Worldview, Risk Perception and Underwriting Performance: An Empirical Study of Property/Liability Insurance Industry

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ABSTRACT

Underwriting process is the core function of property/liability insurance companies. An appropriate underwriting policy can avoid adverse selection and make sure that insurance companies select only those insured whose actual loss will not exceed the expected loss. This study attempts to connect the culture theory of risk, risk perception with underwriting performance of underwriters in property/liability insurance companies. This study explores the effects of different types of worldviews upon the underwriting performance and evaluates various underwriters' financial risk perception based on different worldview by use of conjoint expected risk model. Interesting and fascinated empirical evidence could be found that risk perceptions represent a considerable part on underwriting process, which has not been found yet in previous finance or insurance literature.

Keywords: Culture Theory of Risk, Risk Perception, Underwriting Performance

1. INTRODUCTION

Underwriting is the core function of property/liability insurance companies. Underwriting refers to the process of selecting and classifying applicants for insurance and is the means by which insurance companies judge whether an applicant should be accepted for insurance. The underwriting manager (i.e., underwriter) is the person who decides to accept or reject an application. They also provide services including premium calculation, auditing and reinsurance arrangement. The fundamental objective of underwriting is to produce a profitable book of business and

to avoid adverse selection. Underwriting starts with a clear statement of underwriting policy which is consistent with company objectives. A good underwriting policy can avoid potential adverse selection and make sure that underwriter can select only those insured whose actual loss experience will not exceed the expected loss assumed by insurance companies. This study is a new attempt to figure out whether underwriters' worldview and underwriters' risk perception have effects upon underwriting performance. If such relationships are valid by this empirical study, evidence from this study could conform that risk perceptions play an important role on underwriting process, which is considered as a core function of insurance operations. The overall findings might be provided as a new paradigm for training department of insurance companies, managers who design underwriting policy and regulators of insurance industry.

Over the past few years a considerable number of studies have been made on risk perception. Risk perception is an important aspect of decision when making decisions under risk and uncertainty. Perceived risk has also been a focus of interest of policymakers. The field of geography, sociology, political science, and psychology has made several important contributions to our understanding of risk perception. There are also growing researches on management science and finance has focused on the applications of risk perception and provides a new paradigm.

The famous theory, which attempts to explain risk perception, is the culture theory of risk. The theory considers that, to preserve personal own living style, individual of different culture background has different risk perceptions. Many earlier studies suggest such a kind of view (e.g., Weber and Hsee [21], 1998; Bontempo et al., 1997 [3]). Cultural theory provides a functional explanation for risk perception and focuses on the characteristics of the perceiver and provides a typology of people that transcends gender, ethnicity, and national origin (Palmer, 1996) [16]. More hierarchical societies (such as China) are described as deciding more by standard operating procedures and consequently as more cautious and risk-averse (Hsee and Weber, 1999) [11]. It would be interested to understand whether underwriters' worldview, underwriters' risk perception and underwriters' risk preference are factors of underwriting process.

There are several theories to explain risk perceptions. Personality theory, which support that personality and risk perception are correlated, should be a good way to tackle the risk perception. (Dake and Wildavsky, 1982) [6] The other famous theory is culture theory which consider that, to preserve personal own living style, individual of different culture background has different risk perceptions. Many earlier studies suggest such kind of view. (e.g.,Weber and Hsee, 1998 [21]; Bontempo et al., 1997 [3]). Cultural theory provides a functional explanation for risk perception and focuses on the characteristics of the perceiver and provides a typology of people that transcends gender, ethnicity, and national origin. (Palmer, 1996) [16] More hierarchical and bureaucratic societies (such as China) are described as deciding more by standard operating procedures and consequently as more cautious and risk-averse (Hsee and Weber, 1999) [11]. In contrasts, societies in which an individualistic market orientation predominates (such as the United States) should be more risk-taking.

As mentioned above, underwriting, as a core function of insurance operation, is the means by which insurance companies judge whether an applicant should be accepted for insurance. The effects of underwriters' worldview, underwriters' risk perception and underwriters' risk preference upon underwriting process would be revealed in this empirical study. If such relationships are valid by this empirical study, the results can provide as solid evidence that risk perceptions represent an important part on underwriting process, which has not been found yet in previous literature.

