SCREENING FOR BID RIGGING IN RURAL ROAD PROCUREMENT OF THAILAND

Sutthi Suntharanurak

A Dissertation Submitted in Partial

Fulfillment of the Requirements for the Degree of

Doctor of Philosophy (Economics)

School of Development Economics

National Institute of Development Administration

2012

SCREENING FOR BID RIGGING IN RURAL ROAD PROCUREMENT OF THAILAND

Sutthi Suntharanurak

School of Development Economics

Assistant Professor...Major Advisor

(Amornrat Apinunmahakul, Ph.D.)

Professor...Co-Advisor

(Direk Patmasiriwat, Ph.D.)

Assistant Professor...Co-Advisor

(Dararatt Anantanasuwong, Ph.D.)

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

Professor...Committee Chairperson

(Medhi Krongkaew, Ph.D.)

Assistant Professor...Committee

(Amornrat Apinunmahakul, Ph.D.)

Professor...Committee

(Direk Patmasiriwat, Ph.D.)

Assistant Professor...Committee

(Dararatt Anantanasuwong, Ph.D.)

Associate Professor...Dean

(Adis Israngkura, Ph.D.)

July 24, 2012

ABSTRACT

Title of Dissertation	Screening for Bid Rigging in Rural Road Procurement of Thailand
Author	Mr. Sutthi Suntharanurak
Degree	Doctor of Philosophy (Economics)
Year	2012

The fundamental objective of public procurement is to promote efficiency in the procurement process especially to ensure that the supplier offers the lowest price given the acceptable quality of goods and services through a bidding process. However, the collusion among bidders is still a critical problem of public procurement especially the main form of collusion is bid rigging behavior. In Thailand, the government has enacted "Anti-Collusion Law" since 1999; however, bid rigging behavior is still a pervasive problem in public procurement auctions. It reflects the difficulties in detecting or screening bid rigging behavior.

This study examines the screening test which focuses on determining whether the fundamental conduct is anomalous or inconsistent with competitive behavior. The research proposes the economic concept of collusion, the industrial organization paradigm, and the econometric method will be used to uncover the screening method for the rural road procurement of Thailand during 2006-2009. The main research question is how to detect bid rigging in the rural road procurement market and to analyze the factors facilitating collusive bidding.

The analyses consisted of two models for screening bid rigging behavior in the rural road projects and characteristics of bidding firms. The first model suggested the screening method from project level by using the engineers' estimated cost. The result showed that if the winning bid is close to the engineers' estimated cost; it has a tendency of bid rigging in the procurement process. The second model proposed the

screening method from firm level which a firm has a chance to win the large project and its area as a local winner. The results showed that a firm had a chance to be the winner when it bid increasingly. However, the interesting result found that a firm which related with the local politicians had a chance to be the winner firm on the large project.

Findings in this study are useful for those in the anti-collusive practices especially the National Anti-Corruption Commission and Office of the Auditor General. They could utilize these findings to review the bid rigging behavior and the loopholes in the Anti-Collusion Law also to develop guidelines for audit of bid rigging in the public procurement process.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

Figures	Page

CHAPTER 1

INTRODUCTION

1.1 Introduction

Each year Thai government spends a large share of taxpayers' money through public procurement-purchasing goods and services ranging from stationery, military weaponry, medicine, road construction, and so on. The Organisation for Economic Co-operation and Development or OECD estimated that public procurement accounts, on average, for 15% of Gross Domestic Product in OECD countries, but the share is higher in non OECD countries. (OECD, 2010: 23) Through the value of public procurement, the public sector can affect a market structure and create incentives to firms to compete or collude in the long run.

The fundamental objective of public procurement is to promote efficiency in the procurement process especially to ensure that the supplier offers the lowest price given the acceptable quality of goods and services through a bidding process. In the bidding procedure a government seeks and receives bidding quotes from many firms for a procurement project; it will be efficient when competitors make their bids honestly and independently. Therefore, real competition among suppliers will support the public sector to achieve the best value for tax money. Effective public procurement should avoid mismanagement and waste of public expenditure. Thus, it is necessary that the public procurement should not be influenced by collusion among bidders or corruption of government officials.

Presently, corruption in public procurement is widespread in almost every country. Transparency International Organization stated that the economic impact of corruption in public procurement has burdened government with operational maintenance, and debt service liability for investments, and a decrease in capital levels due to corruption costs and threats to sustainable development.

In addition, corruption may lead to bias behaviors and distortion decisions of stakeholders. For example, several bidders may collude to rig bids or intervene in technical specifications in the government auction. Likewise, many government officials who are responsible for awarding contracts can conspire with some bidders to restrict competition, such as the official may set technical specifications that can eliminate some bidders, using legal loopholes to assist some suppliers, or disqualify some bidders through ambiguous rules in exchange for bribes.

Therefore, the critical problem of public procurement consists of both corruption and collusion among bidders. The corruption in public procurement involves a relationship between one or more bidders and several procurement officials. OECD (2010: 24) clarified that the procurement officials have influence to use discretion or design the procurement process in order to help a particular firm in exchange for bribes or other rewards. The collusion in the public procurement market is a relationship among bidders which restricts competition and harms the public procurement.

In fact, the main form of collusion is bid rigging behavior. (OECD, 2008: 10)Bid rigging is firstly a competition law violation in which bidders illegally agree on a price for goods and services or agree not to bid in a tender. Through the bid rigging behavior, the government will pay artificially high prices for goods or services. It affects not only the national level, but also the international level. (Chowdury, 2008: 2) The impact of collusive bidding at the international level involves domestic cartels attempting to preserve a narrow domestic procurement market by obstructing foreign firms from participating in bidding in the domestic market. For example, during 1990s the construction cartel in Japan known as Dango obstructed construction firms from the US to compete in the tendering of a new international airport project in Japan. Finally, the US government pressured the Japanese government to eliminate the Dango behavior in order to encourage fair competition. (Woodall, 1996: 19) Likewise, Maci (2011) described the context of collusive bidding occurring in EU procurement markets. This restrictive practice contradicts the goal of EU public procurement policy which is aimed at integrating these markets in order to allow public procurers to obtain the benefits of the common market.

Initially, bid rigging is a particular form of collusive price-fixing behavior by which firms coordinate their bids on procurement or project contracts. (Khemani and Shapiro, 1993: 16)Also bid rigging is one of the most widely prosecuted forms of collusion. The Antitrust Division of United States Department of Justice explained that bid rigging is the way in which conspiring competitors effectively raise prices where purchasers such as federal, state or local government acquire goods and services by soliciting competing bids. Likewise, the OECD (2008) clarified that a bid rigging often occurs in the construction industry when bidders agree among themselves to eliminate competition in the procurement process. Under bid rigging behavior, the government always pays for goods and services above the market price. Thus, bid rigging has a direct impact on public expenditure and consequently on taxpayers' resources.

At the start, collusive bidders gather as a "bidding ring" which they can avoid competition in public procurement through many schemes. Generally, the bid rigging takes many forms, but its conspiracies fall into one or more of the following types: 1) Bid suppression or bid limiting occurs when bidders refrain from the auction and another conspirator can win the bidding; 2) Bid rotation is found when all conspired bidders take turns being the designated successful bidder; 3) Subcontracting appears when one bidder gets a contract and then subcontracts to colluding bidders in exchange for not submitting a bid; and 4) Complementary bidding or phony bidding or phantom bidding exists when ring members submit pretending bids highly that they know to be unacceptable to the agency calling for the bids. (Parker and Maher, n.d.:3-4)

However, there are several methods that can discourage the bid rigging activity. The main method is to expand the list of bidders that will make it more difficult for bidders to collude. As the number of bidders' increases, the chance for bidders to participate in public procurement auction might make the bidding process more efficient and reduce the opportunity of bid rigging.

Another way of reducing the bid rigging is strict enforcement of the law. In the United States, bid rigging is a criminal offence under Section 1 of the Sherman

Antitrust Act of 1890[1]. Section 1 of Sherman Antitrust Act forbids agreements in restraint of trade such as price fixing, bid rigging, customer or territorial allocation, or output restriction. Thus, the Sherman Act makes the bid rigging behavior illegal, a felony punishable by fines, imprisonment or both.

Similarly, bid rigging is a criminal offence under the Canada Competition Act of 1985. It appears in Section 47 of this act which gives the definition of bid rigging. Firms and individuals convicted of bid-rigging face fines at the discretion of the court or imprisonment for up to five years.

In the United Kingdom, colluding firms can be prosecuted criminally under the Competition Act of 1998. In 2009, under this act the Office of Fair Trade of United Kingdom (OFT) issued a decision to fine 103 construction companies that had been involved in bid rigging. The Decision was made following an OFT investigation, following a review of tenders between 2000 to 2006, which concluded that many construction firms had engaged in bid-rigging activities contrary to the Competition Act 1998. The main bid rigging activity was complementary bidding whereby competitors would submit artificially high prices leaving the lowest priced bidder facing no real competition, and in some instances this was coupled with the successful bidder making compensation payments to its higher priced competitors.

In Japan, bid rigging is regulated by Antimonopoly Act of 1947. In article 2.6 of this law, it defined bid rigging behavior as the restriction of business activities through mutual cooperation between companies and substantial restraint of competition in certain business areas against public interests. Additionally, the Japanese Penal Code of 1941 set bid rigging behavior as another crime. It stated that there were criminal penalties for participation in collusion at any individual bidding aimed at undermining the fair price or making illegal profits. Participants in the illegal

---

[1] Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $10,000,000 if a corporation, or, if any other person, $350,000, or by imprisonment not exceeding three years, or by both said punishments, in the discretion of the court.

bid rigging will be sentenced to a maximum two years prison in term or fined a maximum 2.5 million yen (Okatani, 1995: 252-257)

For Thailand, in 1999 the National Anti-Corruption Commission (NACC) formally began the enforcement of the Act on Offences Relating to Submission of Bids to State Agencies B.E. 2542, known as the "Anti-Collusion Law" in order to prevent and punish bid rigging behavior. In addition, bid rigging cases are considered special, criminal cases under the scope of authority of the Department of Special Investigation (DSI). Though the laws and regulations are very clear, bid rigging behavior is still prevalent. Each year the NACC submits over 100 cases of bid for investigation (See table 1.1).

Since the Anti-Collusion Law has been enforced in 1999, the NACC can verify decided 30 cases in which wrongful bid rigging occurred (See table 1.2), but there were still a backlog of another 726 cases[2].

Table 1.1 Accusations of Bid Rigging Under the Act on Offences Relating to the
Submission of Bids to State Agencies B.E. 2542

Year	Number of Cases	Found guilty
2000	176	-
2001	182	-
2002	267	1
2003	194	-
2004	155	5
2005	109	-
2006	105	-
2007	151	1

Source: National Anti-Corruption Commission, 2007.

---

[2] Page 42,An inspection report and a report on the performance of duties 2007, Annual year report of NACC

Table 1.2 Found Cases of Bid Rigging, 2000-2012

No. of Decided Cases	Year	Bidding	Government		Province	Region	Involved Politician
			Central	Local			
1. 10154445	2002	Local Road		√	Nakornayok	Central	
2. 00798548	2004	Local Road		√	Bureeram	Northeast	√
3. 03578551	2007	Local Road		√	Surin	Northeast	
4. 00678552	2008	Local Road		√	Ubonratchatanee	Northeast	√
5. 02538352	2008	Local Road		√	Nakornpanom	Northeast	√
6. 05658552	2009	Vehicle		√	Chantaburi	East	√
7. 09098552	2009	Local Road		√	Chiangmai	North	
8. 09738552	2009	Local Road		√	Khonkaen	Northeast	√
9. 17338552	2009	Local Road		√	Nongkai	Northeast	√
10. 03368553	2009	Slaughter House		√	Mukdahan	Northeast	√
11. 04388553	2010	Building		√	Yasothorn	Northeast	
12. 07018553	2010	Local Road		√	Lampang	North	√
13. 10448553	2010	Service		√	Pitsanulok	North	
14. 11548553	2010	Local Road		√	Bureeram	Northeast	√
15. 12928553	2010	Playground		√	Chumporn	South	√
16. 13808553	2010	Construction		√	Kampangpeth	North	√
17. 00848354	2010	Service	√		Bangkok	Central	
18. 02944354	2010	Blanket		√	Bureeram	Northeast	√
19. 04258554	2011	Dredging canals		√	Saraburee	Central	
20. 05698354	2011	Dredging canals		√	Udonthani	Northeast	√
21. 07019354	2011	Plumbing		√	Nakornsrithamarat	South	√
22. 11458554	2011	Construction		√	Srisaket	Northeast	√
23. 12314554,	2011	Local Road		√	Nongkai	Northeast	√
24. 12338554	2011	Construction		√	Tak	North	√
25. 16198554	2011	Weapons	√		Bangkok	Central	√
26. 00284555	2011	Construction		√	Sakonakorn	Northeast	√
27. 01708555	2011	Local Road		√	Srisaket	Northeast	√
28. 03579555	2012	Chemical		√	Pathumthani	Central	
29. 03728555	2012	Local Road		√	Sakonakorn	Northeast	√
30. 11418555	2012	Local Road		√	Tak	North	√

Source: National Anti Corruption Commission, 2007: 42.

Table 1.2 shows the decided cases of bid rigging behavior by the NACC from 2000 to 2012. The data showed that most of bid rigging cases occurred at the local government level. Half of them were found in the bidding of local road construction. Additionally, these cases seemed to involve local politicians, which might be another factor behind bid rigging behavior.

Another interesting question on the bid rigging issue is how to detect bid rigging behavior during the tender process. Though the bid rigging behavior might be difficult to detect, there are a number of signs of such behavior. A number of countries such as the US, Canada, Sweden, and Switzerland have developed check lists to help procurement agencies detect possible collusive behavior. For example, some suppliers unexpectedly withdraw from bidding (bid suppression) or certain companies always submit bids but never win (complementary bidding). Goldberg and Aubertine (2004) indicated some signs that might signal bid rigging, for example; some bids are not based on reasonable cost, and some firms always win in specific geographical areas. Likewise, the OECD has developed guidelines to support government in fighting bid rigging in public procurement. The OECD (2008: 19-21) observed that some characteristics in the construction industry might signal to explain bid rigging behavior in a procurement market such as market concentration where there are only a few firms in a particular sector; high entry barriers making it difficult for new or smaller firms to bid for contracts; opportunities for repeated interaction between market participants and similar firm characteristics; and active trade associations in the public procurement market.

Though bid rigging occurs in all types of goods and services within the public procurement market, it seems to be pervasive in the construction sector (OECD, 2008: 17-18). For example, in 1994 the US Department of Justice filed suit against 53 Japanese construction companies that rigged bids on contracts at the US Atsugi Naval Air Facility from 1984 to early 1990. In 2002, the Dutch government investigated collusion in the Netherlands' construction industry. The Dutch parliamentary enquiry committee concluded that the government agencies were defrauded by an average of 8.8 percent in public construction projects as a result of the collusion. Likewise in 2005, Japan's Fair Trade Commission (JFTC) uncovered a cartel involving collusive 50 bridge building firms, including several major firms. Finally, the JFTC imposed

surcharges totaling more than 12 billion yen. Recently, in 2009 the United Kingdom Office of Trading (OFT) found guilty 112 contractors which were involved bid rigging behavior. This is one of the largest investigations in the history of the OFT; it issued a statement of objections charging 112 British construction firms with conspiring to rig bids in thousands of tenders (OECD, 2008: 18).

Presently, the main government expenditure is in the public construction sector. For example, each year the Thai government signs public construction contracts of over 100,000 million baht in value, which is approximately 10 -30 percent of public expenditure (See table 1.3). Thus, a number of public construction projects are a large market for contractors, and this should be competitive. However, bid rigging behavior is still a problem of concern, distorting competition in public procurement auctions.

Table 1.3 Total Volume of Public Construction Contracts, Fiscal Years 2001-2009 (Including Public Enterprises and Local Governments)

Fiscal Year	Number of Public works contracts (Contracts)	Total volume of Public works contracts (Million Baht)	Public Expenditure (Million Baht)	Percentage of Public Expenditure
2001	17,726	98,055.97	910,000	10.78
2002	20,201	160,779.47	1,023,000	15.72
2003	16,959	115,028.55	999,900	11.50
2004	16,853	230,412.72	1,163,500	19.80
2005	25,165	200,599.59	1,250,000	16.05
2006	30,350	381,468.87	1,360,000	28.05
2007	24,547	196,863.12	1,566,200	12.57
2008	24,294	170,653.83	1,660,000	10.28
2009	30,779	200,665.61	1,835,000	10.94

Source: Office of the Auditor General of Thailand, 2009.

Generally, public construction includes airports, canals, dams, dikes, railroads, pipelines, tunnels, official buildings, national highways, rural roads, etc. The main problem of this sector is non-transparency in public procurement auctions, particularly bid rigging behavior which seems to be traditional conduct in the public construction market. Woodall (1996: 19) explained that many Japanese construction companies have formed bidding rings going back at least a half century through cartels known as the "Dango" or "conference" in Japanese. For public construction in Thailand, a bid rigging ring is called "Hua", a Chinese word that means a meeting for doing something. Both Dango and Hua directly make public construction far more expensive and indirectly cause inefficiencies in the construction sector. However, there are several studies about bid rigging in highway construction auctions such as those of Porter and Zona (1993), Gupta (2001), Bajari and Summers (2002), Bajari and Ye (2003), Lee and Hahn (2003), Jakobsson and Eklof (2003) and Tukiainen (2008). In addition, we can apply the industrial organization framework to explain the collusive behavior in public procurement. Thus, the aim of these studies is to analyze and detect whether bid rigging behavior exists using both econometric techniques and the concept of industrial organization. For Thailand, Visuth Chorvichien et al. (2002) found that a warning sign of bid rigging is the difference between the winning price and the estimated government price being less than 5 percent.

The scope of this study is the public procurement of the Department of Rural Roads (DRR) because the DRR has a mission to develop and improve the rural standard of living by supporting transportation, tourism, and border land development. Each year Thai government allocates a budget of about 1,000 – 8,000 million baht, which is roughly 0.20-0.75 percent of public expenditure for rural road construction under the supervision of the DRR (See table 1.4). However, according to the reference data from Royal Thai Police about bid rigging, in 2007, more than 2,000 cases involved corruption and bid rigging in road construction. But, it is yet difficult to find any evidence (Institute of Investigator, 2010).

A screening method might assist in finding warning signs of bid rigging in the public procurement market. A screening method is a statistical test designed to discover whether there are competition problems and which firms are involved in a conspiracy. (Abaratez-Metz and Bajari, 2009) The screening method applies with

available data such as prices, costs, estimated market shares, or bids, and then uses statistical tools to identify patterns in the data that are irregular or highly suspicious. Presently, the screening method could support the competition agencies in several countries such as the US, Japan, and South Korea. The purpose of this study is to find the screening method for bid rigging behavior of Thailand rural road construction so as to improve the public procurement process in the future.

Table 1.4 Total Volume of Rural Roads Contracts, Fiscal Years 2003-2009

Fiscal Year	Number of rural roads contracts (Contracts)	Total volume of rural roads contracts (Million Baht)	Public Expenditure (Million Baht)	Percentage of Public Expenditure
2003	223	7,483.20	999,900	0.75
2004	231	4,520.93	1,163,500	0.39
2005	301	8,894.00	1,250,000	0.71
2006	235	5,719.16	1,360,000	0.42
2007	213	4,644.81	1,566,200	0.38
2008	192	2,951.33	1,660,000	0.18
2009	260	4,052.99	1,835,000	0.22

Source: Office of the Auditor General of Thailand, 2009.

1.2 Motivation of This Study

Even though the Thai government enacted the Act on Offences Relating to Submission of Bids to State Agencies B.E. 2542 or Anti-Collusion Law in 1999, bid rigging behavior is still a pervasive problem in public procurement auctions. This reflects the difficulties in detecting or screening bid rigging behavior. The primary obstacle for detection or screening is the fact that collusive agreement making among

competitors is not observable. However, economists have attempted to develop economic screening tests that may enable detection of patterns in irregular bidding. The screening test focuses on determining whether the fundamental conduct is anomalous or inconsistent with competitive behavior. The economic concept of collusion, the industrial organization paradigm, and the econometric method will be used to uncover the screening method for the public procurement market in Thailand.

1.3 Research Questions

The main research question of this study is how to detect bid rigging in the rural road procurement market as well as the factors facilitating collusive bidding.

1.4 Objectives of This Study

1.4.1 To detect bid rigging in the rural road procurement market of Department of Rural Roads

1.4.2 To explore the market structures of the rural road procurement market

1.5 Scope of This Study

Generally, there are many types of public works construction which can be used as case studies to analyze bid rigging behavior. However, for this study, the author proposes to test the screening of bid rigging in rural road procurement of the Department of Rural Roads. The reasons for focusing on this public works construction are as follows. First, each fiscal year the government allocates a budget for rural road construction and improvement projects of over a billion baht therefore the rural road market is a large market for the construction sector. Secondly, the DRR procures many rural roads by open tendering in which a number of contractors can compete. However, many scandalous cases of bid rigging have occurred. Finally,

DRR has made public procurement, data available on its website, www.drr.go.th ,
thus made it impossible for analysis in this study.

The screening test for bid rigging will be estimated using bidding data from
January 2006 to December 2009 in rural road auctions where there existed public
procurement every month. The author also focused only on bidding data, especially in
the construction of new rural roads. Data consists of all rural road projects during the
sample period, number of bidders, all bidders' prices and estimated prices of projects.
For variables in testing the model, the author is interested in bidders' characteristics
which might be influence bidders' decisions as classified contractors of the DRR or
the distance from contractors' headquarters to construction sites, etc.

Though it is difficult to identify which contractors displayed bid rigging
behavior, many bid rigging scandals are related to both national and local politicians.
Hence, the author hypothesized that the relationship between construction firms and
politicians could be a source of collusive schemes.

1.6 Contribution of This Study

The author attempts to test several bidding factors which might influence
bidders' decisions; thus it is useful for the policy makers in the concerned areas to
formulate and implement their policies for the purpose of reducing the bid rigging rate
in the future.

