CHAPTER 5

RESEARCH METHODOLOGY

This study is a analytical study for identifying the method to select the optimal premium for the VHI scheme in Haiphong, which will be used as one of the means to extend the membership of this program. Chapter 5 focuses on the concepts, theories and the analytical procedures used to solve the problems, research questions and objectives of this study by research methodology will be described in this chapter.

5.1 Concept of Health Insurance Premium

i) *Premium for Health Insurance* is the amount of installment the insured paid the insurance company to insure the unpredictable future illness, in exchange for which the company will pay the provider of care for some or all of expenses incurred.

ii) **Suggested Criteria of Optimal Premium for VHI Program in Haiphong**

Optimal premium for VHI program in Haiphong is the premium, when the program makes no excess profit, that is low enough to attract insured persons who contribute to the total revenue of VHI program which will equal health care cost incurred by VHI patients.

In order to use it as one of the means to increase the membership of VHI program in Haiphong, optimal premium is the premium that satisfies the conditions as follows :

Chapter 3 showed that in 1993-1995, the indicators of *health budget per capita* (see Table 3.5), *budget for hospital bed per year and per day* (see Table 3.6), *average cost and government subsidy for one VHI patient* in Haiphong (see Table 3.7) are nearly the same. This is the evidence we can use to make *the assumption that the quantity of health care services supplying for VHI patients are the same among 3 years 1993-1995, and in the short run it is constant with every premium level.*

In the case using assumption that supply is constant with every premium level

(1) Demand is elastic, that means $\eta > 1$, and a given change in price will result in a greater percentage change in quantity demanded.

In case supply is not perfectly elastic

According to the Figure 5.1, the condition that can make a given change in price result in a greater percentage change in quantity demanded is where the absolute value of η_D minus η_S is bigger than 1.

$$|\eta_D| - |\eta_S| > 1 \qquad (5.1)$$

where

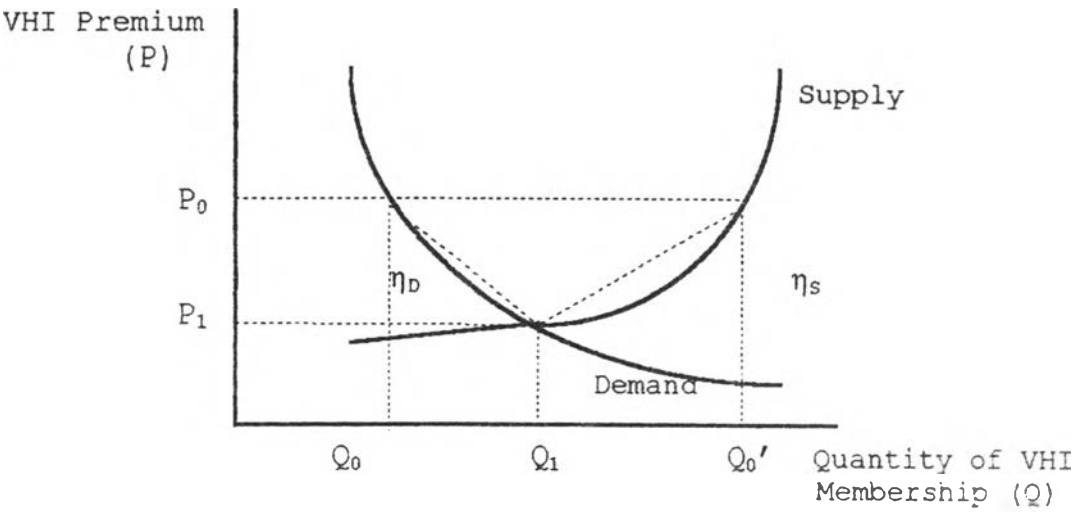
η_D is price elasticity of *demand* for VHI
η_S is price elasticity of *supply* for VHI

In this thesis, because of use of the *assumption* derived from the real situation mentioned above, the author focuses on the case study using the assumption that in the short run the supply is constant with every premium level. Further study could consider the wider scope of the case where the supply side is not perfectly elastic.

(2) Total revenue of the program calculated by this premium multiplied by the number of insured persons must be equal or a bit higher than the total cost of the VHI program.

(3) Lower than current premium.

Figure 5.1 : Demand Curve, Supply Curve, η_D and η_S



where

P_0, P_1 are premium levels of VHI program,

Q_0, Q_1, Q_1' are quantities of VHI insured, corresponding with P_0 and P_1

η_D is price elasticity of *demand* for VHI

$$\eta_D = - \frac{Q_1 - Q_0}{P_1 - P_0} x \frac{P_1 + P_0}{Q_1 + Q_0} \qquad (5.2)$$

where

P_0 is the current premium of VHI program,

P_1 is the suggested lower premium which is used to calculate η_D,

Q_0 is the current number of membership of VHI program,

Q_1 is the number of membership of VHI program corresponding with P_1 in demand curve,

Q_1' is the number of membership of VHI program corresponding with P_1 in supply curve,

η_S is the price elasticity of *supply* for VHI

$$\eta_S = \frac{Q_1 - Q_0'}{P_1 - P_0} x \frac{P_1 + P_0}{Q_1 + Q_0} \qquad (5.3)$$

From the evidence provided we can see that optimal premium for VHI program in Haiphong has to take into consideration the demand and supply side of health care services, health insurance and the predictable number of population who will be willing to buy the VHI card when the premium has been lowered. The methods of study to be used in this thesis will incorporate the use of concepts and theories of law of demand, price elasticity of demand, logit analysis model and the suggested features of the optimal premium for the VHI program in Haiphong. Together with all of these concepts, theories and methods of studies to be used in the study, the study would also have to assume that the supply curve of VHI program will be constant for every level of premium. All of and each of these concepts and theories will be explained in detail below.