This study attempts to achieve the following purposes. First, this study use culture theory of risk to explore the effects of different types of worldviews upon the underwriters' performance. Second, focused on financial risk perceptions, the conjoint expected risk (CER) model (Luce and Weber, 1986) [14] is utilized in this study to evaluate various underwriters' risk perception. Different worldview may causes differences risk perceptions (measured by the coefficients of CER models). Third, this study attempts to construct empirical models to analysis the relationship between financial risk perception and underwriting performance. Such a model could provide a linkage between risk perception and decisions of risk management strategy.

Insurance companies traditionally are viewed as a financial institution to provide assurance for various risks. The core function of property/liability insurance

companies, underwriting, also known as risk selection, is responsible for making sure that the company accepts only those insurance applicants whose risk do not exceed the level that companies can afford. Risk perception of underwriting managers (i.e., underwriters) will directly affect the operation and risk taking of insurance companies. The investigation of underwriters' worldview can make us to know about philosophy of underwriting policy of various insurance companies. This new attempt might provide interesting and fascinated evidence which could be viewed as a new paradigm of risk management strategy of insurance companies. The overall findings might be provided as a case study of insurance companies for the implications of behavior finance.

2. THEORY

(1). Culture Theory of Risk

The four risk attitudes were first described by Mary Douglas in 1982 [6]. This framework has been used extensively in the context of public policy decision-making to help to navigate conflicting agendas over environmental and aesthetic objections to public. To date, it has not been used in finance or insurance academic literature. There are four attitudes of Cultural Theory in this framework. *Individualists* believe the world is self-correcting (i.e., mean-reverting). They are not especially concerned about risk. They believe in unbounded growth of the system: individual effort and imagination will create more for everyone. Individualists tend to have a weak feeling of responsibility for the consequences of their actions. *Egalitarians* believe any major change could result in disaster. They consider resources to be finite; and tend to have strong feelings of accountability for the consequences of their actions. Unions and professional organizations are often groups dominated by this view of risk. *Authoritarians* (i.e., *Hierarchic*) believe that risk taking is acceptable only if controlled by experts. They see a need for rules and laws to keep risk taking under control. Authoritarians tend to have a high degree of concern for consequences. They believe in controlled growth, controlled by them at a level that experts have determined to be best. *Fatalists* believe that the world is unpredictable and uncontrollable. They do not see a need for the strict rules of Authoritarians, lack the fervor of Egalitarians, and have no desire to strike out on their own as an Individualist.

Fatalists tend to consider hedging and insurance as bets that you either win or lose, not strategies for managing risk.

There are no academic literature focuses on the relationship between risk attitudes and risk management strategies. However, practitioner has begun to pay attention on this interesting and fascinated topic. Two actuaries, Ingram and Thompson (2010) [12], believe that four risk attitudes of Cultural Theory can be thought of as four different business strategies. Individualists can be viewed as a *Profit Maximizer* who focuses on return, not the risk. They focus on risk trading strategy during economic boom times. Egalitarians can be viewed as a *Conservator* who highly concerned with risk. They avoid at all costs taking too much risk, usually missing out on upside opportunities while working to avoid the overheated markets. They utilize loss controlling strategy which is the most traditional form of risk management (i.e., to seek to identify and mitigate the firm's most significant risks). Authoritarians (i.e., Hierarchic) can be viewed as a *Risk-Reward Manager* who is a rule maker. They believe that they have the expertise to go after the best business in any market. They use risk steering when risk environment is moderate. Finally, Fatalists can be viewed as a *Pragmatist* who is not tied to any one attitude about risk. They tend to react very late to market signals. Pragmatists tend to favor diversification because it maximizes their tactical flexibility, but they avoid reliance on any particular risk mitigation process.

