THE PUBLIC DEMAND FOR A FREE HIV VACCINATION PROGRAMME

Charoenchai Agmapisarn

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The Examining Committee Approved This Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Economics).

Assistant Professor.....Committee Chairperson
(Penporn Janekarnkij, Ph.D.)

Associate Professor.....Committee
(Udomsak Seenprachawong, Ph.D.)

Associate Professor.....Committee
(Adis Israngkura, Ph.D.)

Associate Professor.....Committee
(Orapan Nabangchang, Ph.D.)

Associate Professor.....Dean
(Rachain Chintayarangsan, Ph.D.)
August 8, 2009

ABSTRACT

Title of Dissertation	The Public Demand for a Free HIV Vaccination Programme
Author	Mr. Charoenchai Agmapisarn
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This study explored the issue of public support for the provision of a "one-year, free HIV vaccination programme". Of all the contingent the valuation method (CVM) studies, this study has led the way in estimating how much the public, the general population, would be willing to pay for supporting this free scheme, targeting only commercial sex workers (CSWs), with a "one-off" payment as part of their yearly income tax. Thailand now faces a changing pattern of HIV/AIDS transmission into low risk groups, as a result of their direct and indirect contact with either male or female CSWs. This free scheme would be regarded as public good as it would reduce the risk of HIV/AIDS infection and prevalence among individuals in society, if an HIV/AIDS vaccine existed.

With the use of a double bounded CVM format followed by an open-ended question, a 600-split sample survey study asked 20-60 year old taxpayers in Bangkok to elicit their willingness to pay (WTP) to support this scheme using either a 30% or 70% effective vaccine with an initial tax payment of either 500, 1,500, 2,000, 3,500, 5,000, or 6,000 baht. The study not only pioneered technique of a "storyboard" to guard against misspecification bias, but also applied "cheap talk scripts" to eliminate hypothetical bias during the interview. As for the measure of total economic benefit, the study divided respondents into "beneficiary" and "non-beneficiary" based on their responses to the questions about their sexual behavior.

The results of the probit model found that the mean WTP values for a vaccine with 70% effectiveness were 2,515 and 2,050 baht as for single and double bounded format estimates, while a vaccine with 30% effectiveness had a mean WTP of 2,147

baht and 1,746 baht respectively. Personal income and the rate of tax payment were the most influential factors when individuals made their decisions on whether to sponsor this scheme.

The study recommends that the Thai government should use a progressive tax to fund this scheme when a vaccine becomes available. It also suggests that the condom use campaign should be relaunched, along with the provision of more information about HIV/AIDS, to help halt this infectious disease.

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ABBREVIATIONS

Abbreviations	Equivalence
AIDS	Acquired Immunodeficiency Syndrome
CDC	Centers for Disease Control and Prevention
CE	Choice Experiment
CSW	Commercial Sex Work
CVM	Contingent Valuation Method
CV	Contingent Valuation
FSW	Female Sex Worker
HIV	Human Immunodeficiency Virus
IDU	Injecting Drug User
MOPH	Ministry of Public Health
MSM	Men Who Have Sex with Men
MSW	Male Sex Worker
NESDB	National Economic and Social Development Board
NSO	National Statistics Office
OI	Opportunistic Infection
STI	Sexually Transmitted Infection
TB	Tuberculosis
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNFPA	United Nations Population Fund
UNGASS	UN General Assembly Special Session (on HIV/AIDS)
UNIFEM	United Nations Development Fund for Women
WHO	World Health Organization
WTP	Willingness to Pay
WTV	Willingness to be Vaccinated

CHAPTER 1

INTRODUCTION

1.1 Background and Rationale

Thailand so far has made significant progress in the fight against HIV/AIDS with a decline in the annual number of new HIV infections. On the other hand, the patterns of HIV transmission in Thailand have changed dramatically over time, with the virus increasingly spreading to people once considered to be at lower risk. Surprisingly, more than four in ten (43%) of new infections in 2005 were among females, the majority of whom probably contracted HIV from husbands or partners who had been infected either during unsafe paid sex or through injecting drugs. In addition, the HIV prevalence among injecting drugs users (IDUs) has remained high over the past 15 years, ranging between 30% and 50%, despite the overall achievements in reversing the HIV epidemic in Thailand (WHO, 2007 quoted in UNAIDS, 2007a: 24 - 25). Another study, consistent with this, showed that of the burden of diseases in 2004 nationwide, AIDS ranked highest amongst Thai males, and second amongst Thai females (Phusit Praklongsai et al., 2008: 1).

HIV transmission patterns in Thailand are shown in the following diagram in accordance with a forecasting model on HIV/AIDS transmission projection by. Dr. Wiwat Peerapatanapokin from the East-West center (See Figure 1.1). The estimated number of new HIV infections in Thailand significantly decreased from 140,000 per year in 1994 to 17,000 in 2005 (WHO-SEARO, 2007: 13). In 1984 the first AIDS case in Thailand was found in homosexual men and attention at first was among injecting drug users (IDUs). Then the HIV/AIDS disease spread through female sex workers (FSW) and their clientele, and also men who have sex with men (MSM). Consequently, HIV was being limited within the general population to heterosexual people and to children born to HIV infected mothers. Incidentally, the vast majority of HIV/AIDS infections in South East Asia region for more than two decades were still

unprotected sex between female sex workers and their clients. Although the prevalence of HIV disease in Thailand now has been lowered among female sex workers, it has still remained high in IDUs and appears to be increasing again in the MSM group. There is also proof that there is a bond between injecting drug users (IDUs) and female sex workers (FSW) in terms of HIV/AIDS transmission based on many studies (UNAIDS, 2008: 49-51).

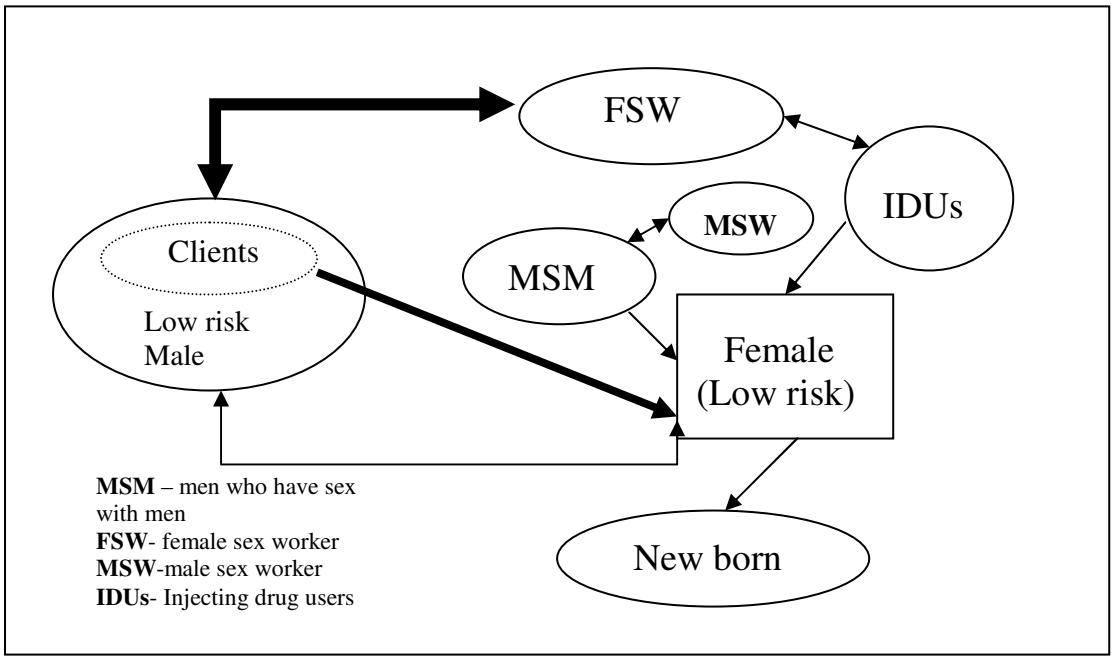

Figure 1.1 The General Pattern of HIV/AIDS Transmission in Thailand
Source: Wiwat Peerapatanapokin, 2007 and author.

Females, as a low risk group, have increasingly contracted more new HIV infections through either their male partners or husbands who either had unprotected sex or had injected drugs. On top of this, they also have to face another risk of exposure from men who have sex with men (MSM). This accounted for 21% of new HIV infections (WHO-SEARO, 2007: 7). One interesting study in 2005 claimed that about 22% of MSM in Bangkok have had sex with both men and women, while almost 40% of them also had unprotected sex intercourse with either steady or casual male partners during the 3 months prior to that study (Van Griensven et al., 2005: 522-523). Another study in 2005 surprisingly showed that of a total of 17,811 new

HIV infections aged 15-49 years old in Thailand, one in five were MSM. This indicated that MSM significantly accounted for the second largest share of new HIV infections in Thailand (Gouew et al., 2006: iii53-iii54). Even worse, according to the 2005 Thailand MSM survey, approximately 80 % of HIV positive MSM in Thailand did not even know their HIV status or had not been tested for HIV.

Although the majority of sex workers in Thailand are female, there is also a considerable number of male sex workers (MSWs) catering to MSM. So there are the highly possibly sexual relations between MSM and MSWs, whom our study took into consideration. In spite of this, no sentinel HIV surveillance has been conducted for MSM and due to the stigmatized nature of homosexuality in Thailand, AIDS cases among MSM hence may be under-reported (WHO-SEARO, 2007: 9).

Thailand has made great progress in preventing mother-to-child transmission. Almost 100% of Thai pregnant women who delivered their babies in public sector hospitals receive HIV consulting and testing. Of those infected with HIV, more than 90% will receive antiretroviral preventive therapy (WHO, 2007 quoted in UNAIDS, 2007b: 17). Still the impact of the HIV epidemic falls more heavily on females, who also assume the role of care-giver when their male partner, children, or parents fall ill. Up to 90 percent of all HIV/AIDS infected women and girls globally provide related care in the home. They may also do so even while trying to earn an income to support their families. In addition, women may cultivate crops to feed their families. By far the worst, both women with HIV and women whose partners die of AIDS also often suffer discrimination and abandonment from society (UNAIDS, UNFPA and UNIFEM, 2004: 31-37).

The current prevention measures can slow the spread of this virus, but the best hope of ending this epidemic lies in a vaccine. However, developing an HIV vaccine presents massive challenges since this virus mutates extremely quickly, enabling it to evade and cripple new treatments. However, many scientists still strongly believe that an HIV vaccine is feasible. Practically everyone's immune system could keep the virus in check for a number of years, some for over two decades. Consistent with this, experimental vaccines have successfully protected monkeys from simian immunodeficiency virus (SIV), a virus that causes a disease in monkeys much like AIDS. So, a vaccine still remains the world's best hope to halt the spread of HIV.

In this respect, this study created the hypothetical scenario, a one-year free HIV vaccination programme targeting only sex workers[1] or commercial sex workers (CSWs) as the high risk group, if an HIV/AIDS vaccine existed. Although an HIV/AIDS vaccine itself as regards health has been considered as a private good, this free HIV scheme would be regarded as an impure public good because it is nonexclusive, but rivalry. That is, this free vaccination scheme can countrywide reduce the risk of HIV/AIDS infection and prevalence among individuals in the society, so all people can benefit from this. Although HIV prevalence rates in Thailand have significantly decreased since the mid-1990s, the HIV/AIDS crisis in Thailand is still far from over. CSWs, both males and females, remain a key HIV/AIDS transmission route. Of the prevalence rate in 2003, almost 16 percent was among both direct and indirect FSWs, followed by MSWs who accounted for 7.9 percent (The World Bank, 2006: 12-17). Other evidence also showed that almost one in five (18%) newly HIV infected people in 2005 were either sex workers (3.9%), their clients (6.1%), and those client's other partners (8.4%) due to the prime route of unsafe paid sex transmission (Gouew et al., 2006: iii53). So individuals, as has been said, realize that they would benefit personally if those sex workers were vaccinated because if this HIV/AIDS epidemic would eventually decrease, it would reduce their own risks and the economy in fact would not be as adversely affected (Lorete, 2004: 30).On the one hand, the consumption of additional units of HIV/AIDS vaccine in this high risk group still involves social marginal costs of production.

To finance this free programme, this study aims to determine the public demand level from the general population through their yearly income tax payments. Consider the provision of our free HIV vaccination programme, where we of course know that the benefits of HIV protection and a set of tax share can make everyone better off. Common tax systems, nonetheless, can assign a tax share that some individuals may consider too expensive for the benefits they receive from HIV/AIDS protection. This may be because they are not involved much in sexual relationships, or because they do not have many sexual activities, such as the old, or because they

[1] The definition of sex workers is female, male and transgender adults and young people who receive money or goods in exchange for sex services either regularly or occasionally (UNAIDS, 2009: 3).

always have safe sex, or because of other reasons. The only approach is to have the tax shares set in accordance with the true willingness to pay for each individual, but this willingness is actually unknown and people would possibly have incentive to understate the truth as their strategic bias (Freidman, 2002: 593-599). Carson et al. (1999: 115-123), in spite of this, shared the view that as for the payment mechanism, the distribution of project costs may matter to individuals. In general respondents have perspicuous preference over forms of taxation, which might be a fairness issue. Many tax mechanisms such as income taxes, sale taxes thus provide the incentive compatibility in the pure public goods in terms of a credible and coercive payment mechanism (Carson and Groves, 2007: 191-192). As a result, this study estimated how much the general population would support this one-year free HIV vaccination scheme with their "one-off" yearly income tax payments.

The contingent valuation method (CVM) was employed to measure the economic benefits of this free HIV vaccination programme. This CVM has been developed to estimate the value of goods or services whose demand cannot be observed in ordinary markets. It has often been used for valuation of health and environmental goods and services (Johansson, 1995: 71-72; Carson, 2000: 1413). The CVM seemed specifically well fitted for evaluating demand in this study of a free HIV vaccination programme because an HIV vaccine has not existed in the real world.

The CVM study was also used to capture the use and non-use values accounted for the total economic value of this free HIV vaccination scheme. Hence our study divided the general population into user namely beneficiary and non-user regarded as non-beneficiary, whose values have been distinctly defined as "use value" referring to "values revealed from market behaviour" and "non-use value" regards as "values not revealed by market behaviour" (Freeman, 2003: 145-146). The readiness of individuals in the general population, both beneficiaries and non-beneficiaries, to participate in making a single payment on our free scheme is for their own benefits, perhaps for the sake of their health as well as for an altruistic feeling towards others. As things stand, it appears that female beneficiaries and non-beneficiaries are willing to pay for this programme because this would prevent them from contracting HIV/AIDS disease in future. In particular housewives or females, previously the low-

risk group in Thailand, now have been increasingly infected with HIV/AIDS from their husbands and male partners (UNAIDS, 2007b: 16).Therefore they are defined as beneficiaries whose values have been indirectly involved and who would benefit from our free HIV vaccination scheme. On the one hand, a single female or perhaps one whose sexual activity is relatively low regarding non-beneficiaries might feel altruism towards other females, future generation, and of course for society, so they will make their tax payments for this free scheme.

Likewise, male beneficiaries and non-beneficiaries are possibly willing to pay for this programme to vaccinate both male and female sex workers because they not only feel that this scheme would prevent them from contracting HIV/AIDS from sex workers, but also because they have an altruistic attitude towards others. As for beneficiaries, males who either regularly or occasionally have sexual relationship with CSWs would not only benefit from this programme, but also hedge against a major problem of being the HIV/AIDS carriers who transmitted the disease to their wives, spouses and other partners.

Despite that, this CVM study was to measure whether respondents whose family members included teenagers aged 15-19 would have willingness to support this free programme. Thailand introduced a 100% Condom use project nationwide in 1991, but it now wrestles with the significantly low rate of condom use among Thai teenagers. A recent survey in 2008 by the national sub-committee on AIDS prevention reported that only 13% of students aged 15-19 in high school (Mathayom Suksa) and university level used condoms when they had sex. Worst of all, this group was not only sexually active, but they also tended to have unsafe sex while having casual sex with multiple partners (Apiradee Treerutkuarkul, 2008: 11). At the very worst, the average age of first sexual activity of both boys and girls in Thailand was 13 years old according to data from the 2004 Behavioral Surveillance Survey of Thailand (WHO-SEARO, 2007: 10). So, individuals with teenagers living in the same household would support this free programme because this is favorable for them if their teenagers perhaps get involved in sexual relations with high risk group such as sex workers.

1.2 Objective and Research Questions

The objective of this study was to obtain in-depth information from the public, the general population including both males and females, on how much they would be willing to pay for supporting a one-year free HIV vaccination programme with the diverse initial income tax payment of THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000, respectively. On this account, this study used double-bounded CVM format followed by open-ended and debriefing questions to elicit the maximum willingness to pay amount for this free scheme. With a one-off payment from their yearly income tax financing the programme, this free programme would be provided countrywide for commercial sex workers (CSWs) consisting of both male and female aged above 15 years old, regarded as the high risk group, and has also been categorized into two different levels of HIV vaccine effectiveness: 30 % and 70%. This study would find out the factors influencing individuals regarding their beneficiary and non-beneficiary's values towards their willingness to pay amounts on this free programme.

Lastly the proposed study could provide policy planners the full details about a free HIV vaccination scheme if an HIV/AIDS vaccine is found, including the estimation of WTP on the free HIV vaccination programme and a potential means of funding this free vaccination scheme. In other words this could analyze the potential benefits of this free vaccination programme.

The research questions are

1) What are the key factors influencing an individual's payment for this free HIV vaccination scheme?

2) What are the differences in the significant determinants between beneficiaries and non-beneficiaries influencing their decisions to sponsor this one-year fee HIV vaccination scheme?

3) How much would individuals be willing to pay as a single shot in their yearly income tax to finance this free scheme?

1.3 Scope of the Study

1.3.1 Population

As for population, this study defined the target population as any person aged between 20 and 60 years old who is a taxpayer with Thai nationality, and who has been working in Bangkok regardless where he originally came from. In this respect, this study randomly sampled 600 people, both male and female, in Bangkok metropolitan area.

1.3.2 Location

As has been said, this study was conducted in Bangkok metropolitan area, the capital city of Thailand, although it does not represent the whole of Thailand. Bangkok still has the highest population density[1] in the nation. This accounted for 10 % of total population in Thailand. Furthermore, there are huge unregistered influxes of migrants from across the country, which makes Bangkok become the largest urban area, the economic centre, and primary city of Thailand.

1.3.3 The Estimation of Willingness to Pay (WTP)

This study with the use of double-bounded CVM format followed by an open-ended question was designed to estimate the mean willingness to pay (WTP) amount with regard to three different aspects: (a) the respondent's behavior: beneficiary/non-beneficiary; (b) vaccine effectiveness: 30/70%,and (c) household characteristics: respondent living together with/without household members who are teenager aged 15-19. They, as for all three differing aspects, were based on a "one-shot" payment as part of the yearly income tax and also calculated in both single and double bounded formats because single bounded format can provide "fully incentive-compatible" issue, while double bounded format increases the statistical efficiency of welfare estimation (Freeman, 2003: 166-167).

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[1] According to Ministry of Interior Thailand, Bangkok as of 2008 has the number of populations, which are 5,700,523 and the population density is 3635.07lnh/km^2.

1.3.4 Determinants

The determinants on demand for a one-year free HIV vaccination scheme, whether respondents as part of the general population are willing to pay as a single shot remittance through their yearly income tax payments, were the rate of tax payment (R); personal monthly income (Y); household size and composition (H), in particular the total number of 15-19 year-old adolescents living in the same household; respondent characteristics (Z) for example age, gender, marital status, occupation and education level; a vector of HIV/AIDS variables (A) such as the knowledge of HIV/AIDS, the awareness of HIV/AIDS problems, the respondent's experience with HIV/AIDS disease; the identified variable whether respondent is perceived as a beneficiary or non-beneficiary towards our free scheme (B); the understanding of vaccine effectiveness variable (U), which the vaccine effectiveness is composed of 30% and 70%; and vaccine effectiveness (V), whose effectiveness is either 30% or 70%, respectively.

1.3.5 Scope Test

The scope test was designed in this CVM study on the subject of two different types of vaccine effectiveness (30% and 70%) in the free HIV vaccination scheme for the validity of responses to our hypothetical free HIV scheme because CVM study has been highly recommended by U.S. National Oceanic and Atmospheric Administration, NOAA (1993: 32-38) to include this scope test in its survey. Otherwise, its results have been considered as unreliable (NOAA, 1993: 37). Then this study used "spilt sample technique" to test the reliability and consistency of respondents' answer towards two different levels of vaccine effectiveness in the free HIV vaccination scheme.

1.4 Significance of Study

Until the present day, no studies of public demand for HIV vaccination have been done in terms of willingness to pay (WTP) approach. Our study had initiated this method to estimate the general population's ability to financially support a one-year

free HIV vaccination programme as well as to analyze the influential factors in this scheme paid for by the public sector with the different initial bid on annual income tax payment of THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000, respectively. The split-sample survey has also been carried out in our study with regard to the different type of vaccine effectiveness: 30% and 70% because this can provide a useful insight into the question of whether an individual makes a "right" design choice with respect to the vaccine effectiveness, one of our HIV vaccine characteristics, incorporated within our free scheme. Even though an HIV vaccine has not yet come into existence, there are some conceptual reasons why it is vital to analyze the public demand for this free HIV vaccination programme. First, our study is intended to ask how much the general population would be willing to pay as a one-off payment on their annual income taxes to subsidize this one-year free vaccination programme. So these details about the structure of the public demand for this plan will be essential to design and organize government intervention if an HIV/AIDS vaccine is developed. In order to make a decision on providing the free vaccination scheme, policy makers need to understand the amount of money from different groups in the population, which are willing to pay for the free scheme because the government budgets are limited. In this regard it can estimate the one-year free HIV vaccination budget required.

Second, the evidence of this study can develop the vaccination strategies for high-risk population groups, who potentially might be vaccinated or prioritized based on their relative risk behaviors, which might be a proxy for the potential benefits of this free programme. This is also in line with the prior studies that the vaccination of high-risk groups is more likely to avert more HIV/AIDS infections than the groups of lower-risk people and also becomes the most cost effective approach (Desmond and Greener, 2003: 11-12; Gandhi et al., 2007: 1-11). If the male and female CSWs as high-risk people have been free vaccinated, this will significantly reduce new infections and also the HIV/AIDS prevalence rate in Thailand because sex workers still have been remained a major risk group and are responsible for spreading many infections of HIV (The World Bank, 2006: 13). Last, public funding by both governments in developing countries and international donor organizations for the development of an HIV vaccination programme is generally low, compared to the magnitude of the HIV/AIDS problems. This study attempts to seek feasible means of

financing this free HIV/AIDS scheme by creating a possible financial source, for example the yearly income taxes as a provision mechanism to compete the need for this one-year free HIV vaccination plan.

1.5 Content Coverage

Regarding the content coverage, this study initially used the "storyboard", a four-illustration board, to make contingent valuation (CV) scenario much more interesting and comprehensible to our respondents. This storyboard will also prevent respondents from a scenario misspecification while having the face-to-face interviews, so that they fully understand the scenario as our study intended it to be understood or respond to the correct valuation scenario (Bateman et al., 2002: 302-304). Besides, this storyboard will make sure that our enumerators give a consistent explanation of the scenario during the interview. This will also ensure a high content validity and also increase the quality of data collection.

To prevent hypothetical bias, respondents beforehand were instructed to consider their budget constraints, fortified to answer the "right" WTP amounts, and informed that there was no right or wrong answers while listening to our hypothetical HIV vaccination scenario. In other words individuals had been told in terms of cheap talk scripts to encourage the respondents to tell the truth before they started to elicit their WTP amounts. This cheap talk script was also employed in our study to eliminate the "hypothetical bias", which caused the free-rider problem for our one-year free HIV vaccination programme (Cummings and Taylor, 1999: 663-664; Murphy et al., 2005: 328).

Incidentally, the rest of this paper is organized as follows: Chapter 2 reviews the previous studies regarding both pubic and private demands for HIV/AIDS vaccine at country level and the study of the vaccine acceptability; Chapter 3 states our theoretical concepts, methodological issues, and modeling analysis of our public demand; Chapter 4 examines the empirical results; and Chapter 5 draws some conclusions from our results on the free HIV vaccination scheme, discusses the methodological issues, and suggests possible HIV/AIDS policies based on our findings.

CHAPTER 2

LITERATURE REVIEWS

2.1 The Public Demand for HIV Vaccine at Country Level

Until now, only five papers have been written estimating the public sector demand and also the government's demand for an HIV vaccine at a national level. These studies have been conducted in Brazil (Novaes et al., 2002), India (Gandhi et al., 2007), Southern Africa region (Desmond and Greener, 2003), Southern India (Seshasri et al., 2003), and Thailand (Viroj Tangcharoensathien et al., 2001). However none of these studies has examined a country's ability to finance HIV vaccines or the willingness to pay for HIV vaccine at alternative price levels. Therefore many key factors influencing the number of vaccines that might be purchased in the public sector remain unexamined (Hecht and Suraratdecha, 2006: 1728-1729). Within these five different papers, we followed the method used in previous work by Suraratdecha et al. (2005a: 1-39) to compare and contrast the various methods used in their works, which are a) the potential target groups; b) the country-level estimate; c) the HIV/AIDS vaccine characteristics; and d) the potential demand.

2.1.1 The Potential Target Group

Among these different five studies, the target groups for the HIV vaccine scheme varied considerably and were determined by epidemiological, behavioral, local political and cultural factors. As shown in Table 2.1, the target population groups in Brazil were much the same as in Thailand, while in the Southern Africa region the study was conducted in only seven countries[1] with an emphasis on the groups of employees, teachers, and migrants.

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[1] The seven countries in Southern Africa region were Bostswana, Lesotho, Namibi, South Africa, Swaziland, Zambia and Zimbabwe.

Table 2.1 Target Populations among Five Studies of Public Demand for HIV Vaccine Programme

Target population	Country/region				
	Brazil	**India**	**Southern Africa**	**Southern India**	**Thailand**
Adolescents		√			
Civil servants					√
Commercial sex workers	√	√	√	√	√ (direct and indirect)
Conscripts	√				√
Female STI patients	√			√	
Formal sector female employees			√		
Formal sector male employees			√		
Health workers	√				√
High school students	√		√ (girls and boys)		√
High school teachers			√		
Intravenous drug users	√	√			√ (in and out of treatment)
Legal cross border migrants			√		
Male sexually transmitted infected (STI) patients	√		√		√
Men aged 15-49 years old	√			√	
Men having sex with men	√	√			√
Military	√		√		
Police	√				√
Population aged 0-6 years old				√	
Population aged 11-14 years old				√	
Pregnant women	√		√ (ANC attendees)	√ (ANC attendees)	√
Prisoners	√		√		√
Transport workers	√		√ (high risk)	√ (truck driver)	√
University students	√				√
Women aged 15-49 years old	√			√ (women of reproductive age)	
Young adults below 26 years old		√ (only single)			

Source: Seshadri et al., 2003: 8; Suraratdecha et al., 2005a: 7.

The study in Southern India within four states[1] focused on eight potential target groups[1], including children and early adolescents (newborn to 14 years old), whereas the target groups for the study in India were both high risk- female sex workers, injecting drug users, and men who have sex with men- and low risk groups – adolescents and young adults under 26 years of age who were not married.

2.1.2 The Country Level Estimate

To assess why certain population target groups were vaccinated, these five studies had different criteria to measure for the public HIV vaccination programme. The studies in India, Southern Africa, Southern India and Thailand prioritized the target groups to be vaccinated based mainly on cost-effectiveness. As for cost-effectiveness approach, the costs therefore were defined as the vaccine cost and the delivery cost, both of which were assumed with ease of access while effectiveness was principally estimated from the number of HIV infections averted from the vaccination.

The Brazil study, in contrast, generally took the public HIV vaccination into account based on compelling economic reasons. In other words, both political and economic considerations were the deciding factors for the government in Brazil to vaccinate their population target groups. Macro level political factors would, for example, play a leading role in the development of successful HIV/AIDS policies (Novaes et al., 2002: 6).

In terms of calculating the number of HIV/AIDS infections averted, the studies conducted in Brazil and Thailand examined whether an HIV vaccine would be substituted for existing HIV prevention methods such as condom use programmes. For the most part, the higher the rate of condom use joined with sustainable sexual behavior changes, the lower the benefits from a AIDS vaccine were (Novaes et al., 2002: 16; Viroj Tangcharoensathien et al., 2001: 128).

Among these diverse studies, the assumptions about the proportion of population groups vaccinated and partial or complete coverage varied at the time of

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[1] The study of four Southen states consisted of Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu.

HIV product introduction. The study in India concluded from its consultation that it would endorse the public HIV vaccine programme for the high-risk population as a priority with vaccine efficacy of at least 50%, while the low-risk target population being vaccinated was only adolescents and younger and single adults under 26 years old with the minimum acceptable threshold of efficacy as high as 70% (Gandhi et al., 2007: 1-11).

The study in Southern Africa, similarly situated, focused on high-risk groups as well as providing vaccination to individuals after they had already received voluntary counseling and testing. In point of fact, the vaccination of high-risk groups was more likely to avert more HIV/AIDS infections than the vaccination of groups of lower-risk people (Desmond and Greener, 2003: 11-12). Then, the Southern India study developed a potential vaccine delivery scheme for each population group. The study in Thailand however aimed the vaccines being allocated as the key to relative cost-effectiveness across groups regardless of the amount of government budgets. Therefore the most effective target of a vaccine progamme was the one with highest benefit and lowest cost, nonetheless, the efficacy and the price of vaccine was so far unknown. In spite of that, the Thai study examined two key aspects: the cost of vaccination and the potential benefit of vaccine strategy. The vaccine cost consisted of vaccine and delivery costs. The latter did not take either vaccine efficacy or effectiveness into account (Viroj Tangcharoensathien et al., 2001: 120-121).

In short, most studies[2] (four out of five) based mainly on approaches geared to cost-effectiveness found an advantage in using it to allow for the ranking of interventions. Using the most cost effective way, a programme usually started with the highest ranking group and vaccinated until the budget ran out or until all of the groups had been vaccinated. The difficulties of using the cost-effectiveness technique, however, were only inputs into a decision process, and then the final decision on designing a vaccination programme would be adjusted by many other economic, social and political aspects, accordingly (Desmond and Greener, 2003: 21).

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[1] Eight potential target groups comprised children under 6 yrs olds, children aged 11-14, pregnant women, commercial sex worker and STI patients.
[2] Four studies were composed of India, Southern Africa, Southern India, and Thailand

2.1.3 The HIV/AIDS Vaccine Characteristics

As regards the HIV vaccine characteristics in Table 2.2, only two studies, Brazil and Thailand, in general assumed a single dose with 100 % effectiveness, while most studies[1] had various assumptions on vaccine efficacy. Thus, the India study used a vaccine efficacy of at least 50%, while the study in Southern India did not make an assumption about the effectiveness or the duration of vaccine. Despite this, the Southern Africa study strongly believed that as for a potential HIV vaccine characteristic, a change in the duration of HIV protection would have a significant impact upon the effectiveness of vaccine among the different risk groups because the sexual behavior within the assorted groups have been varying gradually over time. This would change the ranking of various groups in terms of both effectiveness and cost effectiveness. Hence, the period which the vaccine would prevent people[1] from contracting HIV disease was a crucial factor at this stage. It was presumed that an HIV vaccine would provide protection from HIV for a period of 5 years (Desmond and Greener, 2003: 44).

Still, Desmond and Greener (2003: 10) confirmed that the efficacy of vaccine under the Southern Africa study made no difference in the ranking of strategies in the terms of its effectiveness, only if the vaccination changed risky behavior among the various target groups, so the most effective strategy, on the whole, would be the most effective regardless of vaccine efficacy. Consequently, a change in the vaccine efficacy had a great effect on all groups by the same proportion, but did not affect its effectiveness in relation to different groups. As for an HIV vaccine, the duration of HIV protection, in other words, played a more significant role than vaccine efficacy.

On the other hand both Brazil and Thailand presumed the vaccine could stop people from getting an HIV infection as a lifetime protection. Only the India study assumed the vaccine would provide protection from HIV/AIDS disease for at least three years after having been administered.

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[1] These studies consisted of India, Southern India, and Southern Africa.

Table 2.2 Vaccine Characteristics According to Five Studies of Public HIV Vaccine

Characteristics	Countries				
	Brazil	**India**	**Southern Africa[b]**	**Southern India**	**Thailand**
Efficacy level	100%	50% and 70%	Not specified	Not specified	100%
Number of doses	1 or 2	1	1	1	1
Duration of protection	Lifetime	minimum 3 years	5 years	Not specified	Lifetime
Potential users	Adult 15 and up	16-49 yrs (high risk); 13-26 yrs (low risk)	All ages	(Age 11-14)Low risk and (Age 15-49)High risk	Adult 15 and up
Price	I$[a]1 or I$10	US$ 10 (Rs 440)	Not specified	US$10	US$3-US$29
Others	I$0.2-I$0.4 delivery cost		The case averted per 100 recruits		

Source: Desmond and Greener, 2003: 8-11; Gandhi et al., 2007: 23-25; Hecht and Suraratdecha, 2006: 1729-1730; Novaes et al., 2002: 18-19; Seshadri et al., 2003: 12; Viroj Tangcharoensathien et al., 2001: 120-121.

Note: a) I$ was known as International dollar ($) where R$ per 1I$ costs 0.68 as for the 1988 Brazilian conversion.

b) Vaccine in the Southern Africa study was not for the benefits of people who had already been HIV infected with HIV.

In general one single dose of HIV vaccine, all things considered, costed in the range of US$ 1 to 10, while the vaccine price in the Thailand study widely ranged from US$3 to US$29 per dose. In spite of this, the study in Southern Africa estimated the number of infections averted per vaccine into a vaccination programme whose number of HIV disease averted per 100 HIV-negative entrants. As has been said, the vaccine price in the Southern Africa study varied considerably according to the assumptions about the duration and efficacy of vaccine.

[1] These people imply persons who are not HIV infected or have negative HIV blood test.

Regarding the vaccination strategy, the Thai study took policy priority into consideration when the final decision was made, such as epidemic control and the budget. The number of doses required and financial needs were determined in the light of the size of the non-infected population and an estimated vaccine coverage rate. Added to this, the coverage for low risk HIV groups in Thailand had been assumed to be 100% vaccine coverage, however, if the vaccine cost was so expensive, then the coverage tended to be lower (Viroj Tangcharoensathien et al., 2001: 137).

The study in Southern Africa, similarly considered the relationship between a screening and vaccination strategy as well as the delivery costs. The key to delivery costs was a more significant component of total costs for the high-risk group than the lower risk group because a substantial reduction in the delivery costs of an equal proportion across all groups would intensify the cost effectiveness of high risk group compared with the others. The study in Southern African, in fact, summarized that a costly vaccine should be administered to commercial sex workers, while an inexpensive vaccine thus would be better administered to general population groups, especially to schoolchildren.

The coverage rate therefore varied considerably from country to country within the Southern Africa region[1], where the lowest coverage was 64 %, but they all predominantly focused on young children in principle if the vaccine had been currently available. Nonetheless, the coverage rate did not depend significantly on income, where the highest coverage rate country, Zambia, was the poorest state in the region (Desmond and Greener, 2003: 11-22).