5.2 **Demand, Demand Curve, and the Law of Demand**

i) **Demand**

The concept of demand is one of the most elementary and crucial concepts of economic theory; it provides a systematic framework for interpreting the behavior of any consumer or consuming group. In addition, demand theory is used to facilitate prediction. Once the factors contributing to any event are identified and understood, one is in the good position to predict future events by hypothesizing or extrapolating specific behavior patterns for the causal factor - the factor that determines demand.

Definition : Demand is the amount of a particular good or service that a consumer is willing and able to purchase at each possible price during a specified time period.

ii) **Demand Curve**

(1) Definition : The demand curve for a specific commodity relates equilibrium quantities bought to the market price of the commodity, nominal money income and the nominal prices of other commodities held constant.

Each point on the demand curve represents a price-quantity pair. The firm can pick any such pair. But it can never pick the price corresponding to one point on the demand curve and the quantity corresponding to

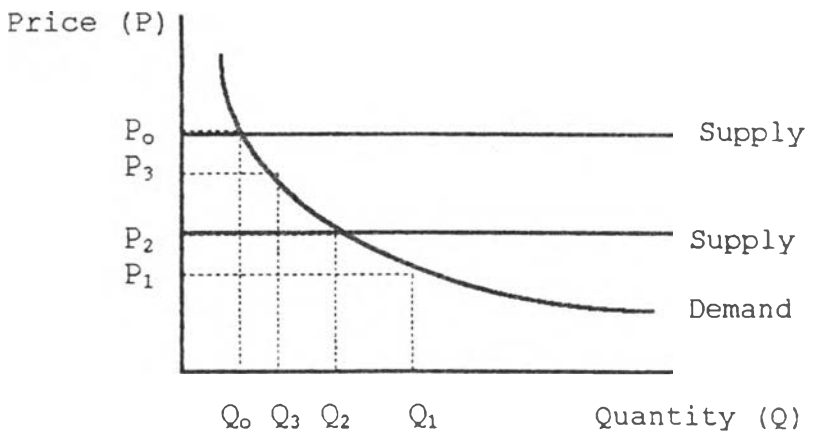
another point, since such an output would never be sold at the selected price.

(2) The Principle of Demand curve : Quantity of demand varies inversely with price, nominal money income and nominal price of other commodities remaining constant.

iii) **The Law of Demand**

(1) The concept of the law of demand states that: *Other things being equal*, the amount of product or service that consumers are willing and able to purchase during some period of time varies inversely with the price of that product or service.

Figure 5.2 : Demand Curve Describes the Law of Demand



where

P is price of product or services,

Q is quantity of product or service the consumers are willing and able to purchase,

(2) Assumption for the supply in this figure is: Supply curve is constant for every premium level.

(3) Comments : As mentioned earlier other factors like improved quality of health care service, income of population and etc... could influence the amount of demand to buy VHI card. However because in the short run sudden changes of the above features could not immediately altered, we could assume that all factors are equal or remain constant over time. Therefor, based on the above presumption, if we select the appropriate

premium where is lower than the present one, while also meeting the requirement of contributing enough revenue to cover costs, then we could increase the demand for VHI card in Haiphong.

5.3 **Logit Model**

Logit analysis presents a unique complement to multiple regression in its ability to utilize a binary dependent variable. Logit analysis does not predict just whether an event occurred or not (one or zero), but instead predicts the probability of an event. In this manner, the dependent variable can be any value between zero and one. This also means that the predicted value must be bounded to fall within the range of zero and one.

The logit model is based on the cumulative logistic probability function :

$$P_i = F(Y) = F(\beta_0 + \beta_i X_i) = \frac{1}{1+e^{-Y}} = \frac{1}{1+e^{-(\beta 0+\beta 1X1+\beta 2X2+\ldots\beta nXn)}} \quad (5.4)$$

where

P_i presents the probability that an individual will make a certain choice, given knowledge of X_i with i = 1..n.

F is a cumulative probability function.

X_i is the individual's attributes which give information to interpret the dependent variables into the logit model.

β_0 is constant and β_i is the coefficient of Xi.

e is exponential, e = 2.7182

From equation (5.4) we can rewrite it as follows :

$$(1+e^{-Y})P_i = 1 \quad (5.4.1)$$

Then

$$e^{-Y} = \frac{1 - P_i}{P_i} \quad (5.4.2)$$

and $$e^{Y} = \frac{P_i}{1 - P_i} \qquad (5.4.3)$$

and taking logarithms of both sides of the equation (5.4.3):

$$Y = \ln \frac{P_i}{1 - P_i} \qquad (5.4.4)$$

Thus, finally

$$\ln \frac{P_i}{1 - P_i} = Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \qquad (5.5)$$

The dependent variable in this regression equation is simply the logarithm of the odds that a particular choice will be made.

5.4 **Price Elasticity of Demand**

Definition :

Price elasticity of demand is defined as the relative responsiveness of quantity demanded to change in price, or in other words the percentage change in quantity demanded resulting from a one percent change in price.

