UNDERSTANDING THE IMPACT OF GAMBLING WITH SPECIAL REFERENCE TO THAILAND

by

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ABSTRACT

This thesis mainly consists of three empirical chapters related to understanding the characteristics, economic impact and the demand for gambling in Thailand. Beginning with a review of the theoretical and empirical literature, this confirms that socio-economic and demographic data are important determinants of the level of gambling participation and gambling expenditure. A Logit model is then used to estimate the participation of gambling. The results suggest that the number games, such as the government lottery, the underground lottery, are popular among old gamblers whereas football betting is popular for adolescents. In the past, most casino customers were old gamblers, but at present the number of young gamblers who participate in casino has considerably increased. A Tobit model is employed to estimate the level of gambling frequency and gambling expenditure. The estimations reveal that there is a "supplementation effect" of casino on other gambling types and the effect also appears among the number games. The gambling expenditures on the number games are high in the group of gamblers who have undergraduate degree or lower while the expenditures on casino and football betting are high in the group of gamblers who have undergraduate degree. However, a higher education level leads to a lower level of gambling expenditures. The focus is then centred on the 2-3 digit lottery. The rational addiction model is tested for the case of the 2-3 digit lottery. In the addiction framework, the 2-3 digit lottery is found to be an addictive goods and the addiction is "myopic addiction". This finding is confirmed by Instrumental Variable estimation.

DEDICATION

To my family

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CHAPTER 1

INTRODUCTION

In this thesis I examine the gambling industry in Thailand and its impact on the economy. In doing so I examine the characteristics of gamblers, gambling expenditure and derive a demand function for gambling.

1.1 The motivation and importance of the study

Thailand, one of the countries in Southeast Asia[1], has been described as a country that contains a large informal economy or underground economy. The underground economy can be defined as economic activities which are not officially recorded. It should be noted that not only illegal occupations, such as the underground lottery agents, the football betting operators, but also some legal occupations, such as farmers, taxi drivers, are included in the underground economy.

The underground economy seems to play an important role in Thai economy. Given its nature measuring the size of the underground economy is fraught with difficulties. The size of the underground economy was estimated to be around 1,800 billion baht (£45,000 million) or 60% of GNP in 1995, and around 1,500 billion baht (£25,000 million) or 40% of GNP in

[1] Consist of 12 countries; Thailand, Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanma, Papua New Guinea, Philippines, Singapore, Timor-Lest, Vietnam

2005. It is widely known that the illegal businesses are a major source capital accumulation and profit making. Further, illegal gambling businesses form the largest proportion of the underground economy.

In 1995 the size of the illegal businesses, excluding the illegal gambling businesses, was 180 billion baht (£4,500 million) or 10% to the dimension of the underground economy, while the size of the illegal gambling businesses was 1,100 billion baht (£27,500 million) or 61% to the same dimension. In 2005, while the size of the illegal gambling businesses approximately increased to 1,300 billion baht or 87% to the dimension of the underground economy, the size of the illegal businesses reduced to 120 billion baht or 8% to the same dimension. It can be seen that the government succeeded in reducing the size of the illegal businesses but the illegal gambling businesses is otherwise (Pasuk *et al.*, 1998; Socatiyanurak, 2007; Somchat, 2005).

Since gambling is social and interactive, it could be understand that many Thais choose gambling as a favourite pastime. However, it should not be construed that Thai people gamble more than citizens of other countries. Pasuk (1999) indicates that there are a large number of adolescents, who regularly gamble, were estimated to be around 70%. The gambling businesses, both legal and illegal, have had rapid growth, in particular, the illegal forms of gambling which have the considerable expansion in recent years.

“Horse racing” and “the government lottery” appear as the only legal forms of gambling in Thailand, whereas most of the popular gambling games are in illegal forms, such as the underground lottery, casino betting, football betting. The growth of illegal gambling businesses has coincided with the increasing awareness that the illegal gambling games create significant impact. This impact can be economic social impacts and a political in nature.

1.1.1 Economic and social impact

The impact can be both positive and negative. On the positive aspect, some illegal gambling businesses, such as casino betting, the underground lottery, are relatively labour-intensive and provide employment to many people. For example, casino employs people for work-services such as preparing food, selling garlands. The underground lottery generates employment to around 4 million people on a few days per month for administrative works, such as receiving bet numbers from gamblers and sending them to agents, hedging betting number with other agents. On the negative aspect, the illegal gambling business has several dimensions of distorting effects. The illegal gambling business contributes very high profits to an owner and this money is invested in other legal businesses. In this situation, it might be unfair to honest businessmen to compete with their business rivals who have access to large reserves of cheap funds.

Some of these profits are laundered through a legal market, such as a stock market, a property market. These flows lead to the inflation and the market price distortion. Although the gambling businesses create employment, which generate income to many people as mentioned earlier, a gamble, generally, transfers money from poor people to rich people. This leads to a distortion of income distribution.

It can be summarised that the negative effects of illegal gambling businesses are to disrupt the country's resource allocations, and create economic and social instability. These effects conduce to economic and social costs which are large, but difficult to estimate.

1.1.2 Political impact

Undoubtedly, the illegal gambling businesses have also created the growth of illegal funds which may be used in what is known as "money politics". This illegal money, indeed, stems from the super-profits of the illegal gambling business. This money is often used to create networks both at the local and national political levels. These networks, consequently, are exploited by organisations for the purpose of vote-buying in elections. Politicians, eventually, take advantage through their position and power to usurp this money.

Since the crucial negative effects of the illegal forms of gambling, all Thai governments have attempted to suppress them but it seems to be failed. Therefore, an approach of legalisation to illegal forms of gambling is raised in the Thai public. Indeed, the legalisation issue is sensitive to the public and the public opinions are broken down into 2 camps, supporting and opposing the gambling legalisation. Most surveys report a similar result even though my own two surveys, which are that opposing opinions are slightly higher than supporting opinions, around 52% to 48%. However, the arguments against this approach seem to be sharper and more significant.

1.1.3 Supporting legalisation

People who support the gambling legalisation explain that: 1) Gambling is actually already so widespread and suppression is also shown that it has not succeeded, and is an ineffective solution. 2) Since illegal money currently supports influential people, legalisation could capture this large amount and use it for social purposes. 3) Legalisation would also tackle money laundering, reduce corruption, exploitation and profiteering, and enable to control the role of influence. 4) In addition, the gambling legalisation is a way to generate government revenue.

1.1.4 Opposing legalisation

People who resist legalisation argue that: 1) The government has a duty to suppress, not to encourage people to participate in gambling. If the legalisation is applied, it seems that the government sends the message to the public that gambling is an acceptable activity. This would encourage people to access to gambling activities. 2) The legal form of gambling may attract people who have never gambled before. This leads to increase in total gambling expenditures, particularly the group of low-income people who have been indicated that playing an important role in a gambling industry. It can be said that legalisation increases the amount of gambling expenditures, and decreases the amount of saving.

3) Basically, there is the connection between the gambling businesses and crime organisations. Hence gambling legalisation can mean promoting crime. 4) Legalisation would result in the negative effects of increased gambling such as poverty, debt, broken family, and crime. 5) It does not definitely assure that legalisation leads to reduce the illegal gambling forms, but it may give these illegal businesses more legitimacy instead. In this case,

legalisation leads to the increase in both legal and illegal gambling businesses thus legalisation would result in private gains, but none of social benefit.

With the reasons for both supporting and opposing legalisation, the gambling legalisation becomes a popular issue among the Thai economists and Thai socialists to explore. Most reasons of opposing legalisation are emphasised on the social effects of gambling legalisation, therefore, the previous Thai gambling studies were focused on the social impacts if the legalisation approach would be applied. Unfortunately, the econometric estimation techniques are difficult to estimate the issue of social impact thus those previous works used the methodologies, which have been used in the area of social research, such as a questionnaire survey, a personal interview, and focus-group.

Since the previous works were dedicated to study the effect of *post*-gambling legalisation, they were neglected to focus on the reality which currently happens. This reality means "the demand for gambling products". Definitely, not all illegal forms of gambling should be legalised since there are different effects of legalising and legalising different types of gambling has led to a different raise in tax revenues. For example, a legal casino generates employment to people while legal football betting may not. It should be noted that if the government legalises a gambling game which is not demanded by the public, the positive effects of legalisation may not occur, whereas there are only the negative effects as a result. Moreover, understanding the demand for gambling would lead to understand the structure of gambling market. Thus one condition is that, the government should realise the public's demand for gambling products before making a decision on legalising any illegal forms of gambling.

Additionally, it is broadly accepted that gambling is one of the economic activities and there is no single economics theory, which is widely accepted by the economists, can determine the demand for gambling. Therefore, the issue of the determination of demand for gambling is a challenging study.

Finally, the motivation of this thesis can be broken down into two reasons: 1) There is a lack of economics research in gambling in Thailand and none of the previous work studied on the demand for gambling, nor applied the econometric model for the gambling studies. The aim of this thesis is to apply econometric estimation techniques to study the demand for gambling and gambling behaviour in Thailand. 2) To derive the demand for gambling poses a significant challenge to the economists, therefore, this study will intend to explore this area of interest further.

1.2 Objectives of the study

This research is an analysis of the gambling participation, gambling frequency, gambling expenditure, and gambling addiction, which are in the area of the demand for gambling. This thesis also studies the demand for gambling through the income elasticity of demand and pent-up demand.

While the gambling participation, gambling frequency, and gambling expenditure will be estimated by using Logit and Tobit estimation techniques on the set of socio-economic and demographic data, the study of gambling addiction will be estimated by using the Instrumental Variable estimation with the framework of addiction model.

This thesis aims to explore three main questions: 1) Who will enter the gambling market? Chapter 4 will contribute to explore this question. It will present the characteristics of Thai gamblers, the gambling frequency of each gambling game. 2) Which gambling products will be purchased? Chapter 5 will contribute to explore this question. It will present the impacts of socio-economic data on the gambling expenditures, the income elasticity of demand for each gambling game, and the pent-up demands for legal casino and football gambling. 3) How do people react to the gambling game which is legalised? Chapter 6 will contribute to explore this question. It will present the type of gambling addiction.

This research has not attempted to indicate whether the government should legalise the illegal forms of gambling, and to support or oppose the gambling legalisation. Instead, it is attempted to be a useful work for policy-makers and the government to use for making any decision on the gambling industry in Thailand. This research is also intended to illustrate the scope of Thai gambling businesses and make people to clearly understand these businesses. Finally, given the dearth of rigorous analysis of the Thai gambling industry, this research has attempted to fill a void in Thai gambling studies.

1.3 Scope of the study

As for the types of gambling included in the empirical study, this thesis focuses on only the five most popular types. They can be divided into 2 forms, legal and illegal forms. Regarding the legal form, the types of gambling studied are the number games, which comprises of the government lottery and the 2-3 digit lottery. With regard to the illegal form, the types of gambling studied are casino betting, football betting and the underground lottery, a kind of the number game. In this study, the number game is defined as a game in which players choose their own numbers against prize numbers.

1.4 Outline of the study

The outline of the thesis is organised as follow. The study begins with a brief literature relevant to the theory of the demand for gambling in Chapter 2. This chapter is to start with the information of the growth of gambling industry around the world, some significant data is reported. The chapter goes on explore some significant theories of demand for gambling, which base on the classical theory of the expected utility, and explore some significant empirical works which relate to the demand for gambling.

Chapter 3 illustrates the framework of gambling industry in Thailand. The details of each type of gambling, such as the history, the rules of the game, the betting network, are described.

Chapter 4 investigates the gambling participation and gambling frequency of each gambling type. The regression is done on both issues. Logit estimation is employed to estimate the characteristics of gamblers, whereas Tobit estimation is used to estimate the gambling frequency. The gambling participation and gambling frequency of each type of casino are also studied. In the area of gambling frequency estimate, the effects of gambling participation in each gambling type on the gambling frequency are examined. These results reflect the effects of “substitution” and ‘supplementation’ among gambling types. The data used in this chapter is the set of socio-economic and demographic data, gambling opinion data, and gambling experience data. The data sources and its adjustment are illustrated.

Chapter 5 contains an empirical work of the gambling expenditures. The data used in this chapter stems from the same sources as the data used in Chapter 4. This chapter begins with estimating the effects of the socio-economic factors, gambling opinions, and gambling experiences on the gambling expenditures of each gambling game. To investigate the demand for gambling, the elasticities of demand, with respect to income, of each gambling type and each type of casino are explored. This chapter also provides an estimate of pent-up demands of legal casino and legal football betting. These results are useful for making a decision on the approach of gambling legalisation.

Chapter 6 explores the issue of gambling addiction and derives the demand for gambling. The 2-3 digit lottery is chosen as a proxy for the study. This is because Chapter 4 and 5 suggest that the underground lottery is the most popular gambling game and the government decided to legalise the underground lottery by issuing the 2-3 digit lottery project. The model used in this chapter is based on the theory of rational addiction (Becker and Murphy, 1998). It looks at how demand changes with respect to the expected price and estimates the demand for gambling. The Instrumental Variable estimation technique is employed in this chapter to estimate the effects of past and future consumption of the 2-3 digit lottery, and its expected price on present consumption. The price elasticity of demand for the 2-3 digit lottery is also mentioned. The data used in this chapter is the time-series data. The data sources and its property are reported as well.

Finally, Chapter 7 concludes the thesis. This chapter comprises of the empirical results summary, the policy implication, the information on the limitation of this study, and the suggestions for some topic for further research.

CHAPTER 2

A BRIEF LITERATURE REVIEW OF THE THEORY OF DEMAND FOR GAMBLING

2.1 Introduction

There has been a substantial global spread of various types of gambling in recent years, including lotteries, casinos, on-track race wagering, such as horse racing, and off-track wagering[2]. Thompson (1998) indicates that the number of world jurisdictions identified in International Gaming and Wagering Business had increased from 140 to 160 between 1986 and 1996 (see Table 2A in Appendix 2A). Pryor (2007) states that formal gambling is a rapid growing consumption activity in many industrialised countries. For example, in the United States, the growth of gross gambling expenditures at annual rate was around 9.7% between 1982 and 2003 while the growth of current GDP was 6.2% on average in the same period.

Volberg *et al.* (2006) conduct a gambling survey in California, with 7,121 respondents. The survey results report that, in 2006, around 83% of adults in California had participated in gambling in their lives. While lottery was the most popular gambling game, casinos were the most favorite place to gamble (see Table 2B in Appendix 2A).

[2]Gambling on, such as horse racing, or greyhound racing, outside a race track

In the U.K., Wardle *et al.* (2007) indicate that the number of adults who played other lotteries increased from 8% to 12%, and who bet on horse races and other venues with a bookmaker also increased from 13% to 17% and 3% to 6% respectively between 1999 and 2007 (see Table 2C in Appendix 2A).

Since gambling industry has become the basis of a large and rapid growing industry throughout the world, it is important to study on the demand for gambling. To understand the determination of gambling, it is plausible to start with reviewing the theoretical and empirical literature on the demand for gambling. This chapter will begin, in section 2.2, with investigating the theoretical structure of expected utility, which has been proposed to underpin the theory of demand for gambling. The development of a theory of gambling demand is illustrated in this section. The final section will hold the conclusions.

2.2 Theoretical frameworks

Although gambling activity has been accepted to be primarily an economic activity, there is no single theory of demand for gambles has gained widespread acceptance among economists (Nyman, 2004). It might be said that explaining gambling behaviour poses a significant challenge to explain the standard theories of decision making under uncertainty. Friedman and Savage (1948), Conlisk (1993), Hartley and Farrell (2002), for example, have tried to explain why people gamble by developing a theory of gambling demand.

Nyman (2004) also states that one obvious theory of gambling is based on the assumption that the gambler's utility as a function of unearned income or wealth is increasing at an increasing rate. However, most economists are reluctant to accept this theory because of three reasons. First, it may against the notion of diminishing marginal utility. Second, while the traditional procedure for determining a consumer's utility function is based on first determining whether the consumer accepts the gamble, this theory is based on circular reason that if an individual decides to gamble, the gambler has to show the utility function that is increasing with successive marginal gains in income or wealth. Third, many people both gamble and purchase insurance simultaneously, thus this theory would require both concavity and non-concavity of the utility function at the same time. Indeed, the risk aversion explanation is always used to explain economic behaviour, such as insurance purchase, whereas gambling will be rejected by strict risk aversion.

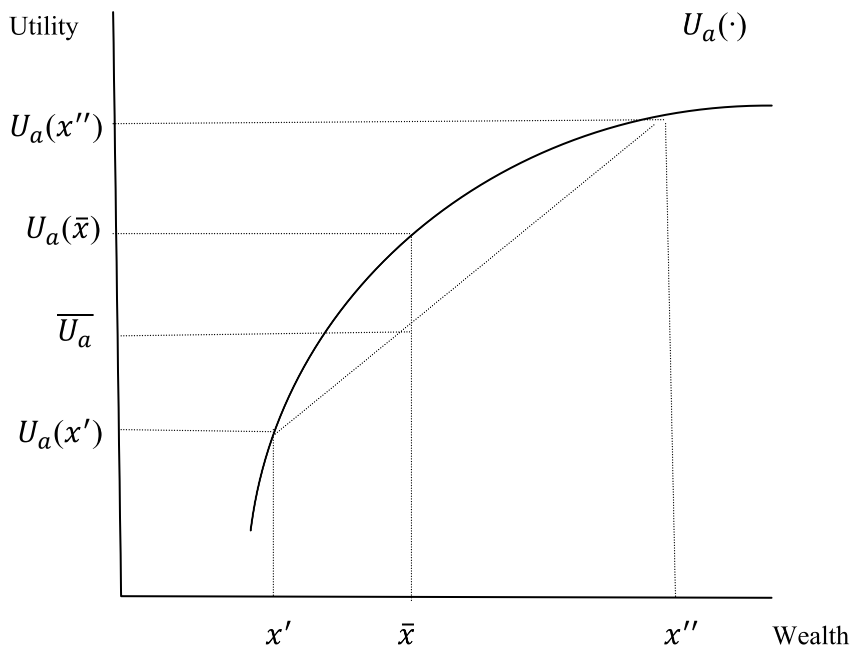
Most theories of demand for gambling base on the classical concept of "expected utility preference" of individual choice under uncertainty. An individual values a gamble by using a probability-weighted utility function instead of the mathematical expectation. The basic assumption is that the attractiveness of a gamble offering the payoffs $(x_1, \ldots . x_n)$ with the probabilities $(p_1, \ldots . p_n)$ is given by its expected value, which can be defined as $\bar{x} = \sum x_i p_i$. Under the choice of uncertainty, if preferences can be explained by a expected utility function, $\bar{u}$, then it is that

$$\bar{u} = U(x_1, p_1; \ldots ; x_n, p_n)$$

$$= \sum_{i=1}^{n} U(x_i) p_i \qquad (2.1)$$

where $U(\cdot)$ is termed a von Neumann-Morgenstern utility function. This function can be subjected to an affine transformation of the form; $a \times U(\mathrm{x}) + b$ whereas $a > 0$, which can be referred to risk attitudes. To determine risk attitudes, Figure 2.1 and 2.2 should be considered. According to both figures, the monotonicity of $U_a(\cdot)$ and $U_b(\cdot)$ imply the property of stochastic dominance preference, where one risky prospect is said to stochastically dominate the other when it can be obtained from it by shifting probability from lower to higher outcome levels[3]. Hence stochastic dominance preference is the analogue of the attitude that "more is better".

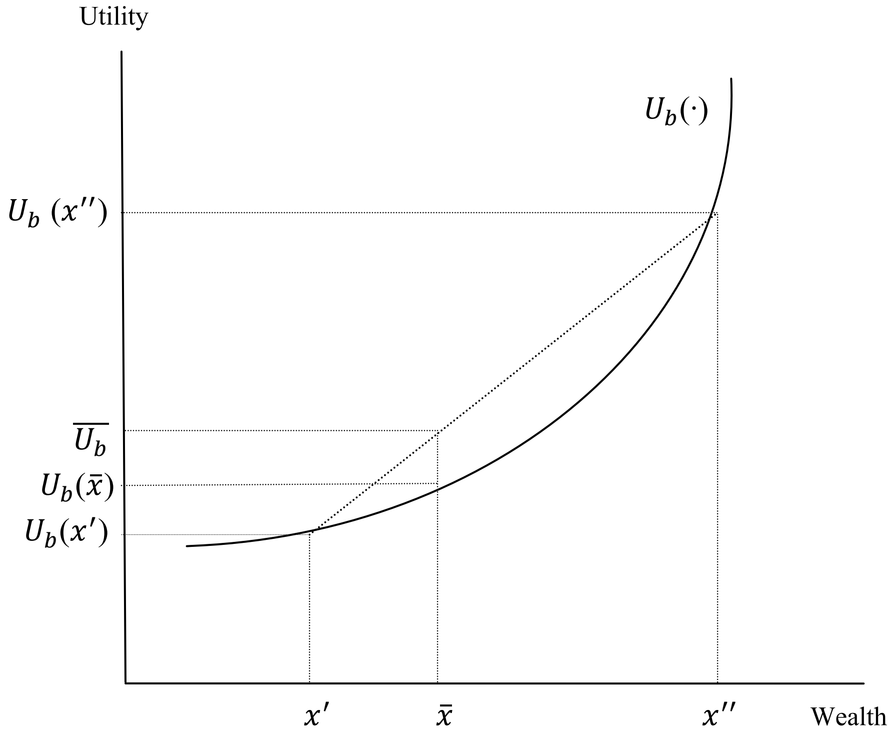
Figure 2.1: Concave utility function of a risk averter



Source: Machina, 1987

[3] For example, a 2/3 : 1/3 chance of £100 or £20 and a 1/2 : 1/2 chance of £100 or £30 both stochastically dominate a 1/2 : 1/2 chance of £100 or £20.

Figure 2.2: Convex utility function of a risk lover



Source: Machina, 1987

For the concave utility function as Figure 2.1, $U_a(\bar{x}) > \overline{U_a}$, which reflects that an individual prefers a sure gain $\bar{x}$ to the gamble. Therefore, concave utility function is termed risk-averse since an individual with a concave utility function will prefer to gain the expected value of a gamble than the gamble itself. Figure 2.2 presents the convex utility function that $\overline{U_b} > U_b(\bar{x})$, which reflects that an individual prefers to bear the risk than gaining the expected value. Thus convex utility function is termed risk-loving (Machina, 1987, 1989; Starmer, 2000).

The most famous work which has been the basic reference on the economic theory of gambling is the work of Milton Friedman and Leonard Savage (1948). Their work present the explanation of insurance purchasing gambler within expected utility theory by assuming a special shape of utility function, i.e. one with nonconcave segments. The nonconcave segment, which implies an increase in marginal utility, is in the middle range of an otherwise concave utility function. The Friedman-Savage utility function can be illustrated by Figure 2.3

Figure 2.3: The Friedman- Savage Utility Function

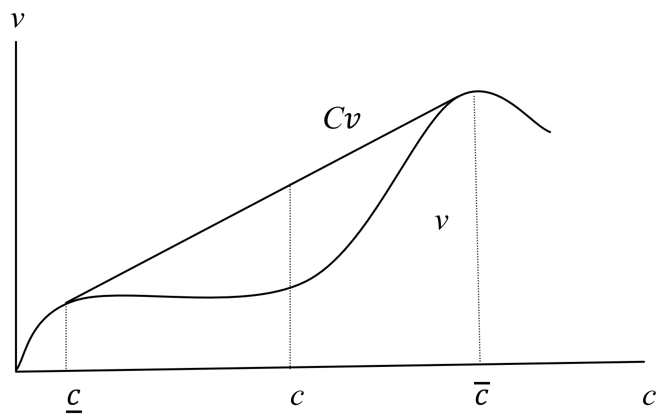
Source: Friedman and Savage, 1948

Friedman and Savage (1948) describe the utility of money income that the marginal utility is positive since the utility increases with income. It is convex from above below some income, concave between that income and some larger income, and convex for all higher incomes; that is diminishing marginal utility for incomes below some income, increasing marginal utility for incomes between that income and some larger income, and diminishing marginal utility for all higher incomes. Most consumers tend to have incomes that place them in the segments of diminishing marginal utility. The various segments of the utility curve reflect socio-economic classes, which is that the segment of increasing marginal utility corresponds to a transitional stage between a lower and a higher socio-economic class. Finally, they could demonstrate that a utility function which included the segment of increasing marginal utility can explain the existence of consumers who both gamble and purchase insurance. One difference between an insurance purchase and a gamble is that; the insurance purchase reflects the certain loss of a small amount, such as the fire insurance premium, in preference to the combination of a little chance of a much larger loss, such as the value of the house, or the factory, and a larger chance of no loss. For the gamble, it reflects a large chance of losing a small amount, such as the lottery purchase, in order to receive a little chance of winning a large prize (Conlisk, 1993; Kwang, 1965; Nyman, 2004; Sauer, 1998)

Markowitz (1952) modifies Friedman and Savage (1948) theory by placing the nonconcave segment of utility at current wealth and treating a gamble as exploitation of local risk preference. The advantage of his model is to allow all segments of the income distribution to make rational gambles. He suggested that the utility function might be best defined in term of change in wealth rather than on final level of wealth.

However, the idea of nonconcave utility function was resisted by Bailey *et al.* (1980), who argued that nonconcave utility function could not in principle explain gambling. To understand the argument, consider Figure 2.4 which developed the Friedman-Savage utility function by Hartley and Farrell in 2002.

Figure 2.4: The Development of Friedman- Savage Utility Function



Source: Hartley and Farrell, 2002

Figure 2.4 presents the Friedman –Savage utility function v with the tangent to the curve at the point $\underline{c}$ and $\overline{c}$. Denote Cv as the concave hull of v where the graph of v is bridged by the common tangent between $\underline{c}$ and $\overline{c}$, $\underline{c}$ is lower bound of consumption, and $\overline{c}$ is upper bound of consumption. Therefore, ($\underline{c}$, $\overline{c}$) is the set of all feasible consumption levels.

Bailey *et al.* (1980) argue that consumers at c can shift their utilities up from $v(c)$ to $Cv(c)$ by purchasing a fair gamble between $\underline{c}$ and $\overline{c}$. When there are two periods, consumers have alternatives which are saving by having lower consumption, $\underline{c}$, in the first period in order to finance higher consumption, $\overline{c}$, in the second period, or borrowing to support higher consumption, $\overline{c}$, in the initial period and lower consumption, $\underline{c}$, in the second period. Gambling behaviour exists when the rate of interest equals consumers' rate of time preference but if they differ, one of these alternatives would be preferred to gambling. In other words, the option of saving and borrowing would dominate when there is the difference between the rate of interest and time preference.

Hartley and Farrell (2002) dispute Bailey *et al.* (1980)'s argument and explain that the required pattern of borrowing and saving, firstly, is only possible when income is appropriately chosen. For example, if the rates of interest and time preference are not different and equal to zero, the amounted save in the first period must be equal to the consumption increase in the second period, this means, income is equal to $(\underline{c} + \overline{c})/2$ (see Figure 2.4). Secondly, Bailey *et al.* ignored one possibility that consumers may wish to gamble as well as save or borrow. Permitting gambling as well as saving or borrowing can restore a demand for gambles though saving or borrowing is preferred to gambling. Moreover, Bailey *et al.*'s model cannot explain the proportion of gambling behaviour if consumers substitute gambling with saving or borrowing. Hence Hartley and Farrell extended the model of Bailey *et al.* (1980) by allowing consumers to gamble as well as save and borrow.

They demonstrated that expected utility with nonconcave utility functions can explain the demand for gambling even though with perfect capital markets and time separable utility functions. Gambling demand exhibits either the rates of time preference and interest are equal or different. In the case that these rates are equal, the demand for gambling will persist unless income happens to take one of a finite set of exceptional values. If these rates are different, there will be a range of income levels for which there is the demand for gambling.

The starting point for Hartley and Farrell's study is formulating the problem of consumer's optimisation when gambles are available, and demonstrating how to solve this problem in terms of a related deterministic problem. They solved the problem in three steps; first, they stated the multiperiod optimisation problem that a consumer can save or borrow in a perfect capital market. A consumer's utility function is also separable which intraperiod preferences are reflected in a nonconcave utility function. They presented the optimal solution of this problem in the case that there is no available gambling. Second, they extend the previous optimisation problem by assuming consumers can access fair gambles and the last step is to provide whether the objective values of the problems in the first two steps are the same.

Refer to the first step, to demonstrate that nonconcave utility functions can explain gambling even though when utility functions are separable. Recall that "no gamble" is available in this state. They assume von Neumann-Morgenstern utility function of the form:

$$\mathrm{U}(c_1, \ldots.., c_T) = \sum_{t=1}^{T} \frac{v(c_t)}{(1+\eta)^t} \qquad (2.2)$$

where c_t is consumption in period t (1, …, T) and ŋ is time preference; (ŋ > 0).

They assumed that utility function v is strictly increasing but not necessarily concave. Regarding figure 2.4, the nonconcave of v means there will be consumption levels c which satisfy $v(c) < Cv(c)$. Consumers, however, will gamble in which the *ex post* wealth is either $\underline{c}$ or $\overline{c}$ and the probability of winning is chosen to make the gamble fair. Although if there is an unfair gamble that giving the expected utility larger than $v(c)$, it is that for $c < \underline{c}$ or $c > \overline{c}$ the consumer is risk averse.

Under the assumption of perfect capital markets with the rate of interest r, the optimal solution without gambling can be existed by maximising utility (U) subject to

$$\sum_{t=1}^{T} \frac{c_t}{(1+r)^t} = y^* \sum_{t=1}^{T} \frac{1}{(1+r)^t} \quad (2.3)$$

where y^* is permanent income.

In the second step, a gamble is introduced and consumers are allowed to increase their wealth in period t by choosing any random X_t satisfying EX_t= 0 for t = 1, …., T. The consumption decision in period t is also allowed to depend on the outcome of the gamble X_t and random events in previous periods. Thus consumption in any period is a random variable and there are no restrictions on the joint distribution of $(X_1, C_1, \dots, X_T, C_T)$. The budget constraint in equation (2.3) is also required to be satisfied for every sample path. Denote CP^T as the consumer's optimisation problem for T periods, CP^T will be:

$$\max \mathrm{E} \sum_{t=1}^{T} \frac{v(C_t)}{(1-\eta)^t}$$

$$\text{subject to } \sum_{t=1}^{T} \frac{C_t}{(1-r)^t} = \sum_{t=1}^{T} \frac{y* - X_T}{(1-r)^t}$$

and EX_1 = … = EX_T = 0, where the maximization is respected to $X_1, C_1, \dots, X_T, C_T$.

In the last step, Cv is substituted for v in CP^T to yield an upper bound to the original problem because of $Cv \geq v$. Hartley and Farrell showed that the deterministic problem, which they referred to as "the deterministic equivalent" of CP^T, yields an upper bound for CP^T:

$$\max \sum_{t=1}^{T} \frac{Cv(c_t)}{(1+\eta)^t} \quad \text{subject to equation (2.3)}$$

They, however, also constructed a solution $(\hat{X}_1, \ \hat{C}_1, \ldots, \hat{X}_T, \hat{C}_T)$ of CP^T which achieve this upper bound, and is optimal. Hence they concluded that an optimal solution to CP^T can be found by solving the deterministic equivalent first, then, using the standard construction to generate a solution of CP^T. It should be noted that the optimal objective values of CP^T and its deterministic equivalent are the same.

The results above extend to two periods and more than two periods in both cases, which the rates of time preference and interest are equal or different. Hartley and Farrell (2002) indicate that when the rates of time preference and interest are equal and income lies between $\underline{c}$ and $\overline{c}$, a demand for gambling still exists. The more periods are available, the more closely the consumer can replicate the gamble. However, the demand of gambling will disappear when the number of periods is allowed to be infinite.

In the case that the rates of time preference and interest differ but this difference is not too large, the optimal solution of the deterministic equivalent of CP^T leads to consumption at a level between $\underline{c}$ and $\overline{c}$ in some period for a range of income. Using the standard construction, it can be found that the optimal solution of CP^T requires a consumer to gamble in that period. Unlike the result when there is no difference between time preference and interest rates, this demand is not ruled out even though the number of periods becomes infinite. For the set of incomes, consumers will demand a gamble although the number of periods is infinity.

Finally, Hartley and Farrell (2002) conclude that it is optimal to gamble in at most one period when the interest rate differs from the rate of time preference. However, although these two rates are equal, consumers would prefer to gamble at most once, weakly if fair gambles are offered and strictly if only unfair gambles can be purchased. As regards the repeated gambling issue, Hartley and Farrell indicated that the only way to account for repeated gambling by using the expected utility theory is to invoke market failure. Nevertheless, an alternative approach is to permit inter period interactions. For example, repeated gambling will exhibit if preference in one period is positive related to previous consumption, as model of rational addiction, which is Becker and Murphy's work in 1988. This model will be further discussed and used to test the gambling addiction in Chapter 6.

Discomfort with special wiggles in utility functions as an explanation of gambling has led some economists to offer a foundation for nonconcavities of the Friedman and Savage type using indivisibilities in market such as Kwang (1965). He focused his work on lottery purchasing and attempted to explain why people buy lottery tickets. The study is made under two assumptions, which are that the pleasures of gambling are ignored, and the marginal utility of income is diminishing. He demonstrated that people do gamble since the expenditure of indivisible goods[4] is itself indivisible. To maximise their utility, therefore, gambling may be an alternative. In other words, the concept of indivisibility of expenditure allows the rationalisation of gambling according to the principle of utility maximization.

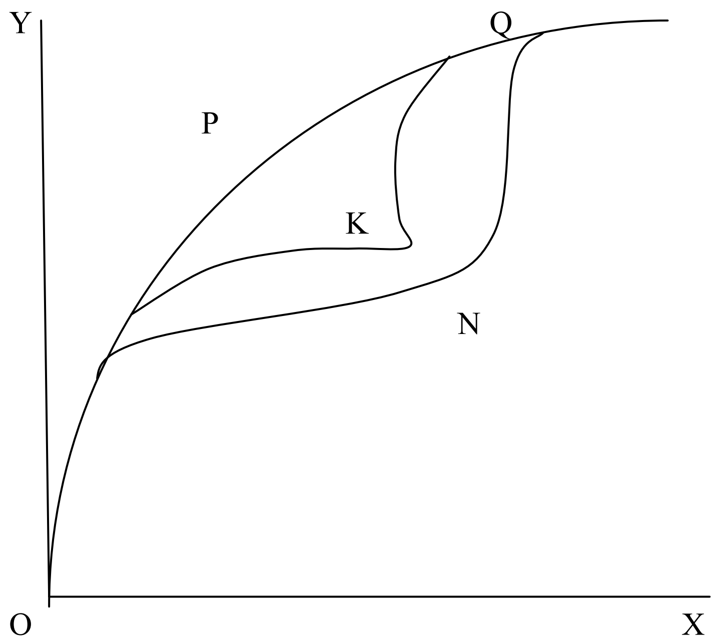
Kwang's work resembles Friedman and Savage's work (1948) in the area that choices which relating risk may be presented by the insurance purchase and the gamble, the lottery ticket purchase, but also differ from it in some parts. He pointed out that the case of the insurance purchase, which the certain loss of a small amount in order to avoid the risk of losing a large value of commodity, has no contradiction between utility maximisation and diminishing marginal utility.

Unlike the insurance purchase, the lottery ticket purchase, which a large chance of losing a small amount in order to win a large prize with a little chance of winning, has a contradiction under the assumption that the pleasure of gambling is ignored. He also asserted the concept of the indivisibility of expenditure could explain the case that people who both purchase insurance and gamble, which implies that choosing certainty and subjecting themselves to risk at the same time, without either demolishing the assumption of utility maximisation or introducing the assumption of increasing marginal utility of income over a certain range of income variation.

[4] The indivisible goods is such as a car, a house, etc.

The difference between the works of Kwang (1965) and Friedman-Savage (1948) can be illustrated by Figure 2.5.

Figure 2.5: The Total Utility Function



Source: Kwang, 1965

Denote X-axis as income and Y-axis as total utility. The total utility function of Kwang is illustrated by OKQ, whereas ONQ presents Friedman-Savage's utility function. The kink at K is caused by the existence of indivisibilities. The curve OPQ presents the traditional utility function, which cannot explain gambling behaviour.

Some economists argue that gambling is not wealth-oriented as the Friedman and Savage's approach and gambling may be motivated by some approaches other than convex utility, such as the behavioural approach. With respect to this argument, the model which related is Conlisk (1993)'s model (Sauer, 1998).

Conlisk (1993) studies the utility of gambling on the basis of an expected utility model, which focuses on the pleasure of gambling. He stated that most standard economic theories treat gambling as the motive to improve gambler's wealth position, such as the Friedman-Savage approach, or the Markowitz approach, have limited power in explaining gambling behaviour. Conlisk cited other works which are about risk attitude. For instance, Kahneman and Tversky in 1979 and 1986, which indicate that risk-seeking dominates over the domain of losses, except when the probability of loss is low, while risk-averting dominates over the domain of gains, except when the probability of gain is low, and that risk-averting dominates over the domain of symmetric risks involving both gains and losses.

Conlisk's model concerns the individual decision that whether a risky prospect is accepted and his model is similar to most risky choice theories, which the model is static no explicit attention to time effects. Assume that the individual must whether accept or reject a risky prospect with the probability, p, of a gain, G, and the probability of a loss, L, therefore, the probability of L equal $1 - p$. This is the fair prospect so $pG - (1 - p)L = 0$.

Thus $p = L / (L + G)$ then $p = 1 / 1[1 + (G / L)]$. Since p is a monotonic function of the gain to loss ratio (G / L), p can be considered as measuring the skewness of the prospect. Hence a convenient interpretation of a fair prospect (G, p) is that G and p give, respectively, the size and skewness of the prospect. The individual's preference can be determined by an expected utility function which is modified to allow a gambling utility.

Given $E(G, p, K)$ as an individual's preference value, if the individual accepts a fair prospect $(G,p,)$, the individual's preference can be expressed as

$$E(G, p, K) = pU[K + G] + (1 - p)U[K - Gp(1 - p)^{-1} + \epsilon V(G, p) \qquad (2.4)$$

where K is the individual's initial wealth. $U(W)$ is the individual's utility-of-wealth function, which is presumed to pass through the origin, to be increasing, to present risk aversion, and to be bounded $[U(0) = 0, U'(W) > 0, U''(W) < 0, U(W) < U_\infty < \infty]$.

Given that (G, p) is the risky prospect, $(K + G)$ with probability p is the individual's wealth, and $(K - L) = K - Gp(1 - p)^{-1}$ with probability 1 - p ; it can be seen that the first two terms of the right hand side of the equation (2.4) are the individual's ordinary expected utility and the last term is the utility of gambling. The individuals will be presumed to accept the fair prospect when $E(G, p, K)$ is higher than $E(0,0, K) = U(K)$.

According to equation (2.4), the term of $\epsilon V(G, p)$ is defined as the utility of gambling, whereas ϵ is a positive parameter used below to scale the smallness of the gambling utility. This function is also assumed continuous and differentiable. If $0 < p < 1$, it can be assumed that $V(G, p)$, as a function of G, passes through the origin, is increasing, and is concave. Hence $V(0, p) = 0$, $V_1(G, p) > 0$, and $V_{11}(G, p) < 0$. The prospect will be defined as nothing if p equal zero, therefore, it is also assumed the G is positive, that means, the utility of gambling increases from zero due to increasing in p from zero. Thus $V(G, 0) = 0$ and $V_2(G, 0) > 0$ for $G > 0$. However, there is no any assumption on the relation between $V(G, p)$ and p, when p is beyond the neighbourhood of zero. Conlisk explained that, from the individual's perspective, there is an ideal skewness, which $V(G, p)$ rises with p initially, then reaches a peak, and finally falls with p.

Conlisk (1993) issues a Fair Prospect Model and uses this model to postulate two theorems which are "Small Gamble Theorem" and "Lottery Theorem". As noted above, the individual will accept a fair game if $E(G, p, K)$ exceeds $U(K\ )$ then a Fair Prospect Model can be expressed as:

$$E(G, p, K) \equiv pU[K + G] + (1-p)U[K - Gp(1-p)^{-1} + \epsilon V(G, p) \qquad (2.5)$$

- Small Gamble Theorem

In this theorem, p is held fixed while G varies, that means, the skewness is held fixed while size is released to vary. Assume the Fair Prospect Model. For given probability of winning, the individual will accept small enough prospects. Moreover, the individual may reject larger prospects when ϵ is small. Formally, consider the prospect (G, p) by holding p fixed where

$0 < p < 1$. If

$$\epsilon \ \leq [U(K) - pU(K/p)] \ / \ V[K(1-p) \ / \ p, p] \qquad (2.6)$$

then the explanations below are held:

1. There is a critical value for G, which separates acceptable from unacceptable prospects. Formally, there is a positive number depending on K, called $C(K)$, so that, $E(G, p, K) > U(K)$ if and only if $0 < G < C(K)$.

2. There is a size of the most preferred prospect within the set of acceptable prospects. Formally, there is a positive number depending on K, called $M(K)$, so that, $0 < M(K) < C(K)$ and $G = M(K)$ maximises $E(G, p, K)$ with respect to G.

3. If the utility-of-wealth function presents a decrease in risk aversion, the acceptable prospect range and the most preferred prospect size will increase with initial wealth. Formally, if $U''' > 0$, then $A'(K)$ and $B'(K) > 0$, where A and B are parameters.

Finally, if the opposite of inequality of equation (2.6) holds, every possible prospect will be accepted, which means that $E(G, p, K) > U(K)$ for every $G \leq K(1 - p) / p$.

This theorem states that some prospect will be accepted when ϵ is positive although it is tiny. The reason is that the individual's utility-of-wealth function is approximately linear, the local risk neutrality, over a small neighbourhood. This local risk neutrality makes the risk-aversion motive second-order small while the motive of the gambling utility is first-order small.

Given $b(G)$ is a net benefit of the gamble (G, p) and p is held fixed, the net benefit of the gamble can be expressed as a function $b(G) \equiv E(G, p, K) - U(K)$ of the gamble size G. It can be verified as:

$$b(0) = 0,\ b'(0) = \epsilon V_1(0, p),\ b''(0) = p(1-p)^{-1}U''(K) + \epsilon V_{11}(0, p)$$

This theorem also insists that, for tiny ϵ, the individual will neglect the prospects with large G, this implies, a small utility of gambling is consistent with risk-averse choice rather than the choice of large stake.

- Lottery Theorem

Assume the Fair Prospect Model. If ϵ is not too small, the individual will accept the prospect when p is small enough, no matter how G is. That is if

$$\epsilon > GU'(K)\ /\ V_2(G, 0) \text{ for all } G > 0 \tag{2.7}$$

thus there is a positive constant D, for any positive G, such that $E(G, p, K) > U(K)$ for any p accepting $) < p < D$.

A typical lottery is a large gamble defining by the prize G while a small gamble is defined by the expected payoff, pG. Conlisk also claimed that for the gamble preferences, smallness in the sense of the expected payoff is enough to make the Small Gamble Theorem can be applied to lotteries. The Lottery theorem gives a sufficient condition (2.7) for lotteries to be accepted. Under this condition, there is a range of small p for which the gamble is tiny enough for (G, p) to be accepted, but this acceptance is in the sense that the lottery is preferred to no gamble at all.

The prospect above is a fair prospect with a fair prospect model that is defined as

$$E(G, p, K) \equiv pU[K + G] + (1 - p)U[K - Gp(1 - p)^{-1} + \epsilon V(G, p)$$

However, this model can be extended to be an unfair prospect model under the concept of an unfair prospect. The unfair prospect can be separated into two components; first a sure payment which is equal to the expected value of the prospect, and second, a fair prospect over deviations about the sure payment. Let (G, L, p), an unfair prospect, be a risky prospect with expected value $S \equiv pG - (1 - p)L$ possibility not equal to zero. Thus the first component of the unfair prospect is a sure payment of S and the second component is a fair prospect about S, namely, (G - S, L + S, p). The way to extend the fair prospect model for the unfair prospect model is to add the sure component S to the individual's initial wealth, K, and to treat the fair prospect component as in the original model. Therefore, the unfair prospect model can be expressed that the individual prefers a risky prospect, (G, L, p), to the corresponding sure payment, $S \equiv pG - (1 - p)L$, if and only if $E(G - S, p, K + S)$ exceeds $U(K + S)$.

It can be summarised that Conlisk's model postulates that gambling has some direct consumption value on its monetary implications. The model suggests that the utility of gambling derives from some value condition, for example, gambling is fun; that is independent of its implications for actual expected changes in income. However, Nyman (2004) criticises this model that there is a lack of variable, which can measure independently the direct consumption value of gambling. In addition, it does not true that all gambling is fun, under this condition, this model fails to explain gambling in the absence of this consumption value.

Nyman (2004) states one important gambling demand explanation is that the gambler's subjective probability is different than either the objective probability or probability which is implied by the wager or payoff ratio. For example, some gamblers may believe in themselves that they are lucky, or may have better gambling information, or may have better skill in the gambling game than their rivals. These gambling motivations are based on the presumption that the gamble is perceived to be, or may be, unfair for some consumers. Nyman took this explanation in to account thus his work is addressed the demand for fair gambles. He also emphasised that the value of gambling derives from the possibility of an actual income gain, as Kearney's empirical work in 2004 which indicates that the demand for gambling will increase with the size of the expected monetary reward.

Nyman identified gambling activity as a way to obtain additional income without working, therefore, the expected benefit from gambling is not only the chance to obtain the additional income, but also the chance of obtaining the additional income while consumers do not need to work. He used the standard labour supply model to explain the consumer's decision for gambling. Individual consumer-worker derives utility from income, y, leisure, l. At wage rate,

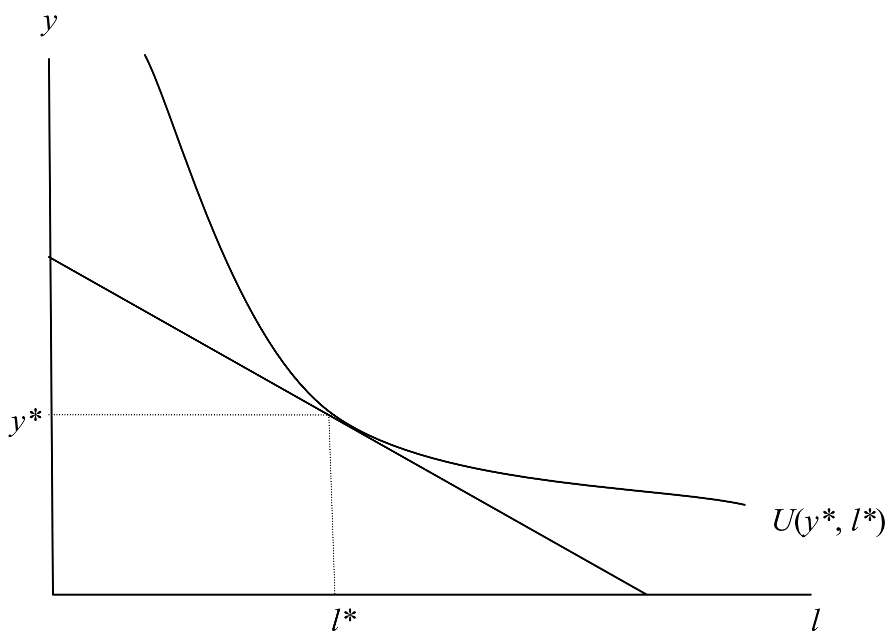
w, individuals have a labour market constraint on their earning based on the total amount of available time which they have for both work and leisure. The total time available is normalised to utility thus the individual's problem is

$$\max u(y, l) \quad \text{subject to } y = w(1-l), \text{ and } 0 < l < 1 \qquad (2.8)$$

where y is income, l is leisure, and w is wage rate

The utility function is assumed to be continuous, twice differentiable, and strictly concave, therefore, u_l, u_y > 0, u_{ll}, u_{yy}, < 0 and $u_{ll}u_{yy}$ - u_{ly}^2 > 0. Intuitively, the consumer maximisation utility is (y^*, l^*) so the consumer maximises utility by working until achieving (y^*,l^*). This can be illustrated by Figure 2.6.

