness of medical selection attenuates after approximately five years of the policy life, and the costs from adverse selection and the moral hazard from suicide begin to occur around the fifth year.

Keywords: adverse selection, moral hazard, whole life insurance, term life insurance, automatic renewal clause of term life insurance, suicide clause

I. *Introduction*

Japan has one of the most developed life insurance markets. The market accounted for 17.5% of the world's insurance premium income in 2010 and is the second largest market (Swiss Re, 2011). Unlike in the top-ranked U.S. market and other developed life insurance markets, there are still relatively few life insurance companies in Japan. For a long period following WWII, for example, the market was serviced mainly by 20 + large domestic companies and the products were skewed toward death protection. Today, we find diversity in product type and distribution scope as well as steep competition between domestic insurers and between domestic and foreign insurers.

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The number of term life insurance policies has been increasing, accounting for 35.9% of the individual life insurance market in 2012 on a primary security amount basis. Average benefits in this category are the highest among all products at $239,100 per policy. This can partially be attributed to the heavy selling of term life insurance by foreign and online insurers, whose market shares have been growing in recent years. As the growth of the Japanese national income stagnates, many consumers prefer products with a low premium payment (e.g., term life insurance).

What can be viewed as unique in the Japanese term life insurance market is the fact that the majority of companies sell policies that are automatically renewed without the insured being subject to a medical examination for renewal. For more than 40 years, the authorities have approved the automatic renewal clause of term life insurance, with the aim of protecting policyholders. Thus, the companies set the price of automatic renewal term life insurance using the same regulated mortality table as that of optional renewal term life insurance. Optional renewal is found only in selected products, for example, Daido Life's Health Discount Term Life, Mitsui Life's Term Life (with a special rate for individuals with good health), Sony Life's Nonrenewal Term Life, and AXA Life's Nonrenewal Term Life.

The automatic renewal provision, on the one hand, is advantageous for policyholders because the policy can be renewed, for example, regardless of the insured's health condition. In the risk pool, the premium charge for the unhealthy insured is the same as that for the healthy insured. On the other hand, insurance companies selling such policies face problems when the unhealthy insured's mortality rates deviate (i.e., rise) more than initially assumed. Ceteris paribus, the more a person's health declines, the higher the probability of that person's renewal and continuance, while the healthier a person, the more likely that person is to switch to another product or company that offers a similar, if not identical, coverage at a lower premium rate. Generally, we assume that the insured has more knowledge about his or her expected losses (claims) than the insurer and that this information asymmetry can lead to problems of adverse selection for the insurance company.

The insured's ability to exercise their rights—albeit not fully— in their own policy (for example, committing suicide *after* policy inception) is an equally important issue in life insurance. Life insurers thus manage the risk of moral hazard.

In this study, we use category-specific data of more than 1.3 million policies in Japan to examine problems of adverse selection and moral hazard in whole life and term life insurance markets in Japan. Adverse selection is the process by which the price and quantity of goods or services in a given market is altered due to one party having information that the other party cannot obtain at reasonable cost. Moral hazard is the lack of any incentive to guard against a risk when you are protected against it (as by insurance). Specifically, we analyze the data to investigate whether adverse selection and moral hazard actually exist, and, if so, attempt to estimate the cost associated with these problems. We assume that the adverse selection problem is caused by people who lack confidence in their health and are willing to subscribe to insurance, thus making the mortality rate of those with life insurance higher than the national mortality rate. Problems of moral hazard might be manifested in the form of suicide by the insured and that insurers incur (significant) cost to obtain relevant information for the better management of such problems.

There are numerous preceding studies, including one by Rothschild and Stiglitz (1976), on adverse selection in insurance markets. Some of the previous literature discusses moral hazard

as well. However, to our knowledge, no study has practically demonstrated how to minimize cost associated with adverse selection or moral hazard, which, if not addressed, would lead to a collapse of the market for the products in the long run. Further, no study has examined whether those risks are reduced to a large extent with practical measures. In the insurance market—that is, in a structured risk-financing market—insurers can significantly mitigate the monetary incentive issue due to asymmetric information with a variety of practical tools and contractual measures. We also attempt to offer a framework that helps insurance companies offer insurance at more reasonable prices, thus, providing benefits for both consumers and insurance companies.

II. *Literature Review*

The life insurance market presents an opportunity to test the existence of adverse selection for several reasons. It is an important market not only from an individual point of view but also from a public policy perspective. Life insurance policies are relatively explicit regarding benefits (although less explicit regarding conditions and exclusions). None of the existing life insurance markets are free from problems of adverse selection or moral hazard. However, moral hazard—*after* policy inception—has been largely ignored in this market based on the belief that an insured person is unlikely to shorten his or her life to help the beneficiary obtain the insurance proceeds. We examine these market problems and funding issues partially on the basis of existing studies.

1. Economics of Adverse Selection and Moral Hazard

The life and healthcare insurance market can be characterized by problems of asymmetric information between the insurer and the insured as well as problems of induced supply of services by healthcare professionals. A substantial amount of theoretical research has addressed these problems, and numerous studies have examined the resulting failures in the insurance markets. In particular, Rothschild and Stiglitz (1976) constructed a basic model of imperfect information in insurance markets and asserted that their model can be applied to many cases, for instance, where communities offer listings of public goods and taxes that individuals refer to when choosing a community. Subsequent research in the first decade after the seminal paper by Rothschild and Stiglitz largely focused on theoretical models. Empirical studies have advanced impressively since then (Cohen and Siegelman, 2010).

