EVALUATING WILLINGNESS-TO-PAY FOR PET INSURANCE PREMUIM IN BANGKOK

BY

MR. CHAIYO SRILERCHAIPANICH

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
PROGRAM IN FINANCE (INTERNATIONAL PROGRAM)
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THAMMASAT UNIVERSITY
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ENTITLED

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was approved as partial fulfillment of the requirements for
the degree of Master of Science (Finance)

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ABSTRACT

This paper estimated willingness-to-pay for pet insurance premium in Bangkok. This study used the stated preference (SP) method in evaluating pet owners' response to bid prices with the coverage condition. The data were collected through the questionnaire survey. The CVM Logit model estimation method is used to estimate the willingness-to-pay for each attribute on the products. There are total eighteen possible combined plans with three variations. The three variations are pet age (young, mature, old), pet size (small, large), and plan types (economy, standard, first class). Key independent characteristic variables include regular spending amount on pet, illness existence on pet and age of the pet owners have a significant effect on the insurance purchase decision. The estimate willingness-to-pays ranged from 439.70 baht to 4,670.23 baht depending on the conditions on the insurance plans.

Keywords: Contingent Valuation Method (CVM), Willingness-To-Pay (WTP)

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Mr. Chaiyo Srilertchaipanich

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INTRODUCTION

1.1 Background

Insurance exists because unexpected bad things occur. Insurance is just a type of financial tool to manage risks. Human insure their lives to mitigate the severe consequences for their family members after the insured person dies. Medical care cost has been skyrocketing and become unaffordable to millions of people. With the insurance coverage, it has become easier for the patients to have access to good quality medical treatments when needed. Auto insurance is mandatory in almost all countries. Without that, driving is illegal. Besides those kinds of insurance, there are many more insurance products offered by the insurers to protect losses according to each situation. One interesting growing product that is in an increasing demand is pet insurance.

For many pet lovers like dog or cat lovers, their pets mean everything to them. Some people love dog or cat pets as much as their children and consider them as family members. Some sleeps with dogs on the bed, kisses them and play with them all day. Some even takes their pets with them to work and let their pets tag them along on holidays. These behaviors have shown how much human fall in love with their pets and proven the close connection between pets and their owners. Since Pets are so important to these groups of people, these people are likely to be happy to pay for their food and medical care to keep their pet healthy. In recent years, as Thai society has gone wealthier, more Thais have become more pet owners. There are more pet clinics and hospital exiting in the urban area in Bangkok. More Veterinarians graduate each year to serve the more demand in the market. However, although the cost of pet health care is not as high as human but it could be costly and the cost is rising up. In the US, The level of medical care complexity for pet is as high as for human. Anything that could be done for human can be applied to pet as well. Cardiac pacemakers can be implanted in a pet body. Hip replacement and organ transparent can be performed. Chemotherapy is given with Pets diagnosed with cancer. Periodic vaccinations are done to protect all kinds of diseases. An accident sometimes occurs

to the pets unexpectedly. Pets can get lost or stolen or die before their life expectancy. As more Thais decide to own pets and want keep their pet healthy mentally and physically, high quality medical care should be provided to the pet. In recent years, the medical care cost for pet has risen up as for human. When the medical care seems to be too expensive, there insurance exists. The insurance for pet might be expensive and not worth paying for, if pets are considered just as products. So, Is it worth paying for pet insurance? According to *Consumer reports* ("Is pet insurance," 2010), it concluded that pet insurance is a poor investment and this conclusion obviously only has taken economic benefit into analysis. However, Pets can generate huge indirect benefits to human. Pet ownership could lead to health improvements for their parents themselves. Many studies have been done to demonstrate health benefits for the pet owners (see table 1.1).

Table 1.1 Health Benefits of Pets

Effects	Sources
Lower heart rate and/or blood pressure	Allen, Blascovich, and Mendes (2002) Allen (2003) Friedmann, et. Al. (2007)
Increased survival after heart attack	Friedmann (1995) Freidmann, Thomas, and Eddy (2000)
Decreased risk of cardiovascular disease	Anderson, Reid, and Jennings (1992)
Greater psychological stability	NIH Workshop (1987)
Lower health care costs	NIH Workshop (1987)
Improved depression	Beck and Katcher (1996)
Decreased anxiety	Davis (2004) Cole, et .al (2007)

In the project, the author investigates the factors that affect pet owners to make their decision on purchasing pet insurance policies. The theory of demand and supply for insurance will be reviewed and applied specifically for pet insurance. The interviews with veterinarians at pet clinics and hospitals will be conducted in order to

make the author to understand more on the cost structure of health care and common treatment for pets. The questionnaires are designed to ask the pet parents for their wiliness to pay for pet insurance with various conditions. The willingness to pay for pet insurance will be calculated. The contingent valuation method model will be employed to obtain the willingness to pay for the pet insurance premium with many conditions in wide coverage range. To the end, there will be suggestion and conclusion for implementation and improvement of pet insurance products by insurance companies.

1.2 Objective of the Study

1. To understand and employ the theory of demand and supply for insurance to pet insurance in particular and use the theory to design the questionnaire
2. To understand the cost structure of pet care and calculate the wiliness to pay for the pet insurance with various conditions.
3. To determine the factors that influence pet owners in making decision to buy pet insurance
4. To determine the Willingness-To-Pay (WTP) for the pet insurance for each product for each characteristic of the owners

1.3 Scope of the Study

1. Study the theory of demand and supply for pet insurance and come up with the designed questionnaire
2. Using a questionnaire survey, data were collected from pet owners in Bangkok area
3. Design and conduct a questionnaire survey with the pet owners in Bangkok.
4. This study used the stated preference (SP) method which can collect data.
5. Panel logit model was used in the analysis to estimate the willingness-to-pay for each pet insurance products

CHAPTER 2
REVIEW OF LITERATURE

In this section, the review literature is classified into two parts: the basic insurance demand theory for both general and pet insurance and the willingness-to-pay measurement techniques. The willingness-to-pay is classified into two revealed preference and stated preference methods.

2.1 Literature Review on Insurance Theory

Insurance exists because bad things happened, Kunreuther and Pauly(2005) have studied on insurance Decision-Making process and market behavior. Kunreuther and Pauly have assumed that all people are risk averse. Each individual tries to maximize his or her utility. Decision on purchasing insurance of an individual thus depends on utility maximization for each agent, whereas insurers are assumed to maximize expected profit. However there are many circumstances for buyers and insurers to behave differently on decision-making process of obtaining and providing insurance. They categorized anomalies and provide explanation for each anomaly for both buyers and insurers. One behavior that Kunreuther and Pualy have observed complied with what Ulrich Schmidt (2012) discussed on his paper that people are unwilling to buy insurance to insure loss that rarely occur even it is partially subsidized by the state, on the other hand, they are likely to buy insurance for fair risk at highly relative cost. Later on (2012) Desrosiers discussed that there are many reasons an individual to purchase or not to purchase insurance and it is not just as simple as the standard expected utility curve comparison between have and not to have insurance. In his discussion, he suggested that the willingness to pay level of individuals can increase on the object they like which comply with what Kunreuther and Pualy(2005) suggested. Eckles and Wise(2011) found that prospect theory can explain several phenomena for insurance demand in the market. The preference on low deductibles is observed; low demand on non-mandatory insurance and great demand for small losses on product or appliance warranties. These observations were also discussed by Kunreuther and Pualy(2005).

2.2 Literature review on Pet Insurance demand

Paul, Skiba (2012) studied A Quantitative Overview if the Health Insurance Market for Pets. They both found that the number of pet parents has increased in US from 1988 to 2010. Keeping pets at home may not provide a simple economic benefit but emotional reasons leading to mentally health benefits for the owners. Young employees, new married couple who delays having their own children may look for pets as their friends. While the number of pet owners has been increasing, there is more cost of pet care associated with it. The current healthcare treatment in pets is as complex as in human. The cost of health care for pets has been rising up as for human. Thus there are many insurance providers offering pet insurance policies to pet parents. Many pet owners have been willing to pay for extremely high cost to keep their pets alive or healthy. They also found that there are strong emotional bonds between many pet owners and their pets providing explanation why people enrolls in health care plan for their animals. The author predicted that the pet insurance business will keep growing up as there is demand from pet owners. According to an article written by Pamela J. HOBART on http://www.bustle.com, total spending on pets in US is expected to be $60 billion, about a quarter of this amount went to veterinarian care. John Volk has presented many ideas of pet insurance and shown there is an increasing demand for pet in North American from 2005 to 2007. John Volk also has pointed out that why many pet owners decided to deny having pet insurance and finally he mentioned how to make pet insurance more attractive to the perspective buyers. Donovan, McManus, Richardson and Westwater (2013) develop a pricing model for pet insurance with the collected data and cost of treatment. Then they tested the model profitability for both cat and dog and found that insurance for dogs is more likely to be profitable than insurance for cats.

According to Consumers report money adviser Magazine (Sep, 2010), the article “Is pet insurance worth the cost?” It was found that a majority of pet owners have set a limitation of veterinary care for $500. However, the cost has moved up quickly, the fewer pet parents seem do not want to keep up with the rising cost. Although pet insurance has been introduced for a while, only 3 percent of dogs and 1 percent of cats are insured. The monthly premiums can go from $10 to $90 depending

on the policy. The premiums are generally determined based on the pet's age, breed, size, the deductible, the coverage and the living location.

Dobson (2002) has found that the skin and soft tissues were the most common sites for tumor development in pet dog with a standardized incidence rate of 1437 per 100,000 dogs per year. The other sites for tumor development are alimentary, mammary, urogenital, and lymphoid. The data based on a database of 130,684 insured dogs, claims relating to the investigation or treatment of tumours or tumour-like lesions during a 12-month period.

2.3 Literature Review on Factors Determining Decisions and Choices and Willingness-To-Pay Measurement Techniques.

Everyday individuals are faced with decisions to maximize their utilities with budget constrain. There have been many studies that relate the decision making process. To purchase any product or service, each buyer does a quick calculation in mind if the trade can gain him or her more utility or not. In a situation, where any individual must select one choice of products or services available, given the same budget, each individual will choose the one to maximize the utility.

Random utility models (RUM) are utility maximized methods for describing discrete choice behavior. McFadden (1995) has suggested the theory of WTP measurement, and provides easily computed WTP bounds based on generalized extreme value (GEV) random utility models (RUM). The models are consistent with individual behavior and economic theory.

McFadden (1974) studied urban travel demand in San Francisco area using the conditional logit model to determine the possibility of a traveler to use car or public transportation (bus), later in the paper, the forecasting demand for a new mode Bay Area Rapid Transit (BART) is investigated added into model. The number of patronages for each type of transportation is computed using three different model: conditional logit, cascade logit, maximum logit. Each model yields different numbers of protonates for each types of transportation since the conditional logit assumes the independence of irrelevant alternatives property. The conditional logit, is used to compute demand elasticity with respect to variety of choice attributes and traveler

characteristics. Chansang (2012) evaluated individual traveler behavior and calculated the valuation of travel time (VOTT) for both work and leisure trips using the stated preference (SP) technique. The nested logit model is used to calculate VOTT. She found that VOTT ranged from 43 to 114 Baht per hour depending on trip purpose and traveler characteristics.

Xiu, Xiu and Bauer (2012) studied Farmer's willingness to pay for cow insurance in Shaanxi Province, China. The author used Contingent Valuation Method (CVM) to calculate willingness to pay for cow insurance. They found that out of 127 sample respondents, 84 farmers (around 66.14%) participated in cow insurance and the rest 33% did not participate. The results showed that more than 80% of farmers thought the premium was too high and did not accept it. Only 69 out of 127 participants have some knowledge on insurance. The farmers who have some knowledge trend to participate in insurance more than the famers who are lack of insurance background. The WTP was calculated showing that insurance for a cow aging from 2 to 8 years costs Yuan 102.56 to Yuan 125 respectively. They suggested although the premium is subsidized by the government, it is too high for most farmers still. Mamat, Yacob, Radam, Ghani and Fui (2013) studied Willingness to pay for protecting natural environments in Pulau Redang Marine Park, Malaysia. The authors used the dichotomous-choice contingent valuation method (CVM) to compute Willingness to pay for protection of the park. It was found that the average WTP ranged between RM10.86 to RM28.69 for the recreationists. That WTP range can contribute up to RM4.36 million in 2008. Keske1 and Mayer (2014) have used the contingent valuation method (CVM) to compute Willingness to pay for recreation entrance fee at Colorado "Fourteeners": peaks that rise higher than 14,000 feet. They found that 62% of respondents are willing to incur an additional fee of $20 or less to recreate at the site.

Menezes, and Vieira (2006) have used the conditional logit model to evaluate the willingness to pay for airline services attributes. They constructed the model including and ignore interaction among attributes. The attributes are cost of travel, penalty for changes in the ticket, quality of food, comfort of seat (leg room), frequency and Reliability (No compensation for delay, Free ticket for the same trip,

and Reimbursement of the cost and of the ticket). The result from both model are close. The highest willing to pay attributes are Reliability, leg room and food upgrade.

Table 2.1 The model with major variables

Authors/year	Topic	Model	Major Variables
McFadden (1974)	The measurement of urban travel demand	Logit, conditional logit, nested cascade model, Maximum model	Level of income, Cost of travel choices, time to wait, travel time
Changsang (2012)	Evaluating travel time in Bangkok, Thailand	Nested logit	Time, Toll, Age, Gender, Education, Occupation, Income, etc.
Xiu, Xiu, Bauer (2012)	Farmers' willingness to Pay for Cow insurance in Shaanxi Province, China	Contingent Valuation Method (CVM)	Age, Gender, Time, Education, No. of Cows, income, etc.
Mamat, Yacob, Radam, Ghani, Fui (2013)	Willingness to pay for protecting natural environments in Pulau Redang Marine Park, Malaysia	Dichotomous-choice contingent valuation method (CVM)	Age, Education, Income, Foreign, Visit, etc
Catherine M. H. Keske1 and Adam Mayer (2014)	Visitor Willingness to Pay U.S. Forest Service Recreation Fees in New West Rural Mountain Economies	Contingent valuation method (CVM)	Distance traveled, small fee, certainty level, bid amount
Menezes, and Vieira (2006)	Willingness to pay for airline services attributes: evidence from a stated preferences choice game	the conditional logit model	cost of travel, penalty for changes in the ticket, quality of food, comfort of seat (leg room), frequency and Reliability
Chanjin Chung, Brian Briggeman, and Sungill Han (2008)	Willingness to Pay for Beef Quality Attributes: Combining Mixed Logit and Latent Segmentation Approach	The mixed logit model (ML)	Age, Gender, Education, Income

2.4 Valuation methods of Willingness-to-pay

There are a variety of methods to measure willingness-to-pay (WTP) for a product. The techniques which are available for WTP estimation have been classified. One classification is based on data collection methods as presented in figure 2.1. At the highest level, the methods are categorized into two major approaching techniques, whether the methods are based on actual or simulated price-response data or based on survey techniques. The price response data which often are referred to as revealed preference data can be obtained by market observations or performing experiments. In

the performing experiment method, there are there different ways of data collecting; laboratory experiment, field experiments, auctions.