In terms of policy implications, this study might support the policy makers in
the anti-collusive practices, especially those of the National Anti-Corruption Commission
(NACC), Office of the Auditor General (OAG), Department of Special Investigation
(DSI), Trade Competition Committee (TCC) and Royal Thai Police (RTP). The
NACC can utilize these findings to review the bid rigging behavior and the loopholes
in the Anti-Collusion Law. The OAG may employ this study to develop guidelines for
bid rigging audits in the public procurement process. Meanwhile, the DSI TCC and
RTP could develop techniques for investigations by using academic research on
suspicious bidding behavior in public procurement auctions.

1.7 Organization of This Study

This study is organized into 5 chapters (including this one). Chapter Two presents the review of related literature in screening methods of bid rigging. The third chapter proposes the conceptual framework of screening methodology and the data of this study. Then the empirical results are shown and interpreted in the fourth chapter. Finally, the concluding chapter provides the summary, conclusions, limitations, and suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

This chapter focuses on the literature of bid rigging in public procurement auctions under economic perception. It consists of four sections. The first section provides an overview of public procurement in Thailand which underlines the importance of competition in the public procurement market through legal and institutional frameworks, especially the role of the anti collusion law of Thailand. The second section summarizes the characteristics of the construction industry, particularly the rural road construction market. The third section explains the differences among cartels, collusion and bid rigging and also gives details about methods of detecting bid rigging behavior. The final section focuses on the screening of bid rigging behavior in the public procurement market that deals with the estimation methods for this dissertation.

2.1 Overview of the Public Procurement Market in Thailand: Legal and Institutional Framework

2.1.1 Regulations on Procurement

The main legislation about public procurement in Thailand is the Regulation of the Office of the Prime Minister on Procurement and its amendment (ROPMP) of 1992. Chulasingh Vasantasingh (2008: 39) noted that this regulation has been revised to be in line with the public procurement of the UN Commission on International Trade Law (UNCITRRAL). Also it was based on the basic principles of proper procedures which ensured fairness, prudence, transparency and accountability. However, the Thai government has established a central procurement agency called the "Office of Procurement Management" or OPM in the Comptroller General's Department (CGD) within the Ministry of Finance. The duty of the OPM is to

supervise or consult the individual procuring entities, monitor compliance with the regulatory framework, set and harmonize procurement policy, as well as recommend reforms. Since 1992 the government has set the Committee in Charge of Procurement (CCP) to interpret the ROPMP, make recommendations concerning its enforcement and amendment, grant exemptions from the ROPMP to procuring agencies, and hear complaints. Further, Thailand's law, regulations, and policy guidelines on public procurement are published in the Royal Gazette. Also they are posted on the websites of the Ministry of Finance.

Under the ROPMP, the procurement methods depend on several factors including the value of the contract, the nature of the goods and services, and the urgency of the procurement. However, since 2005 procurement valued at above 2 million baht has had to be conducted through an electronic auction (e-auction). In the procurement process, the procuring agency must publish the criteria of prequalification and method of selection. The publication of procurement opportunities increases bidding participation, also consequently reduce the risk of collusion or bid rigging in the procurement process.

Generally, all procuring agencies must announce their procurements on the Governments' central procurement website (www.gprocurement.go.th) and relevant agencies' websites. Additionally, they must make these announcements to the Mass Communication Authority of Thailand, the Broadcasting Authority, and the Office of the Auditor General of Thailand.

However, clear definitions of the criteria and procedures for bid selection are the important factors in reducing corruption in the procurement process. (Chulasingh Vasantasingh, 2008: 41) Normally, the ROPMP provides general selection criteria, namely, price, bidder's qualification, and quality. The selection committees are responsible for evaluating and selecting the lowest bidder. The lowest bidder under government criteria will be announced on the website of the procuring agency and finally a contract is signed as "contractor" of the government agencies involved.

2.1.2 The Act on Offences Regulating Submission of Bids to State Agencies, B.E. 2542 (1999)

To ensure the integrity of the procurement and reduce the risk of corrupt practices in public procurement, the ROPMP verifies that tender documents may

require bidders to declare that they have no "conflict of interest" in the tender. The conflict of interest of bidders means that all bidders are not jointly interest bidders; for example, bidders have the same owner and bid as competitors. However, the government issues the Anti Collusion Law or namely The Act on Offences Regulating to Submission of Bids to State Agencies, B.E. 2542 (1999). The operations of public procurement in the past have experienced bid collusion which did not involve real competition for the maximum benefit to state agencies, leading them to incur losses. Moreover, in some cases, politicians or state officials use their position to facilitate collusion, such as helping some bidders. However, this act has focused on curbing collusion and corruption in public procurement which involves three parties, the bidder, state official, and political position holder.

The Anti Collusion Law of 1999, sections 4-9, defines guilty behavior. The law defines the guilty person as any person who might not only be the bidder but also other persons involved in collusive behavior. It defines the unlawful activity of collusion, for example, in section 4 it states:

> Anyone bids in collusion with others with the objective of conferring a benefit to any such persons in the form of a right to enter into a contract with a State agency also by avoiding fair competition or by creating barriers to the offer of the products or services to a State agency or by acquiring an advantage over a State agency in a manner which is not congruous with normal business practice.

Violations of the Anti Collusion law may lead to criminal punishment, both imprisonment and fines. Any bidders who violated this law will receive the highest sentence as the imprisonment for a term from one to ten years in section 6[1].

---

[1] The Anti Collusion Law stipulates that *"Any person who coerces another person to participate in a bid or not participate in a bid or withdraw a bid or bid as directed, by use of force or any form of threat to incite fear of endangerment to life, body, liberty, reputation or properties of the threatened person, or a third party, and as a result thereof the threatened person submits to such coercion, shall be liable to imprisonment for a term from five years to ten years and a fine of fifty percent of the*

Meanwhile, the fine penalties of section 4-8 are fifty percent of the highest price submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher.

Under this legal perspective, the Anti Collusion Law could prevent or warn the bidders or any person who intend to collude in the public procurement process. In the meantime, under the economics view, this law should influence on decision of bidders because they will decide to collude when their benefits from collusion must greater than their wrongdoing costs.

However, the weakness of this law has reflected many problems. The first problem has involved the investigating evidence and facts against the convicted. In Thailand under the Anti Corruption Law of 1999[2] it mandated the National Anti Corruption Commission (NACC) to seek evidence and facts on every single prosecution performed in connection with the inquisitorial system[3]. Meanwhile the Anti Collusion Law of 1999 has used both the inquisitorial system and accusatorial system[4]. This difference has affected the imparity of accused. Under the inquisitorial system, the Anti Corruption Law of 1999 has permitted its mission to include prosecution of politicians, especially in the single politician criminal court. On the contrary, the Anti Collusion Law of 1999 in Article 14 (3) did almost the opposite to prosecution done in connection with the Anti Corruption Law of 1999. This difference has resulted in part of the accused being prosecuted under accusatorial system in the limited single politician criminal court and other parts being prosecuted in the court of justice. (Voravit Thipthamthara, 2010: 46-56)

Voravit Thipthamthara (2010: 46-56) found the independence problem of the NACC in which the Thai Constitution has compulsorily organized the National Anti

---

highest bid submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher"

[2] The Organic Act on Counter Corruption B.E. 2542 (1999)

[3] An inquisitorial system is a legal system where the court or a part of the court is actively involved in investigating the facts of the case.

[4] The accusatorial system or adversary system is a legal system where two advocates represent their parties' positions before an impartial person or group of people, usually a judge who attempt to determine the truth of the case.

Corruption Commission as an independent organization. Contrarily, the Act on Offences Regulating the Submission of Bids to State Agencies, B.E. 2542 (1999) in Articles 14(3) and 15 the NACC is under the Office of the Attorney General.

Thanathip Nawarattanaworakul (2009: 67-94) analyzed the limitations of the Department of Special Investigation (DSI) which prevents and suppresses the offenses relating to the submission of bids to state agencies. According to the Special Case Investigation Act B.E. 2547 (2004), the special investigation methods as eavesdropping devices[5], electronic tracking and camouflaging have been used to investigate lawsuits. However, the DSI must pass the case to the NACC, even if the case is under the authority of the DSI. These investigations are usually limited because of an overload of cases submitted to the DSI because of. Additionally, the structure of the DSI is subject to the whims of political intervention.

Another loophole of the Anti Collusion Law of 1999 has involved the limitations of criminal liability of juristic persons[6]. In Thailand a juristic person cannot commit offence and be subject to criminal punishment except when there is the law expressly or implicitly providing that juristic persons be subject to criminal liability for that particular offence. However, the Act on Offences Regulating to Submission of Bids to State Agencies, B.E. 2542 (1999) most of which involve representatives of juristic person submitting bids to the government agency, is silent about penalties to be imposed upon juristic persons resulting in uncertainty in enforcement of this statue. (Tanin Prempree, 2009)

2.2 Characteristics of the Construction Industry in Thailand

This section summarizes briefly the characteristics of the construction industry in Thailand. First of all, the construction industry is the main industrial sector of the Thai economy. Generally, the construction industry might be roughly divided into 2

---

[5] Or a covert listening device is usually a combination of a miniature radio transmitter with a microphone. The use of eavesdropping device is a common technique in police investigations.

[6] The criminal liability of juristic person is another form of legal personality which it is widely accepted that juristic person can be subject to punishment but there are some problems relating to sentencing or enforcement of criminal punishment against juristic person.

types, that is, the construction of the private sector and public sector construction or public works. The construction of the private sector consists of building new houses, apartments, factories, and offices; meanwhile, public works construction includes highways, roads, bridges, ports, government buildings, dams, railroads, sewers and tunnels, etc. Thus, this industry could make the linkage with other parts such as construction materials or employment. However, in this section it starts with the overview of the structure of the Thai construction industry. This study focuses on the nature of the industry, market concentration, and the barriers to entry the industry. After that we will mention the cartel issues in this industry which seems to be a culture and environment of the industry.

2.2.1 Overview of the Structure of the Thai Construction Industry

2.2.1.1 Nature of the construction market

Actually, the construction market is very wide and different. For example, the market of building construction could be categorized into many types, such as houses, factories, office buildings or football stadiums. These various types show that most of the firms who build homes would not specialize in building football stadiums. Consequently, in the public works construction of Thailand the main government agencies will determine the specialized firm as the class of contractor. For example, the Department of Highway (DOH) determines that any firm, who bids in highway construction, must be prequalified by DOH criteria[7]. DOH will categorize five classes of contractor. Each contractor will be verified by the DOH as specialized firms in highway construction.

However, another consideration of market definition is that some construction firms do not make any products at all. They provide some works to subcontractors, especially the large projects. On the other hand, subcontracting is another form of collusive behavior which sometimes it might not be avoided because

---

[7]In 2008 DOH announced the preliminary evaluation of contractor for selection potential contractor which Bureau of Standard and Evaluation of DOH had responsibility to evaluate and registry the potential contractor.

the main contractor might specialize in some works while its competitor in the tendering might be skilled in other works.

In addition, the geographic area and transportation costs are obviously a key factor in the construction market. Certainly, firms in the local area of the project site will have much lower transportation costs because they might be familiarize with the local supplier materials, labor and equipment.

2.2.1.2 Concentration

Gerard de Valence (2003 quoted in OECD, 2008: 20) noted that most of firms in the construction industry were small firms with fewer than 20 employees. However, a lot of large firms almost appear in the public works market. These large firms have more capacities and higher levels of capital which reflect their previous experience. In Thailand, most of large firms are enlisted as the extra contractor class by several government agencies like the Department of Highways, Department of Rural Roads, and Department of Public Works. However, a competition among large firms seems to be more in the pattern of an oligopolistic market, whereas the small contractors who do basic works as laying bricks or poring concrete tends to be closer to perfect competition.

2.2.1.3 Barriers to Entry

For small firms, the costs of entering in their local market are low because they might only buy few pieces of equipment. For this reason, small firms commonly lease equipment as needed. Conversely, large firms have a high cost to enter the construction market, especially public works market. They must show potential qualifications, as their financial capital, equipment, and both skilled labor and unskilled labor that must be verified by government agencies in order to list as contractor class. However, large firms seem to be better able to absorb transportation costs than smaller firms, thus they could bid across a wider geographic area. Additionally, the reputation factor might be another factor of barriers to entry because normally owner projects prefer large firms, especially reputation firms. Thus, the well known firms will be more likely to take a chance to be the winner. Consequently, the reputation factor may help to explain why the market for large construction projects tends to be more concentrated only in a few large firms. These large firms could develop themselves through large construction projects, making it more difficult for

smaller or newcomer firms to acquire experience. It means that new and smaller firms may not even be allowed to bid on large projects.

However, public policy may cause barriers to entry in the construction market, especially in the public sector. In Thailand, the Regulation of the Office of the Prime Minister on Procurement and its amendment (ROPMP) of 1992, Clause 30 determines that any government agency may select the preliminary evaluation of potential contractors for prequalification. For example, the Department of Rural Roads (DRR) has determined the selection criteria and procedures for the prequalification of contractors since 2004. This criterion has categorized public constructions into 3 fields, i.e., rural roads, bridges, and tunnels or underpasses. Each field separates DRR contractors into five classes. The criterion includes consideration of the financial status of each contractor, the engineering personnel, construction machinery, and previous experience. (See table 2.1-2.4)

Table 2.1 Classifications of DRR Contractors

Class of Contractor	The Right to Get a Contract with DRR (Million baht)		
	Rural Road Field	**Bridge Filed**	**Tunnel or Underpass Field**
Extra	Unlimited	Unlimited	Unlimited
1	Not exceed 150	Not exceed 80	Not exceed 150
2	Not exceed 60	Not exceed 40	Not exceed 60
3	Not exceed 20	Not exceed 20	
4	Not exceed 10	Not exceed 5	

Source: Department of Rural Road, 2004.

Table 2.2 Minimum Requirements for the Financial Status of DRR Contractors

Class of Contractor	Minimum Requirement of Financial Capital (Million baht)		
	Rural Road Field	**Bridge Filed**	**Tunnel or Underpass Field**
Extra	60	60	60
1	50	40	50
2	30	20	30
3	10	10	
4	5	2.5	

Source: Department of Rural Road, 2004.

Table 2.3 Minimum Requirements of Personnel of DRR Contractors

Class of Contractor	Number of Civil Engineer (Classified engineering license)			Number of Electrical engineer or Mechanical engineer
	Charter	**Fellow**	**Associate**	**Fellow**
Extra	1	2	2	1
1	1	1	1	1
2	-	1	1	-
3	-	-	2	
4	-	-	1	

Source: Department of Rural Road, 2004.

Table 2.4 Minimum Requirement of Previous Experience

| Class of Contractor | Minimum Requirement of Previous Experience (Million baht) | | | | | |
| | Rural Road Field | | Bridge Filed | | Tunnel or Underpass Filed | |
	Each Contract	Overall Contracts	Each Contract	Overall Contracts	Each Contract	Overall Contracts
Extra	150	300	60	180	150	300
1	30	120	20	60	30	120
2	10	40	10	30	10	40
3	5	20	5	15		
4	-	-	-	-		

Source: Department of Rural Road, 2004.

Note: Both Job Experience in Each Contract and Overall Contracts Must be During Five Years Until Submitting Prequalification Document

Table 2.5 The Number of Prequalified bidders of DRR

| Class of Contractor | The Number of Prequalified bidders of DRR | | |
	Rural Road Field	Bridge Filed	Tunnel or Underpass Field
Extra	95	59	10
1	76	49	7
2	134	63	1
3	365	67	
4	150	362	
Total	**820**	**600**	**18**

Source: Department of Rural Road, 2004.

Tables 2.1-2.5 can be interpreted that the policy of prequalifying bidders could be barriers to entry in the public procurement market. In the rural road field, there are 820 firms which can pass the prequalified bidders of the DRR. However, most of the large firms are in the extra class or the first one. The number of DRR contractors in the extra class is only 95 firms or 11.5 percent of all prequalified bidders. These large firms have greater capacity to get unlimited DRR contracts. In contrast, more than half of them come from the third and fourth classes which have limited competency; however, they could move to a higher class when they submit their job experience under the minimum requirement of previous experience. Hence, the policy might be the barrier to entry in the procurement market in which government rules and regulations could restrict competition through minimum requirements of financial status, engineering personnel, construction machinery, and previous experience.

2.2.2 Cartel Issues in the Thai Construction Industry

Almost all countries have been encountering the collusion problem or cartels in the construction industry. Doree, et al. (2003 quoted in OECD, 2008: 21) stated that the construction industry seems to have a culture and environment that make it prone to collusion. Likewise, in Thailand the construction industry has been a collusion problem.

The product is homogeneous. Most construction firms still employ low technology. In other words, they tend to use fundamental materials to build the same things like their competitors. The process of road construction is not complex since it uses basic materials such as sand, soil, concrete or asphalt which every firm could provide for construction.

The bidding process is transparent. As mentioned about the ROPMP, the general public could access bid openings for construction projects through announcements of procuring entities or government websites. Thus, the regulation of public procurement in Thailand requires transparency in the procurement process with the aim of discouraging corruption. However, some regulations might be the barriers to entry in the public procurement market, especially the prequalified bidders' policy.

The business is prone to economic fluctuation. In other words, the construction sector is subject to substantial demand swings. For example, during the 1997 financial crisis of Thailand a number of small contractors went bankrupt. Their bankruptcies led to the discarding of several public works projects and many firms were listed on the government blacklist. (Visuth Chorvichien et al., 2002: 1-1) Thus, the private construction and public works depend on the economic cycle. During the boom cycle, the demand for construction will expand; therefore, the market share for construction firms increases. Conversely, recessions might reflect the decreasing demand of construction as a result of the market share decreases.

A large number of buyers in the construction market. Normally, the buyers or customers in the construction market include both the private and public sectors. For the public works market, it could be categorized into both municipal and national governments. However, the collusive behavior in public construction seems to occur at the local government level. (Visuth Chorvichien et al., 2002: 4-6)

Subcontracting is a common behavior in the construction market. Sometimes a winning bidder will subcontract part of a project to a firm that might be competitors in the past. Actually, firms in the construction sector often consider finding partners as a normal way of doing business because many projects could not be completed without subcontracting. For this reason, large infrastructure projects might require the contractors to form joint ventures or consortiums.

2.3 How to Detect Bid Rigging Behavior in the Public Procurement Market

In this section, I first discuss the types of bid rigging or collusive behavior and then will describe how to detect bid rigging behavior in the procurement market.

2.3.1 Types of Bid Rigging

In chapter 1, we mentioned the types of bid rigging in the procurement market. However, this section will clarify more details about these types of bid rigging.

In fact, bid rigging is an anti competitive agreement in which firms seek to set up the outcome of the bidding process by agreeing among bidders. Normally, firms will organize as a bidding ring and designate the winner before the tendering.

Sometimes, the bidding ring determines that each member must pay a bidding fee before participating in the group. The bidding fee will facilitate the collusion among bidders, government officials and politicians. For this reason, the bidding ring attempts to preserve its benefits and obstructs the entrance of new bidders. This behavior could eliminate competition in the procurement process. However, with the purpose of preserving their benefits, the bidding rings have executed several forms of collusion as follows:

1) Bid repression or non submission or withdrawal of bidding : Before tendering, the bidding ring will designate the winner; however, if newcomers try to enter to participate in this tender, the bidding ring might propose an agreement that newcomers refrain from bid submission or withdraw already submitted bids.

2) Complementary bidding or formal bid submission: This collusive scheme seems to follow competitive bidding because all bidders pretend to bid competitively when in fact, they are colluding. The informal agreement of the complementary bidding must be rigorous because the member in the ring might cheat or betray other firms by submitting a bid price under the designated winner.

3) Bid rotation: Initially, the bidding ring may allocate benefits for all members. Sometimes, the benefit might depend on the negotiated power of each member. For example, the leader of the ring might be the most efficient firm which could bid the lowest price; however, it might require more benefits from collusion than the competition. Thus, the lowest cost firm might have the negotiating power to allocate the benefits of the ring. The allocation of benefits may set in the form of bid rotation or rotating the winner. The agreement of the bidding ring might be such that they allocate projects for each member under the negotiating power of each firm. The small firms might get the little projects for job experience, while larger firms might obtain benefits from the large projects.

4) Subcontract bidding: As mentioned in the last part, subcontracting is common behavior in the construction market. The agreement of the bidding ring might be to propose that the designated winner must subcontract to other ring members.

5) Market share arrangement: In market agreements, competing firms may allocate certain customers or a group of buyers from each location or

geographical area. For example, the bidding ring will share the market for each member from certain government agencies or regional area. Sometimes, the agreement for market share might be strict in forbidding other members across the border from competing with a local firm.

```
┌─────────────┐      ┌─────────────┐      ┌──────────────────────────┐
│             │      │             │      │ Sharing Benefits         │
│ Bidding Ring│ ───▶ │ Designated  │ ───▶ │   1) Cash or Bribes      │
│             │      │   Winner    │      │   2) Rotating Winner     │
│             │      │             │      │   3) Sub contracting     │
└─────────────┘      └─────────────┘      └──────────────────────────┘
                            │
                            ▼
            ┌──────────────────────────────────────┐
            │ Pattern of Bid Rigging Behavior      │
            │   1) Bid Suppression                 │
            │   2) Rotating winner                 │
            │   3) Sub Contracting                 │
            │   4) Complementary Bidding           │
            │   5) Market Share Arrangement        │
            └──────────────────────────────────────┘
```
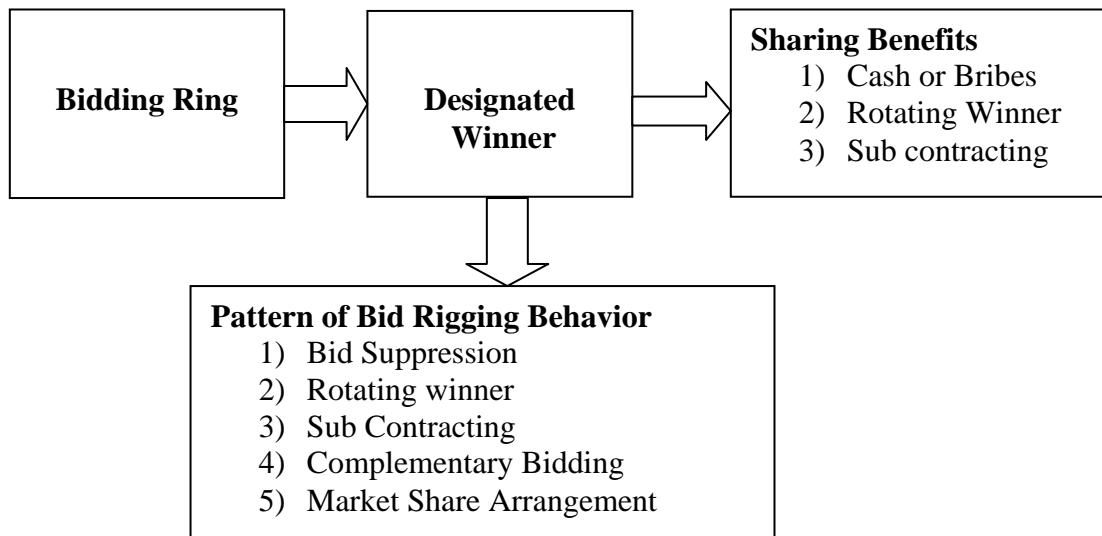
Figure 2.1 The Mechanism of Bid Rigging Behavior

Figure 2.1 shows the mechanisms of bid rigging behavior which may be explained in four parts. Firstly, all collusive bidders decide to gather as a bidding ring. The bidding ring must determine the winner before the tendering, by which they could design the bid rigging behavior in one of the five patterns. However, the designated winner has to share its benefits to other members of the ring in terms of side payments and/or rotating the winner in future tendering or sub contracting.