The coefficient of price elasticity is normally denoted by (η), and

The formula for arc price elasticity of demand is :

$$\eta = - \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_0}{Q_1 + Q_0} \qquad (5.6)$$

where

η is coefficient of price elasticity,

P_1 and P_0 are 2 points of premium levels (price) in the demand curve,

Q_1 and Q_0 are 2 levels for quantity of VHI insured, corresponding with P_1 and P_0.

$\Delta P = P_1 - P_0$

$\Delta Q = Q_1 - Q_0$

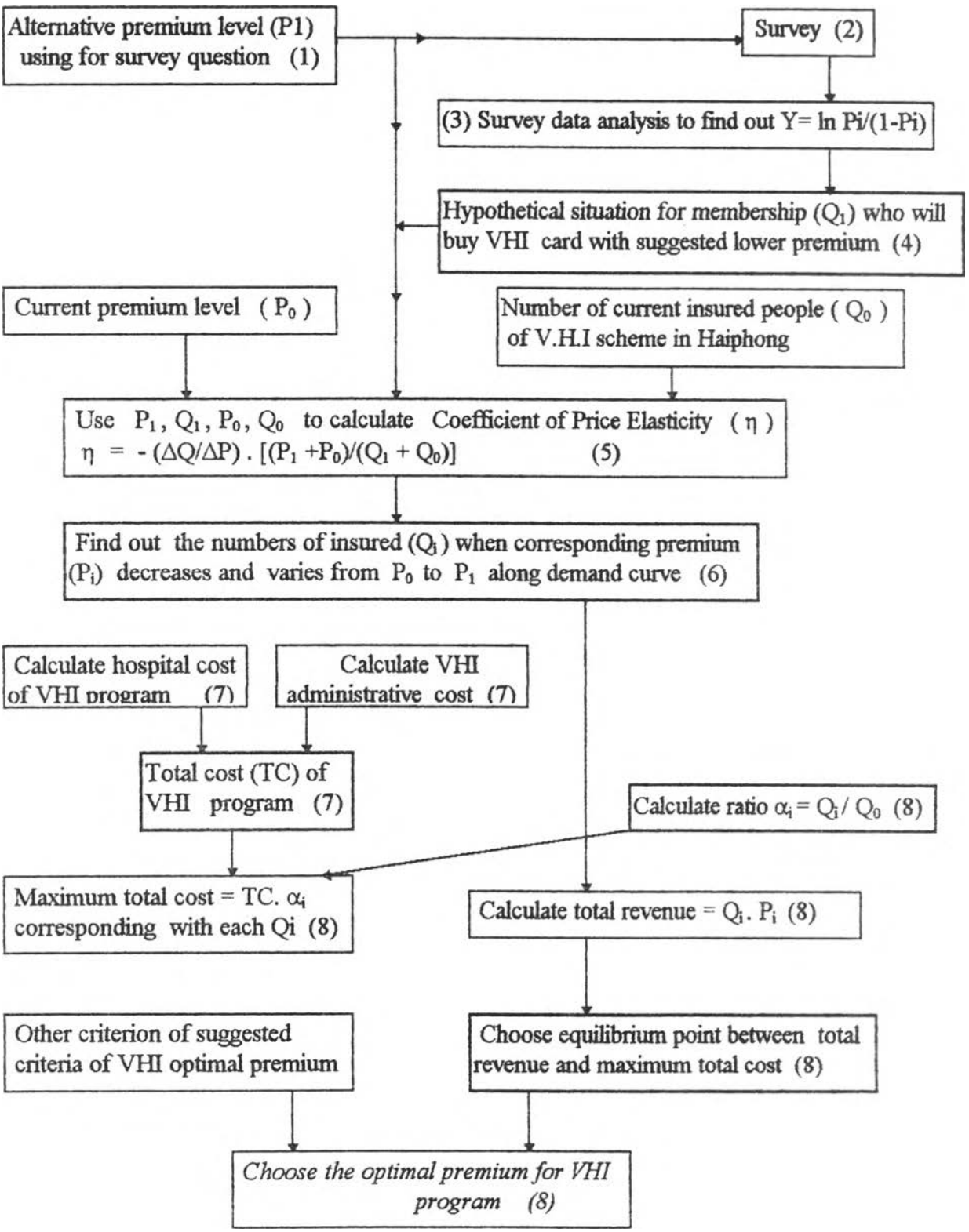
This concept is already illustrated at Figure 5.1.

Utilizing this algebraic formula of the price elasticity of demand we can predict the demand to buy VHI card when premium decreases to any suggested level below the present level of 15,000 dong. The reason why we could estimate the number is because this particular formula of elasticity measures the arc elasticity of demand curve (based on the assumption that other things are constant). The particular formula is called "formula for arc price elastic of demand".

5.5 **The Procedure of VHI Premium Analysis**

The study is divided into 8 steps. Step 1 will present an *alternative premium level* which will be set in survey questions to collect data for running the logit model. The content of step 2 is to *carry out the survey* to collect data which is used to run the logit model. Step 3 presents the process of *survey data analysis*. Step 4 comments on *the hypothetical situation for membership of VHI program* when they sell VHI card with a suggested lower premium level chosen in step 1. In step 5, the method used to *calculate the coefficient of price elasticity* will be introduced. Step 6 presents the way to *find out the numbers of insured*. Step 7 will calculate the total costs of VHI program in Haiphong. Finally, step 8 shows the *decision making process* to choose the optimal premium for VHI program in Haiphong. All the steps of this procedure are described in Figure 5.3 :

Figure 5.3: **Research Framework**



Note : (1),(2)...(8) are steps of study.