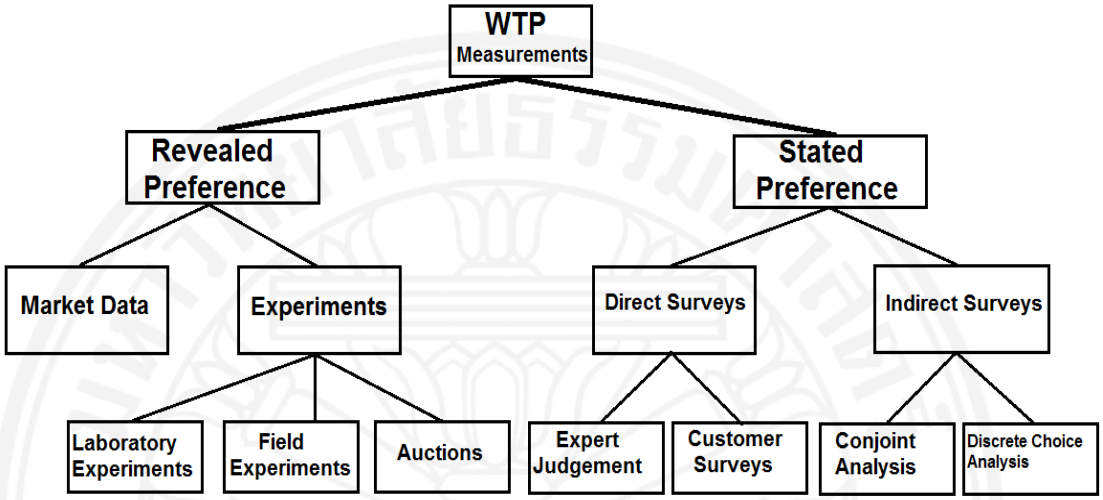

Figure 2.1 Classification frameworks for WTP measurement techniques

On the survey based technique, the data can come from either direct or indirect survey. In the direct survey, the respondents are asked directly on the WTP price for the experiment product. Experiment Judgments and Customer Surveys are two examples of direct survey methods. On the other hand, the indirect survey provides the rating and raking for the products then the model is employed to estimate WTP. Conjoint Analysis and Discrete Choice Model Techniques fall into this indirect survey methodology.

With many choices of WTP techniques available, the researcher should select the most appropriate methods for their experiment to obtain the best data for WTP estimation.

The revealed preference data are collected through the process of choices available for consumers to select given a budget constraint, customers who are observed will select the option that best satisfy their needs or give them the maximum utility. The major advantage of the revealed preference approaches is that they rely on actual choices. With this revealed preference data, respondents consider the internal costs and benefits of their selected choice and selected the one that maximize the

utility. The major disadvantage of this revealed preference methods are that the experiment must employ the historical data. New products and service may go beyond the range of historical price range. Thus the revealed preference methods are not suitable for the conditions that never yet exist.

The stated preference choice technique relies on respondents making choices over hypothetical scenarios. Respondents are asked to choose the best alternative among available options which are completely described by a set of attributes generated from an experimental design. The stated preference methods come with several advantages. This method can be designed qualitatively and quantitatively to test large, diverse samples. This method allows the comparison among different groups of sample and can identify and describe the difference among groups with similar preferences.

According to Figure 2.1 Stated Preference method is classified into direct and indirect surveys. The direct survey is conducted by directly asking either sales or marketing managers. Since Managers are the good resources of information on market competition. The managers are more aware of trend and demand in the market better than other people. Therefore, the interview with sale representative can provide a good approximation of WTP. However, the opinion of sales managers can be biased due to conflict of interest set by the payment system. For example, if the payment relies on the sale volume, the managers may understate the appropriate WTP to make the price lower. Customer interview could be considered a direct survey method. In this survey customers are asked to indicate acceptable prices for goods or services. The questionnaire can be created with price boundaries. The customers are asked the maximum price that they would not buy the product, because they can afford or the product is not worth buying. The direct customer interview has couple weaknesses. By directly asking customers for WTP, the customers can be displaced from other important attributes of the products. Customers may not provide the true feeling on how much they feel it worth for the products. The valuation does not lead to the real purchasing behavior on the product. Overall, the direct Survey may not be the most practical method to obtain the appropriate WTP on the product.

Indirect survey, it is more comfortable a respondent to the question of accept or reject the specific price for a product than direct survey method. When presented with several product attributes, the respondents can rank the alternative in order according to their preferences. Basically, the products with several attributes are presented to customers with a specific price. Then the customers response either accepting or rejecting the offer. According to Figure 2.1, there are two types of indirect surveys; Conjoint Analysis and Discrete choice analysis. In conjoint analysis, there are systematical variations of product attributes in an experimental design for respondents to rank their preference. A set of possible realizations are formed as the attribute's level. A product with several realizations of the product's attributes is ranked according to respondent's perceived preference. The preference data later go through regression analysis giving out coefficients called part-worth analysis and utility estimate. The preference scores are presented for each set of realizations.

Discrete choice model allows respondents to select discrete alternative product profiles. The decision to select an alternative depends on the attributes of the person and the attributes of the alternatives available to the person. For example the choice of transportation from home to work is dependent on the person's income, age, and education as well as attributes of the alternatives such as fee, distance, waiting time and others.

Discrete choice model gives out the probability for a person to select the option among a set of alternatives. The utility is calculated based on a set choice. Each choice set consists of attributes from respondents and alternative choices. The respondents then select which one they would actually choose. The selected option provides the maximum utility that the respondents receive. The coefficients of exogenous attribute variables are calculated through a selected model. In order to calculate WTP, a price level must be included as an attribute exogenous variable. A change in price can be expressed in term of change in utility level. The marginal rate of substitution (MRS) between price and utility can be obtained. This marginal rate of substitution is interpreted as WTP.

2.5 Willingness-To-Pay Measurement in the Project

In this project, the willingness-to-pay for pet insurance premium is computed. The revealed preference may not suit for the project since the pet insurance is considered a new product in the market. The research should rely on Stated Preference method. Both direct and indirect surveys are conducted. There are interviews with people in the field such as veterinarians, clinic owners, pet owners and insurers. With information and idea received from those who are in the industry, later on the questionnaire survey forms are created and designed to ask pet insurance owners. Contingent valuation method (CVM) is the best fit to this study since it asks the pet owner directly on the value of the insurance they can accept. Then for each individual data, panel logit is applied to compute the willingness-to-pay for each product.

2.6 Concept Framework

Insurance Theory

A positive theory of demand

Insurance exists because people are willing to pay to be insured since people are expected to be risk averse and they trade things to maximize their utility with all choices available. An economic theory on utility maximization can explain why an individual is willing to obtain a premium larger than the fair premium. People are willing to pay a price to guarantee a certain wealth. Another party takes advantage of people's risk aversion by providing insurance to them with odd advantage to make profit.

Figure 2.2. shows a normal utility curve for a risk averse person. Initially a person has a wealth of W at point a. At this point, this person would have utility U1. If in case of loss occurs, his or her utility drops to W-L level of wealth at point b with probability p. At this point, this person has utility U2. With these two cases, the expected Wealth of this person is equal to

$$E(Weath) = p(W - L) + (1 - p)W \quad \text{_____(2.1)}$$

With this expected wealth at point c, this person would have expected utility U3. If he or she can guarantee his or her wealth at this point, the guaranteed utility is U4 which greater than U3. The person would prefer a guarantee wealth if that guarantee wealth give him or her utility greater than U3 which means that he or she is willing to pay a premium to ensure his or her wealth that is greater than initial wealth-premium at point d. So the willingness-to-pay for insurance is less than premium for a normal risk averse person.

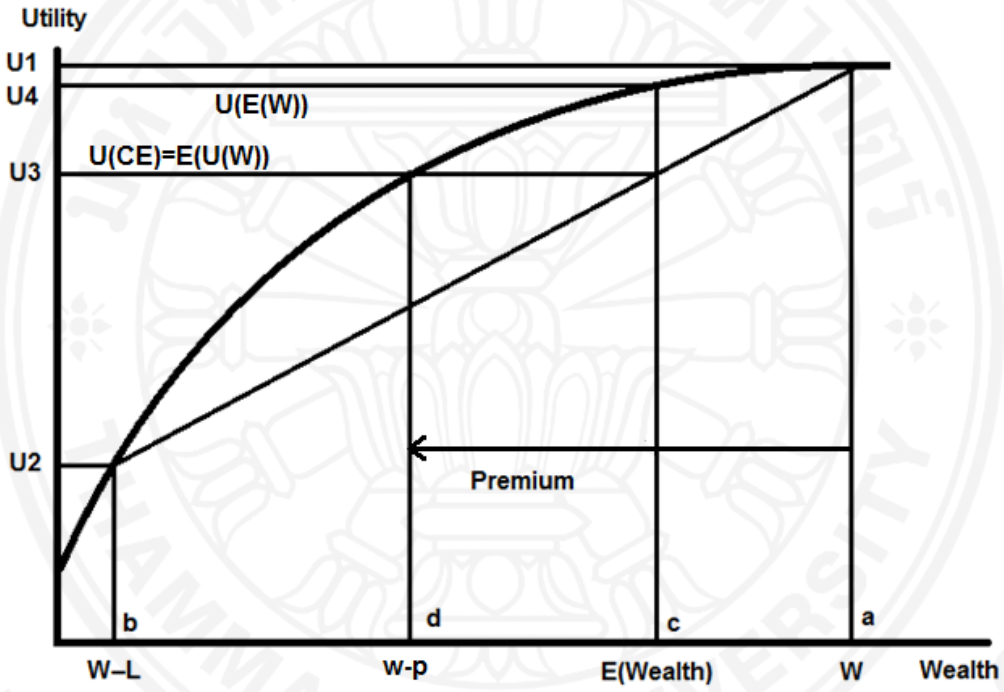

Figure 2.2 A normal utility curve for a risk averse person

Therefore, insurers can charge the premium up to the point d (W-premium) of a person. This premium collected from the buyers should at least cover the administrative costs and the claim in order to generate economic profit. However, the insured amount may not be equal to the loss amount as in figure 2.2. In order to be more realistic, the coverage may be less than loss amount, let's consider figure 2.3. An individual with initial wealth W has utility U1. If the loss L occurs, the wealth drops to W-L then the utility drops from U1 to U2. The expected utility of both case is $E(U) = p \cdot U(W-L) + (1-p)U(W)$ as shown in eq. 2.1. where p is the probability of loss. A premium z per dollar coverage includes the administrative(c) and annual

probability of loss (p). Hence z = c+p. If an individual decides to purchase insurance for I dollar, the expected utility is as follow

$$E(U(I)) = p \cdot U(W - L + I - z \cdot I) + (1 - p) \cdot U(W - z \cdot I) \_\_\_\_\_ (2.2)$$

In order for an individual to purchase insurance, he or she should have E(U(I)) > E(U) as shown in figure 2.3. The expect utility for none insurance purchasing individual is U3 if offered to have an insurance, this individual's utility level must not be less than U3 which is U6 in the figure 2.3 where U6 is the expected utility for an individual who purchase insurance with cost $z \cdot I$. Hence the maximum price for an individual to pay for insurance is $z \cdot I$.

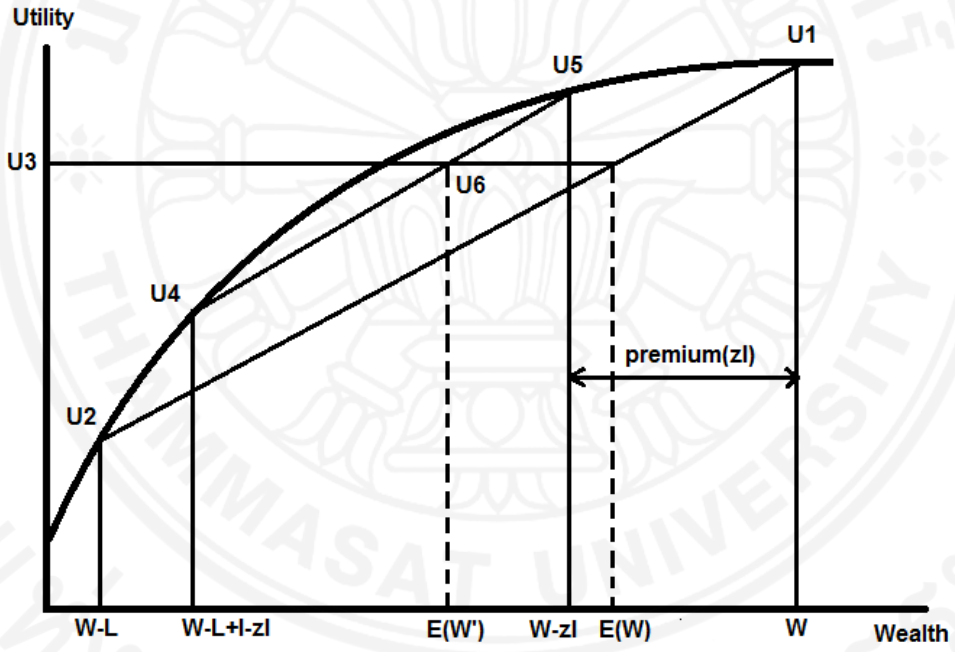

Figure 2.3 A normal utility curve for a risk averse person with cost $z \cdot I$

Of course, the premium from eq .2.1. and 2.2 are based on risk aversion assumption. Although all people are assumed risk averse, the degree of risk aversion could be different from others to others. It means that people could pay premium in excess of the expected claim, and this is still consider rational behavior. There are many other factors that can influent someone to buy or not to buy insurance.

Individual may have misconception of risks of the event that he or she might want to insure, in this case the individual may miscalculate the expect utility for the expected wealth leading to misprice the fair value of insurance and end up purchase non-optimal insurance or no insurance at all. This can be interpreted as a mathematical equation. Let p' and L' represent the perceived probability and loss for an event. The expected utility model from eq. 2.2 then written as follow

$$E(U(I)) = p' \cdot U(W - L' + I - z \cdot I) + (1 - p') \cdot U(W - z \cdot I) \quad \text{(2.3)}$$

If $p' < p$ and/or $L' < L$, the individual may misprice the insurance and end up purchase no insurance. If $p' > p$ or/and $L' > L$, individual with this misperception would end up buy full insurance and willing to pay more price than the fair price.