Adverse selection theory in insurance relates to the correlation between insurance coverage and risk. Ceteris paribus, the insured, knowing that they are high risk, are expected to choose higher insurance coverage (or no or lower deductible) than others. This positive risk-coverage correlation has been a major empirical study subject in insurance. At the same time, there may be unobservable differences in the insured's precaution levels such that those with a higher insurance coverage tend to have less incentive to take precautions that can reduce the loss outcome. Because of the differences in "hidden actions," moral hazard may also produce a positive risk-coverage correlation. Accordingly, the presence of such a correlation can be attributed to adverse selection as well as moral hazard, as emphasized by Dionne et al. (2009).

Okura (2013) applied microeconomic theory to investigate the relationship between moral

hazard and insurance fraud.

Some studies found no evidence of a positive correlation between health insurance coverage and risk (Ettner, 1997; Browne and Doerpinghaus, 1993).

A positive coverage-risk correlation is also absent or weakly observed when the insurer possesses more or better information about an insured individual's risk than the insured individual does (Chiappori and Salanié, 2000). Insurers may acquire this information superiority position through initial and renewal underwriting as well as through risk classification.

Studying the term life insurance market, Hendel and Lizzeri (2003) presented strong evidence of the existence and significance of learning over time. They focused on symmetric learning, in which both the insured and insurers gradually gain new information about the insured's mortality risk. The conclusions of this study are supported by Finkelstein et al. (2005), who found that in the U.S. long-term care market, those insured who discontinue their coverage are subsequently less likely to use a nursing home and that discontinuing their coverage is at least partly a response to positive information about the insured's own health situation.

Cawley and Philipson (1999) have reported several findings that seem difficult to reconcile with the conventional theory of insurance under asymmetric information. They assumed that insurers understand their costs of production better than consumers in this market do, as for most other products. By measuring the ratio of mortality risk of insured males to the overall population of males by age for the period 1970 to 1975, they found that men with life insurance are at a lower mortality risk than the overall population. They also observed that the relatively riskier males are less likely to have insurance.

Chiappori and Salanié (2008) discovered interesting dynamic issues in insurers' strategies. When an insurance company sells a policy that it commits for the long term (e.g., a life insurance policy with a guaranteed renewal clause), it is *de facto* offering an option product, the pricing and hedging of which raise delicate problems. For instance, selective attrition may be a serious concern, and computing provisions is a difficult problem in life insurance.

He (2009) found a significant and positive correlation between the decision to purchase life insurance and subsequent mortality, conditional on risk classification. For example, those insured who died within the 12-year time span after the base year were 19% more likely to have applied for life insurance in that base year than those who survived the 12-year span. Moreover, as might be expected, when individuals possess residual private information, He (2009) found that the earlier an individual died, the more likely he or she was expected to have initially bought insurance.

Colquitt et al. (2012) presented evidence consistent with adverse selection in the credit life insurance market. As credit life insurance pricing does not account for age, they posited that in the presence of adverse selection, there exists a positive relation between age and demand for credit life insurance.

Chen et al. (2008) investigated the relationship between life insurance and suicidal behavior using OECD cross-country data from 1980 to 2002. Through semi-parametric instrumental variable regressions with fixed effects, they found that for the majority of observations, there is a positive relationship between the suicide rate and the life insurance density (per capita premium). As life insurance policies pay death benefits even for suicide cases after the suicide exemption period, the presence of adverse selection and moral hazard suggests an incentive effect that leads to this positive relationship. The novelty of their analysis lies in the use of cross-country variations in the length of the suicide exemption period in life

insurance policies as the identifying instrument for life insurance density. Their results provide compelling evidence for the existence of adverse selection and moral hazard in life insurance markets in OECD countries.

Yamamoto, Yoneyama and Kwon (2012) examined adverse selection and moral hazard in the whole life insurance market. Drawing on data from more than 400,000 cases in Japan, they found that the mortality for the insured at the point of purchase of the policy is lower than that for people in general because of medical selection, and hence, no adverse selection occurs. Concerning the period after the policy is granted, they demonstrated that the mortality for the insured increases owing to adverse selection, and in addition, moral hazard contributes to this increase.

2. Hypothesis Development

Cawley and Philipson (1999) suggested that insurers know the insured's health condition better than the insured do. This may be because the insurers, via the underwriting process, ensure that the insured provide in the application form whether or not each insured has consulted any doctor in the past three months, if any abnormality has been found during the medical checkup in the past two months, if the insured has been treated for seven days or more in the past five years, or if the insured has any disability. Furthermore, when the life insurance benefit exceeds a certain amount, the insurers restrict the sale of insurance to individuals in poor health by obtaining information such as the results of a urine test, blood pressure, height, weight, chest circumference, abdominal circumference, and eyesight, so that equity among the insured individuals is ensured.[1] It is, therefore, expected that at the time of enrolment, the mortality rate of those who are purchasing insurance may be lower compared to that of people in general.