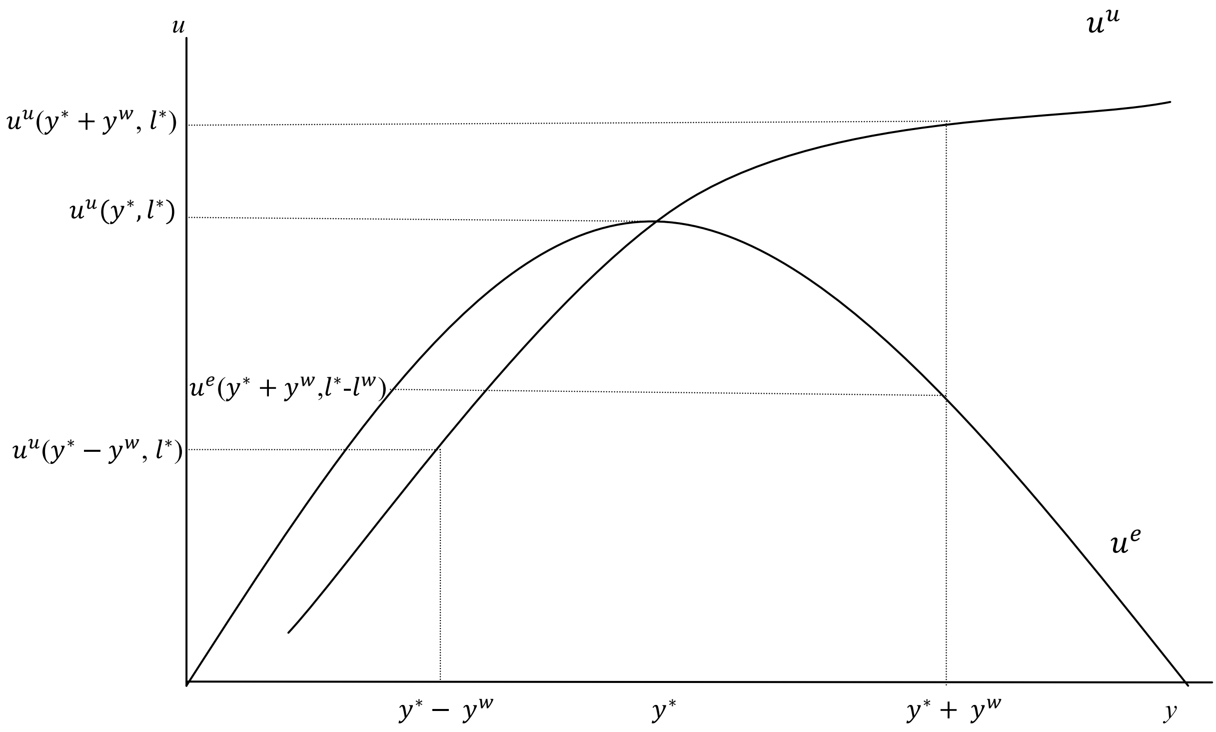
Figure 2.6: The Consumer-Worker's Optimum



Source: Nyman, 2004

Figure 2.6 shows that as the worker gives up leisure from (0, 1), utility from earnings increases until (y*, l*) and decreases after that. Thus (y*, l*) is the position of consumer's maximise utility. Figure 2.7 illustrates the relationship between utility and earnings alone.

Figure 2.7: Net Gain from a Fair Gamble



Source: Nyman (2004)

According to Figure 2.7, denote $u^e(y, l)$ as the relationship between utility and earning while $u^u(y, l \mid l = l^*)$ as the relationship between utility, and gains and losses of unearned income from y^*, the latter utility function is derived from the traditional utility function by holding leisure of u^u function fixed whereas allowing income to vary. Nyman explained that the decision to gamble relies on whether individual consumer-worker considers the context of the gamble the gain in utility measured from a reference point on $u^u(y, l \mid l = l^*)$ or the gain in utility from a reference point on $u^e(y, l)$. That is, it depends on whether the gain in utility is simply the gain from additional goods and services that can be bought with the additional income that is simply given to the customer, or the gain from the additional goods and services that can be bought with the additional income for which it was not necessary for the individual consumer-worker to devote leisure to obtain, respectively. If the reference is u^u, therefore, the individual will not gamble, but if the reference is u^e, the individual may gamble.

For example, suppose a consumer is at (y^*, l^*) and faces a fair gamble where a consumer can win or lose y^w in additional unearned income with a 50-50 percent probability. This game seems as a fair coin-toss game, where a player bets y^w on head and will earn $2y^w$ back if head appears otherwise 0. Figure 2.7 illustrates both gains and losses. Expected utility of unearned income with the gamble is:

$$E(u_g) = pr_{win}\, u^u(y^* + y^w, l \mid l = l^*) + (1-pr_{win})\, u^u(y^* - y^w, l \mid l = l^*) \qquad (2.9)$$

$$= {}^1/_2\, u^u(y^* + y^w, l \mid l = l^*) + {}^1/_2\, u^u(y^* - y^w, l \mid l = l^*)$$

where $E(u_g)$ = expected utility of unearned income with gambling

pr_{win} = probability of winning

and without the gamble is:

$$\mathrm{E}(u_n) = u^u(y^*, l \mid l = l^*) \tag{2.10}$$

$$= {}^1\!/_2\ u^u(y^*, l \mid l = l^*) + {}^1\!/_2\ u^u(y^*, l \mid l = l^*)$$

where $\mathrm{E}(u_n)$ = expected utility of unearned income without gambling

Thus the net gain in utility when the gamble exists:

$$\mathrm{E}(u_g) - \mathrm{E}(u_n) = {}^1\!/_2\ [u^u(y^* + y^w, l \mid l = l^*) - u^u(y^*, l \mid l = l^*)]$$

$$+ {}^1\!/_2\ [u^u(y^* - y^w, l \mid l = l^*) - u^u(y^*, l \mid l = l^*)] \tag{2.11}$$

The net gain in utility is negative because the loss of utility from gambling is evaluated on a steeper portion of u^u than is the payoff gain, hence, the consumer would not gamble.

However, if the consumer considers the gain in gamble as obtaining greater income in an economy characterised by scarce resources, the consumer may compare the gain in utility through winning unearned income from gambling against the reduction of utility which is required to obtain the same income gain through working. The consumer would gamble if the net gain in utility is positive. Expected utility with the gamble is same as equation (2.9), that is

$$\mathrm{E}(u_g) = {}^1\!/_2\ u^u(y^* + y^w, l \mid l = l^*) + {}^1\!/_2\ u^u(y^* - y^w, l \mid l = l^*)$$

and without the gamble:

$$\mathrm{E}(u_w) = {}^1\!/_2\ u^e(y^* +\ y^w, l^* - l^w) + {}^1\!/_2\ u^u(y^*) \tag{2.12}$$

where l^w is the leisure foregone to obtain an additional y^w at the wage rate

Thus the net gain in utility when the gamble exists:

$$\mathrm{E}(u_g) - \mathrm{E}(u_w) = {}^1\!/_2\,[u^u(y^* +\ y^w, l \mid l = l^*) - u^e(y^* +\ y^w, l^* - l^w)]$$

$$+\ {}^1\!/_2\,[u^u(y^* -\ y^w, l \mid l = l^*) - u^u(y^*)] \tag{2.13}$$

It can be seen that the first term of the right hand side is the expected gain from gambling without working while the second term is the expected loss from gambling. Nyman stated that the expected gain is higher than the expected loss thus the net utility gain is positive and the consumer will choose to gamble.

Nyman elaborated his model that an individual consumer has to have earned income already in order to gamble hence the consumer does not need to choose to abandon both income and work in order to gamble, but must abandon only income, in the sense that, the consumer considers the expected utility cost of gambling according to the utility function for unearned income, while the payoff has not been earned yet. Thus there is an ambiguity that whether the consumer considers the context of the utility gain in unearned income from gambling from the reference point of the starting level of utility, or from the utility level after working for an equivalent income gain. Nyman explained the meaning of this ambiguity that a consumer who evaluates the expected gain from the payoff according to the utility function unearned income alone, gambling will not be chosen, while a consumer who evaluates this expected gain compared with the utility from earning the equivalent income from working, gambling will be chosen.

In addition, this finding theory can be used to predict the demand for gambling of consumers who are oriented toward the labour market perspective. Consumers who have low wage seem to have higher gambling demands rather than high wage consumers. This is because the cost, in term of leisure abandoned, of earning a certain amount of additional income from working for it is greater for low wage workers than for high wage workers hence the leisure savings are greater for low wage workers if the additional income is earned by gambling. With this explanation, it may imply that the demand for gambles will be greater among, such as blue collar workers, consumers who dislike their jobs, low income household, unemployed consumers. Nyman also extended his theory to predict the demand for gambling between the gambling game, which has large payoffs but small wagers, and the game which payoffs and wagers are similar. The gambling demands for the former type will be greater than the latter.

Brenner (1986) explains why people gamble relating to the expected utility function. He assumed that an individual's satisfaction which is represented by a utility function, U(..,..), is a function not only of individual's expected wealth, W_0, but also of α ($W > W_0$), which is the percentage of people whose wealth is greater than W_0, given that individual's aspirations are to belong to the wealth class which corresponds to W_0. He also assumed that the individual's utility increases when his wealth increases while other people's wealth is constant, and the individual's utility decreases either when his own wealth decreases or the other people whom comparisons are made become suddenly richer.

People whose expectations are realised and participate in gambling tend to be the group of relatively poorer while the group of relatively richer people will tend to be insure themselves. For people whose expectations are either not realised or have been exceeded and participate in gambling tend to be the group of people whose wealth has suddenly dropped.

2.3 Conclusions

In this chapter, the existing studies on the theory of demand for gambling are reviewed. There are three main factors that encourage economists to study on the demand for gambling. First, gambling, both legal and illegal, has substantially expanded throughout the world and it has become a basis of large and growing industry so far.

Second, gambling is accepted to be one of the economic activities. It is also considered as a significant challenge to the studies of an individual's decision-making under uncertainty. Economists are curious why people demand for gambling even when its aggregate expected return is negative. Some economists, such as Friedman-Savage (1948), Markowitz (1952), compared gambling with other activities which relate to a risk, such as an insurance purchase. Third, there is no single acceptable economics theory that can explain the demand for gambling, therefore, some economists have contributed their works to develop the studies of demand for gamble. For example, Nyman (2004) studies the demand for gambling through the consumer's choices between leisure and working in the labour market. Conlisk (1993) studies the demand for gambling by focusing on the pleasures of gambling.

Most theories of demand for gamble base on the Expected utility Theory. It is the standard theory of individual choice in economics. One economic explanation, based on the context of the expected utility theory, is that gamblers have an attitude of risk-loving over their money for gambling (Peel and Law, 2009). The following summaries can be drawn from the literature review above. The classical work of Friedman and Savage in 1948 was based on the assumption that there is a convex segment in the middle rage of the traditional concave utility function. The convex segment presents an increase in marginal utility and this utility function can explain the existence of gambling and insurance purchasing. Markowitz (1952) develops Friedman-Savage's model and suggests that utility is a function of change in wealth rather than wealth level. It can be said that the works like Friedman-Savage, Markowitz's work rely on the curvature of a function of utility of wealth to explain gambling behaviour (Sauer, 1998).

Bailey *et al.* (1980) dispute the works which rely on the convex utility function. They stated that convexity cannot explain gambling behaviour since consumers would have the options of saving and borrowing when their rate of time preference and the interest rate are different. Hartley and Farrell (2002) object this argument with two reasons. First, the required option of saving and borrowing is practicable only if income is appropriately chosen. Second, consumers may gamble as well as save or borrow. They also indicated that gambling will exist at most one period when the rate of time preference and interest rate are different, and even these two rates are equal, individuals will gamble at most once.

Conlisk (1993) focuses the demand for gambling on the pleasures of gambling. He added a small utility of gambling to the standard expected utility model. He pointed out three crucial issues which are: there is, firstly, a limitation of the size of a satisfactory gambling prospect. Secondly, a preferred gamble size is unique, and lastly, both of these magnitudes will increase with wealth. However, Sauer (1998) supports Conlisk's model in the sense that this model satisfies the important requirement of Friedman-Savage's theory, in which that, a small gamble and an insurance purchase exhibit when a risk is large. According to Nyman's work in 2004, it illustrates that the decision to gamble depends on whether the gain in utility from gaining the additional goods and services that can be bought with the additional income that is simply given to consumers or that is not necessary for consumers to sacrifice their leisure to gain.

Brenner (1986) states that people, whose expectations are either not realized or have been exceeded, would gamble when their wealth is suddenly dropped, whereas people, whose expectations are realised, would gamble when they are relatively poorer. Kwang (1965) indicates that people do gamble, such as purchasing a lottery ticket, according to the indivisibility of expenditures in the market.

Appendix 2A

Table 2A: Numbers of countries with forms of gambling between 1986 and 1996

	Europe	North America	Asia	South America	Africa	Total
Countries						
N 1986	31	25	34	11	39	**140**
N 1996	39 (100%)	32 (100%)	39 (100%)	11 (100%)	39 (100%)	**160 (100%)**
Casino countries						
1986	20 (64.5%)	17 (68.0%)	12 (35.3%)	8 (72.7%)	20 (51.3%)	**77 (55.0%)**
1996	32 (82.1%)	19 (59.4%)	19 (48.7%)	9 (81.8%)	30 (76.9%)	**109 (68.1%)**
Lottery countries						
1986	25 (80.6%)	16 (64.0%)	23 (67.6%)	11 (100%)	25 (64.1%)	**100 (71.4%)**
1996	37 (94.9%)	24 (75.0%)	25 (64.1%)	11 (100%)	24 (61.5%)	**121 (75.6%)**
Horse race countries						
1986	26 (83.9%)	11 (44.0%)	17 (50.0%)	9 (81.8%)	10 (25.6%)	**73 (52.1%)**
1996	26 (66.7%)	16 (50.0%)	17 (43.6%)	9 (81.8%)	15 (38.5%)	**83 (51.9%)**
Off-track betting countries						
1986	16 (51.6%)	7 (28.0%)	10 (29.4%)	5 (45.4%)	3 (7.7%)	**41 (29.3%)**
1996	22 (56.4%)	12 (37.5%)	10 (25.6%)	5 (45.4%)	7 (17.9%)	**56 (35.0%)**

Source: Thompson, 1998

Table 2B: Frequency of gambling participation in California in 2003

Gambling Game	Lifetime Participation (% of 7,121 people)	Past Year Participation (% of 7,121 people)	Monthly Participation (% of 7,121 people)	Weekly Participation (% of 7,121 people)
Lottery	68.2	43.7	16.9	7.5
Casino	63.0	28.0	5.3	1.6
Private	31.0	12.8	4.5	1.3
Track/OTB	27.0	4.9	0.9	0.3
Other	20.5	4.8	-	-
Bingo	9.7	2.1	0.4	0.2
Cardroom	6.2	2.6	1.0	0.2
Internet	2.1	1.1	0.5	0.3
Total	83.1	57.6	22.1	9.7

Source: Volberg *et al.*, 2006.

Table 2C: Comparison of gambling participation in past year in 1999 and 2007

All and past year in 1999 and 2007

Gambling types	All		Past year gamblers	
	1999 (%)	2007 (%)	1999 (%)	2007 (%)
National Lottery Draw	65	57	90	84
Another lottery	8	12	11	17
Scratch cards	22	20	30	29
Football pools	9	3	12	5
Bingo	7	7	10	11
Slot machines	14	14	19	21
Horse races*	13	17	18	25
Dog races*	4	5	5	7
Betting with a bookmaker (other than on horse or dog races)*	3	6	4	9
Fixed odds betting terminals	n.a.	3	n.a.	4
Online betting with a bookmaker on any event or sport	n.a.	4	n.a.	6
Online gambling	n.a.	3	n.a.	4
Table games in a casino	3	4	4	6
Betting exchange	n.a.	1	n.a.	2
Spread betting	n.a.	1	n.a.	1
Private betting (e.g. with friends, colleagues)	11	10	16	15
Another gambling activity	-	-	-	1
Any gambling in past year	72	68	100	100

Note: the columns total more than 100% as more than one gambling type could be chosen.
n.a. = gambling type not asked in 1999 * = do not include any bet made online

Source: Wardle *et al.*, 2007, British Gambling Prevalence Survey 2007

CHAPTER 3

THE GAMBLING INDUSTRY IN THAILAND

3.1 Introduction

The economy of Thailand has two parts, one formal and the other informal, the underground economy. Illegal gambling businesses form the largest proportion of the latter sector. In 1995 the size of the illegal gambling businesses, which included only the underground lottery, casino betting and football betting, equalled 15% of the underground economy, whereas in 2005 the size of all illegal gambling businesses was estimated at approximately 87% of it. Moreover, the total value added of both legal and illegal gambling businesses is now over 200 billion baht a year[5]. Table 3A in Appendix 3A reports the size of the illegal businesses in Thailand between 1993 and 1995 (Pasuk *et al*., 1998; Pasuk, 1999; Somchat, 2005; Socatiyanurak, 2007).

This chapter will focus on the five most popular types of gambling: the government lottery, the underground lottery, the 2-3 digit lottery, football betting, and casino betting. The following section provides a background to the gambling industry in Thailand. Here, the history of Thai gambling, details of the structure of the gambling game and gambling network of each type are presented. Most of the information is based on Pasuk *et al.* (1998) and Sungsidh *et al.* (2003), which are the ultimate academic studies on gambling in Thailand. Some conclusions are drawn in section 3.3.

[5] Legal gambling in Thailand comprises the government lottery and horse racing.

3.2 Background of gambling industry in Thailand

Gambling in Thailand has a long history. The game of bean guessing is recorded as one of the earliest gambling games, and was introduced by the Chinese into Thailand when they were trading and living there. Between 1824 and 1851, the reign of the King Rama III, legal gambling dens, *Bon-Beai,* were promoted throughout the country as a major source of revenue although there were previously only 2 popular gambling games, “Cock Fighting” and “Ska Chess”.

Gambling became an illegal business during the reign of King Rama V, 1868-1910, as many people were addicted to gambling and the rate of bankruptcy and crime increased. In 1930 the government issued the first Gambling Act and it was revised in 1935. By the mid-1940s the government allowed casinos to be set up, open only to members of the wealthy class.

However, the Act was difficult to enforce and as a result casinos did not discriminate. This led, for example, to some people going without food and necessities, increased numbers of debtors from gambling and the degeneration of society. It was clear that the government policy of restricting access to casinos was being flouted. In view of the public pressure, although the government could earn revenue from the casino tax, it decided to close all casinos. Once again, casino became an illegal business in Thailand (Brandy, 2003).

Nowadays, there are only two legal forms of gambling in Thailand, which are “Horse racing” and the “government lottery”. Horse races are normally held once a week, while the government lottery is run twice a month. The latter has three forms: one is issued by the

Government Lottery Office (GLO), another by the Government Savings Bank (GSB) and the third by the Bank for Agriculture and Agricultural Cooperatives (BAAC). Both GSB and BAAC lotteries are run occasionally. Most of the popular gambling games are illegal.

Table 3.1 shows the number of gamblers in Bangkok and its vicinity during 2002. The underground lottery seems to be the most popular and casino gambling comes second among all the types of number game[6] . Table 3.2 shows the volume of money generating among the popular types of gambling in 2002.

[6] Games in which players choose their own numbers against prize numbers, such as the government lottery and the underground lottery.

Table 3.1: The number of gamblers of each gambling game in 2002

Gambling types	Bangkok and the vicinities (in thousands of people)
GLO lottery	21,221
Underground lottery	23,700
GSB lottery	7,788
BAAC lottery	3,592
Stock lottery	2,013
Ping-pong lottery	230
Chinese card	260
Lotteries from other countries (such as Hong Kong, USA, etc.)	18
Malaysian lottery	88
Football betting	1,995
Casinos	4,187
Horse racing	81
Thai Boxing gambling machines	814
Local sport betting (such as cock fighting)	1,251
Gambling on internet	36
Others	294

Note: GLO lottery = Government Lottery Office lottery GSB lottery = Government Savings Bank lottery
BAAC lottery = Bank for Agriculture and Agricultural lottery
Stock lottery = Betting on the last two digits of the stock market index
Source: Sungsidh *et al*., 2003

Table 3.2: The amount spent on types of popular gambling in 2002

Type of Gambling Games	Volume of Money (Million baht)
GLO lottery	38,710
Underground lottery	92,073
GSB lottery	9,341
BAAC lottery	3,471
Stock lottery	16,156
Football betting	51,085
Casinos	113,959
Total	324,795

Note: GLO lottery = Government Lottery Office lottery GSB lottery = Government Savings Bank lottery
BAAC lottery = Bank for Agriculture and Agricultural lottery
Stock lottery = Betting on the last two digits of the stock market index
Source: Sungsidh *et al.,* 2003

3.2.1 The government lottery

The government lottery was introduced by an Englishman in the reign of King Rama V and was held occasionally to generate funds for charity. In 1939 the Lottery Bureau was established to organise a regular monthly lottery draw and in 1989 the lottery draw was extended to twice a month.

Before 1995, the government ran two draws a month, printing 14 million lottery tickets per draw. These generated 13,440 million baht a year. In addition, there were 12-15 charity draws per year with 18-22 million tickets sold per draw; these generated between 10,800 and 13,200 million baht a year. Since 1996, the charity draws have been absorbed in the regular draws, which occur regularly on the 1st and 16th of each month, with 38 million tickets issued per draw. In 1996 the total expenditure on the government lottery was 36,480 million baht at 40 baht per ticket).

The sales revenue is broken down as follows: 28% is government income or goes to charity in charity lotteries, 12% is management costs and the remaining portion, 60%, is returned to the players in prizes. Each ticket bears 6 digits; the prize numbers include five groups of 6-digit numbers, four last 3-digit numbers, corresponding to the last 3 numbers on the ticket, and one last 2-digit number. In this thesis, the government lottery is defined only as the lottery which is issued by the Government Lottery Office, GLO.

3.2.2 The underground lottery

The underground lottery is one of the largest illegal gambling games in Thailand. It was introduced by Chinese immigrants in 1820 and runs in parallel with the government lottery; gamblers bet against the prize numbers which are drawn in the government lottery. However, there are more betting options on the underground lottery than the government lottery. For example, players can bet on the last 2 digits of the first prize number in the government lottery and the winner receives 65 times the stake. Alternatively, gamblers can also bet on the last 3 digits of the first prize number in the government lottery and the winner receives 500 times the stake.

Compared with the government lottery, the underground lottery seems more attractive for many reasons. For example, players can bet with small amounts of money while the price of the government lottery ticket is at least 40 baht. The underground lottery also offers exotic combinations to bet on. The odds of winning in the underground lottery are better than in the government lottery. Around 70%-75% of the stake money in the underground lottery is returned to the players in prize money, while the return on the government lottery, as mentioned above, is around 60%,.

3.2.2.1 Underground lottery betting network

The network of the underground lottery is complex and has changed over time. The network can be divided into four levels.

The top level is without doubt the big operators, called *jao-mue-yai*, who are usually located a single province but sometimes control more than this. Therefore, all provinces have an operator.

The second level consists of the ordinary operators, called *jao-mue* or *yi-bua*. Each owner operates a similar system, such as hedging bets with the larger operators. They hedge their bets when they face a heavy risk; for example, if many customers decide on a number and bet heavily on it. The size of these ordinary operations depends on their financial strength and their ability to keep their customers. Pasuk *et al*. (1998) indicate that most operators at this level have a turnover of around 2 to10 million baht per draw per region.

The third level holds a number of the sales agents, called *kuk*, of each ordinary operator, *yi-bua*. Their job is to collect bets from customers and pass them up the line to the owners at the second level. They are paid by a commission on the sales they generate. This network can be found in most factories, offices and large villages.

The bottom level is the less formal network of sales agents of each operator in the third level, *kuk*. The network operates as a connection among friends, colleagues, or subagents who collect the bets from the distant villages and pass them to the sales agents at the third level. The remuneration depends on the negotiation of sales agents in the third and the bottom levels.

Figure 3.1 illustrates the network of the underground lottery

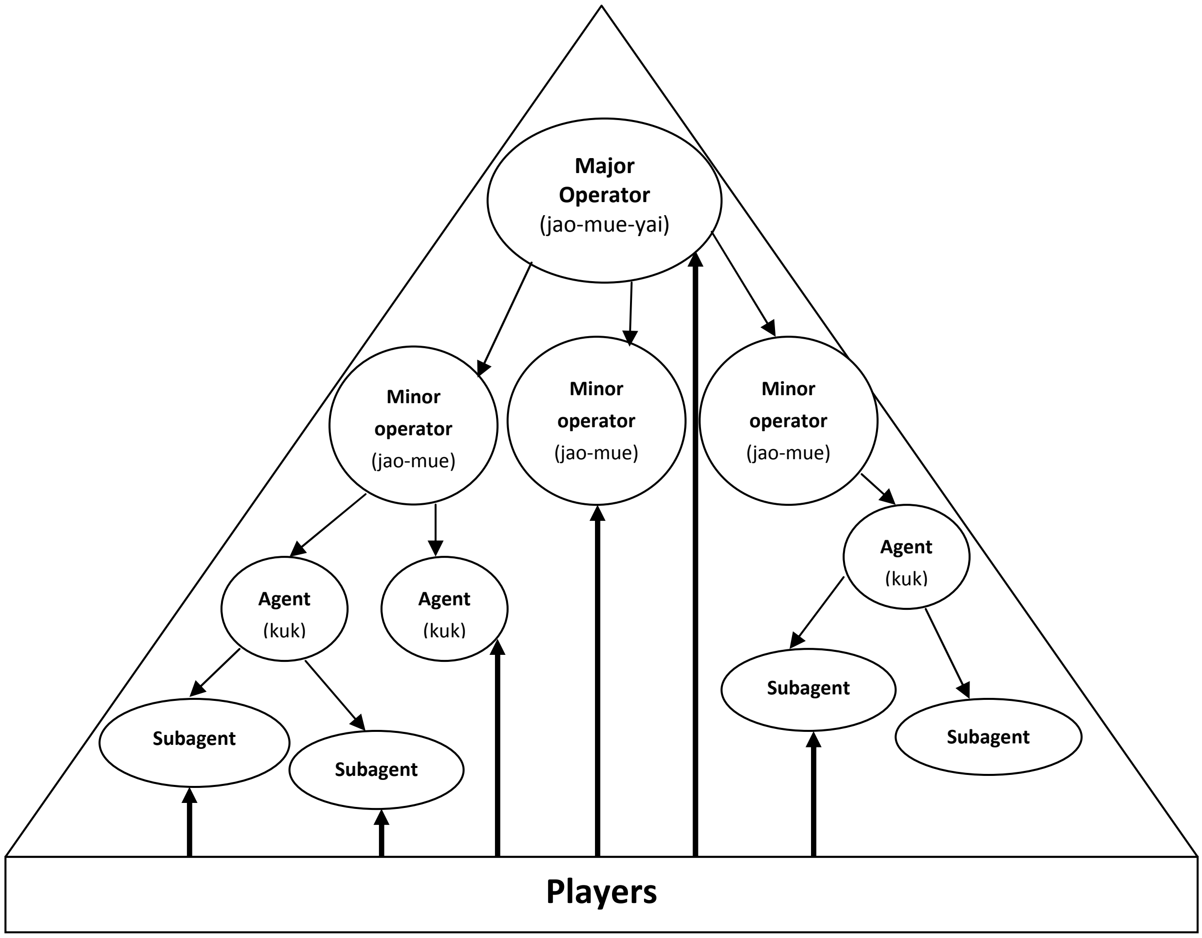


Figure 3.1 illustrates that this triangle is actually a mass of smaller ones. Some big operators may collect bets directly from their own network of third-level agents. Customers are sometimes offered relatively favourable odds and also some discounts on the value of the bet, such as a 100-baht stake for 90 baht. At all levels of the network, operators or sales agents have to take on a portion of the risk and the potential profit. Most of the sales agents at the third level prefer to retain all the bets from a group of customers to make a profit. They hope to build up capital and become minor operators, *yi-bua*. However, sales agents at the third level may easily be wiped out if their customers' winnings exceed their capital.

At the top and second levels, successful operators must have enough power to collect the sales money and prevent sales agents from diverting the income to their own pockets. Thus most operators have teams of gangsters to enforce the payment of sales revenue. The underground lottery, nowadays, is internationalised. In some provinces, in the south part of Thailand in particular, big operators hedge bets with bigger operators in Malaysia and Indonesia (Sungsidh *et al.*, 2003).

3.2.2.2 The size of the underground lottery

Kasikorn Bank Research Centre estimated that the total amount spent on the underground lottery in 1995 was around 110 billion baht or 2.5% of GNP. The research centre indicated that seven out of every ten people of working age (between 15 and 65 years old) played the underground lottery and spent on average 100 baht per draw.

However, Pasuk *et al.* (1998) suggest that the estimate of the *Kasikorn* Bank Research Centre was an underestimate. In a study in 1991, the average sales per round was 2.5 million baht and the population of the two districts in the eastern province which were taken as examples was 9,500, giving an average spending per draw of 263 baht per head, equivalent to a total spending of 10,257 baht per year. The provincial per capita income of this province in 1991 was 77,500 baht. Thus the amount spent on the underground lottery was 13.2 percent of the provincial per capita income.

The total turnover of the underground lottery was estimated to be 290 billion baht, 8% of GNP in 1994 and 540 billion baht, 11% of GNP in 2002 (Pasuk *et al.* 1998; Sungsidh *et al*, 2003). Table 3B in Appendix 3A reports the amount spent on the underground lottery by region in 1994.

3.2.2.3 The underground lottery and politics

The politics of Thailand are conducted within the framework of a constitutional democratic monarchy. The Prime Minister is the head of cabinet and a hereditary monarch is head of state. Thai politics can be divided into 2 levels, local and national. The election process at both levels is similar: that is, people in each area directly vote for their political representatives. Hence most politicians and political parties seek to build up their own vote-banks and canvassers. There are at present 500 national representatives altogether who vote for the Prime Minister.

Many operators can enter local or national politics by offering themselves as candidates in elections and by operating as vote-banks and canvassers for candidates. The networks of relationships of the operators can be converted into political assets:

First, the relationships between buyers and sellers of the underground lottery can create a network of voters. Second, the sales network can be turned into an electioneering machine by using the network of the collectors of sales sheets to act as canvassers. Third, the operators invest some of their profits to build up their political image. They then trade their image in exchange for political and other gains at election time. Some operators generate good relations with their customers by giving small loans without interest (Somchart, 2005).

3.2.3 The 2-3 digit lottery

To tackle the problem of the underground lottery business, the government decided in 2004 to legalise the 2-3 digit lottery project and operate it under government authority. Because of a legal technicality, however, this project has been suspended since 2007 and the government no longer receives any revenue from it. The government had gained 29,500 million baht as net profit from the 80 draws of this 2-3 digit lottery.

The 2-3 digit lottery had run in parallel with the government lottery and gamblers bet against the prize numbers drawn in the government lottery as they had done in the underground lottery. In this thesis, this type of gambling will be tested for a gambling addiction in Chapter 6.

3.2.4 Football betting

Football betting in Thailand is a form of gambling for the technological age and over the last 80 years has become global. Gamblers can place a bet without moving, by means of telephones, fax machines, satellite television and electronic bank transfers. Thai gamblers would rather bet on international matches than local matches, following the games which are broadcast on television and radio. English football is the most popular, followed by Italian, Spanish, German and French football.

3.2.4.1 Market structure of football betting business

In general, the market structure of football betting in Thailand is similar to the structure of football betting in other Asian countries, in particular, Malaysia, Singapore and Indonesia. The market structure is composed of two sides, the operator side and the gambler side. The gambler side is a group of people which demands a gambling service, as consumers, while the operator side consists of a group of people which supplies a gambling service, as producers. The link between these two sides is the odds.

The operator side can be divided into three types: small, medium-sized and big operators. To categorise the size of operator, two factors are concerned, namely, the percentage of the odds difference, called *kar-narm*, and the volume of stake per match. The gambler side, for its part, can be split into two groups. One is the group of people who enroll only as gamblers. The other is the group of people who enroll as not only gamblers but also as operators.

According to the odds, it can be divided into two main types, European Style and Asian Style. European Style contains several betting forms, such as Home-Draw-Away, Correct Score form, and Half time/Full time form. For example, Team A (a home team) competes with Team B (an away team) with the odds being Home (2/7) Draw (10/3) Away (8/1).

- With odds of 2/7 on a home win, if a gambler bets £7, he will get £9 if the home team wins, otherwise he will lose £7.
- With odds of 10/3 on a draw, for every £3 staked, a gambler will get £13 for a draw, otherwise he will lose.

- With odds of 8/1 on an away win, if a gambler bets £1, he will get £9 if the away team wins, otherwise he will lose £1.

This odds style is not popular in Thailand. To increase the attraction, in some cases the teams are unequally matched, thus operators are reluctant to offer European Style odds. Instead operators will add an additional handicap element, which is called Asian Style.

The odds of the Asian Style or what might be called the "Asian Handicap" have been adapted by calculating the probability of a match result. Before 1997, operators in Indonesia had been named as leaders of the Asian operator group. The odds, which were set and transferred to operators in other Asian countries, were frequently demanded from the Indonesian operators. Nowadays, the group of Malaysian operators has been named as leader.

To illustrate the Asian Handicap, it should be split into 2 sections, "the difference between a number of goals in a match" and "the price of a handicap".

The difference between the numbers of goals in a match means the difference between the numbers of goals in the final score. For instance, if team A is given a handicap of one goal to team B, this means that team B has one goal advantage when the game starts.

- A gambler who bets on team A will win when team A wins the game by a higher score than the handicap, 2 goals or more, such as 2-0, 4-1.

- A gambler who bets on team B will win when team B wins the game or the game ends in a draw.
- The final score, such as 1-0, 2-1 (team A winning), would count as a draw since the difference between the number of goals equals the handicap. This means that the gamblers on each side neither win nor lose. Their stakes are returned to them.

In cases where there is a quarter handicap, such as 1/4, 3/4, 1 1/4, a gambler may win half of what he could have won or may lose only half of his stake. For example, if team A is given a handicap of 3/4 goal to team B, this means that when the game starts team B has 3/4 goal advantage.

- A gambler who bets on team A will win a full net winning when team A wins the game by 2 goals or more, for example, as 2-0, 4-1.
- A gambler who bets on team A will win 50% of a full net winning when team A wins the game by one goal, for example, 1-0, 2-1.
- A gambler who bets on team B will win a full net winning when team B wins or the match is a draw.
- A gambler who bets on team B will lose 50% of the stake when team A wins by one goal, for example, 1-0, 2-1 to team A.

Regarding the price of a handicap, it comprises 4 forms, namely, (-5/4), (-10/9), (+10/9), and (=). All price forms are used for the team which is the underdog in each match. Each price form can be explained as follows: Given that a gambler bets £10 on the underdog team, the price forms are as follows:

- (-5/4); if he wins, he will receive £18, otherwise he will lose £10
- (-10/9); if he wins, he will receive £19, otherwise he will lose £10
- (+10/9); if he wins, he will receive £20, otherwise he will lose £9
- (=); if he wins, he will receive £20, otherwise he will lose £10

Intuitively, football betting gamblers realise that these four price forms will be adjusted if they bet on the advantaged team. Given that a gambler bets £10 on the advantaged team, the price forms are as follows:

- (-5/4); the price form will be adjusted to (=), which means that, if he wins, he will receive £20, otherwise he will lose £10
- (-10/9); only this price form will not be adjusted. Thus, if he wins, he will receive £19, otherwise he will lose £10
- (+10/9); the price form will be adjusted to (11/8), which means that if he wins, he will receive £18, otherwise he will lose £11
- (=); the price form will be adjusted to (5/4), which means that, if he wins, he will receive £18, otherwise he will lose £10

Since the price forms of the advantaged team have to be adjusted, the net gain and loss are different, by around 10%-30% of the stake. This amount generates income for the football betting operator. For example, the odds of a football match between team A and team B are 1/2 (=). This means that team A is given a handicap of a half goal to team B. If the final score is 1-0 to team A, given a stake of £10, a gambler who bets on team A will receive £8 (excluding the stake of £10), while a gambler who bets on team B would lose £10. It can be seen that a football betting operator receives £2 (20% of the stake) as his income. The size of income depends on the form of the handicap price and the stake on each team. However, the operator does not gain this income with every match. For example, given the same situation as in the latter example, except the final score is now 1-1, in this case the operator receives nothing, since a gambler who bets on team A would lose £10 whereas a gambler who bets on team B would receive £10 (excluding the stake of £10).

The odds may change to attract players and to manage their risks, in particular during the last 7-8 hours before the match kick-off. If the operators believe that too many gamblers have bet on one team, they will manage their risks by transferring the bet to the bigger operators. Some operators may then pass on their risks by hedging their bets with an international betting firm abroad. The relatively small operator who transfers the bet to the bigger operator will gain a commission from the bigger operator.

With regard to the football betting operator's income, it stems from two sources: 1), a commission from the bet transfers, called the rate of commission; and 2), the different amounts of the handicap price, called the percentage of the odds difference or *kar-narm*. The rate of commission is set by the bigger operator.

Kar-narm can be expressed as the difference between the discount rate of the odds, which is set by the operators for their customers. To a customer who regularly bets with a big stake, the operator will offer a discount by reducing the percentage of the adjusted price forms. A customer who is a small operator and who transfers a large bet to a relatively big operator would also receive this discount. Recall the adjusted price forms; they are the different between the handicap price to gamblers who bet on the advantaged team and those who bet on the underdog. This amount equals the operator's income.

A small operator can get the benefit from the discount such that, if his customer loses, he will collect a full loss but pay part of this amount to a bigger operator. Similarly, if his customer wins, he will receive the full gain but transfer part of this amount to his customer. Customers who receive a discount also get the benefit; they may lose with a smaller amount and may gain with a larger amount. For example, suppose the odds on a football match are (-5/4), given that a gambler bets £10 on the advantaged team, he may win or lose with an amount of £10. If the operator reduces *kar-narm*, say from 20% to 7.5%, given the same assumption, he will gain £10 if he wins but if he loses he will lose only £8.75. It can be seen that a gambler may gain the same amount if he wins, but if he loses he will lose less.

Table 3.3 shows the different percentages of *kar-narm* in terms of gamblers and operators. Clearly, the reduction of *kar-narm* affects only a gambler who bets on the advantaged team since the odds on the underdog do not need to be adjusted.

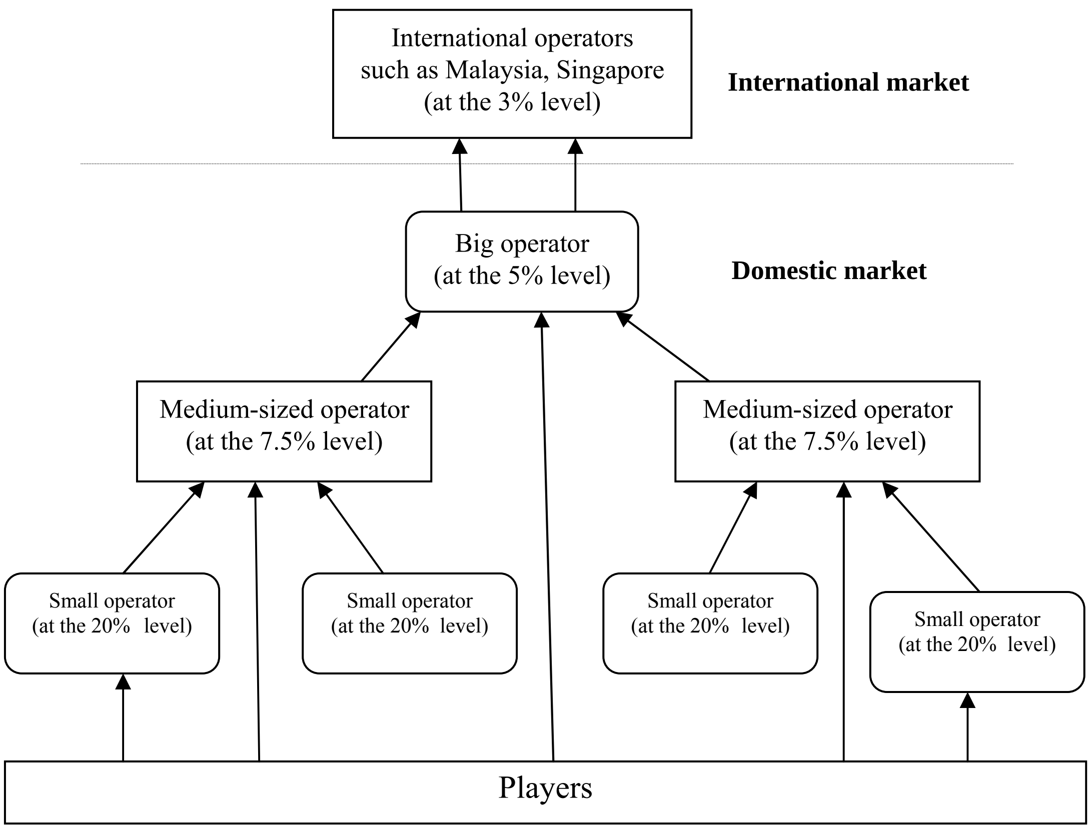
Table 3.3 shows the percentage of the odds difference, *kar-narm*, between 20% and 7.5%

Asian Handicap	The prices for an advantage	Stakes to £10 on an advantage		Stakes to £10 on an underdog		The operator's income (per £10)
		win	lose	win	lose	
Small operator (20%)						
(-5:4)	=	£10	£10	£8	£10	May earn £2 or none
(-10 : 9)	10 : 9	£9	£10	£9	£10	Earn £1 every stake
(=)	5 : 4	£8	£10	£10	£10	May earn £2 or none
(+10 : 9)	11 : 8	£8	£11	£10	£9	Earn £1 every stake
Medium-sized operator (7.5%)						
(-5:4)	8.75 : 10	£10	£8.75	£8	£10	May earn £0.75 or none
(-10 : 9)	9.75 : 10	£10	£9.75	£9	£10	May earn £0.75 or none
(=)	10: 9.75	£9.25	£10	£10	£10	May earn £0.75 or none
(+10 : 9)	10: 8.25	£8.25	£10	£10	£9	May earn £0.75 or none

The percentage of the odds difference, *kar-narm,* can be used to categorise the size of the football betting operator since the discount on *kar-narm* is offered for a big stake. Generally, there are 3 rates of *kar-narm*: 20%, 7.5% and 5%. Given that the size of an operator is measured by the size of a stake, an operator who receives 20% of *kar-narm* can be defined as a small operator, 7.5% is a medium-sized operator and 5% is a big operator. In addition, some operators transfer their bet to an international betting operator; they then receive 3% of *kar-narm*. Regarding Table 3.3, a smaller operator (at the 20% level) earns higher income per unit than a medium-sized operator (at the 7.5% level), but the stake volume of a medium-sized operator is considerably larger than that of a small operator. Thus a medium-sized operator's income should be higher. Hence it can be stated that, with a small stake, a large percentage of the odds difference, *kar-narm*, generates income to a small operator, whereas a smaller percentage of the odds difference with a larger stake generates income to a big operator.

Figure 3.2 illustrates the structure of the football betting market

Figure 3.2: Market structure of the football betting business



3.2.4.2 The football betting network

Football betting is popular among young people, such as school and university students, office workers and middle-class salary earners. Two systems are used to operate this business. First, bets and payments pass directly between operators and gamblers without bank transactions. This system is confined to a limited group of players.

Second, bets are passed by telephone and money is transferred through banks. General gamblers and big operators may not know each other because bets will be passed through a middleman. New customers are recommended by existing gamblers. Operators and gamblers open their own bank accounts. They normally use the same bank because the money transfer is easier. Gains and losses are transferred on the first bank working day after a match.

The football betting networks are very extensive and widespread. There are four big well-known operators in Thailand. Three of them operate in Bangkok and the remaining one is in *Had Yai*, the south part of Thailand. Almost all provinces have medium-sized and small operators. Most of them also help to run the underground lottery business.

3.2.4.3 Involved money in football betting business

In Bangkok, the minimum stake per match is around 2,000 baht, but some operators who want to increase their customer base may allow a lower minimum stake of 1,000 baht per match. In provincial areas, the minimum stake may be down to 500 baht per match.

From interviews by Pasuk *et al.* (1998), it appears that one operator who claimed to be a small operator reported that he received total 500 million baht during the World Cup competition in 1994, while in 1996 one high-ranking policeman stated that the total amount involved in football betting for the whole country was probably around 6 billion baht a week.

3.2.4.4 Other aspects of football betting

It might be said that casinos and the underground lotteries are local affairs while football betting is international in its activity and scope. The main factors aiding this form of gambling are the satellite broadcasts of international football matches, the quick transfer of information through electronic media and the electronic transfer of money.

Sports magazines are among the most profitable businesses from football betting. Most players buy a sports magazine or newspaper to help them decide on their betting from the information on football matches. There is one specialist sports daily, which was established in 1984. In 1995 the circulation was 200,000 per day and readership approached 900,000.

One player revealed that *"he started betting because he enjoyed football as a sport. Gambling enhanced the excitement of watching. Football betting did not interrupt his regular work habit as much as other gambling games such as casinos. Sometimes he could earn a lot of money from football betting. The most important thing was there was little risk of being caught by the police"* (Pasuk *et al.*, 1998).

3.2.5 Casino betting

Casinos, more suitably described as "Gambling dens", are illegal in Thailand. In earlier studies of casinos they divide into 3 levels. Large organised casinos, though not as large as those in Las Vegas, should be placed at the top while small neighbourhood gambling dens are placed in the middle. The bottom level is the group of impermanent gambling dens or "flying casinos" which often shift from place to place. In the newer studies of this subject, casinos are divided into four types, namely, home/flying casinos, domestic permanent casinos, casinos in neighbouring countries, such as Laos or Cambodia, and casinos in other countries such as USA or Australia.

3.2.5.1 Earlier studies

Casinos have operated as a business since 1971, when one was opened by a Chinese merchant in Chinatown, Bangkok. They operate between 10 am. and 4 am. Their total revenue circulation is around 500,000 baht a day, with about 100 customers per day. Most of the customers are Chinese, together with some government officers. The gambling games are card games and the Chinese game of bean guessing, which is the most popular.

Since 1972, casinos in Macao-Hong Kong have become popular among Thai gamblers. Cashier cheques are exchanged for gambling chips. Baccarat, a kind of casino table game, is the most popular.

A number of casinos were established in Bangkok in 1974-5. Most casino owners are politicians and high-ranking police officers. However, during this period, one casino owner was a Minister of the Interior Ministry and responsible for the Royal Thai Police (Pasuk *et al.*, 1998; Sungsidh *et al.*, 2003). As noted above, before 2002, casinos in Thailand can be categorised into 3 types: large organised casinos, neighbourhood gambling dens and flying casinos.

3.2.5.1.1 Large organised casinos

In 1996, there were around 4 to 5 large casinos in Bangkok, which each had a turnover of around 100 million baht a day.

"If you play baccarat and you stake two thousand baht, the casino-owners do not want you to play. They ask you not to play. They do not want poor people. The acceptable stake is four to five hundred thousand baht and may be as high as ten million per round" (Pasuk *et al.*, 1998).

"Chat Taopoon" has been dubbed the godfather of casinos, a description which he has always denied. He is also known as a generous patron in the district of *Taopoon*. He began work as a croupier in many dens and then set up his own casino. He indicated in 1995 that most Thai gamblers prefer to gamble in Macao, Malaysia, Indonesia, Australia and the USA, resulting in a loss of at least 21 billion baht a year to Thailand. The casinos in Macao were the most popular among Thai gamblers. They spent 500 million baht there every week. He also believes that, if the government legalises the casino business, not only there will be a large rise in government revenues but also a number of jobs will be created. Fewer Thai people will be sent to work abroad.