The study in India, on the one hand, considered only coverage and wastage in the analysis due to the lack of data availability. The coverage rates, at a rate of 40% targeted two groups: low and high HIV risk people in accordance with a 10% wastage factor. For example, for every ten people who are fully vaccinated, one course is wasted (Gandhi et al., 2007: 21). The Southern India study nevertheless went further to describe potential delivery strategies for both high and low HIV risk populations, giving a clear understanding of the scope of the challenge to introduce a new vaccine

[1] Seven countries carried out in Southern Africa region as the case study are Bostswana, Lesotho, Namibi, South Africa, Swaziland, Zambia and Zimbabwe.

in the region (Seshadri et al., 2003: 6). Under its HIV vaccine programme, no assumptions were made about the duration or effectiveness or the wastage of potential vaccines (Seshadri et al., 2003: 11).

2.1.4 The Potential Demand

The potential demand therefore was estimated by multiplying population size by the estimated coverage rate. Then, the required budget was calculated by multiplying price by the number of doses. These five studies proposed that the number of vaccine doses needed in the first stage could be considerable with the following broad target groups - more than 121 million doses in Brazil and 195 million doses in Southern India (Novaes et al., 2002: 22; Seshadri et al., 2003: 5). India, on the other hand, would consider mostly both low and high risk groups, where it, as the low risk group, would vaccinate only adolescents and young adult below the age of 26 only if the vaccine efficacy is high at least 70%. As for the 13-26 year old low-risk population in India, it is estimated to be around 237 million people in 2015 (Gandhi et al., 2007: 12-20).

To vaccinate only the high-risk population as a specific strategy, the number of doses required was significantly low, except for India. To illustrate, 9.1 million doses would be required in Brazil for those at the highest risk, 9.6 million doses in Southern India, targeting purely both high-risk individuals and women receiving antenatal care service, and 1.3 million doses for 15-year old school students in Southern Africa region (Hecht and Suraratdecha, 2006: 1730). In contrast India would, first and foremost, prefer to target for high-risk groups, comprising of female sex workers, injecting drug users, and men who have sex with men all of which accounted for approximately 131 million people in India (Gandhi et al., 2007: 19).

Thailand however would vaccinate the priority groups (See Table 2.1) with 5.9 million doses as a nationwide scheme with an additional 1.3 million doses needed annually to maintain coverage (Viroj Tangcharoensathien et al., 2001: 131). As has been noted, the coverage rate and demand level heavily relied on the vaccine characteristic. However the hypothetical vaccines described in these five studies was not feasible, even though they are described in a simple approach. Their findings projected a number of doses of HIV vaccine, purchased by the public, but they all fail

to estimate public sector demand. This study with the contingent valuation method would then analyze further how much people (individuals) in general were willing to pay for a free HIV vaccination programme in accordance with different price levels. This scheme therefore targeted commercial sex workers comprising males and females as the high risk group. It would provide useful insights into the crucial factors relating to how the public (individuals) make a decision on financing this free HIV/AIDS vaccination scheme.

2.2 The Private Demand for HIV/AIDS Vaccine at Country Level

2.2.1 The Study of Private Demand for HIV/AIDS vaccine in Most Cases

On the whole the study of private demand for an HIV/AIDS vaccine was mostly related to the willingness to pay (WTP) study as the part of CVM.

Table 2.3 The Five Studies of Private Demand for an HIV/AIDS Vaccine in Line with the Willingness to Pay (WTP) as the Part of CVM study

Study	The country case study	Target population	Size
Forsythe et al. (2000)	Kenya	General population (aged 18-55)	890
Whittington et al. (2002)	Mexico	Shoppers in shopping centre (aged 18-55)	234
Suraratdecha et al. (2002)	Thailand	CSW[a] (aged 18-57); IDU[b] (aged 16-55)	600;200
Bishai et al. (2004)	Uganda	General population (aged 18-60)	1,677
Suraratdecha et al. (2005b)	Thailand	General population (aged 18-60)	2,524

Source: Suraratdecha et al., 2005a: 10.

Note: a) Commercial Sex Worker; b) Injecting Drug Users

Up until now, there have been five studies conducted in various countries, target populations and sample sizes with the aim of estimating the level of private demand for an HIV/AIDS vaccine. (See Table 2.3) The studies in Kenya, Mexico, Thailand and Uganda surveyed mainly samples of the general adult population with different sample sizes, however, there was only one study in Thailand by

Suraratdecha et al. (2005a: 7-12) focusing on high risk groups: commercial sex workers and injecting drug users.

Table 2.4 shows the vaccine characteristics used in the five studies. Most studies tended to use a single dose HIV/AIDS vaccine with its partial efficacy, 10-year protection, and no side effects with various price levels as the general vaccine characteristics to question respondents how much would they be willing to pay for themselves if an HIV/AIDS vaccine existed.

Table 2.4 Vaccine Characteristics According to Five WTP Studies

Study	Vaccine characteristics					
	Efficacy level	**Number of doses**	**Duration**	**Route**	**Side-effect**	**Price range (US$)**
Forsythe et al. (2000)	50 or 100%	1	Not specified	Not specified	None	0-360
Whittington et al. (2002)	100%	1	Lifetime	Injection or oral drops	None	0-over 10,000
Suraratdecha et al. (2002)	50 or 95%	1	10 years	Not specified	None	12.5-500
Bishai et al. (2004)	50 or 95%	1	10 years	Not specified	None	2.86-286
Suraratdecha et al. (2005b)	50 or 95%	1	10 years	Not specified	None	5-1,500

Source: Bishai et al., 2004: 653-654; Suraratdecha et al., 2005a: 11; Suraratdecha et al., 2005b: 273-275; Whittington et al., 2002: 2586-2587.

Despite this, the Thai study (Suraratdecha et al., 2005b: 283-284) initially launched a tool - a plastic tray and a set of more than 100 small rubber dolls - with a view to explaining to respondents the vaccine efficacy and also asked respondents about their understanding of the concept of vaccine efficacy during the face-to-face interviews. Although the assessment of vaccine efficacy concept was beyond the grasp of many people, this tool in fact was easily comprehensible to many people regarding to vaccine efficacy of either 50 or 95 %.

Table 2.5 The Outcomes of Willingness to Pay Amounts among Five Different Studies

Study	The Willingness to Pay (WTP) Amounts on an HIV/AIDS Vaccine (US$)
Forsythe et al.(2000)	more than 20% people are WTP for vaccine at US$7
Whittington et al. (2002)	mean and median WTP of adults is US$669, US$ 316 respectively for a vaccine
Suraratdecha et al. (2002)	80% CSWs are WTP for 95% efficacy vaccine at US$25
	75% IDUs are WTP for 95% efficacy vaccine at US$25
Bishai et al. (2004)	Three-quarters of people WTP for both 50 and 95% efficacy vaccine at US$ 3
Suraratdecha et al. (2005b)	65% people WTP for both 50 and 95% efficacy vaccine at US$5

Source: Bishai et al., 2004: 655-656; Suraratdecha et al., 2005a: 12; Suraratdecha et al., 2005b: 278; Whittington et al., 2002: 2587.

Regarding the private demand for an HIV/AIDS vaccine among different population groups (See Table 2.5), the amounts of an individuals' willingness to pay for an HIV/AIDS vaccine had been diversely in line with the vaccine efficacy. Compared with other studies, the Mexico study in Guadalajara suggested the highest willingness by people to pay for a vaccine at an average of US$669 with the mean of US$316 for a single HIV/AIDS vaccine. Given that price, this one-shot HIV vaccine would have to provide 100% HIV/AIDS protection for an individual's entire lifetime. It was also clear evidence that in Guadalajara people with higher income had a statistically significant higher WTP for an HIV vaccine than did low-income people. Younger persons, similarly expressed, were more likely to pay higher price for an HIV vaccine than were older people (Whittington et al., 2002: 2589).

2.2.2 The Key Determinants on WTP Study

Among these five studies as shown in Table 2.6, at least three out of five studies confirmed that the significant determinants having a positive impact on willingness to pay at a given price, were income, risk of acquiring HIV, and marital status.

Table 2.6 Key Determinants on Different WTP Studies on Private Demand

Determinant	Forsythe et al. (2000)	Whittington et al. (2002)	Suraratdecha et al. (2002)	Bishai et al. (2004)	Suraratdecha et al. (2005b)
Efficacy	Not significant	N/A	Not significant	Not significant	95% (+)
Price	N/A	N/A		(-)	(-)
Income proxy	HH Expenditure (+)	(+)		Highest quintile (+)	(+)
Risk	Not significant	(+)		(+)	(+)[d]
Know someone with AIDS	Not significant	N/A		(+)[c]	(+)
AIDS is curable	N/A	Not significant[b]		(+)	Not significant
Understand efficacy	N/A	N/A		(+)	(+)
Female	Not significant	Not significant		(-)	Not significant
Married	Single (+)	(+)		(+)	(-)
Age	Not significant	N/A		(-)	Age 20-34 (+)[e]
Education	(+)[a]	Not significant		(+)	Not significant

Source: Bishai et al., 2004: 657; Suraratdecha et al., 2005a: 14; Suraratdecha et al., 2005b: 279; Whittington et al., 2002: 2590.

Note: a) Less than secondary and more than secondary level, compared to the secondary level.

b) Knowledge with ART; c) Number of relatives who had died from AIDS; d) Any risk, did not know risk compared to no risk; e) It compared with less than 20 yrs old or more than 34 yrs old.

The risk determinant played the most significant role on willingness to pay. Given the same vaccine price, people with high risk of HIV infection tend to purchase more vaccines for themselves compared to people in lower risk groups (Suraratdecha et al., 2005a: 13-14).

Incidentally, the study in Thailand examined three different target groups: the general population, commercial sex workers (CSWs), and injecting drug users (IDUs) on the willingness to pay for an HIV/AIDS vaccine in the wide range of price: US$12.50 – US$500. Regarding the private demand for an HIV vaccine among these three groups, CSWs were the most likely to pay at a given price, followed by IDUs and the general population respectively. Nonetheless the vaccine efficacy had no

impact on both CSWs and IDUs in the shape of WTP for an HIV/AIDS vaccine. That is, those high-risk groups: CSWs and IDUs at the various price levels had the same rate of WTP for an HIV/AIDS vaccine on its vaccine efficacy either of 50 or 95%. The general population group, on the contrary, had particular preference for a higher-efficacy vaccine at any given price. On the evidence of this, it could be undoubtedly stated that the role of perceived HIV risk has an influence on the private demand for an HIV/AIDS vaccine, as supported by the similar findings to the both studies in Kenya and Uganda (Bishai et al., 2004: 652-660; Suraratdecha et al., 2005a: 13-14).

In addition only two studies found the same outcomes in terms of price and the understanding of vaccine efficacy. First, the price level had negative relationship to demand on AIDS vaccine. A higher vaccine price would significantly reduce the level of demand, accordingly. Second, the understanding of vaccine efficacy would increase the level of demand as well as the amount of WTP (Bishai et al., 2004: 657; Suraratdecha et al., 2005b: 279).

2.2.3 A Case Study in Thailand as for the General Population Group

Thailand has recently been studied nationwide in terms of private demand for an AIDS vaccine by Suraratdecha et al.(2005b: 271-287).The hypothetical AIDS vaccine conducted in this study was firstly described as safe with no side-effects, assuming a 10 year prevention period from contracting HIV/AIDS disease, and with an efficacy of either 50 or 90%.The outcome however revealed the demand of private AIDS vaccine, according to 65% of Thai respondents, was at the price of 200 baht (US$5). It was surprising that approximately 60 % of Thai respondents would not buy the vaccine in either 50% and 95% efficacy AIDS vaccines with a 10-year lasting because they strongly believed that they were not at risk of HIV infection.

Despite this, another question in this study asked Thai respondents whether they would be willing to be vaccinated if the Thai government provided them both free hypothetical AIDS vaccines of 50% and 95% efficacy with a 10 year-duration. The findings had unexpectedly shown that nearly 80% of respondents in both male and female would agree to be vaccinated for free. Thai women were more likely to be willing to be vaccinated than were men. Also, the difference between two types of hypothetical vaccine in terms of 50% and 95% effectiveness was statistically

significant. Thai respondents therefore were approximately 5% higher in terms of willingness to be vaccinated 95% efficacy, compared with a 50% effective vaccine regardless of household resources (Suraratdecha et al., 2005b: 280-281).

In terms of a 95% efficacy AIDS vaccine, women had a higher willingness to be vaccinated (WTV) than did men. The difference in age group also had an effect on WTV, as younger groups tended to be more WTV than do older groups. A 95% effective AIDS vaccine however was more preferred to a 50% effective AIDS vaccine in terms of WTV regardless of education level. Both Thai men and women, on the other hand, were equally willing to be vaccinated for a hypothetical AIDS vaccine of 50% effectiveness, even in different age groups.

Suraratdecha et al. (2005b: 282) also emphasized that for both 50% and 95% efficacy AIDS vaccines the more Thai respondents understood the perceptible definition of effectiveness in both hypothetical AIDS vaccines, the more they were willing to be vaccinated. Interestingly, more than 85% of respondents who were willing to be vaccinated with both the 95% and 50% effective vaccines still intended to use condom with non-spousal partners even if they had already received the HIV/AIDS vaccination. This evidence strongly suggested respondents understood the increased risk of infection with both efficacy vaccines and also reinforced themselves to prevent reductions in condom use.

2.3 A Study of Vaccine Acceptability among Thai People

Another relevant study on an HIV/AIDS vaccine is a study on vaccine acceptability. Unlike the study on CVM, the method used in this study called “conjoint analysis” drew upon social marking experiences and focused on small numbers of people mostly in high risk target groups. It tried to identify the crucial factors which influenced HIV / AIDS vaccine acceptability. Individuals therefore were questioned about whether they intended to get vaccinated and were also asked about their attitudes towards an HIV vaccine. This also came down in favor of indispensable factors such as the health beliefs and behaviors and the potential vaccine characteristics (Suraratdecha et al., 2005a: 15).

Based on several studies on this topic, it has been so far only one study relating to Thailand. This study investigated the HIV vaccine acceptability among immigrant Thai residents in Los Angeles, California, who were not high risk groups (Sung-Jae Lee et al., 2008: 1-8).

Table 2.7 Acceptability of Hypothetical HIV Vaccines and Impact of Vaccine Attributes on Acceptability (n =27)

Hypothetical HIV vaccine number[a]	HIV vaccine acceptability (mean)	Vaccine attributes						
		Efficacy (%)	Side-effects	Duration of protection	Protection (cross-clade)	Cost ($)	Doses	Route
1	85.22	99	None	10 years	One type	0	1	Injection
2	72.2	99	Minor	10 years	Multiple types	250	4	Injection
3	70.4	99	None	1 years	Multiple types	250	1	Oral
4	57.4	99	Minor	1 years	One type	0	4	Oral
5	30.6	50	None	1 years	Multiple types	0	4	Injection
6	23.2	50	Minor	10 years	Multiple types	0	1	Oral
7	18.5	50	None	10 years	One type	250	4	Oral
8	7.4	50	Minor	1 years	One type	250	1	Injection
Mean Impact Score[b]		**51.4**[*]	**11.1**[*]	**8.3**[*]	6.9	6.9	1.9	-6.5

Source: Sung-Jae Lee et al., 2008: 6

Note: a) HIV vaccine numbers set in order of gradual decline in acceptability

b) It showed the impact of each vaccine attribute on acceptability with 5 % significant level

With the combination of a qualitative research method (focus groups) and an innovative market research method (conjoint analysis), the study attempted to analyze these Thai focus groups with regard to acceptance and utilization of preventive HIV vaccines. This was consisted of five key issues: (a) vaccine characteristics, (b) fear of a vaccine, (c) vaccine acceptability and optimism, (d) social and family responses, and (e) behavioral disinhibition (Sung-Jae Lee et al., 2008: 3).

Among these 27-native Thai people focus groups, they mostly were married females with the average age of 46, who had been living in the United States for almost 20 years. Of these Thai native speakers in this study, 80 % were HIV-negative

and more than 50% had been tested for an HIV check-up. Given the different eight hypothetical HIV vaccine scenarios, twenty seven participants in these focus groups ranked their likelihood of accepting each of eight vaccines on a 5-point Likert-type scale, ranging from highly likely to highly unlikely. Then, ratings were interpreted into a 0-100 scale. For each vaccine attribute, individual-specific impact scores were then concluded across participants as the attributes mean impact on vaccine acceptability with the t- test at 95% level of significance. The vaccine attributes conducted in this study comprised efficacy, physical side-effects, duration of protection, cross-clade protection, cost, doses, and route, respectively.

As for Table 2.7, it was clear that these Thai focus groups had a strong preference for an HIV vaccine in line with these following attributes: 99% efficacy, no side-effects, 10 years of protection, protects from only one type, free, one dose and given by injection at the highest acceptability of 85.2% as an average, while the least preferable vaccine attributes were consisted of 50% efficacy, minor side-effect, 1 year of protection, protects from only one type, US$250, one dose and given by injection.

Of the number of diverse vaccine attributes, vaccine efficacy, physical side-effects, and duration of protection all had a great influence on the HIV vaccine acceptability in this study. Vaccine efficacy, the most influential attribute, played a major part in the decision making process about whether people wanted to accept the HIV vaccines. That is, a change from 50% to 99% vaccine efficacy would therefore escalate sharply to the level of vaccine acceptability among these Thai focus groups from a scale of 20 to 70 as the leapfrog.

On the evidence of a previous study among multi-ethnic adults in Los Angeles (Newman et al., 2006: 2097), it also confirmed that vaccine efficacy took precedence over other influential vaccine attributes in terms of vaccine acceptability, following by side-effects, duration of protection. Another study in Thailand by Suraratdecha et al. (2005b: 279) also showed that a highly effective vaccine would significantly raise the level of private demand for AIDS vaccines nationwide.

Both studies[1] nonetheless found that dose, cost, and route as all the vaccine attributes were not statistically important factors affecting the HIV vaccine

[1] Both two studies consisted of the Newman et al. (2006) and Sung-Jae Lee et al. (2008).

acceptability among these two groups: immigrant Thai residents and multi-ethnic adults in Los Angeles. Taking this into consideration, Thais would strongly prefer to have a potential HIV vaccine whose vaccine efficacy was very high as top priority, followed by no side-effects and a 10 year-protection if they wanted to get HIV vaccination.

As a result all these interesting findings relating to Thailand gave a clear picture about the future HIV vaccine for Thais, even if it did not exist. Despite that, this study in the next chapter would take them into consideration for creating a potential HIV vaccine incorporated into our free HIV vaccination scheme, so our study would analyze how much the public in Thailand would be able to support this free HIV vaccination programme in line with the use of CVM.

CHAPTER 3

METHODOLOGY

3.1 Theoretical Concept

3.1.1 Beneficiary and Non-Beneficiary Values

Our study used a survey interview technique to present a hypothetical CVM scenario and asked whether the general population (households) in Bangkok would be willing to financially support a free HIV vaccination scheme. We specifically surveyed their willingness to pay (WTP) for a one-year free HIV vaccination programme, targeting a high-risk target group: both male and female sex workers over the age of 15, at a specific rate. In order to support our free vaccination programme, we asked households how much they were willing to make as a "one-off" payment or their willingness-to-pay (WTP) as part of their yearly income taxes for this scheme.

As for this WTP amount, our study divided it into the value of user and non-user (See Appendix A) in accordance with individual's behavior. The definition of "use value" was defined as a beneficiary whose values were revealed from market behavior, while "non-use value" referred to a non-beneficiary whose values were not revealed by market behavior (Freeman, 2003: 146). In other words people as beneficiaries will fully endorse this programme because they will have benefits from this free HIV vaccination scheme. Provided that both male and female sex workers would be vaccinated, this would bring many benefits to both males and females. Males who had regular or intermittent sexual contact with sex workers would reduce their own risks, while females who were married would be protected from getting infected with HIV/AIDS through sexual transmission from their male partners.

On the one hand, both male and female non-beneficiaries who either have never had any sexual contact with commercial sex workers will possibly agree to subsidize this free HIV vaccination scheme due to altruistic reasons. They may also feel safer if commercial sex workers were being vaccinated, resulting in a lower

HIV/AIDS prevalence in society, and also would see positive or beneficial externalities on macroeconomic effects because a decline in the HIV/AIDS epidemic will provide a countrywide increase in emotional and physical well-being. In addition these non-beneficiaries involved may support in this programme as an expression of their paternalistic altruism towards others who benefited from this scheme if commercial sex workers were vaccinated. According to A. Myrick Freeman (2003: 141-151), as for the literature on paternalistic altruism, it referred to a case where one individual (non-beneficiaries) cared about the general level of well-being of others and did have preference regarding the composition of consumption bundles of others.

If individual A had such preference, they could be presented by

$$u^A = u^A\left[X^A, u^B\left(X^B, q^B\right)\right] \qquad (3.1.1)$$

In regard to equation 3.1.1, there are two individuals: A and B. An individual generally has a preference ordering over a vector of market goods X and some non-marketed resource q. The individual nonetheless has no control over the level of q, but take it as given. Here q is considered to be a scalar measure of some characteristics of the free HIV vaccination programme which could represent a measure of either quality or quantity.

A rise in q would lead to an increase in utility (u^B) of individual B, thus individual A would also be better off. A's willingness to pay (WTP) for this improvement could be defined in the usual way; however; it would not be proper to add this to B's WTP in an economic assessment of the policy, at least if the increase in q was not costless. So someone has to bear the cost of the increase in q. If individual B bears the cost, this reduces B's utility and therefore A's WTP for the increase. As long as altruism takes the form shown in equation 1, the terms representing altruism cancel out the conditions for Pareto optimality. Nevertheless, if A's altruism arises from a concern for the level of q that B experiences, then A's willingness to pay (WTP) for B's improvement in q is relevant for economic assessments.

That is, if altruism takes the paternalistic form, then the resulting non-beneficiary values are applicable to the policy analysis. Also, when paternalistic altruism prevails, existence value plays a major role in determining whether benefits exceed costs because existence value is a person's willingness to pay for the preservation, protection, or enhancement of resources for which he or she has no plans for personal use. This role that altruism plays in generating existence value, and hence its influence on benefit cost analysis, depends on the motives for altruism (Lazo et al., 1997: 35-36.; McConnell, 1998 quoted in Freeman, 2003: 141-151). Again, if non-beneficiaries have willingness to pay this free HIV programme due to altruistic reasons, their WTP values will be useful for the health policy study.

3.1.2 Discrete Choice Contingent Valuation Question Format: Double Bounded Format with a Following Open-Ended Question

CVM, a survey-based method, is commonly used for placing monetary values on health and environmental goods and services, which are not bought and sold in the marketplace. It is the only feasible method for including passive-use or non-use studies in an economic analysis, a practice that has engendered considerable controversy (Carson, 2000: 1413). In readiness for our CVM study, our questionnaire survey was based on a double-bounded format with a following open-ended question. The double-bounded format was originally developed by Hanemann, Loomis and Kanninen (1991: 1255-1263). There is some empirical and theoretical evidence that this format is quite efficient. Actually, with a given number of interviews, more information on the distribution of willingness to pay is obtained, and this information therefore reduces the variance of the estimates of mean willingness to pay (WTP). A. Myrick Freeman (2003: 166) clearly explained that this format firstly asked each respondent randomly whether he or she would be willing to pay a specified amount of money to gain the environmental change in question.

In this case, our study asked members of the general population whether they would like to pay an additional fixed amount as part of their income tax to support our one-year free HIV vaccination scheme. If a respondent answered yes, that person indicated a WTP that was higher than or equal to the specified sum. If the response was no, then that sum of money could be taken as an upper bound on their true WTP.

This is defined as “single-bounded format”. Despite this respondents had been given randomly to different subsamples; however; each subsample was asked to answer to a different amount of tax payment. Next, a follow-up question was asked of the same respondent, if the answer to the first question was yes, the respondent was asked a second question on a higher amount. If the answer to the first question was no, the respondent was asked a second question about a lower amount. This approach is called a “double-bounded format”. As for the second question, our study thus increased by one and half times the original amount when respondent answered “yes” on the first question, while the amount was lowered to two-third of the original one if respondent’s answer was “no” on the initial question. Lastly, each respondent was asked to state his/her maximum WTP amount for our free HIV vaccination scheme as an open ended question (See Figure 3.1).

Nevertheless the design of the set of first and second prices offered to subjects is a key consideration. If the range of offers is too low, the estimated mean WTP will be biased downward due to the lack of information from respondents who would likely answer yes to the first question but no to the second one (Alberini, 1995: 297-300).

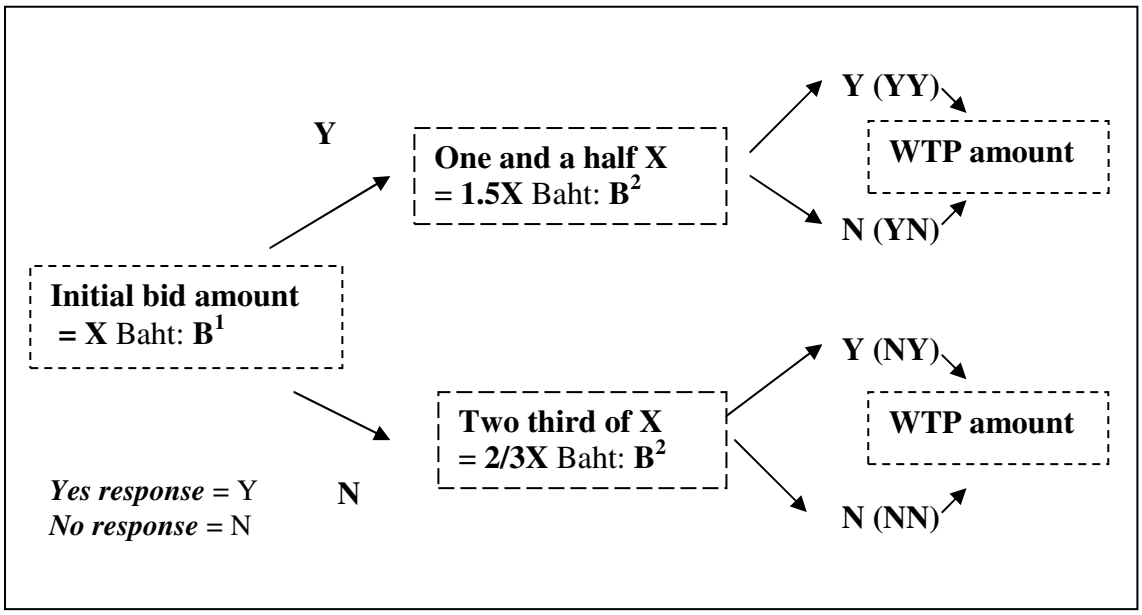
3.1.2.1 The Double-Bounded Model

Haab and McConnell (2002: 115-117) illustrated this double-bounded format (See Figure 3.1), the following general form, and gives more clearly details on its nature of efficiency gain and the attendant problems:

Let B^1 be the first bid price and B^2 be the second. The bounds on WTP therefore are

1. $B^1 \leq WTP < B^2$ for the yes-no (YN) responses;
2. $B^1 > WTP \geq B^2$ for the no-yes (NY) responses;
3. $WTP \geq B^2$ for the yes-yes (YY) responses;
4. $WTP < B^2$ for the no-no (NN) responses.

Figure 3.1 The Diagram of Double-Bounded Format with the Followed Open-Ended Question



Source: Haab and McConnell, 2002: 114-136 and author.

The general econometric model for the double-bounded data derives from this following formulation.

$$WTP_{ij} = \mu_i + \varepsilon_{ij} \qquad (3.1.2)$$

where WTP_{ij} represents the j^{th} respondent's willingness to pay, while i = 1,2 represents the first and second answers. The μ_1 and μ_2 are the means for the first and second responses. We could not make the same arguments by having the means depend on individual covariates: $\mu_{ij} = Z_{ij}\beta$. This change in notation would not effect a substantive change in the arguments. This general model includes the idea that, for an individual, the first and second responses to the CV questions are varied, perhaps motivated by different covariates, perhaps by the same covariates but with various response vectors, and with different random terms. Such a general model is not necessarily consistent with the rises in efficiency that follow intuitively from the Hanemann, Loomis and Kanninen formulation. If respondents consult the same preferences for each question, then this general model would fail in the original

framework, as we show below. For the moment, we assume that mean WTP is the same for all individuals, but potentially differs on questions.

To create the likelihood function, we at first derive the probability of observing each of the possible two bid response sequences: yes-yes (YY), yes-no (YN), no-yes (NY), no-no (NN). For instance, the probability that respondent j answers yes to the first bid and no to the second is given by

$$\Pr(yes, no) = \Pr(WTP_{1j} \geq B^1, WTP_{2j} < B^2) \qquad (3.1.3)$$

substitute (3.1.2) into (3.1.3)

$$= \Pr(\mu_1 + \varepsilon_{1j} \geq B^1, \mu_2 + \varepsilon_{2j} < B^2) \qquad (3.1.4)$$

The other three response sequences can be illustrated analogously. The j^{th} contribution to the likelihood function comes to be

$$L_j(\mu / B) = \Pr(\mu_1 + \varepsilon_{1j} \geq B^1, \mu_2 + \varepsilon_{2j} < B^2)^{YN}$$
$$\times \Pr(\mu_1 + \varepsilon_{1j} > B^1, \mu_2 + \varepsilon_{2j} \geq B^2)^{YY}$$
$$\times \Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} < B^2)^{NN}$$
$$\times \Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} > B^2)^{NY} \qquad (3.1.5)$$

For YY = 1 for a yes-yes answer, 0 otherwise, NY = 1 for a no-yes answer, etc. This formulation is related to as the bivariate discrete choice model. If the errors are assumed to be normally distributed with means zero and respective variances of σ_1^2 and σ_2^2, then WTP_{1j} and WTP_{2j} have a bivariate normal distribution with means μ_1 and μ_2, variances σ_1^2 and σ_2^2 ,and correlation coefficient ρ where $\rho = \sigma_{12} / \sqrt{\sigma_1^2 + \sigma_2^2}$. Therefore σ_{12} is the covariance between the errors for the two WTP functions.

3.1.2.2 The General Bivariate Probit

Still Haab and McConnell (2002: 117-118) demonstrated how to derive the likelihood function for the general bivariate probit model: Given the dichotomous choice responses to each question, the normally distributed model is referred to as the bivariate probit model. Therefore the likelihood function for this bivariate probit

model can be derived as follows. The probability that both $WTP_{1j} < B^1$ and $WTP_{2j} < B^2$, for example, the probability of a no-no (NN) response, is

$$\Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} < B^2) = \phi_{\varepsilon_1\varepsilon_2}\left(\frac{B^1 - \mu_1}{\sigma_1}, \frac{B^2 - \mu_2}{\sigma_2}, \rho\right) \tag{3.1.6}$$

where $\phi_{\varepsilon_1\varepsilon_2}(.)$ is the standardized bivariate normal cumulative distribution function with zero means, unit variances and correlation coefficient ρ. Exactly like (3.1.6), the probability of a no-yes (NY) response is

$$\Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} \geq B^2) = \phi_{\varepsilon_1\varepsilon_2}\left(\frac{B^1 - \mu_1}{\sigma_1}, -\frac{B^2 - \mu_2}{\sigma_2}, -\rho\right) \tag{3.1.7}$$

The probability of a yes-no (YN) response is

$$\Pr(\mu_1 + \varepsilon_{1j} \geq B^1, \mu_2 + \varepsilon_{2j} < B^2) = \phi_{\varepsilon_1\varepsilon_2}\left(-\frac{B^1 - \mu_1}{\sigma_1}, \frac{B^2 - \mu_2}{\sigma_2}, -\rho\right) \tag{3.1.8}$$

and the probability of a yes-yes (YY) response is

$$\Pr(\mu_1 + \varepsilon_{1j} \geq B^1, \mu_2 + \varepsilon_{2j} \geq B^2) = \phi_{\varepsilon_1\varepsilon_2}\left(-\frac{B^1 - \mu_1}{\sigma_1}, -\frac{B^2 - \mu_2}{\sigma_2}, \rho\right) \tag{3.1.9}$$

Let $y_{1j} = 1$ if the response to the first question is yes, and 0 otherwise, $y_{2j} = 1$ if the response to the second question is yes, and 0 otherwise, $d_{1j} = 2y_{1j} - 1$, and $d_{2j} = 2y_{2j} - 1$, then the j^{th} contribution to the bivariate probit likelihood function becomes

$$L_j(\mu / t) = \phi_{\varepsilon_1\varepsilon_2}\left(d_{1j}\left(\frac{B^1 - \mu_1}{\sigma_1}\right), d_{2j}\left(\frac{B^2 - \mu_2}{\sigma_2}\right), d_{1j}d_{2j}\rho\right) \tag{3.1.10}$$

On the whole, this bivariate probit model is a general parametic model for two-response surveys, which is firstly introduced to the contingent valuation literature by Cameron and Quiggin (1994: 218-234).

While this model is quite simple, it causes many difficulties for the contingent valuation researchers because they can get two different estimates of WTP, but they have no idea which one to use. Obviously if the bivariate probit model is estimated on a dichotomous choice CV question with a follow-up, and the parameter estimates thus indicate that either the means, or variances or both differ between the

initial bid-price and the follow-up, the researcher must decide which outcomes to use to calculate the WTP measure. Despite this, it is unclear whether an outcome of different means and variances across offered prices is a generalization of the findings in the CV literature. Because of this, we will use the interval data model to eliminate this problem.

3.1.2.3 The Interval Data Model

The interval model is the first formulation of Hanemann et al. (1991: 1259-1262). This format is that the double-bounded model provides the highest increase in efficiency, with the least ambiguity about recovered preferences. Recall the bivariate dichotomous choice likelihood function (3.1.10), if we impose the restriction that $\mu_1 = \mu_2 = \mu$. In this specific case, we would expect a raise in efficiency because both answers are used to estimate the parameter μ.