Cost of obtaining information could be another factor that discourages a person to have insurance. Suppose p' and L' are the perceived probability and loss for an event and z' is the prior estimate of the lowest premium they will find. If an individual decides not to purchase insurance, the expected utility would be the same as eq 2.1

$$E(I = 0) = p' \cdot (W - L') + (1 - p') \cdot W \quad \text{(2.4)}$$

If a person incur cost S search for an optimal insurance and end up having insurance, he or she would have perceived expected utility as follow

$$E(U(I,S)) = p' \cdot U(W - L' + I - z' \cdot I - S) + (1 - p') \cdot U(W - z' \cdot I - S) \quad \text{(2.5)}$$

If E(U(I,S)) > E(I=0), then a person would purchase insurance since the incur search cost S is still worth doing. On the other hand, if E(U(I,S))<E(I=0), a person may end up with no insurance. However, the search cost can be reduced by sharing information among friend and neighbors. Status quo bias is an influential factor since people are accustomed to their current wealth level and they are reluctant to deviate away from their current wealth although such an action can significantly improve their wealth. A study suggested that a person makes decisions by comparing the change in value if the action is taken rather than the final wealth. In this case, a value function [V(x)] is used instead of a utility function U(x) to determine behaviors of

individuals on making decisions. The value function for non-purchasing insurance is set as follow

$$E[(V(I=0))] = p' \cdot V(-L') + (1-p')V(0) \quad (2.6)$$

A value function for insurance (I) is as follow

$$E[(V(I=I))] = p' \cdot V(-L' + I - z' \cdot I - S) + (1-p')V(-z' \cdot I - S) \quad (2.7)$$

This value concept make insurance even less attractive compared with the utility function concept. In this value concept based on eq. 2.6 and eq. 2.7, an individual purchases insurance only if he or she think that the probability or loss is greater than insurers think.

Budget constraints could be an obstacle for someone who perceives insurance worth buying but have insufficient money to obtain. An individual know in advance that the certain income would occur and already has a plan to spend. Other than the plan, it can be consider unaffordable.

Feeling on things may cause an individual to behave irrationally. Those feeling includes regret, disappointment, elation or even comfortable. Such feelings can change one's utility function. Recently Economic Researchers found that feelings play an important role on how an individual making decision to purchase insurance or not. Individual are willing to pay more premium to insure things they love or they spend more time on collecting claim payment on their love insured things. These behaviors are not included for attribution to the benchmark model of choice. Similarly fear feeling has a great effect to increase willingness to pay for premium for the event that individuals are concerned such as car loss, paint being stolen or earthquake. Feeling can perhaps be an additional attribute into the utility or value function. If this feeling attribute (x) is included in the value function, Equations 2.6 and 2.7 then become

$$E[(V(I=0))] = p' \cdot V(-L', x) + (1-p')V(0, x) \quad (2.8)$$

$$E[(V(I=I))] = p' \cdot V(-L' + I - z' \cdot I - S, x) + (1-p')V(-z' \cdot I - S, x) \quad (2.9)$$

If x = 1 and the marginal utility of money was higher, such a person is more interested in searching for coverage at a fixed premium per dollar, z. That is, if higher insurance payments can be claimed, the person would definitely feel better and insurance would be more likely to be purchased.

Besides the insurance demand theory, Anomalies on demand sides have been discussed on by Howard Kunteuther and Mark Pauly (2005). Anomalies that were discussed are

1. Preference on low deductibles
2. Unwillingness to make small claims above their deductible
3. Preferences for policies with rebates when a no rebate policy is more financially attractive
4. Limited interest in catastrophic coverage (e.g. major medical, floods)
5. Influence of emotions on insurance purchase and claim decisions
6. Purchase of insurance is more likely to occur after a disaster rather than prior to its occurrence
7. Purchase of flight insurance even though life insurance is a better deal
8. Insurance purchase because of social norms
9. Framing a problem in terms of insurance rather than a loss increases demand for coverage
10. Cancellation of flood insurance if one hasn't collected on one's policy over time

A positive theory of supply

In term of insurance providers, the insurance firm would definitely supply unlimited insurance policies to the market as long as the premium z per dollar can cover the administrative costs per dollar (c) and the chances of a loss occurring (p). Insurers are assumed to be risk neutral and do whatever to maximize the profit and take advantages of risk aversion of the buyers. In addition, insurance firms are assumed to have access to the capital markets when additional funds are needed. However, actual behaviors of firms may deviate from the ideal world for reasons.

Insurance firms may suffer from adverse selection that is the offered premium may be observed from all levels of risk from perspective buyers. Obviously, only bad risk individuals would purchase insurance since each individual would know their risk level better than insurance firms do. With this drawback, insurance firms end up losing the odd advantages over the buyers since the premium is calculated based on average lost for the entire population. This situation is called adverse selection. However, the premium can be adjusted based on risk level of individuals, for example, car insurance premium depends on driver characteristics such as driving historical record, age, and marriage status.

The behavior of insurance buyers can change after the buyers are insured with the coverage. At the time buying insurance, individuals are careful drivers. After there are insured, their driving behaviors can change since the insured individuals have less motivation to drive carefully. Hence the probability of loss has increased accordingly creating the higher chances of a loss occurring (p). This situation is called moral hazard. The deviation from expected profit maximization can occur if the manager charges higher premium than the premium that calculated based on the actuarial theory. This situation can occur when management feels unsecured or concerned on insolvency that might happen to their firms. Such higher premium may be refused by the potential buyers to insure their things. This creates non optimal profitability for the firm. Stone (1973) came up with a formula for the ideal of solvency certainty. Basically the firm would set up a threshold level (q*) and ensure the probability of insolvency below it. The ideal of insolvency constrain can be interpreted as a mathematical inequality equation

$$\sum_{j=1}^{m}\{prob[(Y + jL) > (A + mz^*)]\} < q^* \quad \text{(2.8)}$$

Where Y is a random variable representing the total loss from the insurer's current portfolio of risks and A = total asset value of the insurer. m is the number of policies to be sold by the insurer. Each policy insures the loss L. Hence the premium charged by the insurer is z* in order to keep the left side eq. 4.8 below q* and the equation 2.8 then called the insurer's survivability constraint. Besides the insurance

supply theory, Anomalies on supply sides have been discussed on by Howard Kunteuther and Mark Pauly (2005). Anomalies that were discussed are

1. Insurers overweight recent losses in setting future rates
2. Market success of individual health insurance with guaranteed renewability
3. Limited impact of financial instruments in securitizing insurance risk
4. Reinsurance prices decline as time between last major disaster increases
5. Insurers do not provide premium discounts when individuals adopt loss protective measures in disaster-prone areas

Linkage between insurance theory and pet insurance

Paul and Skiba (2012) show that many people are willing to spend money to enhance the life quality of their pet. The pet owners considered their pet as their family members. Some pet owners can even gone into debt to provide well-being to their pets. These are associated with the demand theory affected by Kunteuther and Pauly (2005). The demand for insurance would increase if the owners have a love feeling to the thing they can insure.

According to www.ncconsumer.org, article name "Survey Finds Pets are more expensive than Owners expect", Approximately 8 out of 10 pet parents said that the cost of pet care is more expensive than they have expected. This concurs with the demand theory for insurance that if the insurance buyers see the loss amount less than the actual loss (L'< L,), they perhaps thinks it is not worth buying for. The article continue on discussing that if there is necessary health expense for their pet, the owners were willing to cut back the daily expense or even finance it.

According to www.thisismoney.co.uk article name "I'm not sure I'll be able to afford in insure my dog again': Why it's more expensive to insure a dog in Dorking than Durham, a pet owner named Charlotte Stockley say "she will not be able to afford to renew her pet insurance policy due to increasing price. This decision agrees with the demand theory for insurance written by Kunteuther and Pauly (2005). The pet owner knows the insurance is worth buying but it is just unaffordable for her.

According to the Article "Should you buy pet insurance?" written by Rebecca Wallick on www.thebark.com, couple cases are mentioned to support the idea of buying pet insurance but the buyer should look for the best suit to his pet. One case is one of patty Glynn's three dogs became ill and very nearly died. It turned out that she had inflammatory bowel disease and required transfusions, among other care. The total cost of the treatment was close to $5,000. Fortunately, at that time, it was affordable for the pet owners but after this treatment Glynn had looked for pet insurance. This agree with the insurance theory that the insurance become more appealing to people who had bad experience and want it to be insured. Another case illustrate buying pet insurance is just a gamble rolling dice. Dana Mongillo, dog trainer who owns a dog purchased pet insurance with a cancer rider for her dog named Mango. It initially cost her $20 a month. Over the next few years, Mango remained healthy and no claims were made on the policy. Then, the premium increased to about $50 a month. She decide to keep insuring her dog then a vet visit for a slight limp ended up with the worst diagnosis possible: Mango had cancer." Her dogs then had gone through a complex cancer diagnosis and treatment and end up cost nearly $5,000. She compared this to the gambling. If her dogs end up having no illness, she would pay for the insurance for free, but she is happy to do that.

Brea(2011) has collected the data on top 10 most expensive pet health condition, Torn Knee Ligament/Cartilage is the highest condition in number of claim but the Intervertebral Disc Disease is the most expensive health condition. The table summary is show in table 2.2.

Table 2.2 the list of the most expensive Pet health conditions

Condition	**Number of claims**	**Average cost per claim**
1. Torn Knee Ligament/Carilage	6,831	$1,578
2. Intestinal-Foreign Object	1,005	$1,967
3. Stomach-Foreign Object	954	$1,502
4. Intervertebral Disc Disease	879	$3,282
5. Stomach Torsion/Bloat	372	$2,509
6. Broken leg(Plate)	350	$1,586
7. Laryngeal Paralysis	126	$2,042
8. Tumor of the throat	124	$1,677
9. Ear Cana Surgery-Ablation	104	$1,285
10. Ruptured Bile duct	102	$2,245

Brea (2014) has collected the data on 10 most common medical conditions for dog and cat. R Brea found that Skin Allergies is the most common condition for dogs whereas Bladder or urinary tract diseases are the most common conditions for cats. The other common medical conditions are listed in the table 2.3.

Table 2.3 the list of the common medical condition for dogs and cats

Dogs	**Cats**
1. Skin Allergies	1. Bladder or Urinary Tract Disease
2. Ear Infection	2. Periodontitis/Dental Disease
3. Non-cancerous Skin Mass	3. Chronic Kidney Disease
4. Skin Infection	4. Vomiting/Upset Stomach
5. Arthritis /Degenerative joint Disease	5. Excessive Thyroid Hormone
6. Vomiting/Upset Stomach	6. Diarrhea/Intestinal Upset
7. Periodontitis/Dental Disease	7. Diabetes
8. Diarrhea/ Intestinal Upset	8. Inflammatory Bowel Disease
9. Bladder or Urinary Tract Infection	9. Upper Respiratory Infection
10. Soft Tissue Trauma (Bruise or Contusion)	10. Lymphoma

This pet owners whose pets do not seem to have any condition on table 2.2 and 2.3 may not consider buying insurance at all, since they think other disease will not occur to their pets. This idea is also associated with the demand theory for insurance. When the perception probability of the event is too low, the individual may not be interested in insurance policies.

However, the common disease depends on breeding, age and size. The Arthritis can occur in any dog older than 1 year especially in big size dogs. The skin disease can last long and require chronicle treatment depending on the severity. The website www.hillspet.com list most common dog diseases: signs, symptom and treatment. The following diseases are list on the website.

1. **Allergic Dermatitis and Skin Conditions in Dogs**

This skin disease is the most concern among pet parents. It can be easily observable and become less adorable. When this problem occurs, most of pet owners bring their pet to the clinic to see veterinarians. The cost of treatment can vary according to the level of severity of the problem from couple thousand up to ten thousands.

2. **Arthritis and Joint Pain in Dogs**

The bone joint is important in pets. Arthritis is an abnormal change in a joint that can cause painfulness on them. These changes occur when cartilage is worn away faster than it can be replaced. Cartilage acts as a cushion to protect the bones.

3. **Brain Aging, Behavioral Changes & Alertness in Dogs**

Remember aging is a natural part of all living things. As your dog ages, he or she may begin to behave differently. Aging takes a toll on a dog's entire body, including his or her brain. This may lead to behavioral changes.

4. **Cancer in Dogs**

Dogs are like human. Disease that appear in human can appear in Dog’s body. Tumor can develop in dog’s body and it can lead to cancer. When cancer is developed in dog, the treatment can be provided to them like human.

5. **Dental Disease in Dogs**

Dogs can chew the bone and tear off sticky meat because they have strong teeth. Like us, Dog’ Teeth should be taken care of properly. Taking care of your pet's teeth can do more than just freshen his breath and it could improve his quality of life.

6. **Developmental Growth Disorders in Puppies**

Good nutrition is the best way to keep your puppy healthy for his life. The development chance of a Growth Disorder is reduced, If the proper and adequate nutrition is provided to your pets.

7. Diabetes Mellitus in Dogs

If your dog appears weak or thirsty, frequently urinates, experiences rapid weight loss, is depressed, or has abdominal pain, he could be diabetic.

8. Food Allergy and Food Intolerance in Dogs

Dogs can be allergic to some kinds of food. The sign of Allergies can be vomiting, diarrhea, irritated skin. When allergies occurs, it isn't fun for anyone, but especially not for your dog who can't tell you what's making him so sick.

9. Gastrointestinal and Digestive Disorders in Dogs

Gastrointestinal (GI) disorders and diseases affect a dog's stomach and intestines, resulting in pain and other problems.

10. Heart Disease in Dogs

No matter your dog's size, he has a big heart - metaphorically speaking, of course. He has a personality all his own, he is a loyal companion and seems to know when you need a good laugh.

However, the cost of treatment can vary according to the level of severity of the illness and the size of dogs, the need of equipment on treatment. A visit without admittance can cause up to thousands. If in case of admittance, the cost can go up a lot higher. The cost can be classified as human ones. Some clinic may not separate the cost of treatment in detail but the high standard animal hospital do separation. The categories of cost of treatment are Doctor Fee, Equipment, Diagnosis, Nursing Care, Case, Operation, and Medicine.

Website www.catthailand.com has listed the cost of general treatment for dog and cat. Here are some examples

1.	5 disease vaccination	300 baht
2.	Pyometra	2,500 baht
3.	cesarean section	2,500 up baht
4.	Blood checking	450 Baht
5.	SNAP TEST	900 baht
6.	Rabies test	800 baht
7.	Skin infection	2,000 up baht
8.	Operation	5,000 up

These treatment cost are rising up which eventually make pet parent turn to insurance. Based on veterinarian pet insurance company (VPI) in the US on https://www.petinsurance.com. The premium is mainly determined by location, age, and breeding. Thus this research questionnaire will mainly focus on those factors. The VI offer different options for plan, basic coverage, intermediate coverage and full coverage with different coverage and price making pet parent to buy the most suitable plan for them.

Theoretical Framework under RUM

An individual *n* faces a choice among *J* alternatives, *j=1,…,J.* The utility that individual n obtain from alternative *j* is U_{nj}. Then, the utility is decomposed as $U_{nj} = V_{nj} + \varepsilon_{nj}$, which is the simplest form, where V_{nj} is defined as a linear expression that captures the observed factors, and ε_{nj} captures unobserved factors. However, the individual *n* chooses an alternative that provides the highest utility.