He (2009) analyzed data for a period of 12 years after the insured had purchased their policies and found that the mortality rate of those covered by insurance is much higher than that for people in general. This, which seemingly contradicts the suggestion by Cawley and Philipson (1999), may reconcile with the fact that the mortality rate until 11 years after the purchase of an insurance policy is lower than that of people in general, and the mortality rate 12 years after such a purchase is higher than that of people in general. In other words, even though the mortality rate of those who purchase insurance is lower than that of people in general at the time of enrolment, the insurer does not carry out further medical examinations thereafter, and those who continue their life insurance policies are thus likely to have a higher mortality rate than that of those who cancel their policies. Although adverse selection during the insurance process is prevented through assessment, it is presumable that this no longer holds true once the policy has been granted.

According to Chen et al. (2008), there is a positive relationship between suicide rate and insurance density in OECD countries. In addition, they suggest this outcome is reasonable because life insurance benefits are paid even for a suicide after the suicide exemption period. This phenomenon falls within the criteria of moral hazard. Moreover, in the long term, moral

[1] This threshold varies depending on age. For a term life insurance by Lifenet Insurance Company, for example, the amount is ¥30 million for individuals aged 18~40, ¥25 million for those aged 41~45, ¥20 million for those aged 46~50, ¥15 million for those aged 51~55, and ¥10 million for those aged 56~64.

hazard may contribute to a higher mortality rate of those covered by insurance than for people in general.

In light of these preceding studies, we verify the following three hypotheses in this paper:

Hypothesis 1: In whole life, we cannot recognize any effects by adverse selection and moral hazard.

Hypothesis 2: In automatically renewable term life, the mortality rate of the insured exceeds the national mortality rate after five years because of adverse selection. With term life wherein death benefits are the primary reason for buying a policy, moral hazards appear after five years.

The model proposed by Rothschild and Stiglitz (1976) is based on the assumption that only individuals know their own health condition and private insurers cannot set correct premiums based purely on the information provided by the individuals. Thus, the insurers charge all clients the same premiums reflecting the average risk in the pool. This pooled premium structure attracts more high risks than low risks, and the market is not sufficiently efficient.

Despite the theoretical model's innovative expression of asymmetric information, it does not accurately reflect the reality that private insurers charge different premiums based in part on the findings from the application form and underwriting. The insurance companies reduce adverse selection significantly through medical selection during the policy approval process, but it appears that in principle, neither adverse selection nor moral hazard can be avoided.

III. *Model and Data*

Prior to determining whether the actual mortality rate is significantly higher or lower, it is essential to define the standard, that is, the national mortality rate calculated by age and gender. The comparison between the actual mortality rate for a specific product in a specific year and the general national mortality rate is not meaningful because the gender composition ratio and the age composition of a specific product in a specific year differ from those for the general national mortality rate. Therefore, we must first calculate the national mortality rate that corresponds to the gender composition ratio and the age composition of a specific product in a specific year, and then compare the calculated value with the actual mortality rate. If we calculate the mortality rate by gender and age by evaluating the total insurance policy value of a specific product, contracted by a specific company in a specific year, and weigh the national mortality rate by its policy value for the gender and age, we can obtain the national mortality rate and compare it with the actual mortality rate associated with a specific product in a specific year. Equation (3) below illustrates the calculation.

Our paper is superior to existing studies with respect to the collection and analysis of data, as we obtained data for whole life insurance policies (872,646 + 418,300 policies) and term life insurance policies (25, 576 policies) from insurance companies then calculate the national mortality rate and the actual mortality rate using the *Abridged Life Table 2007* (from the Ministry of Health, Labour and Welfare, 2007). Moreover, we compare the national mortality rate with the actual mortality rate for term life insurance more extensively than existing studies

do and estimate the occurrence of adverse selection and moral hazard.

Factors other than adverse selection and moral hazard can explain the differences between the national mortality rate and actual mortality rate, but these factors have not had much effect on life insurance owing to the law of large numbers. For example, according to the Ministry of Health, Labour and Welfare, the national mortality rate of Japan in 2011 was 10.0 (per 1,000 people), which only slightly exceeded the 9.5 (per 1,000 people) rate in 2010 despite the Great East Japan Earthquake.

1. Model

Taking the model in which the termination event is limited to the three possibilities—death (other than suicide), suicide, and discontinue—the national survival rate (p_x) of an x-year old insured at policy inception is

$$p_x = 1 - q1_x - q2_x = 1 - q_x \tag{1}$$

where x is the age at entry, $q1_x$ is the national mortality rate (from death other than suicide), $q2_x$ is the national suicide rate, and $q_x = q1_x + q2_x$.

Then, the actual survival rate (p'_x) becomes

$$p'_x = 1 - q1'_x - q2'_x - w_x = 1 - q'_x - w_x \tag{2}$$

where p'_x is the actual survival rate, $q1'_x$ is the actual death rate (from other than suicide), $q2'_x$ is the actual suicide rate, w_x is the actual discontinue rate, and $q'_x = q1'_x + q2'_x$.

The national mortality rate (FY2010, elapse$=t$) weighted by policy value is then

$$AQ(t) = \frac{\sum_{\substack{i \in N \\ t_i = t}} q(x_i + t_i,\ s_i) \times V(x_i + t_i,\ s_i)}{\sum_{\substack{i \in N \\ t_i = t}} V(x_i + t_i,\ s_i)} \tag{3}$$

where N is the set of contracts in force for the particular product for FY2010 (total subscriptions for Fiscal Year 2010), $i \in$ N, x_i is the age of an insured of policy i at the time of subscription, t_i is the elapsed time (=t) of contract i and s_i is the sex of an insured of contract i, q(x_i, s_i) is the national mortality rate of age group x_i, resulting in $x_i + t_i$ as the attained age of the insured for FY2010 and $V(x_i + t_i,\ s_i)$ is the policy value of group (x_i, s_i).