Assume also that the covariance between the two errors is zero. In terms of the normal distribution case, zero covariance implies independence, we then can write the j^{th} contribution to the likelihood function as follow

$$L_j(\mu / B) = [\Pr(\mu_1 + \varepsilon_{1j} > B^1).\Pr(\mu_2 + \varepsilon_{2j} < B^2)]^{YN}$$
$$\times [\Pr(\mu_1 + \varepsilon_{1j} > B^1).\Pr(\mu_2 + \varepsilon_{2j} > B^2)]^{YY}$$
$$\times [\Pr(\mu_1 + \varepsilon_{1j} < B^1).\Pr(\mu_2 + \varepsilon_{2j} < B^2)]^{NN}$$
$$\times [\Pr(\mu_1 + \varepsilon_{1j} < B^1).\Pr(\mu_2 + \varepsilon_{2j} > B^2)]^{NY} \qquad (3.1.11)$$

Thus we see that estimation of μ should be more efficient than a single bid model because we essentially double the number of observations. However the first case developed by Hanemann et al. (1991: 1255-1263) assumes that the model in all its parts is the same for each question. For the j^{th} individual, that is

$$WTP_j = \mu + \varepsilon_j \qquad (3.1.12)$$

so that the same error applies to each question and also the same deterministic part of preferences. At present we write the j^{th} contribution to the likelihood function as

$$L_j(\mu / B) = \Pr(\mu_1 + \varepsilon_{1j} > B^1, \mu_2 + \varepsilon_{2j} < B^2)^{YN}$$
$$\times \Pr(\mu_1 + \varepsilon_{1j} > B^1, \mu_2 + \varepsilon_{2j} > B^2)^{YY}$$

$$\times \Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} < B^2)^{NN}$$

$$\times \Pr(\mu_1 + \varepsilon_{1j} < B^1, \mu_2 + \varepsilon_{2j} > B^2)^{NY} \quad (3.1.13)$$

As for the yes-yes (YY) sequence consistent with the Bayes's rule $\Pr(a,b) = \Pr(b/a)\Pr(a)$, we can write

$$\Pr(WTP > B^1, WTP > B^2) = \Pr(WTP > B^1 / WTP > B^2).\Pr(WTP > B^2)$$

$$= \Pr(WTP > B^2) \text{ where } B^2 > B^1 \quad (3.1.14)$$

In this case, the probability that WTP is higher than B^1, given that it is also higher than B^2 when $B^2 > B^1$, is 1. Analogous reasoning also holds for the no-no (NN) sequence. And with the single error, the probability of the yes-no (YN) and no-yes (NY) pairs is just the probability that willingness to pay falls in the interval. Thus we can rewrite the j^{th} contribution following as

$$L_j(\mu / B) = \Pr(B^2 - \mu > \varepsilon_j > B^1 - \mu)^{YN}.\Pr(\mu + \varepsilon_j > B^2)^{YY}$$

$$\times \Pr(\mu + \varepsilon_j < B^2)^{NN}.\Pr(B^1 - \mu > \varepsilon_j > B^2 - \mu)^{NY} \quad (3.1.15)$$

Above all, written with the error as normal, this is the likelihood function which Hanemann et al. (1991: 1255-1263) used to estimate their parameters. Because of this, the efficiency gains particularly come from the restrictions on the range of the random preferences. This makes the double-bounded model to become a more efficient tool (Haab and McConnell, 2002: 123-124).

3.1.2.4 The Pros and Cons of the Double-Bounded Format

Double-bounded format has a distinct advantage over other WTP formats because it not only increases the information gained from each respondent, but also raises the statistical efficacy of welfare estimation in three ways. First, the answer sequences yes-no (YN) or no-yes (NY) yield obviously clear bound on WTP. Second, as regards the no-no (NN) pairs and the yes-yes (YY) pairs, there are also efficiency gains because of a follow-up question. Last, the number of responses is raised, so that a given function is fitted with more numbers of observation (Haab and McConnell, 2002: 115).

On the account of content validity, the double-bounded format nonetheless has some difficulties because the offer of the good at a second bid price ruins the incentive compatibility of the discrete choice question, while single bounded format has been considered as incentive compatibility. Therefore the actual outcome principally depends on how respondents interpret the new information they have just received. To illustrate, the second bid offer could create uncertainty about what the actual price to be charged will be. The individual then will respond differently due to this uncertainty. In other words, the person might interpret the second bid price as signaling that the agency is willing to bargain about the price. So the individual might provide a "no" answer in the hope that an even lower offer will be forthcoming (Freeman, 2003: 181-182).

Another finding by Hanemann et al. (1991: 1259-1262) confirmed that the mean WTP for the sample is lower when the second question is introduced and has been corresponded with many other studies. Also the systematic analysis of data from double-bounded models suggests that this tendency can be clearly explained by the proclivity for the initial "yes" respondents to answer "no" to the second question, regardless of the amount. The aggregate proportion of yes's to a given bid is lower, and the double-bounded responses will yield a lower mean willingness, accordingly. There are, in addition, several explanations on this for example the respondents, who firstly answered "yes" might feel they are being exploited when asked to pay an even higher amount.

In fact, an essential problem is that the respondent's expectations have been varied after the first question. At first, assuming no untoward strategic behavior, the respondent has no reason to believe that the first question will be followed by a second question. When the second question is asked, the respondents may doubt whether another will follow, and might adjust their responses strategically. Hence this is an obvious strategic behavior on the following-questions (Haab and McConnell, 2002: 124). In spite of this, using the double-bounded format has a trade-off between bias and variance, but this trade-off still has not been well characterized. So it would be a question for a future research. Our study in short measured the welfare values from both "single-bounded" and "double-bounded" formats because the former has

been principally regarded as "incentive compatible" while the double bounded model is very statistically efficient.

3.1.3 Estimation of Mean Willingness to Pay (WTP) in General

Our study will estimate the mean WTP from two different formats: double and single bounded. First, as for double bounded method the WTP function is

$$WTP_j = \mu + \varepsilon_j \tag{3.1.16}$$

$$P[Yes] = P[WTP_j > B_j] = 1 - F_c(B_j) \tag{3.1.17}$$

That is, for the j^{th} individual. This is the origin model proposed by Hanemann et al. (1991:1255-1263). Then, we assume that the preferences are the same in the first and the second stage. So, this implies that we can write out the log-likelihood function as consisting of four parts:

$$\begin{aligned}
&\Pr\{Yes/Yes\} = P[WTP_j > B_H] = P^{yy} = 1 - F_c(B_H) \\
&\Pr\{No/No\} = P[WTP_j < B_L] = P^{nn} = F_c(B_L) \\
&\Pr\{Yes/No\} = P[B < WTP_j < B_H] = P^{yn} = F_c(B_H) - F_c(B) \\
&\Pr\{No/Yes\} = P[B_l < WTP_j < B] = P^{ny} = F_c(B) - F_c(B_L)
\end{aligned} \tag{3.1.18}$$

where F_c is any underlying WTP distribution, B is initial bid, B_L is lower bid in the follow-up question, B_H is higher bid in the follow-up question. Given these, the log-likelihood function for double bounded model is

$$InL = \sum_{i-1}^{n} \left[I_{yy} InP_i^{yy} + I_{nn} InP_i^{nn} + I_{yn} InP_i^{yn} + I_{ny} InP_i^{ny} \right] \tag{3.1.19}$$

where I_{xy} is a function indicator that equals one when the two responses are XY, and zero otherwise. To continue this analysis, it is necessary to make assumptions about the distribution type of the WTP responses, which is $\mu_1 = \mu_2 = \mu$. An analysis of respondents' answers to debriefing questions has led to the assumption that for all respondents in the sample, the WTP for a one-year free HIV vaccination programme takes a positive value.

Second, for the single bounded format our mean WTP under the linear random utility model for the standard normal distribution can be defined as. Let us begin the

simplest utility function, a linear in income (M). For individual j the indirect utility for a certain level of our free HIV vaccination scheme:

$$v_{ij} = \alpha_i + \mu M + \varepsilon_{ij} \tag{3.1.20}$$

where μ is the marginal utility of money and $i = 0$ or 1.

This is a rather restrictive functional form, even though we can extend it somewhat by allowing for interaction terms with socio-economic characteristics.

To form the probabilities of the responses we can use the utility levels for the two responses- No and Yes are

$v_{oj} = \alpha_0 + \mu M + \varepsilon_{oj}$: No response

$$v_{1j} = \alpha_1 + \mu(M - B_j) + \varepsilon_{1j} \text{ : Yes response} \tag{3.1.21}$$

The change in the deterministic part of the utility is $\Delta U = \alpha - \mu B_j$, where $\alpha = \alpha_1 - \alpha_0$. Thus the probability that a respondent will say Yes (see 3.1.31 and 3.1.32) to an initial bid B_j can be expressed as

$$P[Yes] = P[\Delta U \geq \eta_j] = P[(\alpha - \mu B_j \geq \eta_j)] = F_\eta(\Delta U) \tag{3.1.22}$$

where $\eta_j = \varepsilon_{1j} - \varepsilon_{0j}$ and F_η is the CDF of η_j

So our error terms are assumed as independently and identically distributed (IID) with mean zero, which is defined as the normal distribution. Then, the WTP for our free HIV vaccination scheme is given by the following condition:

$$\alpha_0 + \mu M + \varepsilon_{oj} = \alpha_1 + \mu(M - WTP_j) + \varepsilon_{1j} \tag{3.1.23}$$

Solving this, yields the following expression for individual *j* 's WTP:

$$WTP_j = \frac{\alpha + \eta_j}{\mu} \tag{3.1.24}$$

We should note that WTP is a function of the random part of the utility function. Thus the distributional assumption about the error term of the utility function will have an effect on the distribution of the WTP. Also, given this linear

utility function, WTP is not a function of income. As for the mean WTP[1] or the expected value, in this case of a linear utility function for the standard normal distribution is

$$E\left[WTP_j\right] = E_\eta\left[\frac{\alpha+\eta_j}{\mu}\right] = \frac{\alpha}{\mu} + \frac{E\left[\eta_j\right]}{\mu} = \frac{\alpha}{\mu} \text{ since } E[\eta] = 0 \text{ or}$$

$$\text{The mean } WTP = \frac{\alpha}{\mu} \tag{3.1.25}$$

Therefore our mean WTP must be non-negative but not exceed the discretionary income of a household: $0 < mean(WTP) < M$ and the median WTP in this case is also $\frac{\alpha}{\mu}$.

3.1.4 The Random Utility Model

Our public demand analysis was mainly based on the random utility model log-linear in income, which originally came from the random utility theory (Hanemann, 1984: 332-341; McFadden, 1974: 105-142). The key idea behind random utility theory is that even if we assume that individuals know their utility, the researcher is unable to observe the utility or the preferences completely. From the researcher's point of view, there are random elements of the utility function which are unobservable. These unobservable elements could be individual characteristics, measurement error and/or heterogeneity of the preferences. Therefore a random element, denoted ε is introduced in the utility function (Carlsson, 2007: n.d. 1-2; Haab and McConnell, 2002: 24-26):

Suppose that an individual is confronted with contingent valuation (CV) scenario, which a discrete change in an environmental good from q_0 to q_1 is proposed. Thus the indirect utility function is

$$V(p, q, M, \varepsilon) \tag{3.1.26}$$

where p is a vector of prices, M is income and ε is a random disturbance. To simplify, we delete the price vector from the indirect utility function. Then, suppose

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[1] See more details on Haab and McConnell, 2002: 32-36.

that the change in the environmental good in regard to an improvement is;

$$V(q_1, M, \varepsilon) \geq V(q_0, M, \varepsilon) \tag{3.1.27}$$

In the CV scenario, a certain bid or cost is therefore proposed. So the probability which the respondent will answer with a Yes to the suggested improvement given the bid B_j for the j^{th} individual can be written as

$$P[Yes] = P[V(q_1, M - B_j, \varepsilon_1) \geq V(q_0, M, \varepsilon_0)] \tag{3.1.28}$$

It is vital to be aware of the assumptions that we used while we set up this probability. In that regard, we assumed that individual understands the proposed change in the environmental good, so it is capable of evaluating the effect of this change on his or her utility as well as consider the proposed bid level. Also his or her response still depends on this evaluation. Given these assumptions, we have to add more assumptions in order to be able to analyze easily. An additional general assumption is that the deterministic and stochastic parts of the utility function are additively separable, so

$$v(q_i, M) + \varepsilon_i \text{ where } i = 0 \text{ or } 1 \tag{3..1.29}$$

With this assumption, we rewrite the probability of a Yes response in (3.1.28) with a substitute of (3.1.29), therefore

$$P[Yes] = P[v(q_1, M - B_j) - v(q_0, M) + \varepsilon_1 - \varepsilon_0 \geq 0] \tag{3.1.30}$$

The interpretation of the above probability is that individual will respond with a Yes if the sum of the deterministic change in utility, $\Delta U = v(q_1, M - B_j) - v(q_0, M)$ and the difference in the errors terms, $\eta = \varepsilon_1 - \varepsilon_0$, is greater than zero. Hence the probability can be again written as

$$P[Yes] = P[\eta \geq -\Delta U] \tag{3.1.31}$$

From probability theory, we can have

$$P[Yes] = P[\eta \geq -\Delta U] = 1 - F_\eta(-\Delta U) \tag{3.1.32}$$

where F_η is the cumulative density function(CDF) of η. For a symmetric distribution we also have $F(x) = 1 - F(-x)$. As a result, we assume that η is symmetrically distributed, thus we can write the Yes probability as

$$P[Yes] = F_\eta(\Delta U) \tag{3.1.33}$$

On the contrary, the probability of a No response is

$$P[No] = 1 - F_{\eta}(\Delta U) \tag{3.1.34}$$

3.1.5 The Random Utility Model Log Linear in Income

At first we assumed that our utility function was logarithmic in income because we might expect WTP to be increasing in income, but at a decreasing rate. Therefore we will introduce the covariates directly in this utility function. Then,

$$v_{ij} = \beta_i z_j + \mu InM + \varepsilon_{ij} \tag{3.1.35}$$

For individual j the indirect utility for a certain level of the public good where μ is the marginal utility of money, M is income, $i = 0$ or 1, z_j is a vector of socio-economic characteristic such as household characteristics, β_i is the corresponding vector of parameters, and ε_{ij} is a component of preferences known to the individual respondent but not observed by the researcher. In order to form the probabilities of the responses we can use the result from (3.1.28) to (3.1.30). The utility function levels for the two responses- No and Yes respectively are:

$$v_{0j} = \beta_0 z_j + \mu InM + \varepsilon_{0j} \tag{3.1.36}$$

$$v_{1j} = \beta_1 z_j + \mu In(M - B_j) + \varepsilon_{0j} \tag{3.1.37}$$

The change in the deterministic part of the utility is $\Delta U = \beta z_j + \mu In\left(1 - \frac{B_j}{M}\right)$

where $\beta = \beta_1 - \beta_0$. Using the results from (3.1.30) to (3.1.32), we have the probability that an individual will respond a Yes to a proposed bid B_j can be described as

$$P[Yes] = P[\Delta U \geq \eta] = P\left[\beta z_j + \mu In\left(1 - \frac{B_j}{M}\right) + \eta_j \geq 0\right] = F_{\eta}(\Delta U) \tag{3.1.38}$$

where $\eta_j = \varepsilon_{1j} - \varepsilon_{oj}$ and F_{η} is the CDF of η.

Assumed that our error term is normally distributed $\varepsilon_j \sim N(0, \sigma^2)$. We want to estimate the model, so we have to convert the distribution to a standard normal $\theta_j \sim N(0,1)$. Let $\theta = \varepsilon / \sigma$ then $\theta_j \sim N(0,1)$.

The probability of a Yes response is then described as

$$P[Yes] = P[\eta_j \leq \Delta U] = \phi\left(\frac{\beta z_j}{\sigma} + \frac{\mu}{\sigma} In\left(1 - \frac{B_j}{M}\right)\right) \quad (3.1.39)$$

where $\phi(x)$ is the standard normal CDF. Also the parameters are divided by the unknown scale parameter (Carlsson, 2007: n.d. 10-11; Haab and McConnell, 2002: 36-37). Therefore this form is called standard normal distribution or Probit estimation (See Appendix I)

3.1.6 A General Form for Our Public Demand Model

As has been said, our study used the random utility model log-linear in income in order to estimate the public demand for a free HIV vaccination programme. Therefore we presumed that the WTP depends on income, so this log-linear model is able to capture the income effect, while the linear utility function does not account for it (Bateman et al., 2002: 184-188). The general form of the indirect utility function in the log-linear model (3.1.35) again is

$$v_{ij} = \beta_i z_j + \mu InM + \varepsilon_{ij}$$

where i = 0 or 1 and for j^{th} individual $(j = 1,....600)$, μ is marginal utility of income, M is income, z_j is a vector of household characteristics such as gender, the knowledge of HIV/AIDS, demographic characteristics, or questionnaire variations etc, β_i is the corresponding vector of parameters, and ε_{ij} is an error term assumed to be normally distributed $\varepsilon_j \sim N(0, \sigma^2)$.

The v_{ij} is defined as the binary variable for j^{th} respondent where

$v_{1j} = 1$ if respondent (j) says "Yes" on the initial rate of tax payment (B)

on WTP to support our free HIV vaccine scheme or the state or condition that prevails when our one-year free HIV vaccination programme is implemented.

$v_{0j} = 0$ if respondent (j) says "No" on the initial rate of tax payment (B) on WTP to finance our free HIV vaccine scheme or the status quo.

Consequently our public demand model has been estimated as probit model because we assumed that our error term is normal distribution, so the probability of a

Yes response which implied that our free HIV vaccine scheme is carried out, is again (3.1.39) described as

$$P[Yes] = P[\eta_j \leq \Delta U] = \phi\left(\frac{\beta z_j}{\sigma} + \frac{\mu}{\sigma} In\left(1 - \frac{B_j}{M}\right)\right)$$

where $\phi(x)$ is the standard normal CDF.

3.2 Methodological Issue

3.2.1 State of Work

3.2.1.1 Focus Group

Before the questionnaire had been designed and written, our study conducted 12 focus groups: pre and post-questionnaire focus groups (See Appendix E and F). Each focus group normally had 6-11 participants, selected to be homogenous on sex, age, education and occupation. We conducted six pre-questionnaire focus groups with the aim of constructing a questionnaire structure including the CV scenario, the following-up questions, and payment method. Prior to constructing our CVM draft questionnaire, we asked these six focus groups whether they chose to pay either for a free HIV vaccination programme or for research on HIV vaccination. Of these focus groups, more than half preferred to pay for a free HIV vaccination scheme because it was more practical and useful, while there was no guarantee that the HIV research would be carried out. On this account they mostly were willing to pay for vaccination of teenagers rather than either sex workers or injecting drug users.

Despite this, focus groups did not substitute for the main survey because the participants were not randomly selected and were too small a sample to yield reliable estimates (Bateman et al., 2002: 153). As for this free HIV vaccination scheme, we had one-to-one interviews with several HIV vaccine experts (See Appendix D) before we finally chose which target group between teenagers, commercial sex workers and injecting drug users would be taken into account.

As a result of many HIV vaccine specialists recommending using commercial sex workers (CSWs) as the target group in this free scheme because of the lowest cost with highest benefit., our study ended up choosing CSW as the target

group. After the questionnaire had been drafted, we had another six post-questionnaire focus groups and again some HIV vaccine experts' comments[1] to debrief us about its contents, structure or wordings, and tax rate payments. This was a useful approach for fine-tuning the questionnaire, the survey instrument, and detecting early problems.

3.2.1.2 Pre-Testing

After the CVM questionnaire had been tested out by focus groups and commented on by many HIV/AIDS specialists, it was then been pre-tested in terms of carrying out a field pilot survey. Our pilot survey, conducted during the period from November 1-15, 2008, was done with a draft questionnaire to a sample of 200 respondents similar to the ones which would be used in the final survey and under the same conditions to be followed in the final survey. During our face-to-face pilot survey, we asked respondents to describe the meaning of each question, to explain their answers, and to state any problems and difficulties they have had regarding our draft questionnaire. This in fact served the purpose of fine-tuning the questionnaire and of training the enumerators (See Appendix G). The responses in this pilot survey were also coded and analyzed to ensure the adequacy of data collected. This alerted us to some problems in the questionnaire design and allowed for improvements prior to the beginning of the actual survey. Added to this, this 200-questionnaire-pilot survey served to decide a possible range of the rate on tax payment for the maximum WTP to be used in this study's final double bounded format question. From this, we decided on the range of "one-off" yearly income tax payments as follows: THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000 respectively.

3.2.1.3 Survey

Our study was conducted in Bangkok, the capital city of Thailand. Even though Bangkok does not represent the whole of Thailand, it has the highest population density[2] in the nation. Also, there are huge unregistered influxes of

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[1] Prof. Dale Whittington, Chutima Suraratdecha, PhD and Dr.Charung Muengchana.

[2] According to Ministry of Interior Thailand, Bangkok as of 2008 has the number of populations, which are 5,700,523 and the population density is 3635.07lnh/km^2.

migrants from across the country, which makes Bangkok a crowded city in the prime centre of politics, economics and socio-culture in the country.

Therefore our sampling procedure was basically based on multistage area sampling, which did not require a complete sample frame. It was also more convenient as well as more economical than one-stage simple random sample when the CV survey was conducted for the large populations (Bateman et al., 2002: 99). Since our target population was taxpayers aged between 20 and 60 years old who were working in Bangkok, we employed a three-state design for our multi-stage sampling.

As for the first stage we randomly sampled 15 of the 50 districts or “khet” in Bangkok as seen in Table 3.1.Then at the second stage, within each sampled district we did a quota sample concerned with its population density to select the number of samples. So, the higher the population density within a district was, the higher proportion we selected the number of samples within a sampled district to be. This ended up with a total of 600 selected samples.

Table 3.1 Multistage Area Sampling, 15 Sampled Districts Conducted on this Survey

Sampled district	Total population	Male	Female	Density[a]	Sampled quota[b]
Bang Kapi	149,093	68,489	80,604	5,227	23
Bang Na	101,667	48,170	53,497	5,411	24
Bang Rak	50,023	23,621	26,402	9,036	40
Chatuchak	169,113	80,559	88,554	5,139	23
Din Daeng	146,031	69,142	76,889	17,480	78
Don Mueang	159,506	79,150	80,356	4,334	19
Huai Khwang	76,213	35,522	40,691	5,070	23
Khlong Toei	122,919	59,466	63,453	9,460	42
Lat Phrao	117,711	54,420	63,291	5,386	24
Pathum Wan	63,192	29,686	33,506	7,551	34
Phaya Thai	77,232	38,228	39,004	8,049	36
Phra Nakhon	67,357	32,504	34,853	12,167	54
Ratchathewi	99,827	48,604	51,223	14,009	62
Sathon	95,089	45,616	49,473	10,196	45
Thon Buri	136,971	65,272	71,699	16,018	71
Total	**1,763,589**	**849,495**	**914,094**	**134,533**	**600**

Source: Department of Provincial Administration. Bureau of Registration Administration, 2005.

Note: a) Density population per square kilometers.

b) It is in proportion to its density population.

As for these 600 samples, we randomly chose any person aged between 20 and 60 years old from each sampled quota in terms of the our final stage selection. So a randomly chosen person must be a taxpayer with Thai nationality, who has been working in Bangkok regardless where he originally came from. Our study, as a result, selected 600 samples which were people in Bangkok metropolitan area aged between 20-60 years old who still work and also pay taxes.

According to our 600 samples in this survey, we selected a sample size with the criteria on the estimation of the coefficient of variation, V where:

$$V = \frac{\sigma}{\overline{TWTP}}$$

σ is also the standard deviation of WTP responds and $\overline{TWTP}$ is the true WTP or the population mean. Mitchell and Carson (1993: 224-225) clearly explained the following formula for the necessary sample size, N:

$$N = \frac{Z\hat{\sigma}}{\delta \overline{RWTP}}$$

where N is the sample size needed. $\overline{RWTP}$ is the mean of the estimated WTP bids, δ is the percentage difference between the true willingness to pay and $\overline{RWTP}$, $\hat{\sigma}$ is the estimated standard deviation to the WTP response, and Z represents the critical values for t-statistics. Table 3.2 presents the indicated sample sizes for different combination of relative error (V), confidence levels $(1-\alpha)$ and the percentage difference between $\overline{TWTP}$ and $\overline{RWTP}$ which researcher is willing to tolerate (δ).

Table 3.2 Sample Sizes Needed (Usable Responses)

		δ [b]						
		0.05	**0.1**	**0.15**	**0.2**	**0.25**	**0.3**	**0.5**
V[a] = 1	α **=0.1**	1,143	286	127	72	46	32	12
V = 1	α **=0.05**	1,537	385	171	97	62	43	16
V = 1.5	α **= 0.1**	2,571	643	286	161	103	72	26
V = 1.5	α **= 0.05**	3,458	865	385	217	139	97	36
V =2.0	α **= 0.1**	4,570	1,143	508	**286**	183	127	46
V =2.0	α **= 0.05**	6,174	1,537	683	385	246	171	62
V = 2.5	α **= 0.1**	7,141	1,786	794	447	286	199	72
V = 2.5	α **= 0.05**	9,604	2,401	1,608	601	385	267	97
V = 3.0	α **= 0.1**	10,282	2,570	1,143	643	412	286	103
V = 3.0	α **= 0.05**	13,830	3,458	1,537	865	554	385	139

Source: Mitchell and Carson, 1993: 225.

Note: a) V is the coefficient of variation $\frac{\sigma}{\overline{RWTP}}$ where V of at least 2.0 is advisable.

b) δ is the possible deviation as percentage of $\overline{RWTP}$

Since our survey used the "split sample technique" with respect to two types of vaccine effectiveness: 30 and 70%,in each type, we selected 300 samples in accordance with the standard deviation of WTP responds shown in Table 3.2. Value circle in Table 3.2 indicates that a sample size of 286 usable WTP amounts for each type of vaccine effectiveness would be required because our study anticipated a coefficient of variation of 2.0 and was willing to accept a δ of 0.20, and also wanted a two-sided 90 percent $(1-\alpha)$confidence level$(t=1.645)$. Assuming that $\overline{RWTP}$ is 100, the 90 percent interval for $\overline{TWTP}$ will be around [60,140], accordingly. We therefore rounded the sample sized to 300 for each split sample. With two split samples of our study, we finally come up with 600 sample sizes. Because of limitation on survey budget, many studies compromised with lower standard of precision for each split sample estimates than for the overall group estimates. This is a trade-off between survey budget cost and its precision (Bateman et al., 2002: 110-111). Of the total 600 sample sizes, we had the face-to face interviews in line with our questionnaire format, double bounded with a following open-ended question. On top of this 600 sample sizes, we still had to be prepared for the unusable WTP responses, for example non-respondents and protest zeros by adding more 5-10% to the sample sizes.

3.2.2 Respondent and Survey Protocol

Our one-year free HIV vaccination programme had been assigned two different levels of vaccine effectiveness (30% and 70%) with regard to our target group, CSW. These levels had been under discussion with many HIV/AIDS vaccine experts (See Appendix D). Also a range of six one-off income tax payments- THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000. (US$15, US$45.50, US$61, US$106, US$152, and US$182[1])- were applied to these two types of vaccination programme, yielding 12 possible combinations of tax payment and vaccine effectiveness as shown in Table 3.3. This wide range of income tax payments was set during the pilot survey

[1] 1 USD = THB 33 as of October 23, 2008.

and was intended to try to reach both extremes of the demand continuum, for example low rate-high demand and high rate-low demand.

This split-sample technique was used in our study with the aim of estimating respondents' willingness to pay as well as testing the reliability and consistency of respondents' answers. For example, different respondents in a CV survey will receive various sets of information to consider. If ones talked with another about their interviews, they might get confused as to why they were told something totally different to others in the community (Whittington, 1998: 21-30; 2004: 511).

Table 3.3 Distribution of Respondents in Sample with Respect to Various Tax Payments and Vaccine Effectiveness

	Total = 600	
Target group	**CSW (n =600)**	
Effectiveness	**30% (n= 300)**	**70% (n=300)**
Payment= 500 baht	50	50
Payment= 1,500 baht	50	50
Payment= 2,000 baht	50	50
Payment= 3,500 baht	50	50
Payment= 5,000 baht	50	50
Payment= 6,000 baht	50	50

Source: Author.

Moreover Whittington (2002: 335-345) stressed the importance of using "split sample technique" in the CV design with two good reasons. First, a CV researcher can use this split sample technique to gain more understanding of the question of whether he or she made the "right" design choice with respect to a few critical issues. Our study for instance can learn whether a respondent's answer can be manipulated by changes in survey design or the information of vaccine effectiveness presented in the CV scenario in ways that a "reasonable observer" might anticipate. A failure of such techniques to elicit the response that was expected raised doubts about the confidence one can place in CV results and the research design choices that were made. Second, conducting a CV survey has given the funding agency an opportunity to learn more

about what works and does not work in terms of different research design choices in a specific culture. Funding agencies in fact need to know whether one method of conducting CV surveys is more likely to yield accurate, reliable answers and the cost implements of various research designs. Then the use of split sample technique will provide the funding agencies with the opportunity to collate information which can benefit its future operational work. Consequently each respondent in our study was randomly asked about their willingness to pay by only one type of free vaccination programme with respect to the vaccine effectiveness and income tax payment from the array of 12 as shown in Table 3.3.

In this regard our total sample size of 600 was mainly based on a target of approximately 50 completed interviews per experimental design point, to illustrate, for each of a combination of the payment and vaccine effectiveness. Because of a one-time payment, each respondent was asked whether he or she would be willing to pay through their income tax payments in order to support our free HIV vaccination programme.

3.2.3 Questionnaire Structure

Our survey questionnaire(See Appendix B) was composed of six sectors: (1) demographic characteristics of the respondent and the household as well as socio-economic information, (2) perception and attitudes towards the HIV/AIDS knowledge, (3) perception and attitudes to vaccination, (4) understanding and opinion of the current social problems about the HIV/AIDS situation in Thailand, (5) assessment of WTP for a free HIV vaccination programme, and (6) assessment of the sexual behavior towards our scheme. Also sector (5) provided more explanation for the CV scenario, the target group on the free vaccination programme, the hypothetical vaccine characteristic, and the assessing perception of vaccine effectiveness.

3.2.4 The Assessing Perception of Vaccine Effectiveness

The process of explaining and checking understanding of the vaccine effectiveness concept followed the prior work by Suraratdecha et al. (2005b: 283-285) and Do Gia Canh et al. (2006: 243), added to this, and described that vaccine effectiveness was explained by the joint probability of (i) being exposed to illness and

(ii) being protected by a vaccine. As shown in Figure 3.2, the full description of this vaccine effectiveness concept as a visual card is depicted as many light and yellow smiling faces standing for persons with different levels of protection from HIV/AIDS disease.

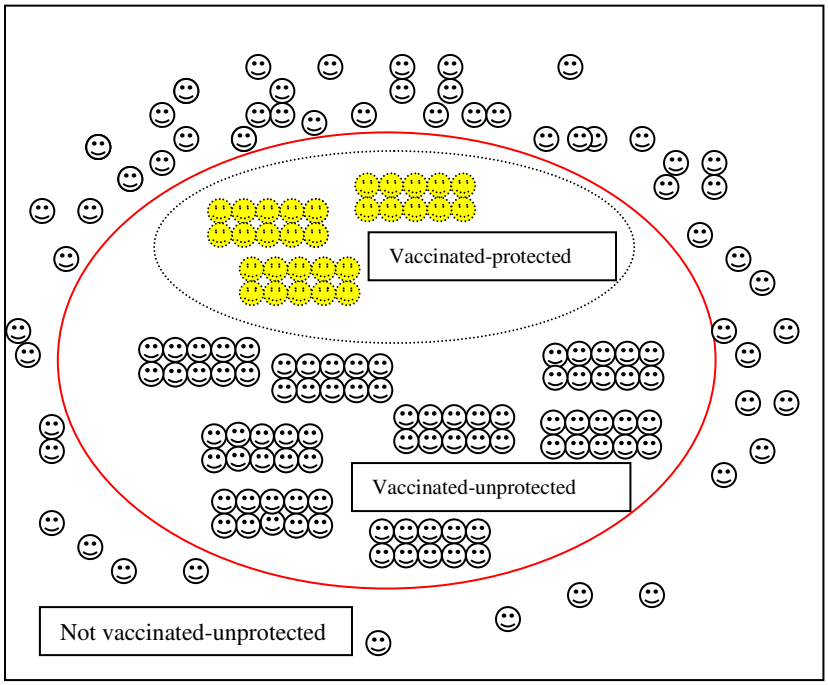

Figure 3.2 The Visual Card Used for Explaining Vaccine Effectiveness
Source: Do Gia Canh et al. (2006: 244) and author.

This visual card shows that if each of these little smiling face figures symbolizes a person. Under the red circle, the 100 smiling face figures represent 100 people who have been vaccinated, while those smiling faces outside the red circle stand for who have not received a vaccine. This HIV vaccine is not fully 100% effective; however; it is only [30 or 70%] effective. Of the 100 people having been vaccinated in this circle, there will be only [30% or 70%] of them protected because the vaccine works well for them. The vaccine hence prevents them from getting HIV for a period of 15 years. So the yellow smiling faces inside this circle describe these people.

The rest of people who are in circle [70 people or 30 people] will not be protected from HIV disease, although they have already been vaccinated because the vaccine is ineffective in protecting them against HIV. As a result, they are still at the same risk of getting infected with HIV as before they received the HIV vaccination, or people who outside the circle have not received an HIV vaccine. People who get the HIV vaccine are unable to know whether the vaccine will work for them and they are being protected or they can still contract HIV disease. Therefore respondents verified their perception of vaccine effectiveness after listening to the explanation of this concept. This issue will therefore be discussed in detail in Appendix H and also sector 3.3.1 on (g).

3.2.5 Contingent Valuation (CV) Scenario

Until now an HIV/AIDS vaccination programme has never existed because an HIV/AIDS vaccine is not available. The XVIIth International AIDS conference held in Mexico City presently confirmed that there is a little hope of an HIV/AIDS vaccine. For example, one big trial reported that it has more than just failed, as for many of participants the vaccine seemed to make things worse. Beside that the consensus among vaccine researchers presently seems to be that future HIV/AIDS trials should be deserted and the money saved spent on the basic science (The Economist, 2008: 75).

As there has never been an HIV/AIDS vaccination programme, we used a CV technique to collect data from the general population with regard to the public support for on a free HIV vaccination scheme. The face-to-face interview survey-based method, measuring respondents' preferences for presently unavailable goods, has been broadly used in the field of both health and environmental economics (Carson, 2000: 1413-1418). While explaining our CV scenario, our enumerators showed a "storyboard" which was composed of 4 illustrations to built up a clear picture of our CV scenario.

Our survey asked both males and females as part of the general population in Bangkok how much they were willing to pay for supporting a one-year free HIV vaccination programme with respect to different vaccine effectiveness, and at a range of "one-off" payments, which they would be willing to make as part of their income.

In this regard the CV scenario was divided into 30% and 70% vaccine effectiveness discussed in this following statement.

CV Scenario with 30% vaccine effectiveness

> Although there has recently been an overall decline in the rate of new HIV infections in Thailand, there has been a shift in new infections from high risk to lower risk groups such as women, in particular young women and housewives. These women have mostly been infected through sex with their male partners who had engaged in unprotected sex, either with commercial sex workers or with other partners. On account of this, the Thai government is concerned about this issue, and then supposedly initiates "A free HIV vaccination programme" under the administration of department of AIDS, Ministry of Public Health. Assuming that, this scheme takes only one year by sending many professional officers or staff to vaccinate both male and female commercial sex workers over the age of 15 for free in red light districts, bars, night clubs, saunas, and discos around major cities such as Bangkok, Phuket, Pattaya, and Chiang Mai. The HIV vaccine attributes used in this programme are 30% effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and a one dose injection.
>
> This HIV vaccine, in fact, would not be of any benefit to people who have already contracted HIV/AIDS. Also, this programme will neither provide blood testing due to the costs involved in testing, nor verify people by their blood test results due to the conflict with the privacy. By vaccinating male and female sex workers with a highly effective 30% vaccine under this scheme, it is expected that this will prevent 370,000 new infections nationwide per year. The scheme will need to be financially supported by the public because the government

budget is limited. Because of this, Thai taxpayers aged between 20 and 60 years old countrywide will be responsible for financing this programme through their yearly income tax payments. The payment will be a one-time payment for financing this one-year free HIV vaccination scheme.