Under RUM, the behavior of choice decision is determined by several attributes. Observed factors can be separated into three groups, the first group is the insurance product attributes X_{nj} pet owner characteristics Y_{ni} and pet characteristics Z_{ni} Thus the Utility model can be written as an equation as

$$U_{nj} = \beta_{0j} + \beta_1 X_{nj} + \beta_2 Y_{ni} + \beta_3 Z_{ni} + \varepsilon_{nj} \quad \text{(eq. 2.10)}$$

where X_{nj} denotes product related characteristics, Y_{ni} denotes pet owner characteristics, Z_{ni} denotes pet characteristics, and ε_{nj} is denotes unobserved factors. The coefficient β_1, β_2 and β_3 of the dependent variable in eq.2.10 capture the change effect in insurance policy attributes and pet owner characteristics, respectively, β_{0j} is an alternative specific constant for an alternative j .

The behavioral model chooses the alternative *i* if and only if $U_{ni} > U_{nj} \ \forall j \neq i$. An individual *n* obtains the greatest utility when choosing alternative *i*. Thus, probability that individual *n* chooses alternative *i* is given by

$$P_{ni} = \Pr ob\left(U_{ni} > U_{nj} \forall i \neq j\right)$$
$$P_{ni} = \Pr ob\left(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall i \neq j\right) \_\text{(eq.2.11)}$$
$$P_{ni} = \Pr ob\left(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj} \forall i \neq j\right)$$

In Equation 2.11, an individual *n* chooses alternative *i* when the difference in the unobserved factor between alternative *j* and *i* is less than the difference in the observed utility of alternative *i* and *j*.

Randomness in the utility model is a result of our establishing a way of handling information on the unobserved factor (ε)associated with each individual. Difference discrete choice models are then obtained from the different assumptions on the distribution of the unobserved factor of utility.

CHAPTER 3
METHODOLOGY

3.1 CVM Logit Model

In this project, the first step is to understand the cost structure of veterinary health care by visiting veterinary clinics and interviewing veterinarians who work at pet hospitals or clinics. During visits, all classifications of health care cost are determined. Common illness or sickness will be recorded with treatment cost associated with them. Then calculate the probability of illness and sickness occurrences for all breeding of dogs. Then the premium is determined based on the cost for each treatment and the probability of illness.

The second step is to set up the questionnaire. Attributes in the model are characteristics and behavior of the pet owners and price conditions on insurance policies. The interview is conducted at veterinary clinics and hospitals. With the interview result, the discrete choice model is used to estimate the willingness-to-pay for insurance premium.

Based on these reviews of willingness-to-pay technique, the discrete choice model is used to estimate willingness-to-pay. Comparing to other method, the discrete choice model is the most appropriate for the study. Stated Preference method data should be used for this study since there is no complex insurance product available in the market. In Stated Preference method, the CVM is the most appropriate for this study since it's the simplest method to measure WTP for each attribute of the product. The discrete choice model can be more complicated and time consuming with variety of attributes. This can create troublesome for the respondent to answer when interviewed. Thus CVM is the most proper choice for this project.

There are J alternative, J=1,2,…,J for a respondents to select. The Utility earned from the selected choice is $U_{nj} = V_{nj} + \varepsilon_{nj}$ where ,V_{nj} are captures observed factors on choice attribute and ε_{nj} are unobservable factors. The choice that a person selects will give him or her highest utility.

The Utility is determined by two groups of variable, the first group is the insurance product attributes X_{nj} , pet owner characteristics Y_{nj} and pet characteristics Z_{nj} Thus the Utility model can be written as an equation as

$$U_{nj} = \beta_{0j} + \beta_1 X_{nj} + \beta_2 Y_{ni} + \beta_3 Z_{ni} + \varepsilon_{nj} \text{ _____(eq. 3.1)}$$

The coefficient β_1 , β_2 and β_3 of the dependent variable in eq.3.1 capture the change effect in insurance policy attributes and pet owner characteristics, respectively, β_{0j} is an alternative specific constant for an alternative j .

In contingent valuation method, either single bounded or double bounded can be used to measure willingness-to-pay (WTP) when an attribute is added to the product.

Single bounded CVM

The respondents are asked if they will be willing to pay for the product for price P. If he or she say yes then assign y=1 if NO then assign y=0. This demonstrates the willingness for the respondent to give up his or her money to get the product. The respondent will buy if their utility is higher or equal to the utility if they do not trade. Basically, they are willing to give up the money P to be compensated with the product and end up with higher utility.

This explanation can be written down as an equation as follow

The Utility of a person before trading off is

$$U_1 = \beta_0 + \beta_1 X_1 + \beta_2 M + \varepsilon \text{ _____(eq. 3.2)}$$

The Utility of the person if trade occurs is

$$U_2 = \beta_0 + \beta_1 X_2 + \beta_2 (M - P) + \varepsilon \text{ _____(eq. 3.3)}$$

Where

X_1 = the original attribution

X_2 = the new attribution (product)

M = the net worth of the individual

P = price of the product

If $U_2(X_2, M-P) \geq U_1(X_1, M)$ then the individual will buy the product.

If $U_2(X_2, M-P) < U_1(X_1, M)$ then the individual will not buy the product

The difference of utility between two decisions (buying and not buying) is

$$U_2 - U_1 = (\beta_0 - \beta_0) + \beta_1(X_2 - X_1) + \beta_2(M-P) - \beta_2 M + (\varepsilon - \varepsilon) \quad \text{(eq. 3.4)}$$

$$U_2 - U_1 = \beta_1(\Delta x) - \beta_2 P \quad \text{(eq.3.5)}$$

An individual will buy the product if $[U_2 - U_1 = \beta_1(\Delta x) - \beta_2 P] \geq 0$

Apply the logit model y=1 when buying the product, y =0 when not buying the product.

$$Y = \begin{cases} 1 & if \quad \beta_1(\Delta x) - \beta_2 P \geq 0 \quad = \quad purchaing \\ 0 & if \quad \beta_1(\Delta x) - \beta_2 P \quad < 0 \quad = not \quad purchaing \end{cases}$$

The chance for an individual to buy is

$$\Pr(y=1) = \frac{1}{1+e^{-(\beta_1(\Delta x) - \beta_2 p)}}$$

Log odds of the logit model is then

$$\ln\left(\frac{\Pr(y=1)}{1-\Pr(y=1)}\right) = \ln\left(e^{\beta_1(\Delta x) - \beta_2 P}\right) = \beta_1(\Delta x) - \beta_2 P$$

An individual will buy the product if $\beta_1(\Delta x) - \beta_2 P \geq 0$

Or $$P \leq \frac{\beta_1(\Delta x)}{\beta_2}$$

Thus the maximum price for any individual to buy the product is then

$$P_{\max} = \frac{\beta_1(\Delta x)}{\beta_2}$$

Double bounded CVM

In double bound CVM, the respondent will be asked twice starting by the first bid price P if the respondents say yes then he or she will be asked again at 2P. If the respondent rejects then he or she will be asked again at P/2. Thus there are four possible answers: YesYes(YY), YesNo(YN), NoYes(NY), and NoNo(NN). There are four possible outcomes. The probability of each outcome can be calculated as follow.

$$\Pr(y = YY) = \Pr(WTP \geq 2P)$$
$$\Pr(y = YN) = \Pr(P \leq WTP < 2P)$$
$$\Pr(y = NY) = \Pr(P/2 \leq WTP < P)$$
$$\Pr(y = NN) = \Pr(WTP < P/2)$$

Cumulative probability density function (c.d.f.) for logit model for each outcome is the following.

$$\Pr(y = YY) = \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+2\beta_2 P)}}\right)$$
$$\Pr(y = YN) = \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+\beta_2 P)}}\right) - \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+2\beta_2 P)}}\right)$$
$$\Pr(y = NY) = \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+\beta_2 P/2)}}\right) - \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+\beta_2 P)}}\right)$$
$$\Pr(y = NN) = 1 - \left(\frac{1}{1+e^{-(\beta_1(\Delta x)+\beta_2 P/2)}}\right)$$

The likelihood function is construct according to the four possible outcome

$$L = \prod_{1}^{N}\left[\Pr(y = YY)^{d_n^{YY}} \cdot \Pr(y = YN)^{d_n^{YN}} \cdot \Pr(y = NY)^{d_n^{NY}} \cdot \Pr(y = NN)^{d_n^{NN}}\right]$$

The log-likelihood function is then

$$LL = \sum_{1}^{N}\left[d_n^{YY} \ln \Pr(y = YY) \cdot d_n^{YN} \ln \Pr(y = YN) \cdot d_n^{NY} \ln \Pr(y = NY) \cdot d_n^{NN} \ln \Pr(y = NN)\right]$$

Then the coefficient β_1 and β_2 are computed

The willingness-to-pay is $P \leq \frac{\beta_1(\Delta x)}{\beta_2}$ or $P_{\max} = \frac{\beta_1(\Delta x)}{\beta_2}$.

3.2 Linkage between Creation of variables and Theory of Insurance

In this study, there are three groups of variables: product characteristics, pet owner characteristics and pet characteristics. Each variable in the model is created by the insurance theory.

3.2.1 Product Characteristics

Obviously, individuals are willing to pay more to insure the higher expect loss for different products. The cost of treatment for large size pets is higher than small size pet. With this fact, the initial bid to insure large size pet is higher than small size pet. The age of the pets play an important role on the probability and loss amount (cost of treatment) of the pet, physically, the older a pet is, the more likely illness of the pet occurs. With the higher probability, ages of pets do matter on willingness-to-pay for insurance. The conditions on the plans can determine willingness-to-pay for insurance. The more benefits the owners can get, the higher willingness-to-pay is. In this study, there are three type of product starting from the basic plan to full coverage plan. The initial bids for those three plans are differential according to benefit conditions stated on the plans.

3.2.1 Pet Owner Characteristics

Characteristics of pet owners affect the decision of insurance purchasing. Individual with different occupation may have different utility curve, for example, government officials have a low-to-moderate stable income with no bonus at year ends. These government officials may have plan to spend their income and may not want to set aside their income portion for unnecessary expense. Business owners have volatile income thus they may occasionally have extra income to spend on unnecessary things. The educational background can effect on how individual see the insurance. The higher educated people may understand better on how the trade-off between the cost and benefits on the insurance. Male owners may have different utility curve than female. Female may have higher utility when purchase things for

her pets than men. Gender is then believed to be a key variable that affect insurance buying decision. People in different age have different preferences. Younger may feel more bonded with the pet. Older may not feel connected as much as younger owners. Level income of the pet owners is an obvious key variable for insurance purchasing decision. Owners with higher income are more likely to buy insurance since it is affordable for them whereas the lower income owners may not buy insurance although they know insurance is worth buying for.

3.2.3 Pet Characteristics

Breeds of the pet can affect the cost and probability of illness. Pets in some breeds may have a heredity illness and could be costly for the treatment. If the pet owners of such pets, see more benefits than cost of insurance, they would insure their pet. Pets in some breeds are for sale at high price, these pets can be considers are a valuable object for the owners to insure it. The age of the pet play a key role to determine probability of illness, the older pets are more likely to get ill and could be costly for the treatment. The higher probability the illness occurs, the higher willingness-to-pay is. The years of ownership of pet can affect the level of utility of the ownership. The longer the ownership is, the more love feeling on the pet is. The owners with longer ownership are believed to have higher willingness-to-pay for insurance. The regular spending on pet clearly impacts the purchasing decision on insurance. The high spending pet owners are more likely to buy insurance since they have already invested in their pet. The owners with pets with illness are likely to buy insurance. This behavior is associated with theory of adverse selection on insured products.

3.3 Definitions of Variables and their prediction

The pet owners' behavior on buying insurance decisions is analyzed using the CVM logit model. The variables are included according to the theory of demand and supply for insurance. Their measurements and expected relationship with the dependent variable are sown in Table 3.1. The RUM can be specified by

$$U_{ni} = \beta_0 + \beta X_{nk} + \alpha Y_{ni} + \gamma Z_{ni} + \varepsilon_n \quad \text{_____eq.(3.1)}$$

Variables included in X_{nk} measure the following product characteristics:

TYPE	The size of the pet (Small/Big)
AGE	The age of the pet (Young/Adult/Old)
PLAN	The plan of the insurance product (Economy/Standard/FirstClass)
BID	Price of the Product in Baht

Variables included in Y_{ni} measure the following pet owner characteristics:

GENDER	Gender of the owner (Female/Male)
AGE	Age of the owner (years)
EDU	Educational Background (Below Bachelor/Bachelor/Above Bachelor)
JOB	Occupation(Business-Owner/Medical/Academia/Lawyer/Engineer/ Finance/Military/Government Official/Sale/Others)
INC	Monthly Income (0-20,000 baht/20,001-40,000 baht/40,001-70,000 baht/ more than 70,000)
INSURANCE	Awareness of pet insurance (YES/NO)
RISK	Risk aversion level

Variables included in Z_{ni} measure the following pet owner characteristics:

BREEDS	The Breeds of the pet (Poodle/Terrier/Pomerania/Pug/Shih-Tzu/Chihuahua/Other/Small/Golden/Siberian/ Husky/Labrador/Other Big)
AGE_P	The age of the pet (0-2 years/2-5 years/5-8 years/ above 8 years)
YEAR	The number of years owing the pet (0-2 years/2-5 years/5-8 years/above 8 years)

SPEND	Monthly Spending on the pet (0-2,000 baht/2,001-4,000 baht/more than 4,000 baht)
Ill	If you pet have an current illness (YES/NO)

The model consists of the deterministic part and the random variable. The coefficient β_0 is an alternative specific constant. β , α and γ are the coefficients of insurance product, pet owner characteristics and pet characteristics. The directions of the coefficients are predicted in detail in the following section.

Insurance Product characteristics

Type of Pet (S_typeBig): The type of the pet is classified according to the size of pet, either big (10kg up) or small (less than10kg). According to the interview, larger size ones require more amount of medicine and more room when admitted to hospital.

Age of Pet (S_age): The age of the pet affects the probability of illness occurrence. The older the pet is, the more likely illness occurs.

Plan of Insurance (S_plan): There are three plans of insurance starting from the basic one which only offer basic benefits to the higher plan than offer more benefits to the insured pets.

Price (S_price): The bidding prices of each insurance product depend on size of pet, age of pet and plan type of insurance. The higher bidding price, the more unlikely the buyer purchases.

Pet owner characteristics

Gender (c_sex): The gender of the owners may affect the decision making. Females are expected to pay more on the same insurance product since they are believed to care more about pet then men do.

Age (c_age): The age of the owners influence the willingness to pay for insurance. The senior are not familiar with the insurance products and are unlikely to

buy them whereas the youngers have positive image on the insurance and they trend to buy insurance to protect the loss.

Level of education (c_edu): Education Background of respondents may affect the buying decision on insurance. People with higher education should understand more on insurance and trend to buy them if they are worth buying.

Occupation (c_job): Occupation of respondents may affect the buying decision on insurance. People in Government sector have a fix low income and may not be able to set aside to buy extra things they want.

Individual income (c_inc): Income level probably affects willingness-to-pay for insurance. Pet owners with higher income have more money to spend extra things they want to.

Awareness of pet insurance (c_insurance): the awareness of insurance may affect the decision of buying insurance for pet owners who are unaware of pet insurance existence

Risk Aversion level (c_risk): The level of risk aversion of the pet owners can determine the willingness to pay for insurance. The higher risk aversion they have, the more likely they buy insurance.