3.2.5.1.2 Neighbourhood gambling dens

The owner of a gambling den revealed that the turnover in 1995 was around 1 million baht per day, with large profits being made on Friday, Saturday and at the end of the month. There may be a loss on other days. His gambling den normally opens from 10 a.m. and continues as long as there are customers. During the day, most of his customers are female. The dealer of cards earns around 20,000 baht per round on average and pays 3,200 baht or 16 percent as commission to the owner. Each round takes 4 minutes; thus with 210 rounds the total commission income will be around 672,000 baht, if the gambling den opens from 10 a.m. until 2 a.m.

There is an alternative way for the owner to earn revenue. Because gamblers frequently run out of cash, most customers often pawn their valuables. Thus the owner can make a profit on the difference between his valuation and the pawnshop valuation of these goods.

3.2.5.1.3 Flying casinos

The process of setting up a flying casino requires negotiations with police officers and the offer of money. The casino can operate immediately after the officers agree on the amount to be paid. If the owner cannot afford the bribe, the casino has to close until new negotiations are successful. Payments are normally made every 7 or 15 days. Most flying casinos are open between 18 and 20 hours a day. The money generation of each casino is around 5 million baht a day, of which the casino owner earns around 500,000 to 800,000 baht. The owner has to cover the monthly expense of staff and, inevitably, police officers. The customers here tend to be housewives and unemployed workers.

3.2.5.2 Later studies

The Thai government passed the 1935 Gambling Act, which is still in force. Under the terms of this Act, gambling games are of two kinds.

The first (*Bun-Chee Gor*), such as, casino table games, allows gambling in a place established by the government. The government has to issue a royal decree for each permit and the process takes a long time. Thus most people do not, in fact, ask for such permission.

The second group (*Bun-Chee Kor*), such as, cock fighting, bull fighting, Bingo, can be allowed only by the local police officer. Obviously, the gambling activities in this group are easier to obtain permission than the games in the other group, but most of the games in this group are less popular.

Between 1995 and 1997, the number of recorded criminal cases of gambling in Thailand was around 250,000 cases per year, whereas between 2004 and 2006 the number of arrested gamblers in Bangkok fluctuated at around 37,000 gamblers per year, less than 1% of the population of Bangkok (see Table 3C and 3D in Appendix 3A).

During the Thai economic boom between 1988 and 1991, a great deal of money generated in each casino. They catered for around 1,500 gamblers a day. Most of the gamblers were politicians and high-ranking government officers, betting on Baccarat and wagering around

10 to 20 million baht per round. Sometimes when the police were clamping down on gaming, these gamblers would go to other countries to bet.

Since 1997, while the number of gamblers who were politicians and high-ranking government officers declined, an increasing number of young businessmen, between 20 and 40 years old, began to gamble. Unlike the group of politicians and government officers who gambled, this new groups bet with lower stakes, between 10,000 and 100,000 per round. Moreover, the boom in the casinos in neighbouring countries such as Laos, Cambodia and Myanmar since 2003 has also affected Thai casinos as a whole. Most illegal casinos in Thailand had to make themselves more attractive than in the past in order to keep their customers.

Sungsidh *et al.* (2003) state that after interviewing some high-ranking government officers, high-ranking police officers and senators, they learned that in 2001 around 1,200 to 1,500 casinos were estimated to exist throughout the whole country. Around 200 casinos were in Bangkok, which can be broken down into 10 big permanent casinos, 50 medium-sized and small casinos, and around 100 to 140 flying casinos.

Thailand has 75 provinces with one big permanent casino per province on average. It was estimated that there was also at least one medium-sized permanent casino and one flying casino in each district. With 705 districts and 81 sub-districts in 2001, there were at least 861 casinos in provincial towns.

Since the boom in the casinos of neighbouring countries, the casino market can be divided into four types: home/flying casinos, domestic permanent casinos, casinos in neighbouring countries and casinos in other countries.

3.2.5.2.1 Home/flying casinos

The process of setting up this type of casino is still the same as in 1996, that is, negotiating with police officers and offering them a bribe. The location of such casinos moves from place to place every 3-4 days, hence their name. Basically, the casinos' customers are people who live in a neighbourhood. Most gamblers in each area know the location of the casino and where it will move in the next 3-4 days. This is because there is a good relationship among the gamblers and between them and the casino owner.

A home/flying casino owner with over 10 years' experience interviewed on 27 April 2002 according to Sungsidh *et al.* (2003), claimed that at this time a daily revenue of between 300,000 and 400,000 baht was circulating. This differed from the figure between 1992 and 1996 when the money circulation was around 800,000 to 1,000,000 baht. The casino would start every day at 11 am and continue until a time negotiated between the dealer and the gamblers.

If the casino owner and the dealer are not the same person, the dealer's income is probably around 100,000 to 200,000 baht a day. The source of the casino owner's income is the fee, called *kar-tonk*, which is around 10,000 to 20,000 baht a day. The fee is normally 10% of the profit and the casino owner collects it from the dealer after the last round. However, if the dealer loses continuously for three rounds, the gamblers who win the third round have to pay a fee of 2%. Negotiating with the police officers and finding the location are the responsibility of the casino owner. The fee rate which the casino owner has to pay to the police is around 80,000 to 100,000 baht per month, as well as 2,000 baht per day in rent to the house owner.

The interviewee also stated that the home/flying casino had on average 100 customers per day. Most of them were housewives, policemen, teachers and unemployed workers. 70% of the customers were female.

One particular kind of flying casino which should be mentioned is a casino at a funeral, called *bon-ngan-sop*. Thai Buddhists always prepare a funeral at a temple for three, five or seven nights before the ceremony. Two or three people have to stay at the temple every night before the funeral and funeral casinos have operated as a business since 1981. The host of the funeral earns rent of around 2,000 to 10,000 baht a night from the dealer and the dealer has to pay around 5,000 to 20,000 baht to the police as a bribe. The payment depends on the area where the funeral is located. In densely populated districts, the payment is high.

In 2001, the revenue generated was between 100,000 and 300,000 baht per night, while funeral casinos operated around 700,000 to 1,000,000 times a year (Sungsidh *et al*., 2003).

3.2.5.2.2 Domestic permanent casino

In 2001, there were 11 permanent casinos in Bangkok. The casino owners in Bangkok are powerful gamblers, supported by certain high-ranking policemen and high-ranking soldiers. Unlike the casino owners in Bangkok, most casino owners in provincial towns are businessmen and most of them also become local and national politicians. Sungsidh *et al.*, (2003) show that there is at least one casino in each province, generating around 1 to 10 million baht a day.

One casino owner in Bangkok, interviewed on 25 April 2007, revealed that he had been in business since 1987 and he estimated that the volume of money which generated in his casino in 2006 was around 10 to 20 million baht a day. Around 20% of revenue was profit (around 2 to 4 million baht a day). He had to pay around 500,000 baht a month, however, to the police in his area. Moreover, he also had to pay some high-ranking police officers in other departments, such as the Crime Suppression Division.

Sometimes an owner may let his casino or some of his casino tables to the dealer. For tables, the rent is around 30,000 to 50,000 baht per round or per game. Most dealers rent a casino table for Baccarat, which takes around 5 minutes per round.

The domestic permanent casino, in fact, is of a higher standard than the home/flying casino. Since 2005, the standard of the domestic permanent casino was the same as the standard in neighbouring countries. Although the area of the domestic permanent casino is smaller, the table games are the same size, including the machine games in some domestic permanent casinos. For those who fear being arrested by a police officer, this type of casino is safer than the home/flying casino. Unlike the latter, this type of casino opens 24 hours a day, like the casinos in neighbouring countries.

3.2.5.2.3 Casinos in neighbouring countries

The first legal casino owned by Thai businessmen in a neighbouring country was built in 1995 on the border between Thailand and Myanmar. In 2007 there were 17 casinos on the border between Thailand and its neighbours: 12 casinos between Thailand and Cambodia; 4 between Thailand and Myanmar; and 1 in the Golden Triangle, the border between Thailand and Laos. Most of them are owned by Thai businessmen. Some of them, for example, 4 in Cambodia and 2 in Myanmar, are 100% owned by Thai nationals but some are jointly owned by Thais and local businessmen from each country. All the casinos are classifiable as big, and most are built as part of an entertainment complex, which is attractive to Thai gamblers. Indeed, the largest group of customers in this group of casinos is Thai.

Since 2003 the casinos in the Cambodian town, Poipet, on the Cambodia/Thailand border, have become the most popular of all in these countries. In 2007 there was a total of 8 casinos in Poipet, 4 of them owned by Thais.

In an interview on 29 May 2007 the executive manager of a casino in Poipet, which he has headed since 2001, he said he was responsible for 70 casino tables, 100 slot machines and 200 hotel rooms. The owner had to pay 50 million baht to the Cambodian government for the license to build the casino. The casino's monthly expenditure is around 35 to 40 million baht on such things as wages and food. The casino also pays 500,000 baht a month in tax to the Cambodian government and 200,000 baht in bribes to both the Thai and the Cambodian immigration officers. However, the casino's gross profit is around 100 million baht a month in high season and around 20 million baht a month in low season. He stated that around 20% of the turnover is the owner's gross profit, which might apply to all casinos. Most of his clientele, around 95%, are Thai. He also estimated that a number of gamblers who visit Poipet is between 2,000 and 3,000 gamblers a day on weekdays and twice as many at weekends.

Table 3.4 shows the number of people who cross the border between Thailand and neighbouring countries, where the casinos are located. It can be seen that the highest number are bound for Poipet.

Table 3.4: Number of people departing for neighbouring countries

Immigration	2004		2005		2006	
	Foreigner	Thai	Foreigner	Thai	Foreigner	Thai
Aranya Prated (to Poipet)	**258,356**	**838,864**	**306,998**	**842,898**	**317,599**	**998,776**
Klong Yai (to Cambodia)	22,591	34,675	23,313	41,242	28,268	48,399
Karb Cherng (to Cambodia)	4,463	68,996	5,190	116,836	6,383	231,818
Mae Sai (to Myanmar)	76,747	5,228	90,330	5,036	103,151	4,530
Cheang San (to Myanmar)	1,834	1,314	4,621	885	2,236	889
Ra Nong (to Myanmar)	51,098	1,535	56,401	1,459	65,884	1,684
Cheang Kong (to Laos)	40,435	4,316	45,553	13,835	54,396	16,522
Pong Narmron (to Cambodia)	7,009	150,905	7,522	77,382	68,310	170,342
Total	462,533	1,105,833	539,928	1,099,573	646,227	1,472,960

Source: Immigration Bureau, 2007

According to the casino owner, probably around 1-1.3 million people a year visit the casinos in neighbouring countries. In terms of money generation, each casino at Poipet makes a net profit of between 50 and 60 million baht a month and the gross income per month is 85 to100 million baht. Thus the money earned among the 8 casinos at Poipet is between 40,000 and 45,000 million baht a year. Money generation can be expressed as:

$$\text{Money Generation} = \frac{(\text{Net Profit} + \text{Monthly Expenditure}) \times 12}{20\%}$$

In 2002 each casino at Poipet had a monthly expenditure of around 50 million baht and a net profit of between 42 and 58 million baht a month. There were 7 casinos in 2002 so the total gross profit of 7 casinos was around 6,624 to 7,776 million baht a year. If the profit from casinos is around 20% of the volume of generated money, the amount of money being wagered in 7 casinos by Thais in 2002 would have been between 33,120 and 38,880 million baht per year (Sungsidh *et al.*, 2003).

The volume of generated money estimated in both years, 2002 and 2007, is approximately the same. In 2002 the 7 casinos in Poipet generated between 33,120 and 38,880 million baht a year, while between 40,000 and 45,000 million baht circulated among the 8 casinos in 2007.

From the survey in Poipet between April and July 2007, it can be seen that all casinos are in the category of big casinos, with some being part of a luxury entertainment complex. Each casino provides transportation for its customers, hiring a coach company to ship in gamblers from each big province, including Bangkok, within reasonable distance of Poipet. Casinos sometimes minimise their costs by joining together to hire the same coach. There are five stops for these coaches all round Bangkok and each customer knows the nearest one. Luxury coaches run from 5.30 am until 11.30 am; after this a luxury van is provided until 3 pm. every day, when a big coach could cause traffic problems. It takes two and a half hours to go from Bangkok to Poipet. After crossing the border, the coach company staffs take their customers to the casino which has provided the transport. From the border to each casino takes around five minutes

Every customer has to sign up at the casino’s reception desk and collect a coupon for lunch or dinner. After signing up at one casino, customers can go to any other casino by free taxi; the journey from one to another takes less than five minutes. Moreover, customers who want to leave can use one of the many coaches, which are available every day between 12 pm. and 7.30 pm. Anyone can go to gamble at Poipet and return on the same day. Some casinos offer customers hotel accommodation. Any customer who buys a gambling chip for 2,500 baht, will get a 4-star hotel room free for a night. A customer without a chip has to pay 500 baht per night.

3.2.5.2.4 Casinos in other countries

The casinos in this category are the well-known ones of high standard: Genting Casino, Malaysia; Macao, Hong Kong; those in Australia, New Zealand and in Las Vegas, USA. Sungsidh *et al.* (2003) estimate that the volume of money spent on gambling by Thais in those countries is likely to be between 5,000 and 6,000 million baht a year.

3.2.5.3 The economics of casinos

Pasuk *et al.* (1998) estimate the casinos' turnover and profit in Bangkok on the basis of interviews. In 1996 the number of casinos in Bangkok was around 300, with a total annual turnover of between 136,429 and 673,900 million baht. Around 20% of their turnover is estimated as casino profit equivalent to between 27,286 and 134,780 million baht a year (see Table 3E in Appendix 3A).

In 1996 half of all provinces had casinos. Around 13 provinces had at least three casinos with a turnover of around 5 million baht per day while the other 25 provinces had at least two casinos with a turnover of between 1 and 4 million baht per day. The total annual turnover of casinos outside Bangkok was in the range of 88,200 to 142,200 million baht and the casinos' annual profit of 20 % of turnover suggests between 17,640 and 28,440 million baht a year (see Table 3F in Appendix 3A).

Sungsidh *et al.* (2003) estimate the size of casino turnover and casino profit in 2002. They indicate that casinos in Bangkok generated between 181,305 and 204,600 million baht a year, whereas casinos in other provinces generated between 288,729 and 536,696 million baht a year. The total annual turnover of casinos in Thailand in 2002 was between 470,079 and 741,296 million baht, while the total annual profit of casinos was between 94,019 and 148,259 million baht (see Table 3G in Appendix 3A).

Adding the turnover of the casinos in Poipet, the medium and small-sized casinos in neighbouring countries and casinos in other countries, Table 3.5 reveals the turnover of all casinos in Thailand. The casino annual turnover in 2002 was between 541,447 and 825,728 million baht. If 20% of annual turnover is the casinos' annual profit, then it equals between 108,290 and 165,146 million baht, around 2.5% of GDP. It also can be said that the volume of gambling money which was transferred to other countries in 2002 was between 14,274 and 16,886 million baht, 0.3% of GDP.

Table 3.5: An estimate of casino turnover and casino profits in Thailand and other countries in 2002

Casino Types	Annual Turnover (million baht)	Annual Profit (million baht)
Casinos in Thailand	**470,079-741,296**	**94,016-148,259**
Casinos in Bangkok	181,350-204,600	36,270-40,920
Provincial casinos	252,495-435,240	50,499-87,048
Casinos at funerals	36,234-101,456	7,247-20,291
Casinos in Neighbouring Countries and other Countries	**71,368-84,432**	**14,274-16,886**
7 casinos at Poipet	33,120-38,880	6,624-7,776
25 big and small casinos in other areas (Neighbouring Countries)	13,248-15,552	2,650-3,110
Casino in Other Countries	25,000-30,000	5,000-6,000
Total	**541,447-825,728**	**108,290-165,146**

Source: Sungsidh *et al*., 2003

Table 3.6 presents the casino turnover and casino profit. It should be noted that the casinos' annual turnover between 1993 and 1995 was estimated from the domestic casinos only, while the casinos' annual turnover in 1996 and 2002 was estimated from the domestic casinos, the casinos in neighbouring countries and the casinos in other countries. There are various reasons for the difference in the casinos' annual turnover between 1996 and 2002. First, the number of provincial casinos was estimated at around 89 casinos in 1996, while in 2002, it was estimated at between 1,000 and 1,300 casinos. Second, the casinos at funerals, operating around 725,000-1,015,000 times a year, were not included in 1996 but were included in the 2002 figures.

Table 3.6: The proportion of casino turnover and casino profit to GDP at the 1988 Price

Year	Annual Turnover (million baht)	Annual Profit (million baht)	GDP at constant 1988 price (million million baht)	% of GDP at constant 1988 price of casino turnover	% of GDP at constant 1988 price of casino profit
1993-1995	45,000-163,000	9,000-32,600	2.7 (average)	1.6-6%	0.3-1.2%
1996	224,629-816,100	44,926-162,220	3.1	7.2-26%	1.4-5.2%
2002	541,447-825,728	108,290-165,146	3.2	16-25%	3.3-5.1%

3.3 Conclusions

The gambling industry in Thailand includes several illegal gambling businesses. However, some illegal gambling games can occasionally be set up with the permission of a government officer. It can be said that Thai law controls gambling in two ways. First, a gambling licence can be issued for a short period, less than one day, on special occasions such as a boat race, or card playing at funerals. However, the process of obtaining permission takes a long time, discouraging most gamblers from observing the law. Second, at horse races, gambling is licensed semi-permanently, but it is permitted only inside the venue.

For Thai people, the underground lottery appears to be the most popular form of illegal gambling, followed by casino betting. In the past, most casino betting customers were old people, while football betting was the choice of the young. Nowadays, the number of young gamblers who engage in casino betting, in particular, the domestic casinos, has considerably increased. The profiles and characteristics of Thai gamblers, however, will be studied in the next chapter.

Appendix 3A

Table 3A: The size of illegal businesses in Thailand, 1993-1995

Illegal business	Value-added (Billion baht/year)
Drug trafficking	28-33
Trading in contraband arms	6-31
Diesel oil smuggling	9
Prostitution in Thailand	100
Trafficking in people	5-7
Illegal gambling	138-277
-Underground Lottery	(81-98)
-Casino betting	(45-163)
-Football betting	(12-16)
Total	**286-457**

Note: Thailand's GNP between 1993 and 1995 averaged 3.6 million million baht a year (£90 billion). The size of illegal gambling business equals 7% of GNP.
Source: Pasuk *et al.*, 1998

Table 3B: Amount estimated to be spent per person on the underground lottery in 1994, by region

	Population (in thousands of people)	Per capita income (baht)	Per capita spending per draw of the underground lottery (baht)	Per capita spending on the underground lottery per year (baht)
Metropolis	6,778	203,650	-	-
Vicinities	3,191	149,028	506	19,734
Eastern	3,710	100,321	340	13,270
Central	2,856	57,022	193	7,527
Western	3,312	46,028	156	6,084
Southern	7,743	39,789	135	5,625
Northern	11,057	31,064	101	3,939
Northeastern	20,062	20,235	64	2,496
Average	58,709	61,335	126	4,918

Source: Pasuk *et al.*, 1998

Table 3C: Criminal rate of gambling

Year	Number of cases per year
1995	226,718
1996	271,291
1997	288,613
1998	281,199
1999	239, 544
2000	212,764
2001	221,118

Source: Sungsidh *et al.,* 2003

Table 3D: Rate of Arrests for gambling and number of arrested gamblers in Bangkok

Year	Number of cases (per year)	Number of arrested gamblers (per year)
2004	12,618	40,123
2005	10,819	34,669
2006	11,738	36,377

Note: The average population in Bangkok between 2004 and 2006 was 5.6 million people
Source: Metropolitan Police Bureau, 2007

Table 3E: Estimate of casino turnovers and casino profits in Bangkok in 1996

Size (million baht/day)	Number of casinos	Turnover (Weekday) (million baht/day)	Turnover (Fri./Sat.) (million baht/day)	Annual turnover (million baht)	Annual profit (million baht)
Less than 1	61-100	0.5	0.5	10,950-18,000	2,190-3,600
1-10	122-200	1-10	1-10	57,780-577,800	11,556-115,560
More than 10	5	100	4-500	67,700-78,100	13,540-15,620
Total	**188-300**	**691-2,201**	**2,191-4,201**	**136,429-673,900**	**27,286-134,780**

Note: 1. Derived from interview with policemen, owners of small, medium-sized and large casinos
2. Assume operation on 256 weekdays and 104 Friday/Saturdays, profit as 20 % of turnover
Source: Pasuk *et al.*, 1998

Table 3F shows the estimates of turnover and profit of provincial casinos in 1996

Size (million baht/day)	Number of casinos	Turnover (million baht/day)	Annual turnover (million baht)	Annual profit (million baht)
1-4	50	50-200	18,000-72,000	3,600-14,400
5 and over	39	195	70,200	14,040
Total	**89**	**245-395**	**88,200-142,200**	**17,640-28,440**

Note: Derived from interview policemen and documents from the Narcotics Control Board
Source: Pasuk *et al.*, 1998

Table 3G: Estimated casino turnover and casino profit in Thailand in 2002

Areas	Number of casinos	Turnover (million baht/day/casino)	Total turnover (million baht/day)	Annual turnover (million baht)	Annual profit (million baht)
			Bangkok		
Big Domestic Permanent Casinos	10	20	200	93,000	18,600
Medium-sized and small Domestic Permanent Casinos	50	1-2	50-100	23,250-46,500	4,650-9,300
Flying Casinos	100	1	100	65,100	13,020
Total	**160**	**-**	**390-440**	**181,350-204,600**	**36,270-40,920**
			Provincial Towns (75 provinces)		
Big Domestic Permanent Casinos	75	1	75	34,875	6,975
Medium-sized and Flying casinos	786	0.5-1	393-786	182,745-365,490	36,549-73,098
Total (Provincial Towns)	**861**	**-**	**543-936**	**252,495-435,240**	**50,499-87,048**
Casinos at Funerals	725,000-1,015,000	0.05-0.1	-	36,234-101,456	7,247-20,291
Total domestic permanent casinos (Provincial Towns)	**726,407-1,014,560**	**-**	**-**	**288,729-536,696**	**57,749-107,339**
Total	**726,567-1,016,442**	**-**	**-**	**470,079-741,296**	**94,019-148,259**

Source: Sungsidh *et al.*, 2003

CHAPTER 4

ESTIMATING THE CHARACTERISTICS OF GAMBLERS

4.1 Introduction

Gambling is one of the most popular activities for Thai people, although many of gambling games are illegal. There are, generally, only two types of legal gambling games. First, there is the lottery which is run by the state and drawn twice a month. Second, is horse racing, which takes place in Bangkok, normally, happens once a week. Indeed, most illegal gambling games are more popular than the legal gambling games. Sungsidh *et al.* (2003) state that, in 2002, there were around 24 million people bet on the underground lottery, which was an illegal activity. In comparison, 21 million people, in the same period, bet on the government lottery. There were around 4 million people and 2 million people participated in casino gambling and football betting respectively, which were illegal, in 2002, compared with 80,000 people who bet on horse racing. Moreover, around 74% of the population stated that they had gambled, with 65% claiming to have gambled in the past twelve months (see Table 4A and 4B in Appendix 4A).

However, research on Thai gambling is scarce and all researches estimated the number of Thai gamblers and the amount of money generated by Thai gambling businesses. None of the research has studied the characteristics of Thai gambling participant. In this respect, the present study is unique and fills a void in the gambling studies in Thailand.

This chapter studies the characteristics and frequency of Thai gamblers. Moreover, the notions of a “substitution effect” and a “supplementation effect” among gambling games will be analysed. The following section summarises the significant literature on gambling participation. The empirical works will describe the regression method which will be employed to estimate the characteristics of gamblers, with the results presented in section 4.3. Section 4.4 analyses the results. The final section contains the conclusions.

4.2 Literature review: Prevalence of gambling participation

Brenner (1986) indicates why people gamble. He divided people into two groups. The first group is people who realise their expectations and the second group comprises people whose expectations either are not realised or have been exceeded. He stated that people who are in the first group and relatively richer will tend to insure themselves. People who are relatively poorer may plan to participate in games of chance in which there is only a small price is paid for participating but win a big prize, even though there is a small probability of winning.

As regards, individuals who are in the second group, people who experience a sudden drop in wealth may participate in gambling, commit a crime, or work harder. People whose wealth has suddenly increased may both take out previously shunned insurance and make less effort. Kwang (1965) explains why low income people buy lottery tickets and similar gambling games rather than rich people through the concept of expenditure indivisibility. The indivisibility of expenditure, such as the costs of purchasing a house, a car, has to be higher than poor people’s disposable incomes. Poor people seem unable to consume unless money is obtained by gambling. On the other hand some gambling expenditure is only a small proportion of rich people’s income.

Some studies evaluated the influence of a number of socio-economic and demographic variables on the gambling participation. MacDonald *et al.* (2004) study the distribution of gambling and the impact of gambling spending on households in Canada. The results suggest that younger gamblers, those under the age 25, and older gamblers, those over the age 65, have the lowest incidence of gambling. A low rate of gambling is also found for individuals who have less than 9 years of education or who have a university degree. This result is consistent with Jackson (1994)'s work, which indicated that per capita lottery sales in a community in Massachusetts in 1983 and 1990 declined as education level increased. However, MacDonald *et al.* (2004) state that higher levels of income lead to an increase in frequency of gambling, for example, in Nova Scotia, Canada, 70% of households with incomes less than 20,000 dollars gamble, compare to 92% of households with incomes at least 80,000 dollars or more.

Worthington *et al.* (2007) evaluate the gambling patterns on the basis of 6,892 households in Australia. Only the four largest categories of gambling game are mentioned, which are 1) lottery tickets, 2) lotto-type games and instant lottery, 3) TAB on-course[7] and related betting, and 4) poker machines and ticket machines. They indicated that, for instance, people who live alone, lone parents with children, and households with a spouse from North Africa or the Middle East have a lower rate of gambling participation on lottery tickets, while households headed by a person aged between 30 and 69 years participate relatively more.

Clotfelter and Cook (1991) find that, in America, black people, males, and people aged between 24 and 54 purchase lottery ticket rather than white people, females, and people who

[7] TAB on-course means Totaliser Agency Board (TAB) and on-course betting

are very young or very old, respectively. The result corresponds to the finding in Canada, Kitchen and Powells (1991), who found that households headed by a female purchase a lottery less than households headed by a male. Households where the head has a university degree spend less on a lottery than households where the head had less than 9 years of elementary schooling.

Numerous studies focus on the gambling participation of adolescents. The studies report that between 70% and 90 % of adolescents in North America have gambled sometime in their lives and around 80% declared to be current gamblers in 2000. In comparison, 96% of Icelandic adolescents, in 2004, had gambled in their lives, 79% at least once in the preceding year and around 10% of adolescents gambled at least once a week. In the United States, 86% of 12,066 Louisiana students who studied between grade 6 and 12 had gambled during the 1996-1997 and 10% indicated a gambling problem in the past year. Weekly-or-more gambling participation rates were 16.5% for lottery scratch cards while 12.5% for sports betting. The most popular game was lottery scratch cards ticket which was purchased by 65% of students.

Around 86% of Minnesota adolescents claimed to have gambled in 1992, whereas 86% of 892 New Jersey high school students participated in gambling in 1986 and 91% admitted to gambling in their lifetime. There were 76% of 1,612 high school students in Quebec, Canada, who reported to have gambled at least once in their lifetime in 1988. The corresponding figure was 90% of 965 high school students in Windsor, Ontario, also gambled in 1996 (Giacopassi *et al*., 2006; Olason *et al*., 2005; Westphal *et al*., 2000).

4.3 The empirical works

4.3.1 Methodology

The primary focus of this chapter is to estimate the effect of socio-economic factors on the participation of each type of gambling due to characteristics of the individuals. The dependent variable is discrete rather than continuous. To deal with a discrete choice model, Logit maximum likelihood estimation is employed. A number of previous studies have used this technique, such as Layton and Worthington (1999), to estimate the effect of socio-economic factors on the probability of purchasing a gambling product, or Pugh and Webley (2000), when analysing the participation in National Lottery draw and participation in National Lottery Instants.

The Logit estimation technique can be defined as

$$\log[P_i / (1 - P_i)] = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i \tag{4.1}$$

where P_i is the probability that the *i* th person will make a particular choice and u_i is the error term. The left-hand side of the equation is the log-odds ratio so it is a linear function of the explanatory variables (Gujarati, 2003; Maddala, 1988; Mittelhammer *et al.*, 2000; Studenmund and Cassidy, 1987). This can be solved for P_i as well by taking the antilog of equation (4.1) then P_i can be expressed as

$$P_i = \frac{1}{1 + e^{-(\beta_0 + \sum_{j=1}^{k} \beta_j x_{ij})}} \tag{4.2}$$

The frequency of gambling of each type will be estimated. To specify the gambling frequency, the estimation technique used here is adapted from some models for measuring the gambling expenditure, such as Kitchen and Powells (1991), and Worthington *et al.* (2007).

Kitchen and Powells (1991) indicate that limited dependent variables exist when the observed value for the dependent variable takes on a zero or positive value. In other words, the dependent variable is censored at zero. To deal with this problem, ordinary least squares estimation should not be applicable because the condition that the expected value of the error term equals zero for unbiased estimates is not satisfied. Tobit estimation seems to be the best technique to be employed to solve the problem

The Tobit estimation technique is appropriate for censored sample, and is a hybrid of Probit analysis and the multiple regression approach (Hansen, 1995; Maddala, 1988; Mittelhammer *et al*., 2000; Tobin, 1958; Scott and Garen, 1994; Worthington, 2001).

The general form of the regression model is

$$F_i^* = \beta X_i + u_i \text{ , } u_i \sim N[0, \sigma^2] \tag{4.3}$$

If $F_i^* \leq 0$, then $F_i^* = 0$ and

If $F_i^* > 0$, then $F_i^* = F_i^* = \beta X_i + u_i$

where F_i^* = Gambling frequency, β = A set of parameters to be estimated

X_i = A set of independent variable u_i = error term

The technique is appropriate for this study as gambling frequency takes on non-negative values. Thus the gambling frequency can be defined as the dependent variable, censored at zero, while the explanatory variables are the socio-economic and demographic series.

4.3.2 Model estimated

Two models are the basis of the empirical analysis in this chapter. The first model estimates the gambling participation, where the dependent variable is discrete. This model is estimated by the Logit estimation technique. The second model estimates the frequency of gambling, which the dependent variable is continuous. This model is estimated by the Tobit estimation technique.

The first model used is

$$G_j = \beta_0 + \sum_{j=1} \beta_j x_j + u_j \tag{4.4}$$

where G_j = Gambling participation β_0, β_j = A set of coefficients to be estimated

x_j = A set of independent variables u_j = error term

And the second model used is

$$F_j = \beta_0 + \sum_{j=1} \beta_j x_j + u_j \tag{4.5}$$

where F_j = Gambling frequency β_0, β_j = A set of coefficients to be estimated

x_j = A set of independent variables u_j = error term

4.3.3 Data

The data used in the regression models are provided by three surveys. Each survey will be briefly discussed.

4.3.3.1 The first survey

The first survey was undertaken in 2002 by Sungsidh Piriyarangsan and his research team. The main objective of this survey was to discover the participation rate of individuals in Thailand. The country was divided into 2 parts: Bangkok and the vicinities, and other provinces. The random provinces were from all 4 parts of the whole country: Northern; Northeastern; Central, which included Western and Eastern; and the South. Moreover, each part was also divided into sub-parts, such as the Northern part and the Southern part were divided into 2 sub-parts while the other two parts were divided into 3 sub-parts. The researchers claimed that the survey procedures were the same as the survey procedures of National Statistical Office of Thailand.

The sample comprised 5,000 people divided into 3 regions. First, there were 2,000 people who lived in Bangkok and the vicinities. Second, 1,500 people who resided inside the municipal area of the provinces. The last group was 1,500 people who resided outside the municipal area of the provinces.

As regards the questionnaire, it comprises three sections in three pages. Section one contains 6 questions of a personal and demographic nature, such as gender, age, marital status. The respondents were required to indicate their age by choosing one of four age ranges, which were 15-22 years, 23-35 years, 36-50 years, and over 60 years. Likewise, the respondents were also asked to choose one of five marital status types: single, married, widow, divorce, and separated.

Section two is about the gambling experience of the individual. The respondents were shown the list of types of gambling activities, 15 games, and asked about their participation in each type in the past 12 months. However, to cover all types of gambling available in Thailand and to allow the possibility that some types were missed by the research team, the option was provided for the individual to write any gambling games which were not in the list. The respondents were also asked about their gambling expenditure, their gambling frequency of each gambling game, and the reasons for gambling.

Section three attempts to investigate their opinions on gambling. This section asks 6 main questions, such as whether agree or disagree with the government legalising some gambling businesses, what situations you believed would happen if the gambling business is legalised.

Table 4.1 reports the definitions and descriptive statistics of the sets of the data in the 2002 survey.

Table 4.1: Definitions and descriptive statistics of the data in the 2002 survey

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.56	.49
2. Age		
a. Age1 (15-22 years old)	.17	.37
b. Age2 (23-35 years old)	.30	.46
c. Age3 (36-50 years old)	.33	.49
d. Age4 (51-60- years old)	.11	.31
e. Age5 (over 60 years old)	.09	.29
3. Marital status (0 = Single, 1 = Married)	.62	.48
a. Status1 (single)	.31	.46
b. Status2 (married)	.62	.48
c. Status3 (widow, divorce, or separate)	.07	.24
4. Occupation		
a. Unemployed	.09	.29
b. Housewife	.11	.31
c. University student	.11	.31
d. Agriculturist	.13	.33
e. Government officer	.07	.25
f. Business/industry owner	.24	.42
g. Private employee	.25	.43
5. Education	.16	.36
6. Income (per month)[a]	5.95 (5,843.47)	4.01

Table 4.1 (continued)

Variable	Mean	Standard deviation
7. Type of betting (0 = No, 1 = Bet)		
a. Gambled in the past	.76	.42
b. Gambled last 12 month	.67	.46
c. Bet on the government lottery	.76	.42
d. Bet on the underground lottery	.75	.43
e. Bet on football	.08	.26
f. Bet on casino	.14	.34
g. Bet on home/flying casino	.80	.40
h. Bet on domestic permanent casino	.16	.37
i. Bet in casinos in neighbouring countries	.13	.33
j. Bet in casinos in other countries	.08	.27
8. Frequency of betting (per year)		
a. Frequency of casino betting	29.67	66.58
b. Frequency of football betting	69.51	224.02
c. Frequency of government lottery betting	11.62	8.64
d. Frequency of underground lottery betting	13.47	8.40

Table 4.1 (continued)

Variable	Mean	Standard deviation
9. Gambling opinion		
(0 = disagree, 1 = agree)		
a. Do you think that the government should legalise casino business?	.42	.49
b. Do you think that the government should legalise football gambling?	.35	.47
c. Do you think that the government should issue the 2-3 digit lottery?	.51	.50
10. Reason for gambling		
(0 = No, 1 = Yes)		
a. Gambling as a business	.01	.10
b. Gambling for the extra income	.07	.25
c. Gambling for the risk	.80	.39
d. Gambling for entertaining	.32	.46

Note: Education: 0=lower than an undergraduate degree 1=undergraduate degree or higher
[a]Income: in the natural logarithm form, the value in parentheses is the actual mean value (per month)

Table 4.1 reports that 56% were female and 62% of the respondents were married. The proportion of the respondents, who obtained an undergraduate degree or higher, was 16% and the monthly income was around 5,840 baht. In comparison, with the Thai population in 2002, around 62 million people, 51% were female. Around 2% of people in the labour force were unemployed. People who achieved a university degree were 11% of people aged over 15 years old. The monthly income and monthly expenditure in 2002, respectively, were 4,000 baht and 3,100 baht per person on average.

Table 4.1 also shows that the proportion of respondents who had gambled in their lives was 76%, whereas 67% had gambled in the past 12 months. The government lottery and the underground lottery were the most popular games. There were around 75% of the respondents who participated in these two gambling types, in 2002, with the frequency of gambling around 12 out of 24 draws per year. With respect to the group of people who bet on casino, most of them, 80%, prefer to bet in home/flying casinos. The proportions of the respondents who supported the government to legalise casino and football betting were 42% and 35% respectively, compared with 51% of the respondents who supported the government to issue the 2-3 digit lottery. Regarding the reasons for gambling, around 80% of gamblers revealed that they gambled since they preferred to risk, followed by the reason of gambling for entertaining which was 32%.

4.3.3.2 The second survey

The second survey was completed in 2007, with the same set of questions used in the 2002 survey. The major difference between these two surveys is the size and the characteristics of the samples. All respondents of the 2007 survey were gamblers as the principle objective of this survey was to ascertain gambling behaviour and gambling expenditure in Thailand. Moreover, this survey, initially, was expected to determine the consumer surplus of different types of gambling. However, it seems to be difficult to calculate the consumer surplus of an addictive good as gambling or alcohol since the decision on gambling or drinking may not always be based on a rational decision (Volberg *et al.*, 2001).

To capture the group of gamblers, the survey was conducted at some casino bus service points, which were in Bangkok, and in the bordering countries where casinos were located, such as between Thailand and Cambodia, Thailand and Laos, Thailand and Myanmar.

Moreover, some domestic permanent casinos in Bangkok were approached as well. There is no doubt the potential issue of sampling bias. Some gamblers refused to fill in the questionnaires and some gamblers also omitted to answer certain questions. In total, there were 509 respondents.

Nevertheless, it should be noted that the 2007 survey focused on only three gambling activities: casinos, the underground lottery, and the 2-3 digit lottery. This is because these three types of gambling were the most popular games played by those over 30 years old. The questionnaire of this survey contains three sections in three pages. Similar to the questionnaire of the 2002 survey, section one has questions of a personal and demographic nature with the additional question of the number of children.

Although section two follows the questionnaire of the 2002 survey, which is about the gambling experience, there are some differences about the number of gambling activities. As noted above, this survey focused on only three gambling types thus the respondents were asked about their expenditure and their frequency of gambling on casinos, the underground lottery, and the 2-3 digit lottery. The definitions of gambling and each casino type were explained to all respondents, particularly the definition of home/flying casino.

Section three contains 35 questions describing the opinions and requiring a response on a five-point scale. The respondents were asked the situations, which believed to be happened, if the government legalises the casino business, and were also asked about their reasons of gambling. Although this questionnaire did not ask about the issue of agree or disagree to legalise the gambling business, the survey, instead, asked the respondents about their opinions on some situations after the government issued the 2-3 digit lottery project. Table 4.2 presents the definitions and descriptive statistics of the data from the survey in 2007.

Table 4.2: Definitions and descriptive statistics of the data in the 2007 survey

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.42	.49
2. Age		
a. Age1 (15-22 years old)	.09	.28
b. Age2 (23-35 years old)	.35	.47
c. Age3 (36-50 years old)	.36	.47
d. Age4 (51-60- years old)	.16	.36
e. Age5 (over 60 years old)	.05	.22
3. Marital status (0 = Single, 1 = Married)	.44	.49
a. Status1 (single)	.44	.49
b. Status2 (married)	.44	.49
c. Status3 (widow, divorce, or separate)	.12	.33
4. Children	1.14	1.55
5. Occupation		
a. Unemployed	.09	.28
b. Housewife	.09	.29
c. University student	.11	.31
d. Agriculturist	.01	.09
e. Government officer	.10	.29
f. Business/industry owner	.24	.43
g. Private employee	.35	.47
6. Education	.53	.50
7. Income (per month)[a]	9.70 (32,580.54)	0.93

Table 4.2 (continued)

Variable	Mean	Standard deviation
8. Type of betting		
(0 = No, 1 = Bet)		
a. Bet on the underground lottery	.48	.50
b. Bet on the 2-3 digit lottery	.49	.50
c. Bet on casino	.83	.37
d. Bet on home/flying casino	.39	.48
e. Bet on domestic permanent casino	.12	.32
f. Bet in casinos in neighbouring countries	.69	.46
g. Bet in casinos in other countries	.23	.41
9. Frequency of betting		
(per year)		
a. Frequency of casino betting	57.12	71.49
b. Frequency of underground lottery betting	15.63	7.29
c. Frequency of 2-3 digit lottery betting	13.04	7.17
10. Reason for gambling		
(5 point-scale)		
a. Gambling as a business	1.81	1.20
b. Gambling for the extra income	3.02	1.35
c. Gambling for the risk	3.91	1.09
d. Gambling for entertaining	4.00	1.16

Note: Children: per family
Education: 0=lower than an undergraduate degree 1=undergraduate degree or higher
[a]Income: in the natural logarithm form, the value in parentheses is the actual mean value
Reason for gambling: Gambling as a business, Gambling for the extra income, Gambling for the risk, Gambling for entertaining: there are 5 point-scale

Regarding Table 4.2, it can be seen that around 42% of gamblers were female. The proportions of single gamblers and married gamblers were equal at 44% of gamblers. There were 270 gamblers, 53%, who had an undergraduate degree or higher. Their monthly income was around 32,580 baht. In comparison the number of Thai population in 2007, around 63 million people, 51% were female. Around 1.4% of people in the labour force were unemployed. In the same year, people who obtained a university degree were 12% of people aged over 15 years old. The monthly income and monthly expenditure were approximately 6,500 baht and 5,300 baht per person respectively.

Table 4.2 also reports that 83% of gamblers bet on casino, whereas the proportion of underground lottery players equalled to the proportion of 2-3 digit lottery players which were around 50% of gamblers. Most casino gamblers preferred to bet on casinos in neighbouring countries, 69%, with the frequencies at 57 times a year. According to the reasons for gambling, most gamblers revealed that they gambled since loving to risk and for entertaining.

4.3.3.3 The third survey

The analysis of the 2002 and the 2007 data indicate that there were a number of young people involved in some forms of gambling in Thailand, even though most of gambling types are illegal. Pugh and Webley (2000) state that gambling, which is intrinsically relevant to money and speculation, facilitates expectations and behaviour, not usually found in the context of the entertainment. Furthermore, it is considered dangerous for children and adolescents to be encouraged to gambling at a young age. This is because their lives are not structured by the constraints, obligations and rewards of adult life which can prevent excessive involvement. It is no surprise to insist that if these valued groups in society (such as children or adolescents) develop pathological gambling, there will be a potential individual and social cost, and also affect national productivity, when they enter the working world after finishing their study. Hence, the third survey, which was undertaken in 2008, focused on gambling behaviour of university students. The main objective of this survey is to discover the adolescents' gambling participation and gambling behaviour.

In order to obtain a highly representative and completely random sample due to the purposes of this study, six universities, 3 public and 3 private, were approached. The number of respondents of each university was around 500 students on average. The respondents who participated were master's students (21%) and undergraduate degree students (79%) from four separate year classes chosen randomly from each of the six universities. The age range of respondents was between 17 and 35 years old. All respondents filled a questionnaire in a controlled environment at their respective university. Thus none of student refused to fill in the questionnaire but some of them neglected to answer certain questions. The total sample size was 2,883 individuals.

The set of questions used in those two previous surveys had been retained. It can be said that some 2002 and 2007 survey protocols were duplicated in the 2008 survey. The questionnaire comprised four sections in four pages. Section one was still about personal and demographic characteristics. The questions of marital status and occupation were excluded while some questions, such as family income or information on family members, were included.

Section two describes gambling experience. The definitions of gambling and each casino type were explained to all students as in the two previous surveys. However, the funeral casino was excluded from the type of home/flying casino in this survey due to potential confusion. This is because most students did not understand funeral casinos and was beyond their gambling experience. The students were also asked their gambling expenditure and the gambling frequency of 5 gambling types, which were casino betting, football betting, the government lottery, the 2-3 digit lottery, and the underground lottery. As regards the students who bet in casinos, they were asked the reasons of casino gambling and the frequency in the past one week.

Moreover, there are some questions in this section, which are attempted to ask students who bet on casino and football betting about their expectation of gambling expenditure and gambling frequency if these two types are legalised. Section three contains the questions on gambling opinion and some questions concern the gambling experience of students' parents. Section four of this questionnaire is quite similar to the third section of the two previous questionnaires. The questions related to the situations that might be occurred if the gambling businesses become legal.

However, there are some issues concerning the survey data that should be raised. Although every survey was seriously conducted with the academic regime, there were still some problems with the survey. For example, most gambling activities are illegal in Thailand hence not everyone wants to provide the truth about his/her gambling behaviour or experience. Or some questions of some gambling types, which appeared in the questionnaire, are hardly specified such as the frequency of football betting. In general, some gambling games, such as the underground lottery, the government lottery, are easier to recall accurately, even though long periods such as a year. In contrast, some gambling types, such as sports betting, poker games, which a gambling event often occurs, are difficult to make a realistic assessment. Moreover, the definition of frequency differs among the football betting gamblers. Some respondents gambled on one match at a time but gambled 3 times a day thus they might assess their frequencies as 3 times a day, while some gambled on a group of matches per time as a pool betting thus their frequencies might be assessed as 1 time a day. Others, who adopted both types, might assess 1 time a day. Therefore, the question on the frequency of football betting was excluded in this questionnaire.

It is probably realised that the survey data of gambling is anecdotal. Nevertheless, some solutions are applied for solving the problems of measurement error such as maintaining the main protocols of previous survey for the new survey.

Table 4.3 reports the definitions and descriptive statistics of the data from the 2008 survey.

Table 4.3: Definitions and descriptive statistics of the data from the 2008 survey

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.55	.49
2. Age	22.01	4.11
3. Education	.21	.40
4. Live	.36	.47
5. Family member	4.49	1.19
6. Personal income[a] (per month)	9.05 (11,470.41)	.72
7. Family income[b] (per month)	10.96 (88,449.34)	.90
8. Type of betting (0 = No, 1 = Bet)		
a. Gambled in the past	.74	.43
b. Gambled last 12 month	.52	.50
c. Bet on the government lottery	.36	.48
d. Bet on the 2-3 digit lottery	.15	.36
e. Bet on the underground lottery	.24	.43
f. Bet on football	.68	.46
g. Bet on casino	.83	.37
h. Bet on home/flying casino	.66	.47
i. Bet on domestic permanent casino	.42	.49
j. Bet in casinos in neighbouring countries	.24	.42
k. Bet in casinos in other countries	.08	.27

Table 4.3 (continued)

Variable	Mean	Standard deviation
9.Frequency of betting (per year)		
a. Frequency of casino betting	29.85	62.05
b. Frequency of government lottery betting	7.65	7.15
c. Frequency of 2-3 digit lottery betting	7.92	7.22
d. Frequency of underground lottery betting	9.94	7.71
10. Reason for gambling (0 = No, 1 = Yes)		
a. Gambling as a business	.06	.22
b. Gambling for the extra income	.22	.41
c. Gambling for the risk	.68	.46
d. Gambling for entertaining	.98	.13
B212	.59	.49
B214	.51	.50
B215	.76	.42
B217	.17	.37
C31	.29	.45
C32	.46	.49
C33	.23	.42
C34	.12	.93
C35	.36	.47
C36	.59	.49
C37	.44	.49

Table 4.3 (continued)

Variable	Mean	Standard deviation
C38	.60	.49
C39	.62	.48
C310	.25	.43
C311	.46	.49
C312	.76	.42

Note: Education: 0=Undergraduate degree 1=Master degree
Live: 0=With family/relative 1= alone/with friend
[a]Personal income: in the natural logarithm form, the values in parentheses is the actual mean values (per month)
[b]Family income: in the natural logarithm form, the values in parentheses is the actual mean values (per month)

b212= agree/disagree that government legalises casino business; 0=Disagree 1=Agree
b214= parents ever/never bet on casino; 0=No 1=Yes
b215= agree/disagree that government legalizes football; 0=Disagree 1=Agree
b217= parents ever/never bet on football betting; 0=No 1=Yes
c31= ever had a bad effect on your study because of gambling? 0=No 1=Yes
c32= ever thought about the gambling (reliving past gambling experience, planning the next gambling)? 0=No 1=Yes
c33= you and your family ever faced financial problems because of gambling? 0=No, 1=Yes
c34= currently in debt because of gambling? 0=No 1=Yes
c35= guilty on gambling? 0=No 1=Yes
c36= parents ever gambled? 0=No 1=Yes
c37= gambling has caused household financial problems? 0=No 1=Yes
c38= gambling is a bad activity? 0=No 1=Yes c39= gambling is dangerous for family life? 0=No 1=Yes
c310= gambling is good for communities? 0=No 1=Yes
c311= government should ban all types of gambling? 0=No 1=Yes
c312= agree after the government issued the 2-3 digit lottery? 0=No 1=Yes

A number of the university students in Thailand in 2008 were around 2,100,000 students, 75% studied in the public universities and 14% of all students were master's student. The monthly income and the monthly consumption expenditures in 2008 were approximately 26,660 baht and 20,735 baht per household respectively. According to Table 4.3, the proportion of female students was 55%. The average age of the students was 22 years old. Around 21% of the respondents were master's student and 36% of all students lived independently or with friends. Their monthly personal income was 11,500 baht whereas their monthly family income was 88,500 baht on average. There were 74% of students who declared that they had gambled in their lives while 52% claimed to have gambled in the past twelve months. Casino betting and football betting were the most two popular types of gambling, with the proportion of 83% and 68%, respectively, of students who had gambled in the preceding year.