The national mortality rate, q($x_i + t_i$, s_i) is from the *Abridged Life Table 2007*, published by the Ministry of Health, Labour and Welfare, and the 'policy value' is the sum payable on the death of an insured. Using Equation (3), the calculation of the national mortality rate (elapse = t) is illustrated in Table 1.

Accordingly, the actual mortality rate (*FY2010,* $t_i = t$) weighted by policy value is

$$AQ'(\mathrm{t}) = \frac{\sum_{\substack{i \in N \\ t_i = t}} q'i \times V(x_i + t_i,\ s_i)}{\sum_{\substack{i \in N \\ t_i = t}} V(x_i + t_i,\ s_i)} \tag{4}$$

where N is the set of contracts in force for the particular product for Fiscal Year 2010, $i \in N$, t_i is the elapsed time(=t),

TABLE 1. NATIONAL MORTALITY RATE CORRELATING WITH WHOLE LIFE INSURANCE IN 2010 (Example)

Group	Sex	Attained Age $(x(i)+t)$ (years)	(a) Mortality Rate in the National Life Table (‰)	(b) Total Amount of Insurance in Force ($ billion)	(a)×(b)
1	Male	30	0.70	10	7.00
2	Male	40	1.40	20	28.00
3	Male	50	3.31	10	33.10
4	Female	30	0.36	2	0.72
5	Female	40	0.71	4	2.84
6	Female	50	1.71	2	3.42
Total			1.56	48	75.08

$q'_i = 1$ if insured i died in FY2010.
$q'_i = 0$ *otherwise*

We define *M(Elapse=t)*, **the mortality ratio** weighted by policy value at year *FY2010*, as

$$M(t) = \frac{AQ'(t)}{AQ(t)} \tag{5}$$

Then, the national suicide rate (*FY2010, Elapse=t*) weighted by policy value is

$$AQ2(t) = \frac{\sum_{i \in N,\ t_i = t} q2(x_i + t_i,\ s_i) \times V(x_i + t_i,\ s_i)}{\sum_{i \in N,\ t_i = t} V(x_i + t_i,\ s_i)} \tag{6}$$

and the actual suicide rate (*FY2010*) weighted by policy value is

$$\mathrm{AQ2'(t)} = \frac{\sum_{i \in N,\ t_i = t} \mathrm{q2'}_i \times V(x_i + t_i,\ s_i)}{\sum_{i \in N,\ t_i = t} V(x_i + t_i,\ s_i)} \tag{7}$$

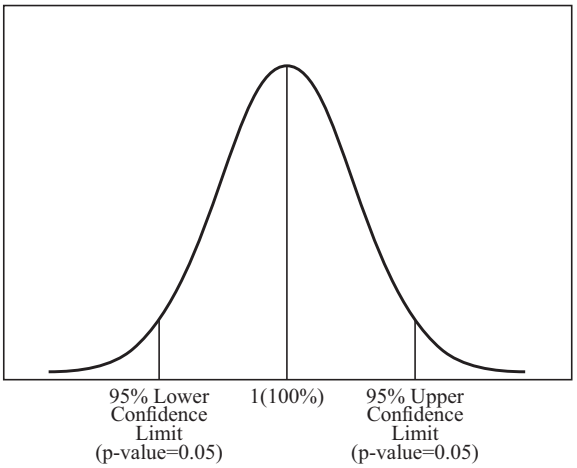
We define S*(Elapse=t)*, **the suicide ratio** weighted by policy value, as

$$S(t) = \frac{AQ2'(t)}{AQ2(t)} \tag{8}$$

When the actual mortality rate (weighted by policy value) and the national mortality rate (weighted by policy value) are equal, the mortality ratio is 1 (or 100%). If the mortality ratio exceeds 100%, then the mortality rate of the insured (after taking age and gender into account) has surpassed the mortality rate of the population as a whole. In other words, the insured have more knowledge of their health condition than the insurer, and adverse selection can be said to have occurred. With the aim of improving the logical consistency of our method, we examine both tails of the distribution while applying a significance level of 5%. Accordingly, if the mortality ratio surpasses the 95% upper confidence limit of $100\% + u(0.975)\sqrt{(1 - AQ(t))/AQ(t)n}$, we demonstrate statistically that adverse selection has occurred (Fig. 1).

If the mortality ratio is lower than 100%, the mortality rate of the insured (after taking age

FIG. 1. DISTRIBUTION OF MORTALITY RATIO



Note: The figure indicates a standard normal distribution of 2.5 percentage points for each side or 5 percentage points overall.

and gender into account) is lower than the average mortality rate of the general population. In other words, the insurer has managed to avoid adverse selection and its risk selection effect is maintained.

Our methods are illustrated below.

At a 95% lower confidence limit of $100\% - u(0.975)\sqrt{(1-AQ(t))/AQ(t)n}$, we conclude that if the mortality ratio falls below the 95% lower confidence limit, the lack of adverse selection is corroborated statistically as well as anecdotally. The sustainability of the insurer's selection effect is equally validated.