Pet owner characteristics

Breed (d_breed): The breed of pet may effect on making decision on insurance purchasing. The owners of certain breeds such as Siberian husky or Pomeranian may be likely to buy insurance for their dogs.

Age of dog (d_age): The age of dogs owners own can affect the decision of buying insurance. The pet owners who own older dogs may experience more frequent illnesses on their dogs and they are expected to buy insurance.

Year of Ownership (d_year):The longer the pet owners own the pets, the more connected mentally they have with their pets. They care more about the pet and they are more likely to insure their pets.

Monthly Spending (d_spend): The owners who regularly spending more on their pets are believed to be more likely to buy insurance for the pets.

Illness Existence (d_ill): The current existing illnesson their pet definitely make the pet owners to insure their pet.

Table 3.1 The summary of all variables and their predictions

Product Characteristics	**Description**	**Prediction Direction**
Dog Type (s_typeBig)	TYPE, 1 if Big, 0 if Small	+
AGE of the insured dog(s_age2,s_age3)	S_age2,1 if Adult; S_age3, 1 if Old; (none if Young)	+
Plan Type(S_planB,S_planC)	S_planB, 1 if Stantdard; S_palnC, 1 if FirstClass; (none if Economy)	+
BID Price(s_price)	BID Price for each product(Baht)	
Pet Owners Characteristics	**Description**	**Prediction Direction**
Gender(c_sex)	Gender of the respondent, 0 if female, 1 if male	-
Age(c_age)	Age of the respondent(years)	+/-
Education Level(c_eduMaster)	Education Level, 1 if owner has a degree above Bachelor degree, 0 otherwise	+
Occupation(c_jobGov)	JOB of the respondent, 1 if government, 0 otherwise	-
Monthly Income(c_inc40Kup)	Monthly income of respondent, 1 if more than 40,000 baht	+

Insurance(c_insurance)	Awareness of Pet insurance, 1 if yes, 0 if no	-
RISK(risk aversion level)	Computed by factor analysis [-2.33,1.45]	+
Pet Characteristics	**Description**	**Prediction Direction**
Breeds(d_breedBig)	Dog breeds, 1 if big breeds, 0 if small breeds year	+/-
Breeds(d_husky)	Dog breeds,1 if Siberian husky is the breed, 0 otherwise	+
Breeds(d_pom)	Dog breeds,1 if Pomeranian is the breed, 0 otherwise	+
Age of the pet(d_age)	d_age, 1 if age > 5 years, 0 otherewise	+
YEAR (year of ownership,d_year5up)	d_year5up,1 if 5 or longer(years), 0 otherwise	+
SPEND(monthly spending on pet,d_spend4Kup)	D_spend4Kup, 1 if more than 4,000 baht, 0 otherwise	+
Ill(illness of the pet, d_ill)	D_ill, 1 if pet has illness, 0 if not	+

The random utility model estimated by nested logit model is as follows:

$$
\begin{aligned}
U = {} & \alpha + \beta_{S\_typeBig} S\_typeBig + \beta_{S\_age2} S\_age2 + \beta_{S\_age3} S\_age3 + \beta_{S\_planB} S\_planB \\
& + \beta_{S\_planC} S\_planC + \beta_{S\_price} S\_price + \beta_{d\_breedBIG} d\_breedBIG + \beta_{d\_husky} d\_husky \\
& + \beta_{d\_pom} d\_pom + \beta_{d\_age} d\_age + \beta_{d\_year5up} d\_year5up + \beta_{d\_spend4Kup} d\_spend4Kup \\
& + \beta_{d\_ill} d\_ill + \beta_{c\_risk} c\_risk + \beta_{c\_sex} c\_sex + \beta_{c\_age} c\_age + \beta_{c\_eduMaster} c\_eduMaster \\
& + \beta_{c\_jobGov} c\_jobGov + \beta_{c\_inc40Kup} c\_inc40Kup + \beta_{c\_insurance} c\_insurance + \varepsilon
\end{aligned}
$$

3.4 Process on the initial bid set up

In this project, the plans mimicked from Veterinary Pet Insurance Company (VPI) in the U.S. where VPI offers three plans depend on the degree of coverage from prevention, all major medical and full coverage.

The initial bids were set up based on the existing insurance plans in the country. Muangthai amd Mittare insurance companies are the only two insurance companies that have offered pet insurance products to pet owners.

CHAPTER 4
EMPERICAL RESULTS

This section discusses the results of the questionnaire survey. Data are estimated by Double-bound CVM logit model. The surveys were conducted at the pet clinics and hospitals and workplace and school. Totally, after elimination of incomplete questionnaire, only 180 are valid to be used in the model estimation.

4.1 Overviews of the Respondents

This part of the study discusses the statistical pet owner characteristics collected from questionnaire survey.

Gender: Out of total 183 respondents, 114(62.30%) of whom are female and 69 were male. The pie graph proportion representation is shown in figure 4.1

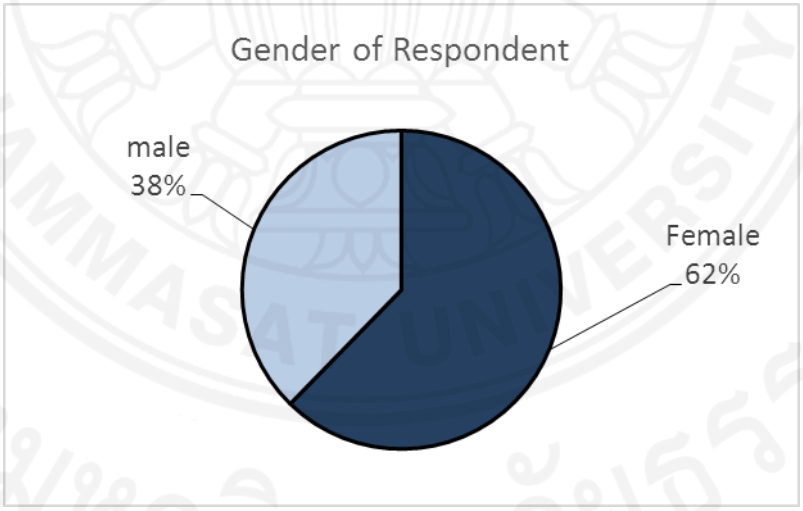

Figure 4.1 Genders of Respondents

Age: The age of respondents ranged from 21 to 73 years. The average was 40.48 years. The bar representation of age of respondents is shown in figure 4.2.

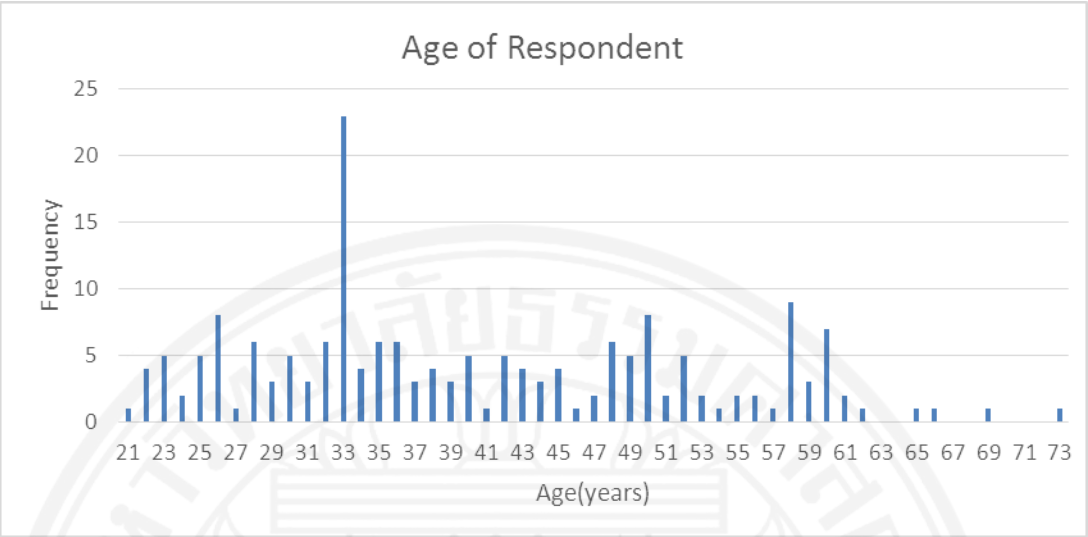

Figure 4.2 Ages of Respondents

Education level: The respondents were classified into 3 education levels which are below bachelor degree, bachelor degree and above bachelor degree. 30(16%) of the respondents have not earn a bachelor degree, 99(54%) of whom have a college degree and the rest 54(30%) have a graduate degree. The pie graph representation of the proportion of each education level is shown in figure 4.3.

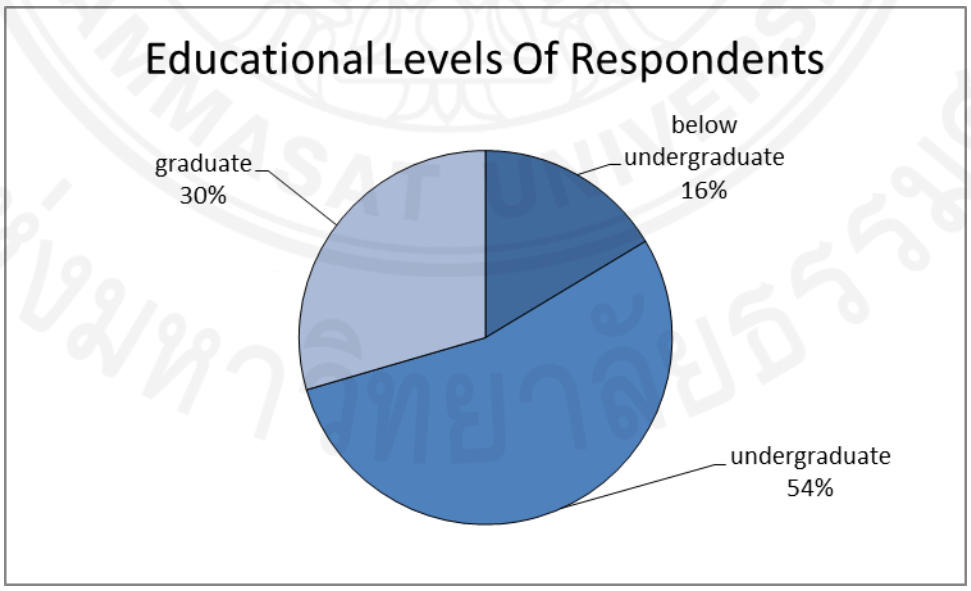

Figure 4.3 Educational Backgrounds of Respondents

Occupation: In this study, the respondents were classified into 10 occupations but they were grouped into two major groups which are government and others. 34(19%) of the respondents are government officials and 147(81%) have other occupations.

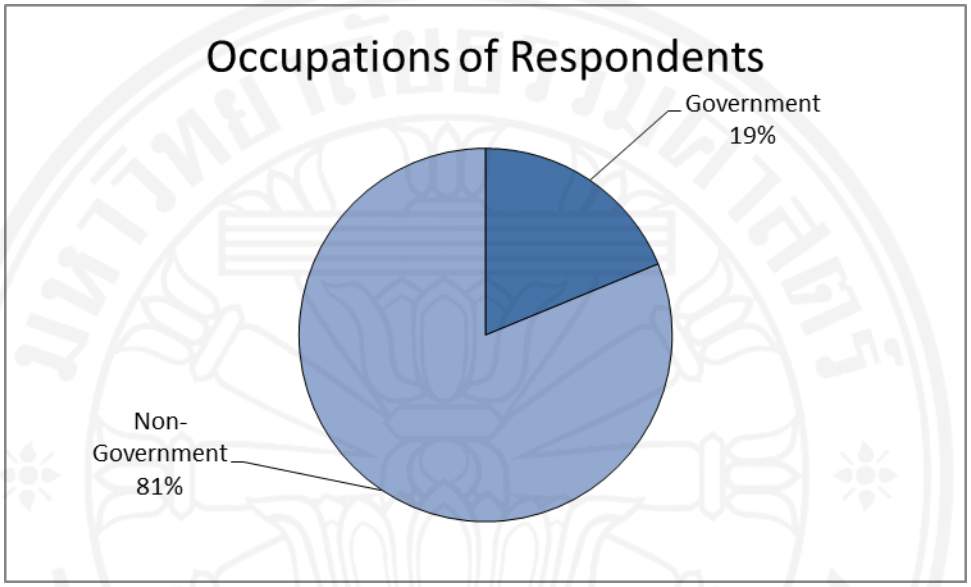

Figure 4.4 Occupations of Respondents

Monthly income: There are 4 classifications of monthly income of respondents. 0-20,000 baht, 20,000-40,000 baht, 40,000-70,000 baht and more than 70,000 are the four classifications of monthly income of respondents. Of those four income levels, 22(12%) of whom have their income below 20,000 baht, 66(36%) of whom have income of 20,000-40,000 baht, 61(33%) of them have income of 40,000-70,000 baht and the rest 34(19%) have income higher than 70,000 baht. The pie representation of proportion of respondents are shown in figure 4.5

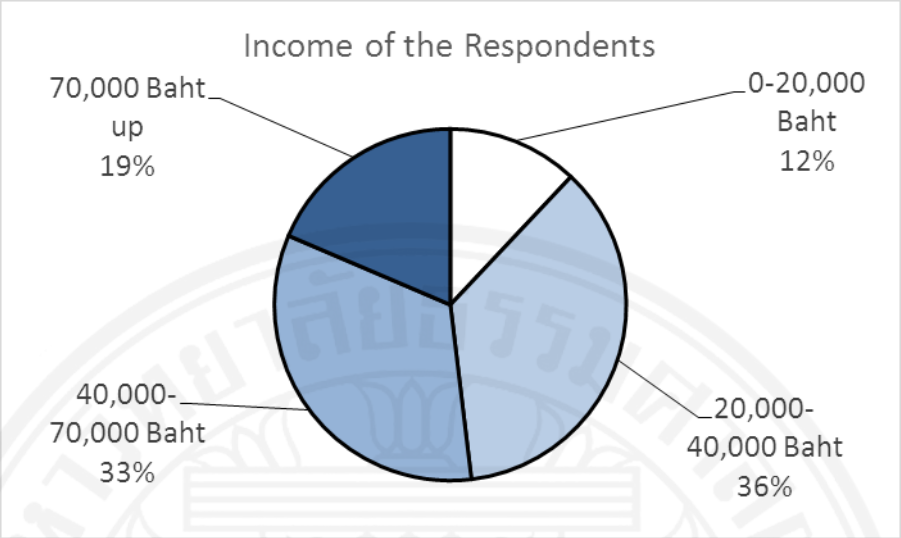

Figure 4.5 Monthly Incomes of Respondents

Awareness of pet insurance: The respondents were asked if they were aware of pet insurance. 138(75%) said NO and 45(25%) said YES. The pie graph of representation of proportion is shown in figure 4.6