Focusing on the group of students who participated in casino betting, 66% bet on the type of home/flying casino while 42% engaged in domestic permanent casinos. Comparing the gambling frequency, the frequency of casino betting was the highest, around 30 times a year. With regard to the reason for gambling, most students, 98%, declared that they gambled for entertaining, whereas 68% gambled since loving to risk. Around 60% of students supported a legal casino while the proportion of students who supported the government to legalise football betting and who agreed after the government operated the 2-3 digit lottery were equal at 76%. However, 46% of students had an idea that the government should ban all types of gambling. The proportion of students whose parents ever gambled was equivalent to 59%, whereas there were 51% of students whose parents participated in casino and only 17% whose parents bet on football betting.

4.3.4 Empirical results

The estimated coefficients, standard errors, and Z-statistics of the parameters for the Logit and Tobit regressions are presented in each estimate. The F-statistics for the null hypothesis that all the slope coefficients are jointly zero are reported. Also included in the results presented are McFadden R-squared (for Logit estimation), R^2 and $\bar{R}^2$ (for Tobit estimation), Akaike Information Criterion, Schwarz Criterion, and Hannan-Quinn Criterion, which are used as a guide to model selection. All standard errors incorporate Huber/White robust covariances to allow for heteroskedasticity. Regarding the McFadden R-squared, it is the measure of goodness of fit, which the value ranges between 0 and 1.

Table 4.4 provides the results of the estimation of the gamblers' characteristics. The first three columns are the estimate of gambling participation in the past. The dependent variable is the participation in gambling and the explanatory variables are the socio-economic data. Column 4-6 are the results of the estimate of gambling participation in the past 12 months on the set of socio-economic data. The omitted category for occupation dummy is the university student.

Table 4.4: Determinants of gambler characteristics in 2002

Colum 1-3: The dependent variable is gambling participation (0 = No bet, 1 = Bet)
The independent variables are the socio-economic data
Colum 4-6: The dependent variable is gambling participation in the past 12 month (0 = No bet, 1 = Bet)
The independent variables are the socio-economic data
Occupation: there are 7 occupations and the control for occupation is university student.
Observations: 5,000 people

Variables	Ever gambled			Gambled last 12 month		
	(1) Coef.	**(2) Std. Error**	**(3) *Z*-stat**	**(4) Coef.**	**(5) Std. Error**	**(6) *Z*-stat**
C	-2.04	0.45	-4.50	-1.73	0.41	-4.18
Gender	-0.45***	0.07	-6.05	-0.30***	0.06	-4.44
Age	0.19***	0.03	5.14	0.05	0.03	1.48
Marital status	0.42***	0.08	4.99	0.44***	0.07	5.80
Unemployed	0.40**	0.16	2.52	0.57***	0.15	3.66
Housewife	1.05***	0.16	6.28	1.21***	0.15	7.73
Agriculturist	1.08***	0.16	6.62	1.24***	0.15	8.17
Government officer	1.10***	0.19	5.75	1.25***	0.17	7.27
Business/industry owner	1.35***	0.14	9.45	1.38***	0.13	10.27
Private employee	1.16***	0.12	9.24	1.30***	0.12	10.66
Education	0.04	0.10	0.41	-0.10	0.10	-1.02
Income	0.23***	0.05	4.37	0.14***	0.04	3.00
McF R^2	0.09	-	-	0.07	-	-
Akaike info criterion	1.00	-	-	1.17	-	-
Schwarz criterion	1.02	-	-	1.19	-	-
Hannan-Quinn criter.	1.01	-	-	1.18	-	-
F- stat	58.22			47.48		

Note: McF R^2 is McFadden R-squared
F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

These two models are highly significant since the F-statistics reject the hypothesis that all the slope coefficients are jointly zero, at the 1% significance level. To interpret the Logit regression result, it should be realised that each coefficient measures the change in the estimated logit for a unit change in the value of the given variable by holding other variables constant. Therefore, Males are more likely to gamble than females, other factors remaining the same, with the probability of 0.7 (in the last twelve month) according to equation (4.2). Old people are also more likely to gamble than young people. Given the students is the omitted category for occupation dummy, every occupation seems to be more likely to gamble than students. People who have received a relatively lower income rarely gamble than higher income people. Regarding the gamblers' marital status, given the group of being divorced/separated/widowed is the omitted category for the characteristic of marital status dummy, single people rarely gamble than married people and married people also prefer to gamble than the group of people who are divorced/separated/widowed (see Table 4C in Appendix 4A).

As mentioned above, there were 15 types of gambles in the questionnaire but the four most four gambling games were casino, football betting, the government lottery, and the underground lottery. Thus only these four gambling types are studied. Moreover, it should be noted that, again, the definition of the government lottery is the lottery that is issued by the Government Lottery Office. The number of observations of this estimation was 3,367 respondents.

In term of variables of the next models, the participation in each gambling type is treated as the dependent variable, while the set of socio-economic data and the opinions on agree/disagree to legalise each gambling type are treated as the independent variable.

According to table 4.5, the first three columns are the results of casino betting. Column 4-6 are the results of football betting. Column 7-9 are the estimated results of the government lottery and the estimated results of the underground lottery are shown in column 10 to 12.

Table 4.5: Determinants of gambler characteristics of each gambling type in 2002

Column 1-3: The dependent variable is casino betting (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting
Column 4-6: The dependent variable is football betting (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise football betting
Column 7-9: The dependent variable is the government lottery (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to the 2-3 digit lottery
Column 10-12: The dependent variable is the underground lottery (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to the 2-3 digit lottery (0 = disagree, 1 = agree)
Occupation: there are 7 occupations and the control for occupation is the university student
Observations: 3,367 people

Variables	Casino			Football Betting			Government Lottery			Underground Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	-0.10	0.67	-0.15	-2.95	1.00	-2.95	-5.16	0.60	-8.50	1.07	0.53	1.99
Gender	-1.23***	0.12	-10.05	-2.53***	0.24	-10.38	-0.14	0.09	-1.50	0.55***	0.08	6.16
Age	-0.54***	0.06	-8.84	-1.02***	0.12	-8.38	0.36***	0.05	7.31	-0.14***	0.04	-3.08
Marital status	-0.16	0.12	-1.34	-0.68***	0.20	-3.41	0.23**	0.10	2.18	0.43***	0.09	4.34
Unemployed	0.52*	0.27	1.89	-0.17	0.38	-0.44	0.48**	0.24	1.96	0.85***	0.24	3.53
Housewife	0.29	0.31	0.93	-0.24	0.49	-0.49	0.73***	0.24	2.99	1.12***	0.24	4.63
Agriculturist	0.21	0.26	0.80	-1.48***	0.45	-3.25	0.46**	0.23	2.0	1.29***	0.22	5.62
Government officer	0.47*	0.27	1.75	-0.36	0.37	-0.96	1.89***	0.30	6.21	1.28***	0.24	5.34
Business/industry owner	0.20	0.23	0.84	0.06	0.31	0.19	1.42***	0.21	6.52	1.00***	0.20	4.89
Private employee	0.08	0.21	0.38	-0.41	0.26	-1.56	1.24***	0.19	6.27	1.16***	0.19	6.02
Education	0.05	0.16	0.36	0.22	0.22	1.01	0.37**	0.16	2.31	-0.55***	0.12	-4.39
Income	-0.07	0.07	-0.88	0.24**	0.12	2.01	0.48***	0.06	6.91	-0.18***	0.06	-2.94

Table 4.5 (continued)

Variables	Casino			Football Betting			Government Lottery			Underground Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8)) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
agree with the government to legalise casino business	0.30***	0.11	2.79	-	-	-	-	-	-	-	-	-
agree with the government to legalise football betting	-	-	-	1.80***	0.17	10.51	-	-	-	-	-	-
Agree with the government to issue 2-3 digit lottery	-	-	-	-	-	-	1.11***	0.09	12.19	0.74***	0.08	8.73
McF R^2	0.11	-	-	0.39	-	-	0.15	-	-	0.08	-	-
Akaike info criterion	0.72	-	-	0.33	-	-	0.93	-	-	1.05	-	-
Schwarz criterion	0.74	-	-	0.36	-	-	0.96	-	-	1.07	-	-
Hannan-Quinn criter.	0.73	-	-	0.34	-	-	0.94	-	-	1.05	-	-
F- stat	28.90			125.28			56.61			29.76		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The estimated models are highly significant since the joint hypothesis that all slope coefficients are jointly zero is rejected. The results from Table 4.5 suggest that males are likely to bet on every gambling type except the underground lottery. Unlike the government lottery betting, an older person rarely bet on casino, football, and the underground lottery. Given the omitted category for age is between 36 and 50 years old, most gamblers who bet in casinos and on football are between 15 and 50 years of age while the groups of gamblers who prefer to bet on the number games such as the government lottery and the underground lottery, are aged between 36 and 50 years old (see Table 4D in Appendix 4A).

Sungsidh *et al.* (2003) indicate that nearly 40 percent of casino gamblers, which is the highest proportion, are aged between 23 and 35 years old, the next group is between 36 and 50 years of age with around 30 percent. The lowest proportion is the group of gamblers who are older than 60 years old, which is around 4 percent.

Given that the group of people who are divorced/separated/widowed is the omitted category for marital status dummy, gamblers who are single prefer to gamble on football than married gamblers and gamblers in the group control. Most gamblers, unlike football betting gamblers, who prefer to bet on the government lottery or the underground lottery, are married. The gamblers who are divorced/separated/widowed are also likely to bet on the number games than single gamblers (see Table 4E in Appendix 4A).

Every occupation is more likely to bet in casinos, on the underground lottery and the government lottery than students, whereas students have a higher probability to gamble on football matches.

Regarding the characteristic of gamblers' education, highly educated gamblers prefer to bet on the government lottery while rarely bet on the underground lottery than lower educated gamblers. The income coefficients for football betting and the government lottery are statistically significant at the 5% and 1% significance level respectively, and implied that, high income gamblers are likely to bet on these two gambling types than low income gamblers while they do not prefer to bet on the underground lottery. To compare the estimated coefficients of income between football and the government lottery, the estimated coefficient for the government lottery (0.48) is higher than the coefficient for football betting (0.24), which means that, an increase in income would increase in the probability of gambling on the government lottery rather than on football. Obviously, gamblers who agree on legalising the gambling business are likely to gamble since the coefficients on these variables are statistically significant at the 1% significance level.

The casino can be categorised into 4 types; Home/flying casino, Domestic permanent casino, Casino in neighbouring countries, and Casino in other countries. The number of casino gamblers in 2002 survey was 462 gamblers. The next four models are used to estimate the characteristics of casino gamblers in each type of casino. The dependent variable of these models is the participation in each casino type and the explanatory variables are socio-economic characteristics and the opinion on agree/disagree to legalise casino betting. The regression results are reported in Table 4.6. The results which correspond to the type of home/flying casino are presented in column 1-3 while column 4-6 show the results which correspond to the type of domestic permanent casino. Column 7-9 show the regression results of the gambling participation in casinos in neighbouring countries and the results in column 10-12 relate to casinos in other countries.

Table 4.6: Determinants of gambler characteristics of casino betting in 2002

Column 1-3: The dependent variable is home/flying casino (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting

Column 4-6: The dependent variable is domestic permanent casino (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting

Column 7-9: The dependent variable is casino in neighbouring countries (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting

Column 10-12: The dependent variable is casino in other countries (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting

(0 = disagree, 1 = agree)

Occupation: there are 7 occupations and the control for occupation is the university student

Observations: 462 people

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	9.84	1.57	6.26	-5.69	1.53	-3.70	-10.33	1.78	-5.79	-13.41	2.67	-5.02
Gender	0.13	0.32	0.42	-0.22	0.34	-0.66	-0.30	0.39	-0.77	-0.31	0.46	-0.66
Age	-0.19	0.20	-0.96	0.11	0.22	0.53	-0.07	0.18	-0.40	0.29	0.29	1.01
Marital status	0.53*	0.34	1.54	-0.41	0.37	-1.10	-0.00	0.35	-0.01	-0.20	0.45	-0.44
Unemployed	4.05***	0.98	4.10	-4.09***	0.99	-4.13	-1.59	1.18	-1.34	-0.62	0.81	-0.76
Housewife	2.1***	0.71	3.01	-2.32***	0.77	-2.99	0.64	0.85	0.75	0.14	0.98	0.14
Agriculturist	2.46***	0.84	2.93	-2.19***	0.70	-3.11	0.87	0.78	1.12	-0.13	1.06	-0.12
Government officer	1.44***	0.56	2.56	-2.74***	0.71	-3.85	0.69	0.74	0.93	-1.30	1.13	-1.14
Business/industry owner	1.63***	0.52	3.10	-2.25***	0.59	-3.77	0.18	0.73	0.25	-0.84	0.95	-0.88
Private employee	1.54***	0.43	3.50	-1.64***	0.42	-3.89	0.21	0.67	0.32	-1.34	0.85	-1.57

Table 4.6 (continued)

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1) Coef.	**(2) Std. Error**	**(3) Z-Stat.**	**(4) Coef.**	**(5) Std. Error**	**(6) Z-Stat.**	**(7) Coef.**	**(8) Std. Error**	**(9) Z-Stat.**	**(10) Coef.**	**(11) Std. Error**	**(12) Z-Stat.**
Education	-0.06	0.34	-0.19	-0.45	0.35	-1.27	-0.10	0.42	-0.24	1.12***	0.45	2.44
Income	-1.12***	0.19	-5.65	0.69***	0.19	3.58	0.91***	0.20	4.53	1.23***	0.31	3.88
agree with the government to legalise casino business	-0.13	0.27	-0.50	0.05	0.27	0.18	0.32	0.32	1.02	-0.02	0.40	-0.06
McF R^2	0.18	-	-	0.12	-	-	0.11	-	-	0.21	-	-
Akaike info criterion	0.87	-	-	0.83	-	-	0.73	-	-	0.49	-	-
Schwarz criterion	0.99	-	-	0.95	-	-	0.85	-	-	0.61	-	-
Hannan-Quinn criter.	0.92	-	-	0.88	-	-	0.78	-	-	0.54	-	-
F- stat	7.09			4.77			3.40			8.81		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The estimated models are highly significant since *F*- statistics of all coefficients jointly equaling zero are rejected. All coefficients on the occupation variables of home/flying casino and domestic permanent casino are highly significant, at the 1% significance level. This can be interpreted that every occupation is definitely rarely bet on the style of domestic permanent casino but more likely bet on the home/flying casino style than students, which are the group control. This result relates to the variable of gamblers' marital status, which indicates that married gamblers prefer to bet on home/flying casino rather than single gamblers.

It is no surprise that high educated casino gamblers do prefer to bet in casinos in other countries. One characteristic which is considerably statistically significant is the set of income variables. They show that high income casino gamblers are likely to bet in domestic permanent casinos, casinos in neighbouring countries, and casinos in other countries but rarely bet in home/flying casinos. Although the female coefficients are not statistical significant in any levels, it can be interpreted that females seem to be likely to bet in home/flying casinos while most customers of other casino types are males.

The next issue focuses on the frequency of gambling. As previously mentioned, Tobit estimation technique is employed. The estimation starts with the estimate of frequency of each gambling activity on the socio-economic data and the opinion of agree/disagree with legalising each gambling activity. Regarding Table 4.7, the dependent variable for column 1-3 is the frequency of casino betting whereas the dependent variable for column 4-6 is the frequency of football betting. The frequency of purchasing the government lottery ticket is conducted as the dependent variable for column 7-9 and the frequency of the underground lottery betting is the dependent variable for column 10-12.

Table 4.7 shows the frequency of gambling of each gambling type in 2002

Column 1-3: The dependent variable is casino betting frequency; The independent variables are the socio-economic data and agree/disagree to legalise casino betting
Column 4-6: The dependent variable is football betting frequency; The independent variables are the socio-economic data and agree/disagree to legalise football betting
Column 7-9: The dependent variable is the government lottery betting frequency; The independent variables are the socio-economic data and agree/disagree to the 2-3 digit lottery
Column 10-12: The dependent variable is the underground lottery betting frequency; The independent variables are the socio-economic data and agree/disagree to the 2-3 digit lottery
(0 = disagree, 1 = agree)
Occupation: there are 7 occupations and the control for occupation is the university student

Variables	Casino (462 gamblers)			Football Betting (261 gamblers)			Government Lottery (2,572 gamblers)			Underground Lottery (2,513 gamblers)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.
C	2.43	1.41	1.72	-2.26	3.06	-0.73	-3.43	0.68	-5.00	0.18	0.56	0.33
Gender	-0.55*	0.30	-1.81	1.17*	0.73	1.58	-0.53***	0.11	-4.85	-0.13	0.09	-1.44
Age	-0.14	0.17	-0.80	0.07	0.36	0.20	0.18***	0.05	3.25	0.01	0.04	0.26
Marital status	0.31	0.32	0.95	-0.28	0.55	-0.51	0.41***	0.12	3.28	0.25**	0.10	2.39
Unemployed	0.18	0.62	0.29	0.08	0.83	0.10	0.42	0.4	1.04	0.81**	0.36	2.26
Housewife	0.93	0.65	1.42	-20.2***	1.61	-12.59	0.89**	0.39	2.26	1.11***	0.33	3.29
Agriculturist	-0.94*	0.54	-1.72	-19.37***	1.17	-16.51	0.48	0.38	1.24	0.86***	0.32	2.66
Government officer	-0.15	0.55	-0.28	-1.69*	1.06	-1.58	1.24***	0.38	3.23	1.13***	0.34	3.31
Business/industry owner	-0.10	0.53	-0.19	0.57	0.78	0.73	1.14***	0.36	3.11	1.17***	0.31	3.68
Private employee	-0.27	0.44	-0.60	-0.72	0.63	-1.14	0.95***	0.35	2.67	0.98***	0.31	3.18
Education	-0.05	0.36	-0.16	-0.12	0.47	-0.25	-0.66***	0.16	-4.01	-0.78***	0.16	-4.81
Income	-0.30*	0.17	-1.71	0.07	0.37	0.21	0.36***	0.07	4.76	0.02	0.06	0.46

Table 4.7 (continued)

Variables	Casino			Football Betting			Government Lottery			Underground Lottery		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
	Coef.	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**
agree with the government to legalise casino business	0.96***	0.25	3.81	-	-	-	-	-	-	-	-	-
agree with the government to legalise football gambling	-	-	-	1.42***	0.49	2.86	-	-	-	-	-	-
Agree with the government to issue 2-3 digit lottery	-	-	-	-	-	-	0.12	0.10	1.18	0.28***	0.08	3.23
R^2	0.04	-	-	0.12	-	-	0.06	-	-	0.03	-	-
$\bar{R}^2$	0.02	-	-	0.07	-	-	0.05	-	-	0.03	-	-
Akaike info criterion	2.96	-	-	2.46	-	-	3.44	-	-	3.67	-	-
Schwarz criterion	3.08	-	-	2.65	-	-	3.47	-	-	3.70	-	-
Hannan-Quinn criter.	3.01	-	-	2.53	-	-	3.45	-	-	3.68	-	-
F- stat	1.73			2.89			13.01			7.37		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The hypothesis that all slope coefficients are jointly zero is rejected. From Table 4.7, it can be seen that females seem to frequently bet than males on only football. Older people frequently bet on the government lottery rather than young gamblers. The frequency of number games, such as the government lottery and the underground lottery, of married gamblers is higher than single gamblers.

Given that the students is the omitted category for occupation dummy , every occupation frequently bet on the underground lottery and the government lottery rather than students. The coefficients on occupation are also reported for casino and football betting but they appear to have limited statistical significance. However, it seems that students have high frequency betting on these two types of gambling. Education is one of the factors, which shows that a higher education level leads to infrequent betting, particularly on the government lottery and the underground lottery.

The coefficients on the income variable appear to be a significant factor for government lottery betting, which shows that high income leads to increasing frequency of betting; and for casinos, higher income leads to a decrease in betting. Gamblers who agree with legalising gambling business have the high gambling frequency. For example, gamblers who agree with legalising casino business have the increasing frequency of casino betting.

The dependent variable of the next models is still the frequency of gambling but the explanatory variables have changed to be the reasons for gambling. Although four reasons for gambling are reported, they seem to have limited success in explaining on casino betting, football betting, and the government lottery. The reason of gambling for the extra income seems to be the only one factor that leads to an increase in the frequency of football betting while the reason of gambling for the risk also seems to be the only factor that leads to an increase in the frequency of the government lottery betting. Gamblers who are risk lovers, do gamble as a business, or do gamble for the extra income frequently bet on the underground lottery (see Table 4F in Appendix 4A).

The link between the gambling frequency and the participation in each type of gambling are shown by the four following tables (Table 4.8-4.11). In these models, the participation in each gambling activity is treated as the explanatory variable. It can be seen that gamblers who bet on the underground lottery also frequently bet on the government lottery as same as gamblers who bet on the government lottery and in casinos also frequently bet on the underground lottery. It is probably said that there is the supplementation effect between the government lottery and the underground lottery.

The regression result still reports that gamblers who bet in casinos also frequently bet on football while gamblers who bet on football seem to infrequently bet in casinos. This means people who enter the casino seem easily to find a chance to bet on other illegal gambling types such as football or the underground lottery, but people who bet on football may not need to bet in casinos. Thus, it might be stated that there is a notion of supplementary effect of casino on other gambling types.

4.8. Casino

The dependent variable is the frequency of casino betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	1.51	0.67	2.24
Government lottery	0.14	0.30	0.48
Underground lottery	-0.30	0.32	-0.94
Football betting	-0.70**	0.29	-2.35

4.9. Football Betting

The dependent variable is the frequency of football betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	-1.26	0.40	-3.08
Government lottery	-0.39	0.49	-0.79
Underground lottery	0.28	0.49	0.56
Casino	1.29***	0.42	3.02

4.10. Government Lottery

The dependent variable is the frequency of government lottery betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	0.51	0.10	4.80
Underground lottery	0.60***	0.12	4.96
Football betting	0.02	0.21	0.12
Casino	0.14	0.16	0.92

4.11. Underground Lottery

The dependent variable is the frequency of the underground lottery betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	0.87	0.09	9.73
Government lottery	0.92***	0.10	9.12
Football betting	0.06	0.18	0.37
Casino	0.45***	0.12	3.54

Focusing on the casino betting, the estimated results show the link of the frequency of casino betting and the participation in each type of casino. In present models, the participation in each casino type plays important role as the explanatory variables. The coefficient on the variable of home/flying casino is positive and statistical significant at the 10% significance level, which can be interpreted that casino gamblers who bet in home/flying casinos have the high frequency of casino betting (see Table 4G in Appendix 4A).

The data used for the next estimation obtained from the 2007 survey. The dependent variable is the participation in each gambling type and the explanatory variables are the set of socio-economic and demographic characteristics. The estimated model on casino betting is significant since the hypothesis that all slope coefficients are jointly zero is rejected at the 1% level, whereas the estimated models for the underground lottery and the 2-3 digit lottery are poorly fitting. The first 3 columns report the results of casino betting while column 4 to 6 and column 7 to 9 report the results of the participation in the underground lottery and the 2-3 digit lottery respectively.

Table 4.12: Determinants of gambler characteristics of each gambling type in 2007

Column 1-3: The dependent variable is the casino betting (0 = No, 1 = Bet); The independent variables are the socio-economic data
Column 4-6: The dependent variable is the underground lottery betting (0 = No, 1 = Bet); The independent variables are the socio-economic data
Column 6-9: The dependent variable is the 2-3 digit lottery betting (0 = No, 1 = Bet); The independent variables are the socio-economic data
Occupation: there are 7 occupations and the control for occupation is the university student
Observations: 509 people

Variables	Casino			Underground Lottery			2-3 digit Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.
C	-3.02	1.82	-1.65	-1.27	1.01	-1.25	-0.04	1.02	-0.04
Gender	-0.93***	0.25	-3.63	0.58***	0.19	2.94	0.49**	0.19	2.51
Age	0.03	0.19	0.18	0.01	0.12	0.16	-0.03	0.12	-0.26
Marital status	0.03	0.32	0.10	-0.26	0.21	-1.21	-0.04	0.21	-0.20
Unemployed	1.46**	0.75	1.92	0.14	0.47	0.30	0.11	0.47	0.24
Housewife	1.13*	0.68	1.66	-0.24	0.48	-0.50	-0.30	0.48	-0.63
Agriculturist	0.35	1.26	0.28	0.70	1.03	0.68	0.63	0.92	0.68
Government officer	0.37	0.57	0.66	-0.07	0.44	-0.16	-0.42	0.43	-0.97
Business/industry owner	0.61	0.51	1.19	0.22	0.39	0.56	0.00	0.39	0.01
Private employee	0.12	0.41	0.30	0.34	0.33	1.03	0.18	0.34	0.55

Table 4.12 (continued)

Variables	Casino			Underground Lottery			2-3 digit Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.
Education	-0.03	0.29	-0.12	-0.18	0.21	-0.90	0.35*	0.21	1.71
Income	0.48**	0.20	2.35	0.09	0.11	0.87	-0.03	0.11	-0.30
McF R^2	0.09	-	-	0.02	-	-	0.02	-	-
Akaike info criterion	0.87	-	-	1.40	-	-	1.40	-	-
Schwarz criterion	0.97	-	-	1.49	-	-	1.50	-	-
Hannan-Quinn criter.	0.91	-	-	1.43	-	-	1.44	-	-
F- stat	4.35			1.42			1.38		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Table 4.12 suggests the gamblers' characteristics that males are more likely to bet on casino but rarely bet on the underground lottery and the 2-3 digit lottery. Given the omitted category for occupation dummy is student, all coefficients on occupation variable are positive for casino betting, but only the coefficients of being unemployed and housewife are statistical significant, which means that, every occupation prefers to bet in casinos than students, particularly gamblers who are unemployed and housewife.

Highly educated gamblers preferred to bet on legal form of gambling in 2007, which was the 2-3 digit lottery. The income coefficient is statistical significant for casino betting, which implied that, gamblers who received higher income were more likely bet in casinos.

The next four models in Table 4.13 estimate the participation in each type of casino on the socio-economic and demographic data. There were 422 respondents who had claimed to be casino gamblers. The data of a number of children per family is added in each model as one of the explanatory variables. The estimated results of the type of home/flying casino are presented in column 1 to 3 and the results of the type of domestic permanent casino are presented in column 4 to 6. Column 7-9 and column 10-12 indicate the characteristics of casino gamblers who bet in casinos in neighbouring countries and casinos in other countries respectively.

Table 4.13: Determinants of gambler characteristics of casino betting in 2007

Column 1-3: The dependent variable is home/flying casino (0 = No, 1 = Bet); The independent variables are the socio-economic data
Column 4-6: The dependent variable is domestic permanent casino (0 = No, 1 = Bet); The independent variables are the socio-economic data
Column 7-9: The dependent variable is casino in neighbouring countries (0 = No, 1 = Bet); The independent variables are the socio-economic data
Column 10-12: The dependent variable is casino in other countries (0 = No, 1 = Bet); The independent variables are the socio-economic data
Occupation: there are 7 occupations and the control for occupation is the university student
Observations: 422 people

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	1.62	1.31	1.23	-5.12	1.63	-3.13	1.46	1.41	1.03	-11.65	2.04	-5.70
Gender	-0.23	0.24	-0.95	-0.07	0.35	-0.21	0.47*	0.26	1.77	0.02	0.30	0.09
Age	-0.45***	0.15	-2.83	0.08	0.24	0.31	0.73***	0.18	3.90	-0.10	0.19	-0.56
Marital status	0.40	0.29	1.37	-1.04**	0.45	-2.27	0.07	0.32	0.23	0.54*	0.32	1.65
Children	0.02	0.10	0.27	0.29**	0.14	2.08	-0.19*	0.11	-1.60	0.18	0.13	1.37
Unemployed	-1.66***	0.60	-2.75	-2.00**	0.97	-2.06	2.10***	0.63	3.33	1.68	1.12	1.49
Housewife	-2.27***	0.65	-3.49	-1.65*	0.99	-1.67	1.95***	0.69	2.82	1.92*	1.14	1.68
Agriculturist	-1.32	1.14	-1.15	0.87	1.38	0.62	2.07*	1.17	1.77	2.36*	1.45	1.62
Government officer	-1.38**	0.54	-2.53	-0.81	0.79	-1.01	3.17***	0.70	4.52	2.03*	1.12	1.80
Business/industry owner	-1.81***	0.50	-3.57	-0.39	0.64	-0.60	2.40***	0.57	4.16	1.37	1.07	1.27
Private employee	-1.09**	0.45	-2.38	-0.87	0.57	-1.53	1.41***	0.48	2.91	1.67*	1.04	1.60

Table 4.13 (continued)

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
Education	-0.20	0.25	-0.79	-0.33	0.37	-0.89	0.15	0.28	0.54	0.32	0.31	1.01
Income	0.01	0.14	0.04	0.39**	0.17	2.23	-0.38**	0.15	-2.41	0.83***	0.19	4.33
McF R^2	0.10	-	-	0.09	-	-	0.17	-	-	0.16	-	-
Akaike info criterion	1.27	-	-	0.71	-	-	1.08	-	-	0.95	-	-
Schwarz criterion	1.39	-	-	0.83	-	-	1.20	-	-	1.07	-	-
Hannan-Quinn criter.	1.31	-	-	0.76	-	-	1.13	-	-	1.00	-	-
F- stat	4.85			2.88			8.59			7.85		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10

According to the estimated models in Table 4.13, all coefficients in each model are not jointly zero. The results state that females and older gamblers are likely to bet in casinos in neighbouring countries. The coefficients on children variable are positively significant at the 5% significance level for the type of domestic permanent casino and negatively significant at the 10% significance level for the type of casino in neighbouring countries, interpreted that, gamblers who have children prefer the domestic permanent casinos to the casinos in neighbouring countries.

The variables of occupation group show that every occupation seems to rarely bet in home/flying casinos and domestic permanent casinos but be likely to bet in casinos in neighbouring countries and casinos in other countries than students. High income gamblers are unlikely to bet in casinos in neighbouring countries but likely to bet in domestic permanent casinos and casinos in other countries.

The age coefficients are highly statistical significant for home/flying casino and casino in neighbouring countries, and the marital status coefficients are negatively significant for domestic permanent casino and positively significant for casino in other countries. It can be interpreted that older casino gamblers rarely bet in home/flying casinos but are likely to bet in casinos in neighbouring countries. Given that between 36 and 50 of age is the omitted category for age dummy, most customers of home/flying casino are between 15 and 50 years of age, in particular, teenage gamblers who are between 15 and 22 years old. Regarding the customers of casinos in neighbouring countries, most of them are over 50 years old. In other words, there is a lack of teenage gamblers in the casinos in neighbouring countries (see Table 4H in Appendix 4A).

Married gamblers are unlikely to bet in domestic permanent casinos but likely to bet in casinos in other countries. With regard to the group of casino gamblers who being divorced/separated/widowed, gamblers who are married prefer casinos in other countries to the type of domestic permanent casino (see Table 4I in Appendix 4A).

In respect to the frequency of gambling, Tobit estimation is employed to estimate as the previous frequency estimation. The gambling frequency of each gambling type is the dependent variable in each model and the set of socio-economic and demographic data is treated as the independent variables. Column 1-3 in Table 4.14 show the results which correspond to casino, column 4-6 correspond to the underground lottery, and column 7-9 correspond to the 2-3 digit lottery.

Table 4.14: Determinants of gambling frequency of each gambling type in 2007

Column 1-3: The dependent variable is casino betting frequency; The independent variables are the socio-economic data
Column 4-6: The dependent variable is the underground lottery betting frequency; The independent variables are the socio-economic data
Column 7-9: The dependent variable is the 2-3 digit lottery betting frequency; The independent variables are the socio-economic data
Occupation: there are 7 occupations and the control for occupation is the university student

Variables	Casino (422 gamblers)			Underground Lottery (242 gamblers)			2-3 digit Lottery (250 gamblers)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.
C	3.01	1.07	2.78	0.67	1.16	0.57	1.18	1.14	1.03
Gender	0.14	0.20	0.69	-0.21	0.22	-0.98	-0.27	0.22	-1.22
Age	0.27**	0.13	2.11	0.22*	0.14	1.60	0.30**	0.14	2.14
Marital status	0.14	0.22	0.65	-0.01	0.22	-0.07	0.05	0.23	0.22
Unemployed	0.29	0.56	0.52	0.70	0.55	1.26	1.60***	0.55	2.86
Housewife	0.58	0.54	1.06	0.95*	0.54	1.75	1.12**	0.53	2.08
Agriculturist	1.13*	0.64	1.76	0.34	0.96	0.36	-0.21	0.94	-0.21
Government officer	-0.03	0.51	-0.07	0.32	0.60	0.52	1.59***	0.55	2.88
Business/industry owner	0.39	0.46	0.85	0.59	0.50	1.19	1.35***	0.49	2.76
Private employee	0.01	0.40	0.03	0.43	0.43	0.97	0.90**	0.43	2.08

Table 4.14 (continued)

Variables	Casino			Underground Lottery			2-3 digit Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.
Education	0.02	0.21	0.11	0.01	0.23	0.05	-0.65***	0.22	-2.91
Income	-0.20*	0.11	-1.82	0.08	0.12	0.64	-0.05	0.12	-0.46
R^2	0.05	-	-	0.06	-	-	0.22	-	-
$\bar{R}^2$	0.02	-	-	0.01	-	-	0.18	-	-
Akaike info criterion	3.67	-	-	3.61	-	-	3.35	-	-
Schwarz criterion	3.80	-	-	3.80	-	-	3.53	-	-
Hannan-Quinn criter.	3.79	-	-	3.69	-	-	3.42	-	-
F- stat	2.04			1.41			6.16		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The estimated models (Table 4.14) on the casino and the 2-3 digit lottery are significant at the 5% level and lower since *F*- statistics report to reject the hypothesis that the slope coefficients are jointly zero but the general model of underground lottery betting is poorly fitting. The regression results appear to have limited statistical significance between the level of gambling frequency and the groups of casino and the underground lottery. The age variable seems to be the best factor to predict the frequency of these three gambling types. It shows that older gamblers frequently bet on these three gambling types rather than young gamblers. Housewives and gamblers who are unemployed, government officer, business/industry owner, and private employee have a higher level of frequency betting on the 2-3 digit lottery, compared with students. The result also reports that education is a factor which can explain the frequency of 2-3 digit lottery betting. Highly educated gamblers have a decreasing frequency of 2-3 digit lottery betting.

As regards the relation between the reasons for gambling and the frequency of gambling, the reason of gambling for the extra income is obviously the significant factor that leads to an increase in the frequency of betting on these three gambling types (see Table 4J in Appendix 4A).

The link of the frequency of gambling among gambling games is also reported in Table 4.15 - 4.17. The gambling frequency is treated as the dependent variable and the gambling participation in each gambling type is treated as the independent variable.

4.15. Casino

The dependent variable is the frequency of casino betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	1.93	0.15	12.58
Underground lottery	-0.12	0.23	-0.54
2-3 digit lottery	-0.07	0.23	-0.32

4.16. Underground Lottery

The dependent variable is the frequency of underground lottery betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	1.60	0.23	6.77
Casino	0.75***	0.24	3.06
2-3 digit lottery	0.10	0.23	0.46

4.17. 2-3 digit Lottery

The dependent variable is the frequency of 2-3 digit lottery betting
The independent variables are the participation in each gambling activity
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Variables	Coef.	Std. Error	Z-stat
C	0.52	0.27	1.93
Casino	1.02***	0.26	3.87
Underground lottery	0.50**	0.23	2.13

Gamblers who bet in casinos seem to frequently bet on other gambling types. As previously mentioned, other gambling types can be easily provided in casino, especially the illegal gambling form such as the underground lottery. This result is strong support for the supplementary effect of casino betting. The result also indicates that gamblers who bet on the underground lottery also frequently bet on the 2-3 digit lottery. In this case, it might be said that, for the same type of game such as the underground lottery and the 2-3 digit lottery, one being illegal and the other legal, general gamblers who bet on the legal one may not demand the illegal one but the gamblers who bet on the illegal one probably bet on the legal one as well. Most gamblers in the latter group are the underground lottery agents. In general, the underground lottery agents reduce their risks by betting on the 2-3 digit lottery with the same betting numbers which they received from their customers.

The regression results also report the link between the frequency of casino gambling and the participation in each casino type. The independent variables now are the participation of each casino. The results report that casino gamblers who bet in home/flying casinos, casinos in neighbouring countries, and casinos in other countries have high frequency level of casino betting (see Table 4K in Appendix 4A).

Table 4.18 shows the regression results which are estimated from the 2008 survey data. The dependent variable for the results in column 1-3 is the previous gambling participation whereas for the results in column 4-6 is the past 12 months gambling participation. The explanatory variables of both models are the set of socio-economic data, gambling experiences, and the opinions on gambling.

Table 4.18: Determinants of gambler characteristics in 2008

Colum 1-3: The dependent variable is gambling participation (0 = No bet, 1 = Bet)
The independent variables are the socio-economic data, gambling experience, and gambling opinion
Colum 4-6: The dependent variable is gambling participation in the past 12 month (0 = No bet, 1 = Bet)
The independent variables are the socio-economic data, gambling experience, and gambling opinion
Observations: 2,883 people

Variables	Ever gambled			Gambled last 12 month		
	(1) Coef.	(2) Std. Error	(3) *Z*-stat	(4) Coef.	(5) Std. Error	(6) *Z*-stat
C	0.09	0.92	0.10	-1.30	0.81	-1.59
Gender	-1.32***	0.10	-12.54	-1.22***	0.08	-14.24
Age	0.06***	0.02	2.81	0.06***	0.02	3.32
Education	-0.86***	0.22	-3.89	-0.53***	0.20	-2.62
Live	0.22**	0.10	2.19	0.13	0.09	1.47
Personal income	0.17*	0.09	1.91	0.11	0.08	1.36
Family member	0.03	0.03	0.83	0.06*	0.03	1.81
Family income	0.02	0.05	0.35	0.03	0.05	0.63
C36	0.43***	0.10	3.98	0.32***	0.09	3.45
C37	-1.29***	0.13	-9.87	-1.09***	0.10	-10.84
C38	-0.22**	0.12	-1.77	-0.36***	0.10	-3.50
C39	-0.68***	0.15	-4.37	-0.49***	0.11	-4.23
C310	0.24**	0.11	2.16	0.29***	0.10	2.86
C311	-0.03	0.09	-0.36	0.11	0.08	1.26
McF R^2	0.17	-	-	0.17	-	-
Akaike info criterion	0.94	-	-	1.15	-	-
Schwarz criterion	0.97	-	-	1.18	-	-
Hannan-Quinn criter.	0.95	-	-	1.16	-	-
F-stat	54.47			62.55		

Note: McF R^2 is McFadden R-squared
F-statistic for the null hypothesis that all slope coefficients are jointly zero
Live:0=with family/relative 1= alone/with friend c36= parents ever gambled? (0=No, 1=Bet)
c37= gambling has caused household financial problems? (0=No, 1=Yes)
c38= gambling is a bad activity? (0=No, 1=Yes) c39= gambling is dangerous for family life? (0=No, 1=Yes)
c310= gambling is good for communities? (0=No, 1=Yes)
c311= government should ban all types of gambling? (0=No, 1=Yes)
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

These two models are significant since the hypothesis that all slope coefficients are jointly zero is rejected. Table 4.18 suggests that male and older students are more likely to gamble than female and younger students. Masters students seem not to prefer to gamble while students who live independently or with their friends probably gamble rather than students who live with their family. The number of family member is also one of the variables in these models, which the coefficient has a positive sign, interpreted that responsibility student who has a relatively bigger family is more likely to gamble than student who has a smaller family. Regarding an income factor, students who receive relatively higher income or whose family receives high income do prefer to gamble.

It can be indicated that parents' gambling participation affects their children as the result which is insisted that students who have parents ever gambled are likely to gamble as well. The results also state students who have believed that gambling has caused household financial problem, gambling is a bad activity, and gambling is dangerous for family life rarely gamble. Unlike the latter student group, students who believe that gambling is good for their community seem to be more likely to bet. The idea that government should ban all types of gambling is also reported but, unfortunately, it is not statistically significant.

The next models in Table 4.19 are employed to evaluate the characteristic of student who prefer to gamble. There were 1,504 students who had participated in gambling in the 2008 survey. In each model, the dependent variable is the participation in each gambling type and the explanatory variables are the data of socio-economic characteristics, gambling experiences, and the opinions on gambling.

Table 4.19: Determinants of gambler characteristics of each gambling type in 2008

Colum 1-3: The dependent variable is casino betting (0 = No bet, 1 = Bet);The independent variables are the socio-economic data, gambling experience, and gambling opinion
Colum 4-6: The dependent variable is football betting (0 = No bet, 1 = Bet);The independent variables are the socio-economic data, gambling experience, and gambling opinion
Colum 7-9: The dependent variable is the government lottery (0 = No bet, 1 = Bet); The independent variables are the socio-economic data, gambling experience, and gambling opinion
Colum 10-12:The dependent variable is the 2-3 digit lottery (0 = No bet,1= Bet);The independent variables are the socio-economic data, gambling experience, and gambling opinion
Colum 13-15:The dependent variable is the underground lottery (0 = No bet, 1 = Bet); The independent variables are the socio-economic data, gambling experience, and gambling opinion
Observations: 1,504 people

Variables	Casino			Football Betting			Government Lottery			2-3 Digit Lottery			Underground Lottery		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.
C	-0.88	1.34	-0.65	0.41	1.81	0.22	-5.80	1.19	-4.87	-6.17	1.30	-4.73	-2.06	1.18	-1.74
Gender	-0.56***	0.14	-3.77	-4.02***	0.22	-17.59	0.22*	0.12	1.83	0.31**	0.15	2.05	0.14	0.12	1.10
Age	-0.12***	0.02	-4.52	0.00	0.04	0.01	0.17***	0.02	5.89	0.15***	0.02	5.30	0.12***	0.02	4.87
Education	-0.19	0.28	-0.69	-0.93**	0.42	-2.21	0.19	0.26	0.74	-0.48*	0.29	-1.65	-0.00	0.25	-0.00
Live	-0.10	0.15	-0.64	0.32	0.21	1.51	0.23**	0.12	1.95	0.17	0.15	1.12	0.09	0.13	0.71
Personal income	0.11	0.14	0.81	0.13	0.18	0.69	0.25**	0.11	2.14	0.10	0.14	0.69	0.05	0.13	0.41
Family member	0.04	0.06	0.65	-0.02	0.07	-0.33	0.07*	0.04	1.60	0.15***	0.05	2.71	0.02	0.05	0.55
Family income	0.36***	0.09	3.84	-0.04	0.11	-0.34	-0.16**	0.07	-2.33	-0.12	0.09	-1.42	-0.27***	0.07	-3.48
B212	0.31**	0.14	2.13	-	-	-	-	-	-	-	-	-	-	-	-
B214	0.80***	0.15	5.26	-	-	-	-	-	-	-	-	-	-	-	-
B215	-	-	-	2.94***	0.27	10.63	-	-	-	-	-	-	-	-	-
B217	-	-	-	-0.02	0.25	-0.11	-	-	-	-	-	-	-	-	-

Table 4.19 (continued)

Variables	Casino			Football Betting			Government Lottery			2-3 Digit Lottery			Underground Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.	(13) Coef.	(14) Std. Error	(15) Z-Stat.
C36	-	-	-	-		-	0.16	0.11	1.37	0.29**	0.15	1.95	0.38***	0.12	3.00
C312	-	-	-	-		-	0.38***	0.14	2.60	0.64***	0.19	3.23	0.28*	0.15	1.84
McF R^2	0.11	-	-	0.63	-	-	0.13	-	-	0.06	-	-	0.07	-	-
Akaike info criterion	0.82	-	-	0.46	-	-	1.15	-	-	0.81	-	-	1.05	-	-
Schwarz criterion	0.85	-	-	0.50	-	-	1.18	-	-	0.84	-	-	1.08	-	-
Hannan-Quinn criter.	0.83	-	-	0.48	-	-	1.16	-	-	0.82	-	-	1.06	-	-
F-stat	22.87			359.06			34.56			10.47			14.18		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
b212= agree/disagree with the government to legalise casino business (0 = Disagree, 1 = Agree) b214= parents ever/never bet on casino (0=No, 1=Bet)
b215= agree/disagree with the government to legalise football gambling (0 = Disagree, 1 = Agree) b217= parents ever/never bet on football betting (0=No, 1=Bet)
c36= parents ever gambled? (0=No, 1=Bet) c312= agree after the government issued 2-3 digit lotteries? (0 = Disagree, 1 = Agree)

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Males prefer to bet in casino and on football while females prefer to bet on the number games such as the government lottery and the 2-3 digit lottery. Older students seem to rarely bet on casino but are likely to bet on the other types, in particular, the number games betting. The variables of education and living arrangements have limited statistical significance. They can be interpreted that master students do not prefer to gamble on football and the 2-3 digit lottery but students who live independently or with friends prefer to bet on the number games.

The number of family member affects only the 2-3 digit lottery and the government lottery betting. Both coefficients have positive signs, which means, students are from a big family probably bet on these two types. With regard to the variables of both personal and family incomes, the increase in both incomes leads to increase in a gamble on the legal form. High personal incomes, apparently, lead to gamble on the government lottery while high family incomes lead to gamble on the government lottery and the 2-3 digit lottery. The opinion of agree/disagree for legalising gambling business and the gambling behaviour of students' parents are also reported. Students who agree with legalising the gambling type that they gamble considerably bet on that gambling type. For example, students who agree with legalising the casino business prefer to bet in casinos, or students who agree with the government to issue the 2-3 digit lottery prefer to bet on the number games.

Moreover, students, whose parents have gambled in casinos, are likely to bet in casinos. Likewise students, whose parents have gambled, are likely to bet on the number games as well. Unlike the latter group, students whose parents have never gambled on football seem to be likely to bet on this gambling type. This may be because football is not popular for old gamblers.

The participation in gambling is also estimated on the respondents' experiences. The independent variables of the present models are the data group of gambling experiences and gambling opinions whereas the dependent variable is gambling participation.

According to the regression results (see Table 4L in Appendix 4A), students whose studies are affected by gambling seem to stop gambling on casino and football. Students who gamble on the number games still gamble even though they face a bad effect on their study. It is probably because the bad effect from betting on the number games is less dangerous than the effect from gambling in a casino and on football. The result also apparently shows that students who gamble on football and the number games, especially the government lottery, always think about the gambling in sense of reliving past gambling experiences or planning the next time of betting. This does not hold true for casino betting. This may be because football betting and the number games need the information, such as previous results of the football match or some information of football players for football betting, or previous results of winning number for number games betting.