The study uses collected data in the form of both secondary and primary data. *Secondary data* can be obtained from the following source :

(1) Data about the number of VHI scheme members; number of VHI patients; revenue and expenditure from 1990 to 1995, collected from the Vietnamese Health Insurance Department and the Health Insurance Office of Haiphong.

(2) Data on health status, economic situation of Haiphong and Vietnam collected from MOH of Vietnam and the National Statistics Department of Vietnam.

Primary data can be obtained from conducting a survey in Haiphong used for running logit model, related to 5 attributes of interviewees : household's income; age; education level counted by the number of years studying in school and university; number of persons in family including householder, spouse and dependents; and resident area coded (1) for urban, (2) for rural.

5.5.1 **Step 1:** *Alternative Premium*

Analyze historical data of VHI scheme in Haiphong by survey questions to collect data for running logit model.

The historical data for 6 years in Table 5.1 showed that :

i) η calculated between each year and last year varied from 1.7 to 2. It is a bit high: this may depend on some factors beside the decreasing of VHI premium, such as the high amount of foreign aid in 1990-1992 which improved the recognizable level of quality of hospital care in Haiphong. After 1992 η remained stable around 1.7.

ii) For satisfying 2 among 3 conditions of optimal premium: the number of VHI insured increased and $\eta > 1$:

Each year VHI premium decreased around 8-13%; then over 6 years from 1990-1995 VHI premium decreased 35.5% while membership of VHI program increased 123% with $\eta = 1.76$. From 1991 to 1995 VHI premium decreased 29% while membership of VHI program increased 80% with $\eta = 1.68$.

Table 5.1: Historical Data on VHI Actual Insured, Premium and η

Item \ Year	1990	1991	1992	1993	1994	1995
1. # of actual insured	47,127	58,547	70,326	89,302	108,004	105,000
- % increase compare to last year	0	*24.23*	*20.12*	*27.0*	*21.0*	0
- % increase compare to 1990	0	*24.43*	*49.22*	*89.5*	*129*	*123*
2.Premium(1990 price)[a] (dong)	8,000	7,270	6,634	5,767	5,157	5,164
- % decrease compare to last year	0	*-10.0*	*-8.75*	*-13.0*	*-10.6*	0
- % decrease compare to 1990	0	*-10.0*	*-13*	*-28*	*-35.5*	*-35.5*
3.η between each year and last year		2.2	2	1.7	1.7	na
4. η between 1995 and each year	1.76	1.68	1.6	1.5	na	

Source : VHI Office of Haiphong

a. The method to get 1990 price of VHI premium was presented at page 29, explained the way to convert the value of premium from current price to 1990 price in item B6 of table 3.8 .

Supposes that the VHI program intended to do the survey in the fall of 1995. At that time, in the short run, the environments of VHI issues in Haiphong were not changing, and assume that it is near the same the environment in 1992-1993 as in analysis in the point (ii) of section 5.1; so, based on the analysis above, if the VHI Program wants to set up the suggested premium used for the questionnaire in order to collect accurate survey data, with $\eta > 1$, it may be close to the previous time, for example around 1.6 - 1.7; it is better if they choose a suggested premium which is lower than the current premium by about 30-35%, similarly with historical data linked between 1995 and 1990, 1995 and 1991.

With the current premium of 15,000 dong, the premium suggested (lower by 30-35%) is around 9,750-10,500 dong. For the survey's questionnaire, it is more suitable to use an even number, i.e. 10,000 dong, for asking whether the interviewee is willing and able to buy VHI card.

5.5.2 **Step 2:** *Carrying out the Survey*

The next step is to carry out the survey to collect data which is to be used to run the logit model, in order to predict probability of the number of the population who are willing and able to buy VHI card with lower premium (suggested in Step 1 is 10,000 dong) than current premium.

i) **Survey Question Form and Lower Premium Suggested**

The survey question form must include some major factors which affect demand to buy VHI card, such as *age, income* of household, *education* level calculated by number of years go to school, *family size* (Household and dependent), *resident area* (see Appendix 1).

According to the analysis in Step 1, the survey designers should choose a lower premium suggested 10,000 dong to ask people whether they want to buy VHI card with that premium level or not.

ii) **Sample Size** :

Haiphong can be divided into 4 zones : city, rural, sea-side for tourism and fishing zone, or simply divide it into 2 zones : urban and rural, depending on the design of the survey.

For each zone, we can choose the sample by using the formula :

$$n = \frac{Z^2_{\alpha} \cdot p \cdot q}{d^2} \qquad (5.7)$$

where

n is desired sample size (when population > 10,000).

Z_{α} is the degree of confidence (odds ratio) which is required to be within the specified range (+/-d). A value of Z = 2 or Z= 1.96 is often chosen since this provides a degree of confidence equal to odds of 19 to 1. This is technically termed a 95% confidence interval.

p is the variability of characteristic to be measured in the population. In this case, it is an estimation of the proportion of persons who will buy VHI card if the

program decreases the premium from 15,000 dong to 10,000 dong.

It is difficult to predict this proportion, it relates to optimal premium and the correspondent the VHI membership which we cannot know now. So if we choose wrong one, we can not get appropriate sample size for the survey.

Finally, it is better if we follow the theory of sampling : choose P = 0.5, when we can not estimate or it is not reasonable to estimate P.

q = 1-p is a pessimistic value, if there is no reasonable value, or cannot estimate the value of P then we use 50% (p = 0.5), so q = 0.5. This maximizes the expected variance (pq = 0.25) and ensures the sample is large enough for the purpose.

d is degree of accuracy required. This is the maximum error for the sample. This is the largest acceptable percentage of difference between the estimated value from the sample and the true population value. Here, the degree of accuracy required is 5% .