Next, we examine suicide rates and compare the national suicide rate with the actual suicide rate of the insured.[2]

If the suicide ratio exceeds 100%, we conclude the presence of moral hazard in the market. Here, we also apply a significance level of 5% and examine both tails of the distribution.

From this, we estimated the 95% upper confidence limit for the suicide ratio. At this 95% upper confidence limit, $100\% + u(0.975)\sqrt{(1-AQ2(t))/AQ2(t)n}$. If the suicide ratio among the insureds is greater than this 95% upper confidence limit, it is statistically demonstrated that moral hazard has occurred. On the other hand, if the suicide ratio is less than 100%, we can conclude that moral hazard has *not* occurred.

In addition, at a 95% lower confidence limit of $100\% - u(0.975)\sqrt{(1-AQ2(t))/AQ2(t)n}$, we can statistically demonstrate the lack of moral hazard.

[2] The national suicide rates are from *An Overview of Suicides that Occurred in 2010*, published by the Life and Safety Department, Life and Safety Planning Division, the National Police Agency of Japan.

2. Data

For empirical examination, we obtained data from a life insurance company in Japan, denoted here as Company A. We made a summary data of Tables 2 and 3. (See Appendix.)

Table 2 shows mortality rate statistics calculated for 872,646 whole life insurance policies issued by Company A, which were in force at the end of Fiscal Year 2010 (ending in March 2011). The statistics (elapse) in the table indicate the elapsed time since policy inception (i.e., arranged by the year in which the policy was initially issued). The national mortality rate is calculated on the basis of the national mortality rate, taking into account the in-force length of the policies (0~1 years, 1~2 years,..., 15~16 years, 16＋years), weighted by policy value for the age and gender of policyholders.

The National and Actual Mortality Rate (Table 2) for Company A's policies is the Mortality Rate, calculated for the gender and age differentials, and taking into account the time elapsed, for Fiscal Year 2010.

The Actual Suicide Rate (Table 2) is the proportion of deaths that were accounted for by suicide. As Company A applies a suicide exclusion clause during the first three years of the policy, the Actual Suicide Rate is logically 0 until three years have elapsed.

Table 3 shows the mortality rate statistics calculated with 25,576 automatic renewal term life insurance policies issued by Company A, which were in force at the end of Fiscal Year 2010. The method we use for Table 3 is identical to the one for Table 2.

The Actual Suicide Rate is the proportion that was deemed to be accounted for by suicide. As Company A applies a suicide exclusion clause during the first three years of the policy, the Actual Suicide Rates for 0~1, 1~2, and 2~3 years elapsed are set to 0.

As the number of retained contracts is relatively small (25,576), there is a lack of life insurance data in this case, thus leading to our results being highly skewed. We resolve this discrepancy below.

IV. *Estimation of Adverse Selection and Moral Hazard*

1. Whole Life Insurance

Figure 2 and Fig. 3 show our estimation results for whole life insurance.

Adverse selection does not occur in whole life insurance. (Fig. 2) The mortality ratio does not cross 100% at the time of issuance or any time after. In addition, most fall below the 95% lower confidence limit for both tails. Statistically, it is safe to say that adverse selection is *not* occurring and that the insurer generally makes more accurate predictions about the insured's mortality rate than the insured do.

Moral hazard does not occur in whole life insurance. (Fig. 3) We find that the number of suicides that could be classified as moral hazard is statistically insignificant compared to the national suicide rate.

2. Term Life Insurance

Figure 4 and Fig. 5 show our estimation results for term life insurance. For term life

FIG. 2. MORTALITY RATIO (Actual/National) (Whole Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

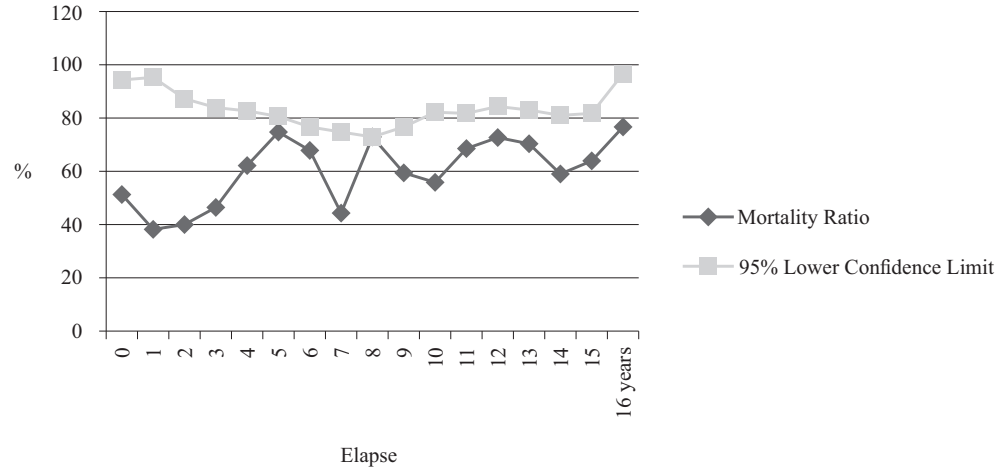
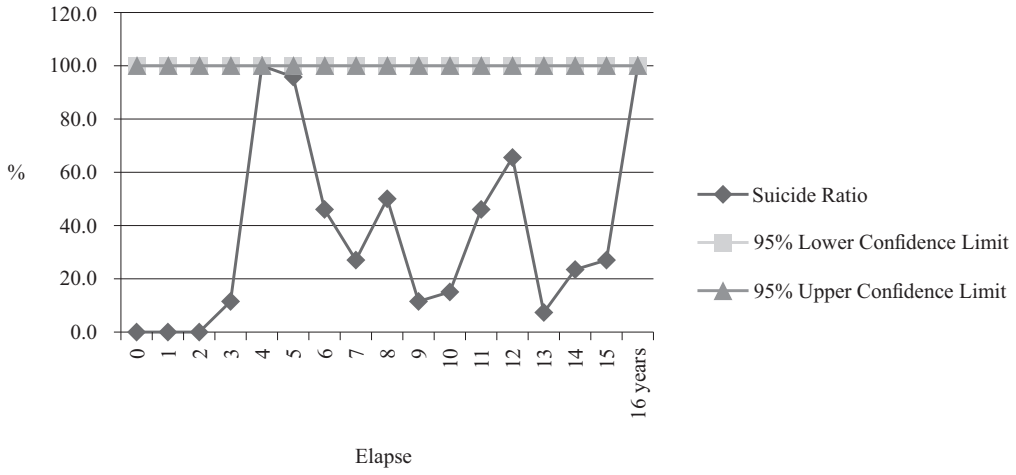