Students who face financial problems because of gambling decide to stop gambling on casino and football, but not on the number games. This should be because an amount of money which is staked on the number games is not huge as on casino and football. It probably implies that betting on the number games may not cause serious financial problems. Ironically, students who feel guilty on gambling or accept that gambling is a bad activity still gamble on every type of gambling except casino betting. Debt due to gambling is also considered and it is significant for casinos, the government lottery, and the underground lottery. It shows that students who are in debt because of gambling decide to stop betting on casino but still continue to bet on the other games. It may be because the stake of casino betting is huge and if a gambler faces a financial problem due to the debt, it is difficult for a gambler to bet on casino. Unlike, football betting or the underground lottery, credit is not available in casinos.

Table 4.20 illustrates the characteristics of casino gamblers in each type of casino. The dependent variable of these four models is the participation in each casino type while the explanatory variables are the socio-economic data and the opinion on agree or disagree to the casino legalisation. The results in column 1-3 and in column 4-6 relate to the type of home/flying casino and domestic permanent casino respectively, whereas column 7-9 and column 10-12 report the regression results which relate to the casinos in neighbouring countries and in other countries.

Table 4.20: Determinants of casino gambler characteristics in 2008

Column 1-3: The dependent variable is home/flying casino (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting
Column 4-6: The dependent variable is domestic permanent casino (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting
Column 7-9:The dependent variable is casino in neighbouring countries (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting
Column 10-12: The dependent variable is casino in other countries (0 = No, 1 = Bet); The independent variables are the socio-economic data and agree/disagree to legalise casino betting
(0 = disagree, 1 = agree)
Observations: 1,245 people

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	46.59	4.22	11.02	-20.81	1.81	-11.48	-16.12	1.64	-9.80	-21.14	2.09	-10.11
Gender	0.05	0.17	0.29	0.27**	0.13	1.97	-0.23	0.15	-1.50	-0.19	0.23	-0.82
Age	-0.01	0.05	-0.25	-0.01	0.03	-0.35	0.00	0.03	0.06	0.06	0.03	1.54
Education	0.79**	0.45	1.75	-0.79**	0.33	-2.38	-1.73***	0.40	-4.26	-1.16***	0.42	-2.76
Live	-0.12	0.17	-0.73	-0.10	0.13	-0.74	0.15	0.15	1.02	-1.08***	0.28	-3.78
Personal income	-4.60***	0.50	-9.04	2.20***	0.22	9.96	1.49***	0.18	8.03	1.36***	0.22	6.14
Family member	-0.15**	0.07	-2.11	0.04	0.05	0.79	0.05	0.05	0.92	0.06	0.09	0.66
Family income	-0.23**	0.10	-2.19	0.05	0.08	0.70	0.10	0.09	1.09	0.40***	0.12	3.26

Table 4.20 (continued)

Variables	Home/flying Casino			Domestic Permanent Casino			Casino in Neighbouring Countries			Casino in Other Countries		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
	Coef.	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**
B212	-0.34*	0.18	-1.87	-0.04	0.13	-0.34	0.24	0.15	1.58	0.67***	0.24	2.79
McF R^2	0.49	-	-	0.20	-	-	0.11	-	-	0.19	-	-
Akaike info criterion	0.66	-	-	1.10	-	-	0.99	-	-	0.47	-	-
Schwarz criterion	0.70	-	-	1.13	-	-	1.03	-	-	0.50	-	-
Hannan-Quinn criter.	0.67	-	-	1.11	-	-	1.01	-	-	0.48	-	-
F-stat	230.33			55.70			19.71			30.82		

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero
b212= agree/disagree with the government to legalise casino business (0 = Disagree, 1 = Agree)

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

All models in Table 4.20 are highly significant since the hypothesis that all slope coefficients are jointly zero is rejected. Although most variables appear to have limited statistical significance, they suggest that female students seem to be likely to bet in the domestic permanent casinos. Masters students may not prefer to bet on every types of casino, except the style of home/flying casino. Personal income also affects casino betting, which can be interpreted that high personal income students prefer to bet on every casino type except the type of home/flying casino. Likewise student, whose family has a high level income, prefer the casinos in other countries to the home/flying casinos. The regression results also state that students who have a big family are unlikely to bet on home/flying casino. Students who support to legalise the casino business do not prefer to bet on home/flying casino while the casinos in other countries is popular for these students.

The frequencies of betting on each gambling type are also reported by Table 4.21. As usual, Tobit estimation is employed to model the frequency of gambling which is the dependent variable. The explanatory variables of the model are the data of socio-economic and demographic, gambling experiences, and gambling opinions. It should be noted that there is no the modeling of football betting frequency. This is because, as mentioned above, it is too difficult and maybe created the confusion for the respondents to assess their frequency of football betting. This experience had been learnt by re-analysing the data of the 2002 survey.

Table 4.21: Determinants of gambling frequency of each gambling type in 2008

Column 1-3: The dependent variable is the casino betting frequency; The independent variables are the socio-economic data, gambling opinion, and gambling experience
Column 4-6: The dependent variable is the government lottery betting frequency; The independent variables are the socio-economic data, gambling opinion, and gambling experience
Column 7-9: The dependent variable is the 2-3 digit lottery betting frequency; The independent variables are the socio-economic data, gambling opinion, and gambling experience
Column 10-12: The dependent variable is the underground lottery betting frequency; The independent variables are the socio-economic data, gambling opinion, and gambling experience

Variables	Casino (1,245 students)			Government Lottery (548 students)			2-3 Digit Lottery (231 students)			Underground Lottery (367 students)		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	-1.07	1.62	-0.66	-1.38	2.16	-0.63	2.46	3.58	0.68	-1.51	2.14	-0.70
Gender	-0.80***	0.18	-4.37	-0.49**	0.24	-2.02	-0.34	0.35	-0.95	-0.61**	0.25	-2.37
Age	0.05	0.04	1.24	0.09***	0.04	2.25	0.14**	0.06	2.40	0.15***	0.04	3.45
Education	-0.61	0.41	-1.47	-0.20	0.45	-0.45	-0.37	0.65	-0.56	-0.94**	0.46	-2.03
Live	0.32*	0.17	1.89	0.11	0.25	0.46	0.41	0.35	1.17	-0.11	0.27	-0.40
Personal income	0.04	0.16	0.27	0.36*	0.22	1.67	-0.31	0.32	-0.96	-0.04	0.23	-0.18
Family member	-0.01	0.07	-0.20	-0.08	0.09	-0.88	-0.19*	0.11	-1.65	0.06	0.09	0.69
Family income	-0.04	0.09	-0.41	-0.41***	0.14	-2.79	-0.24	0.23	-1.05	-0.09	0.16	-0.59

Table 4.21 (continued)

Variables	Casino			Government Lottery			2-3 Digit Lottery			Underground Lottery		
	(1) Coef.	**(2) Std. Error**	**(3) Z-Stat.**	**(4) Coef.**	**(5) Std. Error**	**(6) Z-Stat.**	**(7) Coef.**	**(8) Std. Error**	**(9) Z-Stat.**	**(10) Coef.**	**(11) Std. Error**	**(12) Z-Stat.**
B212	0.37**	0.17	2.11	-	-	-	-	-	-	-	-	-
C312	-	-	-	0.51	0.33	1.51	0.61	0.52	1.16	0.21	0.32	0.65
C34	0.24***	0.05	4.35	-0.48	0.80	-0.60	0.78	1.06	0.73	-0.25	0.72	-0.34
R^2	0.02	-	-	0.07	-	-	0.06	-	-	0.05	-	-
$\bar{R}^2$	0.01	-	-	0.06	-	-	0.02	-	-	0.03	-	-
Akaike info criterion	2.93	-	-	2.74	-	-	2.84	-	-	3.22	-	-
Schwarz criterion	2.97	-	-	2.82	-	-	3.01	-	-	3.33	-	-
Hannan-Quinn criter.	2.94	-	-	2.77	-	-	2.91	-	-	3.26	-	-
F-stat	2.51			4.83			1.61			2.34		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero

b212= agree/disagree with the government to legalise casino business (0 = Disagree, 1 = Agree) c34= currently in debt because of gambling? (0 = No, 1 = Yes)
c312= agree after the government issued 2-3 digit lottery? (0 = Disagree, 1 = Agree)

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Only the estimated model for the 2-3 digit lottery is a poor fit since the null hypothesis that all slope coefficients are jointly zero is not rejected. Table 4.21 suggests that male students frequently bet on every gambling type than female students and older students frequently bet on every gambling type than younger students as well. Masters students bet less frequently than undergraduate students, especially the underground lottery betting which the coefficient is significant at the 5% significance level. Students who live independently or with friends often bet in a casino and other gambling types, except the underground lottery betting. This result is sensible because students who live alone or with friends seem to have more chance in gambling than students who live with their families. The personal income has a significantly positive effect on the frequency of purchasing a government lottery ticket, increasing in income leads to increase in the frequency of the purchase. In contrast, the family income has a significantly negative effect on the frequency of the purchase, that is, high family income leads to low frequency of gambling on the government lottery.

The family member coefficient has a negative sign and statistical significance for the 2-3 digit lottery, which can be inferred that, students who are from a big family do not often bet on this game. According to the students' opinion on legalising gambling business, all coefficients on this variable have positive signs but only for casino betting, that the coefficient is statistically significant. It can be implied that students who agree with this proposition have the increasing frequency of gambling, particularly the students who bet in casinos. There is another factor that should be mentioned, which is the debt. The regression result can be interpreted that students who are in debt do often bet on casino but infrequently bet on the other types. It may be because a chance for gambling on casino is higher than gambling on the number games, which draw two times a month on average. Thus, most gamblers who hope to recover their lost money from gambling, it might be said that casino betting seems to be the first choice for them.

As above, the link between the gambling frequency and the gambling types are also reported by using the data from the 2008 survey. The dependent variable of these models has not changed but the explanatory variables are changed to be the participation of gambling on each gambling type. The results are shown between Table 4.22 and 4.25.

4.22. Casino

The dependent variable is the frequency of casino betting
The independent variables are the participation in each gambling activity

Variables	Coef.	Std. Error	Z-stat
C	-0.86	0.18	-4.64
Football betting	1.04***	0.19	5.43
Government lottery	-0.09	0.21	-0.42
2-3digit lottery	0.24	0.28	0.87
Underground lottery	0.05	0.23	0.23

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

4.23. Government lottery

The dependent variable is the frequency of government lottery betting
The independent variables are the participation in each gambling activity

Variables	Coef.	Std. Error	Z-stat
C	-0.71	0.28	-2.49
Casino	-0.48*	0.27	-1.77
Football betting	0.65**	0.26	2.41
2-3digit lottery	0.16	0.28	0.60
Underground lottery	0.56**	0.27	2.08

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

4.24. 2-3 digit lottery

The dependent variable is the frequency of 2-3 digit lottery betting
The independent variables are the participation in each gambling activity

Variables	Coef.	Std. Error	Z-stat
C	-2.37	0.61	-3.83
Casino	-0.03	0.39	-0.07
Football betting	0.56	0.37	1.50
Government lottery	1.15**	0.47	2.43
Underground lottery	1.41***	0.40	3.52

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

4.25. Underground lottery

The dependent variable is the frequency of underground lottery betting
The independent variables are the participation in each gambling activity

Variables	Coef.	Std. Error	Z-stat
C	-0.29	0.35	-0.84
Casino	-0.42	0.30	-1.40
Football betting	0.86***	0.28	3.02
Government lottery	0.75***	0.29	2.57
2-3 digit lottery	0.20	0.26	0.78

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

Regarding the results, it can be seen that students who bet on one type of the number games also frequently bet on the other two types. Students, for example, who bet on the underground lottery also frequently bet on the government lottery and the 2-3 digit lottery. Hence it can be indicated that there is a supplementation effect among the number games. Students who gamble on football seem to often bet on every gambling type while students who bet on casino less frequently bet on the number games, especially on the government lottery.

According to the 2008 survey, there is a set of questions which mention the reasons of betting on casino. In the present models, the independent variable is the frequency of casino betting while the explanatory variables are the set of reasons of casino betting. The regression results show that most students frequently bet on casino because they prefer to risk and hope to earn the extra income. However, students who bet on casino for entertaining themselves seem to have low betting frequency (see Table 4M in Appendix 4A).

The link between the frequency of gambling and the casino types is also studied, but unfortunately, all coefficients on the independent variables are not statistically significant. Thus it can be said that the participation in each casino type is not the significant factor of casino gambling frequency in the 2008 survey.

4.4 Discussion

The regression result from those three surveys may be difficult to compare directly because of variation in some factors such as age groups and population characteristics. Moreover, some indirect factors also influence the survey result, such as law enforcement, government policies on gambling. For example, during the period when law enforcement on gambling is weak, such as between 1996 and 1998, people seem to participate more in gambling than in other periods such as between 2000 and 2001 (see Table 3C in Appendix 3A) (Sungsidh *et al.,* 2003). These two different situations probably create two different respondent's answers even though the same question being asked. It should be emphasised that most gambling activities in Thailand are illegal.

In the case that the survey result might be affected by the government policy, for instance, the first survey (the 2002 survey) was conducted before the government issued the 2-3 digit lottery while the second survey (the 2007 survey) was conducted after the government legalised the underground lottery betting by issuing the 2-3 digit lottery project, and the third survey (the 2008 survey) was undertaken after the 2-3 digit lottery has been suspended. It can be realised that the respondents' answers, such as the gambling behavior, gambling attitude, vary in these three periods due to the fluctuating gambling sentiment.

Although the groups of result cannot be directly compared, they can indicate the trend of gambler characteristics in the past and present, and may be able to use to predict the future situation. In this sense, it is probably useful for those who are a policy maker.

According to the regression results, men participate in gambling activity rather than women. The particular gambling types which attract to men are casino and football betting while women prefer to bet on the number games such as the government lottery, the underground lottery, and the 2-3 digit lottery. This result is similar to the survey result which is stated in Sungsidh *et al.* (2003). They stated that, in 2002, 75% and 97% of population who bet in casino and on football, respectively, were males while 55% and 50% of population who bet on the underground lottery and the government lottery, respectively, were females. It can be said that women like to bet on the gambling type which is not needed a technical skill. Moreover, there is probably a macho mindset in some types of gambling, such as casino, football betting, that leads males to participate than females.

Most people who participate in gambling have age between 15 and 50 years old. Regard to the customer age of each gambling business, most customers of casino and football betting are 15-50 years old while most customers of the number games are aged between 36-50 years old. In the 2008 survey, the respondents were asked their age which they started gambling on casino. It can be found that most of them start gambling at 15 years old. The structure of Thai gambler age seems to be similar to Canadian gamblers. MacDonald *et al.* (2004) indicates that higher gambling rate in Canada are found in middle age household groups and gamblers, who have aged 65 and over, have the lowest incident of gambling while Brenner (1986) states that the group of Canadian gambler, who have aged 45 and over, play the most important role in lottery ticket, nearly similar to New York and New Jersey, which the large age group of lottery gamblers is 41 years old and over. He also explains that people at around this age may realise that they cannot achieve their expected position in the wealth distribution through their customary behaviour hence they may start to participate in gambling.

Education seems to help people neglect or reduce the gambling. Although some highly educated people prefer to gamble, they seem to prefer to gamble on legal gambling type such as the government lottery, casinos in other countries. Moreover, the results also indicate that the underground lottery and some types of casino, such as a home/flying casino, are popular for people who have relatively lower education. It can be found similar evidences in the US, U.K., and Canada studies, which illustrate that the lower the level of education, the greater the proportion of gamblers' wealth will be spent on gambling, especially on the number games. This may be because general people who have a less formal education level may have a low level of wealth. To achieve their expectations, gambling may be one of the alternatives, and the gambling game which attracts poor people should be the type that a small price is paid for betting but win a big prize, thus the number games are popular among poor gambler (Brenner, 1986; Farrell and Walker, 1999; MacDonald *et al*., 2004).

In respect to the characteristic of marital status, the group of people who are married have a higher probability of gambling participation than the group of people who are single, divorced/separated/widowed. Married gamblers prefer to bet on the number games, which seems to be less harmful than casino and football betting which are popular for single gamblers. It might be said that single gamblers prefer to risk rather than married gamblers.

Similar evidence is studied by Farrell and Walker in 1999 which indicated that, in the U.K., gamblers who are single, divorced, separated, and widowed bet less on lotto.

It does not doubt that every occupation has a higher probability of gambling participation rather than students. Focusing on the casino participation of students, the results in 2002 suggest that students prefer to bet in domestic permanent casinos and the results in 2007 suggest that student prefer to bet in both types of home/flying casino and domestic permanent casino. In the 2008 survey, the results report that 83% of students prefer to bet on casino while 66% and 42% of students who bet on casino are likely to bet in home/flying casinos and domestic permanent casinos, respectively. It can be analysed that while older casino gamblers changed to bet in casinos in neighbouring countries where they become popular among Thai gamblers since 2003, a number of students who bet in the domestic casinos, such as home/flying casinos, and domestic permanent casino, tended to increase. However, the result states that relatively higher income gamblers seem to rarely bet in home/flying casinos since this casino type can be evaluated as a non-standard casino, regarding the place and the games provided.

The respondents, who agree with the gambling legalisation, have the high probability of gambling participation as same as the group of respondents who have either of parents gamble. It might be assumed that gambling behaviour is a kind of imitated behaviour like the behaviours of cigarette smoking or alcohol drinking. Giacopassi *et al.* (2006) find that one of motives of American under-age gambler is their parents. A large percentage of under-age, in fact, visited a casino with family members. This practise tends to increase in the view that gambling is an accepted activity within the society.

The respondents, who agree for casino legalisation, prefer to bet on the types of casino in neighbouring countries and casino in other countries. It is probably implied that if government decides to legalise casino business, to capture the demand for casino gambling, the legal casino should be established in the style of casino complex or super casino same as casinos in Las Vegas, in Australia, not in the style of small casino such as casinos in the U.K.

Considering on gambling frequency, the characteristics of people who have high probability of gambling participation are same as the characteristics of people who have high frequency of gambling. In other words, the frequency of gambling depends on the probability of gambling participation. For example, males have a higher probability of gambling participation also have a higher frequency of gambling than females. Highly educated people are unlikely to gamble also infrequently gamble in any types of gambling.

Gamblers, who have received relatively lower income, frequently bet in casinos rather than gamblers who are relatively richer. This result is supported by Perfetto and Woodside (2009), which indicated that 35 gamblers (14%) of the 244 extremely frequent casino gamblers in the U.S. are from very low income households, while 10% are from high income households.

The regression result also reports that old gamblers have a high frequency of gambling on the number games. This finding is similar to Canada study which reports that almost half of frequent lottery customers are in the 45-60 age range (Brenner 1986).

All respondents who gamble were asked the reasons for gambling. The results suggest that most gamblers frequently gamble for the extra income, particularly who bet on the number games. Undoubtedly, this is because the number game is the game that required a low stake but attracting with the high return. Some gamblers frequently bet because they gamble as doing a business. Most gamblers in this group are gambling agents or operators and being a customer at the same time. For example, they collect bets from the customer and also stake their own bets then pass them to the other operators, likewise the networks of football betting, or the underground lottery. For some gamblers, who gamble for entertaining, would have low frequency of gambling. It can be said that these gamblers probably think gambling is one of leisure activities. Sungsidh *et al.* (2003)'s survey reports that 83% of gamblers declared that they gambled for the risk while 31% of this group gamble for entertaining (see Table 4N in Appendix 4A)

The participation in one type of gambling also affects the frequency of betting in other types. For instance, people who bet on casino seem to frequently bet on other gambling types, specifically the illegal gambling games. This is because the illegal gambling activities are always provided for the customers in most casinos, such as the domestic permanent casinos, and casinos in neighbouring countries. For example, casinos in neighbouring countries and most domestic permanent casinos provide a live broadcast of football matches and operate football betting for their customers who prefer to gamble on football. Some domestic permanent casinos and home/flying casinos provide the underground lottery for their customers. Likewise some casinos in neighbouring countries operate their own number game like the 2-3 digit lottery. It is drawn every 2-3 hours a day. This finding leads to the issue of the substitution effect and supplementation effect among the gambling types.

Marfels (1997) studies on the substitution and supplementation effects between casino gaming and the video lottery terminal (VLTs) in Canada. He stated that the substitution effect is valid in the case that two products compete for the same consumer's money while the supplementation effect is based on two products enlarging the demand and increasing the overall market.

Marfels found no indication of a substitution effect between these two gambling types, based on 2 reasons. Firstly, the discretionary consumer expenditures still increase after introducing VLT play. There are some evidences to show that no negative sales impact on casino gaming from the introduction of VLT gaming. Secondly, the different characteristics between casino and VLT gaming. VLT play is casual play in a casual atmosphere with low steaks while casino play is high steaks play in a formal atmosphere. Casino is opposite of the dimension from VLT such as a variety of gaming devices, a richer selection of table games. Furthermore, VLT players are between 19 and 29 years old with high school education while casino customers are 40 to 60 years old with college education.

Base on Marfels's study and the regression results in this chapter, it can be concluded that there is the supplementation effect of casino betting on other gambling types, regarding the second reason in Marfels's work, and there is also the supplementation effect among the number games, regarding the first reason of Marfels.

4.5 Conclusions

In this chapter, Logit and Tobit estimation techniques were applied for evaluating the characteristics of Thai gambler and the frequency of gambling. Logit regression estimation was used to estimate gambler characteristics while Tobit estimation was used for estimating of gambling frequency. These are because Logit estimation is applicable to the discrete dependent variable, and Tobit estimation is suitable for the censored dependent variable.

Thus it used to estimate data for the (censored) sample of gamblers only. The data used obtains from three surveys, the 2002, the 2007, and the 2008 survey.

To categorise the gambler characteristics, the models are tested by regressing gambling participation on the data groups of socio-economic nature, gambling opinions, and gambling experiences. Similarly to evaluate the frequency level of gambling, the same data groups are used as the explanatory variable while the dependent variable is the gambling frequency. The model which is tested for estimating the gambling frequency adapted from the model which is employed to estimate the gambling expenditures such as household lottery expenditures.

Although there appear to have limited statistical significance between the dependent and independent variables in some models, the regression results can illustrate the trend of gambling behavior and other gambling issues. The results suggest that males have a higher level of gambling participation than females. Married people are likely to gamble on the gambling types which have a low level of risk, such as the number games, whereas people who are single prefer to bet on the games which have a relatively higher level of risk such as football betting. Students prefer home/flying casinos and domestic permanent casinos to casinos in neighbouring and in other countries.

The results also reveal that the structure of Thai gamblers' characteristics is similar to gamblers' characteristics in other nations such as Canadian gamblers, Australian gamblers, U.K. gamblers, and American gamblers. The gambling frequency relates to the probability of gambling participation in the same direction. For example, people, who have a high education level, rarely participate in a gamble also have a low level of gambling frequency. Moreover, some regression results here are inferred to support for the supplementation effect of casino betting on other gambling types, and found no evidence of the substitution effect among gambling games.

Gambling activity has spread over the Thai society. The number games are popular among the old people while football betting is popular for the young. Additionally, most customers of casinos in Thailand, in the past, were aged people, nowadays, the number of adolescents who bet in the domestic casinos, both types of home/flying casino and domestic permanent casino, has significantly increased.

Finally, it can be concluded that this study attempts to fill a void in Thai gambling studies. The results from this study may be useful for policy makers or anyone who has an interest in the impact of gambler characteristics on gambling demands and gambling participation.

Appendix 4A

Table 4A: The percentage of population who ever or never gambled in the past

	Bangkok and the vicinities	The provinces (inside the municipal area)	The provinces (outside the municipal area)	Nationwide
Never	23.13	23.02	28.25	26.10
Ever	76.87	76.98	71.75	73.90
Total	100	100	100	100

Source: Sungsidh *et al*., 2003

Table 4B: The percentage of population who had ever or never gambled in the last 12 months

	Bangkok and the vicinities	The provinces (inside the municipal area)	The provinces (outside the municipal area)	Nationwide
Never	32.73	31.75	36.23	34.58
Ever	67.27	68.25	63.77	65.42
Total	100	100	100	100

Source: Sungsidh *et al*., 2003

Table 4C shows the characteristics of gambler status in 2002

Variables	Ever gambled		Gambled last 12 month	
	Coef.	*Z*-stat	Coef.	*Z*-stat
C	1.33	9.78	0.58	5.02
Single	-0.86***	-5.94	-0.47***	-3.76
Married	0.24*	1.71	0.52***	4.22

Note: (***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level
The control for status is the group of widow, divorce, or separate
The dependent variable is gambling participation and the independent variables are gamblers' marital status

Table 4D shows the characteristics of gambler ages in 2002

Variables	Casino		Football Betting		Government Lottery		Underground Lottery	
	Coef.	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**
C	-2.13	-23.21	-3.38	-21.31	1.51	20.57	1.38	19.58
15-22 years old	1.30***	8.62	2.64***	13.35	-1.90***	-14.15	-1.16***	-8.79
23-35 years old	0.57***	4.63	1.19***	6.33	-0.23**	-2.19	-0.15	-1.55
51-60 years old	-0.43**	-2.06	-1.03**	-2.16	-0.05	-0.36	-0.37***	-2.85
Over 60 years old	-0.94***	-3.17	-2.30**	-2.26	-0.17	-1.06	-0.73***	-5.19

Note: (***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level
The control for age is between 36 and 50 years old
The dependent variable is gambling participation and the independent variables are gamblers' age

Table 4E shows the characteristics of gambler status in 2002

Variables	Football Betting		Government Lottery		Underground Lottery	
	Coef.	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**
C	-4.23	-7.27	1.26	7.57	1.05	6.67
Single	2.95***	5.02	-0.56***	-3.05	-0.53***	-3.02
Married	0.89	1.49	0.09	0.53	0.25	1.54

Note: (***) = 1% significance level
The control for status is the group of widow, divorce, or separate
The dependent variable is gambling participation and the independent variables are gambler's marital status

Table 4F: Determinants of gambling frequency by reasons of gambling in 2002

Variables	Casino		Football Betting		Government Lottery		Underground Lottery	
	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.
C	0.11	0.37	-1.40	-2.51	0.64	4.00	1.10	8.55
Gambling as a business	0.72	0.86	0.59	0.50	0.57	1.08	1.48***	3.35
Gambling for the extra income	0.33	0.81	1.84***	2.75	0.20	1.04	0.96***	6.05
Gambling for the risk	-0.07	-0.25	0.62	1.39	0.40**	2.56	0.57***	4.53
Gambling for entertaining	-0.10	-0.38	-0.18	-0.41	-0.08	-0.66	-0.06	-0.69

Note: (***) = 1% significance level
The dependent variable is gambling frequency and the independent variables are the set of reasons for gambling

Table 4G: Determinants of casino betting frequency in 2002

Variables	Coef.	Z-stat
C	-0.74	-1.51
Home/flying Casino	0.84*	1.77
Domestic Permanent Casino	0.18	0.42
Casino in Neighbouring Casino	0.46	1.02
Casino in Other Countries	0.51	1.10

Note: (*) = 10% significance level
The dependent variable is casino betting frequency and the independent variables are the casino participation in each type

Table 4H shows the characteristics of casino gambler age in 2007

Variables	Home/flying Casino		Casino in Neighbouring Countries	
	Coef.	Z-Stat.	Coef.	Z-Stat.
C	-0.53	-3.19	1.12	5.97
15-22 years old	1.54***	3.47	-2.13***	-4.69
23-35 years old	0.36	1.53	-0.75***	-2.95
51-60 years old	-0.53*	-1.69	0.99**	2.38
Over 60 years old	-1.77**	-2.33	0.38	0.66

Note: (***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level
The control for age is between 36 and 50 years old
The dependent variable is casino participation and the independent variable are gamblers' age

Table 4I shows the characteristics of casino gambler status in 2007

Variables	Domestic Permanent Casino		Casino in Other Countries	
	Coef.	**Z-Stat.**	**Coef.**	**Z-Stat.**
C	-0.97	-3.10	-2.46	-4.73
Single	-1.34***	-3.29	0.82	1.47
Married	-1.24***	-3.14	1.72***	3.16

Note: (***) = 1% significance level
The control for status is the group of widow, divorce, or separate
The dependent variable is casino participation and the independent variables are gamblers' marital status

Table 4J shows the reasons of gambling participation in 2007

Variables	Casino		Underground Lottery		2-3 digit Lottery	
	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.
C	0.66	1.42	1.99	4.49	0.84	1.69
Gambling as a business	-0.05	-0.70	-0.04	-0.45	-0.13	-1.35
Gambling for the extra income	0.33***	4.18	0.17*	1.81	0.21**	2.17
Gambling for the risk	0.16	1.57	0.03	0.30	0.17	1.51
Gambling for entertaining	-0.09	-1.02	-0.07	-0.86	-0.06	-0.63

Note: (***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level
The dependent variable is gambling participation and the independent variables are the set of reasons for gambling

Table 4K: Determinants of casino betting frequency in 2007

Variables	Coef.	Z-stat
C	0.64	2.59
Home/flying Casino	0.73***	3.36
Domestic Permanent Casino	0.01	0.03
Casino in Neighbouring Casino	1.12***	4.90
Casino in Other Countries	0.50**	2.24

Note: (***) = 1% significance level, (**) = 5% significance level
The dependent variable is casino betting frequency and the independent variables are the casino participation in each type

Table 4L: Determinants of gambling factors in 2008

Colum 1, 2: The dependent variable is casino betting (0 = No bet, 1 = Bet);The independent variables are the gambling experiences
Colum 3, 4: The dependent variable is football betting (0 = No bet, 1 = Bet);The independent variables are gambling experiences
Colum 5, 6: The dependent variable is the government lottery (0 = No bet, 1 = Bet); The independent variables are the gambling experiences
Colum 7, 8: The dependent variable is the 2-3 digit lottery (0 = No bet,1= Bet);The independent variables are the gambling experiences
Colum 9, 10: The dependent variable is the underground lottery (0 = No bet, 1 = Bet); The independent variables are the gambling experiences

Variables	Casino		Football Betting		Government Lottery		2-3 Digit Lottery		Underground Lottery	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.	Coef.	Z-Stat.
C	2.28	14.88	0.31	3.51	-1.00	-10.78	-2.02	-16.15	-1.55	-12.71
C31	-0.39***	-2.60	-0.21*	-1.60	0.34***	2.67	0.14	0.85	0.24*	1.73
C32	-0.18	-1.31	0.61***	5.04	0.26**	2.35	0.00	0.02	0.13	1.05
C33	-	-	-0.01	-0.10	0.33**	2.39	0.41**	2.31	0.46***	3.09
C34	-0.17***	-2.83	0.02	0.44	0.13**	2.35	0.00	0.09	0.15***	2.66
C35	-	-	0.75***	5.75	0.33***	2.86	0.40***	2.63	-	-
C37	-0.54***	-3.60	-	-	-	-	-	-	-	-
C38	-0.30*	-1.92	-	-	-	-	-	-	0.24*	1.87
McF R^2	0.03	-	0.03	-	0.02	-	0.02	-	0.02	-
Akaike info criterion	0.89	-	1.22	-	1.28	-	0.85	-	1.09	-
Schwarz criterion	0.91	-	1.24	-	1.30	-	0.87	-	1.11	-
Hannan-Quinn criter.	0.90	-	1.22	-	1.29	-	0.85	-	1.10	-
F-stat	10.13		13.09		9.73		4.22		6.71	

Note: McF R^2 is McFadden R-squared F-statistic for the null hypothesis that all slope coefficients are jointly zero rejected
c31= a bad effect on your study because of gambling? (0=No, 1=Yes) c32= ever thought about the gambling? (0=No, 1=Yes)
c33= you and your family ever faced financial problems because of gambling? (0=No, 1=Yes) c34= currently in debt because of gambling? (0=No, 1=Yes)
c35= guilty on gambling? (0=No, 1=Yes) c37= gambling has caused household financial problems? (0=No, 1=Yes)
c38= gambling is a bad activity? (0=No, 1=Yes)
(***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level

Table 4M: Determinants of the reasons of casino betting frequency in 2008

Variables	Casino	
	Coef.	Z-Stat.
C	0.46	0.79
Gambling as a business	-0.16	-0.44
Gambling for the extra income	0.85***	4.00
Gambling for the risk	0.43**	2.28
Gambling for entertaining	-1.00*	-1.77

Note: (***) = 1% significance level, (**) = 5% significance level, (*) = 10% significance level
The dependent variable is casino betting frequency and the independent variables are the set of reasons for gambling

Table 4N shows the reasons of gambling in 2002

	Bangkok and the vicinities	the provinces (inside the municipal area)	the provinces (outside the municipal area)	Nationwide
Gambling as a business	0.58	1.58	0.80	0.91
For the extra income	4.03	9.00	6.85	6.65
For the risk	79.24	81.15	85.74	83.41
For entertaining	36.15	32.30	28.96	31.20
Others	5.77	3.13	2.25	3.20

Source: Sungsidh *et al.*, 2003

CHAPTER 5

ESTIMATING THE EFFECTS OF SOCIO-ECONOMIC FACTORS ON GAMBLING EXPENDITURES

5.1 Introduction

In several countries where some gambling types are legalised, those legal gambling types have contributed large amount of money to State revenues so far. For instance, in New South Wales, Australia, the taxes, fees, and fines on gambling contributed some 1.2 billion AU dollars (more than 10% of State taxes) to State revenues in 1996/97, in the US around 6.7 billion US dollars was the expenditures in casinos in 1974 while lotteries generated nearly 36 billion US dollars in sale during 1999, in Canada nearly 2.2 billion US dollars was spent on public lotteries in 1985, and in the U.K. around £65 million per draw was spent on lottery in 1999 (Farrell and Walker, 1999; Garrett and Marsh, 2002; Livernois, 1986; Suits, 1977; Worthington, 2001). In Thailand the government lottery, one of the legal gambling types, also has contributed an amount of money to government revenues (see Table 5A in Appendix 5A).

State revenues from gambling games, such as gambling tax, stem from a part of gambling expenditure individuals and, broadly speaking, the pattern of expenditure probably work to the relative detriment of low income individuals (Farrell and Walker, 1999; Layton and Worthington, 1999). Jackson (1994) states that gambling expenditures are the amount of money which gamblers are willing to pay a premium of an unfavourable investment, which is that, can possibly yield a payoff large enough to enhance their economic or social standing.

In this chapter, not only the gambling expenditures on each gambling type are empirically investigated but the demands for each gambling type are also estimated by evaluating the income elasticity, including the “pent-up” demand. To evaluate the income elasticity of the legal gambling type will relate to indicate whether the gambling tax is progressive or regressive. Moreover, the income elasticity of the illegal gambling type can be also indicated whether the tax on gambling will be progressive if the illegal form is legalised.

The illustration of existing works, which correspond to the gambling expenditures, and the definition of pent-up demand are in the following section. Section 5.3 contains the empirical work. Here, the details of data used, methodology, and regression results are reported. The discussion on the results is in 5.4 and the last section provides the conclusions.

5.2 Literature review: Prevalence of gambling expenditure

There is a significant amount of literature on gambling-related expenditure. For example, Worthington (2001) evaluates the statistical significant of a number of socio-economic and demographic variables on the level of gambling-type expenditures and examined the incidence of gambling-type expenditures in New South Wales, Australia. Scott and Garen (1994) estimate the demand for lottery tickets and also investigate individual lottery ticket purchases by using household survey data in Kentucky, the US. Kitchen and Powells (1991) study lottery expenditure in six regions of Canada by using socio-economic and demographic data, while Borg and Mason (1988) study the relation of the expenditures-revenues of lottery and the state budget of education in Illinois, the U.S. Jackson (1994) evaluates the demand for lottery in Massachusetts, the U.S. Spiro (1974), Borg *et al.* (1991), and Hansen (1995) studied the link between the gambling expenditures and the tax incidence.

Most of those empirical studies, such as Worthington (2001), Hansen (1995), Scott and Garen (1994), employ a Tobit model estimation to evaluate the gambling expenditure. They claim that Tobit estimation is appropriate because the expenditure model is a standard case of censored regression. There are at least two gambling issues can be evaluated by Tobit estimation, first, the influences of the various explanatory variables on the decision of whether purchase the gambling products, second, the influences of the decision on the amount to spend. Regarding the Scott and Garen's work in 1994, they attempted to estimate lottery demand by using Heckman's likelihood function and compared the results to those which using Tobit estimation. They did not find any different conclusions. They also emphasised that the decision to purchase a goods is affected by additional factors, which may not influence the quantity purchased in the same manner.

According to Worthington (2001), at least two results of empirical work should be mentioned. First, the socio-economic and demographic data can explain the gambling expenditure, for instance, lottery expenditure is significantly influenced by household occupation, whereas the expenditure of lotto and instant lotto is influenced by the age of household head. Second, the incidence of gambling-related taxation is regressive, which means that, gambling expenditure as a percentage of income decreases when income increases. In respect to Suits index of regressivity, the degree of regression can range from -1 to +1, -1 reflects extremely regressive whereas +1 reflects extremely progressive (Kitchen and Powells, 1991).

The latter result is the same as Kitchen and Powells's work in 1991, which stated that the lottery expenditure as a percentage of after-tax household income declined in every region when increasing in household income. Spiro (1974) indicates that the lottery ticket purchased in Pennsylvania was regressed against income. Hansen (1995), Jackson (1994), Borg and Mason (1988), and Borg *et al*. (1991) also confirm that gambling tax was regressive.

Hansen (1995) presents that the share of income spent on instant game tickets in Colorado is negatively related to per capita income, and per capita instant game expenditures are negatively related to income in regressions. This suggests that instant game tickets are an inferior good. Massachusetts state lottery tax also showed the degree of tax regressivity in 1994. The lottery is a regressive source of government revenue because per capita expenditure does not increase proportionately with income. Moreover, all lottery products decreased with increasing education levels (Jackson, 1994). The study of Borg and Mason in 1988 exhibited the excise tax of lottery in Illinois that was extremely regressive. The result was insisted when considering the tax incidence independently and when considering the incidence of the net tax, which the lottery revenues supported the state budget of education. The study results also revealed that age, race, and place of residence affected the propensity to purchase the lottery.

Borg *et al.* (1991) study the gambling tax on casino in Las Vegas and Atlantic City. The study exhibits that the tax on casino gambling is regressive. However, there is one issue should be mentioned from this study, which is the sample of population. They raised a question that whether calculating the tax incidence should be based on a global sample of all people or a sample of only gamblers, in other words, on a sample of people who give themselves access to the taxed activity. Nevertheless, they suggested that the latter approach is appropriate. This issue is related to Scott and Garen's work in 1994. They stated that using Tobit estimation might lead to assume that the gambling participation and the level of gambling expenditures have proportional effects when, in fact, this is not. This leads to error in estimating the gambling expenditure since some respondents who do not gamble, where zero value of gambling expenditure, are counted as a gambling purchaser. The researchers also suggested that other studies should be conducted with caution when estimating demand for goods with non-purchasers in the sample.

With these previous experiences and suggestions, the data used in this chapter is gathered from only gamblers of each gambling type. The survey data of the respondents, who have never participated in gambling, is excluded from the estimation.

5.2.1 Pent-up demand

Pent-up demand is the demand for product which is not available in the market. The definition of pent-up demand is:

“When demand for a product is exceptionally strong, perhaps because the demand built up during a recession when people could not afford to buy the product or because the product was temporarily not available to be sold.” (Hunter, 2006)

5.3 The empirical work

5.3.1 Methodology

The estimate method is to start with estimating the determinant of gambling expenditures, followed by the evaluation of the income elasticity and the pent-up demand. To estimate the gambling expenditures, the regression model used is not conceptually different from other models which have been used to measure the expenditure on gambling product (Scott and Garen, 1994; Worthington, 2001). Tobit estimation technique is employed to measure the gambling expenditure. This is because Tobit model is appropriate for the limited dependent variable as the consumer expenditure, such as gambling expenditure, which has never been a negative value.

Recall the Tobit model, it is a hybrid of Probit analysis and the multiple regression approach (Hansen, 1995; Kitchen and Powells, 1991; Scott and Garen, 1994; Tobin, 1958; Worthington, 2001).

The general form of regression model is

$$E_i^* = \beta X_i + u_i \text{ , } u_i \sim N[0, \sigma^2] \tag{5.1}$$

If $E_i^* \leq 0$, then $E_i^* = 0$ and

If $E_i^* > 0$, then $E_i^* = E_i^* = \beta X_i + u_i$

Where E_i^* = Gambling expenditure, β = A set of parameters to be estimated

X_i = A set of independent variable u_i = error term

To compute the income elasticity and the pent-up demand, the classical Ordinary Least Square (OLS) estimation is employed to estimate. They can be calculated by regressing a log-linear model of the gambling expenditures on the respondents' personal and their family incomes.

5.3.2 Model estimated

The model which will be used to estimate the expenditures on gambling can be expressed as:

$$E_k = \alpha_0 + \sum_{k=1} \alpha_k x_k + u_k \tag{5.2}$$

where E_k = Gambling expenditures α_0, α_k = A set of coefficients to be estimated

x_k = A set of independent variables u_k = error term

5.3.3 Data

The data used in this chapter gained from the three surveys, which were the same as in Chapter 4. However, it should be emphasised that all observations in this chapter are gambler.

5.3.3.1 The first survey

The first data set received from Sungsidh *et.al* (2003). The populations of this survey were 5,000 people, which were divided into 3 parts of living areas. First, 2,000 people who lived in Bangkok and the vicinities. Second, 1,500 people who lived inside the municipal area of provinces and the last group was 1,500 people who lived outside the municipal area of provinces. The respondents were presented the list of gambling types, 15 games, and asked their expenditures on each type in the past 12 months. However, there were only the four most popular games reported; casino gambling, football betting, the government lottery, and the underground lottery.

The survey results reported that the proportions of the government lottery expenditure to income were the lowest in every income range in 2002. At the level of monthly income less than 5,000 baht, around 6% and 9% of income were spent on the government lottery and the underground lottery, respectively, for the respondents who bet on these two types. The respondents who bet on casino would spend 55% of their income in casinos. Gamblers, who had received monthly income less than 5,000 baht and gambled on football betting, spent more than 2 times of the income on gambling. As mentioned in Chapter 3, football betting can be bet on credit, in other words, gamblers do not need to stake in cash. This may lead football betting gamblers to be easily in debt. The results also suggested that the expenditures on casino, the government lottery, and the underground lottery are regressive respect to income (see Table 5B in Appendix 5A).

Regarding the casino expenditures in 2002, 35% of casino gamblers spent lower than 1,000 baht a year in casinos and 23% spent between 1,000 and 3,000 baht. There were only 7% of casino gamblers who spent higher than 50,000 baht in casinos. In the same year, around 23% of football betting gamblers spent lower than 1,000 baht a year on football while 17% spent higher than 50,000 baht (see table 5C in Appendix 5A).

As regards the annual expenditures on the government lottery in 2002, there were around 39% of government lottery players spent less than 500 baht on a lottery ticket, while 30% spent between 500 and 1,999 baht. Similarly, the government lottery expenditures, 39% of underground lottery gamblers had the expenditures lower than 500 baht a year on the underground lottery. The number of gamblers who spent higher than 2,000 baht on the underground lottery was around 34% of underground lottery players (see Table 5D and 5E in Appendix 5A).

As noted above, with Tobit estimation technique, the gambling expenditures should be estimated only on the group of gamblers. In the 2002 survey, there were 67% of respondents who had gambled in the past 12 months, therefore, the total sample size was 3,367 gamblers. According to the group of gamblers, there were 2,572 government lottery gamblers, 2,513 underground lottery gamblers, 261 football betting gamblers, and 462 casino gamblers.

Table 5.1 reports the definitions and descriptive statistics of data in the 2002 survey. Around 54% of gamblers were female. The proportion of married gambler was 70% of gamblers. Around 14% of gamblers obtained an undergraduate degree or higher. Their monthly income was 8,220 baht on average. In 2002 the annual expenditure on football betting was the highest among other gambling expenditures, 206,380 baht on average, followed by the expenditure on casino was around 45,870 a year. The expenditure on the underground lottery and the government lottery were 5,200 baht and 3,750 baht a year, respectively.

Table 5.1: Definitions and descriptive statistics of data in the 2002 survey

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.54	.49
2. Age		
a. Age1 (15-22 years old)	.10	.29
b. Age2 (23-35 years old)	.32	.46
c. Age3 (36-50 years old)	.37	.48
d. Age4 (51-60- years old)	.12	.33
e. Age5 (over 60 years old)	.09	.28
3. Marital status (0 = Single, 1 = Married)	.70	.46
a.Status1 (single)	.24	.42
b.Status2 (married)	.70	.46
c.Status3 (widow, divorce, or separate)	.06	.24
4. Occupation		
a. Unemployed	.08	.27
b. Housewife	.11	.31
c. University student	.06	.23
d. Agriculturist	.14	.34
e. Government officer	.08	.26
f. Business/industry owner	.27	.44
g. Private employee	.27	.44
5. Education	.14	.35
6. Income (per month)[a]	8.65 (8,223.01)	0.86

Table 5.1 (continued)

Variable	Mean	Standard deviation
7. Type of betting (0 = No, 1 = Bet)		
a. Bet on the government lottery	.76	.42
b. Bet on the underground lottery	.75	.43
c. Bet on football	.08	.26
d. Bet on casino	.14	.34
e. Bet on home/flying casino	.80	.40
f. Bet on domestic permanent casino	.16	.37
g. Bet in casinos in neighbouring countries	.13	.33
h. Bet in casinos in other countries	.08	.27
8. Gambling expenditure[b] (per year)		
a. Expenditure on the government lottery	6.97 (3,753.86)	1.38
b. Expenditure on the underground lottery	6.92 (5,209.78)	1.83
c. Expenditure on football betting	8.40 (206,378.65)	2.26
d. Expenditure on casino betting	7.82 (45,868.77)	2.27

Table 5.1 (continued)

Variable	Mean	Standard deviation
9. Gambling opinion (0 = disagree, 1 = agree)		
a. Agree or disagree with the government to legalise casino business	.42	.49
b. Agree or disagree with the government to legalise football gambling	.35	.47
c. Agree or disagree with the government to issue the 2-3 digit lottery	.51	.50
10. Reason for gambling (0 = No, 1 = Yes)		
a. Gambling as a business	.01	.10
b. Gambling for the extra income	.07	.25
c. Gambling for the risk	.80	.39
d. Gambling for entertaining	.32	.46

Note: Education: 0 = lower than an undergraduate degree, 1= undergraduate degree or higher;
[a]Income: in the natural logarithm form, the value in parentheses is the actual mean value
[b]Expenditure on the government lottery, the underground lottery, football betting, and casino betting: in the natural logarithm form, the values in parentheses is the actual mean values

5.3.3.2 The second survey

The second survey was conducted in 2007 with 509 gamblers, who participated in casino gambling (422 gamblers), the underground lottery (242 gamblers), and the 2-3 digit lottery (250 gamblers). Most questions of this survey were duplicated from the set of questions used in the 2002 survey. However, the respondents were not asked about the opinion on supporting the gambling business legalisation. This is because all respondents were gamblers thus it might be inferred that they probably supported the legalisation.