(1) If we choose the degree of confidence Z = 1.96 :

$$n = \frac{(1.96)^2 \cdot (0.5).(0.5)}{(0.05)^2} = 385 \text{ for each zone}$$

(2) If we choose Z = 2, following the formula (3) above, the desired sample size n = 400 is calculated for each zone.

From the results of the survey, we can sum the data into a summary table in order to use it to run the logit model by computer.

(3) **Summary Data**

Survey data can be set into the summary table, and keyed right away into the Lotus 123 spreadsheet to prepare for running logit model.

Table 5.2: Summary Table Form of Survey's Result for Running Logit Model

Interview Numbering	Premium 10,000 buy: (1) not: (0) Y	Income (dong) INC	Age AGE	Education (year) EDU	Family size[a] FAMS	Location urban: (1) rural: (2) LOCA
1	0	500,000	38	9	6	0
2	1	700,000	54	12	4	1
3	1	1,000,000	40	16	4	1
4	0	600,000	45	6	5	0
5	1	1,500,000	50	9	3	0
6	0	800,000	42	9	4	1
7	0	500,000	20	12	2	1
8	1	900,000	65	6	5	0
9	1	800,000	49	9	4	0
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.

a. Including householder, spouse and dependents.

5.5.3 **Step 3**: *Survey's Data Analysis*

Use the survey data to run the logit model for finding the regression Y related to probability (Pi) of population who are willing and able to buy VHI card with the lower premium suggested (10,000 dong) (P_1).

i) **Compute the Logarithm Odd Ratio y**

Running the estimated logit model by using the survey data collected in the Step 2, the computer will compute the logarithm odds ratio Y, which is also the regression of individual's attributes X_i, which give information to interpret the dependent variables in the logit model.

$$Y = \ln\frac{Pi}{1 - Pi} = \beta_0 + \beta_1 INC + \beta_2 AGE + \beta_3 EDU + \beta_4 FAMS + \beta_5 LOCA \quad (5.8)$$

Where :

β_0 is constant

β_1, β_2, β_3, β_4, β_5 are the coefficients of independent variables INC, AGE, EDU, FAMS, LOCA respectively.

INC is income variable of household.

AGE is age variable of householder.

EDU is education level variable of householder counted by the years studying in school and University.

FAMS is family size variable, included householder, husband or wife and his or her dependent.

LOCA is resident location binary variable of household, with (1) urban, (0) rural.

ii) **Test for Significance of Each Variable**

For the logit model analysis we can test the hypothesis that a coefficient is different from zero by using the *t value* to assess the significance of each coefficient, with :

$H_0 : \beta_i = 0$

$H_1 : \beta_i \neq 0 \quad i = 1,2...5$.

The meaning of this test is if the null hypothesis H_0 is true, the corresponding independent variable is not related to regression Y, and its value is useless; in the opposite case when alternative H_1 is true, we can conclude that there is a relationship between that variable and regression Y.

Conduct a two-sided test with significance α = 0.05 and at least 400 degrees of freedom , the critical value *t table* = ± 1.96.

Reject *Ho,* if *the computed t value for each coefficient* $|t| > 1.96$,

Accept *Ho* if $-1.96 \leq t$ *test for each coefficient* ≤ 1.96

After this process, we can certify the form of the regression Y.

5.5.4 **Step 4:** *Hypothetical Situation for Membership (Q_1) of VHI Program when They Sell VHI Card with Lower Premium Suggested 10,000 dong (P_1)*

i) **Calculate the Value of Regression Y**

After estimating the logit model by data collected from survey, we can get the form of regression Y, with coefficient β_1, β_2, β_3, β_4, β_5, constant β_0 computed by computer.

$$Y = \beta_0 + \beta_1 INC + \beta_2 AGE + \beta_3 EDU + \beta_4 FAMS + \beta_5 LOCA \qquad (5.8)$$

(1) Depending on the purpose of analysis, a lot of values of Y can be calculated from different values suggested for variables INC, AGE, EDU, FAMS, LOCA, based on the secondary data or survey data about income, age, education, family size and resident location of people who are the target population of VHI program in Haiphong, classified firstly following a certain criterion among 5 criteria represented by 5 variables; then by each other criterion for the next steps.

Some hypothetical situations :

a. Purpose of analysis is to predict the probability of buying VHI card among different population groups classified by resident location and income.

The way to do this is to divide the VHI target population into two main groups : *Urban* and *rural* (based on the resident location criterion), after that *urban* target population should be divided into three groups : *High*, *average* and *low* income, among them, each of three groups get the different average *indices* of *income*, *age* an *education* level. Using those indices in regression Y, we can estimate the different values of Y for each group.

b. The purpose of analysis is to predict the probability of buying VHI card among the population classified by income levels.

The way to do : target population can be divided firstly into three groups (*high*, *average* and *low* income based on income criterion), after that, each income group can be indexed by the different values of age, education level, family size and resident location. By including

those indices into regression Y, we can estimate the different values of Y for each group.

c. The purpose of analysis is to predict the probability of buying VHI card among the population classified by age group.

The way to do this is to divide the target population into some groups based on the age criterion, for example under 30 years old, from 31-40 years old, from 41-50 years old, from 51-60 years old, over 61 years old. After that, each group can be indexed according to the different values of income, education level, family size, and resident location. By including those indices in regression Y, we can estimate the different values of Y for each group.