This study utilizes culture theory of risk to figure out risk attitudes of underwriters and try to find the relationship between risk attitudes and underwriting performance. As mentioned above, underwriting process is a core function of property/liability insurance company. In practice, risk management strategy of property/liability insurance company can be reflected from its underwriting policy. Therefore, to analysis the relationship between underwriting performance and underwriters' risk perception can provide a linkage between designs of risk management strategy and risk perceptions of underwriters. If the relationship is strongly supported from empirical evidence, it might conclude that risk perception has to be considered when establishing risk management strategy of property/liability insurance companies

(2). Risk Perception

There are various kinds of definitions of risk perception. Researchers have suggested that risk perception can be defined as the probability of an adverse event, (Hayes, 1992) [8] the probability and severity of negative outcomes, (Hallenbeck and Cunningham, 1986) [7] the qualitative attributes of an activity (Slovic et al., 1979) [18] or the quantitative attributes of a gamble (Luce and Weber, 1986) [14]. Benthin et al., (1993) [1] provide a risk perception measure to assess both risk perception and risk preference. Much evidence from cognitive, social, and clinical psychology demonstrates that risk perceptions are influenced by association- and affect-driven processes more than by analytic processes (Loewenstein et al., 2001) [15]. Even in seemingly "objective" contexts, such as financial investment decisions, subjective and largely affective factors have been shown to influence perceptions of risk. For example, Holtgrave and Weber (1993) [10] show that both affective variables (e.g., dread or konwledge) and cognitive-consequentialist variables (e.g., expectations and probabilities generated from the SCER model) are necessary to predict people's perception of risk in the financial and health domain. Hertwig et al. (2004) [9] describe the affective processing and updating mechanisms by which personal experience with rare events (e.g., negative consequences that have a low probability of occurrence) leads to a greater risk taking and lower risk perception.

The perception of financial risks attracts academic attentions in the recent years. Weber and Hsee (1998, 1999) [11],[21] find differences in the perception of financial risks between American and Chinese investors—with Chinese investors perceiving the risks of investment options to be lower and showing greater willingness to invest in risky options. They explained that Chinese investors tend to have larger social networks (e.g. family members) than American investors. Such networks provide implicit insurance against catastrophic risks, and thus lower the experienced level of risk. Weber (2004) [22] discusses the role of risk perception of retirement planning. She suggests that cost-benefit decisions about whether to engage in some retirement portfolio review may not result in a decision that is in a person's long term financial best interest. This is because the costs of taking action are immediate and concrete, and the benefits distant and abstract. Weber et al. (2005) [23] use historical volatility as an explaining variable of risk perception. They find that expectations of future asset risk were biased in systematic ways as a function of factors that should not have had any effect (e.g., presentation format of historical returns) and failed to be influenced

factors that should have had an effect (e.g., diversification). Such results show that perceived asset risk is not synonymous with expected volatility. Klos et al. (2005) [13] shows that perceived risk judgments has only low correlations with standard deviation estimates, but were instead related to the anticipated probability of a loss (which was overestimated), mean excess loss, and the coefficient of variation. Biais and Weber (2009) [2] find that hindsight bias reduces volatility estimates and more biased agents have lower performance. The results suggest cognitive biases do affect information processing and performance in financial markets.

3. METHODOLOGY

(1). Culture Theory of Risk: Grid/group Model

The basis of Cultural Theory is Douglas's anthropological grid/group model of variations in social context (Douglas, 1982) [6]. One dimension of social relations, 'group', consists of the degree to which an individual is part of a bounded group. The second dimension, 'grid', is the degree to which an individual is constrained by rules and regulations. These grid/group influences can be either weak or strong, resulting in the four sorts of social context as shown in Figure 1. The dimension a person belongs to will guide his or her interaction with the environment. Each of them, in addition to certain social relation, is therefore described as one of four worldviews. The individualistic worldview is characterized by low group and grid. Egalitarians are members of high group and low grid cultures, high grid and high group defines the hierarchical way of life, while high grid and low group is the fatalistic worldview.

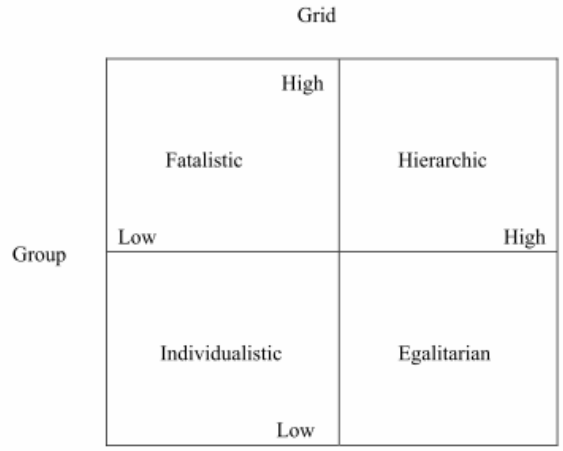

Figure 1. The Four Types of Social Context Based on Douglas's Grid/group Model.