2.3.2 Detecting Bid Rigging in the Public Procurement Market

In fact, several signs of bid rigging may appear when firms collude in order to determine the result of the tendering process. The detection of bid rigging in public procurement focuses on some strange patterns of bidding in the market and warning signs that might be found in documents, pricing, statements or correspondence and behavior.

2.3.2.1 Detecting when bids are submitted: In concentrated markets it seems to be easy for the firm which could organize the ring to be the winner. For example, the same bidders may always win bids of a certain type or size; meanwhile another bidder never wins but still keeps bidding. Likewise, the bid pattern may show one firm that consistently wins bids but always subcontracts to smaller firms refrains unexpectedly for no reason.

2.3.2.2 Detecting from documents submitted: Initially, the documentation may also be a clear indicator of collusion among firms. For example, firms may employ the same personnel to create the bidding document. This creates visible errors in the documents where they may use the same type of paper, the same misspelling, handwriting, wording, calculations. In order to use this detecting method, officials must scrutinize all documentation thoroughly.

2.3.2.3 Detecting from pricing or pricing related signals: It is important to look for price increases that cannot be explained by cost increases. We might be aware of the market trends with respect to input cost, such as changes in raw material costs or variances in oil prices which will push the final prices of the bidder. Though cost might not affect the bidding price, the bidding ring might set up that the losing firm's bids are much higher than the designated winner in complementary bidding. In addition, another warning sign of bid rigging is that the bidding price might be higher than the engineering cost estimates, or higher than prior bids for similar tenders may also indicate collusion.

In the next section, we will discuss detecting collusion in the public procurement market under the economic approach, in particular, the literature on bid rigging in road or highway procurement.

2.4 Economics of Bid Rigging

In the past, the literature on bid rigging behavior in the public procurement market mainly focused on the methods of detection. Likewise, several studies explained the determinants or factors associated with a firm's decision to bid. However, some studies attempted to show the role of government officials or

politicians in public tendering. Their roles might be the facilitating factor behind collusive behavior in the public procurement market. For example, government officials might obstruct new bidders from entering in the procurement market by using their biased judgment or unfair discretion. Likewise, local politicians may impede outsider firms from participating in bidding in their area. These behaviors are forms of corruption in public procurement which this study will not emphasize.

However, let us start with the cartel form among bidders in public procurement or the bidding ring. As discussed above, the bidding ring consists of a conspiracy of members who decide to collude in order to seek benefits from collusive bidding. Hence, in bid rigging analysis, some studies describe how the bidding ring allocates bids and transfers benefits to its member.

We may observe collusive behavior through unusual bidding patterns. For example, some bids are much higher than published price lists, previous bids by the same firms, or engineering cost estimates, have fewer than the normal number of competitors submitting bids, or bid prices drop whenever a newcomer submits a bid (Parker and Maher, n.d.: 4-7). However, we could analyze the unusual bidding patterns by requiring additional information on cost factors and underlying costs, and other characteristics of the procurement market that may influence bidding behavior. For this reason, bid rigging analysis requires information of both project characteristics or properties of firms.

Haider and Hunter (2010: 2-6) noted that some collusive bidding tests might develop and be applied by economists and proposed for possible use as a screening in a variety of markets. These are based on the economic intuition that bids should suitably reflect costs in a competitive market. Likewise, bids should be independent. In other words, two bidders should submit bids individually. Under economic intuition, bids submitted by competing firms are supposed to independent from other firms.

Asker (2009: 2-3) describes bidding rings in which bidders in an auction collude in order to decrease the competition among them and earn greater surplus from tendering. Therefore, the result of the cartel is often referred to as a bidding ring. The act of colluding in an auction is called bid rigging. Theoretically, McAfee and

McMillan (1992: 579-599) explored bidding rings and give details on how weak and strong cartels function and maintain their collusive behavior. They explain that cartels use mechanisms such as a phase of the moon to designate the winner in the tendering. In other words, a phase of the moon means that the ring chooses a bid rotation scheme in which each ring member is allocated as a phase of the moon. At the time of the auction a phase of the moon is set during which certain ring members have the right to bid without competition (Asker, 2009: 2-3). Likewise, the bidding ring could enforce collusive behavior if any members cheat. McAfee and McMillan found that all members of weak cartels submit the same bid, but members of strong cartels can organize side payments for each member as well as obstruct newcomers from the market.

Additionally, the theoretical literature on bidding rings attempt to explain how the ring can allocate bids and share benefits among its members .The bidding ring might allocate bids by distributing information to bidders before tendering, which means that each member of the ring will know the other bidding prices early. Likewise, the bidding ring may allocate surplus benefits from collusion; for example, the bidding ring might pay obvious side payments to each member, or the designated winner must subcontract to other members in the ring. For example, the study of Pesendorfer (2000: 381-411) examined bidding rings in the bid auctions for contracts to supply school milk in Florida and Texas by using data collected during the prosecution of the rings. It found that the bidding rings in Florida allocated the collusive benefit in terms of market division while the bidding ring in Texas used the system of obvious side payments.

However, Asker (2009: 2-3) noted that empirical work on bidding rings seems to be limited by the difficulty in achieving quality data, especially the secret data of bidding rings. Hence, the popular empirical studies on bidding rings and bid rigging focuses on the statistical detection or screening of bidding patterns which might coincide with cartel behavior. In fact, the statistical detection of bidding rings relies on the model of the suspected ring and compares the observed bidding patterns with competitive bidding.

Traditionally, the reliable indicators of bid rigging behavior might include the presence of stable market shares, bids not correlated with project costs, also the

sudden rise or fall in prices that are not correlated with the changes in cost. However, these signals might not necessarily prove collusive behavior. For this reason, it seems difficult to obtain solid evidence of collusion. Thus, it might support the detection of bid rigging as one based on determining whether the bid submission is inconsistent with competitive behavior.

For the empirical studies in detecting collusive bidding, we start with the study of Feinstein et al. (1985 quoted in Porter and Zona, 1993:520) which analyzed how cartels colluded in procurement markets. This study focused on cartels in highway construction, of which the results showed that cartels sought the engineer's cost estimate through misinformation. They explained that contractors made decisions based on expectations of the current and future periods during which they could substitute demand among periods because projects were substituted for one other. Roughly speaking, contractors made decisions to bid based on the expectation of how they would bid on future projects compared to the prices for current projects. The government could utilize bids to gain information because the government agency considered the results of past bidding and expected future low bids. Under the assumption of this study, contractor costs fluctuate at all times so the bids will also fluctuate. However, when contractors recognized this gathering information, they will form a cartel and provide misinformation to the government with the aim of changing the price expectations of the government. Hence, the cartels could use the advantage of cost fluctuations to show that they will bid up gradually through time. For this reason, the government will start to adjust its expectations that low bids should increase. Finally, Feinstein et al. found that benefits from collusive firms led to inefficiencies in the highway procurement market.

The cartel of contractors attempted to manipulate the government through distribution of asymmetric information. Normally, contractors have information about costs for materials, labor, and time for project completion. However, this information is not always available to the government which is procuring the project from the contractor. If firms conspire together, they could control their bids to change the expectations of the government on what constitutes a reasonable bid in the future.

The study of Feinstein et al. (1985 quoted in Barrus, 2011: 34) focused on the theoretical and empirical models about asymmetric information. They pointed out that

the construction cartel could manipulate the government by raising the bidding prices. They tested the empirical data of highway procurement of North Carolina during 1977-1979; however, the government agencies did not detect collusive behavior in highway tendering. Hence, this study analyzed data collusive and non- collusive bidding.

To compare competitive and collusive behavior in the procurement market, Hendricks and Porter (1989) suggested the proper way is to adapt with empirical work for special cases and to identify the differences between observable implications of collusive and competitive behavior. They found that the mean of submitted bids is higher in cartel bids; also the cartel firms appear to bid less aggressively than non-cartel firms. Similarly, the variance of cartel bids is less than that of non-cartel bids. The final finding showed that the frequency with which bidders together join in a project was greater for cartel bids than non-cartel bids.

However, in the study of Porter and Zona (1993) the agency knew that collusive bidding existed. This study developed an econometric test to detect bid rigging in the highway procurement market. Porter and Zona attempted to compare bidding behavior between the known collusive bids and the competitive bids of construction firms in New York. They employed the data bidding of pavement contracts of Nassau and Suffolk counties in New York during 1979-1985. The explanatory variables include bidding information, capacity constraints as job backlog data, a variable indicating whether or not the firm was a non cartel firm that had never won a project, as well as a variable indicating whether or not the firm was located on Long Island. These variables were proxies of costs of both competitive and cartel firms. Interestingly, Porter and Zona found that all cartel firms were on Long Island. For the dependent variable, they used the logarithm of the bid that a firm submitted for a particular job.

They attempted to explain phantom bidding or complementary bidding which is a bid that looks competitive because cartel members seem to bids competitively; in fact they were colluding. Porter and Zona (1993) explained that if collusive behavior existed, the market share would be more stable and the distribution of bids would have less variation. This study tested the probability of winning by using multinomial logit analysis. They ran three regressions with a combined group, a competitive

group, and a cartel group. The results showed that there were statistical differences between competitive firms and collusive firms. These results support the hypothesis that phantom bidding exists and the higher bids were made by collusive behavior. Finally, Porter and Zona concluded that cartel bids did not coincide with costs.

The study of Porter and Zona (1999: 263-288) focused on the institutional details of school milk procurement, bidding data, statements of diary executives and supply characteristics. They employed data of the Ohio school milk market during 1980s. They compared the bidding behavior of a group of firms to a control group as a competitive group. The results showed that the behavior of each of the firms differed from that of the control group. Hence, they implied that the behavior of these firms was consistent with collusion. Finally, they estimated the average effect of collusion on market prices was about 6.5 percent.

For estimating damage in bid rigging, Howard and Kaserman (1989 quoted in Porter and Zona, 1993: 520) proposed a regression based method for estimating damages in bid rigging cases of the sewer construction industry. Under the estimating damages on three statistical approaches, they found that damage ratios amounted to 32% in bid rigging cases of the sewer construction industry. Later, McMillan (1991: 201-218) estimated the cost of the collusive scheme in Japanese construction known as Dango that excessive profits from collusion were common in Japan's public works contracts and typically amounted to 16 to 33 percent of the price. Likewise, the study of Lee and Hahn (2002: 82-85) attempted to gauge the possible effects of bid rigging on auction prices in South Korea. They estimated the potential damage of structural bid rigging in public works and found that the overcharge ratio based on a forecasting approach was 15.5% of the total government expenditure from 1995-1998.

Although the designated winners will get the project under collusive strategy, they might encounter the winner's curse which means that the winner will tend to overpay in the auction. In fact, winner's curse could reflect that the winner may still obtain the net benefit but will be worse off than anticipated. However, Hong and Shum (2002 quoted in Barrus, 2011: 36) investigated the winners' curse by using data of public works in New Jersey, i.e. highway, bridge construction and maintenance, and road paving. They are interested in common value components of projects and how these impact whether firms bid or not. Initially, they found that the average cost

of non paving and bridge repairs increased as competition increased. These types of projects have common cost uncertainty where a firm is not always clear how much a bridge project will cost and different firms may have different expectations of these costs. In contrast, in private value projects such as asphalt paving, a firm has no uncertainty costs for completing the project. Hong and Shum explained that firms that have extremely positive views about the value of these common value projects and win the bid may finish up with negative expected profits. Thus, rational firms will not bid as aggressively if there are more competitors because they may be concerned about winner's curse effect. Additionally, Hong and Shum described that the increase in competitors tends to lower the bids. This is known as the competitive effect. Thus, if the winner's curse effect is larger than the competitive effect, then bid levels might increase as more firms enter the market.

Another interesting study about detecting collusive bidding is the study of Bajari and Ye (2003). This study developed econometric tools for detecting collusive behavior in the procurement market. However, this study included industry opinions and cost asymmetries among bidders into detecting models. Bajari and Ye explained that these cost asymmetries occur due to firm location, capacity constraints, or knowledge of local regulations. They analyzed data of seal coating contracts from 1994-1998 in Minnesota, North Dakota, and South Dakota.

Initially, they set two conditions for testing collusive bidding. The first is conditional independence which explains bidders should bid independently, while the second is exchangeability to see if costs are actually driving bid levels and not just due to the presence of competitors.

In the Bajari and Ye model, it focused on a procurement auction model with private value costs which means that firms know the costs needed to compete for a project. Bajari and Ye set a bid function as created for all firms. The dependent variable of the bid function was the ratio of the bid divided by the engineer's estimate. For the explanatory variables, they included variables for distance, capacity utilization level and market concentration. For capacity utilization, they defined that firms' total winning bids to the time of the bid divided by a firm's total of winning in the entire

time. Furthermore, competitor variables consisted of maximum free capacity among competitors and minimal distance among competitors.

Bajari and Ye (2003) tested the conditional independence by dividing the market into 2 segments, that is, the top 11 firms and others. They employed the Fisher test to test this condition and found that one set of firms who regularly bid against each other violated conditional independence. In other words, they found that some firms might bid depend on other firms. Meanwhile, the test for exchangeability means that the capacities and distance should enter in a symmetric way, and they found that another pair of firms might violate the exchangeability condition.

Subsequently, the concept of conditional independence of Bajari and Ye was implemented in the study of Jakobsson and Ekloff (2003) which focused on the bid rigging behavior in the Swedish asphalt paving sector. Jakobsson and Ekloff explained that a group of firms in a public procurement market with collusive behavior as indicating the existence of collusion They employed the testing of conditional independence of Bajari and Ye (2003) which states if firms act competitively they should submit independent bids. This concept explained that the difference between observed and predicted bids correlating between firms. If a negative correlation is observed, it might be possible to detect bid rigging. They found that the negative correlation appeared in this testing. In other words, it might show collusive bidding in the Swedish asphalt paving market.

Under one method of detecting bid rigging, Harrington (2005: 4-22) proposed the screening method for cartels in public procurement auctions. He noted that we could observe collusive indicators by using bids pattern as follows. Firstly, the competitive model predicts bids are independent. Harrington (2005) mentioned the study of Bajari and Ye (2003) as the example of this case. Secondly, the lowest bid performs differently from the non lowest bids. Thirdly, bidders' bids respond to cost and demand factors in a manner contrary to the competitive model and finally, bids are better explained by a model with fewer bidders than actually participated.

In fact, we could detect bid rigging or collusive behavior from firms' capacity or firm characteristics such as distance between location of the firm and construction sites. These factors could reflect costs of firms in procurement market. For example,

the study of Jofre-Bonet and Pesendorfer (2003: 1443-1489) analyzed the repeated auctions and considered how capacity constraints and firm efficiencies impact bidding behavior in California. They found that capacity constraints might increase costs for firms. On the other hand, De Silva et al. (2003: 295-316) found that the distance between the location of a firm and the construction site might not be related to bidding behavior.

As mentioned on the facilitating factors of collusion, few studies explored the political factors, especially the intervention of politicians in the bidding process. For instance, the study of Coviello and Gagaliarducci (2009: 21-26) investigated the relationship between the time politician remained in power and the functioning of public procurement auctions. This study employed a dataset on Italian municipal governments and all the public procurement auctions during 2000-2005. However, the assumption of this study set that if a mayor takes time to make friends, one would expect long lasting mayors to collude more with local bidders as far as political longevity increases. Interestingly, the results showed that the relationship between the political longevity of mayors and local bidders might increase the chances of collusion at the local level. Similarly, the study of Hyytinen, Sofia and Otto; 2007 studied the effect of politics on public procurement in Swedish municipalities. This study used the data on the procurement market for cleaning services. They found that political factors might influence the process so that some favorite bidders continually win the cleaning service contracts.

The next study of De Silva et al. (2005: quoted in Barrus, 2011: 35-37) attempted to analyze bidding patterns of new entrants and current firms in the procurement market. First of all, they found that newcomers tend to bid more aggressively than old bidders. They also found that past winning and capacity constraints might affect firms' bidding behavior. Likewise, the study of Ishii (2007) which found that the entering of potential bidders outside the bidding ring might make for irregular bidding wars with members of the bidding ring.

However, the study of Li and Zheng (2009: 1397-1429) which estimated distribution of entry costs and bidder costs in the highway mowing procurement market in Texas. This study employed a structural model and a semi parametric Bayesian method for estimation. Li and Zheng (2009) found that increasing potential

bidders for procurement market could lead to less aggressive bidding behavior and expected procurement costs may increase. They called this the entry effect and competitive effect. The entry effect means that where firms bid less aggressively with more firms and cause procurement costs to rise firms realize their chances of winning a bid decrease with added firms. Also it is costly to prepare a bid, thus the firms decided to bid less aggressively. Li and Zheng (2009) concluded that if the entry effect is larger than or dominates the competitive effect, bids will actually rise with more potential bidders.

The study of Feinstein et al. (1985) and Porter and Zona (1993) focused on the detection method for collusive bidding in highway construction after collusive behavior has been identified. In contrast, Bajari and Ye (2003) and Jakobsson and Ekloff (2003) emphasized the methodology to detect collusive behavior when it is not known whether it is occurring or not.

Likewise, in this dissertation the author follows the detection analysis employed in the studies of Bajari and Ye (2003) and Jakobsson and Ekloff (2003) because the author does not know whether collusive behavior in the rural road procurement market exists.

CHAPTER 3

CONCEPTUAL FRAMEWORK AND RESEARCH METHODOLOGY

This chapter presents a conceptual framework which describes how to screen the bid rigging behavior in rural road auctions. In the first section, the author starts with the economic concept involving the collusion in the public procurement by comparing the benefit and cost of collusion. However, this study focuses on the importance of engineers' estimated cost of public work that might indicate the warning sign of bid rigging in the public procurement market. In addition, the author employs the principle of competitive bidding to explain characteristics of bidding competition. Finally, we discuss the harmful effect of bid rigging in the public procurement. For the second section, this study proposes the research methodology which the first model employs the screening bid rigging method by using the engineers' estimated cost. Likewise, the author uses the important estimated results from the previous model to construct the second model.

3.1 Concept of Collusion in Public Procurement

3.1.1 Comparing Benefit and Cost of Collusion

Basically, all bidders want to maximize their profits in the competitive bidding. In the public procurement process, the lowest bidding firm will be selected as the winner. Hence, a firm's bidding decision is a function of expected profits. These expected profits are dependent on costs and revenues multiplied by the probability of winning bid. Meanwhile, the probability of winning bid depends on the other firms bidding and the level of their bid. If there are many firms bidding on project, it would decrease the probability of the firm in winning the project and lowering the expected profits, consequently.

On the other hand, if all bidders decide to collude in the public procurement as a collusive group or a bidding ring, the aim of collusion is to increase bidding prices like a monopolist in the public procurement market and gain more revenue than they would in a competitive environment.

Under the competitive bidding, a firm which submits the lowest bid will be the winner. The winner will obtain the profit from competition (π_{com}) equal to the difference between the bid price (b) and costs of firm (c) as the equation 3.1.

$$\pi_{com} = b - c \tag{3.1}$$

However, in the collusive bidding all bidders decide to collude in term of a bidding ring when they consider that the benefit from collusion (X_{col}) is greater than the cost of collusion (C_{col}). Likewise, the lowest cost firm will decide to collude when the benefit from collusion is greater than the profit from competition as follows the equation 3.2.

$$X_{col} > \pi_{com} \tag{3.2}$$

Initially, the bidding ring will determine the designated winner before the auction. However, the bidding ring or the designated winner must allocate benefits from collusion for all members. The pattern of sharing benefit might be in term of paying the side payment, the subcontract for members or rotating winner for the next project. For this reason, the bidding ring will set the proper number of members in the ring because if the number of members in the bidding ring increase, the sharing benefits from collusion decrease.

However, this study determines the cost of collusion which consists of four main components as follows;

1) The probability of detected collusive behavior by the government agency (Φ_1) ;

2) The probability of collusive firm to be prosecuted and imprisoned for the highest sentence (Φ_2) ;

3) The probability of offender to get the fine penalty (Φ_3) ;

4) The probability of offender to be blacklisted representing the opportunity cost of losing revenue for the next project (Φ_4).

All members in the bidding ring have an equal chance to be detected in bid rigging, prosecuted in the court and get the fine penalty. However, they have different

opportunity cost of losing future revenue for the next project due to different in the size of firms. A large or famous contractor has higher cost than small or unknown firm. The costs of collusion can be represented by the equation 3.3.

$$C_{col} = \Phi_1\,(V) + \Phi_2\,(V) + \Phi_3\,(V) + \Phi_4\,(FV) \qquad (3.3)$$

From tequation 3.3, Φ_1 Φ_2 and Φ_3 depend on the project value (V). Government auditor hence should monitor the large scale project rather than the small project because its result is more worthiness. When the auditor found any wrongdoing about the collusive behavior, the auditor will submit the case to the prosecution process. Once the court adjudged the guilty, the offender will get the imprisonment and fine penalty. However, each bidder has a different chance of losing revenue for the next project. Φ_4 is depended on the values of the future projects (FV).

Each bidder decides whether to collude as a bidding ring by comparing the benefit and cost from collusion. If the benefit from collusion is greater than its cost, the bidder will collude with other firms. But, if the benefit from collusion reduces which might come from the increasing numbers of bidders, the bidder will not collude for it is not worth when comparing with the costs of collusion. Therefore, when the cost of collusion increases, the probability to form a bidding ring declines.