Table 5.2: Definitions and descriptive statistics of data in the 2007 survey

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.42	.49
2. Age		
a. Age1 (15-22 years old)	.09	.28
b. Age2 (23-35 years old)	.35	.47
c. Age3 (36-50 years old)	.36	.47
d. Age4 (51-60- years old)	.16	.36
e. Age5 (over 60 years old)	.05	.22
3. Marital status (0 = Single, 1 = Married)	.44	.49
a. Status1 (single)	.44	.49
b. Status2 (married)	.44	.49
c. Status3 (widow, divorce, or separate)	.12	.33
4. **Children** (per family)	1.14	1.55
5. Occupation		
a. Unemployed	.09	.28
b. Housewife	.09	.29
c. University student	.11	.31
d. Agriculturist	.01	.09
e. Government officer	.10	.29
f. Business/industry owner	.24	.43
g. Private employee	.35	.47
6. Education	.53	.50
7. Income (per month)[a]	9.70 (32,580.54)	0.93

Table 5.2 (continued)

Variable	Mean	Standard deviation
8. Type of betting		
(0 = No, 1 = Bet)		
a. Bet on the underground lottery	.48	.50
b. Bet on the 2-3 digit lottery	.49	.50
c. Bet on casino	.83	.37
d. Bet on home/flying casino	.39	.48
e. Bet on domestic permanent casino	.12	.32
f. Bet in casinos in neighbouring countries	.69	.46
g. Bet in casinos in other countries	.23	.41
9. Gambling expenditure[b]		
(per year)		
a. Expenditure on casino gambling	8.83 (228,577.05)	4.51
b. Expenditure on the underground lottery	7.69 (15,887.81)	3.26
c. Expenditure on the 2-3 digits lottery	6.83 (9,036.49)	3.41
10. Reason for gambling		
(5 point-scale)		
a. Gambling as a business	1.81	1.20
b. Gambling for the extra income	3.02	1.35
c. Gambling for the risk	3.91	1.09
d. Gambling for entertaining	4.00	1.16

Note: Education: 0 = lower than an undergraduate degree, 1 = undergraduate degree or higher;
[a]Income: in the natural logarithm form, the value in parentheses is the actual mean value
[b]Expenditure on casino gambling, the underground lottery, the 2-3 digit lottery: in the natural logarithm form, the values in parentheses is the actual mean value
Children: Number of children per family

Table 5.2 presents the definitions and descriptive statistics of the data set in the 2007 survey. The proportion of female gamblers was equivalent to 42% of gamblers and 44% of gamblers were married. Around 53% of gamblers had an undergraduate degree or higher. Their monthly income was 32,580 baht on average. In this survey, the annual expenditure on casino betting was the highest, 228,580 baht on average, compared with the amount spent on the underground lottery was around 15,890 baht a year, and the expenditure on a 2-3 digit lottery ticket was equal to 9,040 baht a year.

5.3.3.3 The third survey

The final survey was undertaken in 2008 with 2,883 university students. Only five gambling types were focused, which were casino betting, football betting, the government lottery, the 2-3 digit lottery, and the underground lottery. The set of questions used in both previous surveys was retained and some questions were included, such as whether drinking alcohol or smoking while betting in casinos, whether bet in casinos in the past one week, whether casino and football betting businesses should be legalised.

There were 52% of students who declared that they had gambled in the past 12 months, therefore, the total sample size for the estimate was 1,504 students. In respect of these students, there were 1,245 students had gambled in casino while 1,022 students gambled on football betting. The number of students who bet on the government lottery was 548 students, on the 2-3 digit lottery was 231 students, and on the underground lottery equalled 367 students.

The survey results also revealed that 23% of students who had bet in casinos also bet in casinos in the past one week; 92% bet in home/flying casinos, 6.7% bet in domestic permanent casinos, only 0.1% bet in casinos in neighbouring countries, and around 1.8% bet in casinos in other countries. A number of 1,959 students agreed to legalise casino gambling and football betting businesses, with 56% of this group supported the government to legalise casino gambling before legalising football betting. However, 35% of students, who bet in casinos, declared that they still bet in illegal casinos even though there would be a legal form of casino.

In this survey, the students, who had gambled in casinos or on football betting, were asked about their expectation of gambling expenditures on these two types if they would be legalised. This set of questions can be used to derive the pent-up demand for gambling. This issue will be explored and discussed later.

Table 5.3 shows the definitions and the descriptive statistics of the data in the 2008 survey. Around 40% were female and their monthly personal income was 11,830 baht whereas their monthly family income was 94,030 baht on average. The amount spent on football betting was the highest, 52,560 baht a year, compared with the other gambling expenditures, followed by the amount spent in casino that was 8,390 baht a year. Among the expenditures on the number games, the expenditure on the underground lottery formed the highest proportion, around 4,440 baht a year. The expenditure on the 2-3 digit lottery and the government lottery were equivalent to 2,850 baht and 2,560 baht a year, respectively.

Table 5.3: Definitions and descriptive statistics of data in the 2008

Variable	Mean	Standard deviation
1. Gender (0 = Male, 1 = Female)	.40	0.48
2. Age	22.12	4.15
3. Education	.21	0.40
4. Live (0= with family/relative,1= alone/with friend)	.36	0.48
5. Family member	4.52	1.22
6. Personal income[a] (per month)	9.09 (11,826.55)	0.71
7. Family income[b] (per month)	11.01 (94,029.00)	0.90
8. Type of betting (0 = No, 1 = Bet)		
a.. Bet on the government lottery	.36	.48
b. Bet on the 2-3 digit lottery	.15	.36
c. Bet on the underground lottery	.24	.43
d. Bet on football	.68	.46
e. Bet on casino	.83	.37
f. Bet on home/flying casino	.66	.47
g. Bet on domestic permanent casino	.42	.49
h. Bet in casinos in neighbouring countries	.24	.42
i. Bet in casinos in other countries	.08	.27

Table 5.3 (continued)

Variable	Mean	Standard deviation
9. Gambling expenditure[c]		
(per year)		
a. Expenditure on casino gambling	6.14	2.97
	(8,387.92)	
b. Expenditure on football betting	9.19	2.75
	(52,562.15)	
c. Expenditure on the government lottery	6.65	1.42
	(2,561.13)	
d. Expenditure on the 2-3 digit lottery	6.46	1.72
	(2,854.76)	
e. Expenditure on the underground lottery	7.04	1.64
	(4,438.46)	
10. Reason for gambling		
(0 = No, 1 = Yes)		
a. Gambling as a business	.06	.22
b. Gambling for the extra income	.22	.41
c. Gambling for the risk	.68	.46
d. Gambling for entertaining	.98	.13
11. Drinking while betting in casino	.23	.41
(0 = No, 1 = Yes)		
12. Smoking while betting in casino	.15	.35
(0 = No, 1 = Yes)		
B212	.59	.49
B214	.51	.50
B215	.76	.42
B217	.17	.37
C31	.29	.45
C32	.46	.49

Table 5.3 (continued)

Variable	Mean	Standard deviation
C33	.23	.42
C34	.12	.93
C35	.36	.47
C36	.41	.49
C312	.76	.42

Note: Education: 0=Undergraduate degree 1=Master degree
[a]Personal income: in the natural logarithm form, the value in parentheses is the actual mean value
[b]Family income: in the natural logarithm form, the value in parentheses is the actual mean value
[c]Expenditure on the government lottery, the underground lottery, football betting, and casino gambling: annual rate, the values in parentheses is the actual mean values

b212= agree/disagree with the government to legalise casino business; 0=Disagree 1=Agree
b214= parents ever/never bet on casino; 0=No 1=Yes
b215= agree/disagree with the government legalizes football; 0=Disagree 1=Agree
b217= parents ever/never bet on football; 0=No 1=Yes
c31= a bad effect on your study because of gambling? 0=No 1=Yes
c32= ever thought about the gambling (reliving past gambling experience, planning the next gambling)? 0=No1=Yes
c33= you and your family ever faced financial problems because of gambling? (0=No, 1=Yes)
c34= currently in debt because of gambling? 0=No 1=Yes
c35= guilty on gambling? 0=No 1=Yes
c36= parents ever gambled? 0=No 1=Yes
c312= agree after the government issued 2-3 digits lottery? 0=No 1=Yes

5.3.4 Empirical results

The estimated coefficients, standard errors, and Z-statistics of the parameters for the Tobit regressions are reported in each estimate. The F-statistics for the null hypothesis that all the slope coefficients are jointly zero are shown. Also included in the tables are R^2 and $\bar{R}^2$, Akaike Information Criterion, Schwarz Criterion, and Hannan-Quinn Criterion, which are used as a guide to model selection. All standard errors incorporate Huber/White robust covariances to allow for heteroskedasticity.

Table 5.4 presents the estimated results of the gambling expenditures. The first three columns are the results, which correspond to the casino expenditures, while column 4-6 correspond to the football betting expenditures. The results in column 7-9 and column 10-12 correspond to the expenditures on the government lottery and the underground lottery, respectively. The dependent variable in each model is the expenditure and the independent variables are the data sets of socio-economic, opinion on the gambling legalisation, and reason for gambling.

Table 5.4 Determinants of gambling expenditure in 2002

Column 1-3: The dependent variable is expenditure on casino; The independent variables are the socio-economic data, agree/disagree to legalise casino betting, and reasons for gambling

Column 4-6: The dependent variable is expenditure on football; The independent variables are the socio-economic data, agree/disagree to legalise football betting, and reasons for gambling

Column 7-9: The dependent variable is expenditure on the government lottery; The independent variables are the socio-economic data, agree/disagree to legalise the 2-3 digit lottery, and reasons for gambling

Column 10-12: The dependent variable is expenditure on the underground lottery; The independent variables are the socio-economic data, agree/disagree to legalise the 2-3 digit lottery, and reasons for gambling

Variables	Casino (462 gamblers)			Football Betting (261 gamblers)			Government Lottery (2,572 gamblers)			Underground Lottery (2,513 gamblers)		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.
C	-3.18	1.49	-2.13	-3.29	2.91	-1.13	-4.99	0.78	-6.36	-5.56	0.66	-8.30
Gender	-1.14***	0.37	-3.07	-0.47	0.68	-0.68	-0.90***	0.12	-7.52	-0.48***	0.10	-4.40
Age	-0.09	0.20	-0.48	0.09	0.29	0.31	0.19***	0.06	3.15	-0.23***	0.05	-4.05
Marital status	-0.31	0.34	-0.92	-0.13	0.50	-0.27	0.38***	0.13	2.86	0.28**	0.12	2.20
Unemployed	0.76	0.69	1.09	-0.46	0.81	-0.57	-0.31	0.46	-0.67	0.04	0.41	0.11
Housewife	2.34***	0.80	2.90	-0.14	1.06	-0.13	0.30	0.44	0.69	0.98**	0.39	2.47
Agriculturist	0.54	0.62	0.86	-0.43	1.11	-0.39	-0.03	0.43	-0.06	0.56	0.37	1.50
Government officer	1.32**	0.61	2.16	-1.12	0.86	-1.29	0.63	0.43	1.45	0.83**	0.39	2.10
Business/industry owner	1.64***	0.58	2.80	0.52	0.69	0.75	0.83**	0.41	2.00	1.61***	0.36	4.38
Private employee	0.68	0.52	1.31	-0.42	0.56	-0.74	0.36	0.40	0.91	1.07***	0.35	3.01

Table 5.4 (continued)

Variables	Casino			Football Betting			Government Lottery			Underground Lottery		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8))**	**(9)**	**(10)**	**(11)**	**(12)**
	Coef.	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**	**Coef.**	**Std. Error**	**Z-Stat.**
Education	0.041	0.40	0.102	0.38	0.42	0.91	-0.43**	0.18	-2.35	-0.31*	0.18	-1.67
Income	0.38**	0.18	2.13	0.57	0.36	1.59	0.64***	0.08	7.69	0.82***	0.07	11.35
agree with the government to legalise casino business	1.52***	0.28	5.36	-	-	-	-	-	-	-	-	-
agree with the government to legalise football gambling	-	-	-	0.77*	0.39	1.94	-	-	-	-	-	-
Agree with the government to issue 2-3 digits lottery	-	-	-	-		-	0.12	0.11	1.11	0.43***	0.10	4.22

Table 5.4 (continued)

Variables	Casino			Football Betting			Government Lottery			Underground Lottery		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8))	(9)	(10)	(11)	(12)
	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.	Coef.	Std. Error	Z-Stat.
Gambling as a business	2.66***	1.01	2.62	1.26	1.32	0.95	0.47	0.58	0.81	2.07***		4.40
Gambling for the extra income	0.76*	0.43	1.76	1.14**	0.52	2.18	0.07	0.21	0.36	1.07***		6.11
Gambling for the risk	0.27	0.30	0.91	0.37	0.36	1.02	0.32*	0.17	1.90	0.59***		3.91
Gambling for entertaining	-0.40	0.28	-1.46	-0.56	0.38	-1.47	0.02	0.12	0.17	0.02		0.19
R^2	0.16	-	-	0.16	-	-	0.15	-	-	0.15	-	-
$\bar{R}^2$	0.13	-	-	0.10	-	-	0.14	-	-	0.14	-	-
Akaike info criterion	3.89	-	-	4.27	-	-	3.78	-	-	4.21	-	-
Schwarz criterion	4.05	-	-	4.51	-	-	3.83	-	-	4.25	-	-
Hannan-Quinn criter.	3.95	-	-	4.36	-	-	3.80	-	-	4.23	-	-
F- stat	5.18			2.78			17.05			26.85		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero
Agree/disagree to the legalisation (0 = disagree, 1 = agree) Reasons for gambling (0 = No, 1 = Yes)
Occupation: there are 7 occupations and the control for occupation is the university student
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

From Table 5.4, The *F*-statistic of each model suggests that all slope coefficients are not jointly zero. The gender coefficients are statistically significant at the 1% significance level, except the coefficient on the football betting expenditure. It can be interpreted that females have a lower level of gambling expenditures than males. Old gamblers tend to spend more on the government lottery, but spend less on the underground lottery. The expenditures on number games, such as the government lottery and the underground lottery, seem to reach a maximum at middle-aged gamblers, between 36 and 50 years old (see Table 5F in Appendix 5A).

The coefficients of marital status are statistical significant on the number game expenditures, which means that, married gamblers have a higher level of expenditures than single gamblers. Moreover, married gamblers significantly spend more on the government lottery than gamblers who divorced/separated/widowed (see Table 5G in Appendix 5A).

A level of education has a significantly negative effect on the number game expenditures, which can be interpreted that, increasing in education level leads to decrease in the gambling expenditures. The level of income also significantly affects the number games and casino expenditures, which is that, increasing in income positively affects on gambling expenditures. Moreover, the estimated coefficients of income for all gambling types can be implied that a unit increase in income would be probably spent on the underground lottery rather than other gambling types since the income coefficient for the underground lottery is the highest.

According to the opinion on the legalisation, gamblers who support the government to legalise illegal gambling forms, have a high level of gambling expenditures. Gamblers, who spend more on the number games, declare that they gamble since they prefer to risk, whereas gamblers, who claim that they gamble as a business, would have high expenditures on the underground lottery, casino, and football betting.

Although six occupational groupings are shown, there appears to be limited statistical significance between gambling expenditures and the occupation of gamblers. Given that the omitted category for occupation dummy is student, the results report that every occupation seems to have a higher gambling expenditure on casino and the number games, compared with students, whereas most students spend more on football betting.

The participation in each type of casino is also considered as one of the factors, which may affect the gambling expenditure. The model is test by regressing casino expenditures on the participations in each casino type. The regression results suggest that gamblers, who bet in casinos in other countries, have a significantly higher expenditure than gamblers who bet in the other types of casino (see Table 5H in Appendix 5A).

The data used for the next estimation received from the 2007 survey. The model of this present study is tested by regressing the gambling expenditures on a number of socio-economic and demographic variables, and the data set of reasons for gambling. The columns between 1 and 3 in Table 5.5 report the estimated results of casino expenditures and the columns between 4 and 6 report the estimated results of underground lottery expenditures. The last three columns present the results of the expenditures on the 2-3 digit lottery.

Table 5.5: Determinants of gambling expenditure in 2007

Column 1-3: The dependent variable is expenditure on casino; The independent variables are the socio-economic data and reasons for gambling

Column 4-6: The dependent variable is expenditure on the underground lottery; The independent variables are the socio-economic data and reasons for gambling

Column 7-9: The dependent variable is expenditure on the 2-3 digit lottery; The independent variables are the socio-economic data and reasons for gambling

Variables	Casino (422 gamblers)			Underground Lottery (242 gamblers)			2-3 digit Lottery (250 gamblers)		
	(1) Coef.	**(2) Std. Error**	**(3) Z-Stat.**	**(4) Coef.**	**(5) Std. Error**	**(6) Z-Stat.**	**(7) Coef.**	**(8) Std. Error**	**(9) Z-Stat.**
C	-3.30	1.90	-1.73	-4.53	2.92	-1.54	-0.14	2.84	-0.05
Gender	-0.64*	0.39	-1.63	0.01	0.43	0.04	-0.53	0.46	-1.16
Age	-0.13	0.25	-0.53	-0.18	0.33	-0.54	0.16	0.34	0.46
Marital status	-0.64	0.46	-1.40	0.72	0.53	1.35	1.28**	0.54	2.34
Children	0.31**	0.15	2.02	0.09	0.15	0.64	-0.13	0.16	-0.85
Unemployed	1.70**	0.83	2.05	-0.01	1.11	-0.01	0.22	1.16	0.19
Housewife	0.76	0.99	0.77	0.56	1.14	0.49	-0.17	1.16	-0.15
Agriculturist	1.65	1.84	0.89	-0.16	2.98	-0.05	-0.82	2.73	-0.30
Government officer	1.58**	0.76	2.07	-0.65	1.21	-0.53	0.55	1.14	0.48
Business/industry owner	1.72**	0.72	2.38	0.75	0.91	0.82	0.51	1.01	0.51
Private employee	0.57	0.64	0.89	0.86	0.78	1.11	0.71	0.77	0.92
Education	-0.40	0.39	-1.02	-0.28	0.50	-0.55	-0.43	0.53	-0.82
Income	0.66***	0.18	3.51	0.72**	0.30	2.38	0.12	0.31	0.40

Table 5.5 (continued)

Variables	Casino			Underground Lottery			2-3 digit Lottery		
	(1) Coef.	**(2) Std. Error**	**(3) Z-Stat.**	**(4) Coef.**	**(5) Std. Error**	**(6) Z-Stat.**	**(7) Coef.**	**(8) Std. Error**	**(9) Z-Stat.**
Gambling as a business	-0.19	0.16	-1.18	-0.25	0.20	-1.23	0.21	0.20	1.01
Gambling for the extra income	0.07	0.13	0.57	0.26	0.17	1.55	0.21	0.17	1.25
Gambling for the risk	0.06	0.16	0.39	0.45**	0.22	1.98	0.12	0.21	0.60
Gambling for entertaining	0.07	0.17	0.43	-0.01	0.17	-0.09	0.16	0.19	0.85
R^2	0.13	-	-	0.13	-	-	0.12	-	-
$\bar{R}^2$	0.09	-	-	0.07	-	-	0.05	-	-
Akaike info criterion	4.70	-	-	4.84	-	-	4.76	-	-
Schwarz criterion	4.87	-	-	5.10	-	-	5.01	-	-
Hannan-Quinn criter.	4.77	-	-	4.95	-	-	4.86	-	-
F- stat	3.73			2.21			1.95		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero
Reasons for gambling (5 point-scale)
Occupation: there are 7 occupations and the control for occupation is the university student
(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The estimated models are significant since the hypothesis that all slope coefficients are jointly zero is rejected. Most variables appear to have limited statistical significance. The results indicate that males have higher expenditures in casinos than females and gamblers, who have more children, are likely to spend more money in casinos. Given the group of students is the omitted category for occupation dummy, every occupation, specifically, unemployed, government officer, and business/owner industry has a higher level of casino expenditures than students. Increasing in gamblers' income leads to spend more in casinos and on the underground lottery. However, a unit increase in income would be spent on the underground lottery rather than in casino since the value of income coefficient for the underground lottery is higher than casino. Married gamblers significantly spend more on a 2-3 digit lottery ticket than single gamblers and gamblers who are divorced/ separated/ widowed (see Table 5I in Appendix 5A).

Regarding the variables of reason for gambling, only the coefficient of gambling for the risk on the underground lottery expenditures is positive and statistically significant at the 5% significance level. This means that gamblers, who gamble since they prefer to risk, would spend more money on an underground lottery ticket. This result is consistent with the estimated result in 2002.

While coefficients on the following variables are not statistical significant at any levels, they can be implied that old gamblers spend less money in casinos and on the underground lottery, but spend more on the 2-3 digit lottery. Married gamblers are likely to spend more money on the underground lottery. Compared with students, business/ industry owners, and private employees have a higher level of the number game expenditures. Housewives spend more money on the underground lottery but spend less on the 2-3 digit lottery.

The effect of casino participation on the casino expenditure is also evaluated. The dependent variable is the expenditure on casino while the explanatory variables are the participation in each casino type. The results reveal that the participation in every type of casino has a significantly positive effect on casino expenditures and it seems that casino gamblers, who bet in casinos in neighbouring countries, have the highest level of casino expenditures (see Table 5J in Appendix 5A).

The data used for the next estimate based on the 2008 survey. Table 5.6 provides the regression results; with column 1-3 relate to casino expenditures, column 4-6 relate to football betting expenditures. Column 7-9 contain the estimated result of the government lottery expenditures and column 10-12 are the results of the 2-3 digit lottery expenditures. The last three columns present the results of the expenditures on the underground lottery. All five models are tested by regressing the gambling expenditures on the data sets of socio-economic and demographic, gambling experience, and gambling opinion. However, two groups of variable, drinking and smoking while gambling, and the reasons for gabling, are added into the set of explanatory variables of the casino expenditure model.

Table 5.6: Determinants of gambling expenditure in 2008

Column 1-3: The dependent variable is expenditure on casino; The independent variables are the socio-economic data, gambling experience, drink and smoking, gambling opinion, and reason for gambling

Column 4-6: The dependent variable is expenditure on football; The independent variables are the socio-economic data, gambling experience, and gambling opinion

Column 7-9: The dependent variable is expenditure on the government lottery; The independent variables are the socio-economic data, gambling experience, and gambling opinion

Column 10-12: The dependent variable is expenditure on the 2-3 digit lottery; The independent variables are the socio-economic data, gambling experience, and gambling opinion

Column 13-15: The dependent variable is expenditure on the underground lottery; The independent variables are the socio-economic data, gambling experience, and gambling opinion

Variables	Casino (1,245 gamblers)			Football Betting (1,022 gamblers)			Government Lottery (548 gamblers)			2-3 Digit Lottery (231 gamblers)			Underground Lottery (367 gamblers)		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.	(13) Coef.	(14) Std. Error	(15) Z-Stat.
C	-10.87	1.85	-5.85	4.42	1.67	2.64	-7.11	2.32	-3.05	-7.03	5.01	-1.40	-5.24	2.41	-2.17
Gender	-1.61***	0.19	-8.12	-0.60**	0.27	-2.22	-0.76***	0.26	-2.93	-0.90**	0.45	-1.99	-0.73***	0.25	-2.88
Age	0.05	0.04	1.21	-0.15***	0.04	-3.31	0.19***	0.04	4.46	0.26***	0.07	3.63	0.21***	0.04	4.50
Education	-0.90*	0.46	-1.93	-1.30***	0.47	-2.73	-1.63***	0.46	-3.50	-1.03	0.70	-1.46	-1.17**	0.49	-2.38
Live	0.25	0.18	1.37	-0.05	0.17	-0.29	-0.01	0.27	-0.02	0.69	0.45	1.53	0.24	0.26	0.94
Personal income	0.64***	0.17	3.66	0.30*	0.16	1.79	0.69***	0.25	2.69	0.22	0.52	0.42	0.18	0.27	0.65
Family member	0.09	0.06	1.46	-0.11	0.07	-1.54	-0.17*	0.09	-1.77	-0.12	0.16	-0.75	0.03	0.09	0.32
Family income	0.12	0.10	1.17	0.06	0.09	0.73	-0.15	0.17	-0.90	-0.05	0.29	-0.18	0.20	0.17	1.16
B212	0.53***	0.18	2.92	-	-	-	-	-	-	-	-	-	-	-	-
B214	0.32*	0.17	1.83	-	-	-	-	-	-	-	-	-	-	-	-
B215	-	-	-	0.04	0.42	0.11	-	-	-	-	-	-	-	-	-
B217	-	-	-	0.33	0.21	1.54	-	-	-	-	-	-	-	-	-
C36	-	-	-	-	-	-	-0.15	0.26	-0.58	-0.04	0.44	-0.10	-0.30	0.26	-1.17
C312	-	-	-	-	-	-	0.38	0.33	1.14	1.25*	0.68	1.82	0.10	0.33	0.32

Table 5.6 (continued)

Variables	Casino			Football Betting			Government Lottery			2-3 Digit Lottery			Underground Lottery		
	(1) Coef.	(2) Std. Error	(3) Z-Stat.	(4) Coef.	(5) Std. Error	(6) Z-Stat.	(7) Coef.	(8) Std. Error	(9) Z-Stat.	(10) Coef.	(11) Std. Error	(12) Z-Stat.	(13) Coef.	(14) Std. Error	(15) Z-Stat.
Gambling as a business	0.23	0.37	0.61	-	-	-	-	-	-	-	-	-	-	-	-
Gambling for the extra income	0.98***	0.21	4.53	-	-	-	-	-	-	-	-	-	-	-	-
Gambling for the risk	0.49**	0.20	2.47	-	-	-	-	-	-	-	-	-	-	-	-
Gambling for entertaining	1.22	0.76	1.59	-	-	-	-	-	-	-	-	-	-	-	-
Drinking while betting in casino	0.49**	0.21	2.28	-	-	-	-	-	-	-	-	-	-	-	-
Smoking while betting in casino	1.18***	0.25	4.59	-	-	-	-	-	-	-	-	-	-	-	-
R^2	0.20	-	-	0.09	-	-	0.10	-	-	0.12	-	-	0.11	-	-
$\bar{R}^2$	0.19	-	-	0.08	-	-	0.08	-	-	0.08	-	-	0.09	-	-
Akaike info criterion	3.03	-	-	4.47	-	-	3.54	-	-	3.56	-	-	4.33	-	-
Schwarz criterion	3.10	-	-	4.52	-	-	3.62	-	-	3.72	-	-	4.45	-	-
Hannan-Quinn criter.	3.06	-	-	4.49	-	-	3.57	-	-	3.62	-	-	4.38	-	-
F-stat	20.38			11.41			6.78			3.30			5.07		

Note: F-statistic for the null hypothesis that all slope coefficients are jointly zero (***) = 1% significance level (**) = 5% significance level (*) = 10% significance level
Live: 0=with family/relative 1= alone/with friend b212= agree/disagree with the government to legalise casino business (0=disagree, 1=agree) b214= parents ever/never bet in casino (0=No, 1=Yes)
b215= agree/disagree with the government to legalise football betting (0=disagree, 1=agree) b217= parents ever/never bet on football (0=No, 1=Yes) c36= parents ever gambled? (0=No, 1=Yes)
c312= agree after the government issued 2-3 digit lottery? (0=disagree, 1=agree)

The null hypothesis that all slope coefficients are jointly zero is rejected for every model in Table 5.6. The results indicate that male students have a higher level of the expenditures on every gambling type than female students. Older students spend more on the number games but spend less on football. Masters students have a lower gambling expenditure than the undergraduate students. Increasing in personal income leads to increase in gambling expenditures, in particular, the expenditures on casino, football, and the government lottery. It seems that family income is not a good factor to determine the gambling expenditures.

The variables of the opinion on the gambling legalisation are statistically significant on the casino and 2-3 digit lottery expenditures, which can be interpreted that, students who agree to legalise casino have a high level of casino expenditures, and students who support the government to issue the 2-3 digit lottery spend more on a 2-3 digit lottery. The result also suggests that the parents' gambling experience is one of the factors that enhance the expenditures on casino. This means that students, whose parents have gambled in casinos, have a high level of casino expenditures.

Students, who gamble for the extra income and for a risk, have a high level of casino expenditures as same as students who either drink alcohol or smoke cigarette while betting in casinos.

Although the following variables are not statistically significant at any levels, it can be inferred that students, who live independently or with friends, tend to spend more money on gambling, except football betting and the government lottery, than students who live with their family or their relatives.

The regression results of the effects of gambling experiences on gambling expenditures are provided in Table 5K in Appendix 5A. The independent variables are the data of gambling experiences and the dependent variable is the gambling expenditures. The results indicate that students who ever thought about the gambling, such as reliving past gambling experiences or planning the next time of betting, significantly spend more on casino betting. Surprisingly, students, who experienced gambling caused financial problem, also spend more on casino and football as same as the group of students who are currently in debt due to a gamble. This result is consistent with the result in the 2002 survey, which states that football betting easily caused gamblers to be indebted. Students who feel guilty on gambling have significantly positive effects on casino and the number game expenditures, but for football betting is otherwise.

With regard to the relation between the casino expenditures and the casino participation in each type, students who bet in casinos in neighbouring countries and in other countries have a positive effect on casino expenditures, in contrast to, students who participate in home/flying casino (see Table 5L in Appendix A).

It should be noted that, in the 2008 survey, playing cards, when money paid among friends, is defined as a gambling in a home/flying casino. Indeed, most students, who define themselves as a home/flying casino gambler, regularly play cards with their friends so that the gambling expenditures are not high unlike the gambling expenditures of students who bet in casinos in neighbouring countries and in other countries. This explanation is consistent with the estimated result, which is that, the casino expenditure of students who participate in home/flying casinos is lower than the others. However, the participation in domestic permanent casinos has no effect on the casino expenditures.

5.3.4.1 Income elasticity of demand

There is an alternative to derive the demand for gambling. It can be derived from the income elasticity, gambling expenditure paid as a percentage of income. The income elasticity can be estimated by regressing a log-linear model of the gambling expenditures on the respondents' income. The coefficient estimates can be interpreted as elasticities since the log-linear model is estimated. Table 5.7 shows the coefficients of gambling expenditures as a percentage of income.

Table 5.7: Income elasticities of each gambling type in 2002

Type of gambling	Income elasticity coefficients
Casino	0.55***
Football betting	0.52***
Government lottery	0.35***
Underground lottery	0.57***

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

According to the value of elasticity of demand, it is claimed as being elastic and inelastic when its value is over than 1 and lower than 1, respectively. Thus it can be said that all gambling expenditures in Table 5.7 are inelastic, which means that, for instance, increasing in 1% of income leads to increase in 0.55% of casino expenditures, and increase in 0.57% of the underground lottery expenditures, respectively. The results indicate that the underground lottery is the most popular gambling type in the 2002 survey.

Table 5.8 reports the percentages of gambling expenditure to income. The results suggest that all gambling expenditures in 2007 are inelastic same as the expenditures in 2002. In 2007 the casino expenditure is the most inelastic, which implies that a 10% increase in income yields a

7.9% increase in casino gambling budgets. The income elasticities of the underground lottery between 2002 and 2007 are in the same level.

Table 5.8: Income elasticities of each gambling type in 2007

Type of gambling	Income elasticity coefficients
Casino	0.79***
Underground lottery	0.58***
2-3 digit lottery	0.19

(***) = 1% significance level

The income elasticity of gambling expenditures in 2008 can be divided into two groups, with respect to the personal income and to the family income. Table 5.9 contains the results of income elasticities of each gambling type.

Table 5.9: Income elasticities of each gambling type in 2008

Type of gambling	Personal income elasticity coefficients	Family income elasticity coefficients
Casino	0.22*	0.18**
Football betting	0.03	0.12*
Government lottery	0.40***	0.02
2-3 Digit lottery	0.41***	-0.09
Underground lottery	0.42***	0.22**

(***) = 1% significance level (**) = 5% significance level (*) = 10% significance level

The results reveal that both personal income and family income positively affect the expenditures on casino and the underground lottery. For example, the increase in personal income and family income yields the increase in both casino and underground lottery expenditures. However, increasing in personal income also leads to increase in the government lottery and the 2-3 digit lottery expenditures. The most inelastic expenditures to the personal income and the family income are the expenditures on the underground lottery, which can be interpreted that the 10% increase in both incomes yield the 4.2% and 2.2% increase in the underground lottery expenditures, respectively.

The demands for each casino type are also derived. Table 5.10 reports the casino expenditures of each casino type as a percentage of personal income.

Table 5.10: Comparison of income elasticities of each casino type

	2002	**2007**	**2008**
Type of casino	**Personal income elasticity coefficients**	**Personal income elasticity coefficients**	**Personal income elasticity coefficients**
Home/flying Casino	0.49***	0.94***	0.17
Domestic Permanent Casino	0.62	0.73	0.32*
Casino in Neighbouring Countries	0.73*	0.59**	-0.16
Casino in Other Countries	0.16	1.28**	-0.25

(**) = 5% significance level (*) = 10% significance level

All casino expenditures are inelastic except the expenditures in casinos in other countries in 2007. It can be implies that an increase in 10% of income leads to increase in 12.8% of casino expenditures in casinos in other countries. This result is sensible since if gamblers' income increases, most casino gamblers will prefer to gamble in casinos in other countries because this casino type is acceptable to have higher standard than the others.

5.3.4.2 Pent-up demand estimates

As mentioned above, there is a set of questions in the 2008 survey, which is attempted to evaluate the pent-up demand for casino and football betting.

The 2008 survey results indicate that 832 students, 29% of respondents, would bet on casino if there was a legal casino and 1,071 students, 37% of respondents, would gamble on football if there was a legal football betting. However, 10% of students who had never gambled in their lives and 35% of students who had not gambled in casino in the past twelve months would bet in a casino if there was a legal casino, whereas 2% of students who had never gambled in their life and 14% of students who had not gambled on football in the past twelve months would gamble on football if there was a legal football betting.

Table 5.11 provides the results of pent-up demand for casino and football betting. The pent-up demand can be derived from regressing the log-linear model of the expected gambling expenditures on the respondents' personal income and their family income. The OLS estimation is used to estimate. The results show that both incomes have a positive effect on both gambling expenditures but there is only statistical significance on casino expenditures with respect to personal income and football betting with respect to family income. These income elasticities of demand are different from those income elasticities above because they are the demand for products which are not available in the market, in other words, they are the expected demand.

Table 5.11: Personal and family income elasticities of legal casino and football betting

Type of gambling	Personal income elasticity coefficients	Family income elasticity coefficients
Casino	0.35**	0.14
Football betting	0.08	0.09*

(**) = 5% significance level (*) = 10% significance level

Table 5.12: Comparison of personal and family income elasticities between legal and illegal casino in 2008

	Personal income elasticity coefficients	Family income elasticity coefficients
Illegal casino	0.22*	0.18**
Legal casino*	0.35**	0.14

Note: * If casino betting is legalised
(**) = 5% significance level (*) = 10% significance level

Table 5.12 illustrates the comparison of demands for a legal and illegal casino. The elasticity of legal casino expenditure, if the government legalises the casino business, with respect to personal income is 0.35. It suggests that if total personal income goes up by 1%, on average, the expenditure on casino betting goes up by 0.35%. The size of the effect on the legal casino is bigger than the effect on the illegal casino, with respect to both personal and family incomes

5.4 Discussion

As mentioned in Chapter 4, the regression results from those three surveys are difficult to compare directly due to variation in some factors, such as different characteristics of respondents. Moreover, it is also difficult to obtain accurate data of gambling expenditures. There are several reasons, for example, there is a macho mindset in some gambling types, such as football betting, which encourages respondents to recall only winning event. Some respondents are likely to remember a single event, such as a large loss than a series of much smaller losses. Some gambling types are easy to recall the expenditures, such as the cost of lottery tickets, whereas some gambling types caused some confusion over the respondents to recall their gambling expenditures, such as casino gambling (Volberg *et al.*, 2001).

However, the regression results report that variables of socio-economic and demographic, gambling opinions, and gambling experiences are important to determine the level of gambling expenditures and the results also reflect the trend of gambling expenditures of each gambling type.

Obviously, males have higher gambling expenditures on every gambling type than females. This result is similar to the prevalence, such as the studies of Borg *et al*. (1991), Worthington (2001), Farrell and Walker (1999). Old gamblers seem to have a high level of gambling expenditures on the number games, in particular, on the government lottery and the 2-3 digit lottery, while young gamblers or adolescents have a high level of gambling expenditures on football betting. This might be because some technical skill on gambling is needed in football betting while the number games are not. In addition, the regression results in Chapter 4 suggest that football betting attracts young gamblers rather than old gamblers.

The aged range of gamblers, who have the highest expenditures on the number games, is between 36 and 50 years old in the 2002 survey while the regression results of the 2008 survey state that high-aged students significantly spend more on the number games. It should be noted that the aged range of respondents in the 2008 survey is between 17 and 35 years old. Thus, it is probably implies that middle-aged gamblers, around 35 of age, highly spend on the number games, and the expenditures reach the maximum at the age of 50.

Borg *et al.* (1991) state that old gamblers gamble because of increase in amount of leisure time available, and decrease in chances of getting rich from their own efforts. Hence, they see gambling as a last hope of striking it rich. MacDonald *et al.* (2004) indicate that Canadian households with member 55 years old and over tend to spend higher amounts as well as a higher proportion of their income on gambling.

This study also found that housewife and being unemployed have a higher level of casino and the underground lottery expenditures but have a lower level of football betting expenditures, compared with students.

An increase in education levels seems to reduce the gambling expenditure, particularly, the expenditures on the number games. However, there is an issue should be discussed on the characteristic of education. In the 2002 and the 2007 surveys, the education variable is divided into two categories, which are lower than undergraduate degree and undergraduate degree/ upper while, in the 2008 survey, it is categorised to be undergraduate degree and master degree. The regression results of the 2002 and the 2007 surveys indicate that gamblers who have undergraduate degree or upper are likely to spend less on the number games and spend more in casinos and on football. The regression results of the 2008 survey indicate that undergraduate students spend more on every gambling type than master students. From these results, it might be stated that the number game expenditure is high among the group of gamblers who have undergraduate degree or lower, while casino and football betting expenditures are high among the group of gamblers who have undergraduate degree. The result is similar to the study of Kitchen and Powells (1991), for example, which reports that Canadian gamblers who have university degree have low expenditures on lottery.

Unsurprisingly, the increase in personal income leads to increase in gambling expenditures while family income seems to have a little effect on the gambling expenditures. It should be cleared that the question about family income was asked in the 2008 survey only and all respondents are students. Most of them, indeed, earn their income from their parents and spend it on their daily life expenditures. They do not need to respond on their family expenditures. Thus this may be one of the reasons that their family incomes do not much affect their gambling expenditures. However, gamblers who support the government to legalise gambling businesses also have high gambling expenditures.

Farrell and Walker (1999) state that married gamblers have a higher level of lotto expenditure than single, widowed, divorced, and separated gamblers in the U.K. This result is consistent with this study, which indicates that the expenditure on the number games reaches the peak among the group of married gamblers. Moreover, these gamblers have a higher expenditure on number games rather than casino and football betting. This may be because gambling on casino or football betting is riskier than betting on the number games. It does not surprise that married gamblers tend to gamble on the game which has a low level of risk. The risk, here, does not mean the probability of winning but it means, such as an amount of money staked, the frequency of gambling, and the probability of being gambling addiction. One regression result can support this notion, which is that, individuals, who gamble since they prefer to risk, tend to spend more on the number games, which have a lower level of risk than casino and football betting. Additionally, one important characteristic of number games, which attracts people, is a small price of betting but win a big prize.

Most gamblers who gamble as a business seem to have a high level of expenditures on casino and the underground lottery. As mentioned in Chapter 3, the underground lottery and casino betting are the most two popular gambling types and they have been operated as a regular business. In respect with the expenditures on football betting, they are high among the group of people who gamble for the extra income. This is because most football betting gamblers are student or adolescent so that they may gamble for an amount of extra money. Gambling as a business may not be a principal reason for most of them.

The factor of gambling experiences is considered in the 2008 survey. The results indicate that students who have a bad effect on their study due to the gambling still spend more on casino and football betting, while spend less on the number games. Although all these variables are not statistical significant, they may be inferred that casino and football betting are easier to be addicted than the number games. The significant result, which can be supported this notion is that, student who regularly relives the past gambling experience or plans for the next gambling has a high expenditure on casino.

According to the Theory of Rational Addiction, Becker and Murphy (1988), indicate that the addiction to a good requires a large effect of past consumption of the good on current consumption. They also divide the addiction into two types, which are “Rational addiction” and “Myopic addiction”. The former addiction is that a person is potentially addicted to a good, increases in past consumption raises current consumption, and plans to maximize utility consistently over time, while the latter addiction is a person has the potential to become addicted whenever an increase in past consumption enhances the marginal utility of current consumption. In other words, myopic consumers ignore the future effects of a change in current consumption. To apply this theory with the regression result of this study, it can be said that casino gamblers are the rational addiction. This is because casino gamblers concern about the future consequences of current consumption, this is why they regularly relive the past and plan for the next gambling.

Regarding the students who face a financial problem and in debt because of gambling, the results indicate that they still spend more money on casino and football betting. This is because, in fact, football betting can be bet by credit, most gamblers do not need to stake in cash and some gamblers stake higher than their income, therefore, the debt can be easily accumulated. Moreover, students who expect to recover their losses from gambling, there are more chances for gambling in casino and on football betting than the number games, which normally draw 2 times a month. It can be seen that the negative effects of casino and football betting are more harmful than the negative effects of number games. For example, there are a lot of cases appear that gamblers sunk in debt because of casino and football betting, but a few case for betting on the number games.

Although, it cannot be stated that gambling behaviour leads to smoking/drinking behaviour, and vice versa, the regression result suggest that smoking/drinking enhance the gambling expenditures. It might be said that gambling expenditures are complements for spending on alcohol and cigarette. This finding is supported by Canada case, which is reported that those gambling households have higher level of alcohol expenditures than non-gambling households (MacDonald *et al.*, 2004).

The results of income elasticity of demand for each gambling type are explored. The study of income elasticity of demand raises at least two areas of interest for policy makers or other involved parties. The first focuses on the evaluation of gambling demand. The demand for gambling can be derived from gamblers' incomes. The second focuses on the incidence of the implicit gambling tax.

All income elasticities of demand with respect to personal income in this study are uniformly positive. All of them are also lower than unity, which can be implied that gambling products are a normal necessity. The income elasticity of demand for the underground lottery was the highest in the 2002 survey, and after the government issued the 2-3 digit lottery as the legal form of the underground lottery in 2004, the income elasticity of the underground lottery was still higher than the income elasticity of the 2-3 digit lottery but both elasticities were nearly equal in the 2008 survey.

It can be seen that although the government attempted to tackle the illegal gambling game by issuing the legal one, the demand for the illegal gambling game is still high. This is because the underground lottery has more variety of prizes than the 2-3 digit lottery. Hence the underground lottery still attracts to gamblers even though betting on the underground lottery is riskier. In some cases, some underground lottery operators neglect to pay the rewards or pay some parts of it if they face a heavy loss. Indeed, most underground lottery operators reduce their risks on popular betting number by transferring the risks to the government, such as betting those popular numbers on the 2-3 digit lottery with the same amount of stake received.

Comparing the expected value between the government lottery and the underground lottery, it can be seen that the expected value of the government lottery is lower. For example:

- The expected value of the government lottery (last 2 digits): One lottery costs 40 baht. The prize is 1,000 baht. The probability to win is 1/100 (0-9 for the first digit and 0-9 for the second digit). Given that Y is personal income so $[0.01\times(Y+1{,}000) + 0.99\times(Y-40)] = Y- 29.6$. This means that if he does not bet, he will receive Y as his income. If he bets, he may receive Y- 29.6 baht.

- The expected value of the underground lottery (last 2 digits): A gambler will win if his numbers on the ticket match with the last 2 digits of the first prize of the government lottery. If he bets 1 baht and wins, he will receive 70 baht. Thus if he bets 40 baht and wins, he will earn 2,800 baht. Given that Y is personal income. The probability to win is 1% as the government lottery so $[0.01\times(Y+2{,}800) + 0.99\times(Y-40)] = Y-11.6$. This means that if he does not bet, he will receive Y as his income. If he bets, he may receive Y- 11.6 baht.

To classify the gamblers' attitude to risk, based on a comparison of certainty income and expected value, it can be stated that gamblers who bet on the number games are risk-attracted (Gravelle and Rees, 2004; Mas-Colell *et al.*, 1995). This is because all expected gains of both the government lottery and the underground lottery are less than zero, but gamblers still purchase a ticket, that means, they are risk-loving (See Appendix 5B).

The expected gain of the government lottery is lower than the expected gain of the underground lottery in every prize. This is one of the factors that the underground lottery attracts gamblers rather than the government lottery although betting on the underground lottery is illegal. The penalty of gambling on the underground lottery is not large, being fined up to 500 baht. Indeed, there are a few cases of gamblers are arrested, compared with a number of underground lottery gamblers. In 2006, there were only 16,192 gamblers were arrested due to betting on the underground lottery, while the number of gamblers who bet on the underground lottery was around 23 million people (Police Central Information Technology Center, 2007). It can be summarised that because of a small penalty and higher expected gain, people may think it is worth to bet on the underground lottery rather than the government lottery.

Kwang (1965) uses the concept of indivisibility of expenditure to explain why lotteries normally have several prizes. First, the amount of lottery expenditure for most people is smaller than the total expenditure to be paid. Second, different buyers of lottery tickets have different indivisible expenditure totals in mind and the same individual may have different sums in mind for different uses. In addition, the offer of multiple prizes may lead the gamblers to believe that their winning chances are higher than they actually are.

According to the income elasticities of casino and football betting, both elasticities are slightly different in 2002, but in 2008, income elasticity, with respect to personal income, of casino is considerably higher. From these results, it might be inferred that if the government decide to legalise either casino or football betting, it seems that the casino legalisation can capture the gamblers' demand rather than legalising football betting. The results in Table 5.10 can support this notion. The results show that the income elasticities of demand for casinos in other countries, which were legal, was the highest in 2007 and the income elasticity of demand for domestic permanent casinos, which were illegal, was the highest in

2008. These results can be implied that casino gamblers demand for a legal casino in a country and the style of a legal casino should be similar to the casinos in other countries.

In term of an international comparison of income elasticities, all income elasticities of the number games in this study are smaller than Canadian estimates, 0.7 in 1986, and all income elasticities of casino also smaller than in Atlantic City, 0.88 in 1987, but higher than in Las Vegas, 0.30 in 1987 (Kitchen and Powells 1991, Borg *et al*. 1991).

As noted above, a number of previous researches, such as Borg *et al.* (1991), Hansen (1995), F.Heavey (1978), Jackson (1994), Spiro (1974), concern with the incident of the implicit gambling tax. Those researches are attempted to indicate whether the gambling tax which is one of the state revenues, such as lottery tax, casino tax, is progressive or regressive by considering the elasticity of gambling products with respect to income directly. The tax is progressive if the income elasticity is greater than unity, the tax is proportional if the income elasticity is unity, and the tax is regressive if the income elasticity is less than unity. All mentioned researches confirm that gambling tax exhibits the regressivity.

The government lottery and the 2-3 digit lottery are the legal gambling games in Thailand so that the taxes of these two games are one of the sources of government revenues. It thus can be seen from this study that the Thai lottery tax is same as the lottery tax of several countries, which is regressive, and the result also indicates the Thai lottery tax is more regressive than the Canadian lottery tax, for example, because the income elasticity of Thai lottery is lower than the Canadian's one on average.

According to the estimation of pent-up demand, the results, again, can be insisted that casino should be legalised rather than football betting due to the higher gamblers' demand. The comparison between the pent-up demands for the legal casino and the illegal casino indicates that the legal casino is demanded and it can be assumed that the casino tax is regressive subject to there being the legal casino.

5.5 Conclusions

This chapter uses Tobit estimation to investigate the determinants of gambling expenditures in Thailand. The income elasticities of each gambling type, which relate to the gambling demand and the incidence of the implicit gambling tax, are also reported. The income elasticity determines how regressive gambling products might be in increasing revenue for the government. However, the regression results can be reaffirmed that socio-economic/demographic data, such as gender, age is indeed an important determinant of the level of gambling expenditures. Moreover, the variables of gambling opinions and gambling experiences also play an important role in the gambling expenditures.

Some results of this study seem to be similar to the results of other researches, for example, males have a high level of gambling expenditures than females, and the education reduces the gambling expenditures. The expenditures on the number games are high in the group of gamblers who have undergraduate degree/lower while the expenditures on casino and football are high in the group of gamblers who have undergraduate degree. Focusing on the occupation, housewives and being unemployed have higher expenditures on casino and the number games than students, while students have a high level of expenditures on football betting. It can be stated that the general structure of Thai gambling expenditures is similar to the gambling expenditures in other countries such as Canada, Australia, and the UK.