In summary, depending on the purpose of analysis, the program can decide what criterion will be used to classify the VHI target population into certain different groups, in order to predict the probability to buy VHI card of each group classified by different ranks among 5 independent variables of regression Y.

(2) Finally, a general way to calculate the value of Y is using the mean of all variables of the sample coming from the survey and computed by logit model, where the maximum error for sample is 0.05 (95% confidence).

ii) **Predict the Probability (Pi) for Buying VHI Card among Target Population in Haiphong**

After calculating the value of Y, anti-Log_e for two sides of equation (5.8) :

$$\text{Ln}\frac{P_i}{1-P_i} = Y = \beta_0 + \beta_1 INC + \beta_2 AGE + \beta_3 EDU + \beta_4 FAMS + \beta_5 LOCA$$

we can be rewrite it by the equation :

$$\frac{P_i}{1-P_i} = \text{anti-Log}_e (Y) \qquad (5.9)$$

From equation (5.9) we can get the value that probability Pi lay between 0 and 1, for using in the step (iii) below.

iii) **Predict Membership (Q_1) of VHI Program when They Sell VHI Card when the Lower Premium Suggested is 10,000 dong (P_1)**

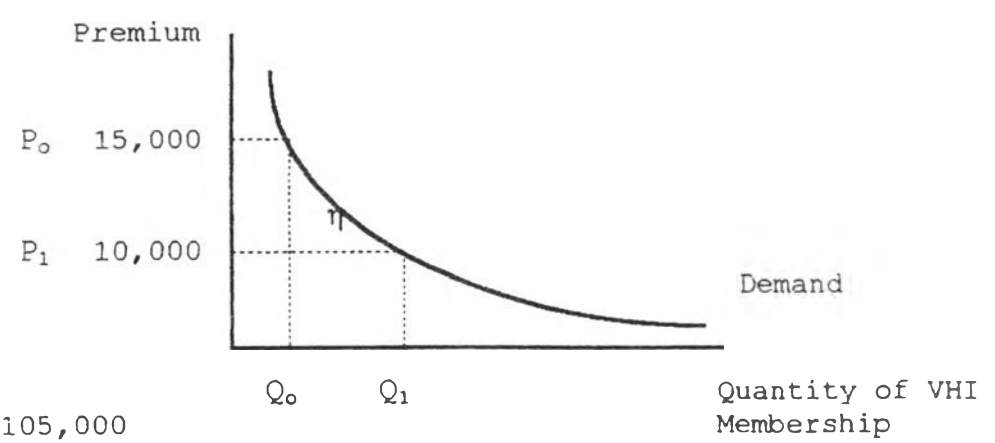
After getting the probability (Pi) of target population for buying VHI card with lower premium (10,000 dong), we use the value of probability Pi multiplied (x) by target population of VHI Program, we can predict membership of VHI program when they sell VHI card with premium of 10,000 dong.

Q_1 = Pi x 1,060,000 people = predicted membership of VHI Program.

5.5.5 **Step 5:** *Calculate the Coefficient of Price Elasticity*

We use the concept of price elasticity of demand to calculate the coefficient of price elasticity (η) between two points on the demand curve corresponding with the current premium of 15,000 dong (P_0), corresponding current VHI insured is 105,000 (Q_0) and the lower premium suggested is 10,000 dong (P_1) with the predicted number of people who are willing and able to buy VHI card at that premium (Q_1) calculated in the point (iii) section 5.5.4. After predicting the membership of VHI Program when they sell VHI lower suggested premium of 10,000 dong, we can use concept of price elasticity of demand to calculate the coefficient of price elasticity (η) between two points of demand curve corresponding with the current premium P_0 = 15,000 dong, P_1 = 10,000 dong and Q_0 = 105,000 person, Q_1 = certain value was calculated in the point (iii) section 5.5.4.

Figure 5.4 : Calculate Coefficient of Price Elasticity η



From origin of formula (5.6) :

$$\eta = - \frac{Q_1 - Q_0}{P_1 - P_0} \times \frac{P_1 + P_0}{Q_1 + Q_0}$$

we can using it to calculate the coefficient of Price elasticity η

$$\eta = - \frac{(Q1 - 105,000)}{(10,000 - 15,000)} \times \frac{(10,000 + 15,000)}{(Q1 + 105,000)}$$

where

Q_1 was predicted in the point (iii) section 5.5.4; P_1 = 10,000 dong; Q_0 = 105,000 person and P_0 = 15,000 dong.

5.5.6 **Step 6:** *Find out the Numbers of Insured*

Predict corresponding Qi when Pi decreases and varies from 15,000 dong to the lower premium suggested is 10,000 dong by using the concept of price elasticity of demand with formula (5.6) above.