CV Scenario with 70% vaccine effectiveness

Although there has recently been an overall decline in the rate of new HIV infections in Thailand, there has been a shift in new infections from high risk to lower risk groups such as women, in particular young women and housewives. These women have mostly been infected through sex with their male partners who had engaged in unprotected sex, either with commercial sex workers or with other partners. On account of this, the Thai government is concerned about this issue, and then supposedly initiates “A free HIV vaccination programme” under the administration of department of AIDS, Ministry of Public Health. Assuming that, this scheme takes only one year by sending many professional officers or staff to vaccinate both male and female commercial sex workers over the age of 15 for free in red light districts, bars, night clubs, saunas, and discos around major cities such as Bangkok, Phuket, Pattaya, and Chiang Mai. The HIV vaccine attributes used in this programme are 70% effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and a one dose injection. This HIV vaccine, in fact, would not be of any benefit to people who have already contracted HIV/AIDS. Also, this programme will neither provide blood testing due to the costs involved in testing, nor verify people by their blood test results due to the conflict with the privacy. By vaccinating male and female sex workers with a highly effective 70% vaccine under

> this scheme, it is expected that this will prevent 1.9 million new infections nationwide per year. The scheme will need to be financially supported by the public because the government budget is limited. Because of this, Thai taxpayers aged between 20 and 60 years old countrywide will be responsible for financing this programme through their yearly income tax payments. The payment will be a one-time payment for financing this one-year free HIV vaccination scheme.

Afterwards the respondents were asked to state what their maximum willingness to pay for supporting this programme would be, using the method of double bounded questions (See more details on Appendix B and H).

3.2.6 The Target Groups on a Free HIV Vaccination Programme

As has been said previously, the target group in our study was commercial sex worker (CSWs). Our CV scenario will place emphasis on CSWs over the age of 15, both male and female, which are regarded as a high risk group, because the HIV prevalence in Thailand has been gradually moving from high risk groups into low risk groups such as women. Of new infections in Thailand in 2005, 43% were among women, the majority of who were infected with HIV/AIDS disease from their husbands or partners who had been infected through either unsafe paid sex or drug injection (UNAIDS, 2007b: 24-25). Hence commercial sex workers were one of the key issues, in 2005 almost 49% of HIV infections in the South and Southeast Asian region were between sex workers and their clients (SEARO-WHO, 2007: 3). HIV prevalence among men who have sex with men (MSM) in Thailand has been rated as the most serious problem. There was clear evidence that there was a significant increase in the infection levels from 17.3% in 2003 to 28.3% in 2005 for the overall HIV prevalence among MSM in Bangkok. Of MSM in Bangkok, 22.3% had sex with both male and female partners during the past 6 months, 36% also had unprotected sex with their causal and steady male partners during the past of 3 months (SEARO-WHO, 2007: 9; Van Griensven et al., 2005: 523-524). In that regard, it could possibly imply that this MSM group might have unsafe sex with their sex partners particularly

in both female and male, or perhaps with commercial male sex workers[1]. Also, the World Bank (2006: 13) claimed that commercial sex workers in Thailand remain the prime risk group. Of the rate of HIV/AIDS prevalence in 2003, 12% were female sex workers, followed by 8% who were male sex workers.

This illustrated that Thai women, previously regarded as a low risk group, have possibly been infected with HIV through their male partners or husbands who probably had sex with either male or female commercial sex workers. Due to gender inequality, women who found out their HIV status was positive, have been in danger of being beaten, abandoned and thrown out from their homes. On the other hand, if their male partners have been infected with HIV/AIDS, women in fact have become the home care takers in terms of nursing the sick and taking in AIDS orphans, while attempting to earn an income as the breadwinner, which is only family means of support (UNAIDS, UNFPA and UNIFEM, 2004: 31-45). Despite this our free HIV vaccination programme would be administered only to commercial sex workers who were not infected with HIV, so our target groups to be vaccinated must be tested as HIV-negative.

3.2.7 The Vaccine Characteristic in this Free Vaccination Programme

Our vaccine characteristics were primarily based on the advice of several HIV/AIDS vaccine specialists (See Appendix D) as well as our literature reviews with regard to a potential HIV/AIDS vaccine. As for the vaccine characteristics in this study: vaccine effectiveness, side-effects, duration of protection, number of dose, route, and the protection (cross-clade) were all taken into consideration. On this account, our hypothetical HIV/AIDS vaccine attributes were 30% or 70% effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and one dose injection. Among these attributes, vaccine effectiveness was the most influential factor followed by side-effects and duration of protection,

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[1] Our study included male commercial sex workers who were in brothel and non-brothel base. However, this issue was beyond our scope of study, our study hypothesized that commercial male sex workers will possibly cause females in Thailand to become the new HIV/AIDS infections.

according to many studies (Newman et al., 2006: 2097; Sung-Jae Lee et al., 2008: 6; Suraratdecha et al., 2005b: 279).

Table 3.4 Total Number of New HIV/AIDS Infection Averted in Accordance with Different Vaccine Efficacy and Coverage in Low-and-Middle-Income Countries

Vaccine efficacy	Coverage	Total new infections averted by an HIV/AIDS vaccine[a]
30%	20%	5.5 million
50%	30%	17 million
70%	40%	28 million

Source: IAVI. 2006: 5

Note: a) Total number of new HIV/AIDS infections averted during the period of 2015-2030 if an AIDS vaccine does exist in 2015

Furthermore many HIV/AIDS scientists confirmed that if the first generation of HIV/AIDS vaccine does exist, it will have only partial effectiveness (IAVI, 2008a). Our study therefore chose 30% and 70% vaccine effectiveness with a different percentage of coverage. In spite of this, a partially effective HIV/AIDS vaccine given a certain percentage of coverage can reduce the number of new infections by 20% to 80%. According to Table 3.4, if vaccine was introduced by 2015, which is the United Nations' goal, it will greatly decrease number of new HIV infections in accordance with different efficacy and coverage (IAVI, 2006 and IAVI, 2008b). A 50% effective vaccine given to just 30% of the population could reduce the number of new infections in the developing world by 17 million over a period of 15 years. On this basis, if we choose a 30% efficacy HIV/AIDS vaccine, given to 20% of the target population will protect approximately 370,000 people from newly HIV/AIDS infection per year. Similarly with a 70% efficacy vaccine, given to only 40% of the target population can guard people against HIV/AIDS disease with an estimated 1.9 million new HIV/AIDS infections annually.

Table 3.5 Vaccine Scenario with Different Vaccine Effectiveness and Coverage

Target group[a]	Vaccine effectiveness	Number of vaccine coverage	Number of newly infections averted[d]
Commercial sex workers (over the age of 15)	30%	40,000[b]	370,000
	70%	75,000[c]	1.9 million

Source: IAVI, 2006: 5; National Statistical Office, 2005-2007; Viroj Tangcharoensathien et al., 2001: 123-124.

Note: a) both male and female; b) 20% of an estimated commercial sex workers; c) 40% of an estimated commercial sex workers; d) an average of number of newly infections averted per year.

Regarding Table 3.5, our study focused on commercial sex workers as the target group, so that given the different vaccine efficacies and coverage rates, the vaccine would considerably reduce the number of new infections. In addition, to vaccinate a high risk group like commercial sex workers was found to be more cost-effective because the benefits from the number of newly infections averted were far more than the costs of the vaccination. In other words it may suggest that vaccination should be available to everyone, but targeting high-risk groups, as the first and foremost strategy, results in the highest cost-effectiveness as well as providing enormous health and economic benefits for our society.

3.2.8 Payment Mechanisms

As has been noted, our study asked the general population including both males and females how much they would be willing to pay as a "one-off" yearly income tax payment for supporting a one-year free HIV vaccination programme. So use of yearly income tax as a payment mechanism for this free scheme is feasible approach. In this regard the distribution of the costs of this free HIV vaccine scheme might have an important effect on people. This annual income tax payment as part of a taxation mechanism to finance the provision of this programme has been considered as a fairness issue because many people expressed a preference for taxation forms

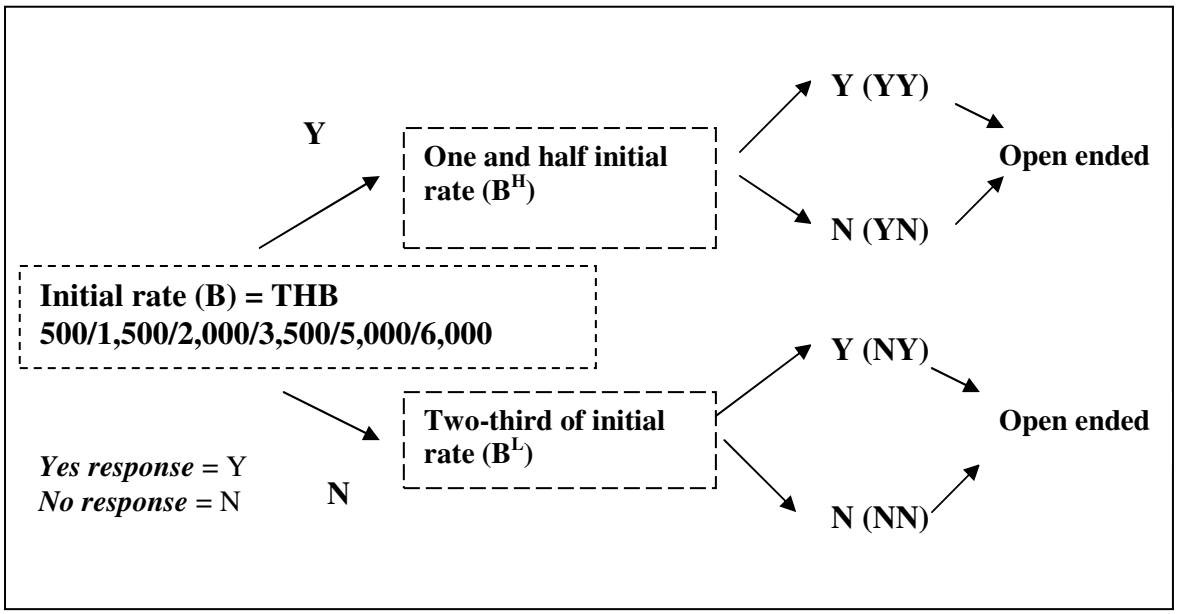
(Carson et al., 1999: 114-115). Tax mechanisms also provide the incentive compatibility in our free HIV vaccination scheme as the public good in terms of a credible and coercive payment mechanism (Carson and Groves, 2007: 191-192).

This income tax payment would be paid as a "one-shot" payment. Despite this, it was the correct welfare measure for the compensating change in wealth, so this amount would be elicited by asking persons a lump-sum question. Although some studies asked respondents about their willingness to pay in equal yearly payments over some period of time, this would have trouble with an annualized calculation of the payment for individuals which was likely to lower the reliability of their responses (Freeman, 2003: 155). As a result our respondents in this study were questioned about paying only a "one-off" payment on their annual income taxes as a provision for our free HIV vaccination scheme.

3.2.9 Elicitation Method and Bids

In order to obtain the amount of willingness to pay (WTP), our study used double-bounded dichotomous choice followed by an open-ended question to estimate the WTP for the public demand on a one-year free vaccination scheme. Given initial rate of tax payment as THB 500, 1,500, 2,000, 2,500, 3,500, 5,000 and 6,000 per year, if respondents answered Yes to the initial rate (B), then individuals were asked a follow-up question which offered them a higher rate (B_H), one and half the original amount. If respondents answered No to the initial rate (B), the individuals were asked a second question about a lower amount (B_L), two-third of the original amount (See Figure 3.3 and Table 3.6).

Figure 3.3 Diagram on Double-Bounded Format with Open-Ended Followed Up in Our Study



Source: Author.

Note: YY = yes/yes, YN = yes/no, NY =no/yes, and NN = no/no

Table 3.6 Bid Structure in Baht

	Initial rate (B)	Higher rate (B_H)	Lower rate (B_L)
1	500	750	300
2	1,500	2,250	1,000
3	2,000	3,000	1,300
4	3,500	5,250	2,300
5	5,000	7,500	3,300
6	6,000	9,000	4,000

Source: Author.

In the end, the individuals were asked to state what was the maximum amount that they would like to pay for this free vaccination programme through their income tax payment. If an individual stated a maximum amount of WTP which is not zero, the individual would be asked the reasons why he or she had come up with this

amount. On the contrary, if the maximum amount of WTP a respondent elicited was zero, the respondent would be asked the reasons why he or she chose to make a zero payment. This open ended format was purposely a debriefing question to confirm whether the zero WTP was valid or biased. If the zero WTP was verified as the bias, their answers on WTP would be dropped out and be considered as a "non-response".

3.2.10 The Caution against Potential Biases in Our CV study

Firstly scenario misspecification bias generally occurred when the respondents did not respond to the correct valuation scenario or they did not understand the scenario as our study intended it to be understood. To guard against this problem, our study created "the storyboard", a four-illustration-board, to make CV scenario much more interesting and comprehensible to our respondents.

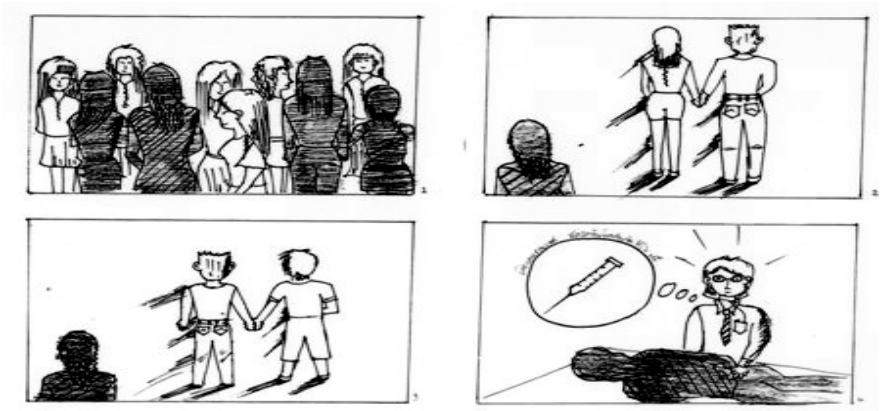


Figure 3.4 A Contingent Valuation Scenario Storyboard
Source: Author.

As for Figure 3.4, this storyboard explained the CV scenario as follows:

Nowadays four in ten of new HIV/AIDS infections were are female. They have been infected through their male partners who have had unprotected sex with either male or female commercial sex workers. Because of this, government provided a free HIV vaccination scheme to vaccinate only commercial

sex workers aged over 15 in major cities around Thailand. The HIV vaccine attributes used in this programme were either 30% or 70%effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and one dose injection, respectively. By vaccinating these CSWs with a highly effective either 30% or 70% vaccine under this free scheme, it will prevent either 370,000 or 1.9 million new infections nationwide per year. This storyboard also ensured the consistency and accuracy on the description of our free HIV vaccination programme among our enumerators when our CV scenario was presented and explained to the respondents by them.

Secondly cheap talk scripts, used in our study are to minimize hypothetical bias from our hypothetical valuation of this free HIV vaccine scheme. Also it is successful in eliciting responses to hypothetical valuation questions that are identical from responses to valuation questions involving real payment (Cummings and Taylor, 1999: 657-659). On this account, respondents beforehand were instructed to consider their budget constraints and informed that there was no right or wrong answer. In addition individuals were told in terms of cheap talk scripts to encourage the respondents to tell the truth before they started to elicit their WTP amounts.

Lastly, whether respondent answered a “Yes” or “No” to support our one-year free HIV vaccine scheme after listening to our hypothetical scenario, they were asked to identify their answers by giving them many different qualifications on their responses. As for the prior work by Whittington (1998: 23-24), when respondents in South-Asia region responded “Yes, if..” with many varied reasons to their answers such as “ if I have money”, “if the rate of tax payment is reduced”, or “if participation is mandatory”, all of which implied “No” in polite way. In this respect we then coded a list of the many ways a respondent might say “Yes, if..” to our questionnaire as the answer of “No”.

3.2.11 The Estimation of Mean Willingness to Pay (WTP)

Our study will calculate mean WTP from both single bounded and double bounded formats because single bounded format can provide "fully incentive-compatible" issue, while double bounded format therefore increases the statistical efficiency of welfare estimation. On this account, we estimated the mean WTP values with regard to three different aspects: (1) the respondent's behavior: beneficiary/non-beneficiary; (2) vaccine effectiveness: 30/70% and (3) household characteristics: whether is the respondent living together with/without household members who are teenagers aged 15-19. As for all three differing aspects, we hypothesized that the WTP amount for this free scheme would be higher for a beneficiary than for a non-beneficiary and also higher for a 70% vaccine effectiveness than for a lower vaccine effectiveness.

Our study also took household characteristics into account, such as whether the respondent had a family member aged 15-19 years old living with them, because recent evidence has found that Thai teenagers aged 15-19 were sexually active and tended not to use the condoms when having casual sex with multiple partners or perhaps with commercial sex workers. This group was coming to be at high risk of contracting HIV/Aids as they had many sex partners without using protection (Apiradee Treerutkuarkul, 2008: 11). We thus hypothesized that the mean WTP value from the respondent, whose household member is 15-19 year old teenager, will be higher because the benefit of our free HIV vaccination scheme will prevent their adolescents from contracting HIV/AIDS.

3.3 Modeling and Analysis of Our Public Demand

In readiness for our free HIV vaccine scheme, we assumed that the respondents would be willing to support this scheme if it maximized their utility relative to the alternative, no free HIV vaccination programme or the status quo, where utility is defined over health and other consumption goods. In addition our study put the respondent as the general population in the role of a unitary decision-maker, inquiring them to maximize their own utility function, which definitely reflected either their own benefits or altruistic preferences towards other people

subject to own income or earnings. This yielded a stated public demand for the free HIV vaccination scheme. Therefore it showed the impact of this free programme on the prevention of the social and economic loss from the current high rate of HIV/AIDS prevalence among Thai population, in particular women regarded as the low risk group.

3.3.1 The Specific Demand Model

The specific demand for a one-year free HIV vaccination scheme, whether respondents as part of the general population are willing to pay as a single shot remittance through their yearly income tax payment, depends on the rate of tax payment (R); personal monthly income (Y); household size and composition (H), in particular the total number of 15-19 year-old adolescents living in the same household; respondent characteristics (Z) for example age, gender, marital status, occupation and education level; a vector of HIV/AIDS variables (A) such as the knowledge of HIV/AIDS, the awareness of HIV/AIDS problems, the respondent's experience with HIV/AIDS disease; the identified variable whether respondent is perceived as a beneficiary or non-beneficiary towards our free scheme (B); the understanding of vaccine effectiveness variable (U), which the vaccine effectiveness is composed of 30% and 70%; and vaccine effectiveness (V), whose effectiveness is either 30% or 70%.

These dependent variables on our model will be described as follows:

a) Rate of tax payment (R): As for six different payments, THB 500, 1,500, 2,000, 3,500, 5,000 and 6,000 respectively, they were in the shape of logarithmic form, so we expected that a higher payment would reduce the level of demand on respondent, willing to pay for our free HIV vaccine scheme when other variables must be held constant.

b) Personal monthly income (Y): our personal income variable was an average of monthly income per person expressed in logarithmic form, however, in the questionnaire respondent was asked his/her income in terms of monthly income before tax deduction. An increase in income, other things being constant, will raise

the level of demand if the one-year basis free vaccination programme considered as a "normal" good.

c) Household size and composition (H): First our study asked the respondent the number of household members, so the answer was expected to be continuous as a unit of persons. We hypothesized, ceteris paribus, that the greater the number of household members, the less the respondent would be willing to pay for free HIV vaccination scheme. It implied that respondents with more household members have more difficulty with the payment for this progamme. So, they would conceivably be willing to pay less for supporting our scheme. Thereafter if respondents had household members living in the same house, they were then asked how many of the household members aged15-19 years old. The answer, likewise, was expected to be number of persons. As has been said, respondents whose household contains 15-19 year-old adolescents would be more likely to support our scheme because the benefit of this free HIV vaccine programme will prevent their teenage relatives from getting infected with HIV/AIDS through sexual transmission. Thai adolescents are group at high risk of infection with HIV/AIDS because they have had multiple sex partners with the lowest-rate of condom use (Apiradee Treerutkuarkul, 2008: 11). Other things being equal, a respondent living with 15-19 year-old teenagers in the same family is more likely to support for our free HIV programme than the others who don't have teenage household members.

d) Respondent characteristics (Z): Our respondent characteristics such as age, gender, marital status, occupation and education were all incorporated into our study as the proxy for socio-economic characteristics. Only the age variable was measured in continuous data as the unit of year, while gender, marital status, occupation and education were measured by dichotomous variables for gender: male and female; the different types of marital status: single, married, and divorced/widow/separated; occupation: public and private; and the varied levels of completed education (elementary: 1-6 years of schooling; primary: 1-9 years of schooling, secondary: 12 years of schooling, university, postgraduate, vocational, and no schooling). As for varied educational levels, our study rearranged them into two different levels: the low educational level was where respondent had completed education below university degree such as primary, secondary, or vocational, as well

as no schooling where the respondent has never attended school, whilst the upper education level was a respondent whose academic level was at least a university degree, this includes person who already completed a postgraduate or a professional course such as medical degree. As a consequence, our educational level variable was either high and low education. All other things being equal, we hypothesized that a respondent who had a higher educational level would tend to pay more on this free HIV vaccine scheme. Older respondents, on the one hand, would perhaps pay less in respect to this programme. Also one might expect that respondents who have a partner or spouse would be willing to pay more than a respondent who has not. Thus respondents living with their partner or spouse may possibly be willing to pay more for the free vaccination scheme because of both their own benefits and their feelings of altruism towards their spouse or partner. These explanations were just a matter of conjecture which we did not have any data on the respondent characteristics with respect to our one-year free vaccination programme.

e) Knowledge, experience, and awareness of HIV/AIDS (A): Given three sets of variables as the proxies for the respondent's personal knowledge, experience, and awareness of HIV/AIDS, we asked respondent three question sets. First, the first question set consisting of five questions with three possible answers: Yes, No, and I do not know: (i) Can the risk of HIV transmission be reduced by having sex with only one uninfected partner who has no other partners?;(ii) Can a person reduce the risk of getting HIV by using a condom every time they have sex?; (iii) Can a healthy looking person have HIV?; (iv) Can a person get HIV from mosquito bites?;(v) Can a person get HIV by sharing food with someone who is infected? Therefore this set of five questions is the core indicator which the United Nations General Assembly Special Session on HIV/AIDS (UNGASS) used as an indicator to assess knowledge about HIV transmission among the general populations (UNAIDS, 2007c: 49-65).The first three questions are supposed to be responded to with a "Yes" answer, while the last two questions: iv and v are common misconceptions and a "No" response is the right answer. As a result of our study on this knowledge of HIV, it is expected that there will be a number of correct answer to these five questions while an answer with "I do not know" should be recorded as incorrect. Hence we expected that respondents with all 5-correct answers would tend

to have more demands on this free HIV vaccine scheme, all other things held constant. Second, regarding the estimation on the experience of HIV/AIDS, the second question set of two dichotomous questions has been included into our questionnaire with two possible answers: Yes or No answer, if respondent replies with "I do not know/ I have never heard about that" answer, which will be coded as " No" response. (a) Have you ever known someone who has had HIV/AIDS? ; (b) Have you ever heard that HIV/AIDS is now curable? We hypothesized that if respondents, who did believe that HIV/AIDS is now curable or had known anyone who has had HIV/AIDS, would be very likely to pay more on this free vaccination programme. Last, for the measurement of the awareness of HIV/AIDS, the third set of four dichotomous questions with three possible answers: Yes, No and I don't know/I do not want to answer, which this answer again will be recorded as No response, will be asked the respondent as follows. i) Among three high risk groups: CSW, IDU and MSM, Commercial sex worker (CSW), consisting of both male and female is still the major cause of the spreading of HIV; ii) Thai teenagers now tend to have more casual sex compared to the past; iii) If a curable HIV vaccine exists, government should prioritize commercial sex worker as the first vaccinated group; iv) As for iii), to vaccinate only commercial sex workers as the priority is the most cost effective approach. Still, this awareness variable is more likely to influence the respondent on the perception of HIV/AIDS. In addition, if respondents answered "Yes" on both question iii) and iv), this implied that they had considered that to vaccinate CSW as the first and prioritized group is the most cost effectiveness approach, other things being equal. As for the assessment on awareness of HIV/AIDS, it would account for only 3 dichotomous questions, which were i), ii) and the combination of only both "Yes" answers on question iii) and iv) accordingly. Due to no prior information support, our study can not expect any possibility of "Yes" response on the willingness to pay towards our free HIV vaccine programme, if respondent says yes or no on these three questions regards as the HIV/AIDS awareness variable.

f) Identifying variable whether respondent is perceived as beneficiary or non-beneficiary towards this free HIV scheme (B). Therefore if only both male and female commercial sex workers (CSW) were freely vaccinated in our programme, this would benefit respondents in either a direct or indirect way. To verify whether a

respondent was perceived as beneficiary or non-beneficiary, we had questions to screen out our both male and female respondents. Male respondents were asked two dichotomous choice questions to determine if they had been in regular or intermittent sexual contact with commercial sex workers, and therefore likely to benefit personally from a free HIV vaccination scheme. The first question asked was whether the male interviewee knew any place or venue in Bangkok area providing either male or female commercial sex workers. With the expected answers either Yes or No, male respondent with a Yes answer will again be asked to complete another following up question, whereas male interviewee with a No response will be recognized as a non-beneficiary. For the following up question, the question was "Have you ever been that place?" with the expected answers of either Yes or No. If he provided with "Yes" answer again, he would be classified as a beneficiary, while "No" answer on this question would identify him as non-beneficiary on this scenario. Female respondents, on the one hand, had been regarded as "beneficiary" if they were married because they will be indirectly protected themselves from getting HIV/AIDS through sexual transmission from their male partners if our free HIV vaccine had been implemented. Unmarried female respondents were asked to rate themselves on their likelihood of contacting HIV/AIDS through the sexual transmission based on her sexual behavior on a scale of 0-100%. (0 is no possibility, whilst 100 is the highest possibility of getting infected with HIV/AIDS). From this, female respondents whose answer was either equal to or higher than 50% were identified as beneficiaries, whereas one with a less-than 50% were regarded as non-beneficiaries. However commercial sex workers are still a major source of HIV/AIDS infections in Thailand. Of the nationwide prevalence rate in 2003, almost 15.5% were female sex workers, followed by male sex workers who accounted for 7.9% (The World Bank, 2006: 13). All things considered, female beneficiaries would benefited from our free HIV vaccine scheme because they will possibly be prevented from becoming infected with HIV/AIDS through the sexual transmissions from their male partners. As has been noted, we assumed that respondents identified as beneficiaries would be more likely to finance our free HIV vaccine scheme through their income tax payments than would non-beneficiaries.

g) Understanding of vaccine effectiveness (U): To obtain this variable, our study asked three questions of the test respondents on vaccine effectiveness of either 30 or 70%. After listening to our enumerator explaining vaccine effectiveness with the visual card (See Figure 3.2), the respondent was tested by being asked to indentify i) the persons vaccinated (100 people in the red circle); ii) those vaccinated and protected (30 or 70 persons whose smiling faces are yellow); iii) the number vaccinated but not protected (70 or 30 figures with normal smiling face, but in the red circle). Suppose the respondents provided with all wrong answers on these three 'identifying' questions, they again would be asked to listen to our explanations on the vaccine effectiveness for the second time. After that, this respondent would be tested again with the same questions. If they failed twice by answering incorrectly for all these three questions, the respondents would be moved on to listen our CV scenario, while they already failed the test on vaccine effectiveness. As a result only a single dichotomous question had been included to check the respondent for understanding of vaccine effectiveness with the expected answer with either Yes or No: Can respondents answer correctly all three questions after they had listened to our explanation either once or twice? As for ceteris paribus, we henceforth expected that a respondent with a 'Yes' answer on this question would be more likely to pay more on our one-year free vaccination programme, whereas respondent with a 'No' on the same question might possibly pay less. People with more understanding of vaccine effectiveness, in other words, were very likely to financially support for our scheme. Nonetheless these explanations were just a matter for conjecture because we did not have much information to support our assumption on the relationship between the respondents' understanding of vaccine effectiveness and their willingness-to-pay (WTP) amounts on our free HIV vaccine scheme, all else being constant.

h) Vaccine effectiveness (V): There were two types of vaccine effectiveness in this model: 30 and 70% effectiveness which our study applied it with our split sample survey (See section 3.4).As regards ceteris paribus, we hypothesized that the more effective the vaccine was, the more the respondent would be willing to pay for our one-year free vaccination programme, and vice-versa.

Above all we divided our estimation into three different models with respect to different type of respondents and vaccine effectiveness for our one-year free HIV vaccination programme.

Model 1: The full demand model for free HIV vaccination scheme with respect to both 30% and 70% vaccine effectiveness.

$$\Pr(WTP_{ij}) = f(R_{ij}, Y_{ij}, H_{ij}, Z_{ij}, A_{ij}, B_{ij}, U_{ij}, V_{ij})$$

where i = 1,2,3..n; n = 600, and j = 1, 2

Model 2: The demand model for beneficiary with regard to both 30% and 70% vaccine effectiveness.

$$\Pr(WTP_{ij}) = f(R_{ij}, Y_{ij}, H_{ij}, Z_{ij}, A_{ij}, U_{ij}, V_{ij})$$

where i = 1,2,3..n; n = 270, and j = 1, 2

Model 3: The demand model for non-beneficiary as regards both 30% and 70% vaccine effectiveness.

$$\Pr(WTP_{ij}) = f(R_{ij}, Y_{ij}, H_{ij}, Z_{ij}, A_{ij}, U_{ij}, V_{ij})$$

where i = 1,2,3..n; n = 330, and j = 1, 2

As regards Table 3.7, our three log-linear models had been more described are as follows. With the use of diverse econometric packages such as Limdep 8.0, Eviews 4.0, STATA 10.0, and SPSS 13.0, our study estimated these log-linear models as the function of probit model(See Appendix I) because we assumed that Pr(WTP_{ij}^{*}) is a normally distributed random variable, so that the probability that WTP_{ij}^{*} is less than(or equal to) WTP_{ij} can be computed from the cumulative normal probability function.

The standardized cumulative normal function is written as $F(WTP_{ij}) = \frac{1}{\sqrt{2\pi}} \int_{-\alpha}^{WTP_{ij}} e^{\frac{-s^2}{2}} ds$ where s is a random variable which is normally distributed with mean zero and unit variance. Most commonly the parameters in probit model are estimated by the method of maximum likelihood. Although maximum likelihood estimator has the property of being consistent, there are two major problems: heteroskedasticity and misspecification causing this maximum

likelihood method become inconsistent. First, heteroskedasticity problem has occurred when the assumption of constant error variance (homoskedasticity) is unreasonable or the error variance is unequal. This problem occurs when there is a cross study of family income and expenditure (Pindyck and Rubinfield, 1998: 145-176). Because of this we at first had to test for heteroskedasticity in our probit model by Lagrange multiplier (LM) test[1] with the binary response model regression or BRMR[2]. Suppose there is a problem of heteroskedasticity, our study will use STATA 10.0 command, called hetprob[3], heteroskedasticity probit model, in order to correct it. Second, the probit model is usually sensitive to misspecification problem, which reflects heteroskedasticity or non-normality of standard error term, so our study will use "robust variance estimators[4]", which is also known as Huber, White, or sandwich standard errors to guard against the misspecification problem (Greene, 2008: 514-515; Long and Freese, 2006: 86).

With the assumption on probit model, the cumulative distribution function (CDF) must follow the normal distribution. In order to use this probit model, we had to test whether our model was normality or not. Our study hence referred to "central limit theorem" which if sample size n is large (often in excess of n = 30), then standardized variable $Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}} \sim N(0,1)$ regardless of the form of the discrete probability density function (PDF), has approximately a standard normal (Z) distribution. Due to the large sample sizes in our study, our model had been qualified for the assumption of normality in the probit model.

To interpret coefficients or results in probit model, it unlike other regression models is not so straightforward to obtain a marginal effect interpretation. In spite of

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[1] See on section 7.1.7: Specification Tests in Binary Choice Models on Verbeek, Marno. 2008. 3rd ed. **A Guide to Modern Econometrics.** West Sussex: Wiley.

[2] More details on Davidson, R. and MacKinnon, J. 2004. **Econometric Theory and Method.** New York: Oxford University Press.

[3] See www.stata.com

[4] See Greene, W.H. 2008. **Econometric Analysis.** 6th ed. New Jersey: Pearson Prentice Hall.

this, it is possible to obtain something akin to a marginal effects interpretation, except in terms of the probability. That is, the conventional regression marginal effect interpretation in simple regression in general is: 'How much does Y as dependent variable change when you change X (independent variable)?', and β then is the answer to this. With qualitative choice model like probit, we altered this to: 'How much does the probability of making choice 1 change when you change X?', however it is not simply β which is the answer to this (Koop, 2008: 281). As a result we used STATA 10.0 command called mfx[1] to estimate the marginal effect of X on the probability of these respondents will say "Yes" on their willingness to pay on a specific income tax payment to support our free HIV vaccine programme. Therefore the marginal effect in general is written as $\frac{\partial E[Y/X,\beta,\Omega]}{\partial X_i} = f(X,\beta,\Omega)\beta_i$ where X is the independent variables, β is the coefficient and Ω is some distribution. So the marginal effect is the coefficient multiplied by some scale factor $f(X,\beta,\Omega)$.

Lastly, the measurement on a goodness-of-fit is a summary statistic indicating the correctness with which the model approximates the observed data, like the R^2 measure in the conventional linear regression model. In this case in which our dependent variable is qualitative, accuracy might be judged either in terms of the fit between the calculated probabilities and observed response frequencies or in terms of the model's ability to forecast observed responses. Unlike the linear regression model, there is no universally accepted goodness-of-fit measure for probit model (Kennedy, 2008: 249; Veerbeek, 2008: 205-207). Therefore our study with the use of STATA 10.0 will provide various measurements in terms of two different measures: i) log-likelihood based measures such as Pseudo-R^2, and ii) information measures, for example Akaike's information criterion (AIC), the Bayesian information criterion (BIC), respectively (See more details on Appendix J). Then chapter 4, the next chapter, provided a detailed description on our survey as well as a detailed analysis on our results with interpretations on this survey study.