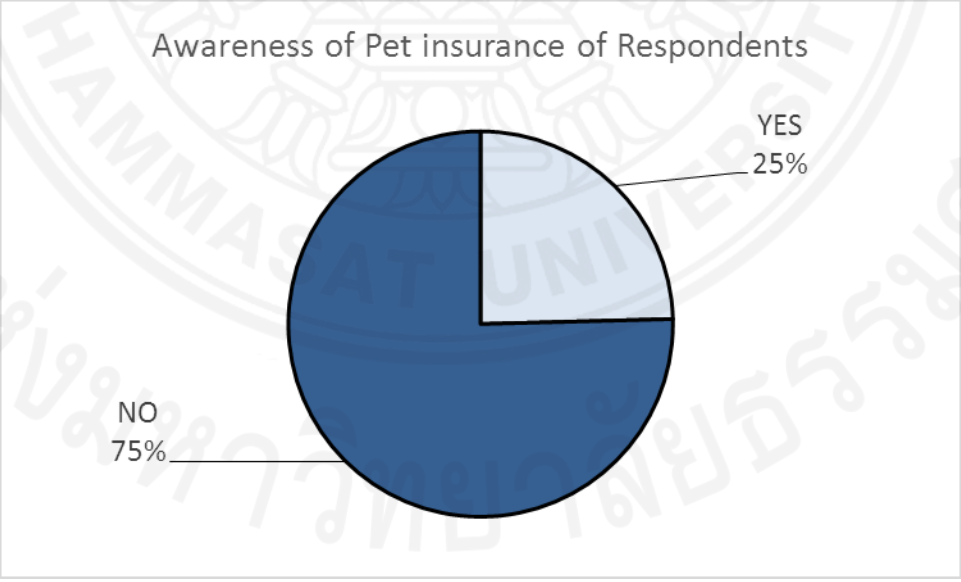

Figure 4.6 Awareness of Pet Insurance of Respondents

Dog Breeds: In this study, the most popular breeds were picked as classifications. Ones that are not classified into any groups would go to either small or big breed which depend on size of the breed. Totally, there are 11 breeds: Poodle, Terrier, Pomeranian, Pug, Shih-tzu, Chihuahua, Other small, Golden retriever, Siberian husky, Labrador and other big. The percentage are shown in pie graph representation in figure 4.7

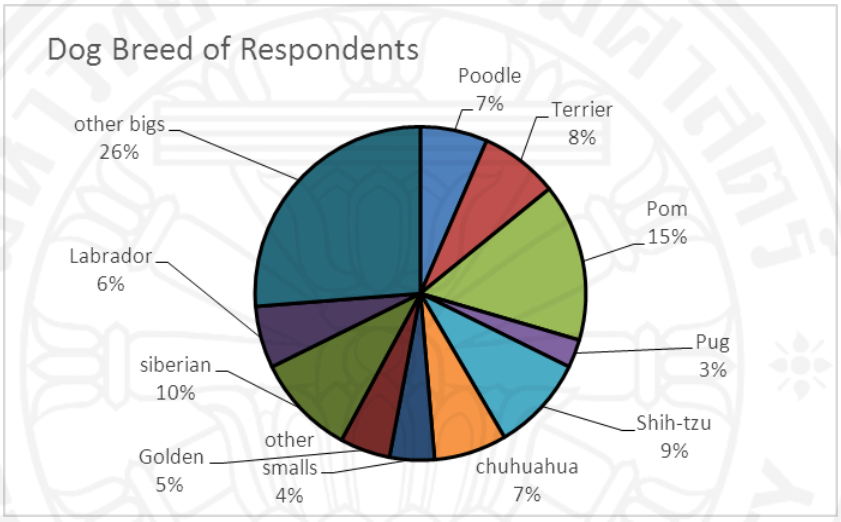

Figure 4.7 Pet Breeds of Respondents

Dog Age: the dogs were classified into 4 following levels of age, 0-2 years,2-5 years,5-8 years and more than 8 years. The proportion for each level is shown in figure 4.8

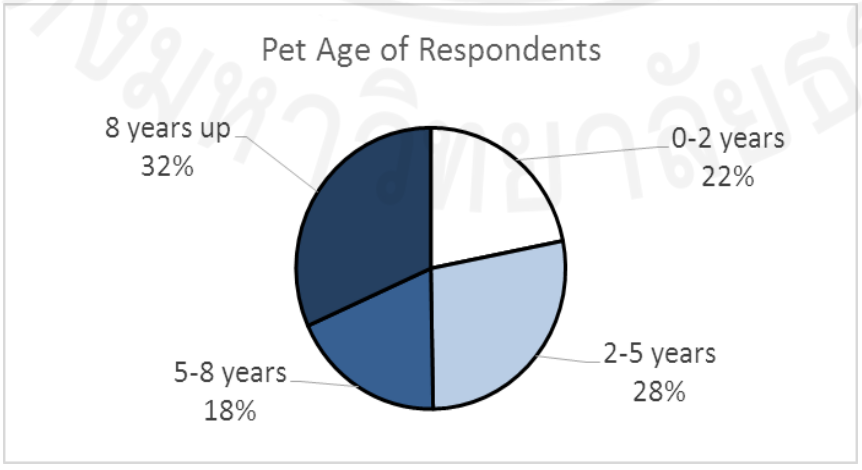

Figure 4.8 Pet Ages of Respondents

The Periods of pet ownership: Similar to pet age, in this study, there are four levels of pet ownership duration,0-2 years,2-5 years, 5-8 years and more than 8 years. Each proportional period is shown in figure 4.9.

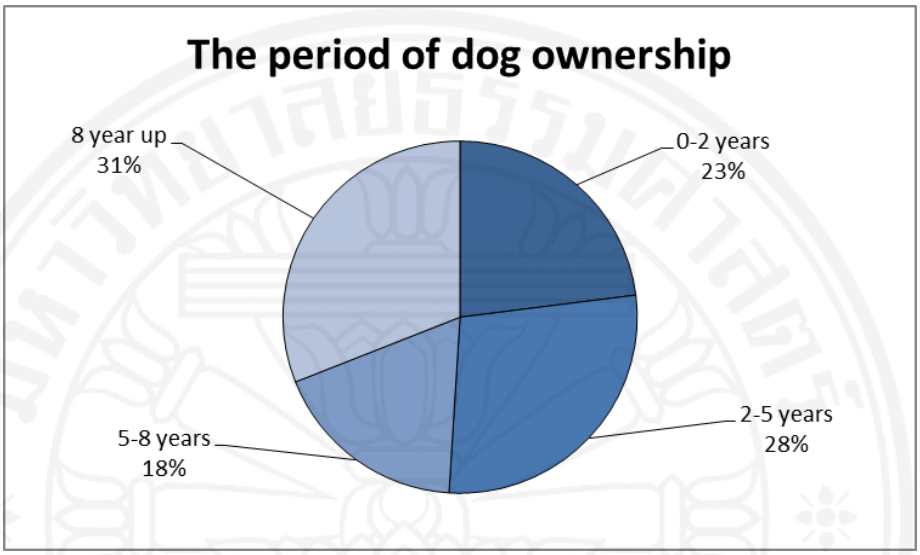

Figure 4.9 Periods of Pet Ownership of Respondents

Monthly Spending on pet: There are 3 ranges of monthly spending on pet, 0-2,000 baht, 2,000-4,000 and 4,000 up. Each proportion monthly spending is shown in figure 4.10

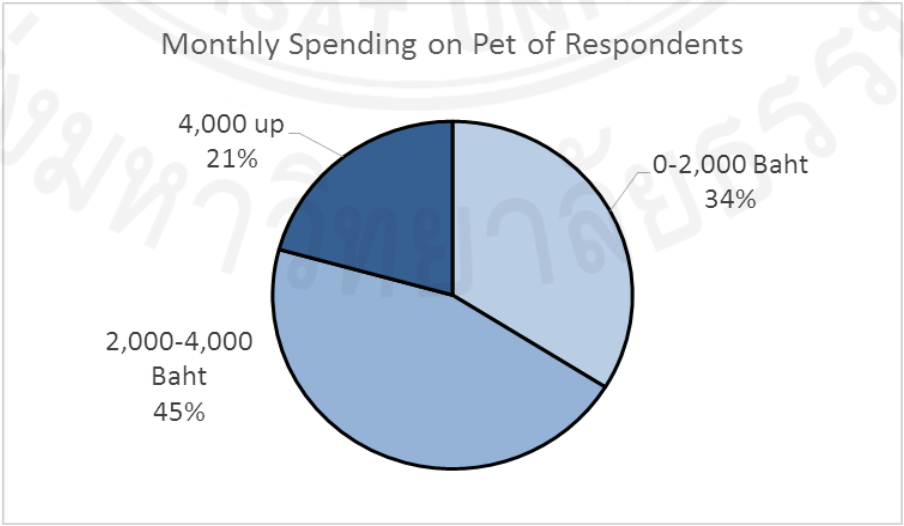

Figure4.10 Monthly Spending on Pet of Respondents

Illness existence: In this study, Pet owners were also asked if their pets have been sick. 114 of whom said NO and 69 said YES. The pie proportion representation is shown in figure 4.11.

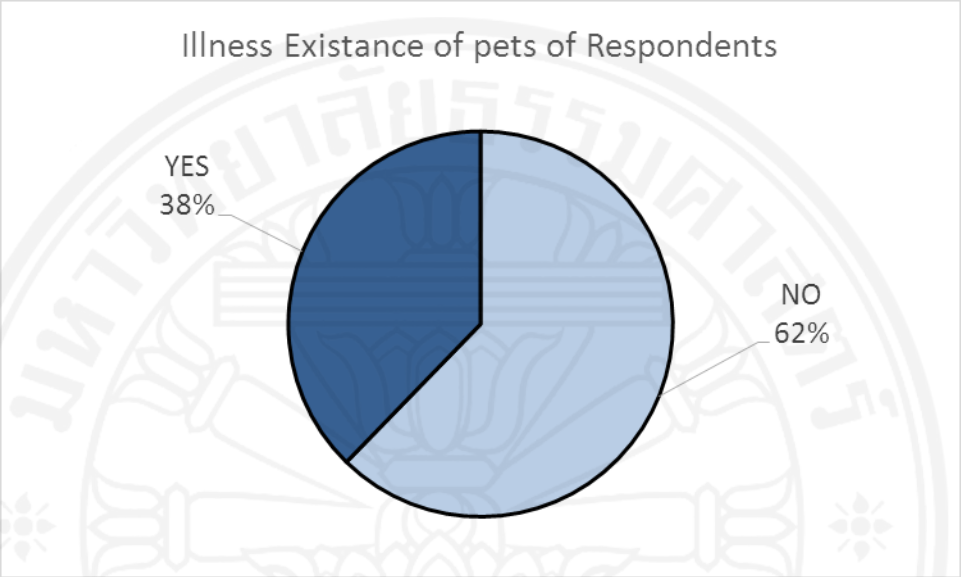

Figure 4.11 Illness existence of Pet of Respondents

Degree of risk aversion: In this study, the degree of risk aversion was measure for each respondent. The behavior on purchasing a lottery was analyzed. The data was then converted to a variable in the model by using factor analysis method. The lottery choosing behavior questions are shown in appendix and the numbers of crossings are shown in table 4.1.

Table 4.1 Risk aversion coefficients and the number of crossovers

C_risk	Numbers of Crossovers
-2.356197	13
-1.911308	10
-1.488989	20
-1.099614	18
-0.728857	23
-0.3745455	44
0	24
0.4447358	11
0.9489357	1
1.45651	19

4.2 Overview of the Experiment

In this section, the decision making behaviors on each insurance product are described. Each respondent was asked if he or she want to buy the products for each particular price that was set as an initial bid. There are two outcomes, either BUY (YES) or DON'T BUY (NO). If BUY is the answer, he or she then was asked again with the double more expensive price. If DON'T BUY is the answer, he or she then was asked again with half lower price. There are total possible 18 different products. Thus each respondent was asked 36 times on for the whole experiment. The table of experimental questionnaire with the number of answers for each scenario is shown in table 4.12 for large size breed dogs and table 4.13 for small size breed dogs.

Each Table consists of 27 distinct scenarios alters in combination of dogs age, type of plan and bid price. Respondents are to choose either buy or don't buy for the first bid. If buy is chosen, then respondent go to the higher bid. If Don't buy is chosen, then respondents go to the lower bid.

For example, a respondent begins at scenario 1, if he or she chooses to buy it with 1,000 baht, then he or she will skip scenario 2 and move on to scenario 3. If he chooses Don't-buy, he will then answer the scenario 2 and skip scenario 3.

Table 4.2 Result of Responds for small size breeding dogs

Scenario	Age (years)	Plan	Bid Price (Baht)	Buy	Don't Buy	Total
1	3 months-4 years	Economy	1,000 Baht	90	93	183
2			500 Baht	46	46	93
3			2,000 Baht	21	69	90
4		Standard	2,000 Baht	92	91	183
5			1,000 Baht	37	54	91
6			4,000 Baht	14	78	92
7		First-Class	3,000 Baht	54	129	183
8			1,500 Baht	63	66	129
9			6,000 Baht	7	47	54
10	4-8 years	Economy	1,200 Baht	80	103	183
11			600 Baht	48	55	103
12			2,400 Baht	12	68	80
13		Standard	2,400 Baht	94	89	183
14			1,200 Baht	21	68	89
15			4,800 Baht	10	84	94
16		First-Class	3,600 Baht	62	121	183
17			1,800 Baht	70	51	121
18			7,200 Baht	5	57	62
19	8 years up	Economy	1,500 Baht	66	117	183
20			750 Baht	45	72	117
21			3,000 Baht	11	55	66
22		Standard	3,000 Baht	87	96	183
23			1,500 Baht	57	39	96
24			6,000 Baht	19	68	87
25		First-Class	4,500 Baht	64	119	183
26			2,250 Baht	70	49	119
27			9,000 Baht	11	53	64

Table 4.3. Result of Responds for large size breeding dogs

Scenario	Age (years)	Plan	Bid Price (Baht)	Buy	Don't Buy	Total
1	3 months-3 years	Economy	1,200 Baht	84	99	183
2			600 Baht	50	49	99
3			2,400 Baht	17	67	84
4		Standard	2,400 Baht	90	93	183
5			1,200 Baht	39	54	93
6			4,800 Baht	14	76	90
7		First-Class	3,600 Baht	58	125	183
8			1,800 Baht	59	66	125
9			7,200 Baht	8	50	58
10	3-7 years	Economy	1,500 Baht	80	103	183
11			750 Baht	41	62	103
12			3,000 Baht	7	73	80
13		Standard	3,000 Baht	91	92	183
14			1,500 Baht	49	43	92
15			6,000 Baht	13	78	91
16		First-Class	4,500 Baht	60	123	183
17			2,250 Baht	70	53	123
18			9,000 Baht	4	56	60
19	7 years up	Economy	1,800 Baht	66	117	183
20			900 Baht	47	70	117
21			3,600 Baht	9	57	66
22		Standard	3,600 Baht	88	95	183
23			1,800 Baht	50	45	95
24			7,200 Baht	16	72	88
25		First-Class	5,400 Baht	63	120	183
26			2,700 Baht	68	52	120
27			10,800 Baht	9	54	63

4.3 Suggestions from the Questionnaire Survey

The pet owners have given many suggestions during the questionnaire survey. These can lead to the improvement on willingness-to-pay measurement and the questionnaire design.