After calculating the value of η, we can rewrite the equation (5.6) to as follows :

$$\eta = - \frac{Qi - 105,000}{Pi - 15,000} \times \frac{Pi + 15,000}{Qi + 105,000}$$

to predict corresponding Qi, when Pi decreases and varies from 15,000 dong to the lower premium 10,000 dong was suggested in step 1.

where

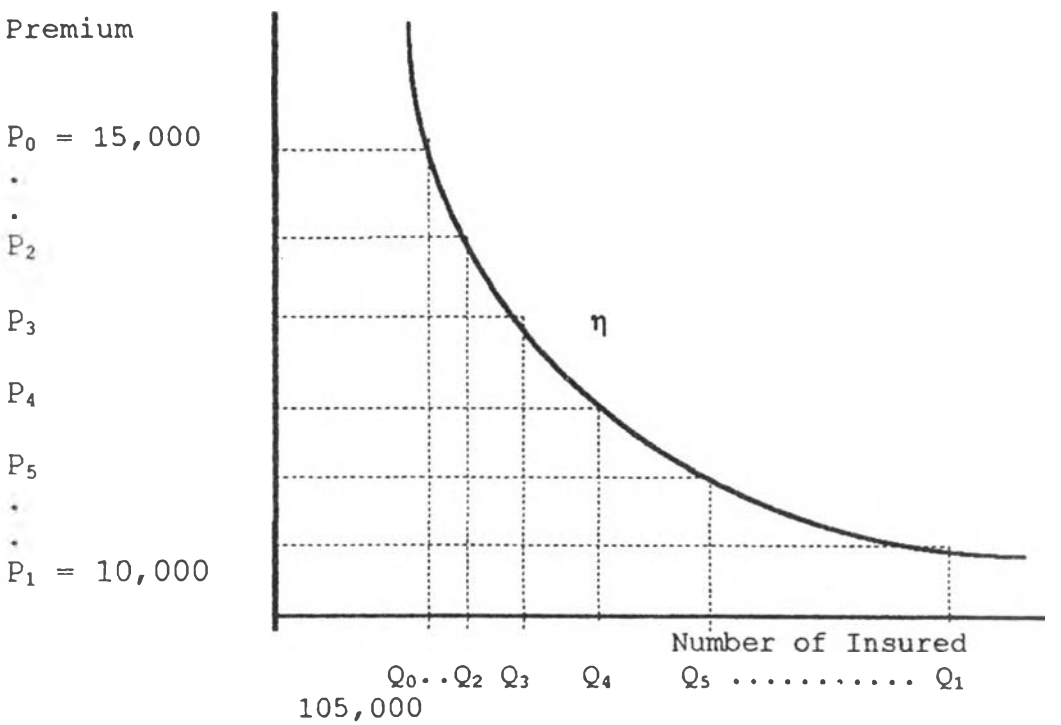
Q_0 = 105,000 is current number of VHI insured which corresponds with current premium P_0 of 15,000 dong.

Pi are different values of VHI premium when it decreases and varies from 15,000 dong to 10,000 dong along the demand curve.

Qi are the numbers of predicted people who will be and able to buy VHI card in Haiphong, correspondingly with each value of Pi when it decreases and varies from 15,000 dong to 10,000 dong along demand curve.

The process of this step can be depicted by Figure 5.5 below :

Figure 5.5 : Predict Corresponding Qi when Pi Decreases and Varies from 15,000 dong to 10,000 along Demand Curve.



In fact, unlimited numbers of Qi can be predicted when Pi decreases and varies along the demand curve which is used in step 8 for choosing the optimal premium of VHI Program in Haiphong.

5.5.7 **Step 7:** *Calculate the Current Costs of VHI Program in Haiphong*

Total current cost of VHI program in Haiphong includes two portions :

i) Hospital cost for VHI's patient (HC).

ii) VHI Administrative cost (AC).

Current hospital cost for VHI patients (HC) can be computed by the formula :

$$HC = \sum_{h=1}^{z} \sum_{j=1}^{m} \sum_{i=1}^{n} \left[\sum_{g=1}^{t} WC_{hijg} + \sum_{r=1}^{u} UC_{hijr} + \sum_{v=1}^{w} SC_{hijv} \right] \quad (5.9)$$

where

h : is number of hospitals, which start from 1 to z where z = 23

i : is number of VHI patients, i = 1...n

j : is number of departments within each hospital, which start from 1 to m where m is total number of departments.

WC : is the monetary term of allowance for physicians and health staff of hospital, calculated by normal unit and the time they took to take care VHI patients.

g : is the type of personnel (doctor, nurse...) g = 1...t

UC : is the monetary term of medical supply for VHI patients, accounted by normal unit, following the regulation of VHI program about the style of supply, such as diagnosis, drug, blood transfusion, X-ray.

r : is the number of medical supplies ; r = 1...u

SC : is the monetary term of supporting facility for VHI patients.

v : is the number of supporting facilities; v = 1...w

This kind of data is collected from the hospitals who sign the contract for health care service supplying the VHI Office, with the checking and supervising by VHI officers who are assembled at each hospital mentioned above.

Administrative cost of VHI program (AC) accounted directly by VHI office of Haiphong, it can be computed by using the formula as follows :

$$AC = \sum_{x=1}^{b} \left[\sum_{q=1}^{c} AD_{qx} + \sum_{t=1}^{k} MA_{tx} + \sum_{p=1}^{e} SA_{px} \right] \quad (5.10)$$

where

x : is the number of offices and agencies of VHI program, which start from 1 to b where b is total number of offices and agencies.

AD : is the monetary term of administrative expenditure of each office or agency.

q : is the type of administrative expenditure; q = 1 ... c.

MA : is the monetary term of maintenance expenditure of each office or agency.

t is type of maintenance expenditure; t = 1...k.

SA : is the monetary term of salary of VHI staff of each office or agency.

p is the level of salary; p = 1 ... e.

So, total cost (TC) of VHI program in Haiphong is:

$$TC = HC + AC$$

It is one of the factors used in step 8 to choose the optimal premium for VHI Program in Haiphong.