FIG. 3. SUICIDE RATIO (Actual/National) (Whole Life Insurance)
(Company A; Fiscal Year Ending in March 2011)



insurance, we find no evidence of adverse selection for 0~4 years. The Mortality Ratio (five-year~ average) is 155.2%, which exceeds 125.0% (95% upper confidence limit for both tails). (Fig. 4) That is, the mortality rate begins to exceed the national average after five years have elapsed from the policy issuance date and the insurer begins to experience a deficit.

In term life insurance, we find that the suicides that could be considered as a manifestation of moral hazard sometimes occur after an elapse of five years, and they statistically surpass the

FIG. 4. MORTALITY RATIO (Actual/National) (Term Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

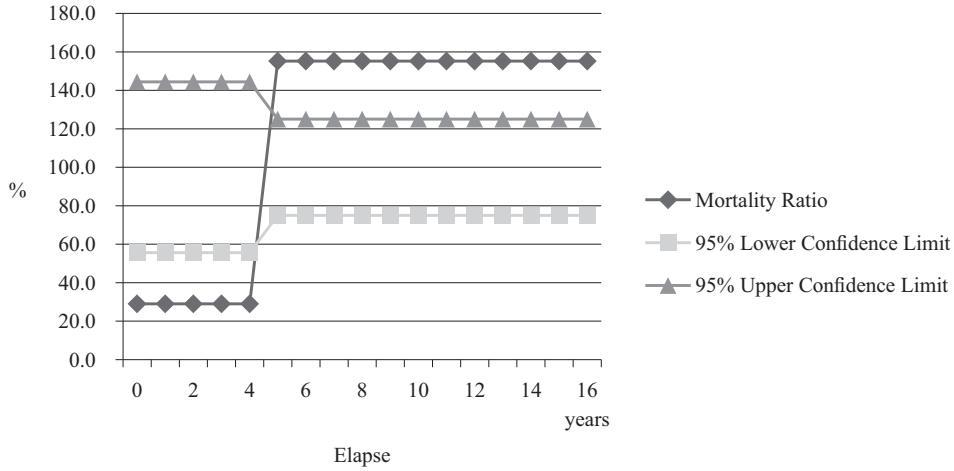
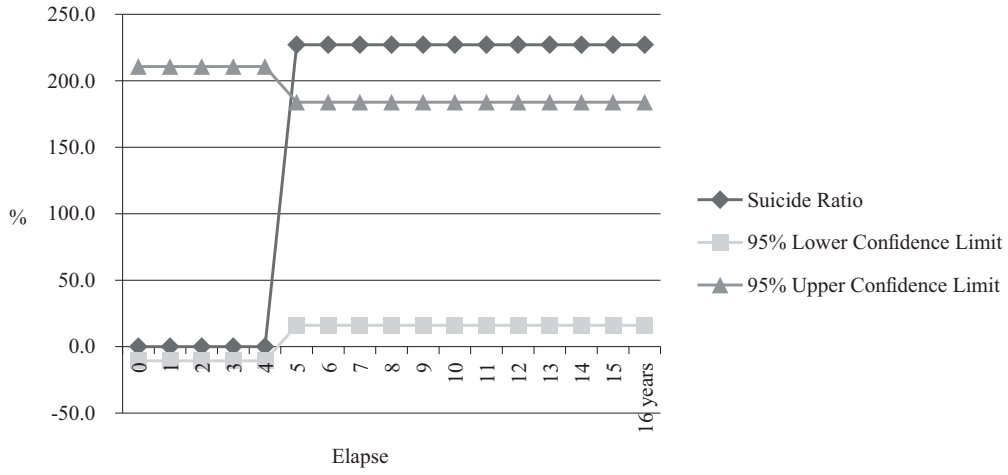


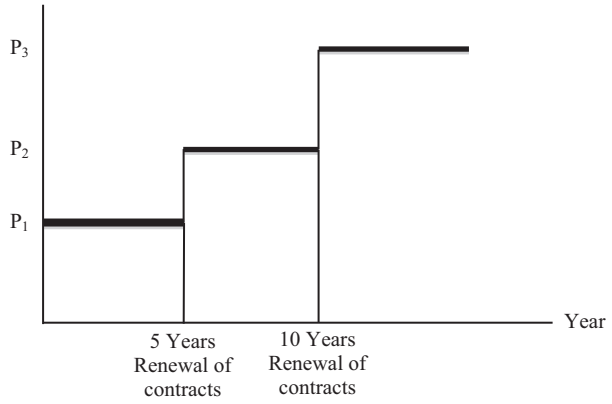
FIG. 5. SUICIDE RATIO (Actual/National) (Term Life Insurance)
(Company A; Fiscal Year Ending in March 2011)



national average after five years on average. (Fig. 5) However, since these suicides occur long after policy inception, it is difficult to claim that there is a causal relationship between the suicides and the intention of those who committed them at policy inception.