Wildavsky and Dake (1990) [24] as well as Dake (1991) [5] have tried to empirically verify the cultural theory. They claim that hierarchical-, egalitarian-, and individualistic ways of life can predict a broad pattern of risk perceptions. Their measure of fatalism is not reported to have been tested empirically in these studies. Rippl (2002) [17] tested all four worldviews and found the dimension to be important. In this study, procedures of Dake (1991) [5] are used for separating different types of risk attitude of underwriters.

The first hypothesis is whether underwriters with different risk attitude have different underwriting performance. The first hypothesis is constructed as:

H_0: $UP_{Individual}$ $UP_{Egalitarian}$ $UP_{Hierarchic}$

H_1: $UP_{Individual}$,$UP_{Egalitarian}$,$UP_{Hierarchic}$ not all equal

where *UP* denotes underwriting performance of individual underwriter. If null hypothesis is rejected, post hoc analysis (e.g., Scheffe test, Tukey test, LSD test) could be conducted for more detail analysis.

(2). Conjoint Expected Risk Model

Luce and Weber (1986) [14] provided the Conjoint Expected Risk (CER) model by a functional form by which probability and expectation of outcome information of risky options is combined. The feature of CER model captures both similarities in people's risk judgments as well as individual differences. Parameters of the CER model can reflect the relative weight given to expected positive and negative outcome and probability information. The CER model can be represented as follows:

$$R(X) = A_0 \Pr(X = 0) + A_+ \Pr(X > 0) + A_- \Pr(X < 0) + B_+ E(X^{K+} \mid \mathrm{X} > 0\ ) \Pr(X > 0) + B_- E(X^{K-} \mid X < 0) \Pr(X < 0). \quad (1)$$

where A_0, A_+ and A_- are probability weights, and B_+ and B_- are weights of the conditional expectations raised to some positive powers, K_+ and K_-. The major advantage of the CER model is that it allows for asymmetric effects of transformations on positive and negative outcomes. To tackle the problem of

estimating powers parameter, the simplified CER model (Carlstrom et al., 2000) [4] posits that risk is an additive, linear combination of the probability of harm [Pr(harm)], probability of benefit [Pr(benefit)], probability of status quo [Pr(status quo)], expected harm [E(harm)] and expected benefit [E(benefit)] of an activity, and can be expressed as the perceived riskiness, R , of activity X :

$$R(X) = A_0 \Pr(status\ quo) + A_+ \Pr(benefit) + A_- \Pr(harm) + B_+ E(benefit) + B_- E(harm) \quad (2)$$

According to Palmer (1996) [16], Cultural theory provides a functional explanation for risk perception. Therefore, SCER model evaluates the relationship between worldview and the risk construct. One purpose of this study is to compare the mean perceived risk of financial activities among the four worldviews. This study constructs following hypotheses to examine:

H0: *A Individual A Egalitarian A Hierarchic*
H1: *A Individual ,A Egalitarian ,A Hierarchic* not all equal

and

H0: *A Individual A Egalitarian A Hierarchic*
H1: *A Individual , A Egalitarian , A Hierarchic* not all equal

and

H0: *B Individual B Egalitarian B Hierarchic*
H1: *B Individual ,B Egalitarian ,B Hierarchic* not all equal

and

H0: *B Individual B Egalitarian B Hierarchic*
H1: *B Individual , B Egalitarian , B Hierarchic* not all equal

Underwriters tend to focus more on risk selection which is planed to avoid obtaining too much risk. This study suggests that there should be different risk perception among four worldviews. Similarly, if null hypothesis is rejected, post hoc analysis (e.g., Scheffe test, Tukey test, LSD test) could be conducted for more detail analysis.

4. EMPIRICAL RESULTS

(1). Quantitative Survey:

There are three kinds of questionnaire prepared for modeling culture grid/group model, SCER model and subjective-risk-return model. More than 200 underwriters recruited from ten property/liability insurance companies are selected for quantitative survey. Each questionnaire is randomly ordered versions. On the other hand, their measurements of underwriting performance are gathered from their companies' human resource database.