3.1.2 The Importance of Engineers' Estimated Cost of Public Works Construction

In Thailand, the engineering estimated cost of rural road is computed from the Engineer Estimating Guidelines for Roadway Construction Projects in 2007. This guideline was introduced by the Board of Regulatory Cost of Public Works Construction. Since 1994 government has attempted to reduce the corruption and collusion in the public procurement process especially the public works sector thus used the engineering estimated cost as a reference price in order to select the winner. Presently, the public works construction which has the value of project more than 100,000 baht; the public agency will calculate the estimated cost for the procurement process by appointing a committee to do so. The estimated cost will then be used in the procurement process by declaring this cost in the invitation bidding document. After that, the process of selecting winning firm will use the estimated cost as the

reference price for the government decision. If the bidder proposes the bid price lowest from the engineers' estimated cost, it will be the winner for this project.

Initially, the engineers' estimated cost consists of the direct cost and indirect cost. The direct cost includes the material cost, transportation cost and labor cost. The indirect cost or administrative expense comprises of overhead cost which the Board of Regulatory Cost of Public Works Construction defines the overhead cost including costs in the contract process as bank charges or revenue stamp, costs in the field site office, contingency and insurance expense. However, the government incorporates overhead cost, interest rate and profit as the Factor form. This factor includes VAT and called Factor F which normally shows in the Factor F table. Likewise, the Engineer Estimating Guideline (2007) determined that the sum of material cost and labor cost in term of cost of works such as the costs of road works or the cost of building works or the cost of irrigation works.

For the calculation of engineering estimated cost, the committee will compute the cost of works and then multiply with Factor F. (See figure 3.1)
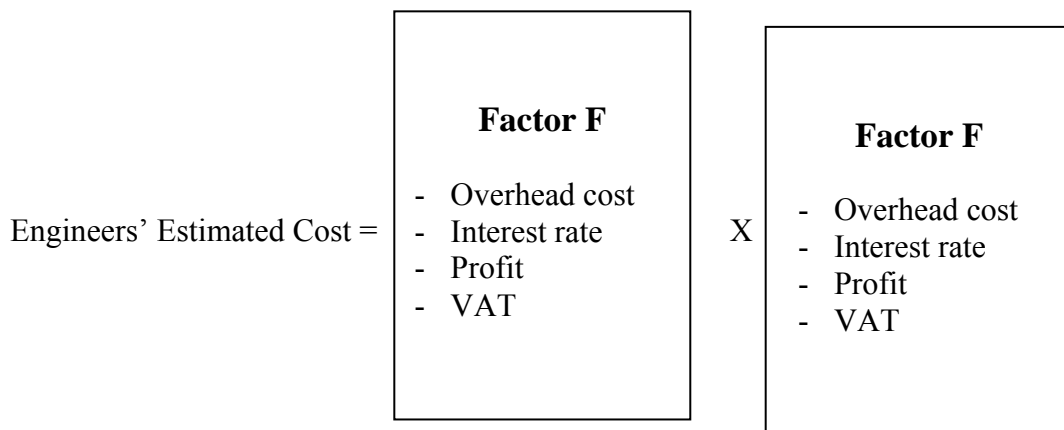
Figure 3.1 The Component of Engineers' Estimated Cost

However, all firms have incentives to maximize profit in the auction so that the Board of Regulatory Cost of Public Works Construction sets the business profit in estimated cost in the Factor F table. From the Factor F table of road construction, the maximized profit is at 3.5 percent when the cost of work is more than 190 million

baht and at 5.5 percent when the cost of work is less than 5 million to 30 million baht. (See in appendix)

3.1.3 Screening Suspicious Project using the Engineering Estimated Cost

Under a competitive bidding, all contractors maximize profit based on their costs. The profit must be enough to cover a portion of general overhead cost and allow a fair profit on their investments. Thus, the contractors' strategies comprise as follows.

1) If the contractor submits higher bid price more than the engineers' estimated cost, the less chance there will be getting the job.

2) Conversely, if the contractor submits the bid price too low less than the engineers' estimated cost, this strategy will obtain winner contract. However, the contractor might not work under its bid price and finally the contract might be terminated.

Thus, the contractor tries to compromise the two extreme approaches in order to bid based on the proper markup. In other words, the contractor considers both returns and the possibility of being the lowest price bidder. (Hendrickson, 1998) However, the question is how to win the bidding since the contractor might concern other bidders. Hence, the contractor should submit the bid price under two strategies.

First, under the competitive bidding, each contractor should bid independently. This condition coincides with the first hypothesis of Bajari and Ye (2003) involving conditional independence. Likewise, a bid price should reflect the costs of contractor thus the ranking of bids should reflect the observable costs also the markup should be reasonable. (Porter and Zona, 1993: 530) If the contractor expects to win the contract and maximize profit, it should attempt to reduce its construction cost even dropping markup. If the contractor would like to maximize profit, it might submit a bid price closely to the engineers' estimated cost. However, it may loss this project because other competitive bidders might bid less than its bid price. Hence, under the competitive bidding all bidders attempt to offer a lowest bid and far away from the engineers' estimated cost in order to be the winner.

Second, under the collusive bidding, each contractor could agree before bidding. Thus, in order to maximize profit the strategy of bidding ring is to designate winner firm before the auction. The winning bid in this case will come close to the engineers' estimated cost. The designate winner does not need to concern other bidders in the ring to compete for the bidding ring will allocate the benefit to all members in the ring through the side payment, the subcontract or rotating a winner for the next project. However, the bidding ring will not set the designated winning bid equal to the engineers' estimated cost since it might show an unusual bidding. The designated winner in general will submit a bid price closely to the engineers' estimated cost.

The author uses an example to describe the reason why we could observe the probability of collusive project by using a difference between engineers' estimated cost and winning bid. For example, if the Department of Rural Road declared 100 million baht for the engineers' estimated cost of rural road project. Any contractors with a construction cost over this estimation will not bid in this auction. Assume A, B and C are firms who will participate in this auction. (See table 3.1)

Table 3.1 The Example of Firms' Decision Between the Competitive Bidding and the Collusive Bidding

Unit: million baht

Firm	Competitive bidding			Collusive bidding		
	Bid	**Cost**	**Profit**	**Bid**	**Cost**	**Sharing Benefit**
A	59.99	50	9.99	99.99	50	49.99
B	69.99	60	0	> 99.99	60	> Cost of Collusion
C	79.99	70	0	> 99.99	70	> Cost of Collusion

Note: The Engineers' Estimated Cost of Rural Road is 100 Million Baht.

From Table 3.1, if all firms did not know bid prices of competitors, they will bid cover their costs with the aim of getting profit from bidding competition. Hence, all firms attempt to bid price far from the engineers' estimated cost in order to be the

winner because they did not confident that other bid prices might be lower. However, all firms could observe competitors' cost from characteristics of rival firms such as the distance between firms and a construction site, a firm's cost of capital or firms' reputation. For this reason, all firms could approximate other firms cost by the observable characteristics of competitors. Under the profit maximization A will bid at 59.99 million baht for the expected profit of 9.99 million baht. A is the lowest cost firm which could submit bid price lower than B and C. However, if A submits bid price more than 60 million, A might lose because B could submit a bid price lower than 60 million. For instance, if A desires more profit and submit bid price at 65 million baht, B could be the winner when B submits bid price at 64.99. Thus, A B and C will attempt to observe information of competitors. A firm tries to approximate its competitors' cost and bid far away from the engineers' estimated cost in order to be the winner. Hence, under the competitive bidding all firms did not know the bid prices of others but they attempted to compete by bidding far away from the engineers' estimated cost.

In this case, if B did not know bid price of A and C, B will submit a bid price at 69.99 million baht in order to get 9.99 million baht for this project. From this example, firm A will be the winner in this rural road auction because it could submit the lowest bid price at 59.99 million baht. If A could observe accurately about costs of B and C, A will decide to submit bid at 59.99 million baht in order to get 9.99 million baht as the profit of competition. Though A may desire more profit than 9.99 million baht, A will not submit over than costs of B or C. Thus, in this rural road auction A will be the winner and B and C will not get anything. For this reason, under the competitive bidding in public procurement market all firms will attempt to submit bid prices to reflect their actual costs and far away from the engineers' estimated cost.

In the collusive bidding, if all firms decide to collude in order to increase benefit from the collusion, they will compare the benefit and costs from collusion. All firms will collude when the benefit from collusion is greater than the costs of collusion. In this case, if A desires more benefit from this bidding, A will negotiate with competitors with the purpose of assembly the bidding ring. Firstly, A will decide to collude when the benefit from collusion is greater than the profit from competition.

From this example, A will decide to collude when the benefit from collusion is higher than 9.99 million baht. Secondly, A will decide to collude when the benefit from collusion is greater than the costs of collusion which this study mentioned to the costs of collusion in the equation 3.3. Thirdly, if A will obtain more benefit from collusion, A must allocate this benefit for B and C as the sharing benefit for collusive bidding.

In this example, if all firms in this bidding decide to collude as a bidding ring, firm A will be as a designated winner and submit bid price at 99.99 million baht. This bid price is nearly the engineers' estimated cost or 100 million baht. However, both B and C will submit bid price over than 99.99 million in order to lose A. Thus, if A submits bid price at 99.99 million baht, A will obtain 49.99 million baht as the benefit from collusion. However, A must allocate this benefit for B and C in term of the side payment, the subcontract, or rotating winner in the next project. Likewise, B and C will decide to collude with A when the sharing benefit from collusion is greater than the costs of collusion. Thus, if all firms decide to conspire as the bidding ring, the designated winner will attempt to submit bid price closely to the engineers' estimated cost in order to get the extra benefit. This extra benefit from collusive behavior is called an economic rent in which all firms in the public procurement market seek to maximize their joint profit. (Auriol et al, 2011: 6-10)

Screening for bid rigging by using engineers' estimated cost is based on the study of Visuth Chorvichien et al. (2002: 4-6) who reported that any public procurement with a difference between engineers' estimate cost and a winning bid price less than 5 percent could signal a bid rigging. The conclusion came from interviews of 48 experienced contractors in the public works construction market of Thailand. Actually, the study of Visuth Chorvichien et al. (2002) still coincided with the screening method of Welsch and Furth (1983) who suggested the bid rigging analysis for investigator, auditor and attorney in US. They found that the initial screening method consisted of the reviewing all bid tabs and selecting those projects from five or fewer bidders which the lowest bid price was within 5 percent of the state engineer's estimate.

Thus, this study will use the difference between the engineers' estimated cost and the winning bid price as a tool for screening collusive bidding. Under the

collusive bidding, the winning bid price will approach the engineers' estimated cost. We use the difference between the engineers' estimated cost and the winning bid price of less than or equal to 5 percent suggested by Visuth Chorvichien (2002).

3.1.4 The Characteristics of Competitive Bidding

Normally, a competitive bidding on construction projects relates to the decision making under uncertainty. (Hendrickson, 1998) Actually, each contractor will determine the bid by concerning many factors. However, the two fundamentals of competitive bidding are: 1) the estimate of direct cost which includes material costs, equipment costs, labor costs and direct filed supervision; and 2) the markup which must be enough for general overhead costs and a fair profit to investment. For this reason, most of contractors confront uncertain bidding conditions by managing their cost, markup and the chance of winning bid.

However, a major factor in the bidding competition is the amount of money which is different between the winning bid price and the price of second lowest bidder. Hendrickson (1998) called as Money left on the table ,for example, if a contractor wins at a bid price of 2,000,000 baht, and the second lowest bid was 2,100,000 baht so that the money left on table is 100,000 baht. The concept of money left on table was employed to detect the bid rigging behavior in the study of Bajari and Ye (2003: 979). However, this study does not utilize this concept.

In addition, Hendrickson (1998) explained the important factors which might affect bidding competition as follows.

1) Geographic Location: The contractors normally tend to familiarize in their particular geographic locations. However, when the work is scarce in the market, the average number of bidders of each project might compete aggressively. The consequences of scarcity may increase the number of bidders per project and assist the pressure on the decreasing bidding price. Meanwhile, some contractors might across to bid in other geographic locations for expansion market share; however, it has the risk to failure in less familiar territories.

2) Direct cost: Generally, the direct cost of contractor consists of material cost and labor wages. However, most of small firms will rent heavy

equipments from large contractors such as the crawler tractor, the back hoe, or the asphalt concrete plant. Thus, if a small contractor encounters the increasing direct cost, it could reduce the firm's probability to win the bidding.

3) Inflation Rates and Interest Rate: These factors may cause the contractor to set a higher markup in order to avoid an uncertainty. Thus, the increasing inflation which might derive from either cost push or demand pull inflation, contractors might be reluctant to commit fixed price contracts in the long term.

This study will use the characteristics of competitive bidding firm mentioned here to construct the explanatory variables later on.

3.1.5 The Harm of Bid Rigging in the Public Procurement

Actually, the bid rigging behavior or collusive practice involves with the anti-competitive law which in Thailand called the Competition Act began with the enactment of Price Fixing and Anti-Monopoly Act of 1979. This act consisted of the price fixing part and the anti-monopoly part. The anti-monopoly part is aimed to promoting fair competition. Thus, it authorized the Central Committee to look after business structures that may create monopoly and restrictive business practices. However, in 1999 the competition act was adjusted to the Trade Competition Act of 1999 or TCA. This Act applied to all types of business operations except those of central, provincial, and local administration, state enterprises under the law on budgetary procedure. (OECD, 2001: 1-6)

Paul and Kallaya Laohaganniyom (2004) explained that the TCA specially has prohibited various anti-competitive practices. The prohibited practices included the agreements and collusive practices that adversely affect competition in Thailand (Section 27). However, since 1999 all cases under the TCA have never been involved with the collusive practices or bid rigging behavior in the public procurement.

In general the objective of Thai public procurement regulation aims to promote the competition in the procurement market. However, since 1999 the National Anti Corruption Commission (NACC) has been enforced the Act on offense relating to Submission of Bids to States Agencies B.E. 2542 or called as Anti

Collusion law. The main purpose of this law is to prevent and punish the bid rigging behavior especially in the public procurement market. It could enforce the bidder, the government official or the politician who violates the law. Moreover, the anti collusion law of Thailand sets the collusive behavior as another criminal case. Thus, the harmful effect of collusive practice might not only affect the competition in public procurement but also criminal penalties

In fact, the main reason of bid rigging in the public procurement market is to share benefit for collusive members. Khemani and Shapiro, 1993: 19) explained that the economic effects of collusion and cartel are the same and sometimes used to interchangeably. Thus, cartel members have agreement not to compete when they share benefits through price fixing, market allocation and bid rigging. Finally, these effects will reduce output and raise price.

The bid rigging behavior is another form of price fixing in which prices are fixed for each project. All bidders decide which firm should be awarded the contract and other will not bid or bid higher than the designated winner. Rubushe (2010) explained that the bid rigging cartel is considered more risky than an ordinary price fixing cartel because agreements of ordinary cartel are much easier to enforce while difficult to cheat. Meanwhile, the bid rigging cartel does not have formal agreement thus the member might betray the bidding ring easily. However, the bidding ring will punish the traitor by excision from the collusive group or using a violence method.

A bidding ring attempts to eliminate the competition and increase the market power of the group in the public procurement market. OECD (2010: 408-421) discussed that the aim of bidding ring is to preserve the stability of market shares. Meanwhile, in the public procurement process several government officials could use their discretion to seek economic rent through the bid rigging behavior among bidders. If the collusive bidding exists in the public procurement process, the resource allocation is not efficient. Because government has to pay a higher construction price than in a competitive market. Firms that do not collude in the bidding ring are unlikely to win in the public procurement market. Finally, they might be out of the market. The bidding ring thus takes it monopoly position.

The designated winner will reduce its cost when signed the contract with the government. It will decrease the quantity or quality of works when it starts to work. The bid rigging delivers projects at low quality. Normally, if the auction is competitive, the winner firm who submits the lowest bid price may result from superior technology, greater experience, and better management, better personal or lower unit cost. Thus, the contractor firm will develop its comparative advantage as compared to its competitors. However, the bid rigging does not encourage the firms to improve their productivity because there is no incentive to improve the productivity under the collusive environment.

The bid rigging also has impact on poor consumers who utilize the public services through public procurement process. OECD (2010: 408-421) noticed that the rigging of public procurement may affect the poor tax payers' proportionally more than rich tax payers.

Moreover, the damage from bid rigging might have an effect on government expenditure like the study of Lee and Hahn (2002). They attempted to find the statistical evidence of collusion in auction for construction contracts and to estimate the possible effects of bid rigging on auction price in Korea. Lee and Hahn found that the damage of bid rigging in term of overcharge ratio based on forecasting approach was 15.5 percent of the Korean government expenditure during 1995-1998. (Lee and Hahn, 2002: 82-84) Likewise, the harm of bid rigging reflected from a massage of the Minister of Construction in Turkey, who is quoted in an OECD study.

> until the enactment of the new Public Procurement Law in 2003, Turkey has suffered exceptionally high construction costs by international comparison. For instance, the cost of construction for 1 km of highway US$ 10 million in Turkey, compared to international reference price of a US$ 4 million. (Gönenç et al., 2005, quoted in OECD 2010: 386)

However, Lewis (2010 quoted in OECD 2010: 415) clarified that the boundary between the bid rigging and the bid corruption seems to be overlapped since a corrupted procurement process might not involve to collusive bidder. For example, corrupted officials sometimes have a relationship with some sellers through family

connections, powerful political connections, or bribery payment. Thus, it shows the bid corruption but not the collusion.

On the contrary, the collusive bidding does not essentially involve the corruption, that is, the bidding ring have a agreement before tendering even the government officials still perform honestly. Nevertheless, the bid rigging and the bid corruption might occur together in the public procurement auctions. Actually, the corrupted procurement officials may assist the bidding ring in several ways, for instance, to provide an advance notice of a bid and consult the bidding ring for preparation of the tender specifications. In addition, the corrupted officials could use their discretion to select the member of bidding ring or disqualify non members from bidding process.

However, the limitation of study about the bid rigging and the bid corruption seems to be difficult to prove the guilty in both collusive bidders and corrupt officials. For example, the study of Porter and Zona (1993) employed cases of bid rigging among bidders from court not mentioned to corrupted officials. Likewise, the studies of Lambert and Zonin (2003) or Lengwiler and Wolfsteter (2005) underlined the corruption of government official in public market auctions which these papers involved with bribes for abusing discretion.

This study focuses on the bid rigging behavior in the public procurement market employing the screening method at the project level and firm level. This study is not related to bidding corruption due to its data limitation.

3.2 Research Methodology

This study proposes the screening method for bid rigging behavior in rural road auctions of Department of Rural Road (DRR) during Jan 2006-Dec 2009. The author analyzed the data of 350 rural road projects and 468 contractor firms of DRR. In this study, the dependent variable involves the probability of collusive bidding by using the engineers' estimated cost for the screening method. For explanatory variables, they are derived from previous studies which involved the bid rigging analysis and bidding factors in the public procurement market. However, this study

will propose the screening method for bid rigging by using the statistical method to test whether a conspiracy exists. Additionally, we suggest the statistical tool to analyze data on prices, cost, estimated market shares or bids. Thus, the research methodologies consist of 1) the measuring market concentration which utilizes the basic concept of industrial organization; 2) the screening method which focuses on project and firm level. Initially, the screening method of project level is a method for suspicious collusive bidding by using the engineers' estimated cost. Meanwhile, the second method is the screening method for characteristics of bidder.

3.2.1 Measuring Market Concentration

Initially, this study analyzed the market structure of rural road market by using the average number of bidder in each year, the Herfindahl-Hirschman Index (HHI) and the N-firms concentration ratio. Presently, the Herfindahl- Hirschman Index is a primary concentration measure used in the antitrust investigation. The calculation of HHI is the sum of squared market shares of all market participants. However, the N-firms concentration ratio is the older measure of concentration. (Schumann, 2011) It is calculated by total share of the N largest firms. Typically, 4-firm and 8 firm concentration ratios were considered.

Schumann (2011) compared the difference between the HHI and N-firms concentration ratio that the HHI has been widely adopted as the standard measure of market concentration which it could reflect the degree of market share inequality across the range of firms that participate in a market. Thus, the higher values of the HHI could show the combined influences of both unequal firm sizes and the concentration of activity among a few a large firms. On the contrary, the N-firm concentration ratio represents only the combined share of the top N-firms and is not illustrate by how shares vary within the top N-firms or how they diverge across all market participants.

3.2.1.1 The Calculation of HHI and the N-firms Concentration

1) Example 1: if there are 9 firms in the public procurement market, the market share of a large dominate firm and a competitive fringe as follow;

(1) The dominate firm obtains 50 percent of market share;

(2) The second largest firm gets 15 percent of market share;

(3) 7 other firms each have a market share of 5 percent

Thus, the HHI $= 50^2 + 15^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 = 2,900$

Meanwhile, the 4-firm concentration or $CR_4 = 50+15+5+5 = 75$

2) Example 2: if there are 7 firms in the public procurement market, the market share of these firms participating in a relevant market are 25, 20, 15, 15, 10, 10, and 5.

Thus, the HHI $= 25^2 + 20^2 + 15^2 + 15^2 + 10^2 + 10^2 + 5^2 = 1,700$

Meanwhile, the 4-firms concentration of CR_4 is still 75 as the same in the first example.

From both examples, they show that the HHI in the first example equals to 2900 and points out a dominated firm which alone accounted for 50 percent of the market. Therefore, the HHI benchmark could show the monopoly of only firm with 100 percent market when HHI equals to 10,000.

3.2.2 The Screening Method

3.2.2.1 Model 1: The Screening Method at Project Level

This study focuses on the suspicious collusive rural road project which may observe by the difference between engineer's estimated cost and winning bid. Under the conceptual framework, if the winning bid price comes closely to the engineers' estimated cost, it may show the collusive bidding. On the other hand, if all bidders compete to bid truly; the winning bid price should be far away from the engineers' estimated cost. Thus, a dependent variable is the difference between engineer's estimated cost and winning bid (Perdiff); however, we will test it robustly by stating difference of 0.5 percent each or the differences from 0 , 0.5,1.0, …, 5.0,5.5,…10 percent respectively. For independent variables, they could explain the relationship between independent factors and Perdiff which bring to screening factors for suspicious projects.