4.3.1 The cost variation on the economy plan across dog ages

It is commonly believed that the older the pet is, the more possible the claim is made. However, the economy plan just focuses on the prevention. Thus the claims on the economy plan are predictable and the older dogs should not need more prevention

as the younger dogs do. So the premium on the economy plan should remain flat across all ages.

4.3.2 The linear increment on cost based on dog age may not reflect the real demand

In this study, it is expected that the older dog trend to make more claim, thus the initial bids were set up according to the age. The older age ranges, the higher initial bids are. However, According to the survey, some pet owners suggested that the dogs at mature ages (4-7 years) are the healthiest ages for dogs and the premium should be the lowest in these ages not the young ages.

4.3.3 The multiple occupations on the pet owners

In the questionnaire survey, the pet owners were asked for their occupation. Some pet owners may have multiple jobs. However, the respondents were suggested to select the one they think should be their occupations

4.3.4 The variation on breeds

Obviously, the different breeds have different kinds of treatments. Thus the premium should be different according to dog breeds since some dog breeds require higher care than others. However, there will be limitation on claim for each plan to limit loss for insurers.

4.3.5 Insurance business image in Thailand

In this study, the degree of risk aversion was measured using the questionnaire on purchasing lottery behavior and convert the result based on factor analysis. However, there were some respondents who have degree of risk aversion and they were supposed to rely on insurance for their risk aversion but they ended up refusing buying all insurance policies because of their bad image on insurance business in the country. Thus, in the next study, there should be a question asking the image on insurance in the country.

4.3.6. Pet identification

Pet identification can be a serious problem for insurers. Many pets in the same breeds may look alike and their owners can take advantage of it. It is the insurer’s job

to ensure identity of the insured pet either taking photos or embedding a microchip on pets

4.4 CVM logit model Estimation

Respondent samples were drawn for the questionnaire survey. The contingent valuation double bound logit model is used to estimate willingness to pay for each product and each attributes. The utility model is estimated for all products and attributes as shown in Equations 4.1. The parameters and their p-values are summarized in the table 4.3

Equation 4.1

$$\begin{aligned} U = {} & 0.4827S\_typeBig^{***} + 0.5637S\_age2^{***} + 1.1290S\_age3^{***} + 2.0900S\_planB^{***} \\ & + 2.6577S\_planC^{***} - 0.0011S\_price^{***} + 0.1631d\_breedBIG - 0.0269d\_husky \\ & + 0.1198d\_pom + 1.1097d\_age - 1.0631d\_year5up + 1.1112d\_spend4Kup^{**} \\ & + 0.7573d\_ill^{*} + 0.2276c\_risk + 0.0931c\_sex - 0.0268c\_age + 0.3966c\_eduMaster \\ & - 0.7841c\_jobGov + 0.3763c\_inc40Kup + 0.0739c\_insurance + 0.1490 \end{aligned}$$

Note: *** is significant at 99% the confident interval

** is significant at 95% the confident interval

* is significant at 90% the confident interval

Table 4.4 Estimation Results for CVM Logit Model

Variable	Coefficient	P-Value
$S\_typeBig$	0.482665	0.000
S_age2	0.563732	0.000
S_age3	1.128958	0.000
S_planB	2.090011	0.000
S_planC	2.657651	0.000
S_price	-0.0011151	0.000
$d\_breedBIG$	0.1630657	0.709
d_husky	-0.0269244	0.966
d_pom	0.1197701	0.820

Variable	Coefficient	P-Value
d_age	1.109714	0.411
$d\_year5up$	-1.06311	0.435
$d\_spend4Kup$	1.111976	0.010
d_ill	0.757341	0.061
c_risk	0.227858	0.194
c_sex	0.0930581	0.796
c_age	-0.026822	0.106
$c\_eduMaster$	0.396579	0.344
c_jobGov	-0.7841475	0.111
$c\_inc40Kup$	0.3763182	0.379
$c\_insurance$	0.0738721	0.858

The coefficients that are highly insignificant are removed from the equation 4.1. Only those that are significant nearly or above 90% confident level are kept in the next estimation. The utility model is estimated for all products and attributes after the removal of all insignificant variables is shown in Equation4.2. The parameters and their p-values are shown in the table 4.5

Equation 4.2

$$U = 0.4828S\_typeBig^{***} + 0.5640S\_age2^{***} + 1.1290S\_age3^{***} + 2.0912S\_planB^{***} + 2.6589S\_planC^{***} - 0.0011S\_price^{***} + 1.122d\_spend4Kup*** + 0.6550d\_ill^{*} - 0.0285c\_age^{**} + 0.4907$$

Note: *** is significant at 99% the confident interval

** is significant at 95% the confident interval

* is significant at 90% the confident interval

Table 4.5 Estimation Results for CVM Logit Model only for significant variables

Variable	Coefficient	P-Value
$S\_typeBig$	0.482802	0.000
S_age2	0.5640447	0.000
S_age3	1.129451	0.000
S_planB	2.091198	0.000
S_planC	2.658895	0.000
S_price	-0.001116	0.000
$d\_spend4Kup$	1.122031	0.009
d_ill	0.6550255	0.071
c_age	-0.028457	0.047

4.5 Willingness-to-pay for pet insurances

The willingness-to-pay (WTP) for the product with no attribution is computed from the inverse of the coefficient as written in equation 4.3.

$$\text{WTP} = -\frac{\alpha}{\beta_{S\_price}} \qquad \text{equation 4.3}$$

Each attribute added to the base product has value. Each attribute value is computed as willingness-to-pay which is equal to the marginal rate of substitution between attributes and the payment as written in equation 4.4. The wiliness-to-pay for base product and all attributes are presented in table 4.6

$$\text{WTP} = -\frac{\beta_{attribute}}{\beta_{S\_price}} \qquad \text{equation 4.4}$$

Willingness-to-pays for all combinations were computed. The overall results are shown in table 4.7 for small size dog insurances and table 4.8 for large size dog insurances.

Table 4.6 Willingness-to-pay for the product and each attributes with 95% intervals

Attributes	WTP(Baht)	Lower bound(95%)	Upper bound (95%)
Base product	439.70	-	-
S_typeBIG	432.60	316.78	548.42
S_age2	505.40	365.00	645.79
S_age3	1012.01	869.00	1155.03
S_planB	1873.76	1732.52	2015.00
S_planC	2382.43	2237.81	2527.06

Table 4.7 Willingness-to-pays for all insurance products for small pets

Scenario	Age (years)	Plan	Bid Price (Baht)	WTP(Baht)	Lower bound	Upper bound
1	3 months-4 years	Economy	1,000 Baht	439.70		
2			500 Baht			
3			2,000 Baht			
4		Standard	2,000 Baht	2,313.48	2,172.24	2,454.72
5			1,000 Baht			
6			4,000 Baht			
7		First-Class	3,000 Baht	2,822.15	2,677.53	2,966.78
8			1,500 Baht			
9			6,000 Baht			
10	4-8 years	Economy	1,200 Baht	945.12	804.72	1,085.51
11			600 Baht			
12			2,400 Baht			
13		Standard	2,400 Baht	2,818.88	2,537.24	3,100.51
14			1,200 Baht			
15			4,800 Baht			
16		First-Class	3,600 Baht	3,327.55	3,042.53	3,602.57
17			1,800 Baht			
18			7,200 Baht			
19	8 years up	Economy	1,500 Baht	1,451.73	1,308.72	1,594.75
20			750 Baht			
21			3,000 Baht			
22		Standard	3,000 Baht	3,325.49	3,041.24	3,609.75
23			1,500 Baht			
24			6,000 Baht			
25		First-Class	4,500 Baht	3,834.16	3,546.53	4,121.81
26			2,250 Baht			
27			9,000 Baht			

Table 4.8 Willingness-to-pays for all insurance products for small pets

Scenario	Age (years)	Plan	Bid Price (Baht)	WTP(Baht)	Lower bound	Upper bound
1	3 months-3 years	Economy	1,200 Baht	872.32	756.50	988.14
2			600 Baht			
3			2,400 Baht			
4		Standard	2,400 Baht	2,746.08	2,489.02	3,003.14
5			1,200 Baht			
6			4,800 Baht			
7		First-Class	3,600 Baht	3,254.75	2,994.31	3,515.20
8			1,800 Baht			
9			7,200 Baht			
10	3-7 years	Economy	1,500 Baht	1,377.72	1,121.50	1,633.93
11			750 Baht			
12			3,000 Baht			
13		Standard	3,000 Baht	3,251.58	2,854.02	3,648.93
14			1,500 Baht			
15			6,000 Baht			
16		First-Class	4,500 Baht	3,760.15	3,359.31	4,160.99
17			2,250 Baht			
18			9,000 Baht			
19	7 years up	Economy	1,800 Baht	1,884.33	1,625.5	2,143.17
20			900 Baht			
21			3,600 Baht			
22		Standard	3,600 Baht	3,758.09	3,358.02	4,158.17
23			1,800 Baht			
24			7,200 Baht			
25		First-Class	5,400 Baht	4,266.76	3,863.31	4,670.23
26			2,700 Baht			
27			10,800 Baht			

4.6 Discussion on Significant Variables of Owner Characteristics

The other significant variables are d_spend4Kup, d_ill and c_age. There three variables influent significantly the buying decision of the pet owners. If the pet owners have spent more than 4,000 baht monthly on their pets, they are more likely to buy insurance. Since these high spending people have already invested substantial amount of money on their pet, they feel the premium worth paying for the coverage. This group is the real professional pet owners who are willing to take care of the pet in the best way.

The owners of the pets with illness are willing to pay more for the insurance. This behavior is supported by the adverse selection supply theory of insurance by Kunreuther and Pauly (2005) when insurers set the same premium for everyone the bad risk types are likely to buy coverage and high risk customers take advantage of it.

The younger pet owners are more willing to buy the insurance at high rate. The older may have bad impression on the insurance business since insurance in the past has bad reputation for the senior. In recent days, the insurance industry is significant improved and become more professional and more standardized. The younger may not experience the pushing behavior by the sale agent as much as the older.

4.7 Comparison between the estimation and the premium offered by existing insurers

The insurance products that were used in this study were mimicked from the product offered by VPI in the US. The bid prices were set up to relate the prices offered by the existing companies both Muangthai PLC and Mittare PLC

Muangthai only insure pets that age between 3 months to 7 years in healthy condition. Muangthai Insurance pet products vary according to the amount of coverage with the same condition but different in claiming amount. The coverage includes Death, Medical Expense by accident and illness, Third Party Liability, and advertisement on lost pets etc. The premium ranges from 2,800 to 7,200 yearly with no microchip embedded and from 2,600 to 6,500 with microchip option. The coverage benefits range from low thousands for plan 4 up to virtually tens of thousands for plan 1. In comparison, Muangthai plans are close to the standard plan with mature ages for both large and small dogs since size of dogs do not matter for Muangthai. The premiums are compared in table 4.9

Mittare similarly only insure pets at mature ages like Muangthai but the premium varies according to breeding. There is no variation by coverage amount by Mittare. The comparison table is presented in table 4.9

Table 4.9 comparisons between plans in the study and plans from insurers

	Plan in the study: first class Plan (large size, mature ages)	Plan 3 with microchip by Muangthai	Mittare (Siberian husky breeding)
Premium	WTP = 3,760.15 Baht	3,536.40 Baht	3,759.98 Baht
Total benefit	35,000 Baht	49,750 Baht	36,500 Baht

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Study

This paper evaluated willingness-to-pay for pet insurance premium. This study used stated preference (SP) data from a questionnaire survey conducted in pet hospital and other areas in Bangkok, Thailand. Data were collected and estimated using Double bound logit model. There are 18 total combinations of the pet insurance products. The attributes include size, age, and type of plan for pet. There were many characteristics of the pet owners included in the model such as gender, age of the owners, occupation, income level, education level, awareness of pet insurance, spending amount on pets, illness existence, pet breeds, duration of ownership but only spending amount, existence of illness on pets and age of the pet owners are influential variables.

The willingness-to-pays were estimated for each combination of products ranging from the lowest at 439.70 baht for the basic one at young age small pet up to the highest at 4,670.23 baht for the first class plan on old pet. Each attribute was estimate for willingness-to-pay. The big size attribute was estimated to be 432.60 baht. The age of pet attributes were 505.40 and 1012.01 for mature and old age respectively. Willingness-to-pay for upgrade from the economy plan to standard plan and first class plan were 1,873.76 baht and 2,382.43 baht respectively. With those significant variables, the owners who spend significant amount on pets are more likely to insure their pets. The owners with pets with illness are likely to buy insurance for their pets and the younger pet owners are, the higher level of willingness-to-pay is.

The experiments were conducted in Chulalongkorn Pet Hospital during Jan 2016 to Feb 2016. The other locations were at community malls when there were pet festivals. Friends, colleagues at work and friends in MIF16 were also helpful for this study.

5.2 Application of the study

In recent years, the number of pet population has been growing couple with the number of pet clinics and hospitals to serve the clients. Inclining cost of health care and treatment makes the owners feel unsecured for their pets. The cost of complex treatment can be unaffordable to many pet owners. The pet insurance can be an alternative for those who want to mitigate the risk of illness. Many pet owners are unaware of pet insurance existence. The pet clinics and hospitals should pay a role providing information about pet insurance and its coverage. According to the interview of the pet owners, many of them are willing to insure their pets if they are aware of insurance. Insurance providers should corporate with the pet clinics to market their products and inform cost and benefits for pet insurance. The ease of reimburse is one of the influent factors for the pet owners on making decision buying an insurance plan. The pet identity should be implemented on insured pets avoiding claiming on different pets. Microchip embedding is considered the easiest way of pet identity implementation.

5.3 Suggestion for further study

There are many suggestions based on the interview and estimation results. Several aspects can be improved to make the future study more useful.

First, the number of observations should be higher. Low frequency of some categories can lead to the difficulty of real relationship determination between independent and dependent variables. The low number of observation makes the estimation inefficient and the spread of answers should be seen for efficient estimation. More than 400 observations is the recommended number.

Second, in some cases, the respondents must use their imagination to answer the question. For example, the small pet owners at young age must imaging how they are going to make decision if their pets are different age or if they owner a big size pet.

Third, the risk aversion level measurement can be confusing. The risk aversion measurement based on making decision buying a lottery might be confusing to some

pet owners and the answers may not reflect their real level of risk aversion. However, this is one of the best methods to measure the level of risk aversion. Thus, the interviewer must spend a little time explaining the question to ensure understanding of the questions on this measurement.

Fourth, the attitude on insurance should be measured. In this study, the question on attitude on insurance is missing. There are many still having a bad attitude on insurance and refuse to buy insurance at all. These pet owners may want to buy insurance if they do not have a bad attitude.