(2). Modeling Grid/group Model

This study essentially replicates the quantitative survey methodology developed by Dake (1991) [5]. Each item of specified worldview scale is rated on a five point Likert scale of agreement/disagreement. The first questionnaire described 24 hypothetical financial and health activities. It was adapted from Holtgrave and Weber (1993) [10] included 16 of their 22 activities. There were four randomly ordered versions of this questionnaire. Cronbach's alpha was 0.68, 0.55, and 0.54 for the hierarchy, individualism, and egalitarianism worldview scales, respectively, in the current sample. The fatalist and hermit worldviews were not assessed in this study.

Table 1. The Cultural Measure (Dake, 1991 [5])

Hierarchy (15 items)
I think there should be more discipline in the youth of today
I would support the introduction of compulsory National Service
I am more strict than most people about what is right and wrong
We should have stronger armed forces than we do now
The police should have the right to listen to private phone calls when investigating crime
Those in power often withhold information about things which are harmful to us
One of the problems with people is that they challenge authority too often
It is important to preserve our custom and heritage
I think it is important to carry on family traditions
In my household, family members have their own places at the dinner table
I always sort out clothes into separate categories before washing
I value regular routines highly
I think being on time is important
My time-tabling of meals is haphazard
I like to plan carefully so that financial risks are not taken
Individualism (9 items)

In a fair system people with more ability should earn more
A free society can only exist by giving companies the opportunity to prosper
If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it
It is just as well that life tends to sort out those who try harder from those who don't
Continued economic growth is the answer to improved quality of life
This country would be better off if we didn't worry so much about how equal people are
Making money is the main reason for hard work
I don't join clubs of any kind
I tend to be sceptical of health food fads
Egalitarianism (11 items)
If people in this country were treated more equally we would have fever problems
The government should make sure everyone has a good standard of living
Those who get ahead should be taxed more to support the less fortunate
I would support a tax change that made people with large incomes pay more
The world could be a more peaceful place if it's wealth were divided more equally among nations
Social security tends to stop people from trying harder to get on
Racial discrimination is a very serious problem in our society
What this country needs is a "fairness revolution" to make the distribution of goods more equal
Most of the meals I eat are vegetarian
Health requirements are very important in my choice of foods
I prefer simple and unprocessed foods
Fatalism (11 items)
There is no use in doing things for other people – you only get in in the neck in the long run
Cooperating with others rarely works
The future is too uncertain for a person to make serious plans
I have often been treated unfairly
A person is better off if he or she doesn't trust anyone
I don't worry about politics because I can't influence things very much
Most people make friends only because friends are useful to them
I feel that life is like lottery
Even if you work hard you never know if that will help you do better
It seems to me that, whoever you vote for, things go on pretty myth the same
I have few financial investments

(3). Modeling CER Models of Financial Risk Perceptions

Underwriters are asked for the second questionnaire, financial risk options, to rate the riskness (risk judgment) of each risk option for financial risk. The questionnaires were filled out in approximately 30 min to complete. In order to evaluate financial risk, 12 risk options for investment (Table 1) are presented. Each risk option contains description of risky investment options in terms of outcomes and associated probability levels (P1, P2, P3) and the options' Expected Values (EV) and Standard Deviations (SD) (Weber and Hsee, 1998) [21]. Each option had three potential outcomes. Respondents are asked to intuitively rate their risk judgment of each option on a scale from 0 to 100. The subjective values generated from underwriters are used to construct SCER model to estimate the coefficients of [Pr(status quo)], benefit [Pr(benefit)], harm[Pr(harm)], harm [E(harm)] and benefit [E(benefit)].

Table 2. Twelve Investment Option, Three Outcome and Associated P Value and the Options' EV and SD

Investment Option	Outcome 1	Outcome 2	Outcome 3	EV	SD
1	$3,500 (0.79)	$5,300 (0.2)	$1,600 (0.01)	$1,544	$3,937
2	$400 (0.56)	$150 (0.38)	$750 (0.06)	$122	$342
3	$1,700 (0.01)	$800 (0.2)	$50 (0.79)	$137	$374
4	$1,250 (0.56)	$450 (0.38)	$2,200 (0.06)	$397	$1,073
5	$2,600 (0.11)	$950 (0.44)	$650 (0.45)	$411	$1,077
6	$9,300 (0.11)	$3,400 (0.44)	$2,400 (0.45)	$1,439	$4,022
7	$4,700 (0.01)	$2,300 (0.2)	$120 (0.79)	$412	$1,058
8	$1,000 (0.79)	$1,400 (0.2)	$4,800 (0.01)	$462	$1,094
9	$900 (0.11)	$350 (0.44)	$200 (0.45)	$163	$367
10	$350 (0.79)	$400 (0.2)	$1,600 (0.01)	$180	$349
11	$4,600 (0.56)	$1,700 (0.38)	$8,100 (0.06)	$1,444	$3,847
12	$17,200 (0.01)	$8,300 (0.2)	$450 (0.79)	$1,476	$3,836