However, this study selects 25 independent variables which may explain the difference between engineer's estimated cost and winning bid. These explanatory variables consist of both the characteristics of rural road project and properties of winner firm (See table 3.2). The author utilizes the rural road length, the type of rural road, the location of rural road construction, the size of rural road project, the number of bidders in each project, and components of rural road price as

proxies of characteristics of rural road projects. In addition the number of bidders is also included in the model for it could reduce the likelihood of collusion.

Likewise, the properties of winner firm may involve to the difference between engineers' estimated cost and winning bid price. For the example, if the local firm has shorter distance between its location and construction site than other firms, it tends to be the winner firm. Thus, the distance between winner location and construction site is another explanatory variable which several studies as Bajari and Ye (2003) or Jakobsson and Eklof (2003) used it as the proxy of firm cost. In addition, this study picked the relationship between winner contractor and political sector as the explanatory variable. This variable could explain the chance of winning bid by using the politician power in the procurement process. (Visuth Chorvichien et al., 2002: 4-9)

However, the size of rural road project is the main factor which could explain bidding incentive because the project size shows the value of contract. In other words, if the rural road project is a large size, it will attract many contractors to participate in the bidding. However, this incentive will lead to the collusive behavior in the bidding which may reflect by the difference between engineers' estimated cost and winning bid price.

In addition, the local winner, which the winner firm won the project in the same area, might explain the collusive practice in the local bidding. Normally, the local firms will attempt to preserve their procurement market so that they might collude as the local bidding ring in order to obtain the benefit from collusion. Moreover, they will try to obstruct non local firms to participate in their market because they do not have more enough information about competitors. Finally, if non local firms participate in a local bidding, it might be risk to lose in the competitive bidding.

Table 3.2 Independent Variables in the Model 1

Variables	Characteristic of Variables		Types of Variables			Source of data And Unit of analysis
	Rural Road Project	Winner firm	Continuous	Discrete	Dummy	
Rdlength	√		√			Data of rural road projects of DRR * (Kilometer)
D_Rd_1, D_Rd_2 D_Rd_3, D_Rd_4	√				√	Data of rural road projects of DRR
D_Bigcity	√				√	Data of province population from national statistic office
D_Rural	√				√	Data of rural road projects of DRR
D_Region_ n D_Region_ c D_Region_ ne D_Region_s	√				√	Data of rural road projects of DRR
Numbid	√			√		Data of rural road projects of DRR
Rwcost	√		√			Data of rural road projects of DRR (Baht)
Factor F	√		√			Data of rural road projects of DRR and Factor F table
D_Lproject	√				√	Data of rural road projects of DRR
Inf_p	√		√			Data of inflation in each province from Bureau of Trade and Economic Indices
D_Cl5, D_Cl4 D_Cl3,D_C l2,D_ Cl1		√			√	Data of pre qualification list or contractors' class of DRR

Variables	Characteristic of Variables		Types of Variables			Source of data And Unit of analysis
	Rural Road Project	Winner firm	Continuous	Discrete	Dummy	
		√			√	Data of DRR contractor from Department of Business Development
Dist		√	√			http://map.server.doh.go.th from Department of Highway (Kilometer)
D_Natpol D_Locpol		√			√	www.thaiswatch.com www.politicalbase.in.th www.info.dla.go.th and other websites which provide the database of national and local politician

Note: DRR is Department of Rural Road

This study selects Perdiff _5.0 as a proxy of dependent variable which means the difference between engineer's estimated cost and winning bid is price less than or equal to 5 percent. Actually, if the winning firm submits the bid price equal to the engineers' estimated cost, it will obtain more benefit as compared to submit nearly the engineers' estimated cost. However, this bidding pattern might contradict with the principle of competitive bidding thus it may be risk to be detected. However, the study of Visuth Chorvichien et al. (2002: 4-6) showed that Thai contractors will not attempt to submit the bid price equal to the engineers' estimated cost because it might be easier to observe the bid rigging. For this reason, Thai contractors will submit the bid price closely to the engineers' estimated cost which the gap is about 5 percent.

Hence, the main reason of selecting this number comes from the study of Visuth Chorvichien et al. (2002) who suggested that 5 percent of the difference between engineer's estimated costs and winning bid signals the collusive project. This study will investigate that if any variables related to Perdiff_5.0 could be used as an indicator for a collusive bidding.

From table 3.2, there are 25 independent variables in the first model. 16 variables represent the characteristic of rural road project, meanwhile the rest of them are the properties of winner firm. However, all variables could be divided in three types as continuous, discrete and dummy variables. Especially, many dummy

variables show the characteristic of rural road project, for example, types of rural road consist of 4 types ,i.e., reinforced concrete pavement (D_Rd_1), double surface concrete pavement (D_Rd_2), asphaltic concrete (D_Rd_3), and cape seal (D_Rd_4). Also, the large rural road project or D_Lproject is defined that the value of rural road project is greater than five million baht. Additionally, some dummy variables characterize the winner firm properties as D_Cl5 shows that the winner firm is in the special contractor class of Department of Rural Road.

Therefore, we could determine the function of model 1 as follows.

Perdiff_5.0 = f (Rdlength, D_Rd_1, D_Rd_2, D_Rd_3, D_Rd_4, D_Bigcity,D_ Rural, D_ Region_n,D_ Region_c,D_ Region_ne, D_Region_s, Numbid, Rwcost, Factor F, D_Lproject, Inf_p, D_Cl5, D_Cl4, D_Cl3, D_Cl2, D_Cl1,D_ Locwin, Dist, D_Natpol, D_Locpol)

For the estimated function, this study employs the probit model for multiple regressions. The most commonly adopted in econometric applications are the standard normal distribution and the standard logistic. If we assume that the probability density function (pdf) of the error term is the standard normal distribution. The standard normal distribution has mean $\mu = 0$ and variance $\sigma^2 = 1$ and is symmetric around its zero mean. Thus, the choice of standard normal for distribution of random error term leads to the probit model. (Wooldridge, 2009: 575-579)

In the probit model, the dependent variable is binomial probabilities or Pr ($Y_i = 1$) and Pr ($Y_i = 0$). For this study, Perdiff_5.0 is a binary or a dichotomous variable, that is, it has two possible outcomes. It denotes 1 as the difference between engineer's estimate cost and winning bid is less than or equal to 5% and 0 is otherwise. We also have a vector of regressors' 25 independent variables. Thus, the model takes form as following equation 3.1.

$$Pr (Y_i = 1| X) = \pi (X^T\beta), \tag{3.4}$$

Where Pr represents the probability and π is a cumulative distribution function of the standard normal distribution (c.d.f) since in the probit model, binomial

probabilities are characterized in terms of the standard normal c.d.f. For β, they are parameters estimated by maximum likelihood.

From the equation 3.1, we clarified that the conventional formulation of binary dependent variable model assumes which an unobserved dependent or latent variable, Y_i^*, is generated by classical linear regression model form in the equation 3.2 as follows.

$$Y_i^* = X_i^T\beta + \varepsilon \tag{3.5}$$

$$Y_i^* = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots \beta_{ij} X_{ij} + \varepsilon \tag{3.6}$$

where:

$Y_i^* =$ a continuous real valued index variable for observation i that is an unobservable or latent variable;

$X^T = (1 \ X_{i1} \ X_{i2} \ \dots \ X_{ij})$, a 1xJ row vector of regressor values for observation i;

$\beta = (\beta_0 \ \beta_1 \ \beta_2 \ \dots \ \beta_j)^T$, a Jx1 column vector of regression of coefficients;

$X_i^T\beta =$ a 1x1 scalar as called the index function for observation i;

$\varepsilon =$ and iid N $(0, \sigma^2)$ random error term for observation i.

From the equation 3.2 and 3.3, the observable outcomes of the binary choice problem are represented by dichotomous variable Y_i that is related to latent dependent Y_i^* as follows:

$$Y_i = 1 \ \text{if } Y_i^* > 0 \tag{3.7}$$

$$Y_i = 0 \ \text{if } Y_i^* \leq 0 \tag{3.8}$$

Thus, the dependent variable Y_i represents the in term of probability as follows.

$$\Pr (Y_i = 1) = \Pr (Y_i^* > 0) \quad = \Pr (X_i^T\beta + \varepsilon > 0) \tag{3.9}$$

$$\Pr (Y_i = 0) = \Pr (Y_i^* \leq 0) \quad = \Pr (X_i^T\beta + \varepsilon \leq 0) \tag{3.10}$$

For this study, the author employs the probit model for screening collusive rural road project by using the engineers' estimated cost. This method observes the difference between engineers' estimated cost and winning bid by using less than or equal 5 percentage of difference as the criteria to detect. Thus, this difference is a dichotomous dependent variable or Perdiff_5.0 which defined as follows:

Perdiff_5.0 = 1 if the difference between engineers' estimated cost and winning bid is less than or equal 5 %;

= 0 if the difference between engineers' estimated cost and winning bid is more than 5%.

From table 3.2, the first model has 25 explanatory variables which five of them are continuous variables, one discrete variable and 19 dummy variables. Thus, the probit index function or $X^T\beta$ in the equation 3.5 is:

$X_i^T\beta = \beta_0 + \beta_1 lnrdlength + \beta_2 D\_Rd\_1 + \beta_3 D\_Rd\_2 + \beta_4 D\_Rd\_3 + \beta_5 D\_Rd\_4 + \beta_6 D\_Bigcity + \beta_7 D\_Rural + \beta_8 D\_Region\_n + \beta_9 D\_Region\_c + \beta_{10} D\_Region\_ne + \beta_{11} D\_Region\_s + \beta12 lnnumbid + \beta13 lnrwcost + \beta_{14} Factor F + \beta_{15} D\_Lproject + \beta_{16} Inf\_p + \beta_{17} D\_Cl5 + \beta_{18} D\_Cl4 + \beta_{19} D\_Cl3 + \beta_{20} D\_Cl2 + \beta_{21} D\_Cl1 + \beta_{22} D\_Locwin + \beta_{23} lndist + \beta_{24} D\_Natpol + \beta_{25} D\_Locpol.$ (3.11)

From the equation 3.11, it shows the independent variables which may affect to the probability of Perdiff_5.0; however, we take the natural log + 1 to variables of Rdlength, Numbid, Rwcost, and Dist in the estimation.

For estimating and interpreting probit model, this study utilizes the Stata 10 by using to compute maximum likelihood estimates of the marginal effects (mfx) of the explanatory in probit models.

The marginal effects or marginal probability effects are the partial effects of each explanatory variable on the probability that observed dependent variables $Y_i = 1$, where in probit model. (Wooldridge, 2009: 580-587)

Pr $(Y_i = 1) = \Phi (X_i^T\beta) =$ Standard normal c.d.f. evaluated at $X_i^T\beta$

Φ shows the standard normal c.d.f.

The concept of marginal effects could be explained by using differentiate between the change of explanatory variable and the probability of dependent variable. However, marginal effects could be divided in 2 cases. The first case is X_j is a continuous or discrete variable and the second is dummy variable. (Wooldridge, 2009: 580-587)

Case 1: X_j is continuous or discrete variable.

Marginal effect of variable $X_j = \dfrac{\partial Pr (Y_i = 1)}{\partial X_{ij}} = \dfrac{\partial \Phi (X_i^T\beta)}{\partial X_{ij}}$ (3.12)

Case 2: X_j is dummy variable.

Marginal effect of dummy variable = $\Phi(X_{1i}^T\beta) - \Phi(X_{0i}^T\beta)$ (3.13)

In case 2, it clarified that X_{1i}^T shows any vector of regressor values with $X_{ij} = 1$. On the other hand, X_{0i}^T is the same vector of regressor values but with $X_{ij} = 0$.

3.2.2.2 Model 2: The Screening Method at Firm Level

For the second model, this study focuses on the characteristics of bidder or firm using the results from the first model. This model utilizes data of 468 firms which are registered as contractors of Department of Rural Road. However, the model employs two main results from the project level which may explain bidders' characteristics in collusive rural road project. From the first model, the result showed that a winner firm tends to submit the bid price closely to the engineers' estimated cost in a large project. In other words, we observe that the suspicious project is likely to be a large project with a contract value of the project exceeds 5 million baht.

However, another important result showed that a local winner firm tends to submit the bid price near to the engineers' estimated cost. In other words, the suspicious collusive rural road project could be a local winner firm. On one hand, the local contractor may have comparative advantage especially to familiarize in location and material supplier as compared to non local firm. On the other hand, local bidders may prevent outsider firms to compete by gathering as the local cartel or local bidding ring to maintain their market share.

Thus, we use the ratio between the number of winning large contracts and total winning of a firm called Winrate_5m as a dependent variable. Likewise, Winraten_p represents the ratio between the number of winning contract in the same province and total bidding of firm.

For the explanatory variables, this study selects 22 variables which may relate to Winrate_5m and Winraten_p (See table 3.3).

Table 3.3 Independent Variables in the Model 2

Variables	Types of Variables			Source of data
	Continuous	Discrete	Dummy	And Unit of analysis
Nbid		√		Data of rural road projects of DRR
D_Region_n,			√	Data of firm from Department of Business
D_Region_c,				Development
D_Region_ne,				
D_Region_s				
Raterd1, Raterd2,	√			Data of rural road projects of DRR
Raterd3, Raterd4				
D_Natpol			√	www.thaiswatch.com
D_Locpol				www.politicalbase.in.th www.info.dla.go.th and
				other websites which provide the database of national
				and local politician
D_Bigcity			√	Data of province population from national statistic
				office
Age		√		Data of firm from Department of Business
				Development
				(Years)
Minwage	√			Data of minimum wage from Ministry of Labor
				(Baht)
D_Cl5, D_Cl4			√	Data of pre qualification list or contractors' class of
D_Cl3,D_Cl2,				DRR
D_ Cl1				
D_Sfirm,			√	Data of firm from Department of Business
D_Mfirm,				Development
D_Lfirm				

Note: DRR is Department of Rural Road

From table 3.3, we choose the firm properties which may influence to the probability to be the winner in the large rural road project (Winrate_5m) or the winner in the same province (Winraten_p). For instance, if a firm submits more number of bids, it has a better chance to win in the large project or same area. Likewise, a winner firm which has a relationship with the local politician (D_Locpol) or national politician (D_Natpol) might have the advantage to award the large contract or the same area. (Visuth Chorvichien et al., 2002: 4-7) Thus, both Winrate_5m and Winraten_p may indicate to detect the characteristic of firms which might be involving about the collusive bidding. Additionally, this study decomposes data of

DRR contractors in term of 4 regions and 5 contactor classes that it might obviously point to the characteristic of bidders.

For the model 2, this study establishes two functions as follows.

Winrate_5m = f (Nbid, D_Region_n, D_Region_c, D_Region_ne, D_Region_s,
Winraten_p   Raterd1, Raterd2, Raterd3, Raterd4, D_Natpol, D_Locpol,
                  D_Bigcity, Age, Minwage, D_Cl5, D_Cl4, D_Cl3, D_Cl2,
                  D_Cl1, D_Sfirm, D_Mfirm, D_Lfirm)

For estimating two functions, we use the logistic regression or logit model which is used to model dichotomous outcome variables. However, if a firm has Winrate_5m more than 0, it shows that a firm has a chance to win large project. Likewise, if Winraten_p is above 0, that means a local firm has a winning probability in the same province of located project. Logistic regression involves with the probability of event occurring of dependent variable. (Tranmer and Elliot, 2008: 6-9) In the logit model, the binomial probabilities Pr $(Y_i = 1)$ and Pr $(Y_i = 0)$ are represented in terms of the standard logistic c.d.f. which has mean $\mu = 0$ and variance $\sigma^2 = \pi^2 / 3$, and is symmetric around its zero mean. (Wooldridge, 2009: 575-579)

The second model will separate 2 equations, that is, the first equation has Winrate_5m as a dependent variable. Likewise, Winraten_p is the dependent variable in the second one. However, we utilize the same explanatory variable to explain the probability to win large project and same area.

Initially, the logit model with explanatory variables sets $(Y_1,X_1),\ldots(Y_n,X_n)$ as random sample from the conditional logit distribution. It shows as follows: (Bierens, 2008: 7)

$$\Pr (Y_j = 1 \mid X_j) = \frac{1}{1+\exp (-\beta_0 - \beta_1 X_j)} \qquad (3.14)$$

$$\Pr (Y_j = 0 \mid X_j) = 1 - \Pr [Y_j = 1 \mid X_j] \qquad (3.15)$$
$$= \frac{\exp (-\beta_0 - \beta_1 X_j)}{1+\exp (-\beta_0 - \beta_1 X_j)}$$

where the X_j shows the explanatory variables and ∞_0 and β_0 are unknown parameters to be estimated. Thus, both equations could be written in the new form as following the equation 3.16.

$$P_j = Pr\ [Y_j = 1\ |\ X_j\qquad]\qquad =\qquad F(\beta_0 + \beta_1 X_j)\qquad\qquad (3.16)$$

$$\text{where}\ \ F(x)\qquad =\qquad \frac{1}{1 + exp\ (-x)}\qquad\qquad (3.17)$$

From equation 3.14- 3.17, when we have a proportion between the probability of $Y_j = 1$ and $Y_j = 0$, we can use logit transformation to link the dependent variable to the set of explanatory variables as follows. (Tranmer and Elliot, 2008: 6-9)

$$Logit\ (P_j) = Log\ [(P_j/\ (1-P_j)] =\qquad \beta_0 + \beta_1 X_j\qquad\qquad (3.18)$$

From equation 3.18, it sets P_j as the probability of winning large project (more than 5 million baht) or chances to win the local project. Meanwhile, X_j is the explanatory variables in table 3.3.

Therefore, we can write the model as follows.

$$Logit\ (P_j)\ =\ \beta_0 + \beta_1 LnNbid + \beta_2 D\_Region\_n + \beta_3 D\_Region\_c + \beta_4 D\_Region\_ne + \beta_5 D\_Region\_s + \beta_6 Raterd1 + \beta_7 Raterd2 + \beta_8 Raterd3 + \beta_9 Raterd4 + \beta_{10} D\_natpol + \beta_{11} D\_Locpol + \beta_{12} D\_Bigcity + \beta_{13} Lnage + \beta_{14} Lnminwage + \beta_{15} D\_Cl5 + \beta_{16} D\_Cl4 + \beta_{17} D\_Cl3 + \beta_{18} D\_Cl2 + \beta_{19} D\_Cl1 + \beta_{20} D\_Sfirm + \beta_{21} D\_Mfirm + \beta_{22} D\_Lfirm\qquad\qquad (3.19)$$

From equation 3.19, we show the relationship between the probabilities of winning and the explanatory variables. However, the estimation process takes natural logarithm + 1.0 in continuous and discrete variables as number of firm bidding, minimum wage and firm age.

However, this study estimates this equation by reporting in term of odds ratio as:

$$Odds_j\qquad =\qquad \frac{P_j}{(1-P_j)}\qquad\qquad (3.20)$$

Or in terms of the probability of the outcome (e.g. winning large project or win the local project) occurring as:

$$P_j = \exp (\beta_0 + \beta_1 X_j) / (1 + \exp ((\beta_0 + \beta_1 X_j)) \qquad (3.21)$$

On the contrary, the probability of outcome not occurring is

$$1 - P_j = 1 / ((1 + \exp ((\beta_0 + \beta_1 X_j)) \qquad (3.22).$$

In conclusion, the main research problem of this study is how to detect the bid rigging behavior in the public procurement market. The screening method might be different under researcher perspective and context of public procurement market in each country. However, most of studies focuses on the public works construction market especially highway or road construction, for example, Porter and Zona (1993), Lee and Hahn (2002), Bajari and Ye (2003), Jakobsson and Ekof (2003), De Silva et al (2003), Barrus (2011), etc. These studies explained the screening method in various ways. Some studies could distinguish the bid rigging behavior by using court evidence as Porter and Zona (1993). Though the conduct of collusive practices in procurement market is difficult to detect, the bidding pattern sometimes may indicate the suspicious of projects and firms.

Thus, this study proposes the screening method under a context of Thai public procurement especially in public works construction market. We utilize the conceptual framework about bidders' decision to collude or not collude. If all bidders decide to collude, they will compare benefit and cost of collusion. However, this study focuses on the importance of engineers' estimated cost as a tool for screening method. Under the competitive bidding, all bidders attempt to submit the bid price far away the engineers' estimated cost in order to be the winner. However, if they decide to collude as the bidding ring, the designated winner will submit the bid price closely to the engineers' estimated cost. After the bidding, the designated winner must allocate the sharing benefit from collusive practices for all members in the ring.

Under the conceptual framework, this study proposes two models for the screening method. The first method is the screening method from project level by using the engineers' estimated cost which we use the probit model for estimation and reporting the marginal probability effect. However, the results from the first model could utilize in the second model which suggests the screening method from firm level by estimating logit model and reporting the odd ratio.

CHAPTER 4

RESULTS

This study focuses on how to detect bid rigging behavior in the rural road procurement market. Under the conceptual framework, it utilizes the engineers' estimated cost of public works as a signal for screening method from project level. Also the probabilities of winning large project and local project will be the screening method from firm level. Initially, the first section explains the rural road market of Department of Rural Road. In the previous chapter, we explain the probit and logit model to find the probability of bid rigging behavior in rural road projects and the behavior of bidders. Thus, this chapter will report the results of marginal probability effect and odds ratio in section 4.2 and 4.3 respectively. The author will interpret and discuss the results using economic perception and relating research in both sections.

4.1 Rural Road Market Background and Data

4.1.1 Descriptive Data of Project and Firm Levels

Under the Regulation of the Office of the Prime Minister on Procurement in 1992, the competitive bidding is the important method which selects the suitable firm to be a contract party of government. However, the winning firm must submit the lowest bid price, qualified and satisfied all the requirements specified in the bidding documents, taking into account price, time delivery, quantity, specifications and terms of conditions benefit to the government.