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[1] See www.stata.com

Table 3.7 The Description of Variables in the Model with Their Expected Signs of Coefficients

Variable	Description	Expected sign
Independent variable		
Rate	Rate of tax payment (Logarithm form, baht) :500, 1,500,2,000,3,500, 5,000,and 6,000	Negative
Personal income		
Income	Personal monthly income (continuous in logarithm form, baht)	Positive
Demographic and socioeconomic		
Male	Gender = 1 if male, 0 if otherwise (Female as a base)	N/A
Age	Age of respondents (continuous, years)	Negative
Single	Marital status = 1 if single, 0 otherwise (Divorce/Widow/Separated as a base)	N/A
Married	Marital status = 1 if married, 0 otherwise (Divorce/Widow/Separated as a base)	Positive
High_edu	Education level = 1 if respondent completed at least university level, 0 otherwise (Low educational level is a base)	Positive
Private	Occupation status = 1 if private, 0 otherwise (Public as a base)	N/A
Household	Number of household members (continuous, persons)	Negative
Teenagers	1 if respondent has teenagers aged 15-19 years living in the same household, 0 otherwise	Positive
Knowledge, Experience and Awareness		
One_partner	1 if respondent believed that the risk of HIV transmission has been reduced by having sex with only one uninfected partner, 0 otherwise	Positive
Condom	1 if respondent believed that a person can reduce the risk of getting HIV by using condom every time when they have sex, 0 otherwise	Positive
Healthylook	1 if respondent believed that a healthy looking person has HIV, 0 otherwise	Positive
Mosquito	1 if respondent believed that a person gets HIV from mosquito bites, 0 otherwise	N/A
Eating	1 if respondent believed that a person can get HIV by sharing food with someone who is infected, 0 otherwise	N/A
Knowledge	HIV/AIDS knowledge = 1 if respondent answered all 5 questions correctly, 0 otherwise	Positive
Known	1 if respondent knows someone who has had HIV/AIDS, 0 otherwise	Positive
Curable	1 if respondent has heard that HIV is now curable, 0 otherwise	Positive
CSW_main	1 if respondent believed that CSW is still the major cause of the spreading of HIV, 0 otherwise	N/A
Young_risk	1if respondent believed that Thai teenagers tend to have more casual sex compared to the past, 0 otherwise	N/A
Low_effectiveness	1 if respondent believed that to vaccinate CSW as the first and priority group is the most cost effective approach, 0 otherwise	N/A

Table 3.7 (Continued)

Understanding of vaccine effectiveness		
Understanding	1 if respondent passed all three questions on the understanding of vaccine effectiveness, 0 otherwise	Positive
Vaccine characteristic and programme		
70% effectiveness	1 = vaccine is 70% effectiveness, 0 otherwise (30% vaccine effectiveness is a base)	Positive
Beneficiary or non-beneficiary		
Beneficiary	1 = as for male respondent if he knew and had been place or venue in Bangkok providing CSW, 0 otherwise, OR 1 = as for female respondent if she is either married or she(except for married one) rated herself the possibility of contracting HIV through her sexual transmission = or > 50%, 0 otherwise	Positive

CHAPTER 4

EMPIRICAL RESULTS

4.1 Profile of Respondent

A total of 600 individuals aged 20-60 years were successfully interviewed during the period from December 2008 to February 2009. The response rate for individuals was 90%, but only 10% were non-responses. Our study compensated for this by adding more survey interviews to obtain the total number of 600 survey interviews. On this account we described the profile of respondents as follows: (1) Socio-demographic characteristics; (2) Knowledge, experience and awareness of HIV/AIDS; (3) Understanding of vaccine effectiveness; and (4) Identify whether the respondent was a beneficiary or non-beneficiary towards our free HIV vaccine scheme.

4.1.1 Socio-Demographic Characteristics

Of the 600 people randomly selected in our Bangkok survey, the majority of respondents were female (52.5%) with an average age of 32 years, and whose martial status was single (68.8%). More than half of the respondents (72.8%) had completed at least a university degree as well as being employed (86.3%) in the private sector. The average household size was 3.16 persons, those with household members aged 15-19 years old living in the same household accounted for 17.8 % (Table 4.1).

Since the target population in our study was people in Bangkok aged 20-60 years old whose jobs were in the formal sector, we had to compare our sampling data with the target population in order to verify whether our survey sample can accurately and reliably be extrapolated to the entire population.

Table 4.1 Socio-Demographic Characteristics of the Respondents

Variable	Descriptive	Mean	S.D
Rate	Rate of tax payment (Logarithm form, baht)	7.751	0.840
Income	Personal monthly income (continuous in logarithm form, baht)	9.747	0.538
	Personal monthly income (continuous, baht)	20151.580	14941.620
Male	Gender = 1 if male, 0 if otherwise (Female as a base)	0.475	0.500
Age	Age of respondents (continuous, years)	31.677	7.006
Single	Marital status = 1 if single, 0 otherwise (Divorce/Widow/Separated as a base)	0.688	0.464
Married	Marital status = 1 if married, 0 otherwise(Divorce/Widow/Separated as a base)	0.307	0.461
High_edu	Education level = 1 if respondent completed at least university, 0 otherwise (Low educational level as a base)	0.728	0.445
Private	Occupation status = 1 if private, 0 otherwise (Public as a base)	0.863	0.344
Household	Number of household members (continuous, persons)	3.164	1.673
Teenager	if 1 = respondent has teenagers aged 15-19 years living in the same household, 0 otherwise	0.178	0.383

Table 4.2 The Comparison between Sampling Results and Target Population

	Our sampling results	**Target population: Bangkok Metropolitan area**
Male	0.475	0.464[a]
Female	0.525	0.536[a]
Age	31.67 yrs	32.50 yrs[b]
Number of household member	3.23 persons	3.29 persons[c]
Monthly income (before taxes)	20151.58 baht	22021.39 baht[c]

Source: a) NSO, 2005-2007; b) NSO, 2003-2006; c) NSO, 2007.

Table 4.2 shows the comparison between our sample and the target population In this regard, gender, age, the number of household members, and monthly income in our sample, for instance, had almost the same average number as the target

population. Of the target population aged 20-60 years old in Bangkok, females who were income earners had a slightly higher proportion than males. On average people in Bangkok metropolitan area were almost 33 years old with an approximate monthly income of 22,000 baht and had 3 members in their households. Consequently our results were an appropriate sample, representing this target population of Bangkok.

4.1.2 Knowledge, Experience, and Awareness of HIV/AIDS

Of 600 respondents in our survey, only 63% respondents answered correctly all 5 questions regarding knowledge, experience, and awareness of HIV/AIDS. As for the knowledge of HIV (Table 4.3 and 4.4), more than 90% of respondents believed that the risk of HIV transmission would be reduced by having sex with only one uninfected partner and using condom every time while having sex, as well knowing that as a healthy looking person can have HIV. Surprisingly, almost 16% of respondents believed that person could get HIV from mosquito bites and 8.5% thought that sharing food with HIV infected people could result in HIV infection.

As regards experience of HIV/AIDS, 23% of respondents had known someone who had HIV/AIDS and almost 30% believed that HIV/AIDS is now curable. On the other hand more than half of respondents had never known any friend who contracted HIV/AIDS as well as did not believe that HIV was currently remediable (Table 4.5).

Almost 100 percent of respondents in terms of HIV/AIDS awareness believed that teenagers now tend to have more casual sex compared to in the past. In addition, almost 65% thought that commercial sex workers were still the crucial cause of the spreading of HIV. Because of this, only 30% reckoned that vaccinating commercial sex workers as the first and only priority would be the most cost effective approach (Table 4.3 and 4.6).

Table 4.3 Knowledge, Experience and Awareness of HIV/AIDS

Variable	Descriptive	Mean	S.D
One_partner	1 if respondent believed that the risk of HIV transmission has been reduced by having sex with only one uninfected partner, 0 otherwise	0.957	0.204
Condom	1 if respondent believed that a person can reduce the risk of getting HIV by using condom every time when they have sex, 0 otherwise	0.937	0.244
Healthylook	1 if respondent believed that a healthy looking person has HIV, 0 otherwise	0.938	0.241
Mosquito	1 if respondent believed that a person gets HIV from mosquito bites, 0 otherwise	0.157	0.364
Eating	1 if respondent believed that a person can get HIV by sharing food with someone who is infected, 0 otherwise	0.085	0.279
Knowledge	HIV/AIDS knowledge = 1 if respondent answered all 5 questions correctly =1, 0 otherwise	0.630	0.483
Known	1 if respondent knows someone who has had HIV/AIDS, 0 otherwise	0.232	0.422
Curable	1 if respondent has heard that HIV is now curable, 0 otherwise	0.280	0.449
CSW_main	1 if respondent believed that CSW is still the major cause of the spreading of HIV, 0 otherwise	0.645	0.479
Young_risk	1if respondent believed that Thai teenagers tend to have more casual sex compared to the past, 0 otherwise	0.980	0.140
Low_effectiveness	1 if respondent believed that to vaccinate CSW as the first and priority group is the most cost effective approach, 0 otherwise	0.300	0.459

Table 4.4 Knowledge of HIV

Knowledge of HIV	Yes	No	Do not know
1. Can the risk of HIV transmission be reduced by having sex with only one uninfected partner who has no other partners?	95.7%	3.5%	0.8%
2. Can a person reduce the risk of getting HIV by using a condom every time they have sex?	93.7%	4.3%	2.0%
3. Can a healthy looking person have HIV?	93.8%	5.2%	1.0%
4. Can a person get HIV from mosquito bites?	15.7%	77%	7.3%
5. Can a person get HIV by sharing food with someone who is infected?	8.5%	88.8%	2.7%
Number of the correct answers ……			

Table 4.5 Experience of HIV/AIDS

Experience of HIV/AIDS	Yes	No	Do not know
2.1 Have you ever known someone who has had HIV/AIDS?	23.2%	76.5%	0.3%
2.2 Have you ever heard that HIV/AIDS is now curable?	28.0%	68.2%	3.8%

Table 4.6 Awareness on HIV/AIDS

Awareness on HIV/AIDS	Yes	No	Do not know
3.1 Among three high risk groups: CSW (Commercial sex worker), IDU(Injecting drug user) and MSM(Men who have sex with men), CSW, both male and female, is still the major cause of the spreading of HIV.	64.5%	33.2%	2.3%
3.2 Thai teenagers now tend to have more casual sex compared to the past	98.0%	0.8%	1.2%
3.3 If an HIV vaccine exists, the government should prioritize commercial sex worker as the first vaccinated group.	60.3%	37.2%	2.5%
3.4 As for 3.3, To vaccinate only commercial sex workers as the priority is the most cost effective approach.	45.2%	46.0%	8.8%

4.1.3 Understanding of Vaccine Effectiveness

Almost 100% of respondents demonstrated that they fully understood vaccine effectiveness of either 30% or 70% by correctly answering all three questions regarding vaccine effectiveness. With the aid of our visual card, respondents had a better grasp of vaccine effectiveness during our explanation of either 30% or 70% effectiveness.

Table 4.7 Understanding of Vaccine Effectiveness

Variable	Descriptive	Mean	S.D
Understanding	1 if respondent passed all three questions on the understanding of vaccine effectiveness, 0 otherwise	0.99	0.099

4.1.4 Beneficiary and non-beneficiary

Our test questions showed that 45% of respondents were perceived as beneficiaries who would benefit from our free HIV vaccination programme. Of all 600 respondents, 21.2% were male and 23.8% were female beneficiaries, accordingly (Table 4.8 and 4.9).

Table 4.8 Beneficiary

Variable	Descriptive	Mean	S.D
Beneficiary	1 = as for male respondent if he has known and been place or venue in Bangkok providing CSW, 0 otherwise 1 = as for female respondent if she is married or she(except for married one) rated herself the possibility of contracting HIV via her sexual transmission = or > 50%, 0 otherwise	0.45	0.498

Table 4.9 The Detailed Description on the Respondents

Gender	Respondent		
	Beneficiary	**Non-beneficiary**	**Total**
Male	127(21.2%)	158(26.3%)	285(47.5%)
Female	143(23.8%)	172(28.7%)	315(52.5%)
Total	270(45%)	330(55%)	600(100%)

As for Table 4.10 and 4.11, all male respondents were asked the question whether they knew any place providing male and female commercial sex workers (CSWs). Of them, 66% male respondents knew of a place, while there were 127 male respondents who knew of a place and already been there. Thus male beneficiaries were accounted for 21.2% of all respondents. On the other hand, 158 male respondents were non-beneficiaries who neither had known nor been to a venue where either male and female commercial sex workers were working.

Table 4.10 Male Beneficiary

	Have male respondent known any place where CSW works there?		
Gender	**Known**	**Never known**	**Total**
Male	187(65.6%)	98(34.4%)	285(100%)

Table 4.11 The Detailed Analysis on the Male Beneficiaries

	Have male respondent been that place?		
	Have already been	**Have never been**	**Total**
Have known the place	127(44.5%)	60(21.1%)	187(65.6%)
Have never known any place	0(0%)	98(34.4%)	98(34.4%)
Total	127(44.5%)	158(55.5%)	285(100%)

Female respondents were asked only one question to identify whether they were beneficiaries. However the married women in our survey were immediately perceived as beneficiaries because they would have benefited from our free HIV vaccine scheme in terms of sexual transmission. Therefore there would be a lower rate of HIV prevalence for them if commercial sex workers were vaccinated.

Our study asked unmarried female respondents to rate themselves how many percent they thought that they would be at risk of contracting HIV/AIDS through sexual transmission. Respondents who rated themselves at greater than a 50% risk were defined as being a beneficiary of our free HIV vaccine scheme. On a scale from 0 to 100%, 44 single females reported that they had at least 50% chance of contracting HIV via their sexual behaviors, while 80% of single female respondents thought that they had a possibility of getting infected HIV of less than 50% (Figure 4.1).

Table 4.12 Detailed Description of Gender and Martial Status

	Gender		
Marital status	**Male**	**Female**	**Total**
Single	200(33.3%)	213(35.5%)	413(68.8%)
Married	85(14.2%)	99(16.5%)	184(30.7%)
Divorce/Separated/Widow	0(0%)	3(5%)	3(5%)
Total	285(47.5%)	315(52.5%)	600(100%)

Those single women whose risk of getting infected with HIV was at least 50% accounted for 20.65% of female beneficiaries. Of these female beneficiaries, 70% were married women and 30% were single females who had a high possibility of contracting HIV through-sexual transmissions (Table 4.12 and 4.13).

Table 4.13 The Detailed Analysis on Female Beneficiary

Perceived risk of contracting HIV/AIDS	**Single female**
At least 50%	44(20.65%)
Less than 50%	169(79.35%)
Total	213(100%)

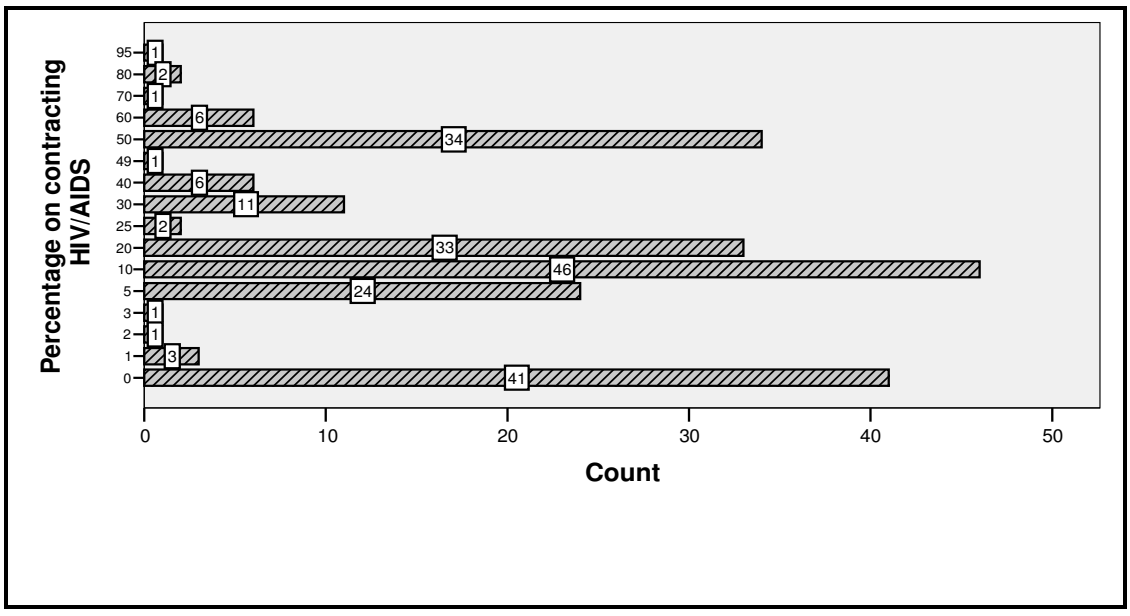

Figure 4.1 Female Beneficiary

4.2 The Public Demand for a Free HIV Vaccination Programme

From our 600 split sample contingent valuation method (CVM) survey with randomization of the two levels of vaccine effectiveness (30% and 70%) and 6 different rates of income tax payments, the results (Table 4.14) showed the number

and percentage of respondents who were willing and able to support our free HIV vaccination programme. As for Figure 4.2, the public demand for a free HIV vaccine scheme had been rapidly diminishing from at least 90% of respondents at tax payment of THB 500 to only 2% at tax payment of THB 6,000. This demand obviously declined with respect to an increase on tax payment and was lower for the 30% vaccine effectiveness at any given the rate of tax payment.

Table 4.14 Number of Respondents Willing and Able to Support Our Free HIV Vaccination Scheme, by the Rate of Tax Payment and Vaccine Effectiveness

Tax payment (baht)	**30% effectiveness (Number of respondent (%))**	**70% effectiveness (Number of respondent (%))**
500	46(92%)	47(94%)
1,500	26(52%)	35(70%)
2,000	23(46%)	27(54%)
3,500	13(26%)	13(26%)
5,000	5(10%)	6(12%)
6,000	1(2%)	1(2%)

Note: Total number of respondent per rate of tax payment and effectiveness equals 50 persons.

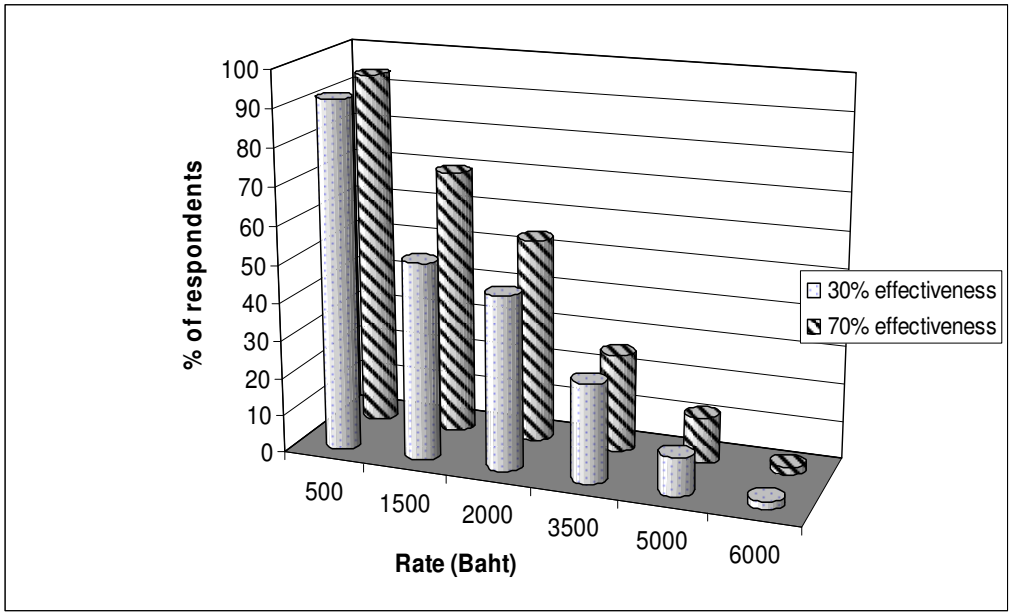

Figure 4.2 Percentage of Respondents Willing and Able to Finance a Free HIV Vaccination Scheme, by the Rate of Tax Payment and Vaccine Effectiveness

As regards the demand analysis, our study had divided it into two sectors: (a) the estimation of the log-linear probit models and (b) the estimation of mean willingness to pay (WTP). Our analysis of the demand for a free HIV vaccine scheme is as follows.

4.2.1 The Estimation of the Log-Linear Probit Model

Our estimation of the log-linear probit models consisted of three different demand models with respect to different types of respondent, tax payment, and vaccine effectiveness for our one-year free HIV vaccination programme. Before we estimated these models with maximum likelihood method, we had detected the outlying observations or outliers and influential observations in our model and then replaced them with their means because the outliers resulted in the rise of heteroscedasticity problem (Gujarati, 2003: 540).

With the Lagrange Multiplier (LM) test under the binary response model regression (BRMR)[1], all three demand models have been exempted from the heteroscedasticity problem. Due to the large numbers of observation in each model, our demand models under the central limit theorem assumed that they have statistically held the properties of normal distribution (Gujarati, 2003: 890) because this is the bottom line of using a probit model (See Appendix I). To guard against the misspecification problem, our study also estimated all probit models with "robust variance estimators", or Huber, White, or sandwich standard errors. These estimates are considered robust in the sense that they provide correct standard errors and also the best possible approximation to the true probability density function (Green, 2008: 514-515; White, 1982: 16-17).

As for the three different demand models, our results of the log-linear probit analysis of the determinants of the willingness and ability to support a free HIV vaccine scheme at randomly assigned income tax payments and vaccine effectiveness are discussed as follows: (a) The full demand model for the free HIV vaccination scheme with respect to both 30 and 70% vaccine effectiveness; (b) The demand model for beneficiary; (c) The demand model for non-beneficiary, which both (b) and (c) were respect to 30% and 70% vaccine effectiveness.

4.2.1.1 The Full Demand Model for a Free HIV Vaccination Scheme

Research question 1: What are the key factors influencing an Individual's payment for this free HIV vaccination scheme?

As shown in Table 4.15, the results present both full and fitted models. The full model depicts all explanatory variables included in the model, while the fitted model, nested in full model, has better goodness-of-fit because it has the lower Akaike's and Bayesian information criterions (AIC and BIC) (See Appendix J). Also the fitted model is statistically preferred to the full model because the difference in BIC between two of them is significantly positive (Raftery, 1995: 137-141).

Although the pseudo R^2 in full model is slightly higher than the fitted model, this measurement, R^2, is not particularly meaningful in probit model (Gujarati,

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[1] See Davidson, R and MacKinnon, J. G. 2004. **Econometric Theory and Methods.** New York: Oxford University Press.

2003: 605). Like F test in the linear regression, the likelihood ratio (LR) statistic test has significantly confirmed with the zero P-value that these two models have rejected the null hypothesis of that all the slope coefficients are simultaneously equal to zero.

Regarding the dependent variable as the demand of willingness to pay for free HIV vaccine scheme (WTP), these findings also depict the probit estimates of all the coefficients (using maximum likelihood methods) as well as estimate of the marginal effects relating to the probability of willingness to pay change when you change one (X) explanatory variable on the model, holding the other explanatory variables constant.

With the robust variance estimators in this probit model (see fitted model), only INCOME, RATE, AGE, MALE and CURABLE all are statistically significant with 5% significant level. INCOME and RATE both play as the major factor on the willingness to pay for our free HIV vaccine scheme.

Table 4.15 Determinants of WTP for the Full Demand Model

Model1: Dependent: Probit of the full demand for a free HIV vaccination programme						
Variable	**Full model**		**Fitted model**			
Independent variable	**Coefficient**	**Robust Std Err.**	**Coefficient**	**Marginal effect**	**Robust Std Err.**	**P-value**
Constant	4.098*	1.742	2.655		1.500	0.077
Income (Logarithm form)	0.881***	0.166	0.871***	0.329	0.154	0.000
Rate (Logarithm form)	-1.499***	0.108	-1.446***	-0.546	0.107	0.000
Age	-0.027*	0.013	-0.021*	-0.008	0.011	0.044
Male	0.284*	0.140	0.280*	0.106	0.134	0.037
Single	-0.351	0.503				
Married	-0.509	0.487				
High_edu	0.1	0.174				
Private	-0.134	0.201				
Teenagers	0.037	0.187				
Beneficiary	0.237	0.145				
Household	0.061	0.044				
Knowledge	0.24	0.225				
One_partner	0.383	0.314				
Condom	-0.169	0.306				
Healthylook	-0.212	0.287				
Mosquito	0.3	0.230				
Eating	0.168	0.267				
Known	0.295	0.169	0.309	0.119	0.160	0.053
Curable	0.397**	0.152	0.393**	0.151	0.150	0.009
CSW_main	-0.137	0.141				
Young_risk	-0.175	0.350				
Low_effectiveness	-0.013	0.154				
Understanding	-0.822	0.627				
70% effectiveness	0.272	0.143	0.227	0.085	0.134	0.09
Remarks: * p<0.05;**p<0.01;***p<0.001						

Summary statistics	**Full model**	**Fitted model**
Number of obs	600	600
Log-likelihood	-231.547	-237.491
LR	346.890(24)	335.002(7)
Prob> LR	0.000	0.000
Pseudo R square	0.4283	0.4136
BIC	-3215.14	-3312
AIC	0.855	0.818

As ceteris paribus, people with higher income are willing to financially support our scheme with the one-third possibility. With a 55% chance, the individual, in contrast, is not going to pay for this scheme if the rate of tax payment has been marginally increased

Consistent with Table 4.16, it also confirmed that a 1% increase in income will lead a 3% rise in demand for free HIV vaccine scheme, while the rate collected to fund this programme is undoubtedly negatively related to the willingness to pay (WTP)'s amount. As a high elasticity, the demand will statistically decline to 42% if the rate is increased by 10%.

Table 4.16 Income and Price Elasticity of the Full Demand

	Elasticity	**Std. E**	**P-vale**	**95% confidence interval**	
Income (Logarithm form)	3.197	0.560	0.000	2.099	4.295
Rate (Logarithm form)	-4.233	0.331	0.000	-4.881	-3.584

Regarding the table 4.15, MALE and CURABLE both have the same sign coefficients as positive whereas the coefficient on AGE is obviously negative. With a 10 % possibility, if an individual were male, he is more likely to sponsor this free scheme than would a female. Then, as for CURABLE, if the respondents have also heard that HIV now is curable, they are more willing to finance this free HIV vaccine scheme. Other things being equal, AGE showed a negative relationship to the demand for the willingness to sponsor this scheme. The elderly in Thailand are more likely to pay less for this free programme than would younger people. Last, both KNOWN and 70% EFFECTIVENESS have an effect on our free HIV scheme, although they are statistically significant with merely 10%. As for the public demand, an individual who knew someone with HIV/AIDS would be more likely to sponsor this free programme. In addition, if a 70% effectiveness HIV vaccine was used in this scheme, it will have a higher chance of getting financially supported by Thai people. Calculated by the probit model in Table 4.15, the Figure 4.3 presents the predicted probability of

respondents, who are willing or able to support a free HIV scheme with regard to the tax payment in the range of 500 baht to 6,000 baht and by vaccine effectiveness.

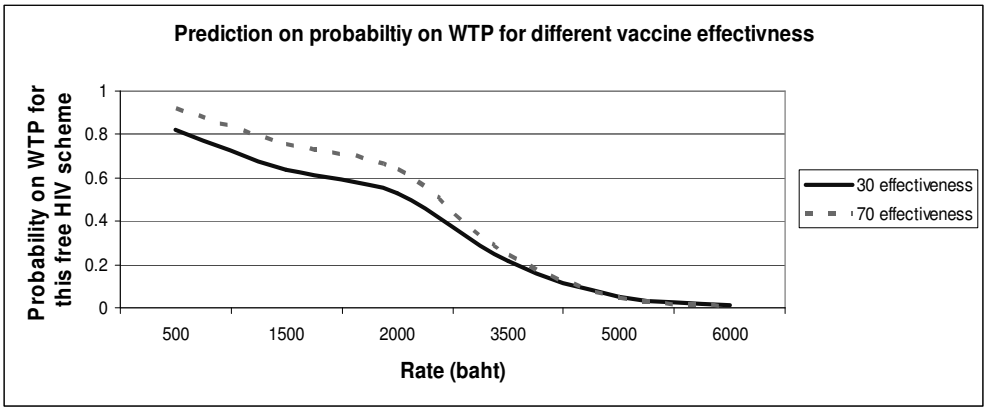

Figure 4.3 Prediction on Probability of Respondent who would able to Support Our Free HIV Vaccine Scheme with Respect to Rate of Tax Payment and Vaccine Effectiveness

Research question 2: What are the differences in the significant determinants between beneficiaries and non-beneficiaries influencing their decisions to sponsor this one-year fee HIV vaccination scheme?

4.2.1.2 The Demand Model for Beneficiary

Our study, as has been said, estimated the demand for this free HIV vaccine programme regarding beneficiaries. So the dependent variable in this probit model is whether the beneficiary is willing or able to pay a subsidy for this free scheme with respect to the HIV vaccine effectiveness. With a zero P-value in the likelihood ratio test (see Table 4.18), this statistically confirmed that all coefficients in independent variables are not equal to zero. The fitted model again is preferred to the full model due to the lower BIC and AIC values. The results of this model shown in Table 4.18 stated that INCOME, RATE, AGE, and KNOWN are the significant factors of which the beneficiaries will decide whether to support this free HIV vaccine programme. As expected, the demand declines with higher rate of tax payment and increases with higher income with other things being equal.

In addition, Table 4.17 and 4.18 support the prediction that a 10% increase in the rate of tax payment will lead to a huge decline (54%) in the demand on willingness to pay for supporting this free scheme. There is an almost 70% chance the beneficiaries will not be

willing to subsidize the scheme if the tax payment is raised marginally. Despite this, the demand for this scheme increased by 30% if the beneficiary's income increased by 10% accordingly. In other words, beneficiaries with higher income will have a 30% greater probability that they would be willing to finance this programme.

Consistent with the prior results on the probit model, AGE and KNOWN both are the key factors for beneficiaries to reach their decisions. Evidently AGE has a negative impact, but KNOWN has a positive effect on willingness to pay for this free HIV vaccine scheme.

Table 4.17 Income and Price Elasticity of Demand for Beneficiary

	Elasticity	**Std. E**	**P-vale**	**95% confidence interval**	
Income (Logarithm form)	3.182	0.936	0.001	1.346	5.017
Rate (Logarithm form)	-5.414	0.624	0.000	-6.637	-4.191

As for vaccine effectiveness, it is statistically insignificant, although an HIV vaccine with 70% effectiveness has a positive impact on the demand for this free HIV programme. With the analysis of the probit model for beneficiary, Figure 4.4 depicts the predicted chance of beneficiaries who would subsidize this free scheme according to the rate of tax payment.

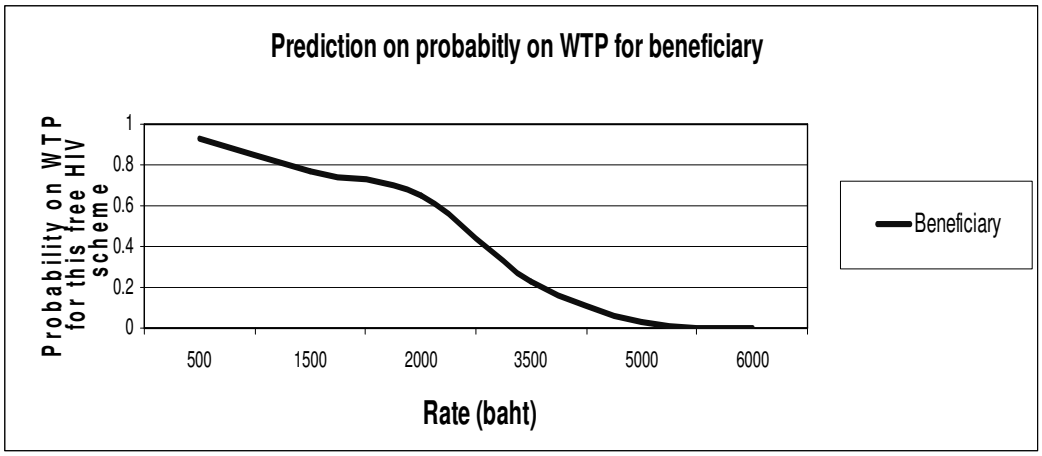

Figure 4.4 Prediction on Probability of Beneficiary Who would Able to Subsidize Our Free HIV Vaccine Scheme with Respect to the Rate of Tax Payment

Table 4.18 Determinants of WTP for Beneficiary

Model 2: Dependent: Probit of the demand for beneficiary						
Variable	**Full model**		**Fitted model**			
Independent variable	**Coefficient**	**Robust Std Err.**	**Coefficient**	**Marginal effect**	**Robust Std Err.**	**P-value**
Constant	9.417***	2.689	6.893**	2.466		0.005
Income (Logarithm form)	0.796**	0.260	0.825***	0.325	0.245	0.001
Rate (Logarithm form)	-1.927***	0.198	-1.773***	-0.698	0.198	0.000
Age	-0.042*	0.018	-0.046**	-0.018	0.016	0.004
Male	0.102	0.244				
Single	0.382	0.318				
High_edu	0.191	0.254				
Private	-0.397	0.328				
Teenagers	0.357	0.282				
Household	0.028	0.067				
Knowledge	0.409	0.379				
One_partner	0.112	0.445				
Condom	-0.186	0.453				
Healthylook	-0.351	0.435				
Mosquito	0.117	0.369				
Eating	0.473	0.412				
Known	0.513*	0.242	0.567**	0.2231	0.2189	0.01
Curable	0.222	0.222				
CSW_main	0.174	0.229				
Young_risk	-0.814	0.743				
Low_effectiveness	-0.212	0.254				
Understanding	-0.787	0.879				
70% effectiveness	0.293	0.221				
Remarks: * p<0.05;**p<0.01;***p<0.001						

Summary statistics	**Full model**	**Fitted model**
Number of obs	270	270
Log-likelihood	-94.016	-101.863
LR	181.453(22)	165.760(4)
Prob> LR	0.000	0.000
Pseudo R square	0.4911	0.4486
BIC	-1194.78	-1279.856
AIC	0.867	0.792

4.2.1.3 The Demand Model for Non-Beneficiary

Table 4.19 shows the outcomes of probit demand among non-beneficiaries for a free HIV vaccination scheme. On this account beneficiaries might feel altruism or have positive externality when the HIV/AIDS prevalence in the society has become lower if this programme was implemented. As a consequence, they are unquestionably willing to pay and sponsor for this programme.

Probit model with a zero P-value in likelihood ratio test shows that all explanatory variables are not statistically equal to zero. As for measuring goodness of fit, the fitted model is a preferable choice (Raftery, 1995: 137-141).With the robust variance estimators in the model, INCOME, RATE, ONE_PARTNER, CURABLE, and CSW_MAIN as the independent variables have statistically significance with the level of 95% confidence interval.

Exactly like the results on the previous two probit models, INCOME and RATE have a profound influence on the willingness to pay amount for this free scheme. Moreover, the income and price elasticity shown in Table 4.20 are in line with the results in Table 4.19.

For non-beneficiaries, INCOME positively affected the demand with a 37% chance they are willing to finance a one-year free HIV vaccine programme if their monthly income earnings have been additionally increased, while RATE has a negative impact with an almost 50 % possibility that they are not able to pay for this free scheme, if the rate of tax payment was marginally increased. Also if RATE increased by 1%, as for price elasticity non-beneficiaries have less magnitude of supporting this free scheme by 3.8% than 5.4% do beneficiaries, other things being equal. In other words non-beneficiaries have more altruistic behavior than beneficiaries if the tax payment on for this free HIV programme was raised marginally.