The effects of casino and football betting, such as being addicted, being in gambling debt, seem to be more dangerous than the effects of betting on the number games. It also can be stated that the risk attitude of number game gamblers is risk-loving. Casino and football betting significantly attract adolescents than the other gambling types. There is no doubt that the problem of gambling addict in the adolescents leads to other problems in both economic and social aspects. The Thai government has realised the problem and tried to control and tackle. Therefore, the approach of a legalisation in the illegal gambling types has been frequently raised in the public. Some people think so while some people strongly oppose. Rather, some people offer that the government should legalise some illegal types, not all types.

Given that the government decides to legalise some popular illegal gambling types, in order to capture the public demands, the income elasticity of demand may be one of the useful measurements for evaluating the public demands. The results of pent-up demand and income elasticities of casino and football betting obviously indicate that the government should legalise casino business rather than football betting. The income elasticity coefficient of a legal casino shows the positive sign thus if there is a legal casino, the government revenue will increase. However, the casino tax will be one of the regressive sources of government revenue.

Finally, it should be emphasised that this present study does not attempt to support the gambling legalisation. Instead, this study tries to fill a void in the Thai gambling studies and intends to illustrate the fact situation and make people to understand it better. Most results should be benefited for policy-maker and other concerned parties since legalising different types of gambling raise different amounts of tax revenue. Thus if the government decides to legalise the gambling business, this study can be served as one of the alternatives to the government to choose the best alternative for the public.

Appendix 5A

Table 5A shows the legal gambling revenues between 1997 and 2004 in Thailand (Million baht)

Year	Government revenue	Gambling fees	Lottery revenue	% of government revenues
1997	844,248	575	4,730	0.62
1998	725,767	695	7,340	1.10
1999	736,947	609	7,300	1.07
2000	855,616	507	9,370	1.15
2001	874,918	974	4,880	0.67
2002	1,032,170	494	5,460	0.58
2003	1,044,413	441	6,464	0.66
2004	1,201,111	591	8,872	0.79

Source: Thai National Statistical Office

Table 5B: the proportions of gambling expenditures to income (in percentage)

Income (baht/month)	Casino	Football Betting	Government Lottery	Underground Lottery
1-5,000	54.97	219.24	5.67	8.50
5,001-10,000	31.19	21.66	4.80	21.99
10,001-20,000	31.51	37.84	1.98	2.63
20,001-50,000	3.47	125.64	1.43	4.57
Over 50,000	5.46	8.51	0.81	4.00

Source: Sungsidh *et al.*, 2003

Table 5C: The percentage of gamblers by the gambling expenditures in 2002

Expenditure (baht/ year)	% of casino gamblers	% of football betting gamblers
Less than 1,000	35.11	23.20
1,000-2,999	22.73	20.82
3,000-5,999	13.83	12.24
6,000-9,999	6.68	5.48
10,000-19,999	8.56	16.94
20,000-49,999	5.62	4.78
50,000-99,999	2.50	10.10
100,000-499,999	3.93	2.73
500,000-999,999	0.57	3.04
Over 1,000,000	0.47	0.67
Total	100	100

Source: Sungsidh *et al*., 2003

Table 5D: The percentage of government lottery players by the government lottery expenditures in 2002

Expenditure (baht/year)	Nationwide
Less than 500	39.08
500-999	14.84
1,000-1,999	14.95
2,000-2,999	11.51
3,000-3,999	2.91
4,000-9,999	11.94
10,000-49,999	4.64
Over 50,000	0.13
Total	100

Source: Sungsidh *et al*., 2003

Table 5E: The percentage of the underground lottery players by the underground lottery expenditures in 2002

Expenditure (baht/year)	Nationwide
Less than 500	39.32
500-999	11.43
1,000-1,999	15.23
2,000-2,999	8.88
3,000-3,999	4.72
4,000-9,999	13.47
10,000-29,999	5.35
30,000-49,999	0.85
50,000-69,999	0.18
70,000-99,999	0.22
100,000-199,999	0.19
Over 200,000	0.16
Total	100

Source: Sungsidh *et al*., 2003

Table 5F shows the government and underground lottery expenditure by ages in 2002

Variables	Government Lottery		Underground Lottery	
	Coef.	**Z-stat**	**Coef.**	**Z-stat**
C	1.87	20.91	3.19	37.56
15-22 years old	-2.30***	-8.04	-1.53***	-6.96
23-35 years old	-0.55***	-4.17	-0.12	-0.97
51-60 years old	-0.22	-1.24	-0.73***	-4.11
Over 60 years old	-0.54***	-2.57	-1.95***	-8.92

(***) = 1% significance level

The dependent variable is gambling expenditures and the independent variables are gamblers' age

Table 5G shows the government and underground lottery expenditure by status in 2002

Variables	Government Lottery		Underground Lottery	
	Coef.	Z-stat	Coef.	Z-stat
C	1.26	5.55	2.62	11.78
Single	-0.31	-1.22	-0.09	-0.38
Married	0.41*	1.73	0.26	1.13

(*) = 10% significance level
The dependent variable is gambling expenditures and the independent variables are gamblers' marital status

Table H: Determinants of casino betting expenditure in 2002

(***) = 1% significance level

Variables	Coef.	Z-stat
C	1.16	2.16
Home/flying Casino	0.20	0.38
Domestic Permanent Casino	-0.05	-0.11
Casino in Neighbouring Countries	0.47	0.94
Casino in Other Countries	2.01***	3.83

The dependent variable is casino expenditures and the independent variables are the participation in each type of casino

Table I shows the 2-3 digit lottery expenditure by status in 2007

Variables	Coef.	Z-stat
C	2.41	3.52
Single	0.94	1.25
Married	2.34***	3.06

(***) = 1% significance level
The dependent variable is 2-3 digit lottery expenditures and the independent variables are gamblers' marital status

Table J: Determinants of casino betting expenditure in 2007

Variables	Coef.	Z-stat
C	2.23	4.90
Home/flying Casino	0.98**	2.46
Domestic Permanent Casino	1.23**	2.29
Casino in Neighbouring Countries	1.45***	3.45
Casino in Other Countries	1.24***	2.99

(***) = 1% significance level (**) = 5% significance level
The dependent variable is casino expenditures and the independent variables are the participation in each type of casino

Table K: Determinants of gambling expenditure by gambling experiences in 2008

Column 1-3: The dependent variable is expenditure on casino; The independent variables are gambling experiences
Column 4-6: The dependent variable is expenditure on football; The independent variables are gambling experiences
Column 7-9: The dependent variable is expenditure on the government lottery; The independent variables are gambling experiences
Column 10-12: The dependent variable is expenditure on the 2-3 digit lottery; The independent variables are gambling experiences
Column 13-15: The dependent variable is expenditure on the underground lottery; The independent variables are gambling experiences

	Casino		**Football Betting**		**Government Lottery**		**2-3 Digit Lottery**		**Underground Lottery**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Variables	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**	**Coef.**	**Z-Stat.**
C	-1.14	-6.78	3.71	25.24	0.45	1.84	0.16	0.37	2.68	11.63
C31	0.26	1.18	0.22	1.11	-0.15	-0.54	0.21	0.39	-0.27	-0.96
C32	1.76***	9.10	0.18	1.04	0.27	0.98	0.22	0.46	0.39	1.42
C33	0.64***	2.66	0.39*	1.74	0.34	1.07	0.73	1.36	0.13	0.41
C34	0.01	0.07	0.89*	1.70	0.05	0.06	-0.49	-0.36	-0.12	-0.14
C35	0.33*	1.65	-0.33*	-1.85	0.51*	1.83	0.28	0.57	0.57**	2.02

Note: c31= a bad effect on your study because of gambling? (0 = No, 1 = Yes) c32= ever thought about the gambling? (0 = No, 1 = Yes)
c33= you and your family ever faced financial problems because of gambling? (0=No, 1=Yes)
c34= currently in debt because of gambling? (0 = No, 1= Yes) c35= guilty on gambling (0 = No, 1 = Yes)
(***) = 1% significance level (**) = 5% significance level

Table L: Determinants of casino betting expenditure in 2008

Variables	Coef.	Z-stat
C	0.21	0.74
Home/flying Casino	-0.62**	-2.34
Domestic Permanent Casino	-0.34	-1.37
Casino in Neighbouring Countries	0.81***	3.52
Casino in Other Countries	1.58***	4.65

(***) = 1% significance level (**) = 5% significance level
The dependent variable is casino expenditures and the independent variables are the participation in each type of casino

Appendix 5B

Government Lottery:

There are 6 digits on a lottery ticket. Each digit can be drawn between 0 and 9. One ticket price is 40 baht. There are 7 prizes.

The first prize is 2 million baht. There is one prize. The probability to win is 1/1,000,000.

The expected gain is $(0.000001\times2{,}000{,}000) + [0.999999\times(-40)] = -38$

The second prize is 100,000 baht. There are 5 prizes (draw 5 times). The probability to win is 5/1,000,000.

The expected gain is $(0.000005\times100{,}000) + [0.999995\times(-40)] = -39.5$

The third prize is 40,000 baht. There are 10 prizes (draw 10 times). The probability to win is 10/1,000,000.

The expected gain is $(0.00001\times40{,}000) + [0.99999\times(-40)] = -39.6$

The fourth prize is 20,000 baht. There are 50 prizes (draw 50 times). The probability to win is 50/1,000,000.

The expected gain is $(0.00005\times20{,}000) + [0.99995\times(-40)] = -39$

The fifth prize is 10,000 baht. There are 100 prizes (draw 100 times). The probability to win is 100/1,000,000.

The expected gain is $(0.0001\times10{,}000) + [0.9999\times(-40)] = -39$

The sixth prize is 3 digits. It is drawn 4 times. Each prize is worth 2,000 baht. The probability to win is 4/1000.

The expected gain is $(0.004\times2{,}000) + [0.996\times(-40)] = -31.84$

The seventh prize is 2 digits. It is drawn one time. The prize is worth 1,000 baht. The probability to win is 1/100.

The expected gain is $(0.01\times1{,}000) + [0.99\times(-40)] = -29.6$

Underground Lottery:

An individual can buy the numbers of 2 digits or 3 digits. There are 4 styles.

The first style is "up-3 digits". An individual will win if his numbers (3 digits) match with the last three digits of the first prize of the government lottery. For example, the number of the first prize of the government lottery is 123456. He will win if his numbers are 456. If he buys 1 baht and he wins, he will receive 500 baht. Thus, he will receive 20,000 baht if he bets 40 baht. The probability to win is 1/1000.

The expected gain is $(0.001\times20{,}000) + [0.999\times(-40)] = -19.96$

The second style is “down-3 digits”. An individual will win if his numbers (3 digits) match with one of the 3 digits prizes of the government lottery. For example, the prize numbers are 111, 222, 333, and 444 (the government lottery would be drawn 4 times for this prize). Suppose he buys number 333 so he wins. If he buys 1 baht and he wins, he will receive 125 baht. Thus, he will receive 5,000 baht if he bets 40 baht. The probability to win is 4/1000.

The expected gain is $(0.004\times5,000) + [0.996\times(-40)] = -19.84$

The third style is “up-2 digits”. An individual will win if his numbers (2 digits) match with the last two digits of the first prize of the government lottery. For example, the prize numbers of the first prize of the government lottery are 123456. He will win if his numbers are 56. If he buys 1 baht and he wins, he will receive 70 baht. Thus, he will receive 2,800 baht if he bets 40 baht. The probability to win is 1/100.

The expected gain is $(0.01\times2,800) + [0.99\times(-40)] = -11.6$

The fourth style is “down-2 digits”. An individual will win if his numbers (2 digits) match with the 2 digits prize of the government lottery. For example, the prize numbers are 11 and he buys numbers 11 so he will wins. If he buys 1 baht and he wins, he will receive 70 baht. Thus, he will receive 2,800 baht if he bets 40 Baht. The probability to win is 1/100. The expected gain of this prize is same as the up-2 digits, which is -11.6.

CHAPTER 6

GAMBLING DEMAND: ESTIMATING THE DEMAND FOR 2-3 DIGIT LOTTERY

6.1 Introduction

The number games, such as a government lottery, an underground lottery, have been the most popular gambling type in Thailand. In 2006, at least 20 million people, approximately one-third of Thai population, were involved in this type of gambling. The circulated gambling money was at least 500 billion baht (£8.3 billion) which was around 6.4% of Thai GDP (The Government Lottery Office, 2007). This type of gambling can be divided into 2 categories, legal and illegal games. Games such as the government lottery, are included in the first category while the illegal gambling games, such as the underground lottery, are in the second category. The underground lottery and the government lottery are the two most popular games of number games, with the underground lottery being more popular. The ratio of underground lottery expenditure to income per household between 1988 and 2002 was 1.79% on average and is higher than the equalised ratio for government lottery expenditure which was 1.11% on average (see Table 6A in Appendix 6A).

The winners of the underground lottery and the government lottery are determined by drawing numbers. For example, to win the 3 digit prize of the underground lottery, the ticket that chosen 3 numbers must match the last 3 digits of the first prize of the government lottery.

In other words, a player bets on the underground lottery against the prize numbers which are drawn in the government lottery. Since the underground lottery betting creates considerably higher revenue and these sums are invested in other illegal businesses, the government had tried to control the underground lottery business by suppressing. However, another alternative that the government could adopt to control the underground lottery business is to legalise such betting; the government alternated this by issuing the 2-3 digit lottery project in August 2004. The government claimed that the main objective of this project is not profit maximisation and that State revenue should not increase from the gambling money contribution. Instead, the main objective is to substitute the underground lottery betting with an official version, with the profit from this project used to enhance the social welfare.

However, the government also sets up the jackpot prize, which the underground lottery betting does not replicate. The government wishes the jackpot prize can attract lottery players and induce them to bet on the 2-3 digit lottery instead of the underground lottery.

In this chapter we use variation in the expected value of the jackpot to estimate demand for the 2-3 digit lottery and in particular examine whether this is an addictive good.

The framework of the 2-3 digit lottery is similar to the underground lottery even though there is less choice. Prizes and the expected return of the underground lottery are described in Appendix 5B in chapter 5. A 2-3 digit lottery ticket can be divided into two types which are a 2 digit ticket and a 3 digit ticket. Equally, the tickets can be also divided into two prices, a 20 baht ticket and a 50 baht ticket. Hence there are 4 types of 2-3 digit lottery ticket offered to players, which are 2 digit 20 baht ticket, 3 digit 20 baht ticket, 2 digit 50 baht ticket, and 3 digit 50 baht ticket. The prize numbers of the 2-3 digit lottery relates to the first prize of the government lottery which consists of 6 digits and each digit can be randomly drawn between “0-9”. The winning 2 digit ticket occurs if the 2 numbers on the ticket are same as the last 2 digits of the first prize of the government lottery. Similarly, for a 3 digit ticket a win is when the 3 numbers on the ticket are same as the last 3 digits of the first prize of the government lottery. The government lottery is drawn 2 times a month, which means that the 2-3 digit lottery can be run 2 times a month.

The prize associated with a winning 2 digit 20 baht ticket is 1,300 baht per ticket whereas the prize for a winning 3 digit 20 baht ticket is 10,000 baht per ticket. The prize of a winning 2 digit 50 baht ticket is 3,250 baht per ticket while the prize of a winning 3 digit 50 baht ticket is 25,000 baht per ticket.

To win the jackpot, it can be explained as follow; there are 8 digits which are printed on each ticket. These 8 digits are divided into 2 groups. The first group comprises first 2 digits, called the set number, and the second group consists of the remaining 6 digits. A ticket will win the jackpot prize if and only if the first 2 digits (the set number) are same as the 2 numbers drawn in the 2 digit prize of the government lottery and the last 6 digits must be same as the 6 numbers drawn in the first prize of the government lottery. These two prizes are separately drawn in each draw.

Individuals cannot choose these 8 numbers by themselves since all 8 digits were already printed by the Government Lottery Office (GLO). The set number is randomly selected and not in any order in each draw. Therefore, it is possible that there is no one wins the jackpot in a draw if the prize numbers of the 2 digit prize of the government lottery are not randomly selected for the set number in that draw. For example, if the prize numbers of the 2 digit prize of the government lottery are “99” but these numbers are not randomly printed on the 2-3 digit lottery tickets in that draw then the jackpot prize is not won. Moreover, there is only one holding ticket can win the jackpot prize per draw since the printed 8 digits are unique. It should be emphasised that the jackpot prize is not shared among the winners, unlike in the U.K. lottery or the U.S. lottery, because there is only one jackpot winner per draw.

The government also injects 20 million baht into the jackpot prize every draw. The jackpot prize, however, will be rolled over to the next draw if it is not won. In any draw where the jackpot size is over 100 million baht, the jackpot prize will be forced to be awarded by randomly drawing the numbers from the set number of that draw only. In other words, there will be a winning ticket in the draw that the jackpot prize is forced to be awarded. Nevertheless, the winning jackpot 20 baht ticket will be awarded 25% of the jackpot size in that draw while if the winning ticket is the type of 50 baht ticket, it will be award 50% of the jackpot size in that draw.

The government launched the 2-3 digit lottery project in 2004, however, since 2007 the project was suspended due to legal problem. This project creates total revenue or the 2-3 digit lottery expenditure around 134,800 million baht, equalised £2,200 million, and the total net profit around 29.5 billion baht, approximately £490 million. In 2006, the total 2-3 digit lottery expenditure was 53.1 billion baht, representing an annual average of 2,900 baht per household nationwide. This is more than the average household spent on tobacco products in 2006 and nearly equal to the alcohol beverages spending. In addition, the total net profit of the 2-3 digit lottery sales in 2006 was 7.5 billion baht, around 0.1% of GDP.

This study will focus on only 20 baht ticket. This is because it is more considerably popular than the other. The GLO reported in the 2008 annual report that the 20 baht ticket purchases make up over 75% of total sales and nearly 90% are 2 digits betting in each draw.

This chapter aims to explore 2 questions which are whether the 2-3 digit 20 baht ticket is an addictive good and whether the addiction is rational or non-rational. The model used in this chapter follows Becker and Murphy's (1998), who indicate that a good is potentially addictive if an increase in past consumption increases its present consumption. One compulsory condition to estimate this model is a variation in prices.

The following section is the prevalence of lottery demand. The theoretical framework would be presented in this section. The empirical work and discussion are in 6.3. Here, the data and regression results are reported in this section. The last section provides the conclusions.

6.2 Literature Review: Prevalence of the demand for the number games

The theory employed in this chapter is "The Theory of Rational Addiction", Becker and Murphy (1988). This theory is developed much further and related to the literature on habit persistence by a number of economists, such as Iannaccone (1986), Pollak (1970, 1976). Becker and Murphy stated that individuals maximise their utility over a good that they may be able to become addicted. Addiction implies that past consumption, which generates the stock of addiction, affects the utility of current consumption. People can be addicted not only to cigarettes, alcohol but also to religion, eating, gambling, and other activities. They also divide the addiction into 2 types which are rational addiction and non-rational addiction, hereafter myopic addiction.

Rational addiction is present when people consider the expected future prices and future consumption when making a decision on current consumption. A decrease in expected future prices will increase both future sales and current consumption for rational addicts, that is, people will accumulate their stock of consumption by increasing their current consumption in order to maximise their utility from the expected increase in future consumption. Myopic addiction is present when people are concerned only about past consumption which affects the present consumption. It may be said that rational addicts are forward looking while myopic addicts are backward looking.

Becker and Murphy's model considers utility maximisation defined over the addictive good. Present consumption depends on the consumption in previous period. However, most empirical works of consumption deal with single period models or assume time separable utility. A single period model implies that present consumption is independent of previous consumption under the assumption of additive separability. Since addictions suppose the linkages in consumption of the same good over time, it is essential to relax the assumption of additive separability by allowing utility in each period to be a function of both consumption in that period and consumption in the previous period of the addictive good. Becker and Murphy state that, at any moment, utility of an individual depends on the consumption of two goods, *Y* and *C*, and assume that current utility depends on a measure of past consumption of only *C*. Thus the utility function can be expressed as:

$$U_t = U(C_t, C_{t-1}, Y_t, e_t) \tag{6.1}$$

where C_t = current period consumption of C

C_{t-1} = one period lag of C_t

Y_t = current consumption of a composite commodity

e_t = the effects of unobservable variables/ current period shocks on utility

Becker and Murphy emphasised that utility (U) is separable over time in past consumption (C_{t-1}), consumption of C, and consumption of a composite commodity (Y) but not in C and Y alone. This is because their marginal utilities depend on past value of C. To maximize this utility function over an individual's life time which is assumed to be infinite, individual chooses to maximise C_t and Y_t under the usual budget constraint where the life-time discounted sum of consumption at the rate *"r"* must be equal to the present value of wealth. If the rate of interest (*r*) is equal to the rate of time preference and if the current price of the good is denoted by P_t, the individual's problem is

$$\text{Max } \sum_{t=1}^{\infty} \beta^{t-1}\, U(C_t, C_{t-1}, Y_t, e_t)$$

such that

$$\sum_{t=1}^{\infty} \beta^{t-1}\, (Y_t + P_t C_t) = A^0 \tag{6.2}$$

where β = discount factor = $1/(1+r)$

r = the rate of time preference

A^0 = the present value of wealth

Any effects of C on earning, on the length of life, on the present value of wealth, and all other types of uncertainty is ignored. The initial condition for the consumer in period one measures the level of consumption of the good in the prior period which under the considerate period. The first-order conditions are:

$$U_y(C_t, C_{t-1}, Y_t, e_t) = \lambda \quad (6.3a)$$

$$U_1(C_t, C_{t-1}, Y_t, e_t) + \beta U_2(C_{t+1}, C_t, Y_{t+1}, e_{t+1}) = \lambda P_t \quad (6.3b)$$

where U_y = marginal utility of consumption in each period

λ = marginal utility of wealth

It can be seen from the equation (6.3a) that the marginal utility of consumption in each period equals the marginal utility of wealth and equation (6.3b) states that the marginal utility of current consumption *plus* the discounted marginal effect on utility in the next period of current consumption *equals* the utility of wealth multiplied by the current price. Becker *et al.* (1994) illustrate that, in the time-separable case, the demand curves for Y and C depend on both the current price and the marginal utility of wealth, but with non-separate utility, these demand curves depend on prices in all periods through the effects of both past and future prices on both past and future consumption.

As regards the utility function (equation 6.1) which is quadratic in C_t, Y_t, and e_t, Becker and Murphy tackled this problem by solving the first-order condition for Y_t then substituting the result into the first-order condition for C_t. Finally, they show a linear difference equation that determines current consumption of the addictive good as a function of past and future consumption, the current price, and the error terms.

$$C_t = \alpha + \theta C_{t-1} + \beta\theta C_{t+1} + \theta_1 P_t + \theta_2 e_t + \theta_3 e_{t+1} \qquad (6.4)$$

where C_t, C_{t-1}, C_{t+1} = the aggregate current, previous, future consumption respectively

α, θ, θ_1, θ_2, θ_3 = the preference parameters

and
$$\theta_1 = \frac{u_{yy}\lambda}{\left(u_{11}u_{yy} - u_{1y}^2\right) + \beta(u_{22}u_{yy} - u_{2y}^2)} < 0$$

$$\theta_2 = \frac{-\left(u_{yy}u_{1e} - u_{1y}u_{ey}\right)}{\left(u_{11}u_{yy} - u_{1y}^2\right) + \beta\left(u_{22}u_{yy} - u_{2y}^2\right)}$$

$$\theta_3 = \frac{-\beta\left(u_{yy}u_{2e} - u_{2y}u_{2e}\right)}{\left(u_{11}u_{yy} - u_{1y}^2\right) + \beta\left(u_{22}u_{yy} - u_{2y}^2\right)}$$

where lower case letters denote the coefficients of the quadratic utility function, and the intercept is suppressed.

Because of the negative value of θ_1 due to concavity of utility (*U*), equation (6.4) indicates that current consumption will decreases when increasing in the current price while the marginal utility of wealth, and both past and future consumption are held fixed. The effects of past or future consumption on current consumption relate to the sign of θ. If θ is positive, greater past or future consumption will increase current consumption, in contrast, greater past or future consumption will decrease current consumption when the sign of θ is negative. Thus current and past consumption are complements when

$$\theta = \frac{-(u_{12}u_{yy} - u_{1y}u_{2y})}{\left(u_{11}u_{yy} - u_{1y}^2\right) + \beta\left(u_{22}u_{yy} - u_{2y}^2\right)} > 0$$

Since current consumption is affected by past consumption, it can be stated that whether a good is an addictive good or not depends on the previous consumption of that good. If and only if an increase in past consumption of that good leads to the increase in current consumption by holding current price, the marginal utility of wealth, and the effects of unobservable variables (e_t, e_{t+1}) fixed, it can be said that the good is addictive. Moreover, the good is more addictive when the greater the reinforcement of previous consumption on present consumption, that is, the level of addiction is higher when θ is larger. It can be noticed that the difference between the lag and lead of consumption coefficients (θC_{t-1} and $\beta\theta C_{t+1}$) is only the discount factor (*β*) according to equation (6.4).

Regarding the discount factor, there are two issues should be focused. First, the greater the value of time preference, *r*→∞ so $\beta \rightarrow 0$, people tend towards the myopic. In this case only past consumption will have a significant coefficient; there is no effect of future consumption on present consumption or it might be said that βU_2 in equation (6.3b) will not exist. Becker and Murphy defined this case as myopic addiction. Second, if there is no variation in the expected future prices, the data cannot identify the rate of time preference because the movement in expected future prices creates future consumption. Hence equation (6.4) cannot be estimated when there is no the variation of expected future prices.

According to equation (6.1), which is the utility function, it must be assumed as a concavity function. However, gambles, such as lottery betting, are intuitively accepted as an unfair game. Thus participating in the unfair gamble is clearly strange according to traditional expected utility theory because, in general, individuals are assumed to be risk averse then they would reject the unfair gamble. Farrell *et al*. (1999) explain this problem that although people reject the unfair gamble, the number game, like lottery betting, generates some positive non-pecuniary effect on well-being. To maintain the concavity assumption, it is necessary to postulate that the utility from gambling is diminishing in the number of lottery tickets purchased.

Becker and Murphy also claimed that equation (6.4) can be used to estimate short-run and long-run demand elasticities for addictive goods. It is clear that when θ has a positive value, a decrease in current price leads to an increase in current consumption and the consumption in the next period, $t+1$, will increase as well. In the same way if this decrease in current price is anticipated in the previous period, $t-1$, the increase in current consumption also stimulates past consumption to increase. Moreover, Becker and Murphy indicated that the effect of a permanent decrease in price on present consumption is greater than the effect of a temporary decrease in price because the permanent decrease in price includes the decrease in current and all future prices.

In addition, they explained the differences between the short-run and long-run effects of the permanent price change on consumption. The short-run effect describes the change in current price, period *t*, and all unanticipated prices in all future periods until period *t* while the long-run effect describes the change in price in all periods. Hence the long-run effect of the price change must be greater than the short-run effect of the price change because past consumption is still the same if the change in price is unanticipated until period *t*. However, the short-run and long-run price elasticities can be calculated, following Farrell *et al*. (1999), by

$$\varepsilon_{short-run} = |\theta_1|\left(\frac{\bar{P}}{\bar{C}}\right) \tag{6.5}$$

$$\varepsilon_{long-run} = \left(\frac{|\theta_1|}{1-|\theta_1|}\right)\left(\frac{\bar{P}}{\bar{C}}\right) \tag{6.6}$$

It can be seen from equation (6.5) and (6.6) that the difference between short-run and long-run price elasticities is small when θ_1 is close to zero. Moreover, Becker *et al*. (1994) also indicate that the difference between short-run and long-run is smaller when there is a smaller degree of addiction, θ, and if θ is quite different from zero, a time separable model is likely to give highly misleading prediction.

Pollak (1970) indicates three reasons for the difference between short-run and long-run demand functions; firstly, consumers may have a commitment with themselves, neglecting to change their consumption in response to a change in prices or income. They may be able to adjust their long-run equilibrium after this commitment is terminated. Secondly, consumers may disregard the choices of consumption or their own tastes which are outside the range of their past consumption experience. The adjustment to a new price or income situation for this case will involve the process of time-consuming learning. The last reason is goods may be "habit forming" thus consumers' current consumption depends on their past consumption.

The change in price or income leads to change in consumption then the change in consumption will induce a change in tastes, a further change in consumption will exist due to taste changing.

6.2.1 The expected price against the actual price

As mentioned above, the model in equation (6.4) cannot be estimated when there is no any variation in price. In other words, the actual price or the face value of a lottery ticket cannot be used to estimate since it does not vary. Farrell, Morgenroth, and Walker (1999) who study the addiction for the U.K. lottery use the "expected price" instead of the price of a ticket (the actual price). The expected price is defined as the face value of the ticket, £1 for the U.K. lottery, *minus* the expected value (1 – EV), where EV is the expected value of the ticket, and the EV is defined as the probability of wining multiplied by the expected return (the probability of win × the expected return). The EV is varying since the individual's expected value is different among the draws. For example, in the case of the U.K. lottery, the jackpot prize has to be shared among the winners thus the expected return is different due to the difference in a number of winners in each draw. The variation in the expected value makes the expected price varies. Hence the actual price should be substituted with the expected price for the estimation.

For the U.K. lottery, rollovers give rise to the variations in the expected value between regular draws and rollover draws (the calculation is shown in Appendix 6B). The rollover draws occur when the jackpot of the previous draw is not claimed, in other words, the jackpot from the previous draw is rolled over. Farrell *et al.* (1999) explain how there is the variation in expected value due to the existence of rollovers that, in each draw, people expect the price in the next draw to be determined by the weighted sum of the expected values when there is a rollover and no rollover. These weights are given by the probabilities that rollovers occur. Since there is price variation, the model can be used to test the addiction.

Farrell, Morgenroth, and Walker stated that U.K. lottery play, or may be called lotto play, is an addictive good as cigarettes but less addictive than cigarette consumption. They compared their work with Becker, Grossman, and Murphy's work in 1994 which test the cigarette addiction in the U.S.. However, the rollovers induce addiction because the lotto sales are higher than average after the rollovers. In addition, the estimated long-run elasticity leads to reject revenue maximisation even it is not statistically significant. Therefore, they suggested to re-arrange the distribution of sales revenue that are allocated to prizes so that a larger proportion of prize leads to large increase in sales.

The issues of the expected price and the expected value have been used in a number of studies on lotteries such as Cook and Clotfelter (1993), Gully and Scott (1993), Sprowls (1970), Kearney (2004), Scoggins (1995). Gully and Scott use the expected price to estimate the demand for lotto in the U.S.. They explained that the typical price of a lottery ticket should be left out from the lottery demand studies. This is because the effective price of the lottery ticket is equal to the take-out rate over long periods and the take-out rate is the proportion of 1 U.S. dollar bet that is not returned to the players as a form of prize. Moreover, States do not vary this rate over time and this rate does not vary much among the States. The price of a lotto bet, which is used to calculate the lottery demand in Gully and Scott's work, equals the purchased price (1 U.S. dollar) *minus* the expected value where the expected value depends on the structure of the game, the amount of previous jackpots that rolled over into this present jackpot, and the number of tickets sold in the current draw.

Cook and Clotfelter studied the lotto in the U.S. and indicated in 1993 that the expected value of a 1 U.S. dollar bet depends on both the portion of the bet going to the prize pool and the total amount bets by other players. In this case, there are both positive and negative externalities to the player. For example, player A will increase the jackpot available to player B when player A bets a dollar. Simultaneously, a player A's one dollar also increases the chance that if player B win the jackpot, player B must share the prize with someone else. The former is the positive externality whereas the latter is the negative externality to player B. Cook and Clotfelter (1993) define the expected value (EV), in their case, as a probability of win multiplied by both the jackpot size and the expected share of the jackpot if win (EV = [probability of win] × [jackpot] × [expected share of jackpot if win]). Sprowls (1970) defines the expected value of his case study as the ratio of total amount paid out in prizes to the total revenue which is derived from the number of tickets purchased.

Scoggins (1995) tries to explore whether the change in the percentage of gross revenue allocated to the lotto prize would enhance the state's net revenue. This study based on the Florida lotto. The result from his study is similar to the Cook and Clotfelter (1993), which reports that the State's net revenue from lottery will be increased by allocating a greater percentage of ticket sold to the grand prize.

6.3 The empirical works and discussion

6.3.1 The estimate of 2 digit 20 baht lottery

6.3.1.1 Methodology

Equation (6.4) is the basis of the empirical analysis in this chapter. Lottery addiction of 2 digit 20 baht ticket can be tested by setting present consumption (C_t) as a dependent variable and the last and next periods' consumption (C_{t-1}, C_{t+1}), expected price (P_t) as independent variables.

The estimate strategy is to start with the myopic model for testing whether the 2 digit lottery is addictive. Under the addictive framework, current consumption must be reinforced by past consumption. Then the expected future prices (P_{t+1}) will be added to the model for testing whether the expected future prices are significant to reinforce current consumption as this addiction might be rational addiction. Recall the framework of rational addiction, current consumption must be affected by past and future consumption. The decrease in the expected future price will increase in future consumption, therefore, people need to accumulate the stock of addiction to maximise the utility of expected future consumption. The way to accumulate the stock of addiction is to increase present consumption, which means that, if and only if the expected future price variable is significant, the addiction would be rational addiction.

6.3.1.2 Model estimated

According to the methodology above, three models will be estimated in this stage. The first model is the conventional model, where the addiction is dropped. The model is defined as;

$$C_t = \alpha + aP_t + e_t \qquad (6.7)$$

where α and a = coefficients C_t = current consumption

P_t = expected price at period *t* e_t = error term

The remaining models, (6.8) and (6.9), estimate the myopic model of addiction, which can be expressed as;

$$C_t = \alpha + aC_{t-1} + bP_t + u_t \qquad (6.8)$$

where α, a, and b = coefficients

C_t = current consumption C_{t-1} = past consumption

P_t = expected price at period *t* u_t = error term

and

$$C_t = \alpha + aC_{t-1} + bP_t + b_1P_{t+1} + v_t \qquad (6.9)$$

where α, a, b, and b_1 = coefficient C_t = current consumption

C_{t-1} = past consumption P_t = expected price at period *t*

P_{t+1} = expected price at period *t+1* v_t = error term

Current consumption (C_t) is the dependent variable in these three models. In model (6.7), the expected price is only one independent variable, where in model (6.8), the expected price (P_t) and past consumption (C_{t-1}) are the independent variables. The expected future price (P_{t+1}) is added as the independent variable in model (6.9). The conventional model (6.7) will be estimated by the Ordinary Least-Squares (OLS) estimation. Regarding model (6.8) and (6.9), past consumption depends on the unobservables, u_t and v_t, respectively, through the optimising behaviour implied by the first-order conditions. In other words, the unobservables such u_t and v_t directly affect consumption at all dates through the optimising behaviour (Becker *et al.*, 1994). Thus past consumption (C_{t-1}) should be treated as an endogenous variable. OLS estimation is not consistent to estimate the model which has an endogeneity problem as model (6.8) and (6.9). Therefore, these two models should be estimated by the Instrumental Variable (IV) estimation. Provided that the unobservable are not correlated with price in the present period, past period's price (P_{t-1}) can be used as an instrumental variable since past price directly affect past consumption.

6.3.1.3 Data

A) The number of ticket sales

According to the 2-3 digit lottery project, there are total 80 draws starting from the first draws on the first of August 2004 and end in the mid of November 2007. It was drawn 2 times a month, every the first and the mid of each month. Hence there are 80 observations for this study. Over this period total sales revenue per draw was around 1,685 million baht and a number of 20 baht tickets sold per draw averaged approximately 64 million tickets, with the sales of 2 digit 20 baht averaging 56.3 million tickets per draw. All data on the number of ticket sales is reported by GLO in the annual reports. Figure 6.1 shows the volume of ticket sales between all types of ticket and the type of 20 baht ticket, whereas Figure 6.2 illustrates the volume of 20 bath ticket sales between 2 and 3 digit ticket. The size of the jackpot in each draw is also illustrated in Figure 6.3 (see also Appendix 6C). Figure 6.4 presents the expected price in each draw.

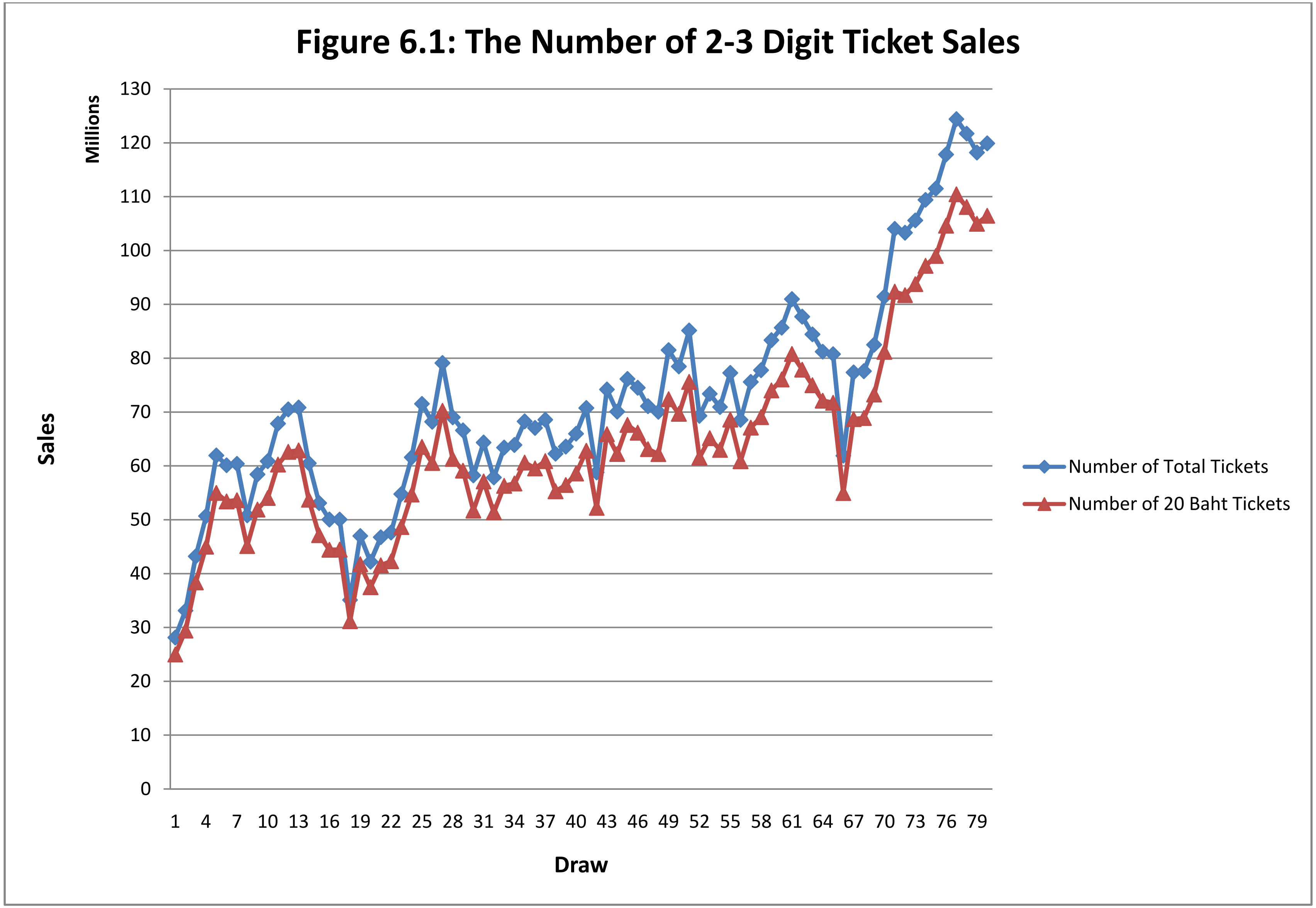


Figure 6.1: The Number of 2-3 Digit Ticket Sales
Millions
Sales
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79
Draw
Number of Total Tickets
Number of 20 Baht Tickets

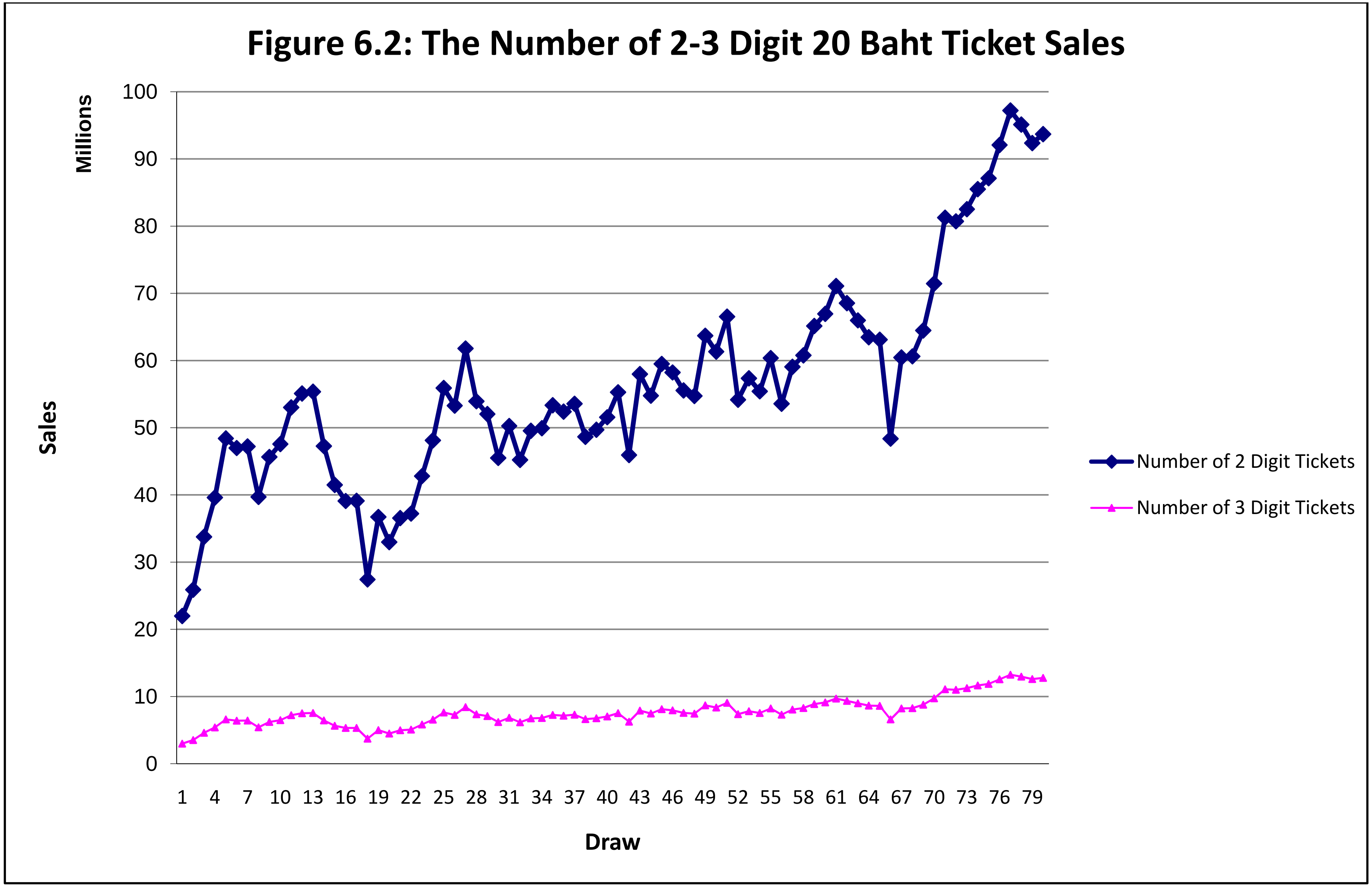


Figure 6.2: The Number of 2-3 Digit 20 Baht Ticket Sales
Millions
Sales
100
90
80
70
60
50
40
30
20
10
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79
Draw
Number of 2 Digit Tickets
Number of 3 Digit Tickets

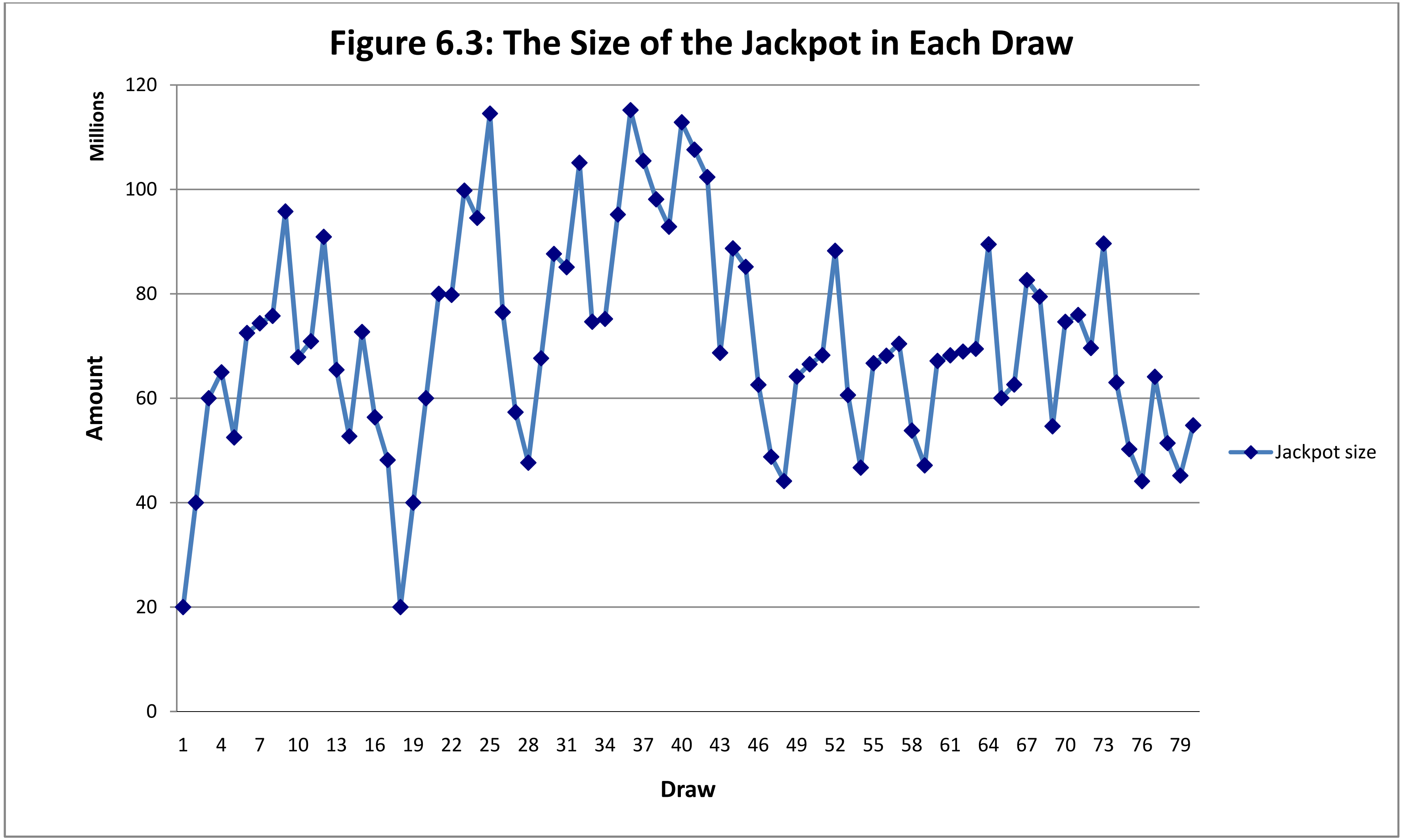


Figure 6.3: The Size of the Jackpot in Each Draw
Millions
Amount
120
100
80
60
40
20
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
52
55
58
61
64
67
70
73
76
79
Draw
Jackpot size

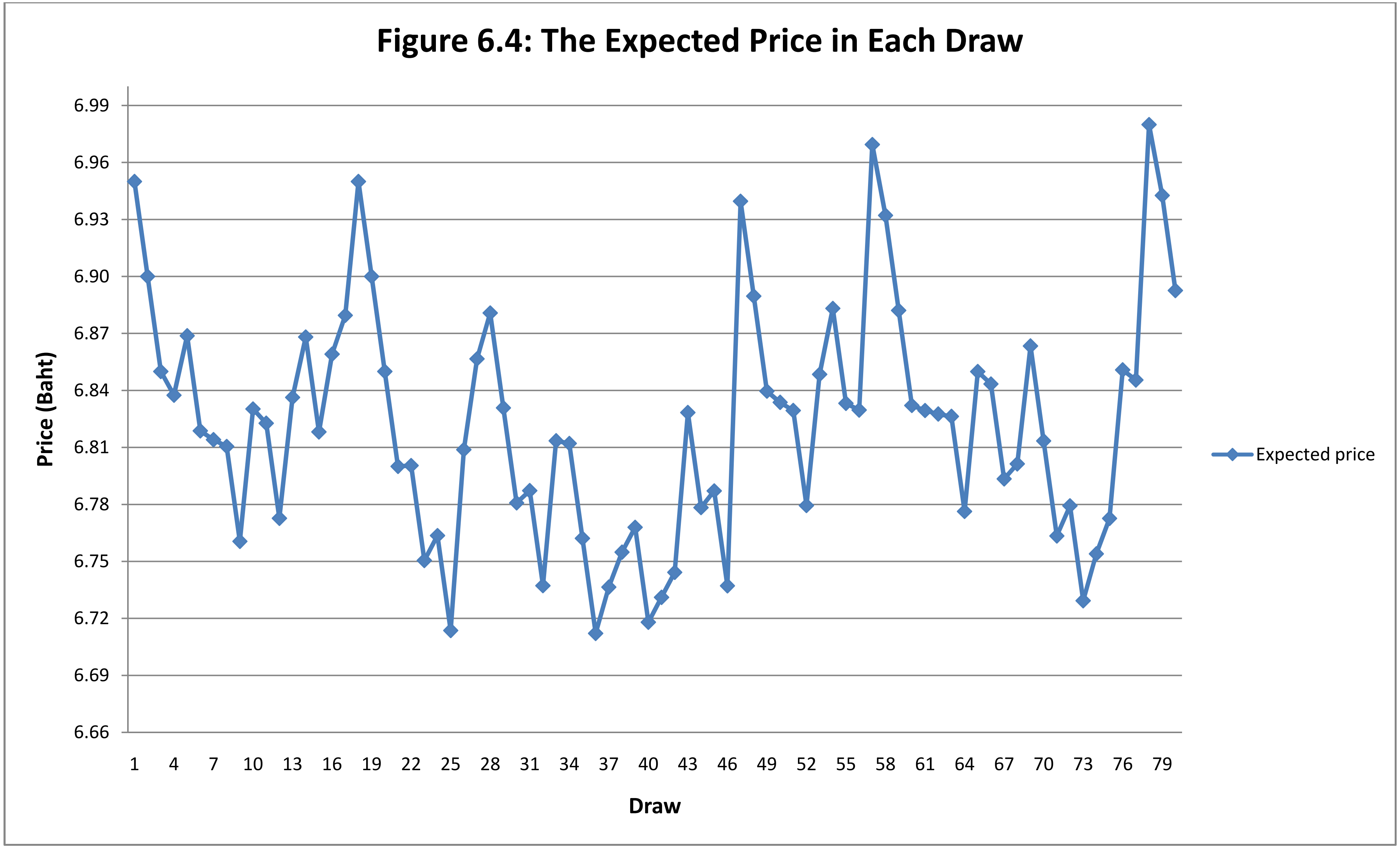


Figure 6.4: The Expected Price in Each Draw
Price (Baht)
6.99
6.96
6.93
6.90
6.87
6.84
6.81
6.78
6.75
6.72
6.69
6.66
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79
Draw
Expected price

B) The expected price

As noted above, the estimated model needs variation in price, therefore, the expected price is substituted for the actual price. The expected price is defined as the difference between the actual price and the expected value (the face value of the ticket – the expected value), whereas the expected value depends on the odds structure of the game. In the case of the Thai lottery, the expected value (EV) can be expressed as:

EV = (probability of win the regular prize × an amount of the regular prize) + (probability of win the jackpot prize × an amount of jackpot prize)

Focusing on the 2 digit ticket, the holding 2 digit ticket will win when those 2 numbers, between 00 and 99, match the last 2 digits of the first prize of the government lottery. Hence the probability of win equals $\frac{1}{10^2}$ or 0.01. The prize of 2 digits is 65 times per one baht so the prize of 2 digits of 20 baht ticket is 1,300 baht per ticket, an amount of the regular prize. Regarding the jackpot prize, there are random 8 digits in each ticket and the holding ticket will win when the first 2 digits are same as the 2 digit prize of the government lottery and the remaining also match the first prize of the government lottery in that draw. To emphasise again, players cannot choose these 8 digits by themselves because all 8 digits were already random and printed on the ticket and there is only one player who can win the jackpot in a draw thus the probability of win the jackpot prize is $\frac{1}{10^8}$. This is because the probability that the set number matches the 2 digit prize of the government lottery is $\frac{1}{10^2}$ and the probability that the last 6 digits match the first prize of the government lottery equals $\frac{1}{10^6}$.