Note: 1. All investment options were included in the original study by Weber and Hsee(1998) [23]
2. The numbers in the parenthesis are p value associated.

Regression analyses of the SCER model were performed on the responses to the activities. The final sample of 144 subjects was composed of 40 hierarchists, 66 individualists, and 34 egalitarians. No fatalistic person has been found in our samples.

Financial activities were then evaluated separately within each worldview group. Regression results and standardized regression coefficients for each worldview and type of activity are shown in Table 2 which reveals that the SCER model accounts for a large proportion of the variation in risk judgments in each of the groups. These results suggest that the full SCER model successfully explains hierarchists' and individualists' judgments of the riskiness of financial activities. The regression weights for pr(harm) and e(harm) were significantly different between hierarchists and egalitarians and between individualists and egalitarians, suggesting that these variables are differentially weighted between these worldviews.

Table 3. Financial Activities by Worldviews

	Pr(harm)	Pr(benefit)	Pr(status quo)	E(harm)	E(benefit)
Hierarchists	0.09	-0.22**	-0.01	0.66***	0.39**
Individualists	0.11	-0.05	-0.05	0.58***	0.15
Egalitarians	0.55***	0.02	-0.12	0.23**	0.01

Note:**means significant at 0.05 level, *** means significant at 0.01 level

Hierarchists are described as comfortable with determining acceptable risk levels for technologies, a process that explicitly considers and weighs harms and benefits. The current data are consistent with this description, as benefits are statistically significant contributors to hierarchists' risk judgments. Individualists are described as viewing risk as opportunity, suggesting a tendency to see benefit, so long as they do not interfere with market mechanisms. From this description, one might expect a positive relationship between benefit and risk. The current data support this description. Finally, egalitarians are described as generally suspicious of technologies, and viewing nature as fragile and in need of protection. This description suggests that egalitarians view risk in terms of harms. The current data are consistent with this interpretation.

This study then investigates the relationship between underwriting performance and underwriters' worldviews. Because individual's performance is internal information of insurance companies which is unable to gather, the underwriting performance by firm are provided as alternative. Loss ratio is usually used as an index

to measure underwriting performance by firm. Greater index means expected insurance cost are much more than actual, more restricted underwriting policy and much more conservative underwriting process. Cases whose sample smaller than 20 are deleted and remainder's results are shown in table 3 and, however, the percentage by various worldviews apparently reveals no clear pattern by insurance companies' underwriting performance.

Table 4. Underwriting Performance of Insurance Company by Worldviews

Insurance companies	Taiwan fire and marine	Chung Kuo	Shinkong	Mingtai	Zurich
Underwriting performance (Loss ratio in year 2011)	51.03%	51.15%	57.18%	48.13%	43.17%
Hierarchists	41%	41%	35%	28%	16%
Individualists	25%	19%	37%	18%	59%
Egalitarians	34%	40%	28%	54%	25%

5. CONCLUSIONS

This study attempts to connect the risk culture theory, risk perception with underwriting performance of underwriters in property/liability insurance companies. Such models could provide a linkage between risk perception and decisions of risk management strategy. In general, this relationship parallels cultural theory's descriptions of each type of worldview, lending support to the cultural theory. It might conclude that risk perception has to be considered when establishing underwriting policy or risk management strategy of property/liability insurance companies. The relationship between underwriting performance and underwriters' worldviews, however, does not reveal visible pattern. Possible explanation is underwriting performance by firm is a biased estimate which might not be able to reflect individual's performance. Internal information about individual underwriters' performance needs to be collected for subsequent researches. The overall findings might be provided as a new paradigm for training department of insurance companies, managers who design underwriting policy and regulators of insurance industry. Risk perceptions represent a considerable part on underwriting process, which has not been found yet in previous finance or insurance literature.

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