The relevant market of this study was the bidding competition of rural road contracts which were more than 1 million baht. During Jan 2006-December 2009, the Department of Rural Road (DRR) provided 350 new rural roads contracts across the country or approximately 2.8 billion baht. However, the average of rural road contract was about 8 million baht per contract. This study divided these projects in four areas

as the north, the central, the northeastern and the southern regions. Roughly 40 percent of total rural roads were constructed in northeastern region. (See table 4.1-4.2)

Table 4.1 Contract Range of New Rural Road Construction

Contract Range (Million)	Number of Contract (Contracts)	Volume of Contract (Million baht)	Percentage of Total rural road (Percent)
1.00-5.00	127	399.716865	36.29
5.01 – 10.00	113	811.576347	32.29
More than 10.01	110	1,582.33042	31.42
Total	**350**	**2,793.626254**	**100**
Min = 1.683 million baht, Max = 61.510 million baht and Mean = 7.981 million baht			

Table 4.2 New Rural Road Constructions in Each Region

Region	Number of Contract (Contracts)	Volume of Contract (Million baht)	Percentage of Total rural road (Percent)
North	75	426.200562	21.43
Central	70	502.961899	20.00
Northeastern	138	1,153.219028	39.43
Southern	67	711.244765	19.14
Total	**350**	**2,793.626254**	**100**

Table 4.3 Types of New Rural Road Construction

Types of Rural Road	Number of Contract (Contracts)	Volume of Contract (Million baht)	Percentage of Total rural road (Percent)
Reinforced concrete pavement	21	133.9263	6.00
Double surface treatment	290	2,383.174855	82.90
Asphaltic concrete	12	99.325	3.43
Cape seal pavement	27	177.200099	7.71
Total	**350**	**2,793.626254**	**100**

Reinforced concrete pavement (Rd_1)   Double surface treatment (Rd_2)

Asphaltic concrete (Rd_3)   Cape seal pavement (Rd_4)

Figure 4.1 Types of Rural Road

Table 4.4 Cost of Each Rural Road Type

Types of Rural Road	Cost per km^2 (Baht)
Reinforced concrete pavement	467
Double surface treatment	72
Asphaltic concrete	143
Cape seal pavement	78.29

Source: Bureau of the Budget, 2007.

From tables 4.3-4.4 and the figure 4.1, the rural road construction consists of four types, that is, the reinforced concrete pavement (Rd_1), the double surface treatment (Rd_2), the asphaltic concrete (Rd_3) and the cape seal pavement (Rd_4). However, the type of reinforced concrete pavement is the most expensive or 467 baht per square kilometer. In contrast, the cheapest type is the double surface treatment which government spends 72 baht per square kilometer. Approximately 82.9 percent of new rural road was the double surface treatment.

However, all bidders in rural road market must be registered and classified as the contractor of DRR. In other words, DRR will classify construction firms by using the criteria of pre-qualification as a financial status of contractor or previous experience with DRR or other government departments. Consequently, DRR categorizes construction firms as DRR contractor in five classes specifically the extra class and the first to fourth classes. Nevertheless, all members of extra class could bid in all rural road projects because DRR determines firm capital more than 60 million baht which could reflect firm capacity in working with DRR. In contrast, firms from the fourth class, who their capitals are less than 5 million baht, could bid in rural road project not exceed 10 million baht. (See table 4.5) Additionally, DRR sets the minimum requirement of road construction equipments; for example, the contractor of extra class must show eight crawler tractors, four motor graders or an asphalt concrete plant.(See in Appendix)

Table 4.5 Pre Qualification of Rural Road Contractor

Class	Project Bidding (Million Baht)	Financial Status		Previous Experience With DRR	
		At least firm capital (Million Baht)	At least bank credit (Million Baht)	Work per contract (Million Baht)	Total works (Million Baht)
Extra	Unlimited	60	120	At least 150	At least 300
1	Not exceed 150	50	50	At least 30	At least 120
2	Not exceed 60	30	30	At least 10	At least 40
3	Not exceed 20	10	10	At least 5	At least 20
4	Not exceed 10	5	5	-	-

Source: Department of Rural Road, 2007.

Table 4.6 The Number of Firms in Each Contractor Class of DRR

Class	Bidding Firms		Winner firms		Ratio between the number of winner firms and number of bidding firms
	Number	Percent	Number	Percent	
Extra	52	11.11	42	12.00	0.81
1	38	8.12	59	16.86	1.55
2	102	21.79	100	28.57	0.98
3	217	46.37	140	40.00	0.65
4	59	12.61	9	2.57	0.15
Total	**468**	**100**	**350**	**100**	**0.75**

Source: The author collected data from database of Class of DRR contractor during 2006-2009

From table 4.6, we collected 468 DRR contractor firms who submitted 2,784 bids in 350 projects. Nearly half of bidding firms came from the third class. Likewise, winner firms in this class won 140 rural road contracts or 40 percent of total projects. However, although 38 bidding firms came from the first class, they could win 59 projects, that means, a firm from the first class had a chance to win a bid in 1.55 times as compared to other classes. In contrast, a firm from the fourth class had a winning probability only 0.15 times.

For the next sub section, it will analyze the market share which may give overall image of competitive condition of rural road market.

4.1.2 Market Share of Rural Road Market

Generally, the condition which facilitates collusive practices in the public procurement market is high market concentration. (OECD, 2010:308) This condition could reduce relative gains from the cheating among bidding ring, and makes the agreement easy to achieve because fewer firms are involved (Estrada and Vazquez, 2011). In addition, the stable market share associates with identical bids in each auction. Athey and Bagwell (2004) derived a collusive scheme where bidders share the market equally in every period; shares among firms thus are stable over time. On the other hand, Athey and Bagwell (2001) and Aoyagi (2003) found that the first best collusion can be achieved using history dependent reallocation of market shares.

This study starts with an examination of the collusive behavior using the market share analysis. Initially, I utilize the market concentration (CR) and the Herfindahl-Hirschman Index (HHI) which suggested in the field of industrial organization. These indexes describe a market structure and measure a primary indicator of market power or competition among firms (Khemani and Shapiro, 1993: 24).

The N-firms concentration shows the percentage of total industry output which a given number of large firms account for. For this study, total industry output explains by the total value of rural road contracts. Therefore, CR_4 or the *four firm concentration ratio* measures the relative share of total value of rural road contracts accounted for by the four largest firms. This study reports CR_4 of rural road market and using the formula to calculate CR_m as following equation 4.1.

$$CR_m \quad = \quad \frac{\sum_{i=1}^{m} P_i \; x \; 100}{\sum_{i=1}^{n} P_i} \qquad (4.1)$$

where: CR_m shows the concentration ratio for m firms in the rural road market.

P_i is the market share of winner firm i.

m is the largest winner firms which we consider in the rural road market.

n is the total of winner firms

The Herfindahl – Hirchman Index or HHI employs the market shares of all firms in the market and these market shares are squared in the calculation to place more weight on the larger firms. Thus, if there are n firms in the rural road market, the HHI can be expressed as

$$HHI \quad = \quad \sum_{i=1}^{n} S_i^2 \qquad (4.2).$$

where S_i is the percentage of market share of the ith firm and n is the number of firms in the market. Unlike the concentration, the HHI will change if there is a shift in the market share among the firms. (Schumann, 2011)

The HHI is calculated by taking the sum of the squares of the percentage of market shares of every firm in the market. For a market with n firms, the index varies between 1/n and 1. It assumes its lower value when all n firms have the same market share, that is, each firm has a market share of 1/n. However, it approaches to the maximum value of 1 when one of the firms has almost the whole share of the market.

This study reports data of each region concluding the number of bidders and bids in each region as presented in table 4.7 below.

Table 4.7 Reporting Data of Each Region

Region	Number of Contracts (Contracts)	Total Volume of Contracts (Million Baht)	Number of Winner (Firms)	Number of Bidders (Firms)	Number of Bids (Bids)
Northern	75	426.200562	51	120	569
Central	70	502.961899	43	130	683
Northeastern	138	1,153.219028	78	156	1,252
Southern	67	711.244765	45	62	280
Total	**350**	**2,793.626254**	**217**	**468**	**2,784**

From table 4.7, during 2006-2009 there were 217 from 468 firms which won contract. Firstly, the number of bidders and bids in the southern area were less than other regions which may reflect the competitive condition in the rural road market. However, the reason might come from the geographic of southern region which became the barrier to bidding. In contrast, the number of bidders and bids in the northeast were larger than other regions. However, only the number could not reflect or explain the competitive condition in the rural road market.

This study analyzes the market structure in each region by using average number of bidder in each year which it could show trend of competition in the rural road market. In particular, if the average number of bidder increases, the market condition should be more competitively. However, we showed the four largest firms in each year which won contracts of each region in table 4.8.

Table 4.8 The Four Largest Firms in Each Year

Region	2006		2007		2008		2009	
	Firm	Contract Value (Million baht)	Firm	Contract Value (Million baht)	Firm	Contract Value (Million baht)	Firm	Contract Value (Million baht)
North	1. N072	17.19	1. N083	31.85	1. N082	15.37	1. **N015**	7.98
	2. N057	12.26	2. **N020**	25.97	2. N005	8.40	2. N058	6.39
	3. **N015**	5.25	3. N088	14.54	3. N065	8.23	3. N018	5.99
	4. **N020**	2.90	4. N089	13.99	4. **N015**	7.98	4. N023	5.93
Central	1. C066	25.63	1. C025	24.65	1. C040	9.89		
	2. C130	24.22	2. C033	23.64	2. C030	9.41		
	3. C107	23.52	3. C089	17.79	3. C006	7.75		
	4. C095	22.79	4. C123	16.65	4. C109	6.26		
Northeast	1. **NE079**	49.12	1. NE093	47.29	1. NE122	23.79	1. NE004	20.44
	2. C036	29.14	2. NE056	36.57	2. NE055	19.45	2. NE152	17.86
	3. NE138	26.34	3. **NE079**	31.54	3. NE036	10.50	3. NE028	12.86
	4. NE052	26.10	4. NE102	28.70	4. NE032	10.18	4. NE103	12.35
South	1. **C094**	61.51	1. S026	20.94	1. **C088**	23.59		
	2. S002	54.17	2. S019	18.98	2. S013	12.36		
	3. **C003**	35.99	3. S001	18.24	3. **NE060**	11.68		
	4. S031	24.13	4. S013	17.13	4. S024	10.19		

Note: The Name of Bidder is Coded in Each Region, for Instance, N means Firms Locates in the North Which Labels as N001-N120.

In 2009, DRR Did Not Construct a New Rural Road in the Central Region.

Meanwhile, there Was Only one Rural Road Project in the South.

From table 4.8, it showed that the four largest firms were not the same firms each year. Especially, in the central region the four largest firms were different firms. However, in the northern region, firm N015 could be in the top four largest firms in 2006, 2008 and 2009 while the firm N020 was at the fourth and second level in 2006 and 2007. Likewise, in the northeastern region the firm NE079 was in the top four largest firms in 2006-2007. This analysis concludes that several firms could diversify to be the winner firms in the rural road market. However, this conclusion could not indicate that the rural road market were a real competitive bidding market because it might occur the rotating winner which is another pattern of sharing benefit from collusive practice.

In addition, almost all top four firms locate on the same area of rural road project which might reflects the advantage of regional firms. Generally, a regional firm or local firm will have a comparative advantage as compared to a non regional or

local firm. For example, a local firm will be familiar with the local material suppliers or regional labor and has low transportation cost as it located near the construction site. Thus, it might be the lower cost firm than non regional or local firms. However, we found that the top four firms in the south were not in the same regional area with project. For example, in 2006 and 2008 two firms from the central region as C094 or C088 could be the top firm of southern area. This showed that firms from non local or regional area could across to be the winners in other area. In fact, under competitive bidding all firms should be the winner equally; however, each firm has different cost which will determine the chance of winning project.

Nevertheless, some firms might be the top four firms when we take account of all contracts during 2006-2009 as showed in the table 4.9.

Table 4.9 The Four Largest Firms during 2006-2009

	North		Central		Northeast		South
Firms	Contract Value (Million baht)	Firms	Contract Value (Million baht)	Firms	Contract Value (Million baht)	Firms	Contract Value (Million baht)
1. N083	31.85	1. C107	36.99	1. **NE079**	80.67	1. S002	62.67
2. **N020**	31.22	2. C130	28.61	2. NE093	61.91	2. C094	61.51
3. **N015**	18.88	3. C112	28.19	3. NE052	41.79	3. S060	40.10
4. N072	17.19	4. C095	26.07	4. NE102	39.69	4. C003	35.99

Note: The Name of Bidder is Coded in Each Region, for Instance, N Means Firms Locates in the North Which Labels as N001-N120.

From table 4.9, when we include all contracts during 2006-2009 we found that N015 and N020 were still in the top four firms of the north. Likewise, NE079 was the largest firm which won the highest volumes of contract in the northeastern.

However, this study analyzed the market structure of rural road market by using the average number of bidder in each year, the HHI, and the CR_4. For the N-firms concentration of four largest firms, it could not point out who were the top four firms in the rural road market obviously because the top four winners were not the

same firms in each year. However, this analysis used the four largest firms in the table 4.9 to find the CR_4 which reported results in the table 4.10.

Table 4.10 Reporting Results of Average Number of Bidder, HHI and CR_4

Year	North				Central				Northeast				South			
	Num Ctr	Av bid	HHI	CR_4	Num Ctr	Av bid	HHI	CR_4	Num Ctr	Av bid	HHI	CR_4	Num Ctr	Av bid	HHI	CR_4
2006	8	5	2800	60.38	19	6	1000	54.76	48	5	600	23.05	30	3	900	50.05
2007	14	6	1100	37.39	33	14	700	9.09	45	13	400	25.65	23	5.	500	8.05
2008	43	9	300	4.39	18	7	700	9.87	28	10	500	4.86	13	4	1200	0.00
2009	10	5	1200	16.68					17	10	800	12.70	1	3		

Note: Num Ctr is Number of Contract in Each Year of Each Region.

Av Bid Shows the Average Number of Bidder in Each Year.

CR_4 is Concentration Ratio of Four Firms During 2006-2009.

HHI is Herfindahl-Hirschman Index.

From table 4.10, we analyzed the rural road market structure by using average number of bidder in each year, HHI and CR_4. Initially, it found that if the average number of bidder increases the HHI decreases. For example, in 2006 the average number of bidder in the northern region was about 5 firms which HHI was 2800 after that in 2007 the average number of bidder increased approximately 6 firms which affected to decrease the HHI to 1100. Similarly, in 2006 the average number of bidder of central region was 6 firms; however, this number increased to 14 firms in 2007 which affected to decrease the HHI from 1000 to 700. This result showed that the increasing number of bidder could decrease the concentrated condition in the market. For the example, in 2006 the average number of bidder of the south was 3 firms; however, in 2007 it increased to 5 firms which make the CR_4 to decrease from 50.05 to 8.05. On the other hand, the CR_4 analysis could not indicate obviously because the top four firms were not the same firms in each year. Therefore, this analysis showed that the importance of increasing the number of bidder which supports competitive condition in the procurement market.

Though the results in table 4.10 could initially explain the competitive condition in public procurement market, they might illustrate only the market structure. They could not clarify the screening bid rigging behavior. These findings seem to agree with the comment of Estrada and Vasquez (2011: 7) who noticed that empirical studies on market share patterns under bid rigging behavior are practically nonexistent because the data they would require is typically not publicly available.

In the next section, I will report the results from the first model that proposes the screening method from project level using the engineers' estimated cost.

4.2 Results of Project Level

4.2.1 Descriptive Data of Project Level

In the previous chapter, we mentioned the first model which proposes the screening method from project level by using the engineers' estimate cost. The null hypothesis is such that rural road project with the difference between engineer's estimate cost and winning bid less than or equal to 5 percent tend to be a suspicious bid rigging project. This assumption is derived from the survey findings of Visuth Chorvichien et al (2002: 4-7).

Therefore, a dependent variable is the difference between engineer's estimate cost and winning bid (Perdiff); however, we tested this variable robustness by stating the differences from 0 , 0.5,1.0, …, 5.0,5.5,… 10 percent respectively. For independent variables, we select 25 independent variables which might involve the difference between engineer's estimate cost and winning bid.

Firstly, we summarize the statistics of project level as follows.

Table 4.11 Summary Statistics of Project Level

Variable	Definition	Mean	Std.dev
Perdiff_5.0	One if the difference between engineers' estimated cost and winning bid is less than or equal 5 percent, zero otherwise.	0.788	0.409
Est_cost	Engineers' estimated cost of rural road project	8,523,455	6,211,776
Win_bid	Winning bid of rural road project	7,981,789	5,897,710
Rdlength	The total length in kilometers of new rural roads construction	2.841	2.611
D_Rd_1	One if the rural road project is reinforced concrete pavement, zero otherwise.	0.060	0.237
D_Rd_2	One if the rural road project is double surface treatment, zero otherwise.	0.828	0.377
D_Rd_3	One if the rural road project is asphaltic concrete, zero otherwise.	0.034	0.182
D_Rd_4	One if the rural road project is cape seal pavement, zero otherwise.	0.077	0.267
D_Bigcity	One if the project is located in the city which has population more than 1 million, zero otherwise.	0.423	0.495
D_Rural	One if the project is located outside muang district, zero otherwise.	0.863	0.344
D_Region_n	One if the project is located in the northern region, zero otherwise.	0.214	0.411
D_Lproject	One if the project is large size project which contract value of rural road is more than 5 million baht, zero otherwise.	0.637	0.481
Inf_p	The inflation of province which project is located.	4.501	2.616

Variable	Definition	Mean	Std.dev
D_Cl5	One if the winner firm is in the extra contractor class of Department of Rural Road.	0.120	0.325
D_Cl4	One if the winner firm is in the first contractor class of Department of Rural Road.	0.168	0.375
D_Cl3	One if the winner firm is in the second contractor class of Department of Rural Road.	0.285	0.452
D_Cl2	One if the winner firm is in the third contractor class of Department of Rural Road.	0.400	0.490
D_Cl1	One if the winner firm is the fourth contractor class of Department of Rural Road.	0.026	0.158
D_Locwin	One if the winner firm is located in the same province of project, zero otherwise.	0.714	0.452
Dist	The distance in kilometers between the winner firm and contract site.	89.276	160.919
D_Natpol	One if the winner firm has the relationship with the national politician as member of parliament or senator through the same surname, zero otherwise.	0.188	0.392
D_Locpol	One if the winner firm has the relationship with the local politician as president of provincial administration organization (PAO) or subdistrict administration organization (SAO) through the same surname, zero otherwise.	0.380	0.486
Number of Obs = 350			

From table 4.11, the definition of variables and descriptive statistics of project level are presented. Initially, we found that almost 80 percent of rural road projects tend to be that the difference between engineers' estimated cost and winning bid is less than or equal 5 percent. In other words, winning bids have a tendency to approach closely to the engineers' estimated cost. Visuth Chorvichien et al. (2002: 4-7) explained that if firms compete really in public procurement market, they will attempt to submit bidding far away from the engineers' estimated cost because of the probability to win. Consequently, all firms in the auction do not know the bidding

price of competitors. However, firms may recognize information of competitors through the previous bidding, reputation, job backlog, even competitor capital but they cannot attain the bidding price of other opponents. Hence, if a winning firm proposes bidding price nearly engineers' estimated cost; it might signal suspicious collusive project. Visuth Chorvichien et al. (2002) employed the field survey by interviewing 48 construction firms. They found that these contractors concluded in the same way about the bid rigging behavior. Almost all firms mentioned that the difference between engineers' estimated cost and winning bid of less than or equal 5 percent tends to indicate bid rigging in procurement process.

However, the percentage difference between the average of engineers' estimated cost (Est_cost) and mean of winning bid (Win_bid) is approximately 6 percent closely our hypothesis in this study.

For the 25 independent variables, we observe both characteristics of variables in rural road project such as road length or number of bidder in each project, meanwhile properties of winning firm such as contractor class of DRR or the relationship with politician. During 2006-2009, DRR constructed an average of 2.8 kilometers new rural roads. Most of rural roads were the double surface treatment which is cheapest type as compared to other types. Approximately 42 percent of rural roads were built in the large provinces which have the population more than one million. However, DRR developed new rural roads mainly outside the city district. Furthermore DRR made of new rural road in every region; however, roughly 40 percent of new rural roads were in the northeast.

The number of bidders is the main factor to promote the competitive procurement market. More bidders could reduce the chance of bid rigging behavior since the bidding ring will be larger and difficult to allocate the benefit. Likewise, we set the large size project as the explanatory variable. The data shows that about 64 percent of new rural roads value more than 5 million baht which this study defines as the large rural road project.

For the properties of winner, we found that 40 percent of winner firms came from the third contractor class of DRR. Likewise, approximately 70 percent of winners were the local contractor which won projects in the same area. It may show the comparative advantage of local firm as compared to non local bidder. For the

example, a local firm will be familiar with the construction area and local material suppliers and labor. These advantages could reduce its cost. However, the table shows that the average of distance between the winner firm and contract site was almost 90 kilometers. It might not reflect that the nearest bidder should bid lower than far away contractor. In this dataset, we found that the maximum distance between the winner and contract site is more than 1,000 km because the winner firm located in the northern region but it could win the rural road project in the south.

This study selects the explanatory variables regarding political factor. Visuth Chorvichien et al. (2002: 4-7) explained that political factor is another important factor of collusive bidding. The study of Coviello and Gagaliarducci (2009) also investigated the relationship between the time politicians remain in power and functioning of public procurement auctions. They employed the dataset of Italian municipal governments and all the public procurement auctions during 2000-2005. They found that the relationship between politicians and contractors increase the chances of collusion at local level. (Coviello and Gagaliarducci, 2009: 29)

For this dissertation, I use the political factor by separating the relationship between the national and local politicians. We found that almost 40 percent of winner firms have connection with the local politicians through the same surnames.

For the next sub section, I will explain the estimated results from the first model.

4.2.2 Estimated Results From Model 1

In previous chapter, it suggested the screening method from project level by using the engineers' estimated cost. We employ the probit analysis for the estimation of this model. However, this study reports the marginal probability effects which could well explain than the coefficients of explanatory variables. In the probit estimation, it separates the dependent variable, Perdiff, in the range of 0 , 0.5, 1.0,…, 5.0,5.5, 6.0....to 10 percent respectively. This separation could prove the estimated results robustly. However, this study focuses on Perdiff_5.0 as the proxy of dependent variable.

Table 4.12 summarizes the results of probit regression of 350 projects by reporting marginal effects (mfx) as follows.