Table 4.19 Determinants of WTP for Non-Beneficiary

Model 3: Dependent: Probit of the demand for non- beneficiary						
Variable	**Full model**		**Fitted model**			
Independent variable	**Coefficient**	**Robust Std Err.**	**Coefficient**	**Marginal effect**	**Robust Std Err.**	**P-value**
Constant	-0.307	2.465	-0.97		2.116	0.647
Income (Logarithm form)	1.114***	0.247	1.027***	0.367	0.211	0.000
Rate (Logarithm form)	-1.430***	0.135	-1.382***	-0.494	0.131	0.000
Age	-0.03	0.022				
Male	0.23	0.210				
Single	-0.292	0.645				
Married	0.083	0.622				
High_edu	-0.043	0.256				
Private	0.172	0.288				
Teenagers	-0.114	0.268				
Household	0.082	0.062				
Knowledge	0.05	0.302				
One_partner	1.497**	0.506	1.430***	0.304	0.403	0.000
Condom	-0.258	0.500				
Healthylook	-0.04	0.448				
Mosquito	0.239	0.332				
Eating	-0.241	0.386				
Known	0.06	0.263				
Curable	0.723**	0.228	0.589**	0.220	0.216	0.006
CSW_main	-0.349	0.202	-0.380*	-0.139	0.193	0.049
Young_risk	0.242	0.438				
Low_effectiveness	0.164	0.202				
Understanding	-0.79	0.940				
70% effectiveness	0.222	0.201				
Remarks: * p<0.05;**p<0.01;***p<0.001						

Summary statistics	**Full model**	**Fitted model**
Number of obs	330	330
Log-likelihood	-122.769	-127.752
LR	193.327(23)	183.361(5)
Prob> LR	0.000	0.000
Pseudo R square	0.441	0.418
BIC	-1528.98	-1623.402
AIC	0.89	0.811

Table 4.20 Income and Price Elasticity of Demand Non-Beneficiary

	Elasticity	**Std. E**	**P-vale**	**95% confidence interval**	
Income (Logarithm form)	3.549	0.731	0.000	2.116	4.981
Rate (Logarithm form)	-3.826	0.384	0.000	-4.580	-3.073

Regarding the CURABLE variable, if non-beneficiaries have heard that HIV is presently curable, they are more likely to support this free scheme. This is a sign of altruism if there is a cure for HIV/AIDS, as the altruistic non-beneficiaries would like this free scheme to be carried out by financing this one-year HIV vaccine programme to considerably reduce the rate of HIV/AIDS spreading among Thais and also to benefit the younger and future generations.

The ceteris paribus effect of being ONE_PARTNER is estimated to be significantly positive. Non-beneficiaries who believe that the risk of HIV transmission would be significantly reduced by having sex with only one uninfected HIV partner will have a 30% chance of supporting this governmental plan.

In spite of this, if non-beneficiaries strongly believed that commercial sex workers currently are responsible for spreading most new infections of HIV, other things being equal, they are less likely to finance this scheme Under the ceteris paribus, of 600 respondents shown in Table 4.3, 70% still believed that if an HIV vaccine existed, vaccinating commercial sex workers as the first and only priority would not be the most cost effective approach.

As regards Figure 4.5, the probit model in Table 4.19 predicted the possibility of non-beneficiary who would contribute to this free HIV vaccination programme with regard to the rate of tax payment. Our study, as has been noted, has estimated three demands for a free HIV vaccination scheme with different types of respondents; beneficiary, non-beneficiary, or the general population with regard to the rate of tax payment and vaccine effectiveness.

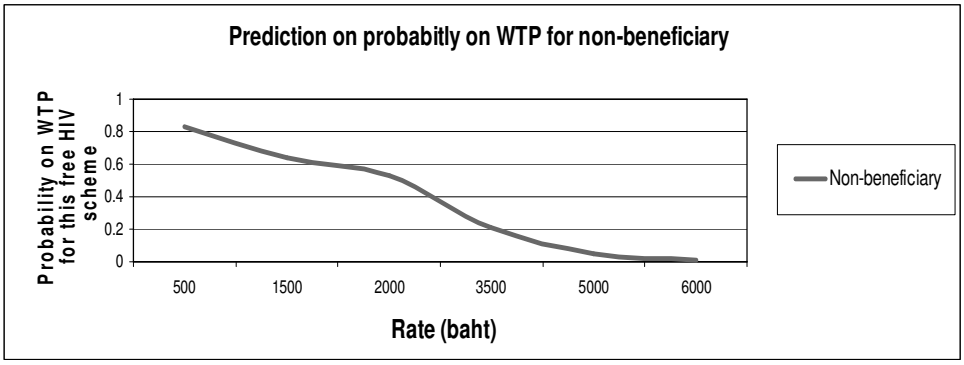

Figure 4.5 Prediction on Probability of Non- Beneficiary who would Able to Sponsor Our Free HIV Vaccine Scheme with Regard to the Rate of Tax Payment

With all differing results from these models, INCOME and RATE are considered as the most important influences on an individual's willingness to subsidize this programme. CURABLE and KNOWN both have a very good effect on the decision whether people are going to sponsor this scheme. Other variables being the same, if people have either known someone with HIV/AIDS or heard that HIV now is curable, they are more willing to pay for this HIV vaccination scheme. 70% EFFECTIVENESS is marginally significant; however, a free HIV programme with higher vaccine effectiveness has an increased likelihood of being funded by people than does the a scheme with a lower effectiveness

Many other variables in our demand models are statistically insignificant. Of them, UNDERSTANDING, referring to how well respondents understand the vaccine effectiveness, has no effect on the demand for our free HIV vaccine programme. Since this variable shows an insignificantly negative coefficient, this influence is meaningless for individuals to decide whether they are willing to sponsor this free scheme. Quite the opposite, the understanding of vaccine effectiveness is a main factor when people opt to purchase an HIV/AIDS vaccine for themselves (Bishai et al., 2004: 657; Suraratdecha et al., 2005b: 279).

4.2.2 The Estimation of Mean Willingness to Pay (WTP)

Regarding our contingent valuation method (CVM) survey, it was based on doubled bounded format with the following open ended question to estimate the

public demand for a free HIV vaccination programme. This method has been discussed on section 3.1.3 in Chapter 3.

Table 4.21 Distribution of Responses by Various Initial Rate of Tax Payment in Double Bounded Format

Vaccine effectiveness	Y/Y		Y/N		N/Y		N/N	
	30% %(n)	70% %(n)	30% %(n)	70% %(n)	30% %(n)	70% %(n)	30% %(n)	70% %(n)
Initial rate = 500 baht	54%(27)	68%(34)	38%(19)	26%(13)	6%(3)	6%(3)	2%(1)	0%(0)
Initial rate = 1,500 baht	18%(9)	24%(12)	34%(17)	46%(23)	12%(6)	22%(11)	36%(18)	8%(4)
Initial rate = 2,000 baht	12%(6)	16%(8)	34%(17)	38%(19)	14%(7)	16%(8)	40%(20)	30%(15)
Initial rate = 3,500 baht	6%(3)	4%(2)	20%(10)	22%(11)	12%(6)	10%(5)	62%(31)	64%(32)
Initial rate = 5,000 baht	0%(0)	0%(0)	10%(5)	12%(6)	18%(9)	16%(8)	72%(36)	72%(36)
Initial rate = 6,000 baht	0%(0)	0%(0)	2%(1)	2%(1)	8%(4)	4%(2)	90%(45)	94%(47)

Note: n = number of respondent; % = percentage of respondent willing and able to pay for our free HIV vaccine scheme with different rate of tax payment (in baht) and vaccine effectiveness (in percent); Y/Y = Yes/Yes; Y/N = Yes/No; N/Y = No/Yes; N/N = No/No; and total number of respondent per rate of tax payment and each vaccine effectiveness equals 50 persons

Research question 3: how much would individuals be willing to pay as a single shot in their yearly income tax to finance this free scheme?

As for the split sample survey on two vaccine effectiveness: 30% and 70%, our results (Table 4.21) showed that respondents opting for the 70% vaccine effectiveness were willing to pay more, compared with the lower vaccine effectiveness. With the Yes/Yes response on initial tax payment as 500 baht, almost 70% of respondents, for instance, would able to support the free 70% vaccine effectiveness HIV scheme, whereas only 54% were willing to finance the free 30% vaccine effectiveness HIV programme.

Despite this, our study estimated mean WTP from both single bounded and double bounded formats because single bounded format can provide “fully incentive-

compatible" issue, whilst double bounded format therefore increases the statistical efficiency of welfare estimation.

With the single and double bounded estimations, our study hence calculated the mean WTP with regard to three different aspects: (1) the respondent's behavior: beneficiary/non-beneficiary; (2) vaccine effectiveness: 30/70% and (3) household characteristics: respondent living together with/without household members who are teenager aged 15-19.

According to Table 4.22, the estimate of mean WTP consists of single and double bounded values with respect to type of respondent: beneficiary/non-beneficiary; type of vaccine effectiveness: 30 %/70%; and socio-characteristics: household with/without 15-19 yrs old teenagers. Despite this, the mean WTP calculated from double bounded is obviously less than the WTP based on the single bounded. This is also consisted with previous studies (Carson and Groves, 2007: 195; Freeman, 2003: 171-172).

Table 4.22 The Mean WTP with Respect to Different Aspects

	Type of mean WTP	Single bounded (Baht)	Standard Error	Double bounded (Baht)	Standard Error
1	**Mean WTP with beneficiary**	2,487.67	142.01	1,910.52	129.37
	Mean WTP with non-beneficiary	2,163.74	177.23	1,901.44	140.01
2	**Mean WTP with 30% vaccine effectiveness**	2,147.09	169.94	1,746.43	147.20
	Mean WTP with 70% vaccine effectiveness	2,515.96	154.53	2,049.78	127.79
3	**Mean WTP with 15-19 yrs old teenager in household**	2,594.45	296.05	1,812.73	256.25
	Mean WTP with no 15-19 yrs old teenager in household	2,278.44	122.14	1,920.96	103.52

Due to the lower standard error value, the mean WTP from double bounded has provided more the statistical efficiency of welfare estimation than single bounded.

Nonetheless the double-bounded estimate is faced with the problem of the strategic bias on the following-up questions (Haab and McConnell, 2003: 124), whereas the single bounded is exempt from it. Even though there is a trade-off between bias and efficiency in the double-bounded use, it is still unclear and questionable on the direction and magnitude of the bias which has not been well characterized (Freeman, 2003: 182).

As for various type of mean WTP (See Table 4.22), our study has to verify those values have statistical difference in the aspects between beneficiary and non-beneficiary; 30% and 70% effectiveness; household with and without teenagers by estimating the probit model including those features as the dummy variables.

Table 4.23 Probit Results for Differing Type of Mean WTP

Model: Dependent: Probit of the full demand for a free HIV vaccination programme				
Variable				
Independent variable	**Coefficient**	**Marginal effect**	**Robust Std Err.**	**P-value**
Constant	-6.606***		1.427	0.000
Income (Logarithm form)	0.800***	0.284	0.149	0.000
Rate	-0.001***	0.000	0.000	0.000
Beneficiary	0.028	0.010	0.131	0.833
70% effectiveness	0.23	0.081	0.131	0.079
Teenagers	0.124	0.045	0.168	0.459
Curable	0.354*	0.130	0.154	0.022
Remarks: * p<0.05;**p<0.01;***p<0.001				
Summary statistics				
Number of Obs	600			
Log-likelihood	-246.716			
LR	316.552(6)			
Prob> LR	0.000			
Pseudo R square	0.3908			
McFadden's R square	0.391			
BIC	-3299.947			
AIC	0.846			

With the method of maximum likelihood estimation, the results of the probit model were presented in Table 4.23 with respect to various aspects of mean WTP as the dummy variables such as BENEFICIARY, 70% EFFECTIVENESS, and TEENAGERS, accordingly.

As regards the likelihood ratio (LR) test, it showed that all coefficients in explanatory variables are not equal to zero at any reasonable significance level. The estimates of the coefficients for this probit had been estimated with the robust variance estimators. INCOME, RATE, and CURABLE are thus statistically significant, while BENEFICIARY and TEENAGERS representing the feature of mean WTP are statistically insignificant at any significance level.

Despite this 70% EFFECTIVENESS is marginally significant with a 90% confidence level. Then only the mean WTP between 30% and 70% vaccine effectiveness are remarkably different, while the rest of mean WTP values in Table 4.22 are statistically the same. On this account the mean WTP values with 70% vaccine effectiveness are 2,515 and 2,050 baht as for single and double estimates, which all statistically higher than the 30% vaccine effectiveness mean WTP of 2,147 baht and 1,746 baht respectively.

The difference in mean WTP between beneficiary and non-beneficiary is not statistically significant. One possible explanation is that our study faces a dilemma when the beneficiary creates strategic bias. A non-beneficiary similarly is too difficult and too complicated to define, although our study attempted to identify whether a respondent was a beneficiary or a non-beneficiary with many questions. This is consistent with the view of "the fallacy of motivational precision[1]", which is hard to ask respondent to separately value the several benefit categories for a given free HIV vaccination scheme (Mitchell and Carson, 1993: 287-288).

As expected, the mean WTP for a beneficiary should be considerably higher than for a non-beneficiary because beneficiary would benefit from our free HIV vaccine scheme. In spite of this, the outcomes in Table 4.22 showed the difference just marginally higher. This implied that beneficiary provides a WTP amount that

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[1]See Chapter 12: Sampling and Aggregation issues in Mitchell R. and Carson R.T. 1993. **Using Surveys to Value Public Goods: the Contingent Valuation Method.** 3rd ed. Washington, D.C.: REF Press.

differs from his/her true WTP amount in an attempt to become a free rider who enjoys the benefits from this free HIV scheme.

A non-beneficiary, despite this, is hard to define because some beneficiaries lie behind the characteristics of non-beneficiary. As for our identifying question, a male respondent for example might pose as a non-beneficiary to trick our interviewers, while in fact he is a patron of the place providing commercial sex workers. A female respondent, especially a single one, will become a future beneficiary if she is going to get married. It is quite possible that she is willing to support this free scheme since it would benefit her in the future. Above all, this makes the mean WTP for a non-beneficiary not much different to that for a beneficiary

4.3 Consequence of the Free HIV Vaccination Programme

At the end of the survey, respondents were asked whether they agreed that people, having been vaccinated for free under this programme, would be more likely to engage in risky behavior such as unprotected sex, or more causal sex.

It is ironic that 97.5% of all respondents in our survey agreed that if this free HIV vaccine scheme was implemented, regardless of vaccine effectiveness, people being vaccinated under this programme would be more likely to engage in unprotected sex or have more casual sex (see Table 4.24). In spite of this there is no strong evidence to support the difference between two free schemes because it just has marginal significance with a 90% confidence interval. Moral hazard, it implies, is however a possible explanation on this issue. So this should be the subject of a future study to investigate people's behavior in response to this free HIV vaccine scheme if an HIV/AIDS vaccine does exist. Lastly, Chapter 5 will discuss these findings related to methodological issues; policy implications; suggestions; and further studies.

Table 4.24 The Respondents' Attitude towards the Impact on Our Free HIV Vaccine Scheme

Do you agree that people, having been vaccinated for free under this scheme, will be more likely to engage in risky behavior such as unprotected sex, more causal sex?	**30% vaccine effectiveness programme**	**70% vaccine effectiveness programme**	**Total**
Agree	99.60%	95.33%	97.50%
Do not agree	0.40%	3.67%	2%
I do not know	0%	1%	0.50%
Number of respondents	300	300	600

Note: The difference in the percentage of this attitude towards the impact on the free HIV scheme between 30% and 70% vaccine effectiveness programme is just marginally significant with 90% confidence interval (See Table 4.15 and 4.23).

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 The Public Demand for a Free HIV Vaccination Scheme

The purpose of this study was to obtain in-depth information from the public, the general population including both males and females, about the degree of financial support for this one-year free HIV vaccination scheme. Also the study, by the use of CVM, was to analyze how much each person would be willing to pay for this free programme with a "one-off" yearly income tax payment and what were the key factors influencing them to finance this free scheme in accordance with their behaviors.

The results from our contingent valuation study showed that there was a potential-demand for a free HIV vaccination programme with the mean willingness to pay (WTP) dependent upon the vaccine effectiveness. The mean WTP values with 70% vaccine effectiveness were 2,515 and 2,050 baht using single and double bounded format estimates, while the 30% vaccine effectiveness had a mean WTP of 2,147 baht and 1,746 baht respectively. Therefore the mean WTP in single bounded was also higher than the double-bounded with a 95% confidence interval. However this study had two limitations. First, this study conducted survey of Thai residents only in the Bangkok metropolitan area which does not represent the whole country-of Thailand. Second, this free HIV vaccination was only a one-year scheme, while in reality if this free scheme was implemented, it would take longer than a single year to be a successful and effective HIV/AIDS prevention programme.

Despite this our study attempted to investigate the determining factors in the public demand for this free HIV vaccination programme. Our study of the public demand had been divided into three models with all respect to vaccine effectiveness and respondent's behavior: (1) The total demand for a free HIV vaccination

programme; (2) The demand for the beneficiary; and (3) The demand for the non-beneficiary.

Using the estimation of maximum likelihood method, the results of our probit model showed many factors influencing individuals to make their decisions whether they were willing to sponsor our free HIV scheme. First, both income and rate of tax payment were the most dominant factors. Income had a strong positive impact on the demand for this free scheme. As expected, people with a higher income were more likely to pay their income taxes to support this scheme. With a high possibility of 0.33, people on higher incomes tended to be willing to finance this scheme, other things being equal. On the other hand, the rate of tax payment for supporting this free scheme had a negative effect on willingness to pay. As the ceteris paribus, an increase in the rate of tax payment would obviously reduce the amount of willingness to pay for supporting this free scheme by a 50% chance.

Second, if an individual is male, he is more likely to be willing to support this free scheme more than is a female. Our study found that regardless of the vaccine effectiveness in a free HIV programme, older people were less likely to be willing to finance this programme, other things being equal. Also younger males had a higher willingness to pay for this free scheme than did older men.

The explanatory variables: KNOWN and CURABLE both also positively influenced Thais to pay for this free HIV programme. If an individual knew someone who had contracted HIV/AIDS, he or she would be willing to pay more for supporting this programme. Similarly people, especially the non-beneficiaries, who believed that HIV was now curable, were willing to pay more because this free scheme would provide them benefits in terms of a huge reduction in the spread HIV/AIDS. Last, the percentage of vaccine effectiveness used in this free programme made a big difference to individuals' willingness to finance this scheme. Evidently, Thais tend to be more willing to pay for the more expensive programme using the vaccine with the higher effectiveness than to pay less for the scheme with the vaccine with the lower effectiveness. On this account vaccine effectiveness has been regarded as the most dominant factor when individuals make up their mind whether to support this free scheme.

Surprisingly, understanding of vaccine effectiveness had little influence on respondents when they made their decision on willingness to pay for supporting this free scheme because the results in the three demand models all showed insignificant negative coefficients. This factor nevertheless has played a crucial role on the private demand when people decide to purchase the HIV/AIDS vaccines for themselves.

5.2 Methodological Issues

Subsequent to our study, there were many interesting methodological issues we would like to discuss and suggest for future studies because we were confronted with these problems which we had been limited in solving. Firstly our CVM study used the double-bounded format followed by an open-ended question. The open-ended questions following the "double-bounded" format questions were designedly to verify whether their responses which were zero WTP were valid or biased. If the zero WTP was proved to be biased, their answers on WTP would then be deleted considered as a "non-response". Nonetheless the double-bounded format has also been controversial with strategic behavior on the follow-up question. In this case, the offer of the free HIV vaccine scheme at a second rate of tax payment destroyed the incentive compatibility of the discrete choice question. This actual result depends on how respondents interpret the new information they have received. For instance, the second offer given the same free scheme could possibly create uncertainty about what the actual rate of tax payment to be charged will be. The individual thus would respond differently due to this uncertainty. On the other hand, the respondent might interpret the second rate of payment as signaling that our study was willing to bargain about this tax payment. Then the respondent might provide a "no" in the hope that an even lower offer would be forthcoming. In spite of this, our study recommended the use of the "one and a half" bid approach introduced by Cooper; Hanemann and Signorelli (2001: 1-27) This approach gains more efficiency than single-bounded and is also exempt from the strategic problems on the follow-up question.

Secondly as for the content validity, our study tried to guard against the scenario misspecification bias which occurs when a respondent does not respond to

the correct valuation scenario. In other words the respondent does not understand the scenario as our study intended it to be understood. This can be avoided by the use of focus groups, pilot surveys, and pretests. On the top of this, our study initially used "the storyboard" to help explain our contingent valuation scenario. The storyboard was immediately comprehensible to respondents while they were listening to our scenario explanation which may be obscure if the respondent was not familiar with HIV/AIDS vaccination schemes or the tax payment issue. At the same time, this storyboard would ensure that the explanation of the scenario given by our enumerators was consistent and accurate. According to our field survey, it was very difficult to keep our enumerator's explanations consistent, as sometimes the enumerators created their own scenario or missed some crucial parts. To hedge against this problem, this storyboard also helped our enumerators to convey complex ideas or bodies of information in our scenario while they had in-person interviews. Our study meanwhile applied "cheap talk script" to encourage the respondent to tell the truth before they started to elicit their WTP amounts. This mechanism was designed to solve hypothetical bias due to the hypothetical nature of the payment commitment (Bateman et al., 2002: 275; Cummings and Taylor, 1999: 663-664).

Thirdly the probit model is generally estimated with the maximum likelihood (ML) method; however; the study by Arana and Leon (2002: 631) found that the results of a probit model analyzed by the Bayesian estimation method led to better results compared to the maximum likelihood methods. According to the goodness of fit measure, this Bayesian method showed more accurate estimation of the parameters with small samples. So our study would strongly recommend this Bayesian method for next future CVM study because it performed better than ML method for conducting inference with the small samples.

Next our study attempted to estimate the mean WTP between beneficiaries and non-beneficiaries from our free HV vaccine scheme. Although our study had some questions to identify whether a respondent was a beneficiary or a non-beneficiary, our results showed that there was no significant difference on mean WTP between them. This issue had already been to fall into the trap of "fallacy of

motivational precision"[1] when a respondent had difficulty separately valuing the various benefit categories for a given free HIV vaccination programme. To ask respondents to say how much they were willing to pay this free scheme which was just for others, not for themselves, was very difficult. Because of this, this issue should be investigated more in future studies.

Lastly, with the limit of the CVM method on this study, we would recommend future research to obtain a detailed analysis of our free HIV vaccination programme by using the choice experiment (CE) approach. On the evidence of many stated preference studies by Bateman et al. (2002: 271-273), there are some advantages in using the choice experiment technique. First, the CE method does better job than the CVM study in terms of measuring the marginal value of changes in the characteristics of goods. This is often a more useful focus from a management or policy perspective than focusing on either the gain or loss of the good, provided by CVM study. Second, the CE method can reduce the extreme multi-collinearity problems in models based on variations in actual attribute values. Last, the CE approach may avoid some of the response difficulties in CVM study. Dichotomous choice designs in the CVM study, for instance might still be the subject to yea-saying despite improvements in design standards. Also the open-ended CVM format avoids the yea-saying problem, but is viewed as facing respondents with a mental task, which may be very difficult. Then it leads to item non-response or random responses. Despite this the CE approach faces respondent with much easier problem with the question of whether the respondent prefers A, B or neither.

5.3 Policy Implications of Results and Suggestions

The study based on the CVM results would suggest some policy implications if the HIV/AIDS vaccine already existed. First, it strongly recommends to our policy makers to provide a free HIV vaccination scheme because it benefits people in terms

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[1]See more details at Mitchell, R. and Carson, Richard T. 1993. **Using Surveys to Value Public Goods: The Contingent Valuation Method.** 3rd ed. Washington, DC: RFF Press.

of reduction in mortality and morbidity; lowering risk of HIV/AIDS prevalence in society; and increasing the free access to comprehensive HIV prevention, treatment, care and support for high risk groups such as sex workers. As for the publicly funded vaccination programme, it should initially target populations at higher risk of exposure to HIV, so both male and female sex workers[1] over the age of 20 would presumably be the first candidates for receiving free HIV vaccination. There is some evidence that the vaccination of high-risk groups is more likely to avert more HIV/AIDS infections than the vaccination of groups of lower-risk people and it also becomes the most cost effective approach (Desmond and Greener, 2003: 11-12; Gandhi et al., 2007: 1-11). If male and female CSWs as high-risk groups were vaccinated, this would significantly reduce new infections, and also lower the HIV/AIDS prevalence rate in Thailand because sex workers have remained a major risk group and are responsible for many new HIV infections (The World Bank, 2006: 13). It would increase health care capacity needs and also make this free scheme more efficient and more cost-effective, based on the interviews with the HIV/AIDS vaccine experts in Thailand.

However UNAIDS (2009: 3-5) claimed that the pattern of sex workers may vary between countries and within communities and also the degree to which it is more or less "formal" or organized. Due to the complexity of sex workers' patterns in our society, our study suggests this free scheme at first should vaccinate sex workers who work in the red light districts, located in major cities such as Bangkok, Pattaya, Phuket and Chieng Mai. Under this programme, the staff provided by ministry of public health would not only approach those sex workers in red light districts for vaccination, but also educate them on the basic knowledge about HIV risk, prevention, treatment and care. This will make this scheme more effective in terms of reducing HIV transmission between sex workers and their clients.

Second, vaccine characteristics used in this free scheme at the start would be a low effectiveness of 30% which has been consistent with HIV/AIDS vaccine experts' advice that the first HIV preventive vaccine will possibly have low effectiveness.

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[1] The definition of sex workers is female, male and transgender adults and young people who receive money or goods in exchange for sex services either regularly or occasionally (UNAIDS, 2009: 3)

Consistent with this, another interesting concern about the vaccine effectiveness is that the government should introduce the lower vaccine effectiveness rather than the higher one because the higher vaccine effectiveness might have a potential impact on sexual behavior and condom use. Therefore if the government provided the highly effective HIV vaccine in the free scheme, some Thais vaccinated under this scheme will possibly behave recklessly in terms of their and be less likely to use condoms with partners who are not their spouse (Suraratdecha et al., 2005b: 283).

Consequently this 30% HIV vaccine effectiveness scheme would be administrated to HIV uninfected individuals, who confirmed their status as HIV negative. Nonetheless, since HIV testing prior to vaccination will be logistically difficult and highly expensive, government should publically inform all potential vaccine receivers that this vaccine will only be effective for HIV negative people, not for HIV infected people. There is also no HIV test provided in this scheme. Therefore any prospective vaccine recipients in this free scheme must show the results of their HIV test before receiving the vaccine, the cost of which they must bear themselves. Anyone who has been diagnosed as HIV positive should consult with doctors or public health staff to receive free antiretroviral drug treatment instead of receiving this free HIV vaccine. This will reduce the cost of implementing this free scheme.

Table 5.1 "One-Off" Income Tax Payment for Supporting the Free HIV Scheme

Annual personal income for person aged 20-60 (Baht: before tax)	**"One-off" tax payment (Baht)***
Less 240,000	0
240,000	2,000
More than 240,000	>2,000 with an addition on 3% progressive income tax

Source: Authors' calculation based on mean WTP and income elasticity

Note: *This taxation is only "one-time" payment. However it could be made as an installment payment, for which the interest rate charge will would be charged.

Third, this publicly funded programme should initially be implemented for two years, according to the prior study (Gandhi et al., 2007: 20). The government could raise money to subsidize this two-year scheme by using a progressive tax. With the positive influence of the individual's income on the amount of willingness to pay, this progressive tax would charge a higher percentage of the individuals' income as their income rises with respect to sponsoring this free scheme. Regarding Table 5.1, it shows the "one-shot" income tax payment based on annual personal income for supporting this programme. To finance this two-year scheme, Thai taxpayers aged 20-60 years are obliged to pay only a "one-off" income tax payment. The payment nonetheless is based on annual personal income. If anyone has annual income (before tax) less than 240,000 baht, they would be given an exemption from paying it. On the other hand any individual whose yearly income is in excess of 240,000 baht is required to pay "one-off" tax payment as the base of 2,000 baht. In addition to this base payment of 2,000 baht, an extra payment based on a 3% tax on annual income of in excess of 240,000 baht. Someone, for example, with his annual income as 250,000 baht has an obligation to pay 2,000 baht plus an additional 300 which has been calculated from 3% of 10,000 baht which was earned in the excess of the 240,000 baht base. The "one-shot" tax payment is made either as a whole single payment or as an installment payment, which the interest rate charge has been applied to. As for these "one-shot" tax payments nationwide, the total sum to support this scheme would be at least 101 million baht[1], which is purposely used to sponsor this two-year free scheme. The government at the same time should have compulsory licensing from the patent owner to produce the HIV preventive vaccine in at an affordable cost with mass production. Thus it will make this free scheme more cost-effective and feasible. This issue should be the subject of a future study in terms of cost-effectiveness.

Last, along with this free HIV vaccination scheme, the government should advocate for and support a comprehensive approach to HIV prevention through combination strategies. Condoms are the most indispensable part of this combined prevention strategy. Although Thailand launched a 100% condom use campaign

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[1] Total number of 20-60 year old people countrywide whose yearly income in excess of 240,000 baht average out at 506,796 persons, based on Labor Force Survey, 2006-2008, National Statistical Office.

nationwide in 1992 with respect to promoting the universal use of condoms among CSWs, this country has still encountered a dilemma in the remarkably low rate of condom use among men having sexual contact with casual female partners or girlfriends, or with other men (Sombat Thanprasetsuk, 2004 quoted in The World Bank, 2006: 22). This is in line with a recent report by Apiradee Treerutkuarkul (2008: 11) which showed only 13% of students in high school and college level countrywide had used a condom while having sex, while only 9% of office employees used condoms while having sex with their partners.

As a result Thai government should relaunch this condom use campaign along with access to information about HIV/AIDS, especially for the youth. Also the government should promote the knowledge and skills for behavior change nationwide such as knowing your HIV status, knowing your risk, being faithful to one partner, and using condoms consistently and correctly. As has been noted there is no single magic bullet for HIV prevention, but the government should use a mix of all the above elements, along with a free HIV vaccine scheme when a vaccine becomes available, to halt this infectious disease.

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APPENDICES

APPENDIX A

A Theoretical Framework of Use and Non-User Value

As A. Myrick Freeman (2003: 143-147) theoretically explained, suppose that an individual has a preference ordering over a vector of market goods **G** and some nonmarketed resource q. The individual has no control over the level of q, but takes it as given. Thus q is taken to be the scalar measure of some characteristic of environment for example the value of some parameter of air quality or the population of some species. An abstract q can symbolize a measure of either a quality or quality. The choice of a unit for measuring q has consequential implications for measurement in practice; however; the question is not addressed here. The assumption that the environment resource can be explained by a single attribute is obviously a simplification. A more realistic model would allow for simultaneous changes in two or more quantitative or qualitative characteristics, or both, of the resource.

Based on the conditional indirect utility function, the compensating surplus (CS) is defined implicitly as the solutions to the following expressions:CS is the solution to

$$v\left(P, M - r.q^0, q^0\right) = v\left(P, M - r.q^1 - CS, q^1\right) \quad (1)$$

Then, assuming that r (the price of q) is zero, the CS measure of welfare change for an increase in q is

$$v\left(P, M - CS, q^1\right) = v\left(P, M, q^0\right) \quad (2)$$

or alternatively

$$\text{CS} = e\left(P, q^0, u^0\right) - e\left(P, q^1, u^0\right) \quad (3)$$

where u^0 is the solution to

$$\max: u\left(X, q^0\right) \text{ subject to } P.G \leq M \quad (4)$$

The derivative of the expenditure function with respect to q gives the compensated inverse demand function for q. Supposed that the inverse demand function is known, the compensating and equivalent surpluses can be measured by integrating over the range of change for q. On this account, there are measures of total value, which can be interpreted as the sum of use value and non-use value, which is;

$$CS = CS^U + CS^{NU} \quad (5)$$

In order to differentiate between use and non-use value, it is necessary to add more structure to the model through assumptions about the preference, which is separable preference. The physical proximity that one in general thinks of as being a key part of use can occur independently of the purchase of a complementary good. For example, a person drives by a nature refuge or scenic outlook while commuting to work or someone sees member of endangered species as an incidental part of his/her daily activities. So the presence or absence of the resource may have no effect on the behavior of the individual, however, this person could have a willingness to pay to preserve the resource. Nonetheless nothing can be inferred about this value from the demand curves fro market goods. The estimation of this type of use value by revealed preference method therefore will not be possible.

Regardless of the ambiguity of the concept of use in these cases, an alternative approach, firstly suggested by Maler et al (1994: quoted in Freeman, 2003: 145-146), might be more appreciate. From the perspective of the measurement of value, most meaningful difference is between those cases where changes in the level of q causes the changes in the behavior of individuals and those where they do not. Maler et al (1994 quoted in Freeman, 2003: 145-146) again propose the terminology of “use value” and “non-use value” defined as “values revealed by market behavior” and “values not revealed by market behavior” accordingly.

Because of this, suppose that the utility function is weakly separable as follows:

$$u = u\left[k(G,q), h(q)\right] \tag{6}$$

This approach of the preceding section based on a complementary relationship between q and a market good is a special case of this formulation. Maximizing either equation (6) or k(G,q) subject to the budget constraint and the exogenous q yields a set of demand function for **G**:

$$g_i(P,M,q) \tag{7}$$

By substituting equation (7) in equation (6), we then get the indirect utility function:

$$u = u\left[v(P,M,q), h(q)\right] \tag{8}$$

The use value of a change in q flows from the expression $v(.)$ and can be recovered from the data on market demands for **G**, while non-use value flows from $h(.)$. Next, modifying equation (1) to account for the assumed structure of preferences provides us the following expression to solve for CS:

$$u\left[v\left(P,M-CS,q^1\right), h\left(q^1\right)\right] = u\left[v\left(P,M,q^0\right), h\left(q^0\right)\right] \tag{9}$$

Given the separable assumption, use value, or CS^U, can be defined as the solution to:

$$v\left(P,M-CS^U,q^1\right) = v\left(P,M,q^0\right) \tag{10}$$

Thus since we must have $CS = CS^U + CS^{NU}$, non-use value or CS^{NU} is the solution to the following:

$$u\left[v\left(P, M - CS^{U} - CS^{NU}, q^{1}\right), h\left(q^{q}\right)\right] = u\left[v\left(P, M - CS^{U}, q^{1}\right), h\left(q^{0}\right)\right] \quad (11)$$

Add to this, the expression for non-use value must be evaluated assuming the compensating payment for use value has already been paid. Nonetheless, this is not the only way we could make use of this framework to define use and non-use values. In turn, we could evaluate non-use value first. Therefore CS^{NU*} could also be defined as the solution to

$$u\left[v\left(P, M - CS^{NU*}, q^{0}\right), h\left(q^{1}\right)\right] = u\left[v\left(P, M, q^{0}\right), h\left(q^{0}\right)\right] \quad (12)$$

Finally, CS^{U*} will be the solution to

$$v\left(P, M - CS^{NU*} - CS^{U*}, q^{1}\right) = v\left(P, M - CS^{NU*}, q^{0}\right) \quad (13)$$

Since equation (13) is evaluated at a differing income level than equation (10), then this will give a different value for CS^{U}. On the whole, Maler and colleague (1994) already make it clear by defining values in terms of differences between expenditure functions evaluated at different positions, as in equation (2). They evidently show that there is no unique way of partitioning total value its use and non-use components.

APPENDIX B

Questionnaire

Questionnaire #…….
Interviewer.....Date.....Supervisor.....
Time.....
Place/Khet.....
[Interviewer: Read the following statement to the respondent] This interview **is intended to assist the doctoral research of** Mr. Charoenchai Agmapisarn, a PhD candidate in Economics at School of Development Economics, NIDA. All information you provide will be held in strict confidence and will be used only for purposes stated for this study. Your answers will not be disclosed or released to others in any way that could identify you. If at any time you wish to stop the interview or not answer the specific question, this is entirely up to you. The interview normally lasts about 10 minutes.
[**If interviewer read all above statement, then you should sign your signature**]
Signature: ..... [Rate: 500, 1500, 2000, 3500, 5000, 6000]
[Effectiveness: 30% or 70%]

A public demand for the free HIV vaccination programme

[Interviewer: Please read these below statement and follow these conditions strictly]
1) The respondents in this survey must be taxpayers who are between the ages of 20 and 60 years old. Our survey will be conducted only in Bangkok area and all interviews will be conducted in Thai language. Also this study is not concerned with whether the respondent is originally from or whether he/she is Bangkokian.
2) Do not allow respondent to see this questionnaire. Interviewer has to narrate and explain to the respondents about questions, scenarios, and story as well as shows the storyboard and visual card. Moreover the interviewer has to fill all of the information taken from the respondent in this questionnaire by himself/herself.