The probability to win the jackpot in the draw that jackpot prize is forced to be awarded is also $\frac{1}{10^8}$ even though the number of players or the number of sales in that draw may be higher than other normal draws (the jackpot prize is not forced to be awarded). Clearly, we are focusing on the expected return of the jackpot prize, which consists of the probability to win and the size of jackpot. This probability is the probability to win the jackpot of each ticket so the number of sales will not affect this probability because there is only one holding ticket will win.

A player who holds 20 baht ticket and wins the jackpot will be awarded 25% of the jackpot size of current draw. Same as the data on the number of ticket sale, the sizes of the jackpot are reported by GLO in the annual reports.

Given all information above, the expected price of the 2 digit 20 baht ticket can be defined as:

Expected price = 20 – (Expected Value)

where Expected Value = (probability of win the regular prize × prize of 2 digit 20 baht ticket) + (probability of win the jackpot × 0.25 × jackpot size)

$$= \left(\frac{1}{10^2} \times 1{,}300\right) + \left(\frac{1}{10^8} \times 0.25 \times J\right)$$

$$\text{Expected price} = 7 - \left(\frac{0.25}{10^8} \times J\right) \qquad (6.10)$$

where J is the jackpot size

It can be seen that the variation in the expected price depends on the size of the jackpot. The increase in the jackpot size leads to reduce the expected price. In other words, the greater jackpot size the lower expected price is. It also can be indicated, in this stage, that a bigger jackpot will induce people to purchase the ticket because they perceive a cheaper price.

Table 6.1 reports the definitions and descriptive statistics of the dependent and independent variables

Variable	Mean	Standard deviation
$\boldsymbol{C_t}$ (tickets)	56.34×10^6	1.60
$\boldsymbol{P_t}$ (baht)	6.82	0.06
$\boldsymbol{J_t}$ (baht)	70.76×10^6	2.46

Note: Dependent variable is the present consumption of 2 digits 20 baht ticket (C_t)
P_t is the expected price and J_t is the size of jackpot

Before estimating the models, there are some data issues which need to be mentioned. A spurious regression problem can be existed when the variables used in regression are nonstationary for time series estimation. The time series properties of each variable should be identified. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are employed to test for stationarity. These tests are performed on both levels and first differences. The lag selection criterion is Schwarz information criterion. Table 6.2 shows the results of ADF unit root test while the results of PP unit root test appear in Table 6.3.

Table 6.2: Augmented Dickey-Fuller test for stationarity

	In levels						First differences					
	C_t	Lag	P_t	Lag	J_t	Lag	C_t	Lag	P_t	Lag	J_t	Lag
Without trend and intercept	0.81	2	-0.14	0	0.06	0	-5.25	1	-10.54	0	-8.47	1
With intercept	-1.85	2	-4.53	0	-5.31	0	-5.29	1	-10.47	0	-8.42	1
With trend and intercept	-3.88	4	-4.52	0	-5.37	0	-10.98	0	-10.46	0	-8.39	1

Note: 95% critical values (Without intercept and trend) = -1.95
95% critical values (With intercept) = -2.90
95% critical values (With intercept and trend) = -3.47

Table 6.3: Phillips-Perron test for stationarity

	In levels						First differences					
	C_t	Lag	P_t	Lag	J_t	Lag	C_t	Lag	P_t	Lag	J_t	Lag
Without trend and intercept	1.56	1	-0.27	19	0.39	20	-10.63	2	-13.14	12	-15.55	15
With intercept	-2.81	2	-4.54	1	-5.34	1	-10.98	1	-13.02	12	-15.40	15
With trend and intercept	-4.46	3	-4.53	1	-5.39	1	-10.77	2	-13.56	13	-16.09	16

Note: 95% critical values (Without intercept and trend) = -1.95
95% critical values (With intercept) = -2.90
95% critical values (With intercept and trend) = -3.47

The ADF test (Table 6.2) and PP test (Table 6.3) confirm stationarity for all the variables. However, first differencing of all the variables shows stationarity under the tests.

6.3.1.4 Empirical results and discussion

Table 6.4 reports the results of Ordinary Least Square (OLS) and Instrumental Variable (IV) estimation.

Table 6.4: Estimates of conventional models and myopic models of addiction

Variables	Conventional Model	Instrumental Variable estimation		
	(1)	(2)	(3)	(4)
Constant	21.50 (8.16)	4.52 (1.80)	4.52 (1.80)	5.30 (1.94)
C_{t-1}	-	0.89*** (11.06)	0.89*** (11.06)	0.89*** (10.07)
P_t	-1.86 (-1.35)	-1.36 (-0.86)	-1.36 (-0.86)	-1.04 (-0.60)
P_{t+1}	-	-	-	-0.69 (-0.51)
AR(1)	0.75 (6.20)	-0.13 (-0.98)	-0.13 (-0.98)	-0.13 (-0.93)
AR(2)	0.52 (4.39)	0.38 (3.43)	0.38 (3.43)	0.38 (3.27)
AR(3)	-0.36 (-3.95)	-	-	-
R^2	0.85	0.85	0.85	0.84
$\overline{R}^2$	0.84	0.84	0.84	0.83
D.W.	1.99	1.99	1.99	2.00
Akaike info criterion	-1.69	-1.65	-1.65	-1.61
Schwarz criterion	-1.54	-1.44	-1.44	-1.37
Obs*R^2	-	1.28	1.28	1.18
LM (P-values)	-	0.52	0.53	0.55

Note: The terms in parentheses are *t* statistics D.W. is Durbin-Watson statistic
Obs*R^2 statistic is the Breusch-Godfrey LM test statistic. (***) = 1% significance level
LM (P-values): The null hypothesis of the LM test is that there is no serial correlation
AR is an autoregressive process
Column (2): The instrument variables are current period's price, past period's price
Column (3): The instrument variables are current period's price, past period's price, and last period's jackpot size
Column (4): The instrument variables are current period's price, past period's price, last period's jackpot size, and future price

According to table 6.4, the set of instrument variables in column (2) is current period's price (P_t) and past period's price (P_{t-1}) while column (3) adds last period's jackpot size (J_{t-1}) into the instruments. The last column also tests the myopic addiction but the future price variable (P_{t+1}) is added into the model as the independent variable. The instruments used in column (4) consist of all instruments used in column (2) and (3) plus the future price (P_{t+1}). The values of C_t, P_t, and J_t are in the natural logarithm form. The estimated coefficient standard errors are heteroskedasticity robust by using White's method. The Durbin-Watson statistic may be not appropriate to test for serial correlation in the model as there is a lagged dependent variable. Thus two statistic tests are used to test for serial correlation, which are Correlogram Q-statistics Test and Breusch-Godfrey Serial Correlation LM Test. LM (*P*-values) is reported under the null hypothesis of the LM test that there is no serial correlation. To consider the criterion of model selection, R^2, $\overline{R}^2$, Akaike and Schwarz information criteria are also considered, which suggesting 2 lag lengths in column (2), (3), and (4).

The coefficient on the expected price in the conventional model (6.7), which has no addiction, has the expected sign but are not statistically significant, implying that an increase in expected price has a negative on consumption. This coefficient reflects the price elasticity. In the estimation of the myopic framework, past consumption is added into column (2), (3), and (4) as the independent variable. These three columns are estimated by IV estimation and past consumption variable is treated as the endogenous variable. The result in column (2) reports the positive and statistically significant coefficient, at the 1% significance level, on past consumption. It can be inferred that the 2 digit 20 baht lottery is the addictive good because the past consumption has a positive and significant effect on the present consumption. A 1% increase of consumption in the previous period will increase 0.89% of consumption in this period. The coefficient on the expected price also has the expected sign as the expected price in the conventional model but is not statistically significant.

When the size of jackpot is added into the set of instruments, the results in column (3) can confirm that 2 digit 20 baht lottery play is addictive since past consumption has a positive and significant effect on current consumption. However, the coefficient on the expected price in this column also has the expected sign same as the expected price in first two columns and they are not statistically significant at any levels. This should be because the variation in expected price is not large enough. The expected price depends on only the size of the jackpot since the probabilities of winning in both regular and jackpot prize are constant throughout the series. Unlike the U.K. lottery which the expected value depends on other factors than the jackpot size; such as the proportion of ticket sales in each draw allocated to the jackpot prize pool, the proportion of ticket sales going to the prize pool in each draw, the winners do not need to share the prize with other winners for the case of the Thai lottery. In other words, the expected return of the Thai lottery is constant if the jackpot size is held fixed. For example, the expected return of winning the 2 digit 20 baht ticket prize, a regular prize, is constant at 1,300 baht per ticket even if 100 people win this prize or the expected return of the jackpot prize is also constant at 25% or 50% of the jackpot size for 20 baht and 50 baht ticket respectively, and there is only one person, or maybe none, who can win the jackpot in each draw.

All coefficients between column (2) and (3) seem to be similar when the size of jackpot is added into the set of instruments in column (3). This would suggest that the jackpot size may not be a proper instrumental variable. However, the actual absolute values of the constant and the expected price in column (3) are slightly higher than the correspondent values in column (2), which means that, the volume of lottery consumption in column (3) is marginally higher. It is also probably implied that the jackpot size definitely rarely affects the lottery purchases.

Again unlike the U.K. lottery which a rollover, the jackpot from the previous draw has rolled over, indeed increases the lottery sales, the size of jackpot cannot play an important role to attract Thai lottery players. This is because the 8 digits, the jackpot winning number, were already randomly printed, that means, players cannot select these numbers by themselves unlike the U.K. lottery that players can choose their own numbers for the challenge of the jackpot prize. Since players cannot choose their own numbers for the Thai lottery case, players may feel the jackpot prize is not rewarding enough. However, it is possible to have one or more winners per jackpot prize per draw for the U.K. lottery but there is only one or none who wins the jackpot per draw for the Thai lottery and the probability of win the jackpot for the Thai lottery (1: 10^8) is considerably lower than the U.K. lottery (1: 13,983,816) (The National Lottery Commission, 2009). Hence, the government has tried to attract players to the jackpot prize by forcing the jackpot to be awarded, when its size is over than 100 million baht for the Thai lottery and after four consecutive draws (three rollovers) for the U.K. lottery.

The model in column (4) tests the rational addiction. This type of lottery play will be the rational addiction if and only if the coefficient on past consumption (C_{t-1}) is positive and statistically significant, and the coefficient on future price (P_{t+1}) is negative and statistically significant. The results in column (4) show that all coefficients have the expected sign, but only coefficient on past consumption is significant at the 1% significance level. These results suggest that the behaviour of betting on this lottery type is the myopic addiction since the change in future price does not affect the present consumption, in other words, a decision on current consumption does not depend on future price. The results in Table 6.4 are consistent with the myopic model of addiction, but inconsistent with the rational model of addiction. However, to confirm that the betting on the addiction of 2 digit 20 baht ticket is myopic addiction, it is suitable to test directly the rational model of addiction. Moreover, the test of rational addiction leads to compute the discount factor (*β*) and the rate of time preference (*r*).

6.3.1.5 Rational addiction test

The model used to estimate the framework of rational addiction is

$$C_t = \alpha + aC_{t-1} + a_1C_{t+1} + bP_t + u_t \qquad (6.11)$$

where α, a, a_1, and b = coefficient C_t = current consumption

C_{t-1} = past consumption C_{t+1} = future consumption

P_t = expected price at period t u_t = error term

From equation (6.11), future consumption (C_{t+1}) can be expressed as

$$C_{t+1} = \alpha_2 + a_2C_t + a_2C_{t+2} + b_2P_{t+1} + v_t \qquad (6.12)$$

where α_2, a_2, a_2, and b_2 = coefficient

C_t, C_{t-1}, and C_{t+1}= consumption at period *t*, *t-1*, and *t+1*, respectively

P_{t+1} = expected price at period *t+1* v_t = error term

It can be seen that the stochastic explanatory variable C_{t+1} in equation (6.11) is distributed independently of u_t and the stochastic explanatory variable C_t in equation (6.12) is distributed independently of v_t. These two stochastic explanatory variables are expected to be correlated with the relevant stochastic disturbances, u_t and v_t, therefore, The OLS estimation is not consistent to estimate these equations. The applicable method should be employed here is the method of Two-Stage Least Squares (TSLS) and instrumental variables, which will give estimator that are efficient and consistent.

Table 6.5 reports the results of TSLS estimate on the rational addiction framework (equation 6.11). The dependent variable is present consumption while the former lag and lead of consumption, and expected price are independent variables. Past consumption (C_{t-1}) and future consumption (C_{t+1}) are treated as endogenous variables. The instruments used are current price, one-period lag and lead of prices. The jackpot size is not considered as an instrumental variable in this estimate since it was suggested earlier that it is not a good instrumental variable.

Table 6.5: Estimates of rational model of addiction

Variables	Two-Stage Least Squares
Constant	-166.51 (-0.00)
C_{t-1}	0.49*** (23.79)
P_t	0.05 (-0.22)
C_{t+1}	0.57*** (21.81)
AR(16)	0.27 (1.98)
R^2	0.97
$\bar{R}^2$	0.96
D.W.	1.86
Akaike info criterion	-2.81
Schwarz criterion	-1.57
Obs*R^2	13.72
LM (P-values)	0.62

Note: The terms in parentheses are *t* statistics D.W. is Durbin-Watson statistic
(***) = 1% significance level Obs*R^2 statistic is the Breusch-Godfrey LM test statistic.
LM (P-values): The null hypothesis of the LM test is that there is no serial correlation.
AR is an autoregressive process and there is no serial correlation at 16 lag length.
The instrument variables are current period's price, one-period lag and lead of prices

Although past and future consumption have the positive and statistically significant on current consumption, the coefficient on expected price also has a positive sign, which is inconsistent according to the traditional model in equation (6.4). Thus the results in Table 6.5 do not support for the rational addiction model.

As mentioned in equation (6.4), the coefficient of future consumption consists of the discount factor (β) and the degree of addiction (θ). Table 6.5 reports that the degree of addiction equals 0.49 (θ = 0.49) and the coefficient of future consumption equals 0.57 ($\beta\theta$ = 0.57), therefore, the discount factor and the rate of time preference (r) can be calculated since β = 1/(1+r). Table 6.6 shows the results of the discount factor (β) and the rate of time preference (r).

Table 6.6: The discount factor and time preference rate

$\boldsymbol{\beta}$	1.16
$\boldsymbol{r}$	-0.14

Note: $\beta\theta$ = 0.57, where θ = 0.49
β = 1/(1+r)

The discount factors correspond to negative time preference rates of – 0.14, which means that, the two-week rate of time preference is approximately – 0.14. This result is an implausible result. The addiction to 2 digit 20 baht ticket betting, therefore, can be indicated as myopic addiction due to the positive sign of the coefficient on the expected price in model (6.12) and the implausible time preference rate. Farrell *et al.* (1999) report the same problem of implausible time preference rate. They found that the weekly rate of time preference of U.K lottery addiction was approximately 12. They gave the reason that the expected price in the next draw depends on the difference between the expected value of a ticket if there is a rollover and no rollover in the current draw. However, this difference, in practice, is nearly constant. In the case of the Thai lottery, the data of expected price is close to being a constant as well thus it may not vary enough to pin down the precise discount factor which can be used to test the hypothesis of rational addiction as a result of implausible time preference rate.

Becker *et al.* (1994) also mention about the estimate of consumer discount factor from aggregate consumption that the consumption of specific goods or leisure obviously vary over time. Some of these estimates imply very high, low, or even negative rate of time preference.

To compare the degrees of addiction (θ) between U.K. and Thai lottery betting, which are indicated by the coefficient on past consumption, the estimate of the coefficient on past consumption in Farrell *et al*. (1999) is 0.33 while the corresponding coefficient on Thai lottery consumption of this estimate is 0.89. This implies that the Thai lottery betting is more addictive than the U.K. lottery betting. The coefficient of past consumption on the U.K. lottery is approximately one-third as large as the estimated coefficient of Thai lottery past consumption. They also compared the degree of addiction to the U.K. lottery betting with cigarette addiction in the U.S., where the coefficient of past consumption on cigarette is 0.45 (Becker *et al.*, 1994). They, therefore, claims that a U.K. lottery play is not as physically addictive as cigarette consumption.

Unlike the U.K. lottery play, the 2 digit 20 bath ticket play is physically addictive, comparing with the cigarette addiction in the U.S., because the estimated coefficient of past consumption on the Thai lottery ticket, 0.89, is approximately double higher than the degree of cigarette addiction, 0.45.

6.3.1.6 Short-run and long-run estimate

As noted above, the estimated coefficient of equation (6.4), which is θ_1, can be used to derive short-run and long-run price elasticities of lottery. Recall the short-run and long-run elasticity effects, short-run elasticity gives the response to change in current price, price in period *t*, and all future periods that prices are not anticipated until period *t,* while long-run elasticity responds to change in prices across all period. Hence the long-run effect does exceed the short-run effect. Indeed, the price elasticity should present a negative relationship between the volume of consumption and the price of a lottery ticket but a positive relationship between the volume of consumption and the expected value (Cook and Clotfelter, 1993, Farrell *et al*., 1999). In the Thai lottery case, the expected value depends on the jackpot size therefore the increase in jackpot size increases in expected value, decreases the expected price of a win, and increase in lottery consumption.

All coefficients on expected price in Table 6.4 are not statistically significant so it may not plausible to estimate short-run and long-run price elasticities because of the imprecise results. However, to attempt to estimate the price elasticities by following equation (6.5) and (6.6), the results are shown in Table 6.7. The long-run effect exceeds the short-run effect as predicted and the size of effect of short-run is approximately one-third as large as the long-run effect. The long-run price elasticity of conventional model (-1.86) is the coefficient of the expected price. This coefficient estimated can be interpreted as elasticity since a log-linear model is estimated.

Table 6.7: Estimates of shot-run and long-run elasticities

Elasticity	Conventional Model	Myopic Model
Short-run	-	-0.15
Long-run	-1.86	-0.42

Note: According to the equations (6.5) and (6.6), $\varepsilon_{short-run} = |\theta_1| \left(\frac{\bar{P}}{\bar{C}}\right)$ and $\varepsilon_{long-run} = \left(\frac{|\theta_1|}{1-|\theta_1|}\right)\left(\frac{\bar{P}}{\bar{C}}\right)$

where $|\theta_1|$ = 1.36, $\bar{P}$ = 1.92, and $\bar{C}$ = 17.80; the values of $\bar{P}$ and $\bar{C}$ are in the natural logarithm form.

6.3.2 The estimate of 3 digit 20 baht lottery

The estimate framework of the addiction to 2 digit 20 baht lottery ticket play is also used to estimate the addiction to 3 digit 20 baht lottery ticket play. The sales of 3 digit 20 baht is 7.7 million tickets per draw on average. According to the 3 digit ticket, the holding ticket will win when those 3 numbers, between 000 and 999, on the ticket are same as last 3 digits of the first prize of the government lottery. Hence the probability of win equals $\frac{1}{10^3}$ or 0.001. The prize of 3 digits is 500 times per one baht so the prize of 3 digits of 20 baht ticket is 10,000 baht per ticket. The rule of winning the jackpot and its award are same as 2 digit ticket, 25% of the jackpot size, since both of them are the same ticket type in money, 20 baht ticket. Hence the expected price of 3 digit 20 baht ticket is defined as

Expected price = 20 – (Expected Value)

where Expected Value = (probability of win the regular prize × prize of 3 digit 20 baht ticket) + (probability of win the jackpot × 0.25 × jackpot size)

$$= \left(\frac{1}{10^3} \times 10{,}000\right) + \left(\frac{1}{10^8} \times 0.25 \times J\right)$$

$$\text{Expected price} = 10 - \left(\frac{0.25}{10^8} \times J\right) \qquad (6.13)$$

where J is the jackpot size

The mean of the expected price of 3 digit 20 baht ticket is approximately 9.82. All variables are tested for nonstationary by Augmented Dickey-Fuller test and Phillips-Perron test. The results are reported in Table 6A and Table 6B in Appendix 6D. The test results indicate that these variables are stationary in levels

The estimated results report that the 3 digit 20 baht lottery ticket betting is an addictive good and the addiction to this gambling type is the myopic addiction since past consumption has a positive and statistically significant on present consumption while future price has no any effect on the present period's consumption. The estimated results are shown in Table 6C in Appendix 6D. The rational addiction model is also tested with 3 digit 20 baht ticket lottery play and the regression results reject the rational addiction hypothesis because of a positive sign of coefficient on the expected price and the implausible rate of time preference, -0.09. The regression results are reported in Table 6D in Appendix 6D. The results of short-run and long-run of the 3 digit 20 baht ticket are provided in Table 6E in Appendix 6D. However, the coefficient on expected price is not significant at any levels thus it may lead to the imprecise results of short-run and long-run price elasticities.

6.4 Conclusions

The government decided to control the underground lottery business which is illegal by issuing the 2-3 digit lottery project in August 2004. Although the project seemed to be successful due to the decrease in underground lottery betting, this kind of gambling still exists. The ratio of underground lottery expenditures to consumption expenditure per household dramatically drops around 61%, from 2.36% to 0.91% on average, pre and post-issuing the 2-3 digit lottery project. In contrast, the State lottery to consumption expenditures per household ratio increase around 71%, from 1.43% to 2.44% after 2-3 digits lottery is offered in the gambling market (see Table 6A in Appendix 6A). This chapter, therefore, aims to explore whether the 2-3 digit lottery is an addictive good and what kind of addiction is. Only 2-3 digit lottery 20 baht ticket is studies since it is more popular than the 50 baht ticket.

The model used to test for the addiction is applied from Becker and Murphy's theory which is "Theory of rational addiction". Clearly, the IV estimates indicate that the behaviour of betting on 2-3 digit lottery 20 baht ticket is addictive since past consumption changes significantly impact present consumption. Although future consumption has a statistically significant effect on current consumption, under the rational addiction hypothesis, the coefficients on the expected price have a positive sign, which is inconsistent with the theory. Moreover, the discount factor and the rate of time preference show poor values thus the addiction to 2-3 digit 20 baht lottery should be the myopic addiction. The Thai lottery seems to be more physically addictive than the U.K. lottery due to the higher degree of addiction, 0.89 and 0.33 respectively.

The variation in expected price of the Thai lottery is low. This may be because it depends only on the size of the jackpot, unlike the U.K. lottery case, where the expected price depends on many factors. It can be implied that Thai lottery players are not much attracted by the jackpot size. In other words, a bigger jackpot size may increase a little of lottery sales unlike the U.K. lottery sales which is indeed increased by a rollover (the jackpot from the previous draw is rolled over the current draw). Because of low variation in expected price, the estimated coefficients on the expected price are insignificant at all. These lead to the estimates of short-run and long-run price elasticities are implausible. However, the elasticity results of the 2-3 digit lottery 20 baht present the correct values under the condition that the long-run elasticity must be greater than the short-run elasticity.

Appendix 6A

Table 6A: Underground lottery and government lottery expenditures per household

Year / Per household	1988	1990	1992	1994	1996
Income (baht/month)	5,098	7,034	9,256	9,324	11,802
Consumption expenditures (baht/month)	4,604	5,974	7,311	7,340	8,525
Government lottery expenditures (baht/month)	83	90	100	91	135
Underground lottery expenditures (baht/month)	100	113	135	165	217
Ratio of government lottery expenditure to income (%)	1.63	1.28	1.08	0.98	1.14
Ratio of underground lottery expenditure to income (%)	1.96	1.61	1.46	1.77	1.84
Ratio of government lottery expenditure to consumption expenditures (%)	1.80	1.51	1.37	1.24	1.58
Ratio of underground lottery expenditure to consumption expenditures (%)	2.17	1.89	1.85	2.25	2.55

Table 6A (continued)

Year / Per household	1998	2000	2002	2004	2006
Income (baht/month)	13,384	13,737	14,361	16,038	17,787
Consumption expenditures (baht/month)	9,348	9,458	10,059	11,618	12,701
Government lottery expenditures (baht/month)	126	139	120	241	355
Underground lottery expenditures (baht/month)	262	248	281	81	142
Ratio of government lottery expenditure to income (%)	0.94	1.01	0.84	1.50	2.00
Ratio of underground lottery expenditure to income (%)	1.96	1.81	1.96	0.51	0.80
Ratio of government lottery expenditure to consumption expenditures (%)	1.35	1.47	1.19	2.07	2.80
Ratio of underground lottery expenditure to consumption expenditures (%)	2.80	2.62	2.79	0.70	1.12

Source: National Statistical Office, 2008 Note: In 2004, the government issued 2-3 digit lottery which could substitute for the underground lottery so the underground lottery sales had dropped since 2004 while the government lottery expenditures increased due to including 2-3 digit lottery expenditures.

Appendix 6B

Given J_t = The size of the jackpot, R_t = the amount of rollover, C_t = The sales revenue,

π_{6t} = The proportion of ticket sales in draw *t* going to the jackpot prize pool

The size of the jackpot in draw *t* is:

$$J_t(\pi_{6t}, R_t;\ C_t) = \ R_t + \ \pi_{6t}C_t$$

Denote p_6 is the probability of a single ticket winning the jackpot. The probability of a rollover equals the probability that none of the players win the jackpot, denoted as $(1 - p_6)^{C_t}$. For the U.K. National Lottery, there are smaller prize awarded for matching any five, four or three of the main numbers and a further prize pool for matching any five main numbers plus a seventh bonus ball, (5 + *b*). The expected value (V) of holding a ticket taking account of the smaller prizes is

$$V(\pi_{6t}, R_t, \pi_{jt}, p_6;\ C_t) = \{[(1 - (1 - p_6)^{C_t}][R_t + \ \pi_{6t}C_t] + \ \textstyle\sum_j \pi_{jt}C_t\}/\ C_t$$

where j = 3, 4, 5, (5 + *b*), $p_j =$ The probability of correctly selecting any *j* numbers,

π_{jt} = The proportion of the ticket sales going to the j^{th} prize pool in draw *t*

Thus $\sum_j \pi_{jt} + \pi_{6t} = (1 - \ \tau)$; j = 3, 4, 5, (5 + b)

where τ = The takeout that is the proportion of sales revenue not returned in the form of prizes. However, V_{C_t}, where subscripts indicates partial derivatives, is equal to

$$V_{C_t} = (p_6C_t(1 - p_6)^{C_t}[(1 - \ \tau)C_t + R_t) - R_t(1 - (1 - p_6)^{C_t})]/C_t$$

Appendix 6C

The amount of the jackpot size in the seventeenth draw (48,182,370 baht) was donated to the charity. This is because the government received the verdict that the jackpot prize could not be issued on behalf of the government (Ministry of Finance). The Government Lottery Office (GLO) is under the Ministry of Finance. Thus the government decided to donate this amount to the charity and then allowed the jackpot prize to be issued on behalf of GLO since the eighteenth draw. This is why the jackpot size of eighteenth draw was 20 million baht same as the first draw. Finally, the Supreme Court returned the verdict of guilty. This is one of the reasons for the suspension of the 2-3 digit lottery project.

Appendix 6D

Table 6A: Augmented Dickey-Fuller test for stationarity

	In levels						**First differences**					
	C_t	Lag	P_t	Lag	J_t	Lag	C_t	Lag	P_t	Lag	J_t	Lag
Without trend and intercept	0.81	2	-0.13	0	0.06	0	-5.25	1	-10.53	0	-8.47	1
With intercept	-1.85	2	-4.53	0	-5.31	0	-5.29	1	-10.47	0	-8.42	1
With trend and intercept	-3.88	4	-4.52	0	-5.37	0	-10.98	0	-10.46	0	-8.39	1

Note: 95% critical values (Without intercept and trend) = -1.95
95% critical values (With intercept) = -2.90
95% critical values (With intercept and trend) = -3.47

Table 6B: Phillips-Perron test for stationarity

	In levels						First differences					
	C_t	Lag	P_t	Lag	J_t	Lag	C_t	Lag	P_t	Lag	J_t	Lag
Without trend and intercept	1.55	1	-0.27	19	0.39	20	-10.63	2	-13.13	12	-15.55	15
With intercept	-2.81	2	-4.55	1	-5.34	1	-10.98	1	-13.01	12	-15.40	15
With trend and intercept	-4.46	3	-4.53	1	-5.39	1	-10.77	2	-13.56	13	-16.09	16

Note: 95% critical values (Without intercept and trend) = -1.95
95% critical values (With intercept) = -2.90
95% critical values (With intercept and trend) = -3.47

Table 6C: Estimates of conventional models and myopic models of addiction (3 digit 20 baht ticket)

The dependent variable is the volume of lottery consumption. There is no addiction in column (1). The instruments in column (2) are current and one lag prices and in column (3) adds one lag of jackpot size. The future price is added into the model in column (4) and the instruments are same as column (3) plus future price. The standard errors are heteroskedasticity robust (using White's method).

Variables	Conventional Model	Instrumental Variable estimation		
	(1)	(2)	(3)	(4)
Constant	22.05 (4.89)	6.18 (1.34)	6.19 (1.35)	7.47 (1.49)
C_{t-1}	-	0.89*** (11.05)	0.89*** (11.06)	0.89*** (10.06)
P_t	-2.67 (-1.36)	-1.97 (-0.86)	-1.97 (-0.86)	-1.51 (-0.61)
P_{t+1}	-	-	-	-1.00 (-0.52)
AR(1)	0.76 (6.20)	-0.13 (-0.98)	-0.13 (-0.98)	-0.13 (-0.92)
AR(2)	0.52 (4.39)	0.38 (3.43)	0.38 (3.43)	0.38 (3.27)
AR(3)	-0.35 (-3.95)	-	-	-
R^2	0.85	0.85	0.85	0.84
$\overline{R}^2$	0.85	0.84	0.84	0.83
D.W.	1.99	1.99	1.99	2.00
Akaike info criterion	-1.69	-1.65	-1.65	-1.61
Schwarz criterion	-1.54	-1.44	-1.44	-1.37
Obs*R^2	-	1.28	1.28	1.18
LM (*P*-values)	-	0.52	0.53	0.55

Note: The terms in parentheses are *t* D.W. is Durbin-Watson statistic (***) = 1% significance level
Obs*R^2 statistic is the Breusch-Godfrey LM test statistic.
LM (*P*-values): The null hypothesis of the LM test is that there is no serial correlation

Table 6D: Estimates of rational model of addiction (3 digit 20 baht ticket)

The dependent variable is the volume of lottery consumption. The instruments in column are current, one lag and lead prices. The standard errors are heteroskedasticity robust (using White's method). Breusch-Godfrey test is used for serial correlation test.

Variables	Two-Stage Least Squares
Constant	-1.31 (-1.96)
C_{t-1}	0.50*** (40.78)
P_t	0.18 (0.70)
C_{t+1}	0.55*** (35.87)
AR(17)	0.17 (1.49)
R^2	0.97
$\overline{R}^2$	0.96
D.W.	1.95
Akaike info criterion	-3.17
Schwarz criterion	-1.85
Obs*R^2	26.35
LM (*P*-values)	0.07

Note: The terms in parentheses are *t* statistics D.W. is Durbin-Watson statistic
(***) = 1% significance level Obs*R^2 statistic is the Breusch-Godfrey LM test statistic.
LM (*P*-values): The null hypothesis of the LM test is that there is no serial correlation.
There is no serial correlation at 17 lag length.

Table 6E: Estimates of shot-run and long-run elasticities

Elasticity	Myopic Model
Short-run	-0.28
Long-run	-0.30

Note: According to the equations (5) and (6), $\varepsilon_{short-run} = |\theta_1|\left(\frac{\bar{P}}{\bar{C}}\right)$ and

$$\varepsilon_{long-run} = \left(\frac{|\theta_1|}{1-|\theta_1|}\right)\left(\frac{\bar{P}}{\bar{C}}\right)$$

where $|\theta_1|$ = 1.97, $\bar{P}$ = 2.29 and $\bar{C}$ = 15.81; the values of $\bar{P}$ and $\bar{C}$ are in the natural logarithm form.

CHAPTER 7

SUMMARY AND CONCLUSIONS

Gambling has become the basis of a large and substantial growing industry in Thailand, in particular, illegal gambling businesses. This thesis attempts to understand the characteristics of Thai gamblers and derive the demand for gambling by employing econometric techniques. This makes it different from other previous works on Thai gambling which have been mainly qualitative. The methodologies used for the estimate in those works are a questionnaire survey, a deep interview, and a focus group technique. These three methodologies are also used in this research but I use econometric techniques to understand the results from surveys and government data on lotteries. I conducted 2 surveys in 2007 and 2008 and the focus groups of people who involve in gambling business in different careers, such as policemen, government officers, local politicians, reporters, and academicians. I also interviewed 3 casino owners, two casinos are located in *Poipet*, Cambodia, and the last one is in Bangkok, 3 underground lottery agents, and at least 10 gamblers in 2007. The results appear in Chapter 3.

The aim of this research is to explore 3 key questions which are: first, who would enter a gambling market, second, what kinds of gambling product were purchased, and third, how people reacted to a gambling game which was legalised. To achieve the aim, three empirical estimations in Chapter 4, 5, and 6 were performed by using different econometric methodologies. The first two estimations, related to gambling participation and gambling expenditures, used the Logit and Tobit estimate techniques to analyse the different socio-economic and demographic data. The last estimation, narrowed the focus on the 2-3 digit lottery, used the Instrumental Variable estimation technique. The data used in the first two estimations were obtained from three surveys in 2002, 2007, and 2008. The main objectives of these three surveys are slightly different. The first survey explored people's gambling behaviours and gambling expenditures over the country as a whole, whereas the second survey focused on only gamblers, with the same objectives as the first survey. The third survey intended to discover gambling participation and gambling expenditures of adolescents.

This research focused on the five most popular gambling types only, which were casino betting, football betting, the government lottery, the underground lottery, and the 2-3 digit lottery. The following section summarises the results of each estimation. Section 7.2 discusses policy implication. Limitation of the study is presented in section 7.3 and this chapter ends with some discussion of further research.

7.1 Summary of empirical results

Chapter 4 aimed to indentify the gamblers' characteristics and gambling frequency of each gambling type. Males participate in gamble more than females, in particular, on casino and football betting. With respect to age, aged people prefer the number games, such as the underground lottery, to casino and football. This is probably because the gambles on casino and football require technical skills while the number games do not. Intuitively it seems plausible that males or younger people have higher gambling skill than females or aged people. The group of married people has a higher probability of gambling participation than the group of people who are single or divorced/separated/widowed. The former group prefers the number games to casino and football betting, which these latter two gambling types seem to be riskier and more harmful. The results also suggest that the characteristics of people, who have high frequency of gambling, are same as people who have high probability of gambling participation. For example, people, who have high education rarely participate in gambling, also have a low rate of gambling frequency. One important finding is that there is a 'supplementation effect' of casino betting on other gambling types and this effect also occurs among the number games.

Chapter 5 investigated gambling expenditures, income elasticities, and pent-up demands. The empirical results in this chapter correspond to the estimated results in Chapter 4. For example, males have higher gambling expenditures than females and aged gamblers spend more on the legal number games, such as the government lottery, or the 2-3 digit lottery, whereas adolescents spend more on the illegal type, such as football betting. Again, education encourages people to spend less on gambling but increasing in gamblers' income leads to increase in gambling expenditures. The number games are popular for low educated gamblers and people who have a relatively lower level of risk in gambling. One peculiarity of the number games is a small stake against a big prize.

Regarding the characteristic of marital status, married gamblers have high expenditures on the number games. This result also corresponds to the finding result in Chapter 4, which reports that this gambling type is popular for married gamblers. With this result, it can be indicated that married gamblers take a lower level of risk in gambling than gamblers who are single or divorced/separated/widowed.

All income elasticities of demand for each gambling type, with respect to the personal income, are positive and inelastic. The income elasticity reflects the demand for gambling. The demand for the underground lottery is the highest although it is an illegal gambling type and even though the government issued the 2-3 digit lottery as a legal form of the underground lottery. The income elasticities of demand for casino and football betting indicate that gamblers demand for casino rather than football betting. The results of pent-up demand also support the latter summary.

Chapter 6 examined gambling behaviour after the government legalised the underground lottery. The 2-3 digit lottery project was issued as a legal gambling form of the underground lottery which is the most popular game according to the results of income elasticity of demand in Chapter 5. Thus the 2-3 digit lottery is suitable to be chosen as a proxy for the study.

The study in this chapter was based on a theory of rational addiction of Becker and Murphy (1988). This theory indicates that a good will become an addictive good if past consumption of this good affects the utility of present consumption of the good. An addiction will be rational addiction when future consumption also affects present consumption otherwise it is myopic addiction. The empirical result is that the 2-3 digit lottery is an addictive good since there is an effect of past consumption on present consumption. Primarily, the addiction of the 2-3 digit lottery should be considered as rational addiction because future consumption also affects current consumption. However, the estimate of a rational addiction model gave the implausible results of a discount factor and the rate of time preference. Moreover, the coefficient on expected price has a positive sign, which is inconsistent with the theory hence the addiction of the 2-3 digit lottery should be defined as myopic addiction.

7.2 Policy implications

Although this research does not directly attempt to point out whether the government should legalise the certain forms of gambling, its empirical results are useful for policy-makers and involved parties. In the case that the government would like to legalise the illegal gambling forms, this study can be also applied to use for making a decision, that which kind of the illegal gambling game should be legalised by understanding the public's demand.

Chapter 4 and 5 indicate that adolescents prefer to gamble in casino and on football, which seem to be more harmful than the number games. In actual fact, the government has tried to suppress these two illegal gambling games, but it seems not to have succeeded. Hence there is one alternative has been raised in the public, that is, to legalise these two illegal gambling games. People who support this alternative suggest that when the illegal gambling game becomes the legal form, it should be easier to be controlled and the government can limit the spread of gambling to the group of adolescents. For example, prohibiting people who are under 18 years old to enter a legal casino or gamble on football by law enforcement.

Under the approach of legalisation, the results of income elasticity of demand and pent-up demand in Chapter 5 suggest that a casino business should be legalised rather than a football betting business because most people demand for a legal casino, not the legal football betting. Since football betting is popular for the group of adolescents, to legalise football betting does not capture the public's demand, in particular, the group of middle-age/old people. Moreover, the legal form of football betting may attract people who have never gambled on this game before.

Regarding the number games, the empirical results indicate that the demand for this type is the highest and the 2-3 digit lottery is an addictive goods (analysed in Chapter 6). In actual fact, the project of the 2-3 digit lottery has been suspended for now. It can be predicted that people who ever bet on only the 2-3 digit lottery might bet on the underground lottery instead since there has been no the 2-3 digit lottery in the Thai gambling market. Thus if the government wants to control the spread of the underground lottery, it should continue the 2-3 digit lottery project. It might be summarised from the study that the negative effect from legalising the number games is not considerably significant since the characteristic of this game is that; individuals stake with a small amount proportion to their income, and this gambling game is popular for the group of mature people.

It should be clear that the approach of legalisation may not reduce the illegal form of gambling, but it may be, instead, able to control the spread of the illegal gambling games. The empirical results of the 'supplementation effect' can support this notion.

Chapter 4 and 5, however, also suggest that education is a crucial factor that can reduce the gambling participation, gambling frequency, and gambling expenditures.

Hence to tackle the illegal gambling problem, the government should follow those three alternatives altogether. Under the approach of legalisation, the government should legalise gambling form of casino, continue the 2-3 digit lottery project, suppress all illegal gambling games by law enforcement, and enhance a level of people's education.

7.3 Limitation of the study

The data used in Chapter 4 and 5 stemmed from three surveys. The limitation of conducting a survey falls into two general areas:

1) People may not respond accurately or truthfully in the survey of gambling. These problems come from several reasons. For example, since most gambling types in Thailand are illegal, some people may not reveal that they have gambled on those illegal forms. Some people do gamble but they neglect because of their social status, or moral reasons.

   People define gambling in different ways. Some people think that playing card game with friends at their own place, even when money is paid to a winner, is not a gamble. Playing card would be defined as gambling when playing in a casino only. Thus one may not be getting a consistent estimate of actual gambling frequency.

   According to the questions of gambling frequency, the definitions of frequency of some gambling games are different among the respondents. Football betting, for example, can be bet into two styles, either bet on match by match or bet on several matches as a group. In this case, an individual who bets on match by match style may calculate the numbers of football match that he bets as his gambling frequency, whereas an individual who bets on the style of several matches as a group may calculate his gambling frequency equals to one. Moreover, some football betting gamblers calculate their gambling frequency on daily rate. Since there are several football matches for betting in each week, it is difficult to gamblers to recall accurately their gambling frequency. The frequency of casino betting also caused some confusion. Some casino gamblers calculate their gambling frequency on daily rate, while some gamblers' calculation based on the numbers of entering a casino in each day.

The questions about gambling expenditures also caused a problem. There is a differential tendency for human being to remember a positive event, such as winning, and to forget a negative event, such as losing. Moreover, a large amount loss seems to be more memorable than a large number of smaller losses. Thus the results of the survey may lower than the actual fact.

2) Doing a survey is costly and has to spend much effort on explaining the question. As noted above, the definitions of gambling or related issues can vary widely. However, it should be borne in mind that willingness to participate in surveys and accuracy in completing all questions are difficult to find from most gamblers.

It might be indicated that the survey data or evidence relating to socio-economic data of gambling activity is largely anecdotal.

Regarding the model used for the estimate in Chapter 6, one important explanatory variable, which is expected to be statistical significant, is the “expected price”. In the case of the Thai lottery, the expected price depends only on the jackpot size, which does not much vary, unlike the U.K. or the U.S. lotteries which their expected prices depend on other than the jackpot size. The low variation of the expected price, for the Thai case, leads to the insignificant coefficient on this variable in every model. This issue might be regarded as the limitation of the study of Chapter 6.

7.4 Further study

There are several avenues should be explored in future work. The positive and negative effects of gambling legalisation should be estimated, based on the econometric estimation techniques used. This issue can be studied to analyse the experiences of other countries in Southeast Asia, where the governments decided to legalise certain forms of gambling. The study on those countries’ gambling experience is useful to understand the likely impact of changes in Thailand since people’s traditions and cultures of those countries less differ from Thai people.

A further development of the studies of the demand for gambling in Thailand should be based on larger samples than this research in order to get more accurate results. Finally, a new (currently illegal) gambling game, gambling on the internet, also deserves scrutiny. This is because most gambling games are included in the internet gambling and it is difficult to prevent individuals, particularly adolescents, to gamble on this gambling type. Thus, it can be also predicted that if the government decides to make any gambling form illegal; the internet gambling will become more popular. These issue, we hope will inspire future work.

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