Table 4.12 Probit Regression of Project Level (Reporting Marginal Effects)

Variables	Mfx at Perdiff 5.0	Mfx at Perdiff 0.0
Lnrdlength+1.0	-0.481 (0.318)	2.58e-06 (0.242)
D_Rd_2	0.109 (0.278)	
D_Rd_3	0.085 (0.462)	
D_Rd_4	-0.135 (0.909)	
D_Bigcity	**-0.194** **(0.001)***	**0.00016** **(0.045)****
D_Rural	0.011 (0.863)	
D_Region_n	-0.043 (0.585)	0.0002 (0.341)
D_Region_c	0.103 (0.134)	
D_Region_ne	**-0.123** **(0.098)***	-2.72e-06 (0.447)
Numbid	**-0.167** **(0.000)***	**-1.51e-06** **(0.016)****
Lnrwcost+1.0	-0.060 (0.453)	5.49e-07 (0.865)
Factor F	**2.743** **(0.022)****	-0.00003 (0.488)
D_Lproject	**0.194** **(0.057)***	
Inf_p	-0.007 (0.436)	-5.14e-07 (0.240)
D_Cl4	-0.043 (0.617)	-9.18e-07 (0.544)
D_Cl3	**-0.203** **(0.022)****	**0.0001** **(0.082)***
D_Cl2	**-0.143** **(0.068)**	4.54e-06 (0.334)
D_Cl1	-0.059 (0.706)	
D_Locwin	**0.228** **(0.001)***	4.83e-07 (0.384)
Lndist+1.0	0.026 (0.288)	-1.31e-07 (0.883)
D_Natpol	-0.125 (0.825)	-1.20e-06 (0.384)
D_Locpol	0.063 (0.171)	4.83e-07 (0.838)
	Num of Obs = 350 LRchi2 = 144.56 Prob> chi2 = 0.000 Log Likelihood = 123.26 Pseudo R^2 = 0.317	Num of Obs = 144 LRchi2 = 38.68 Prob> chi2 = 0.0007 Log Likelihood Pseudo R^2 = 0.532

Note: a. Dependent Variables are Perdiff5.0 and Perdiff0.0.

      b. The Number in Paraphrase Shows the P Value.

      c. ***, **and * Denotes Significance at the 1, 5 and 10 Percent Level,
Respectively.

      d. At mfx Perdiff 0.0, D_Rd2 , D_Rural, D_Lproject ,D_Region_C and
D_Cl1are Dropped Due to Predicted Failure Perfectly. Meanwhile,D_Rd 3
and D_Rd_4 are Dropped Because of Collinearity.

From table 4.12, it focused on the relationship between Perdiff_5.0 and explanatory variables; however, it reported the marginal effect at Perdiff_0.0, too. Firstly, this study assumes that if the difference between engineers' estimated cost and winning bid is less than or equal to 5 percent, it tends to be suspicious bid rigging project. However, the probit analysis could explain that the change of explanatory variable affects to the chances of occurring of dependent variable. For example, the study of De Silva et al., (2009 quoted in Barrus, 2011) employed the probit model for their screening estimation. They found in the probit model that as distance of bidder increases the probability of bidding decreases. Likewise, if the firm has a project in the same area, the probability of bidding increases. (De Silva et al., 2009 quoted in Barrus, 2011:44)

For this study, it reports the marginal probability effects from probit estimation. However, we found that eight independent variables could explain the probability of occurring of suspicious bid rigging project as follows.

      4.2.2.1 D_Bigcity

      This study defines a big city as a province which has population more than 1 million. However, it is a dummy variable as compared to a small city or population less than 1 million. Thus, D_Bigcity represents that the rural road project is located in the big province. From table 4.12, we found that this variable is significance at the 1 percent level and the marginal effect equals to -0.194. The sign of marginal effect is negative which shows the inverse relationship between Perdiff_5.0 and D_Bigcity. However, we could interpret that if the rural road project is in the big city the probability of the difference between engineers' estimated cost

and winning bid less than or equal 5 percent will decrease about 19.4 percent. It means that the rural road project in a big city tends to occur bid rigging behavior less than the rural road project in a small city.

Under the conceptual framework in this study, it suspects that if the winning bid is close to the engineers' estimate cost, it has a tendency of bid rigging in procurement process. Especially, Visuth Chorvichien et al. (2002:4-7) explained that the collusive practice in public works construction market of small province could be more aggressive than in big provinces. The first reason is that there are more supply of public works projects or private constructions in the big city than the small town. In the big city more population will expand to the demand for public works as highways, irrigation projects or official buildings. Moreover, the private constructions in the big city will be grown to follow the increasing population. As compared to the small city, construction firms in the big city have a chance to win in many projects both public works and private constructions. For this reason, they might not necessarily to collude since they have more chance to win various projects.

In addition, construction firms in the big city might consider the cost of collusion when they decide to collude in the public procurement market. In the previous chapter, it assumed that the cost of collusion consists of four main components. One of them is the probability of detecting collusive behavior by a government agency. Actually, the chance of detecting collusion in the big cities seems to be prevalent than in the small provinces. The reason is that most of government auditors or anti-competitive officials often focus on several public works projects in big cities since it might be more cost effective to investigate. In contrast, the chance of detecting collusion in small cities is less because it might not worth to detect. Thus, the cost of collusion in the small city is lower than the big city which may lead to the increasing probability of bid rigging behavior.

4.2.2.2 D_Region_ne

This explanatory variable explains that the rural road project is located on the northeastern region. We found that D_Region_ne related to Perdiff_5.0 significantly at 10 percent level. The marginal effect is -0.123. However, this study leaved the D_Region_s out of the estimation as the reference group for the

interpretation of dummy variable. Therefore, we could interpret this relation that As compared to southern region, the rural road project is in northeastern region the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will decrease about 12.3 percent . In other words, the rural road project in the south may be suspicious bid rigging more than in the northeast.

This relationship could explain by the market structure of rural road. From table 4.10, it illustrated the market structure by using average number of bidder in each year, the HHI and CR_4 which the results showed that the average number of bidder in the northeast is higher than the south. Likewise, the increasing of average number of bidder affects to the decreasing of HHI and CR_4. For example, in 2006 the average number of bidder in the south was about 3 firms which the HHI and CR_4 were 900 and 50.05 respectively. Meanwhile, the average number of bidder in the northeast was approximately 5 firms which the HHI and CR_4 were lesser than the south. It may imply that as compared to the average number of bidder in the south the higher average number of bidder in the northeast could promote the competitive condition in the procurement market.

Under our conceptual framework, we explained that if the number of bidders per project is less, all firms tend to collude in order to obtain more benefit. For example, in 2006 the average number of bidders of southern project is only 3 firms which all firms might easily negotiate to collude before the tender. The designated winner may be the lowest cost firm but it needs more benefit from collusive bidding. However, the designated winner must share its benefit to other firms in the bidding ring. Likewise, other firms in the ring will decide to collude when benefit from collusion cover up their cost of collusion. Thus, a few average numbers of bidders in the south might together easier than collusive firms in the northeast. Hence, a few firms in the south could share more benefit from collusion than firms in the northeast.

However, the results showed that the relationship between Perdiff0.0 – Perdiff 4.5 and D_Region_c is significantly, too. The sign of coefficient and marginal effect is positive. We reported marginal effects are during 0.12-0.22. (See the mfx report in the appendix) We could interpret this relation that As compared to southern region, the rural road project is in central region the probability of the difference

between engineers' estimated cost and winning bid less than or equal 5 percent will increase during 12-22 percent .In other words, the rural road projects in the central region have a chance to bid rigging behavior more than in the south.

On the other hand, these results may contradict with the result of northeast because the average number of bidder in the central is larger than the south. Normally, the increasing number of bidder should decrease the chance of bid rigging behavior in the public procurement market. However, we analyze that whether the cost of collusion in the central might lower than the south. If a bidding ring in the central region decide to collude, the benefit from collusion is greater than the cost of collusion. It assumed that the bidding ring has cost of collusion which consists of four main components, that is, the probability of detected collusive behavior by government agency, the probability of prosecution in the court and imprisonment for highest sentence, the probability of fine penalty, and the probability of blacklisted or the opportunity cost of losing revenue for the next project. Likewise, the bidding ring must allocate the benefit from collusion to all members in the ring. In case of the central region, more number of bidders in the central might allocate more benefit than the south. However, the main reason which the rural road projects in the central tend to be collusive practice as compared to the south is that the cost of collusion in the central might lower than the south.

4.2.2.3 Numbid

The number of bidders in the tender is an importance factor which might affect to the probability of bid rigging behavior. We found that Numbid is highly significant at the 1 percent level and the marginal effect equals to -0.167. The negative sign reflects to the opposite relationship between the number of bidders and the probability of collusion. Hence, we could interpret that if the number of bidders in rural road project increase the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will decrease about 16.7 percent. This relationship means that more bidders could reduce the opportunity of collusion in the procurement market.

Under the conceptual framework of this study, we discussed that the numbers of bidder may affect the sharing benefit from collusion. For example, if the numbers of bidders in rural road project is 3 firms, the designated winner could share

its benefit for two opponent firms in the bidding ring. These benefits must cover cost of collusion. However, if the numbers of bidder increase to 5 firms, the sharing benefit will decrease. Consequently, these benefits from collusion might not cover up the cost of collusion. Firms may not confident if they decide to collude. Thus, the probability of bid rigging will decrease. In addition, if the number of bidding ring increases or has more bidders in the ring, it has a chance to cheat among members because these members do not agree formally to collude. Thus, the probability of betray always occurs.

However, the number of bidders is depended on several factors. Generally, Thai public procurement law or regulation promotes competitive condition in the procurement process. The procurement method is a main factor to determine the number of bidders. In general, an open tender will support competitive bidding in the procurement market. Presently, in Thailand the tendering consists of two schemes, that is, normal open tendering and electronic auction tendering method. Both methods will select the winner from the lowest bid. Thus, in public works construction if bidders compete bid truly, each bidder attempts submit bid far away engineers' estimated cost under covered own cost. The bidder who has the lowest cost tends to be the winner under the profit from competition. Conversely, a bidder who has the cost over than the engineers' estimate will not participate in this bidding. Thus, if the number of bidders increases, the bidders will more decrease bid under competitive bidding.

4.2.2.4 Factor F

Factor F is a component of calculation of engineers' estimated cost. Normally, the main part of engineers' estimated cost is the construction cost or cost of works as material cost and labor cost which represents the direct cost. However, Factor F is a representative of indirect cost which consists of operation cost, interest rate, and profit. In Thailand, the Board of Regulatory Cost of Public Works Construction defines the operation cost including costs in the contract process as bank charges or revenue stamp, costs in the field site office and insurance cost. However, the government incorporates overhead cost, interest rate and profit as the Factor form. This factor includes VAT and finally called as Factor F. It normally shows in the Factor F table. (See the appendix)

Hence, the estimated result shows that Factor F relates to Perdiff_5.0 significantly at 5 percent level and marginal effect equals to 2.743. The positive sign of marginal effect reveals to the corresponding relationship between Factor F and the probability of collusion. We could interpret this relation that if the Factor F of rural road project increases the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will raise more than 270 percent. In other words, if Factor F increases, the chances of collusion will increase aggressively because the winning bid tends to converge to engineers' estimated cost.

Factor F will be changed when the lending rate is changed. The Board of Regulatory Cost of Public Works Construction will announce the new Factor F table when the lending rate is changed. For example, at 6 percent of lending rate and 10 million baht of cost of road works we could use Factor F as 1.2898. (See the appendix)

The increasing of Factor F will affect to the raising of engineers' estimated cost also profit. Thus, if the engineers' estimated cost increases, profit will increase. For the example, we assume the cost of works of rural road project is 10 million baht. At 6 percent of the lending rate, we will use 1.2898 as the Factor F of this project. Thus, the engineers' estimated cost is 12,898,000 baht. If the lending rate increases to 7 percent, the Factor F from table will be 1.2961.The new engineers' estimate cost is 12,961,000 baht. The raising of lending rate will affect to Factor F and finally to engineers' estimated cost. The increasing of engineers' estimated cost reflects the value of project. Thus, if the project value increases, bidder expects to the increasing profit, too.

Under our conceptual framework, the increasing benefit is the incentive of collusion. Thus, if Factor F increase, the engineers' estimated cost will increase. On the other hand, this increasing of engineers' estimated cost will attract the bidder to collude as a bidding ring. However, a bidding ring will decide to collude when the benefit from collusion is larger than the cost of collusion. Thus, if the engineers' estimated cost increases, the expected benefit from collusion will increase. The bidding ring will negotiate to designate the winner firm before open tendering. The designated winner will decide to collude when the sharing benefit is larger than the profit from competition. Similarly, other firms in the ring decide to collude when

the benefit covers their cost of collusion. However, this result shows that in bidders' view the increasing of Factor F has the influence on raising benefit more than cost of collusion. Thus, all bidders tend to bid rigging for sharing more benefit.

4.2.2.5 D_Lproject

This explanatory variable reflects the size of rural road project. This study defines the large project by which the contract value of rural road is more than 5 million baht. The large project may affect to the probability of collusion because the profit of large project is more than small project. However, D_Lproject is a dummy variable as compared to small project which contract value is less than 5 million. We found that D_Lproject is significance at the 5 percent level and the marginal effect equals to 0.194. The sign of marginal effect is positive which explains the same direction between Perdiff_5.0 and D_Lproject. However, we could interpret that if the rural road project is the large project the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will increase 19.4 percent . In other words, the large project of rural roads tends to be collusive bidding as compared to the small project.

In chapter 3, we discussed that all firms in the bidding ring will decide to collude when the sharing benefit is larger than their cost of collusion. For the winner firm, it will decide to collude when the benefit from collusion is greater than the profit from competition. Thus, the large project gives more profit which could attract more bidders. Under competitive bidding, all bidders will bid when their own cost is less than the engineers' estimate cost. All bidders will bid to cover own cost and expected profit. Thus, if bidders desire to be the winner, they will bid to diverge from the engineers' estimated cost. Conversely, if all firms decide to collude, they will bid to cover their cost of collusion. The designated winner firm tends to bid nearly the engineers' estimated cost because other members in bidding ring agree to bid higher than its bid. However, the bidding ring must allocate its benefit from collusion; for instance, the ring will allocate benefit through the side payment, subcontracting or rotating winner. However, this sharing benefit must cover up costs of collusion. Hence, the large project provides more benefit which all bidders tend to collude for sharing benefit. This result coincides with the conclusion of Visuth

Chorvichien et al. (2002:4-9) which concluded the large project is the first facilitated factor for collusion.

    4.2.2.6 D_Cl3 and D_Cl2

    This study employs the contractor classes of Department of Rural Road (DRR) as the explanatory variables in this model. Normally, the contractor could submit bidding in the rural road tendering of DRR when it is selected in the pre qualification list by DRR. This list is called as "The contractor classes". In section 4.1, we explained the detail about contractor classes in the table 4.5 and 4.6. However, the extra contractor class could bid all rural road projects. The extra contractor class (D_Cl5) could reflect efficiency of the large contractors because these firms have more capital, equipments, engineers or labor than other classes. Thus, the extra contractor firms should have a comparative advantage as compared to other contractors. For this reason, we determined the D_Cl5 as the reference group in model estimation.

    The result found that D_Cl3 and D_Cl2 are significantly at 5 percent and 10 percent, respectively. The marginal effect of D_Cl3 is -0203 and -0.143 of D_Cl2. However, the sign of both numbers is negative which shows the inverse relationship between Perdiff_5.0 and D_Cl3 D_Cl2. We could interpret this relation that as compared to the winner in the extra contractor class the winner is in the second and third class the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will decrease about 14-20 percent . In other words, the winner in the extra contractor class tends to collude as compared to the second and the third class.

    This result may contradict with the intuitive idea because all winner firms in the extra class should concern about firm reputation. Thus, if they are detected from bid rigging cases, they will lose their reputations also blacklisted in the future. Hence, the contractor in extra class may have the cost of collusion more than other classes.

    Under the concept of collusion in procurement market, we argue that although the contractors from extra class have more capacity and capital as compared to other classes, they still need more benefit from open tendering. If they compete truly in the procurement auction, they might be the winners and obtain profit from competition. Thus, if the winner contractors from extra class need to win the projects, they tend to bid far away the engineers' estimated cost. Their bids will cover their

own cost and expected profit. However, if they need more benefit from collusive practice, they will form a bidding ring and allocate benefits for other members. The extra contractors concern both high benefit from collusion and high cost of collusion. The extra contractors might have the high collusive cost especially the loss of reputation and chances of blacklisted or opportunity cost of losing revenue for the next project. However, the detecting and prosecuting of bid rigging behavior in Thailand seems to be ineffective which may increase the chances of collusion in the public procurement market. During 2000-2012, the current backlog cases about bid rigging behavior are more than 700 cases. However, National Anti Corruption Commission (NACC) could decide only 30 cases about the guilty of collusive behavior under Anti-Collusion Law of 1999. In addition, Thai government could never enforced the Trade Competition Act of 1999 in the public procurement market which the section 27(4) has issued obviously about collusive practices as follow; fixing an agreement or condition in a collusive manner in order to enable one party to win a bid or a tender for the goods or services or in order to prevent one party from participating in a bid or a tender for the goods or services".

For this reason, if the system of detecting collusive practice by government agency is ineffectual, the extra contractor class may consider that the chance of blacklisted is low, too. Thus, this result shows that the winner firms from the extra class do not concern about the cost of collusion especially the chance of blacklisted or the opportunity cost of losing revenue for the next project. They focus on more benefit from collusion.

4.2.2.7 D_Locwin

This study selects a variable to explain the winner firm that won the rural road project in the same province or as called Local winner. However, this variable is a dummy variable which compares with the non local winner firm. Generally, a local bidder should have a comparative advantage as compared to non local bidders. For example, a local construction firm will familiarize with the geographical area, local material suppliers or local labor. For these reasons, cost of local bidders should be lower than non local bidders. Hence, they could bid for covering their own cost and expected profit.

However, this result shows that D_Locwin is significantly at 1 percent and the marginal effect equal to 0.228. The positive sign of marginal effect represents

the same direction between Perdiff_5.0 and D_Locwin. We could interpret this relation that as compared to non local winner the local winner the probability of the difference between engineers' estimated cost and winning bid less than or equal 5 percent will increase 22.8 percent. In other words, the local winner tends to collude as compared to the non local winner.

Under the competitive bidding, all local bidders will bid far away from the engineers' estimated cost because they have comparative advantage as compared to non local bidders. Conversely, if the non local winners need to win the rural road project, their cost must be lower than local firm bidders. Thus, non local firms will win the rural road projects when their costs are lower than other local bidders. However under the concept of collusion in the open tender, we discuss that the local winner firm tends to collude more than non local winner firm. In general, local bidders could gather as "local bidding ring" easier than non local bidder because they locate in the same area. However, the local bidding ring will decide to collude when benefit from collusion is greater than cost of collusion.

Thus, the local bidding ring will designate a local winner which must allocate benefit from collusion to other firms in the ring. This result seems to coincide with the study of Visuth Chorvichien et al. (2002: 4-9) which explained that all local firms attempt to preserve their local procurement market. Thus, they will form as a local bidding ring and allocate benefit for all members of ring in term of subcontracting or winner rotation. Furthermore, the local bidding ring attempts to obstruct other firms from different areas because the local bidding ring might not obtain enough information of non local firms. If non local firms compete in the open tender, it might be risk for winning of local bidding ring.

4.3 Results of Firm Level

4.3.1 Descriptive Data of Firm Level

In the second model, it focuses on the screening method from firm level by using characteristic of bidder. Initially, we set the null hypothesis that suspicious bid rigging firms have a chance to win the large project which is more than 5 million baht from the project level. The reason of this hypothesis is based on the intuitive concept

that all bidders will attend to submit price in the big project than small one because of earning more return. Hence, the bidding ring or suspicious collusive group attempts to preserve a large project for its member. However, the estimated result of the first model which D_Lproject verified the relationship between the large rural road project and the probability of collusion. We found that a large project tends to be collusive bidding as compared to a small project.

This study sets another null hypothesis that suspicious collusive firms have a winning probability in their area. Actually, the local contractor could be comparative advantage as to familiarize in the location and material supplier as compared to non local firms. On the other hand, all local bidders may prevent outsider firms to compete since they do not have sufficient information about new arrival competitors. Hence, they will gather as the local cartel or local bidding ring in order to maintain the market share.

Therefore, we use the ratio between the numbers of winning contract which more than 5 million baht and total winning of firm or Winrate_5m as dependent variable in the first hypothesis. For the second one, we utilize the ratio between the numbers of winning contract in the same province and total bidding of firm or Winraten_p. For independent variables, this study picked up 22 variables to explain the probability of winning of firm. Further, it divided the testing both hypothesis by categorizing each region and each contractor class.

Initially, we summarize the statistics of firm level in the table 4.13.