.....

Part A Personal Information
[Interviewer] Please mark this sign [x] on the questionnaire form or fill the blank up

A1. Gender 1. Male 2. Female
A2. Age .....years (Remarks: the age 20 years and 8 month is 20 years)
A3. Marital status 1. Single 2. Married 3. Widowed/Divorced/Separated
A4. Educational level 1. No schooling 2. Elementary (6 years of schooling) 3.Primary (9 years of schooling) 4. Secondary (12 years of schooling). 5. Pre-college/Vocational 6. University 7. Postgraduate 8. Others: .....
A5. Occupation 1. Self-employed worker 2. Business owner with salary-paid employees 3. White collar worker in private firm 4.Bureaucrat 5. Staff in the state-enterprise organization 6. Part-time staff in government /state-enterprise organization
A6. Number of member living in the same household .....person(s) Number of 15-19 year old teenager living in the same household .....person(s)

Part B Personal Income

B1. Monthly income before tax (on average).....Baht

Part C Knowledge, Experience and Awareness of HIV/AIDS
[Interviewer: As for the HIV knowledge question, the answer given by the respondent will be only Yes/No/ I do not know. Then please mark this sign √ on the given box and count the number of **correct answers only**. The correct answers are "Yes" for question (1)–(3), while "No" for question (4) - (5). If the answer is "I do not know" given by the respondent, it will be considered as an incorrect answer]

[Remarks: HIV is Human Immunodeficiency Virus, while AIDS is Acquire Immune Deficiency Syndrome]

C1. **[Interviewer asked]** With these following statements, do you think this statement is true?
Knowledge of HIV

Knowledge of HIV	**Yes**	**No**	**Do not know**
1. Can the risk of HIV transmission be reduced by having sex with only one uninfected partner who has no other partners?			
2. Can a person reduce the risk of getting HIV by using a condom every time they have sex?			
3. Can a healthy looking person have HIV?			
4. Can a person get HIV from mosquito bites?			
5. Can a person get HIV by sharing food with someone who is infected?			
Number of the correct answers			

[Interviewer: Regarding the HIV/AIDS experience question, the answer given by the respondent will be only Yes/No/ I do not know and please mark this sign √ on the given box]

C2. **[Interviewer asked]** I would like to know, have you……
Experience of AIDS

Experience of HIV/AIDS	**Yes**	**No**	**Do not know**
2.1 Have you ever known someone who has had HIV/AIDS?			
2.2 Have you ever heard that HIV/AIDS is now curable?			

[Interviewer: Regarding the AIDS awareness question, the answer given by the respondent will be only Yes/No/ I do not know and please mark this sign √ on the given box]

C3. **[Interviewer asked]** In your opinion, is this following statement is true?

Awareness on **HIV/AIDS**

Awareness on HIV/AIDS	**Yes**	**No**	**Do not know**
3.1 Among three high risk groups: CSW (Commercial sex worker), IDU(Injecting drug user) and MSM(Men who have sex with men), CSW, both male and female, is still the major cause of the spreading of HIV.			
3.2 Thai teenagers now tend to have more casual sex compared to the past			
3.3 If an HIV vaccine exists, the government should prioritize commercial sex worker as the first vaccinated group.			
3.4 As for 3.3, To vaccinate only commercial sex workers as the priority is the most cost effective approach.			

Part D Understanding of Vaccine Effectiveness

[**Interviewer:** Show the visual card and explain vaccine effectiveness clearly how it works before the respondent is asked the following questions]

Questions on HIV vaccine effectiveness

I want to make sure that you understand the effectiveness of this vaccine

First time

1. Show me all the people who are vaccinated [Interviewer: Did the respondent correctly show all those vaccinated? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

2. Show me all the people who are protected and can not get HIV/AIDS. [Interviewer: Did the respondent correctly show all those protected? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

3. How many people are vaccinated, but not being protected and also can still get HIV/AIDS? [Interviewer: Did the respondent answer this question correctly? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

[Interviewer: Did the respondent answer all three of these questions correctly? Please check √ in our box]

Yes	☐	**(Continue the scenario)**
No	☐	**(Explain effectiveness using the visual card again)**

Second time

1. Show me all the people who are vaccinated [Interviewer: Did the respondent correctly show all those vaccinated? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

2. Show me all the people who are protected and can not get HIV/AIDS. [Interviewer: Did the respondent correctly show all those protected? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

3. How many people are vaccinated, but not being protected and also can still get HIV/AIDS? [Interviewer: Did the respondent answer this question correctly? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

[Interviewer: Did the respondent answer all three of these questions correctly? Please check √ in our box]

Yes	☐	**(Continue the scenario)**
No	☐	**(Continue the scenario)**

Part E Hypothetical Situation on WTP for a Free HIV Vaccination Programme

[Interviewer: Please show "the storyboard" while explaining the following HIV/AIDS information and hypothetical scenario to the respondent to make sure that he/she understands the situation]

Although there has recently been an overall decline in the rate of new HIV infections in Thailand, there has been a shift in new infections from high risk to lower risk groups such as women, in particular young women and housewives. These women have mostly been infected through sex with their male partners who had engaged in unprotected sex, either with commercial sex workers or with other partners. On account of this, the Thai government is concerned about this issue, and then supposedly initiates "A free HIV vaccination programme" under the administration of department of AIDS, Ministry of Public Health. Assuming that this scheme takes only one year by sending many professional officers or staff to vaccinate both male and female commercial sex workers over the age of 15 for free in red light districts, bars, night clubs, saunas, and discos around major cities such as Bangkok, Phuket, Pattaya, and Chiang Mai. The HIV vaccine attributes used in this programme are (30%/70%) effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and one dose injection, respectively.

This HIV vaccine, in fact, would not be of any benefit to people who have already contracted HIV/AIDS. Also, this programme will neither provide blood testing due to the costs involved in testing, nor verify people by their blood test results due to the conflict with the privacy. By vaccinating male and female sex workers with a highly effective (30%/70%) vaccine under this scheme, it is expected that this will prevent between 370,000 and 1.9 million new infections nationwide per year. The scheme will need to be financially supported by the public since the government budget is limited. Because of this, Thai taxpayers aged between 20 and 60 years old countrywide will be responsible for financing this programme through their yearly income tax payments. The payment will be a one-time payment for financing this one-year free HIV vaccination scheme.

[Interviewer: Before you will ask the respondent the willingness to pay question, please read this statement as a cheap talk script

"Before you tell us how much you would vote on a possible payment as part of your yearly income tax in order to support our free HIV vaccination scheme, I want to ask you to help us with a problem we have in studies like this one. Many people say they would vote "Yes" in a survey but in fact they often vote "No" if real vote is held. We are not sure why people do this. Perhaps people say "Yes" because it makes them feel good to support this programme—or just to please interviewer. Maybe it is because people do not really have to make the payment for this scheme, and thus they do not pay a lot of attention to the payment shown. Perhaps they do not really think about what they would have to give up out of their monthly budget if they actually had to pay their share to support this scheme. If you do not pay attention, our analysis will be wrong. Please help us by paying attention to actual amount of the payment for this scheme before deciding whether to vote "Yes" or "No" for this scheme"

The willingness to pay question

E1. Suppose the government would collect an additional yearly income tax payment of 500, 1,500, 2,000, 3,500, 5,000, or 6,000 Baht, which was a one-time payment to support this free HIV vaccination scheme. Would you be willing and able to pay for this?
[Interviewer: Please choose the one option which most closely resembles your view by marking this sign √ on the given box and also do not read these bellowed answers to the respondent]

[ ] Yes **[Go to E2.]**
[ ] Yes, but I could not pay this tax rate at the moment **[Go to E3.]**
[ ] Yes, if I had more money since I have had a lot of personal expenses to pay **[Go to E3.]**
[ ] Yes, but I would like to know what others think/ or if other people agree **[Go to E3.]**
[ ] Yes, but this tax rate is too expensive **[Go to E3.]**
[ ] Yes, if this tax rate has been reduced **[Go to E3.]**
[ ] No **[Go to E3.]**
[ ] I have no idea/ I do not know **[Go to E3.]**

E2. Supposed it turned out that this tax rate was being increased to the amount of 750, 2,250, 3,000, 5,250, 7,500, 9,000 Baht. Would you be willing and able to pay for this rate?
[Interviewer: Please choose the one option which most closely resembles your view by marking this sign √ on the given box and also do not read these bellowed answers to the respondent]

[ ] Yes **[Go to E4.]**
[ ] Yes, but I could not pay this tax rate at the moment **[Go to E4.]**
[ ] Yes, if I had more money since I have had a lot of personal expenses to pay **[Go to E4.]**
[ ] Yes, but I would like to know what others think/ or if other people agree **[Go to E4.]**
[ ] Yes, but this tax rate is too expensive **[Go to E4.]**
[ ] Yes, if this tax rate has been reduced **[Go to E4.]**
[ ] No **[Go to E4.]**
[ ] I have no idea/ I do not know **[Go to E4.]**

E3. Supposed it turned out that this tax rate was being decreased to the amount of 300, 1,000, 1,300, 2,300, 3,300, 4,000 Baht. Would you be willing and able to pay for this rate?
[Interviewer: Please choose the one option which most closely resembles your view by marking this sign √ on the given box and also do not read these bellowed answers to the respondent]

[ ] Yes **[Go to E4.]**
[ ] Yes, but I could not pay this tax rate at the moment **[Go to E4.]**
[ ] Yes, if I had more money since I have had a lot of personal expenses to pay **[Go to E4.]**
[ ] Yes, but I would like to know what others think/ or if other people agree **[Go to E4.]**
[ ] Yes, but this tax rate is too expensive **[Go to E4.]**
[ ] Yes, if this tax rate has been reduced **[Go to E4.]**
[ ] No **[Go to E4.]**
[ ] I have no idea/ I do not know **[Go to E4.]**

E4. What is the maximum amount that you would be willing and able to pay for supporting this free HIV vaccination programme? .....Baht
[If the amount is 0, please go to E6, otherwise go to E 5]

E5. Please explain why you would be willing and able to pay for supporting this free HIV vaccination scheme. [Interviewer: **Do not read the following list**. Please choose the one option which most closely resembles your view by marking this sign √ on the given box]

[ ] This programme benefits me and my family if the HI/AIDS prevalence has been declined.
[ ] This scheme will provide positive externality for society.
[ ] The tax rate is not too expensive and is affordable.
[ ] This programme will benefit the next generation.
[ ] Ohter, specify.....

E6. Why would you not be willing and able to pay for supporting this free HIV vaccination programme? [Interviewer: **Do not read the following list**. Please choose the one option which most closely resembles your view by marking this sign √ on the given box]

[ ] No money
[ ] Do not see the benefit of this programme
[ ] Do not think that I will get infected with HIV/AIDS
[ ] Do not think that this programme is effective to prevent HIV/AIDS in our society
[ ] Ohter, specify.....

E7. Do you agree that people, having been vaccinated for free under this programme, will be more likely to engage in risky behavior such as unprotected sex, more causal sex? [Interviewer: Please mark this sign √ on the given box and fill information given by the respondent in this blank.]

[ ] Agree
[ ] Disagree because.....
[ ] I do not know/ have no idea, because .....

Part F Identify Respondent whether He/She is Perceived as Beneficiary or Non-Beneficiary towards this Free HIV Scheme

F1 [Interviewer: This question is only for **male respondents**. If the respondent is female, please go to the question F2]

In Bangkok area, have you ever known any place or venue providing either male or female commercial sex workers?

Know	**[Go to F1.1]**
Do not know	**[Non-beneficiary]**

F1.1 Have you ever been that place?

Have been	**[Beneficiary]**
Never have been	**[Non-beneficiary]**

[Interviewer: According to the questions, what is the type of this male respondent? Please mark this sign √ on the given box]

Beneficiary ☐ **[Go to part G]**

Non-beneficiary ☐ **[Go to part G]**

F2 [Interviewer: This question is only for **female respondents**. If the female respondent is **married woman**, please identify her as **beneficiary** and then mark this sign √ on the given box below, otherwise please ask this following question, and then fill in this information provided by the respondents]

How would you rate yourself as being the risk of contracting HIV/AIDS through sexual transmission based on your sexual behavior on a scale of 0-100 % ……....%
(0 is no possibility while 100 is the highest possibility of getting infected with HIV/AIDS)

[Interviewer: Please mark this sign√ on the given box bellows. If the answer is **between 0 -49 %,** she will be identified as **non-beneficiary**; otherwise it is beneficiary as for answer which is **the between 50- 100 %]**

Beneficiary ☐ **[Go to part G]**

Non-beneficiary ☐ **[Go to part G]**

Part G [Interviewer read this following statement to the respondent]

"**This is the end of interview. Thank you very much for your cooperation**. I want to remind you again that there is actually no HIV/AIDS vaccine on the market nor is there a free vaccination programme in our society. In fact, an effective HIV/AIDS vaccine may never be successfully developed during this time. As I told you, the purpose of this study is the part of fulfill requirements for the degree of Doctor of Philosophy in Economics. The aim of this PhD research study is to find out how much the general population would be willing and able to support a free HIV vaccination scheme, so we have asked different respondents with different income tax rates. So please do not be concerned if you hear that someone else in your community has been interviewed and asked about different rates than the ones you and I have discussed"

APPENDIX C

List of All Publications with Respect to Various Types of Vaccines by Professor Dale Whittington

- Cook, Joseph et al. 2007. Reliability of Stated Preferences for Cholera and Typhoid Vaccines with Time to Think in Hue, Vietnam. **Economic Inquiry.** 45(1): 100-114.

- Cropper, Maureen L. et al. 2004. The Demand for a Malaria Vaccine: Evidence from Ethiopia. **Journal of Development Economics.** 75(1): 303-318.

- Do, Gia Canh et al. 2006. Household Demand for Typhoid Fever Vaccines in Hue City, Vietnam: Implications for Immunization Programs. **Health Policy Planning.** 21(3): 241-255.

- Lucas, Marcelino E.S. et al. 2007. Private Demand for Cholera Vaccines in Beira, Mozambique. **Vaccine.** 25(March): 2599-2609.

- Poulos, Christine et al. 2004. A Cost –Benefit Analysis of Typhoid Fever Immunization Programmes in an Indian Urban Slum Community. **Journal of Health**, **Population, and Nutrition.** 22(3): 311-321.

- Whittington, Dale et al. 2002. Private Demand for a HIV/AIDS Vaccine: Evidence from Guadalajara, Mexico. **Vaccine.** 20(19-20): 2585-2591.

- Whittington, Dale et al. 2009. Rethinking Cholera and Typhoid Vaccination Policies for the Poor: Private Demand in Kolkata, India. **World Development.** 37(February): 399-409.

- Suraratdecha, Chutima et al. 2005. The Private Demand for an HIV/AIDS Vaccine in Thailand. **Health Policy.** 71(3): 271-287.

APPENDIX D

List of Interviewees and Advisors

First, Surname	Title, Position/Affiliation
Charung Muengchana	MD, National Vaccine Committee Office (NVCO), Department of Disease Control, Ministry of Public Health, Thailand
Chutima Suraratdecha	Head, JE project at PATH: www.path.org
Dale Whittington	Professor, Department of Environmental Sciences & Engineering, and City & Regional Planning, University of North Carolina at Chapel Hill
Ganrawi Winitdhama	Researcher, Family Health International,www.fhi.org
Paul Newman	Associate Professor, Canada Research Chair in Health and Social Justice, Faculty of Social Work / Centre for Applied Social Research, University of Toronto
Punnee Pitisuttithum	Professor, Head, Dept of Clinical Tropical Medicine; Chief, Clinical Infectious Diseases Research Unit, Faculty of Tropical Medicine, Mahidol University
Ram Rangsin	Assistant Professor, Dept of Military and Community Medicine, Phramongkutklao College of Medicine
Wiwat Peerapatanapokin	MD, Researcher, the East-West center

APPENDIX E

Pre-Questionnaire Focus Groups

First focus group: (Male) at NIDA on June 29, 2008

This focus group of male participants was blue collars, aged between 26-35 yrs with education background at least master degree.With 11 male-focus group, the summary thus was:

- Most participants preferred to pay for the free HIV vaccination programme rather than research on HIV vaccination because it was more practical and useful, while HIV research has still been on progress and there was no guarantee when vaccine will succeed.
- One person raised the problem of moral hazard when people have already been vaccinated.
- Any side-effect on after being vaccinated? Someone raised question that if there was a side-effect, it may pause people to think before they have free vaccination.
- Advised to give this focus group more details on product, where, when, how product worked.
- Someone might pay one dose per 1,000 baht, but most of them needed to know how long they had to subsidize this programme.
- It needed to tell how long the period of free scheme was and what was the target group whom has been vaccinated? It should not all Thais in this nation.
- Most participants were willing to pay for sex workers and drug users. However, they preferred to pay for drug users because someone suggested that sex workers might have low risk since in Bangkok those sex workers in bathhouse have regularly been checked up for HIV test.

- Vehicle payment was still in question, some suggested that to pay in method of VAT, others suggested to pay via social security scheme. However, most of them agreed to use vehicle payment as social security scheme.

- Acharn Udomsak advised to use matching game therefore if anyone paid 100 baht, then government should pay another same amount in order to increase more payment.

- Still, payment vehicle was still in question and whoever was going to pay

- The range of payment was a range from 50 to 1000 baht, however, someone recommended that using other payment vehicle like garbage payment in Bangkok or another method which makes people feel more comfortable to pay.

- Next focus group was needed to be prepared by either picture or graph and should take the photos.

Second focus group at TDRI (Female) July 1, 2008

Participants in this focus group were diverse: researchers and administrators. According to this focus group meeting, the conclusions were:

- Most of them preferred to pay for scientific HIV research for vaccine than HIV vaccine, even it took longer time, only 2-3 persons pay for HIV vaccine

- They mostly thought that investing in HIV vaccine research might gain some new knowledge or ideas, although it took 15 years for this doing research.

- Someone thought that HIV infection was far away from her life and less important for her because she was single.

- They did want this HIV research to make vaccine to only young children who were younger 15 years old since most 15-24 yr old teenagers have been highly infected or vulnerable.

- If those young children (younger than 15 years old) will be vaccinated for last 5 year, so these young children will become immune to HIV/AIDS for next five years.

- Vehicle payment was personal tax (1 percent of income) because they wanted all young children to have free vaccinated: a payment was approximately 100 baht per month for last 15 years.

- If there were two doses for HIV vaccine, some participants paid double like 200 baht. One, on the other hand, would pay the same price as earlier mentioned because she thought that she would not let her child to be vaccinated. She strongly believed that good HIV education will prevent her child from HIV infection.

- Moral hazard will be one issue which was in major consideration because after having HIV vaccination, how people (who got HIV vaccine) will change their behaviors to become more risky

- High risk people like commercial workers and drug users were not in favor by this focus group to make a payment for both HIV research and free HIV vaccine programme.

- Advised to inform all details and information in both HIV research and vaccine before give focus group in terms of discussion because more information, more idea how they chose because most of them in general had little knowledge on HIV/AIDS disease.

Third focus group (Female) on July 5, 2008 at NIDA.

Focus group: Female participants all worked as the human resource officers aged between 25-35 years old.

- Most of them agreed to pay for HIV vaccine (if it exists) rather than HIV research. Someone argued that having own HIV research was like a long-run plan, while free HIV vaccine programme was a short-run project.

- Many females in focus group said that HIV/AIDS was just a common disease where everyone might easily get infected.

- Among four choices: CSW, IDU, Housewives and teenagers, females in this focus group mostly chose teenagers because teenagers (15-24) were tending to be more curious in sex, unaware to have safe sex, and also had been with friends more than their parents. They now grew up so quickly and their friends have had an great

influence on them. In addition teenagers could be either CSW or IDU, so in order to prevent HIV was to vaccinate them as a priority. Teenagers were the major human capital source for our economy and society.

- Female focus group mostly did want to pay for free HIV vaccination programme to teenagers aged around 12-13 years old and if they (participants) have had children, they would bring their children at that age to be vaccinated for free

- Payment vehicle should be paid through fund by the set menu. For example, if anyone with income below 15,000, he/she will pay only 2% of actual salary, while above 15,000 baht will paid of 2% of 15,000 (max) which equaled 300 baht per month. In other words, income earner with above 15,000 baht must pay 300 baht per month for 5 years, below of it he or she will pay only 2% of his/her real income. Or, for poor it should be the fix payment like 50 baht per month suggested from one person in this focus group.

- One participant in focus group suggested that tax did not cover people like vendors as well as social security did not count the bureaucrats. Because of this, paying through fund was the best solution.

<u>Forth focus group (Female) on July 6, 2008 at NIDA.</u>

Our female focus group was working for financial companies with age between 25-30 years old. According to our discussion, the below were the summaries:

- More than half of participants in focus group would pay for free vaccination programme instead of HIV vaccination research. Some suggested that we should do both of them simultaneously.

- Teenager was their foregoing target group which should have prior free HIV vaccination compared with others such as housewife, IDU, and CSW.

- Teenagers, as a result, had no income, so they were unable to prevent themselves from HIV/AIDS infection. They sometimes loved to have fun. Some teenagers would like to have some expensive commodities or branded-name goods, so this made them to have quick sex in order to trade with some money for purchasing these stuffs.

- Most participants in focus group concluded that it should be a regulation or law on vaccinating these young teenagers. So, they did not feel any difference or strange if all of their friends would be vaccinated.

- Their payment vehicle would be paid through fund with an average of 170 baht per month by deducing from wages.

- Asked these female if they were young teenagers whether they would like to get these free HIV vaccines. Half of them refused to get because they argued that they themselves were not highly HIV-risk infectors.

- This focus group unanimously suggested that teenager aged around 12-15 years old was the prime target group for being vaccinated in line with free HIV vaccines.

- All of them said that if they had children with age of 12-13 years old, they would bring them to get free vaccination.

Fifth focus group (Male) on July 6, 2008 at NIDA

Most participants were engineers with aged between 25-30 yrs old. Those were the conclusions from them:

- The majority of this focus group (six people) chose to pay for free HIV programme while only one person paid for HIV vaccine research because they mostly agreed that vaccine could be immediately used for preventing human being from HIV, whereas HIV research did take longer time to succeed in vaccine.

- If a free HIV vaccination programme exists, half of this focus group will select sex workers because they strongly believed that many sex workers not only do not have 100 % safe HIV preventive methods i.e. condom use, but also have not been well educated, while another half of this focus group will choose teenager (15-24 yrs old) to get free vaccinated.

- Readiness for willingness to pay, these focus group will pay on average 762 baht per year for sex worker, while an approximately of 4,000 baht per year for teenager. The payment vehicle will be through HIV fund rather than taxation.

- The target group under this free HIV vaccine programme for sex worker aged between 18-25 years old, while teenager aged around 15 years old.
- If this male participant focus group has children or young relative who are teenagers, they all agreed to bring them to get free HIV vaccines.

Sixth focus group (Male) on July 14, 2008 at NIDA

This male focus group was administrative staffs aged 30-45 years old with low-medium income. It consisted of four Thai males in this focus group. Below was the conclusion from our focus group's discussion.

- More than half of participants will choose to pay for free HIV vaccination, while only one person still insisted to pay for HIV vaccine research because it can built new scientific knowledge on new HIV vaccine discovery.
- Among four choices: IDU, CSW, Teenager, and Housewife, this male focus group mostly selected to pay for teenager in order to have them the free HIV vaccine.
- According to their discussions, Thai teenagers tended to have multiple sex partners, love to have fun, and did not know how to have safe sex, while commercial sex workers had knowledge to prevent themselves from HIV infection.
- Teenager, in Thailand, had been less connected with their parents and became more obsessed with browsing internet websites for example, cyber friendship, game and date matching. This probably created more chances to assess or have casual sex, and sexual dates through cyber internet.
- As for target group, an average age of teenager to be the target could be around 12-14 years old.
- The payment vehicle should be possibly towards HIV fund with an average annual payment around 500 baht.

List of participants for all six focus groups

The name list of first focus group:

Mr. Somkiet Khumtonwong

Mr. Aronon Phuekfhon

Mr. Sigtaporn Kongsree

Mr. Waranon Dilokkhunanan

Mr. Jirayut Poomontre

Lt. Col Pittaya Gomolman

Mr. Pakkapol Leopairut

Mr. Vongphachanh Sengsouvanh

Mr. Cherdpong Janchongyang

Mr. Thammachart Kulprapha

Mr. Sookyuen Tepthong

The name list of second focus group:

Mrs. Ladapun Kurisitsophit

Mrs. Sunee Saw Khoo

Mrs. Korakot Sriwan

Mrs. Jiraporn Plangpraphan

Mrs. Panlada Tripittayakul

Mrs. Siraporn Gebben

Mrs. Suwanna Tulyawasinphong

Mrs. Nipa Srianant

The name list of third focus group:

Ms. Sakunkan Khanthong

Ms. Perayaporn Srisupap

Mrs. Udomrat Kaewtep

Ms. Sillapawanna Limpasoponpanich

Mrs. Wassana Numniyom

Ms. Kasera Pullphol

Ms. Ananya Soriyat

The name list of forth focus group:

Ms. Chanadda Suwanwong

Ms. Natsinee Wiwekapiboon

Ms. Piyaporn Suwanpingkhom

Ms. Mantaraya Srisuwan

Ms. Sukanya Janotan

Ms. Patchanee Aramratsamee

Ms. Chotiros Chantarawong

The name list of fifth focus group:

Mr.Pawat Ouppathumchua

Mr.Montai Wajanaphonsan

Mr.Natapon Tiranankwit

Mr.Veerawat Isarapichaichest

Mr.Siam Buaphuan

Mr.Kittipong Ruangketpun

Mr. Pirapote Fungfoovaghat

The name list of sixth focus group:

Mr. Kraisri Na Songkha

Mr. Pul Sertsri

Mr. Thammarong Pangpinit

Mr. Somporn Sinsuwan

APPENDIX F

Post-Questionnaire Focus Groups

Post-questionnaire on the first female focus-group : October 17, 2008

Participants in focus groups were six females aged between 29-38 years old whose jobs were administrative staffs at Suthisarn area.

- Asset index: none of them owned all asset index commodities, but if someone had internet connection, he or she would have home computer accordingly. In this respect, "computer" asset will be replaced by "automobile" in the asset index list.
- Five questions regarding HIV knowledge: most of them gave correct answers, only few were confused in question 1 and 2 because one of them argued that sometimes using condom could not prevent from HIV infection or having one partner who has no HIV will reduce the HIV prevalence. That was personal idea towards our HIV knowledge tests
- Experience on HIV/AIDS: only one of focus group knew someone having HIV/AIDS virus, whist most of them did not have any friend or relatives having these disease. At the same time, only one of them has heard that HIV/AIDS is presently curable
- Awareness on HIV/AIDS: all participants agreed on " Yes" for all three questions" and they strongly believed that commercial sex workers are now the major source of HIV spreading as well as young teenager now has more causal sex than before.
- For efficacy test, all of them understood and had good perception on the test
- WTP amount for open bid: for commercial sex worker programme (both male and female): two persons would pay only 500 baht , the rest would pay 1000

baht. If it is only one shot payment, most of them are willing to pay, and the maximum of payment was not above 3,000 baht per person.

- The reasons paying for these amounts were mostly for social benefits like doing merits. Most people thought that paying for this vaccination programme was like doing merit for people if this scheme was only for one year as well as the a single shot payment.

- Most of them thought that free condom campaign was not efficient since people did not use it even though there were free condom installments around night clubs in towns.

Post-questionnaire on the second female focus-group : October 17, 2008

Participants in focus groups were four females aged between 25-35 years old whose jobs were bankers and tellers at Krungthai Bank, Suthisarn branch. The following was a summary of their conclusion:

- Asset index: all participants owned the asset index commodities

- Knowledge of HIV: all of them answered with almost correct answers except for the question of "using condom every time while having sex reduces HIV prevalent" Half of them did not believe that and also thought that condom use may protect infecting of HIV , but not 100% effectiveness

- Experience: One of them has had friend who has been HIV infected whereas half of them heard that HIV is now curable

- Awareness: One participant did not believe that commercial sex worker was the major source of HIV spreading and another participant did not think that vaccinating commercial worker as first group, if HIV vaccine occurred, was the most cost-effectiveness.

- For efficacy test, all of them understood and had good perception on the test

- As for WTP for 30% effectiveness/ commercial sex workers: most of them paid only 500 bath; 70% effectiveness/commercial sex workers: most of them paid an average of 1000 baht.

- Free condom giveaway programme was not fully substitute for this free HIV vaccination scheme.

- Remark: people were doubtful that everyone had to pay for this programme. So, it was not the method of donation, so some people thought that 500 baht payment was a lot if everyone nationwide paid for this amount.

Post-questionnaire on the third female and male focus-group : October 18, 2008

Participants in focus groups were the mixture of males and females aged between 27-28 years old whose jobs were relevant to banking or financial business. Six participants were involved of this focus group. The following was a summary of their conclusions:

- Asset index: none of them had all asset indexes, but only “internet” which all six participants have had.

- Knowledge of HIV: Most participants gave correct answers on this issue, only one person believed that mosquito could bring HIV disease to human.

- Experience of HIV: Half of them believed that HIV is now curable

- Awareness: Half of them did not think that to vaccinate commercial sex work was the most cost-benefit efficiency.

- For efficacy test, all of them understood and had good perception on the test

- If the initial bid price was 4,000 baht for commercial sex work at 30% effectiveness. Four persons were willing to pay, whist two persons rejected to pay.

- If the initial bid price was 5,000 baht for commercial sex worker at 70% effectiveness: five participants were willing to pay, only one person rejected to pay

- One person rejected to pay for this vaccination programme because he thought that commercial sex worker created problem, he/she had to take this responsibility which was the protest reason.

- If first bid was raised up to as 6,000 baht, someone can afford it, only if it could be installments with 500 baht per month.

Post-questionnaire on the forth female focus-group : October 18, 2008

Participants in focus groups were four females aged on the average of 27 years old whose jobs were relevant to customer services, secretary and administrative staff. The summary from the focus group discussion was as follows:

- Asset index: Not all participants have owned all asset indexes.
-. Knowledge of HIV: Most of them gave the correct answers, but half of them thought that having meal with HIV infected people was more likely to get HIV infected.
- Experience of HIV: Half of them heard that HIV is at present curable.
- Awareness: All of them had strong awareness on HIV/AIDS.
- For efficacy test, all of them understood and had good perception on the test
- Regarding 30%/CSW- on the average WTP is 500 baht per each
- Regarding 70%/CSW – WTP was around 700-1,000 baht.
- Participant disagreed that the free condom installment around towns was not good idea as well as was not a substitution for free HIV vaccination programme.

Post-questionnaire on the fifth focus-group : October 21, 2008

Participants in focus groups were seven males aged between 30-35 years old whose occupations were sales, manager, mechanics, and electricians in automobile business. The summary from the focus group discussion was as follows:

- Asset index: Only one person had all asset indexes, the rest had some.
- Knowledge of HIV: Five out of seven participants did not believe that condom use could prevent people from HIV effectively; Five participants believed that mosquito could bring HIV to people; Six male participants considered that having meal with HIV infected people will probably get HIV infected.
- Experience on HIV: Two participants have known someone who has had HIV/AIDS and some participants heard that HIV is now curable.

- Awareness: All participants did not think that vaccination commercial sex worker, if vaccine existed, was the most cost-effectiveness method.
- For efficacy test, all of them understood and had good perception on the test.
- Regarding 30%/CSW- the initial bid of 5,000 baht, nobody would pay for that bid, while all participants were paying if the bid was reduced into 2,500 baht.
- Regarding 70%/CSW- the initial bid of 5,000 baht, six participant would pay for this bid
- The maximum WTP: 30%/CSW was around 2,500 baht, while 70%/CSW was approximately 5,000 baht accordingly.

Post-questionnaire on the sixth focus-group : October 21, 2008

Participants in focus groups were five males aged between 25- 28 years old whose occupations were customer service staff, mechanics, and electricians in automobile business. The summary from the focus group discussion was as follows:

- Asset index: Few people had owned the asset indexes
- Knowledge of HIV: All participants believed that having meal with HIV infected person will get HIV infected.
- Experience: Two participants had friends who were HIV infected, and only one participant still believed that HIV is presently curable.
- Awareness: Four out of five participants thought that to vaccinate commercial sex worker was the most cost effectiveness if HIV vaccine exists.
- For efficacy test, all participants understood and had good perception on the test.
- As regards 30%/CSW with the first bid of 5,000 baht, none of participants paid for it, if bid was decreased into 2,000 baht: only three participants would pay for it; all participants were paying for this programme if the bid was only 500 baht.
- As regards 70%/CSW with the first bid of 5,000 baht, none of participants paid for it, if bid was decreased into 2,000 baht: all participants would pay for it
- With maximum WTP for 30%/CSW was around 500-1,000 baht; 70%/CSW was between 1,500-2,000 baht.

- It concluded that higher vaccine effectiveness will increase the amount of WTP from participants.

List of participants for all six focus groups

Name list of first focus group

Patthanun Prasertkij
Auradee Warasuk
Sayumporn Jongranglang
Laddawan Akemapisarn
Jintana Koonprasert
Thunyaporn Boonyasiriworg

Name list of second focus group

Mingkwan Tunwarawuttikul
Nantanut Sanyakhean
Pairada Usatit
Sawitree Ruangskul

Name list of third focus group

Rattapon Sawatdee
Anuphan Ngothanawat
Permpoon Pantuyakorn
Vorapan Kitawat
Kirana Chaikamhang
Phinyarat Manatwinon

Name list of fourth focus group

Nithima Numchaiwong
Panjit Ratpradit
Kantapuk Klamchai
Punjaree Sungkhobol

Name list of fifth focus group

Settapong Kloykaew

Suwig Gatrungsri

Winai Sutapot

Chaiwut Jukrajang

Suwang Intamij

Sarawut Lamul

Vissanukorn Haiyapa

Name list of sixth focus group

Aekamon Tamakean

Suriya Sapapak

Pichitchai Pleanprasert

Panya Upasuk

Montri Piwigliang

APPENDIX G

Training of Enumerators

The job of training and managing enumerators was very important and we therefore tried to follow the advice from Whittington (2002: 323-367). In the recruitment process we used experienced enumerators where possible. For example, our study recruited around 8-9 experienced enumerators, who had previously worked for the Thailand Research Development Institute (TDRI) doing survey fieldwork. If we have to recruit own enumerators, we will try to pick people who are not too extroverted or would not try to influence the views of the respondent (e.g. government officials and other professionals like doctors are usually not good candidates). Students, in particular may be a good choice, but then we had to make sure that they strictly followed the instructions in the questionnaire and did not try to interpret the questions on their own. We picked more enumerators than needed, because we wished to sort out the ones that performed well in the training session.