These findings imply that adverse selection and moral hazard occur in relationship to the renewal and/or continuance of these term life insurance policies because the renewal period of typical term life insurance is usually 5 years or 10 years.

FIG. 6. EXAMPLE OF INSURANCE PREMIUM (Five-Year Automatic Renewal Term Life)



Notes: (1) Premiums are leveled in the period before the next renewal.
(2) Renewal periods of typical life insurance are usually 5 years or 10 years.
(3) No medical examination is required at the renewal.
(4) P_1 is the annual premium between 1 and 5 years. P_2 is the annual premium between 6 and 10 years. P_3 is the annual premium between 11 and 15 years.

As a matter of fact, most Japanese term insurance is automatically renewed as long as the insured wants to continue as if it is a whole life insurance, but the premiums rise every 5 or 10 years. The structure of Japanese term life insurance is illustrated in Fig. 6.

From the above data, we can conclude that at the significance level of 5%, while adverse selection and moral hazard do not occur in whole life insurance, they do occur in term life insurance. It appears that policyholders in whole life insurance generally have a tendency toward saving up and living for a long time. It also appears that people who purchase term life insurance are initially healthy, but if they continue to renew their insurance policies for five years or longer, they are more likely to be classified as less healthy individuals.

See Table 4-7 in the Appendix for the detailed numbers associated with Fig. 2-5.

V. *Concluding Notes*

We find that with Hypothesis 1, we cannot recognize any effects by adverse selection and moral hazard in whole life. With regard to Hypothesis 2, we find that in the case of non-optional renewal of term life policies, the effectiveness of medical selection attenuates after approximately five policy elapsed years and that insurers incur costs reflecting adverse selection and moral hazard.

Our contributions to the literature are as follows:

- We used life insurance companies' data directly to recognize adverse selection, moral hazard, and medical examination effects.
- Our statistical method is simple, but it produced robust results.
- Previous papers have not clearly examined the effects of adverse selection, moral

hazard, and medical examination. This paper clearly examines these effects for each life insurance product and the number of elapsed years.

Appendix

TABLE 2. DATA (Whole Life Insurance) (Company A; Fiscal Year Ending in March 2011)

Elapsed Years	0	1	2	3	4	5	6	7	8
Contract Fiscal Year	2010	2009	2008	2007	2006	2005	2004	2003	2002
No. of Policies	115,088	149,545	75,127	19,685	13,377	11,047	9,716	8,684	7,505
National Mortality Rate (‰)	10.36	12.19	3.27	7.39	9.69	9.13	7.35	7.01	6.99
Actual Mortality Rate (‰)	5.33	4.66	1.31	3.43	6.04	6.83	4.99	3.13	5.06
Actual Suicide Rate (‰)	0	0	0	0.03	0.26	0.25	0.12	0.07	0.13

Elapsed Years	9	10	11	12	13	14	15	16+	Total
Contract Fiscal Year	2001	2000	1999	1998	1997	1996	1995	1994~	
No. of Policies	9,085	16,760	14,397	18,029	13,080	10,405	12,408	368,713	872,646
National Mortality Rate (‰)	7.46	7.18	7.88	8.78	10.02	10.18	9.44	11.12	10.43
Actual Mortality Rate (‰)	4.46	4.01	5.41	6.37	7.07	6.03	6.04	8.54	6.88
Actual Suicide Rate (‰)	0.03	0.04	0.12	0.17	0.02	0.06	0.07	0.26	0.16

TABLE 3. DATA (Term Life Insurance) (Company A; Fiscal Year Ending in March 2011)

Elapsed Years	0	1	2	3	4	5	6	7	8
Contract Fiscal Year	2010	2009	2008	2007	2006	2005	2004	2003	2002
No. of Policies	1,114	2,241	2,288	2,341	2,130	2,055	1,921	2,090	1,909
National Mortality Rate (‰)	1.57	1.71	1.91	2.06	2.20	2.52	2.68	2.85	3.24
Actual Mortality Rate (‰)	0.00	0.00	0.74	1.17	0.74	4.65	4.58	0.66	1.18
Actual Suicide Rate (‰)	0.00	0.00	0.00	0.00	0.00	0.68	0.35	0.00	0.00

Elapsed Years	9	10	11	12	13	14	15	16+	Total
Contract Fiscal Year	2001	2000	1999	1998	1997	1996	1995	1994~	
No. of Policies	1,758	1,152	827	1,206	704	260	171	1,414	25,576
National Mortality Rate (‰)	3.31	4.18	4.18	4.23	4.85	5.93	5.04	8.91	3.15
Actual Mortality Rate (‰)	5.59	5.20	4.45	0.79	6.34	19.76	0.00	17.77	3.31
Actual Suicide Rate (‰)	0.70	1.04	1.47	0.00	5.50	0.00	0.00	0.92	0.45