5.5.8 **Step 8:** *Decision Making for Choosing the Optimal Premium for VHI Program in Haiphong*

i) *The Assumption*

(1) In the short run, when VHI program sells VHI card with lower premium levels $P_i < P_0$,

where

P_0 is current premium 15,000 dong at 1995 price,
P_i are different levels of VHI premium when it decreases and varies along demand curve from current premium level 15,000 dong (P_0) to premium level 10,000 dong suggested in step 1,

Some situations will occur :

Number of membership of VHI program will increase from Q_0 to Q_i, it may lead to increased number of VHI patients, from PA_0 to PA_i, then it may increase the total cost of VHI Program from TC_0 to TC_i.

where

Q_0 is the current membership of VHI program,

Q_i is the hypothetical number of VHI membership corresponding with each Pi.

PA_0 is the current number of VHI patients in Haiphong at the end of the 1995.

PA_i is the number of VHI patients corresponding with each equilibrium point P_i, Q_i.

TC_0 is total current cost.

TC_i is hypothetical total cost corresponding with each equilibrium point P_i, Q_i.

(2) Refer the historical data of VHI issue in Haiphong (see Table 5.3), we assume that :

a. In the short run, if we apply the lower premium ($Pi < P_0$), that increases the number of membership ($Qi > Q_0$) of VHI program, with ratio $Qi / Q_0 = \alpha_i$:

The maximum increased number of VHI patients (PA_i) is not higher than Ratio α_i

(maximum $PA_i / PA_0 = \alpha_i$ and $PA_i = PA_0 * \alpha_i$)

b. Health care services are supplied equally for every level of premium and for the same kind of patient (with the same disease and level of illness), that means *average cost for one VHI patient* (AVC) is constant in the short run when the premium decreases and the number of VHI patients increase.

c. As the result of assumptions (1) and (2), at every premium $Pi < P_0$:

Maximum increasing of total cost of VHI program in Haiphong is not higher than ratio αi (maximum TC_i/TC_o = α_i)

Because

maximum $TC_i = AVC * PA_i = AVC * (PA_0 * \alpha_i) = TC_o * \alpha_i$

so maximum $TC_i = TC_o * \alpha_i$

Table 5.3 below presents some historical data to describe the referring information used to make the assumptions as above.

Table 5.3: Historical Data on VHI Actually Insured, Number of Actual Patients and Increasing Percentages.

Item \ Year	1990	1991	1992	1993	1994	1995
1. # of actual insured	47,127	58,547	70,326	89,302	108,004	105,000
- % increase compare to last year	0	***24.23***	***20.12***	***27.0***	***21.0***	***-2.8***
- % increase compared to 1990	0	*24.43*	*49.22*	*89.5*	*129*	*123*
2. # of actual VHI patient	2,870	3,466	4,126	4,500	4,890	4,600
- % increase compared to last year	0	***20.77***	***19.04***	***9.05***	***8.7***	***-6.0***
- % increase compared to 1990	0	*20.77*	*43.76*	*56.8*	*70.38*	*60.28*

Source : VHI Office of Haiphong

Comments :

For all the cases, even comparing each year with the last year or comparing each year with the year 1990, the increasing percentage of the VHI patients is always lower than increasing percent of VHI insured persons. That means PA_i/ PA_0 is always smaller (<) than ratio $Q_i/ Q_0 = \alpha_i$. The author refers this comment to make assumption (1) that maximum $PA_i/ PA_0 = \alpha_i$.

ii) **Choose the Optimal Premium for VHI Program in Haiphong**

Based on the method described in the step 6, step 7, and "the Assumption" described in the point (i) of section 5.5.8, we can calculate the indices of membership Q_i; Ratio $Q_i/Q_0 = \alpha_i$; total revenue = $Q_i.P_i$; maximum cost $TC_i = TC_0 . \alpha_i$; surplus or deficit fund... corresponding with many levels of premium when it decreases and varies from 15,000 dong to 10,000 dong. Setting the results into the form of Table 5.4 and comparing them with "Criteria of Optimal Premium for VHI program in Haiphong" described in the section 5.1 , we can choose the optimal premium for VHI Program in Haiphong in term of 1995 price (table 5.4).

Table 5.4: The Form to Choose the Optimal Premium for VHI Program

Premium **Pi** (1995 price) / Index	15,000[a] (dong)	... (dong)	... (dong)	... (dong)	10,000 (dong)
1. # of predicted membership **Qi**	105,000[b]				
2. Total revenue =**Qi.Pi** (million dong)	1,575				
3. Ratio **Qi/ Qo = α_i**	1				
4. Maximum cost **$TC_i = TC_o * \alpha_i$**	1,330				
5. Surplus or deficit (million dong)	245				
6. Certified optimal premium of VHI program					

a : The existing premium.
b : The existing membership.

Compared to the criteria of the Optimal premium for VHI program in Haiphong, Table 5.4 can shows the premium level which satisfies all of its requirements : Revenue equal to maximum costs predicted, with surplus equal to 0; increased membership of VHI program by decreasing premium from 15,000 to certain lower premium level with $\eta > 1$.

We can convert the optimal premium predicted above to the 1996 price by the formula as follows :

$$OP_{1996} = OP_{1995} * (1 + r) \qquad (5.11)$$

where

OP_{1996} is optimal premium at 1996 price.

OP_{1995} is optimal premium at 1995 price.

r is the estimated inflation rate in 1996 compared to 1995, or estimated increased percentage of price index in 1996 comparing to 1995.