In the training of the enumerators it was vital that they understood as well that they must follow the script exactly, and also adjust themselves during face-to-face interviews in accordance with the respondent's characteristics (e.g. rich or poor, man or woman). In addition it was crucial that the enumerator did not attempt to convince the respondents that they should be willing to pay for the hypothetical goods or services offered. A no-answer was not a failure. Whittington (2002: 349-350) listed a number of good interview practices and we will go through them in the training:

1. **Read every question exactly as written in the questionnaire – do not improvise**

Comment: Research on the art of asking questions shows that the precise wording of questions may significantly affect a respondent's answers. If each enumerator develops her own way of asking questions, one can never be sure that the same question is being asked. We need to make sure that each respondent is

answering the same question. Reading the question exactly also makes the interview shorter.

2. Read the question slowly enough so that the respondent can understand

Comment: An enumerator has seen each question hundreds of times before. It's natural for the enumerator to want to go quickly over a question that he knows so well, but it's the first time for the respondent. The enumerator thus needs to speak slowly.

3. Wait for the respondent to answer

Comment: Some enumerators will read the question once, then look up and repeat the question, and sometimes even start a lengthy explanation, before letting the respondent answer! Ask once very clearly, and let the respondent think.

4. If the respondent can't answer, repeat the question

Comment: The respondent may not have been paying attention the first time. If, after the second reading the respondent still can't answer, go to the next question.

5. Remain absolutely neutral about the respondent's answers

Comment: Never express surprise, approval, disapproval, judgment, or doubt about a response. Don't let your facial expression change. Just record the answer. For example, if a respondent says that they would be willing to pay a very large amount for a good or service, the enumerator should not say, "wow!" If a respondent gives an answer that is factually wrong, the enumerator should not reveal that he knows the answer is incorrect.

6. Do not act embarrassed about a respondent's answers to sensitive question.

Comment: This will increase the embarrassment of the respondent, not reduce it. Be very matter of fact.

7. Never suggest an answer unless the instructions say to read the answers to the respondent

Comment: For example, if the respondent is having difficulty estimating the most he will pay for a good or service, *do not* prompt him with suggestions like "would you pay more than US$xx? More than US$yy? Less than zz?"

8. Don't repeat the respondent's answers

Comment: This is repetitive and wastes time.

9. Conduct the interview in private

Comment: That means that the interview should not be in earshot of other people in the household. If someone doesn't want to leave, the enumerator should offer to interview him or her separately. If they still won't leave, then the enumerator should explain to the respondent that he will have to return later.

10. Do not give advice to respondents on personal matters

Comment: Enumerators should refer respondents to the appropriate authorities for answers to questions that may arise that are outside the scope of the interview.

11. Answer directly any questions the respondent may have about the purpose of the survey

Comment: Respondents are entitled to know the purpose of the survey and how they have been selected to be interviewed. The enumerator should not be reluctant to take time to provide clear, detailed answers to such questions.

12. Listen carefully to the respondent's answer

Comment: It is very off putting to the respondent if the enumerator is inattentive. Moreover, the respondent may be offering an answer that is in fact different than it first appears to be. In such cases the enumerator needs to be listening carefully to hear what is actually being said.

During the training period it was useful to break the enumerators into pairs to play the role of enumerator/respondent. Supervision was important, since errors would easily spread if one enumerator was interpreting the role wrong. There was also

need for some “real” in-field practice interviews, where the supervisor could follow and adjusted for errors made during the interview.

On the next page a sample schedule for a 10-day training programme for enumerators was presented (Whittington, 2002: 354). This was a very ambitious programme and if we would have the resources we would like to follow this programme. Otherwise, we believed that a one-day programme could work reasonably well.

In our survey, we specifically had to train the enumerators in knowledge about HIV/AIDS to be able to answer or comment briefly on questions raised by the respondents. We also had to train them handling the visual card with the aim of testing the concept of vaccine effectiveness. Also, the conduct and timing of the presentation of the visual cards (e.g. modes of HIV/AIDS transmission, vaccine characteristics) was essential. Most importantly, we had to teach them how to demonstrate the effectiveness of the vaccine. The same method as in Suraratdecha et al. (2005b: 283-285) will be used: “I at present want to explain expressly what I mean when I mentioned the vaccine would be (30 % or 70%) effectiveness. [Display picture] Suppose that each of these little smiling face figures symbolizes a person. [Indicate red circle] The 100 smiling face figures inside this red circle present 100 people who have been vaccinated, while those smiling faces outside the red circle stand for who have not gotten vaccines. This HIV vaccine is not fully 100% effectiveness; however; it is only [30 or 70%] effectiveness. Of the 100 people having been vaccinated in this circle, there will be only [30% or 70%] of them are protected because the vaccine works for them well. The vaccine hence prevents them from getting HIV for a period of 15 years. Therefore the yellow smiling faces inside this circle describe these people.

On the one hand, the rest of people who are in circle [70 people or 30 people] will not be protected from HIV disease, although they have already been vaccinated since the vaccine is ineffective in protecting them against HIV. As a result, they are still at risk from getting infected with HIV exactly like before they get HIV vaccinated or people who are outside the circle have not gotten HIV vaccines. People nonetheless who get HIV vaccine are unable to know whether the vaccine works for

them. In fact, those people being vaccinated will not perceive whether they are being protected and can contract HIV disease."

Furthermore we trained our enumerators how to explain the hypothetical scenario along with the storyboard, to ensure that our enumerators would all elucidate the scenario problems on the same page. It therefore would reduce both theoretical and amenity misspecification biases while having an explanation on scenario to the respondents. Our storyboard consisted of four illustrations which totally explained the problems and the consequences of HIV/AIDS in Thailand as well as how the free HIV vaccination programme would benefit people. Our study initially used the storyboard in order to minimize scenario misspecification bias between the enumerator and respondent before respondents were being asked to state how much they were willing to pay for our scheme.

For rewarding the enumerators we chose to pay a fixed daily fee, but also included a lump sum for the group if they have reached a specific target at the end of the time period. We also provided the enumerators with references and gathered their contact details for potential future work. During the training period and the data collection we tried to make the enumerators feel like a team and to feel responsible for the quality of the research. Meals and rewards were provided as well as activities during "non-working" hours.

During the data sampling we had field supervision and conducted it in three components (Whittington, 2002: 356-360). First, we reviewed the collected questionnaire results as soon as possible to be able to correct for respondent or enumerator mistakes or misunderstandings. Second, we accompanied the enumerators in the field now and then to assess the quality of the interview. Third, random re-checks of the completed interviews were made to see that they were not falsified by the enumerator. Last but not certainly the least, we had to be prepared to immediately dismiss an enumerator who was not sincere on conducting the interview survey.

The Name List of Our Trained Enumerators:

1) Sirinapha Kunasaen
2) Pornchai Khosangruksa
3) Wanphen Techarat

4) Nongkhran Chongngam
5) Piehan Na Phattahlong
6) Sompong Wiyachai
7) Tassanai Kantasri
8) Santi Santisantiwong
9) Marut Chantarasutti

Table A.2. Sample schedule for a two-week training program for enumerators

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	*Day 1*: 1. Introduction of project staff; 2. Explanation of the objectives of the research project; 3. Introduction to the CVM; 4. CV elicitation procedures; 5. Exercise: Enumerators work in small groups to write a CV scenario.	*Day 2*: 1. Presentation on the technical/scientific subject matter of the research; 2. Overview of the technical subject matter in the CV scenario; 3. Trainers answer questions about technical issues involving subject matter; 4. Discussion of the structure of the draft CV questionnaire.	*Day 3*: 1. Researchers role play the CV questionnaire in front of the group; 2. Discussion of good interview practice (do's and don'ts); 3. Trainees are separated into two groups and practice the interview with each other; 4. CV researchers circulate, listen to trainees practice the interview, and offer constructive comments.	*Day 4*: 1. Pairs of trainees practice administering the questionnaire in front of the group; 2. Group discussion of the pros and cons of each trainee's interview style; 3. CV researchers answer questions about the structure and content of the questionnaire; invite trainees' suggestions for changes; 4. Discussion of the logistical arrangements for practice interviews for Day 5	*Day 5*: 1. Trainees work in pairs; each trainee conducts interviews with two respondents and listens to two interviews by his or her partner (4 total interviews); 2. Discussion of the day's interviews and any problems that arose in the practice interviews; 3. Trainees suggest improvements to the questionnaire; 4. Trainees study and memorize questionnaire over the weekend.
Week 2	*Day 6*: 1. Videotaping of selected trainees' practice interviews; 2. Showing of videos to entire group; 3. Discussion and critique of trainees' performances in videotaped interviews; 4. Suggestions to trainees on ways suggest improvements to the questionnaire.	*Day 7*: (same as day 6) 1. Videotaping of selected trainees' practice interviews; 2. Showing of videos to entire group; 3. Discussion and critique of trainees' performances in videotaped interviews; 4. Suggestions to trainees on ways suggest improvements to the questionnaire.	*Day 8*: 1. Trainees conduct practice interviews alone; 2. CV researchers and field supervisors sit in on selected interviews; 3. Discussion of the day's interviews and any problems that arose in the practice interviews; 4. Trainees suggest improvements to the questionnaire.	*Day 9* (same as day 8): 1. Trainees conduct practice interviews alone; 2. CV researchers and field supervisors sit in on selected interviews; 3. Discussion of the day's interviews and any problems that arose in the practice interviews; 4. Trainees suggest improvements to the questionnaire.	*Day 10*: 1. CV researchers conduct oral and written tests of the trainees; 2. CV researchers announce final selection of enumerators for the project.

APPENDIX H

Contingent Valuation Scenario and Vaccine Effectiveness Test

Contingent Valuation Scenario

Commercial sex workers (both male and female)

Although there has recently been an overall decline in the rate of new HIV infections in Thailand, there has been a shift in new infections from high risk to lower risk groups such as women, in particular young women and housewives. These women have mostly been infected through sex with their male partners who had engaged in unprotected sex, either with commercial sex workers or with other partners.

On account of this, the Thai government is concerned about this issue, and then supposedly initiates "A free HIV vaccination programme" under the administration of department of AIDS, Ministry of Public Health. Assuming that this scheme takes only one year by sending many professional officers or staff to vaccinate both male and female commercial sex workers over the age of 15 for free in red light districts, bars, night clubs, saunas, and discos around major cities such as Bangkok, Phuket, Pattaya, and Chiang Mai. The HIV vaccine attributes used in this programme are (30%/70%) effectiveness, no side-effects, 15 years of protection, protects from multiple types of HIV/AIDS, and one dose injection, respectively.

This HIV vaccine, in fact, would not be of any benefit to people who have already contracted HIV/AIDS. Also, this scheme will neither provide blood testing due to the costs involved in testing, nor verify people by their blood test results due to the conflict with the privacy. By vaccinating male and female sex workers with a highly effective (30%/70%) vaccine under this scheme, it is expected that this will prevent (370,000/1.9 million) new infections nationwide per year.

The scheme will need to be financially supported by the public since the government budget is limited. Because of this, Thai taxpayers aged between 20 and 60 years old countrywide will be responsible for financing this programme through

their yearly income tax payments. The payment will be a one-time payment for financing this one-year free HIV vaccination scheme.

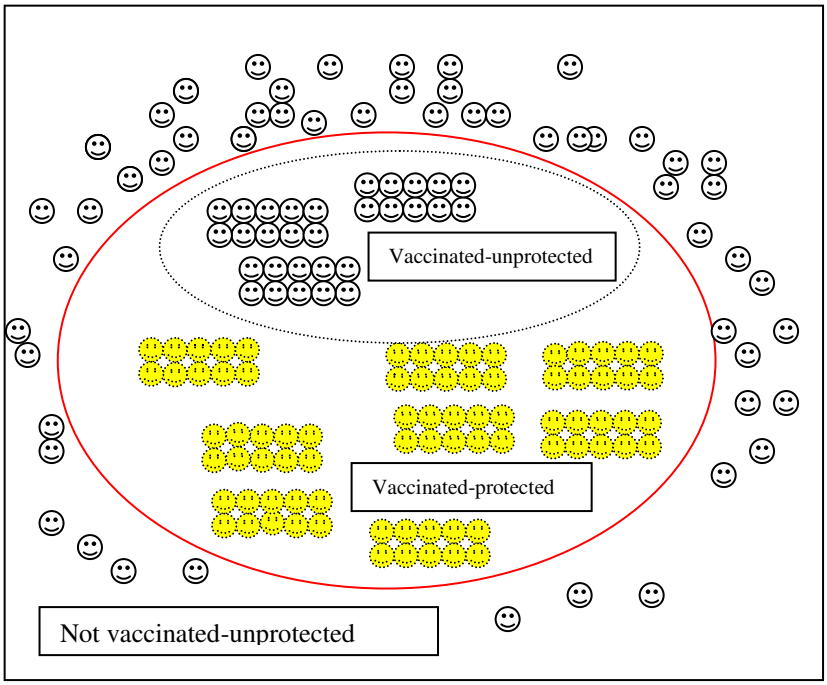
Vaccine Effectiveness Test

If there are no negative side effects such as nausea, fever or headache, our target group of male and female commercial sex workers over 15 years of age will vaccinated with a single injection. This single injection would provide protection for 15 years.

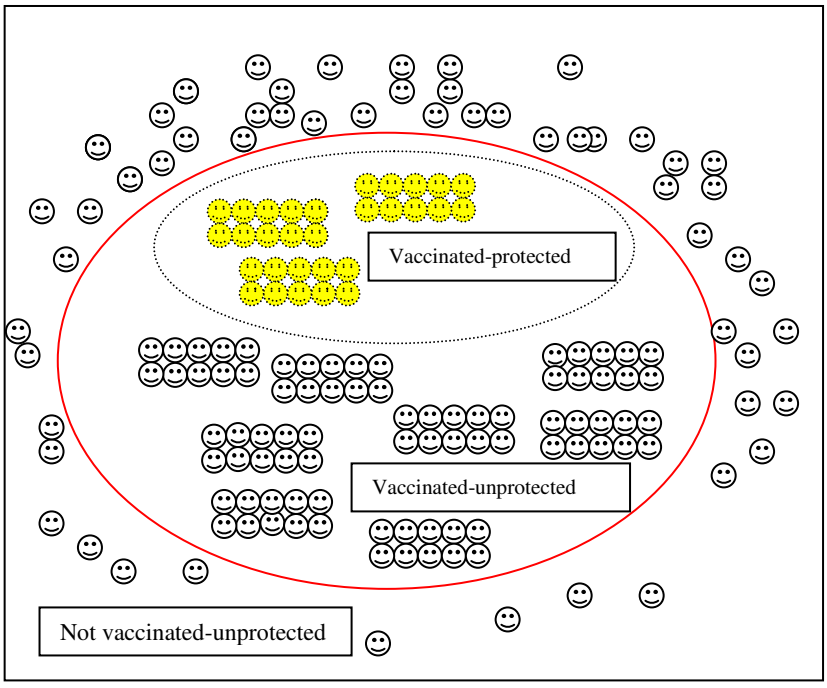
I at present want to explain expressly what I mean when I mentioned the vaccine would be (30 % or 70%) effective.

[Display the visual card] Supposing each of these little smiling face figures symbolizes a person. [Indicate red circle] The 100 smiling face figures inside this red circle represent 100 people who have been vaccinated, while those smiling faces outside the red circle stand for who have not received a vaccine. This HIV vaccine is not fully 100% effectiveness; however; it is only [30 or 70%] effectiveness. Of the 100 people having been vaccinated in this circle, there will be only [30% or 70%] of them are protected because the vaccine works well for them. The vaccine hence prevents them from getting HIV for a period of 15 years. Therefore the yellow smiling faces inside this circle describe these people.

The rest of people who are in circle [70 people or 30 people] will not be protected from HIV disease, although they have already been vaccinated since the vaccine is ineffective in protecting them against HIV. As a result, they are still at the same risk of getting infected with HIV as before they received the HIV vaccination, or people who outside the circle have not received an HIV vaccine. People who get the HIV vaccine are unable to know whether the vaccine will work for them or not, and also whether they are being protected or can still contract HIV disease.



The Visual Card 1: Vaccine with 70% Effectiveness



The Visual Card 2: Vaccine with 30% Effectiveness

Check Questions on Vaccine Effectiveness

I want to make sure that you understand the effectiveness of this vaccine

First Time

1. Show me all the people who are vaccinated [Interviewer: Did the respondent correctly show all those vaccinated? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

2. Show me all the people who are protected and can not get HIV/AIDS. [Interviewer: Did the respondent correctly show all those protected? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

3. How many people are vaccinated, but not being protected and also can still get HIV/AIDS? [Interviewer: Did the respondent answer this question correctly? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

[Interviewer: Did the respondent answer all three of these questions correctly? Please check √ in our box]

Yes ☐ **(Continue the scenario)**

No ☐ **(Explain effectiveness using the visual card again)**

Second Time

1. Show me all the people who are vaccinated [Interviewer: Did the respondent correctly show all those vaccinated? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

2. Show me all the people who are protected and can not get HIV/AIDS. [Interviewer: Did the respondent correctly show all those protected? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

3. How many people are vaccinated, but not being protected and also can still get HIV/AIDS? [Interviewer: Did the respondent answer this question correctly? Then, please check √ in our box]

[ ] Correct

[ ] Incorrect

[Interviewer: Did the respondent answer all three of these questions correctly? Please check √ in our box]

Yes ☐ **(Continue the scenario)**

No ☐ **(Continue the scenario)**

APPENDIX I

Probit Model

Kmenta, Jan[1] (1986: 553-555) described the Probit model that:

An alternative S-shaped curve that satisfies the requirements of a probability model is the cumulative normal distribution function corresponding to the so-called probit model. This model is usually derived as follows. Let us consider an unobservable variable Y_i^* given as

$$Y_i^* = \alpha + \beta X_i + \varepsilon_i$$

where $\varepsilon_i \sim N(0,1)$ and ε_i and $\varepsilon_j (i \neq j)$ are independent. The observable binary variable Y_i is related to Y_i^* in the following way.

$$Y_i = 1 \text{ if } Y_i^* > 0$$

$$= 0 \text{ if } Y_i^* \leq 0$$

Then

$$E(Y_i) = \pi_i = P(Y_i = 1)$$

$$= P(Y_i^* > 0) = P(-\varepsilon_i < \alpha + \beta X_i)$$

$$= F(\alpha + \beta X_i), \qquad (1)$$

where F(.) represents the cumulative distribution function of the standard normal distribution. That is,

$$F(\alpha + \beta X_i) = \int_{-\infty}^{\alpha+\beta X_i} f(z)dz,$$

where $f(z)$ represents the density function of z~ N(0,1). Since $\pi_i = F(\alpha + \beta X_i)$, we can write

$$F^{-1}(\pi_i) = \alpha + \beta X_i \qquad (2)$$

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[1] Kmenta, Jan. 1986. **Elements of Econometrics.** New York: Macmillan.

where $F^{-1}(\pi_i)$ is the inverse of the standard normal cumulative distribution function.

The parameters α and β in (2) can be estimated by the maximum likelihood mothod using the log-likelihood function, $L = \sum_{i-1}^{n} [Y_i \log \pi_i + (1 - Y_i) \log(1 - \pi_i)]$.

Substituting for π_i from (1) into log-likelihood function, we therefore obtain

$$L = \sum \{Y_i \log F(\alpha + \beta X_i) + (1 - Y_i) \log[1 - F(\alpha + \beta X_i)]\} \qquad (3)$$

Maximizing L with respect to α and β and estimating the standard errors with the help of the information matrix is complicated, but computer programs for this purpose are readily available. When we have replicated observations on Y for each different value of X, the problem of estimation becomes simpler. Let p_i be defined as in $p_i = \frac{1}{n_i} \sum_{j-1}^{n_i} Y_{ij}$.

Then we can write

$$F^{-1}(p_i) = F^{-1}(\pi_{-1} + \varepsilon_i)$$

and, using the Taylor expansion around π_i, obtain

$$F^{-1}(p_i) = F^{-1}(\pi_i) + \frac{\partial F^{-1}(\pi_i)}{\partial \pi_i} \varepsilon_i + R_i$$

where R_i represents terms of order higher than one, which can be dropped because they become very small when n_i is larger. Further,

$$\frac{\partial F^{-1}(\pi_{-1})}{\partial \pi_i} = \frac{\partial(\alpha + \beta X_i)}{\partial F(\alpha + \beta X_i)}$$

$$= \frac{1}{\partial F(\alpha + \beta X_i) / \partial(\alpha + \beta X_i)}$$

$$= \frac{1}{f(\alpha + \beta X_i)}$$

where $f(\alpha + \beta X_i)$ is a standard normal density function evaluated at $\alpha + \beta X_i$. Therefore, we obtain the following large-sample relation.

$$F^{-1}(p_i) = \alpha + \beta X_i + \frac{\varepsilon_i}{f(\alpha + \beta X_i)}. \quad (4)$$

Note that

$$E\left[\frac{\varepsilon_i}{f(\alpha + \beta X_i)}\right] = 0,$$

$$Var\left[\frac{\varepsilon_i}{f(\alpha + \beta X_i)}\right] = Var\left[\frac{p_i}{f(\alpha + \beta X_i)}\right] \quad (5)$$

$$= \frac{\pi_i(1 - \pi_i)}{n_i[f(\alpha + \beta X_i)]^2} \quad (6)$$

The latter can be estimated consistently by replacing π_i by p_i and α and β by $\hat{\alpha}$ and $\hat{\beta}$, where $\hat{\alpha}$ and $\hat{\beta}$ are the ordinary least squares estimator of α and β in (4).

After obtaining a consistent estimate of the variance of $\varepsilon_i / f(\alpha + \beta X_i)$, we can obtain least squares estimates corrected for heteroskedasticity. Bothe estimators- maximum likelihood and least squares corrected for heteroskedasticity- are asymptotically normal and have all the desirable asymptotic properties.

The difference between the Logit and Probit models

When dealing with binary dependent variables, a question usually arises as to which of the two nonlinear models either logit or probit model to choose. Kmenta (1986: 555-556) stressed that the best answer to that question would be based on theoretical grounds, but well-developed theory to determine the exact functional form appears to be lacking. Many authors[1], nonetheless, tend to agree on the following points:

a) The logistic and cumulative normal functions are very close in the midrange, but the logistic function (logit model) has slightly heavier tails than the cumulative normal (probit model). Thus it does not matter much which function is used except in cases where the data are heavily concentrated in the tails.

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[1] Judge et al; Maddala, G.S; Schmidt, P and Witte, A.D.

b) The logit model is used because it represents a close approximation to the probit model and is simpler to work with. The close similarly between the logit and probit models is confined to dichotomous dependent variables. When the dependent variable is polytomous, there are major differences between both of them. However researchers are interested in having a scalar measure of the "goodness of fit" of their model. In this standard regression model this role is taken by R^2 or $\bar{R}^2$, in the context of the logit and probit model a similar measure, called the "Likelihood ratio index (LRI)", is given by $LRI = 1 - \frac{L\left(\hat{\Omega}\right)}{L\left(\hat{\omega}\right)}$, where $L\left(\hat{\Omega}\right)$ is the maximum value of the log-likelihood function, and $L\left(\hat{\omega}\right)$ is the maximum value of this function under the constraint that $\beta = 0$. Evidently, $0 \le LRI \le 1$ and the better the fit, the closer the value of LRI will be to one.

The quantities $L\left(\hat{\Omega}\right) and L\left(\hat{\omega}\right)$ can also be used to carry out a likelihood ratio test of the null hypothesis that X is irrelevant in the determination of E(Y). The test statistic for the asymptotic is $-2\left[L\left(\hat{\omega}\right) - L\left(\hat{\Omega}\right)\right] \sim X_I^2$. Note that in general the number of the degrees of freedom of the chi-square variable is given by the number of the explanatory variables in the model.

In many applied studies the researchers use all three probability models- linear, logit, and probit- on the same data and compare the results. The distinction among the three models can be summarized as follows:

Linear Probability model: $F\left(\alpha + \beta X_i\right) = \alpha + \beta X_i$ (7)

Logit: $F\left(\alpha + \beta X_i\right) = \frac{1}{1 + e^{-\alpha - \beta X}}$ (8)

Probit : $F\left(\alpha + \beta X_i\right) = \int_{-\infty}^{\alpha + \beta X_i} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} dz_i$ (9)

where F(.) represents a cumulative distribution function. This should be noted, though, that the values of the estimated coefficients are not comparable because the coefficients have a different interpretation in each model.

To facilitate comparison, Amemiya[1] (1981: 1488) suggested the following approximate scaling adjustments:

$$\hat{\alpha}_{LP} \approx 0.25\hat{\alpha}_{L} + 0.5 \approx 0.4\hat{\alpha}_{P} + 0.5 \qquad (10)$$

$$\hat{\beta}_{LP} \approx 0.25\hat{\beta}_{L} \approx 0.4\hat{\beta}_{P} \qquad (11)$$

where the subscript LP refers to the linear probability model, L to the logit model, and P to the probit model.

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[1] Amemiya, Takeshi. 1981. Qualitative Response Models: A Survey. **Journal of Economic Literature.** 19: 1483-1536.

APPENDIX J

Measuring Goodness of Fit

This measurement goodness of fit with respect to STATA 10.0 use has been divided into two main measures: a) Log-likelihood based and b) information measures[1].On this account, measures of fit can provide a rough index of whether a model is adequate. Nonetheless, there is no convincing evidence that selecting a model that maximizes the value of a given measure results in a model which is optimal in any sense other than the model's having a larger (or smaller) value of that measure. Although measures of fit provide some information, it is only partial information that must be assessed within the context of the theory motivating the analysis, past research, and the estimated parameters of the model being considered (Long and Freese, 2006: 108-113).

a) Log-Likelihood Based Measure

STATA begins maximum likelihood iterations by computing the log likelihood of the model with all parameters but the intercept constrained to zero, referred to as $L(M_{\text{int}\,ercept})$. The log likelihood upon convergence, referred to as M_{FULL}, is also listed. This information is normally presented as the first step of the iteration log and in the header for the estimation results.

- **Chi-squared test of all coefficients**: An LR test of the hypothesis that all coefficients except the intercept are zero can be computed by comparing the log likelihoods: $LR = 2InL(M_{FULL}) - 2InL(M_{\text{int}\,ercept})$. This statistic is sometimes designed as G^2. For example, LR is reported by STATA as LR chi2(7) = 124.48, where the

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[1] See Long, Scott J. and Freese, Jeremy. 2006. **Regression Models for Categorical Dependent Variables Using STATA.** College Station: Stata Press; Maddala, G..S. 1992. **Introduction to Econometrics.** 2nd ed. New Jersey: Prentice-Hall.

degrees of freedom, (7), are the number of constrained parameters. STATA10.0 reports this statistic as $LR(7):124.48$.

- **R^2 in the LRM**: STATA command will report the standard coefficient of determination, which can be defined differently as

$$R^2 = 1 - \frac{\sum_{i=1}^{N}\left(y_i - \hat{y}_i\right)^2}{\sum_{i=1}^{N}\left(y_i - \bar{y}_i\right)} = \frac{\hat{Var}\left(\hat{y}\right)}{\hat{Var}\left(\hat{y}\right) + \hat{Var}\left(\hat{\varepsilon}\right)} = 1 - \left\{\frac{L\left(M_{Intercept}\right)}{L\left(M_{Full}\right)}\right\}^{2/N}$$

The adjusted R^2 is defined as

$\bar{R}^2 = \left(R^2 - \frac{K}{N-1}\right)\left(\frac{N-1}{N-K-1}\right)$ where K is the number of independent variables.

- **McFadden's R^2**: McFadden's R^2, also known as the "likelihood-ration index", compares a model with just the intercept to a model with all parameters. It however is defined as

$$R^2_{McF} = 1 - \frac{In\, L\left(\hat{M}_{Full}\right)}{In\, L\left(\hat{M}_{Intercept}\right)}$$

If model $M_{Intercept} = M_{Full}$, R^2_{McF} equals 0, but R^2_{McF} can never exactly equal 1.

Also R^2_{McF} normally increases as new variable are added, an adjusted version is also available.

$$\bar{R}^2_{McF} = 1 - \frac{In\,\hat{L}\left(\hat{M}_{Full}\right) - K^*}{In\,\hat{L}\left(\hat{M}_{Intercept}\right)}$$

where K^* is the number of parameters (not independent variables).

- **Maximum likelihood R^2**: Another analogy to R^2 in the LRM was suggested by Maddala:

$$R^2_{ML} = 1 - \left\{\frac{L\left(M_{Intercept}\right)}{L\left(M_{Full}\right)}\right\}^{2/N} = 1 - \exp(-G^2/N)$$

Therefore R^2 is known as the Cox-Snell R^2

- Cragg and Uhler's R^2: Since R^2_{ML} reaches a maximum of only $1-L\left(M_{Intercept}\right)^{2/N}$ Cragg and Uhler suggested a normed measure:

$$R^2_{C\&U} = \frac{R^2_{ML}}{\max R^2_{ML}} = \frac{1-\left\{L\left(M_{Intercept}\right)/L\left(M_{Full}\right)\right\}^{2/N}}{1-L\left(M_{Intercept}\right)^{2/N}}$$

This R^2 is also known as the Nagelkerke R^2.

- Efron's R^2: For binary outcomes, Efron's psedo-R^2 defines $\hat{y} = \hat{\pi} = \hat{\Pr}\left(y = 1/x\right)$ and equals

$$R^2_{Efron} = 1 - \frac{\sum_{i=1}^{N}\left(y_i - \hat{\pi}_i\right)^2}{\sum_{i=1}^{N}\left(y_i - \bar{y}\right)^2}$$

- V(y^*), V(ε) ,and Mckelvey and Zavoina's R^2: Some models can be defined in terms of a latent variable y^*. This includes the models for binary or ordinal outcomes such as logit, probit, ologit, oprobit, as well as some models with censoring: tobit, cnreg, and interg. Each model is defined in terms of a regression on a latent variable y^*.

$$y^* = x\beta + \varepsilon$$

Using $\hat{Var}\left(\hat{y}^*\right) = \hat{\beta}'\hat{Var}(x)\hat{\beta}$, McKelvey and Zavoina proposed

$$R^2_{M\&Z} = \frac{\hat{Var}\left(\hat{y}^*\right)}{\hat{Var}\left(y^*\right)} = \frac{\hat{Var}\left(\hat{y}^*\right)}{\hat{Var}\left(\hat{y}^*\right) + Var(\varepsilon)}$$

In model for categorical outcomes, $Var(\varepsilon)$is assumed to identify the model.

- Count and adjusted count R^2: Observed and predicted values can be used in models with categorical outcomes to compute what is known as the count R^2. Consider binary case where the observed y is 0 or 1 and $\pi_i = \hat{\Pr}(y = 1/x)$. Define the expected outcome as $\hat{y}_i = 0$ if $\hat{\pi}_i \leq 0.5$ or 1 if $\hat{\pi}_i > 0.5$. A seemingly appealing measure is the proportion of correct predictions, referred to as the count R^2,

$$R^2_{Count} = \frac{1}{N}\sum_j n_{jj}$$

where the n_{jj} 's are the number of correct predictions for outcome j.

The count R^2 can give the faulty impressive that the model is predicting so well. In a binary model without knowledge about the independent variables, it is possible to correctly predict at least 50% of the cases by choosing the outcome category with the largest percentage of observed cases. To adjust for the largest row marginal.

$$R^2_{AdjCount} = \frac{\sum_j n_{jj} - \max_r(n_{r+})}{N - \max_r(n_{r+})}$$ where n_{r+} is the marginal for row r.

The adjusted count R^2 is the proportion of correct guesses beyond the number that would be correctly guessed by choosing the largest marginal.

b) Information Measures

Information measures can be used to compare both nested and nonnested models.

- **AIC.** Akaike's (1973) information criterion is defined as

$$AIC = \frac{\left\{-2Ln\hat{L}(M_k) + 2P_k\right\}}{N}$$

where $\hat{L}(M_K)$ is likelihood of the model and P_k is the number of parameters in the model (e.g. K+1 in the binary regression model, where K is the number of regressors). Ceteris Paribus, the model with the smaller AIC is considered the better-fitting model.

Another definition of AIC is equal to N times the values we report (for example, Tobias and Campbell(1998)).

- **BIC and BIC'**: The Bayesian information criterion (BIC) has been proposed by Raftery (1996) as a measure to compare nested and nonnested models. There are at least three ways in which the BIC statistics is defined. Even though this can be confusing, the differences are not important, as we will show after presenting the various definitions.

Consider the model M_k with deviance $D(M_k)$. BIC is defined as $BIC_k = D(M_k) - df_k \, InN$ where df_k is the degrees of freedom associated with the deviance. The more negative the BIC_k, the better the fit. A second version of BIC is based on the LR chi-squared with df_k' equal to the number of regressors (not parameters) in the model. Then $BIC_k' = -G^2(M_k) + df_k' InN$. Again the more negative the BIC_k', the better the fit. A third definition, the one that is included with estimates table with the stats(bic) option and in estat ic, is $BIC_k^S = -2InN\,\hat{L}(M_k) + df_k^S InN$ where df_k^2 is the number of parameters in the model including auxiliary parameters such as α in the negative binominal regression model.

The difference in the BICs from two models indicates which model is preferred, at least according to the BIC.

Since $BIC_1 - BIC_2 = BIC_1' - BIC_2' = BIC_1^S - BIC_2^S$, the choice of which from of BIC to use is a matter of convenience. STATA shows you all three: When $BIC_1 - BIC_2 < 0$, the first model is preferred. If the difference between BIC_1 and BIC_2 is more than zero, the second model is preferred. Raftery[1] (1995: 111-163) suggested guidelines for the strength of evidence favoring M_2 against M_1 based on a difference in $BIC, BIC', or BIC^S$:

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[1] Raftery, Andrian E. 1995. Bayesian Model Selection in Social Research. **Sociological Methodology.** 25: 111-163.

Absolute difference	Evidence
Between 0 and 2	Weak
Between 2 and 6	Positive
Between 6 and 10	Strong
More than 10	Very strong

Source: Raftery, 1995: 111-163.

BIOGRAPHY

NAME	Charoenchai Agmapisasrn
ACADEMIC BACKGROUND	Bachelor's Degree with a major in Tourism from Kasetsart University, Bangkok, Thailand in 1995; Bachelor's Degree with a major in Economics from the University of Minnesota at Twin Cities, Minneapolis-St. Paul, the United States in 1998 and a Master's Degree in Applied Economics at the University of Minnesota at Twin Cities, Minneapolis-St.Paul, the United States in 1999
PRESENT POSITION	Part-time lecturer, Department of Finance and Banking, School of Business Administration, Assumption University, Bangkok, Thailand
EXPERIENCES	Received a scholarship from the government of Thailand during 2008-2009 to sponsor the PhD dissertation Nominated from Bank of Thailand to attend the 3rd Lindau meeting for Nobel Prize in Economics Science, Lindau, Germany in 2008 Received a full scholarship from Swedish International Development

Cooperation Agency (SIDA) in 2007 to study two PhD courses in environmental economics at Gothenborg University, Gothenborg, Sweden

Awarded four times College Liberal Arts Dean's lists from Winter Quarter 1997 to Winter Quarter 1998, Department of Economics, the University of Minnesota at Twin Cities, Minneapolis-St. Paul, the United States

Awarded second-class honor medal in Tourism studies, Department of Career Science, Faculty of Humanities, Kasetsart University, Bangkok, Thailand