5.4 Limitation of the study

This study was based on a hypothetical situation. The answers can be biased when the collected data are based on imagination not real situation. The conducting interviews site is limited. In order to conduct the interview in the pet hospitals, the permission is required and it can take many days for the permission to be approved. Some hospitals did not allow the interview in the area.

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APPENDICS

APPENDIX A
THE QUESTIONNAIRES

Research Study: Evaluating Willingness to pay for pet insurance premium in Bangkok
This questionnaire is conducted as a part of master degree in finance, Faculty of commerce, Thammasat University. We gratefully appreciate your valuable time contributing in answering this questionnaire. Your kindness is the key to our research achievement.

Any information obtained in this questionnaire is for academic purpose only.

Section1: Personal information

1. Gender ☐ Female ☐ Male
2. Age …….. year
3. Educational Background
   ☐ School diploma ☐ Bachelor Degree ☐ Above Bachelor Degree
4. Occupation
   ☐ Business Owner ☐ Doctor/Dentist/Veterinarian/Pharmacist
   ☐ Professor ☐ Judge/Prosecutor/Lawyer
   ☐ Engineer/Architect ☐ Finance/Accountant
   ☐ Military/Police ☐ Government official
   ☐ Sale/Marketing ☐ Others
5. Monthly Income (individual)
   ☐ Less than 20,000 ☐ 20,000-40,000 ☐ 40,000-70,000
   ☐ more than 70,000
6. Do you know pet insurance available? ☐ Yes ☐ No

Section2: Information about pets

1. What is your pet breeding?

   ☐ Poodle ☐ Terrier ☐ Pomerania ☐ Bulldog ☐ Chivava

   ☐ Golden ☐ Siberian Husky ☐Others

2. What is your pet age? ☐ 0-2 year old ☐ 2-5 year old ☐ 5-8 year old

   ☐ 8 year old or above

3. How long has you keep your pet with?

   ☐ 0-2 year old ☐2-5 year old ☐5-8 year old ☐8 year old or above

4. How much did you pay for the pet monthly (Baht)?

   ☐ 0-2,000 ☐ 2,000-4,000 ☐ more than 4,000

5. What illness or chronicle disease does your pet have?

   _____

Table consists of 27 distinct scenarios alters in combination of dogs age, type of plan and bid price. Respondents are to choose either buy or don't buy for the first bid. If buy is chosen, then respondent go to the higher bid. If Don't buy is chosen, then respondents go to the lower bid.

For example, a respondent begins at scenario 1, if he or she choose to buy it with 1,000 baht, then he or she will skip scenario 2 and move on to scenario 3. If he choose Don't-buy, he will then answer the scenario 2 and skip scenario 3.

Table A1. Questionnaire for small size breeding dogs.

Scenario	Age (years)	Plan	Bid Price (Baht)	Buy	Don't Buy
1	3 months-4 years	Economy	1,000 Baht		
2			500 Baht		
3			2,000 Baht		
4		Standard	2,000 Baht		
5			1,000 Baht		
6			4,000 Baht		
7		First-Class	3,000 Baht		
8			1,500 Baht		
9			6,000 Baht		
10	4-8 years	Economy	1,200 Baht		
11			600 Baht		
12			2,400 Baht		
13		Standard	2,400 Baht		
14			1,200 Baht		
15			4,800 Baht		
16		First-Class	3,600 Baht		
17			1,800 Baht		
18			7,200 Baht		
19	8 years up	Economy	1,500 Baht		
20			750 Baht		
21			3,000 Baht		
22		Standard	3,000 Baht		
23			1,500 Baht		
24			6,000 Baht		
25		First-Class	4,500 Baht		
26			2,250 Baht		
27			9,000 Baht		

Table A2. Questionnaire for large size breeding dogs.

Scenario	Age (years)	Plan	Bid Price (Baht)	Buy	Don't Buy
1	3 months-3 years	Economy	1,200 Baht		
2			600 Baht		
3			2,400 Baht		
4		Standard	2,400 Baht		
5			1,200 Baht		
6			4,800 Baht		
7		First-Class	3,600 Baht		
8			1,800 Baht		
9			7,200 Baht		
10	3-7 years	Economy	1,500 Baht		
11			750 Baht		
12			3,000 Baht		
13		Standard	3,000 Baht		
14			1,500 Baht		
15			6,000 Baht		
16		First-Class	4,500 Baht		
17			2,250 Baht		
18			9,000 Baht		
19	7 years up	Economy	1,800 Baht		
20			900 Baht		
21			3,600 Baht		
22		Standard	3,600 Baht		
23			1,800 Baht		
24			7,200 Baht		
25		First-Class	5,400 Baht		
26			2,700 Baht		
27			10,800 Baht		

Plan, Condition to claim and Benefits for all types of policies

Table A3. Plans for Small size dogs (less than or equal 10 kg when mature)

Economy (Maximum claim of 5,000)	Standard (Maximum claim of 12,000)	First-Class (Maximum claim of 25,000)
Wellness exams & tests	Wellness exams & tests	Wellness exams & tests
Flea/heartworm prevention	Flea/heartworm prevention	Flea/heartworm prevention
Vaccinations	Vaccinations	Vaccinations
	Exams, lab tests, X-rays	Exams, lab tests, X-rays
	Prescriptions	Prescriptions
	Operation, Surgeries & Hospitalization	Operation, Surgeries & Hospitalization
	Chronic conditions	Chronic conditions
		Hereditary conditions

Table A4. Plans for Large size dogs (greater than 10 kg when mature)

Economy (Maximum claim of 6,000)	Standard (Maximum claim of 15,000)	First-Class (Maximum claim of 35,000)
Wellness exams & tests	Wellness exams & tests	Wellness exams & tests
Flea/heartworm prevention	Flea/heartworm prevention	Flea/heartworm prevention
Vaccinations	Vaccinations	Vaccinations
	Exams, lab tests, X-rays	Exams, lab tests, X-rays
	Prescriptions	Prescriptions
	Operation, Surgeries & Hospitalization	Operation, Surgeries & Hospitalization
	Chronic conditions	Chronic conditions
		Hereditary conditions

Measuring Respondent's Risk Aversion Table

You are expected to choose one out of two lotteries in each situation. The payoff probability in each situation in each situation varies. Each scenario, you must choose one of two lotteries (i.e. in 3.1 you are going to select either lottery 1 that has 10% probability of winning 200 baht and 90% of winning 160 baht and lottery 2 that has 10% of winning 385 baht or 90% of winning 10 baht).

Table A5. Risk Aversion Measurement

	Lottery 1			Lottery 2	
	Reward 200 Baht	Reward 160 Baht		Reward 385 Baht	Reward 10 Baht
3.1) Probability	10%	90%		10%	90%
	☐ choose lottery 1			☐ choose lottery 2	
3.2) Probability	20%	80%		20%	80%
	☐ choose lottery 1			☐ choose lottery 2	
3.3) Probability	30%	70%		30%	70%
	☐ choose lottery 1			☐ choose lottery 2	
3.4) Probability	40%	60%		40%	60%
	☐ choose lottery 1			☐ choose lottery 2	
3.5) Probability	50%	50%		50%	50%
	☐ choose lottery 1			☐ choose lottery 2	
3.6) Probability	60%	40%		60%	40%
	☐ choose lottery 1			☐ choose lottery 2	
3.7) Probability	70%	30%		70%	30%
	☐ choose lottery 1			☐ choose lottery 2	
3.8) Probability	80%	20%		80%	20%
	☐ choose lottery 1			☐ choose lottery 2	
3.9) Probability	90%	10%		90%	10%
	☐ choose lottery 1			☐ choose lottery 2	
3.10) Probability	100%	0%		100%	0%
	☐ choose lottery 1			☐ choose lottery 2	

APPENDIX B
THE CVM LOGIT MODEL ESTIMATION RESULTS
(ALL VARIABLES)

```
Random-effects logistic regression              Number of obs      =
6588
Group variable: ID                              Number of groups   =       183
Random effects u_i ~ Gaussian                   Obs per group: min =        36
                                                               avg =      36.0
                                                               max =        36
                                                Wald chi2(20)      =    993.91
Log likelihood  = -3095.2419                    Prob > chi2        =    0.0000
------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  s_typeBIG |    .482665   .0675162     7.15   0.000     .3503356    .6149944
     s_age2 |    .563732   .0814724     6.92   0.000      .404049    .7234149
     s_age3 |   1.128958   .0869645    12.98   0.000     .9585106    1.299405
     s_planB |   2.090011   .0979009    21.35   0.000     1.898129    2.281893
     s_planC |   2.657651   .1122766    23.67   0.000     2.437593     2.87771
     s_price |  -.0011151   .0000359   -31.05   0.000    -.0011855   -.0010447
  d_breedBIG |   .1630657   .4372041     0.37   0.709    -.6938387     1.01997
     d_husky |  -.0269244   .6338666    -0.04   0.966     -1.26928    1.215431
       d_pom |   .1197701   .5272551     0.23   0.820    -.9136309    1.153171
       d_age |   1.109714   1.348739     0.82   0.411    -1.533766    3.753195
    d_year5up |   -1.06311   1.362074    -0.78   0.435    -3.732726    1.606507
 d_spend4Kup |   1.111976   .4338074     2.56   0.010     .2617292    1.962223
       d_ill |    .757341   .4045517     1.87   0.061    -.0355657    1.550248
      c_risk |    .227585   .1752258     1.30   0.194    -.1158512    .5710211
       c_sex |   .0930581   .3602277     0.26   0.796    -.6129752    .7990914
       c_age |  -.026822   .0165865    -1.62   0.106    -.0593309    .0056869
 c_eduMaster |    .396579   .4189701     0.95   0.344    -.4245873    1.217745
    c_jobGov |  -.7841475   .4916579    -1.59   0.111    -1.747779    .1794844
  c_inc40Kup |   .3763182   .4278243     0.88   0.379     -.462202    1.214838
 c_insurance |   .0738721    .412473     0.18   0.858    -.7345602    .8823044
       _cons |   .1489653   .7274261     0.20   0.838    -1.276764    1.574694
-------------+----------------------------------------------------------------
    /lnsig2u |   1.579509   .1319093                      1.320972    1.838047
-------------+----------------------------------------------------------------
     sigma_u |   2.202856   .1452886                      1.935733    2.506841
         rho |   .5959605   .0317627                      .5324852     .656379
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =  1915.12 Prob >= chibar2 = 0.000
```

THE CVM LOGIT MODEL ESTIMATION RESULTS (SIGNIFICANT VARIABLES)

Random-effects logistic regression — Number of obs = 6588
Group variable: ID — Number of groups = 183
Random effects u_i ~ Gaussian — Obs per group: min = 36
avg = 36.0
max = 36
Wald chi2(9) = 991.64
Log likelihood = -3099.6932 — Prob > chi2 = 0.0000

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
s_typeBIG	.482802	.0675186	7.15	0.000	.350468	.615136
s_age2	.5640447	.0814742	6.92	0.000	.4043583	.7237312
s_age3	1.129451	.0869673	12.99	0.000	.958998	1.299903
s_planB	2.091198	.0979083	21.36	0.000	1.899301	2.283095
s_planC	2.658895	.1122768	23.68	0.000	2.438837	2.878954
s_price	-.001116	.0000359	-31.06	0.000	-.0011865	-.0010456
d_ill	.6550255	.3633325	1.80	0.071	-.0570932	1.367144
d_spend4Kup	1.122031	.4318127	2.60	0.009	.2756939	1.968369
c_age	-.028457	.0143362	-1.98	0.047	-.0565553	-.0003586
_cons	.4906709	.6170364	0.80	0.426	-.7186981	1.70004
/lnsig2u	1.623681	.1318122			1.365334	1.882028
sigma_u	2.252049	.1484237			1.979149	2.562579
rho	.6065501	.0314566			.5435112	.6662295

Likelihood-ratio test of rho=0: chibar2(01) = 1981.61 Prob >= chibar2 = 0.000

APPENDIX C

WILLINGNESS-TO-PAY ESTIMATION RESULTS

	s_age2	s_age3	s_planB	s_planC	s_typeBIG
wtp	505.39747	1012.0146	1873.7628	2382.4334	432.60208
ll	365.001	868.99518	1732.5244	2237.8116	316.78419
ul	645.79394	1155.0341	2015.0011	2527.0553	548.41997

APPENDIX D

THE ESTIMATION COEEFICIENTS OF RISK AVERION VARIABLE

Factor analysis/correlation — Number of obs = 6588
Method: principal-component factors — Retained factors = 1
Rotation: (unrotated) — Number of params = 9

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.39171	2.17349	0.4880	0.4880
Factor2	2.21822	1.26968	0.2465	0.7344
Factor3	0.94854	0.43586	0.1054	0.8398
Factor4	0.51267	0.19386	0.0570	0.8968
Factor5	0.31882	0.09390	0.0354	0.9322
Factor6	0.22492	0.01815	0.0250	0.9572
Factor7	0.20677	0.05606	0.0230	0.9802
Factor8	0.15071	0.12307	0.0167	0.9969
Factor9	0.02765	.	0.0031	1.0000

LR test: independent vs. saturated: chi2(36) = 5.4e+04 Prob>chi2 = 0.00

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
lot1	0.6800	0.5376
lot2	0.6909	0.5226
lot3	0.7327	0.4632
lot4	0.7542	0.4311
lot5	0.7744	0.4004
lot6	0.7687	0.4092
lot7	0.7251	0.4743
lot8	0.6149	0.6219
lot9	0.5020	0.7480

Scoring coefficients (method = regression)

```
    ------------------------
       Variable |  Factor1
    ------------+-----------
           lot1 |  0.15484
           lot2 |  0.15732
           lot3 |  0.16683
           lot4 |  0.17174
           lot5 |  0.17632
           lot6 |  0.17503
           lot7 |  0.16510
           lot8 |  0.14001
           lot9 |  0.11430
    ------------------------
```

Variable	Obs	Mean	Std. Dev.	Min	Max
risk	864	.5411693	0	.5411693	.5411693

	crsover					
c_risk	1	2	3	4	5	Total
-2.356197	0	0	0	0	0	468
-1.911308	0	0	0	0	0	360
-1.488989	0	0	0	0	0	720
-1.099614	0	0	0	0	0	648
-.728357	0	0	0	0	0	828
-.3745455	0	0	0	0	1,584	1,584
0	0	0	0	864	0	864
.4447358	0	0	396	0	0	396
.9489357	0	36	0	0	0	36
1.45651	684	0	0	0	0	684
Total	684	36	396	864	1,584	6,588

	crsover					
c_risk	6	7	8	9	10	Total
-2.356197	0	0	0	0	468	468
-1.911308	0	0	0	360	0	360
-1.488989	0	0	720	0	0	720
-1.099614	0	648	0	0	0	648
-.728357	828	0	0	0	0	828
-.3745455	0	0	0	0	0	1,584
0	0	0	0	0	0	864
.4447358	0	0	0	0	0	396
.9489357	0	0	0	0	0	36
1.45651	0	0	0	0	0	684
Total	828	648	720	360	468	6,588

BIOGRAPHY

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