TABLE 4. MORTALITY RATIO (Actual/National) (Whole Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

Elapsed Years	0	1	2	3	4	5	6	7	8
Contract Fiscal Year	2010	2009	2008	2007	2006	2005	2004	2003	2002
Mortality Ratio (%)	51.4	38.2	40.0	46.4	62.3	74.8	67.8	44.6	72.4
95% Lower Confidence Limit	94.4	95.4	87.5	83.8	82.9	80.6	76.9	75.0	73.0

Elapsed Years	9	10	11	12	13	14	15	16+	Total
Contract Fiscal Year	2001	2000	1999	1998	1997	1996	1995	1994~	
Mortality Ratio (%)	59.8	55.9	68.7	72.5	70.5	59.3	63.9	76.8	66.0
95% Lower Confidence Limit	76.3	82.2	81.7	84.5	83.0	81.1	82.0	97.0	98.0

Note: Shaded cells indicate where the Mortality Ratio falls below the 95% lower confidence limit.

TABLE 5. SUICIDE RATIO (Whole Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

Elapsed years	0	1	2	3	4	5	6	7	8
Suicide Ratio (%)	0.0	0.0	0.0	11.5	100.0	96.2	46.2	26.9	50.0
95% Lower Confidence Limit	100.0	100.0	100.0	99.9	99.9	99.9	99.9	99.9	99.8
95% Upper Confidence Limit	100.0	100.0	100.0	100.1	100.1	100.1	100.1	100.1	100.2

Elapsed years	9	10	11	12	13	14	15	16+
Suicide Ratio (%)	11.5	15.4	46.2	65.4	7.7	23.1	26.9	100.0
95% Lower Confidence Limit	99.9	99.9	99.9	99.9	99.9	99.9	99.9	100.0
95% Upper Confidence Limit	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1

Note: Using National Police Agency statistics (2010 suicide rate among men = 0.36%, suicide rate among women = 0.14%) and Life Insurance Association of Japan statistics (male:female ratio for new whole life insurance policies in Fiscal Year 2010 = 56:44) , we established a weighted average suicide rate of 0.26%. Based on this and the number of contracts by the elapsed time, we established a lower confidence limit of 95% and an upper confidence limit of 95%.
Shaded cells indicate where the Mortality Ratio falls below the 95% lower confidence limit.

TABLE 6. MORTALITY RATIO (Actual/National) (Term Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

Elapsed Years	0	1	2	3	4	5	6	7	8
Contract Fiscal Year	2010	2009	2008	2007	2006	2005	2004	2003	2002
Mortality Ratio (%)	0.0	0.0	38.7	56.7	33.8	184.3	171.0	23.0	36.4
95% Upper Confidence Limit	248.1	200.0	193.7	189.2	190.4	186.0	186.3	180.2	178.7

Elapsed Years	9	10	11	12	13	14	15	16+	Total
Contract Fiscal Year	2001	2000	1999	1998	1997	1996	1995	1994~	
Mortality Ratio (%)	168.8	124.4	106.5	18.6	130.7	333.1	0.0	199.4	105.3
95% Upper Confidence Limit	181.1	189.1	205.2	186.6	205.8	257.4	310.6	155.0	121.8

Elapsed Years	0~4	5~
Contract Fiscal Year	Average	Average
Mortality Ratio (%)	29.0	155.2
95% Upper Confidence Limit	144.4	125.0

Note: Shaded cells indicate where the Mortality Ratio surpasses the 95% upper confidence limit.

TABLE 7. SUICIDE RATIO (Term Life Insurance)
(Company A; Fiscal Year Ending in March 2011)

Elapsed Years	0	1	2	3	4	5	6	7	8
Suicide Ratio (%)	0.0	0.0	0.0	0.0	0.0	219.4	112.9	0.0	0.0
95% Lower Confidence Limit	-233.5	-135.1	-132.7	-130.0	-141.2	-145.5	-153.9	-143.5	-154.7
95% Upper Confidence Limit	433.5	335.1	332.7	330.0	341.2	345.5	353.9	343.5	354.7

Elapsed Years	9	10	11	12	13	14	15	16+
Suicide Ratio (%)	225.8	335.5	474.2	0.0	1774.2	0.0	0.0	296.8
95% Lower Confidence Limit	-165.5	-227.9	-287.0	-220.5	-319.5	-590.3	-751.2	-196.0
95% Upper Confidence Limit	365.5	427.9	487.0	420.5	519.5	790.3	951.2	396.0

Elapsed Years	0～4	5～
Suicide Ratio (%)	0.0	227.1
95% Lower Confidence Limit	-10.7	16.1
95% Upper Confidence Limit	210.7	183.9

Note: Using National Police Agency statistics (2010 suicide rate among men = 0.36%, suicide rate among women = 0.14%) and Life Insurance Association of Japan statistics (male:female ratio for new term life insurance policies in Fiscal Year 2010 = 79:21), we established a weighted average suicide rate of 0.31%. Based on this and the number of contracts by the elapsed time, we established a lower confidence limit of 95% and an upper confidence limit of 95%.
Shaded cells indicate where the Mortality Ratio surpasses the 95% upper confidence limit.

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