Table 4.13 Summary Statistics of Firm Level

Variable	Definition	Mean	Std.dev
Win_t	The number of winning contract of firm	0.747	1.097
Win_p	The number of winning contract of firm in the same province	0.528	0.903
Win_5m	The number of winning contract of firm which more than 5 million baht	0.476	0.477
Winraten_p	The ratio between the number of winning contract in the same province and total bidding of firm	0.121	0.248
Winrate_5m	The ratio between the number of winning contract which more than 5 million baht and total winning of firm	0.128	0.250
Nbid	The number of firm bidding in rural road procurement during 2006-2009	5.948	7.337
D_Region_n	One if firm is located in the northern region, zero otherwise	0.256	0.437
D_Region_c	One if firm is located in the central region, zero otherwise	0.278	0.448
D_Region_ne	One if firm is located in the north eastern region, zero otherwise	0.333	0.472
D_Region_s	One if firm is located in the southern region, zero otherwise	0.132	0.339
Raterd1	The ratio between firm bidding in the reinforced concrete pavement and total bidding of firm	0.059	0.176
Raterd2	The ratio between firm bidding in the double surface treatment and total bidding of firm.	0.873	0.257
Raterd3	The ratio between firm bidding in the asphaltic concrete and total bidding of firm	0.041	0.426
Raterd4	The ratio between firm bidding in the cape seal pavement and total bidding of firm	0.046	0.149
Minwage	Average minimum wage of province during 2006-2009	155.74	13.80
D_Natpol	One if firm has the relationship with the national politician as member of parliament or senator through the same surname	0.126	0.332
D_Locpol	One if firm has the relationship with the local politician as president of provincial administration organization (PAO) or sub district administration organization (SAO) through the same surname	0.271	0.445

Variable	Definition	Mean	Std.dev
D_Bigcity	One if firm is located on the city which has population more than 1 million, zero otherwise	0.472	0.499
Age	Firm age which determines from established year until 2009	22.28	8.31
D_Cl_5	One if firm is in the extra contractor class of Department of Rural Road	0.111	0.314
D_Cl_4	One if firm is in the first contractor class of Department of Rural Road	0.081	0.273
D_Cl_3	One if firm is in the second contractor class of Department of Rural Road	0.218	0.413
D_Cl_2	One if firm is in the third contractor class of Department of Rural Road	0.464	0.499
D_Cl_1	One if firm is the fourth contractor class of Department of Rural Road	0.126	0.332
D_Sfirm	One if firm capital is less than or equal to 10 million baht	0.154	0.361
D_Mfirm	One if firm capital is more than 10 million baht and not exceed 50 million baht	0.455	0.498
D_Lfirm	One if firm capital is more than 50 million baht	0.391	0.488
	Number of Obs = 468		

From table 4.13, it explains the characteristic of bidder firm in the rural road procurement market. This data consists of 468 firms. The table shows that during 2006-2009 the average of number of firm bidding in rural road procurement market (Nbid) was about 6 times. Most of firms submit bid in the open tender of double surface treatment road (Raterd2). For the relationship with the political sector, about 27 percent of all firms have related to the local politicians. For the location of firms, nearly half of all firms were located on the big province which has population more than 1 million (D_Bigcity) and approximately 33 percent of all firms were located on the northeastern region (D_Region_ne). The average of firm age (Age) was about 22 years which could reflect the experienced bidding in the rural road market. Further, we employed the minimum wage (Minwage) as observed cost of firm which during 2006-2009 the average minimum wage of province was 155.74 baht. Likewise, the contractor class of Department of Rural Road could explain the firm capacity and previous experience which approximately 46.4 percent of all firms were in the third class (D_Cl2). Finally, this study defines the firm size by using firm capital. We found that almost half of contractors were the medium firm (D_Mfirm).

For the section 4.3.2, the author will discuss the estimated results from the second model.

4.3.2 Estimated Results From Model 2

In the chapter 3, it proposed the second model to screen for characteristic of bid rigging firms. Initially, we assume that Winrate_5m and Winraten_p could screen the characteristic of bid rigging firms. Additionally, we divide firm data in each region and each class that they might obviously point to characteristic of collusive firms. The second model uses the logit analysis for this estimation. In the first estimation, the dependent variable is Winrate_5m and the second is Winraten_p. It uses the same explanatory variables in both estimations. For this estimation, we report odd ratio which could explain better than the coefficients of explanatory variables.

For the table 4.14, it summarizes results of logit analysis of 468 firms by reporting odd ratio as follows.

Table 4.14 Logit Regression of Firm Level (Reporting Odd Ratio)

Variable	Odd ratio of Dependent variable	
	Winrate_5m	Winraten_p
LnNbid	2.438	1.902
	(0.000)***	(0.000)***
D_Region_n	0.182	0.404
	(0.000)***	(0.016)**
D_Region_c	0.314	0.475
	(0.006)***	(0.073)*
D_Region_ne	0.341	0.324
	(0.004)***	(0.002)***
D_Natpol	1.415	1.584
	(0.298)	(0.163)
D_Locpol	1.538	1.185
	(0.087)*	(0.494)
D_Bigcity	1.229	1.825
	(0.427)	(0.019)**
Lnage	0.762	0.777
	(0.364)	(0.393)
D_Mfirm	0.887	1.190
	(0.750)	(0.659)
D_Lfirm	0.782	0.980
	(0.561)	(0.944)
Lnmwage	0.476	0.001
	(0.707)	(0.003)***
Raterd1	0.145	43.729
	(0.392)	(0.648)

Variable	Odd ratio of Dependent variable	
	Winrate_5m	Winraten_p
Raterd2	0.439	42.162
	(0.693)	(0.649)
Raterd3	0.544	605.086
	(0.734)	(0.442)
Raterd4	0.395	59.034
	(0.677)	(0.622)
D_Cl4	0.705	1.927
	(0.486)	(0.234)
D_Cl3	0.720	2.731
	(0.455)	(0.037)**
D_Cl2	0.638	2.951
	(0.306)	(0.026)**
D_Cl1	0.417	1.797
	(0.142)	(0.332)
Number of obs	468	468
LR chi2(19)	105.78	91.37
Prob > chi2	0.000	0.000
Pseudo R2	0.175	0.150
Log likelihood	-250.238	-258.056

Note: a. The Number in Paraphrase Shows the P Value.

b. ***, **and * Denotes Significance at the 1, 5 and 10 Percent Level,
Respectively.

From table 4.14, it reports the odd ratio from logit analysis of Winrate_5m and Winraten_p. Initially, we discuss the relationship between the explanatory variables and Winrate_5m which odd ratio could explain probability of a contractor who win the rural road project over 5 million baht. This probability may lead to the bid rigging sign of firm. For this estimation, it uses D_region_s, D_Sfirm and D_Cl5 as reference group of dummy variable.

4.3.2.1 Winrate_5m

1) LnNbid

This study uses the number of firm bidding in rural road procurement (Nbid) as the first explanatory variable to explain the probability of winning project over 5 million baht. We define the large project by using over 5 million baht of contract value. The result shows that LnNbid is highly significance at

1 percent level and odd ratio equals to 2.438. In the logit analysis, an odd ratio is greater than 1 or implies that the event is more likely for winning large project. Thus, we could interpret this relationship that if firm bidding increases 1 percent, the probability of winning large project increases about 2.4 times. In other words, a firm has a chance to be the winner firm when it bids increasingly.

Actually, this result accords to the intuitive concept of competitive bidding. More bidding will lead to the chance of winning large project. Generally, all firms will be attracted to participate bidding the large project because they expect more profit. However, we discuss this result based on the concept of collusion in procurement market. Normally, all firms decide to collude when they compare benefit and cost from collusion. If benefit from collusion is larger than cost of collusion, firms will decide to collude as a bidding ring. However, all members of bidding ring focus on the sharing benefit from collusion. Especially, the designated winner will compare the profit from competition and benefit from collusion. If the benefit from collusion is larger than profit from competition, it decides to collude with other firms in a bidding ring. However, the designated winner must allocate sharing benefit by subcontract or side payment. Additionally, these shares must cover cost of collusion, too. For the allocating benefit from collusion, a bidding ring could agree to rotate the designated winner for each project or *bid rotation*. Hence, all members of bidding ring could more participate in the bidding but they may bid in form of rotated winner. Thus, more number of firm bidding may not reflect only the competition bidding but also it might be in the bid rotation scheme.

2) D_Region _n , D_Region_c, and D_Region_ne

For data of region variable, we set them as the dummy variable by using D_Region_S as reference group. The results show that these variables are highly significance at level 1 percent level and odd ratios are 0.182, 0.314, and 0.341. These ratios are less than 1 or imply that the event is less likely for winning large project as compared to the southern region. Thus, we could interpret this relationship that if firm is located on the northern, central and northeastern regions, the probabilities of winning large project decrease about 0.18 to 0.34 times as compared

to firms in the southern region. In other words, bidding firms which located on the south have a chance to be winner in the large project.

Under assumption of model 2, it suspects that collusive firms might be existed in the winning large project. From the first model, we found that the rural road project in the south might be suspicious bid rigging behavior more than in the northeast. For these results of the second model, they indicate that bidding firms in the southern region have a probability of winning large project as compared to other regions. We utilize the results in section 4.1.2 about the market structure of rural road market. We found that each year the average number of bidder in the south is less than other regions. Hence, bidding firms in the south have a chance to win the large project because of few competitors.

3) D_Locpol

This study selects the explanatory variable which explains the relationship between firms and local politicians (D_Locpol) because the political sector could play the role of collusion in procurement market. Visuth Chorvichien et al (2002:4-9) described that the local politician is one of the main factor to facilitated collusion in public works market. However, we found that D_Locpol is significance at 10 percent level and odd ratio is 1.538. Odd ration is greater than 1 or implies that the event is more likely for winning large project. Therefore, we could interpret that if firm has the relationship with local politician, the probability of winning large project increases about 1.5 times as compared to other firms. In other words, a bidding firm which related to a local politician has a chance to be the winner on the large project.

This result coincides to the conclusion of Coviello and Gagaliarducci (2009: 29) which investigated the relationship between the time politicians remain in power and functioning of public procurement auctions. They employed the dataset of Italian municipal governments and all the public procurement auctions during 2000-2005. They found that the relationship between politicians and contractors increase the chances of collusion at local level.

However, we discuss this result based on the collusion concept that the local politicians might use their influence on the intervention of detecting bid rigging in their area. Hence, the probability of detecting bid rigging decreases. When the probability of bid rigging decreases, it will involve the reducing collusion cost of firms. All firms decide to collude when sharing benefit from collusion is larger than

cost of collusion. Thus, if the cost of collusion is low from the intervention of local politician, it might facilitate for collusion in the rural road procurement market.

4.3.2.2 Winraten_p

1) LnNbid

In the estimation of probability of winning project in the same province, we found that the number of firm bidding could explain this probability. Like the probability of winning large project, the increasing of number of firm bidding will affect to the raising of probability of winning project in the same province. This dependent variable (Winraten_p) could be explained that the probability of local firm will win rural road project in its area. From table 4.14, the result shows that LnNbid is highly significance at 1 percent level and odd ratio equals to 1.902. The odd ratio is greater than 1 or implies that the event is more likely for winning project in the same province. Consequently, we could interpret that if firm bidding increases 1 percent, the probability of winning project in the same area increases almost 2 times. In other words, local firms bidding have a chance to be the winner in their areas.

Under the competitive bidding, a local firm could be the comparative advantage than non local firm. For example, a headquarter office of local firm might be near the construction site that make its cost lower than other firms. In addition, a local firm might familiarize with local material suppliers or labor which these factors could support its lower cost as compared to non local firms.

However, the concept of collusion considers that if all local firms desire more benefit from collusive practice, they will form as local bidding ring. Normally, all local firms gather as a local bidding ring easier than non local firms because local firms could communicate each other in the same area. However, the local bidding ring will designate the winner before rural road auction. The designated winner will decide to collude when the benefit from collusion is greater than the profit from competition. However, the designated winner must share its benefit to other firms in the ring. Likewise, other local firms will collude when their benefits from collusion are cover up their cost of collusion. The sharing benefit for other members in the local bidding ring may use subcontract scheme, side payment, and bid rotation.

For bid rotation, all conspirators will submit bids but they rotate being the low bidder; for example, all local competitors take turn on projects according to the size of the project, allocating equal amounts to each conspirator or allocating volumes that match up to the size of each conspirator company. Hence, more number of firm bidding may not reflect only the competition bidding but also it might be in the bid rotation scheme.

2) D_Region _n , D_Region_c, and D_Region_ne

Like the first estimation, it found that the data of region relates to the chance of winning project in the same province. These results show that they are highly significance at level 1 percent level and odd ratios are 0.404, 0.475, and 0.324. These ratios are less than 1 or imply that the event is less likely for winning project in the same province as compared to the southern region. Thus, we could interpret this relationship that if firm is located on the northern, central and northeastern regions, the probabilities of winning project in the same province decrease approximately 0.32 to 0.48 times as compared to firms in the south. In other words, bidding firms which located on the southern region have a chance to winning project in the same province.

From table 4.10, it reported the results of market structure of rural road during 2006-2009 which they show the results of average number of bidder, the HHI and CR_4. These results indicate the facilitated factor of collusion in the procurement market especially in the southern area as compared to other areas. During 2006-2009, the average of number of bidder per project tendering in the south is between 3 and 5 firms which is lower than other regions. A few bidders could form as the local bidding ring in the local area. Thus, the local bidding ring in the south may gather easier than other regions because of few competitors

Based on the collusion in the procurement market, the local bidding ring will form when each member desires more benefit from collusion. The local bidding ring attempts to obstruct other firms from different areas because the bidding ring could not obtain enough information of non local firms. If non local firms compete in the open tender, it might be risk for winning of bidding ring. This situation coincides with the study of Ishii (2007) which found that participation of

outsiders might make irregular bidding wars. This bidding war will affect the sharing benefit of bidding ring and finally the collusion will be failure. Thus, a local bidding ring always attempts to preserve market share in its province.

3) D_Bigcity

D_Bigcity shows that a bidding firm locates on the big city which has population more than 1 million. We found that it is significance at 5 percent level and odd ratio is 1.825. Odd ratio is more than 1 or implies that the event is more likely for winning project in the same province. Thus, we could interpret that if firm is located on the big city, the probability of winning project in the same area increases almost 2 times. In other words, as compared to bidding firms in the small province we found that firms in the big province have a chance to be the winner in their areas.

Normally, the big city could reflect the high potential economy of province. The big provinces also have construction projects more than small provinces. Thus, the construction firms in big province have several choices to bid in the public works or private works. For this reason, the construction market in the big province is larger than the small province. Likewise, construction firms in the big province could obtain the high technology or efficient equipment easily as compared to firms in the small province. Hence, we may assume that firms in the big province have lower cost than firms from the small province.

Under competitive bidding, the lowest cost firm in its area could submit bid lower than other firms. Thus, it has a chance to be the winner in the same area. However, the lowest bidder may desire more benefit from collusive practice. If the benefit from collusion is larger than the profit from competition, the lowest bidder will decide to collude. The lowest bidder will collude with other firms when it compares benefit and cost of collusion. Furthermore, the lowest bidder must allocate sharing benefit for other members in the ring. As mentioned to bidding firms in the big city as the low cost firms, they will decide to collude when they obtain more benefit from collusion and total benefit must cover cost of collusion and sharing benefit. Thus, the chance of firm in the big city to be the winner might not reflect only

lower cost than other firms but also it might involve comparing more benefits from collusion.

4) Lnminwage

This study employs the minimum wage of province during 2006-2009 as the proxy of cost of bidder. Generally, if minimum wage increases, it may decrease the probability of winning project in the same area. The increasing cost affects to the raising of bid price and finally reducing chances to be the winner. From table 4.12, we found that it is highly significance at 1 percent level and odd ratio is **0.001**. The odd ratio is less than 1 or implies that the event is less likely for winning project in the same province. Accordingly, we could interpret that if minimum wage increases 1 baht, the probability of winning project in the same area decrease only 0.001 times. In other words, even though increasing minimum wage might affect to the chance of winning, it only changes very little.

5) D_Cl3 and D_Cl2

These variables show the data of contactor class of Department of Rural Road (DRR) which we select them to explain the probability of winning project in the same province. In the section 4.1, it reported that most of firms were in the second class (D_Cl3) and the third class (D_Cl2). However, this estimation leaved the extra class (D_Cl5) as the reference group. The estimated results showed that D_Cl3 and D_Cl2 were significance at 5 percent level and odd ratio equals to 2.731 and 2.951, respectively. These odd ratios are greater than 1 or imply that the event is more likely for winning project in the same province. As a result, we could interpret that if firms are in the second or third class of DRR, the probability of winning project in the same area increases almost 3 times as compared to the extra class. In other words, bidding firms from the second and the third have chances to be the winner in their areas as compared to the extra class.

We discuss these results that firstly the numbers of firms from the second and third class are almost 70 percent of total firms (See table 4.6) which have probability to be the winner in the same province. However, we view that all firms in the second and the third class desire to move on the higher class in order to bid more contract value of rural road. Thus, if they compete truly, the lowest firm cost

has a chance to be a winner. The lowest cost firm could accumulate job experienced for shifting to higher class.

However, if these firms decide to collude, they will compare the benefit and cost from collusion. In the last chapter, we mentioned that another cost of collusion is the chance of blacklisted or opportunity cost of losing revenue for the next project. Likewise, this opportunity cost could include the cost of contractor in lower class to move on the higher class. Thus, if the opportunity cost to shift on higher class is low, the chance of collusion among bidder in lower class increases.

In another view, the lowest cost firm from the second class or the third class might be a capacity to be the winner; however, it may decide to collude with other firms and bid higher than a designated winner. In this case, the lowest cost firm has the opportunity cost in term of trading benefit from collusion and chance to move on the higher class. However, if the lowest cost firm decides to collude that means the benefit from collusion is higher than the opportunity cost to move on higher class. In addition, it might be possibility that bidding firms which are in the second and third class attempt to preserve their market share by colluding group and dividing benefit as bid rotation or subcontract scheme.

For the next sub section, it will report the estimated result by dividing each region and each contractor class. However, we will discuss the interesting results that might indicate obviously in characteristic of bid rigging firms.

Table 4.15 Logit Regression of Firm Level in Each Region (Reporting Odd ratio)

Variable	Winrate_5m and Odd ratio			
	Region_n	Region_c	Region_ne	Region_s
LnNbid	2.617 (0.016)**	2.304 (0.001)***	2.174 (0.002)***	6.902 (0.006)***
D_Natpol	2.212 (0.289)	0.996 (0.995)	0.669 (0.497)	
D_Locpol	2.774 (0.083)*	1.224 (0.710)	1.332 (0.527)	0.549 (0.627)
D_Bigcity	0.156 (0.016)**	1.210 (0.769)	3.618 (0.010)***	2.324 (0.366)
Lnage	1.225 (0.786)	0.707 (0.546)	0.824 (0.724)	0.160 (0.176)

Variable	Winrate_5m and Odd ratio			
	Region_n	Region_c	Region_ne	Region_s
D_Mfirm	2.417 (0.340)	1.127 (0.888)	1.091 (0.915)	0.254 (0.459)
D_Lfirm	1.102 (0.900)	1.818 (0.305)	0.889 (0.805)	1.288 (0.800)
Lnmwage	1.62e+07 (0.038)**	0.120 (0.494)	0.006 (0.338)	5.0e+13 (0.287)
Raterd1	3.21e+17 (0.823)	7.72e+30 (0.451)	2.99e+64 (0.252)	
Raterd2	2.06e+18 (0.815)	8.73e+31 (0.437)	3.61e+66 (0.235)	0.445 (0.745)
Raterd3		1.03e+33 (0.423)	1.32e+70 0.216()	
Raterd4	2.06e+18 (0.807)	2.98e+32 (0.430)	1.485 (0.685)	3.790 (0.675)
D_Cl4	1.377 (0.805)	0.830 (0.815)	2.338 (0.329)	4.67e-09 (0.000)***
D_Cl3	1.048 (0.965)	0.375 (0.200)	2.338 (0.329)	3.32e-08 (0.000)***
D_Cl2	0.993 (0.995)	0.296 (0.097)*	1.595 (0.588)	4.32e-08 (0.000)***
D_Cl1	1.147 (0.915)	0.301 (0.389)	0.784 (0.834)	
Number of obs	118	130	156	50
LR chi2	28.39	29.29	45.56	22.90
Prob > chi2	0.019	0.022	0.0001	0.028
Pseudo R2	0.228	0.179	0.215	0.330
Log likelihood	-48.031	-67.146	-82.823	-23.169

Note: a. The number in paraphrase shows the p value.

b. ***, **and * denotes significance at the 1, 5 and 10 percent level, respectively.

c. In estimating region_n, raterd3 = 0 predicts success perfectly.

d. In estimating region_s, natpol and raterd1= 0 predict success perfectly. Cl_1 = 0 predicts failure perfectly and rated3 dropped because of collinearity.

From table 4.15, all region shows that the numbers of firm bidding are highly significance at 1 percent level especially odd ratio of the south to be 6.902. We could interpret in each region that if firm bidding increases 1 percent, the probability of winning large project approximately 2-7 times. In other words, the increasing numbers of bidding have a chance to be the winner in the large project. These results coincide with the first estimation in table 4.12. However, we explore the result of each region that the bidders in the north (Region_n) seem to be interesting.

In the northern region, we found that the relationship between firms and local politicians has the influence to win the large project. In data of firm level, we found that there are 14 from 120 firms which related to the local politicians. (See in appendix) The result shows that D_Locpol is significance at 10 percent level and the odd ratio is 2.774. The odd ratio is greater than 1 or implies that the event is more likely for winning large project. Therefore, we could interpret that in the northern region if firm has the relationship with local politician, the probability of winning large project increases about 3 times as compared to other firms. In other words, bidding firms in the north which related with local politicians have a chance to be the winner on the large project. This result suspects that the influence of local politicians in the north might reduce probability of detecting collusion in the procurement market. This reducing probability could affect to decrease collusion cost of firms. Hence, bidding firms decide to collude when their cost of collusion is less than their sharing benefit.

However, this table shows that the dummy variable of big city (D_Bigcity) which estimated results seem to contradict between the north and northeast. From the north, we found that the odd ratio is less than 1 or implies that the event is less likely for winning large project. Conversely, the odd ratio of northeast is 3.618 more than 1 which implies the event is more likely for winning large project. We discuss this difference that if firm is in the north and located on the big province, the chance of winning large project decreases. On the contrary, if firm is in the northeast and located on the big province, the probability of winning large project increase. Thus, the different region of firms' location might have influence on the chance of winner in large project.

Table 4.16 Logit Regression of Firm Level in Each Region (Reporting Odd ratio)

Variable	Winraten_p and Odd ratio			
	Region_n	Region_c	Region_ne	Region_s
LnNbid	2.377	2.022	1.287	9.066
	(0.006)***	(0.015)**	(0.286)	(0.004)***
D_Natpol	0.925	1.607	0.880	
	(0.910)	(0.570)	(0.830)	
D_Locpol	1.525	0.426	2.346	0.635
	(0.423)	(0.179)	(0.061)*	(0.734)
D_Bigcity	1.088	0.361	8.611	3.887
	(0.876)	(0.282)	(0.000)***	(0.169)
Lnage	1.872	1.568	0.754	0.016
	(0.303)	(0.282)	(0.616)	(0.012)**
D_Mfirm	1.679	0.619	0.696	0.618
	(0.488)	(0.626)	(0.658)	(0.780)
D_Lfirm	0.816	0.723	1.195	1.097
	(0.748)	(0.583)	(0.720)	(0.924)
Lnmwage	0.0005	0.002	0.006	319782.8
	(0.352)	(0.150)	(0.347)	(0.575)
Raterd1	36.052	4.97e-32	3.4e+177	
	(0.858)	(0.452)	(0.122)	
Raterd2	299.265	1.72e-31	6.3e+176	
	(0.775)	(0.462)	(0.123)	
Raterd3		6.20e-31	7.1e+184	
		(0.470)	(0.110)	
Raterd4	6.909	3.30e-30	8.0e+175	
	(0.925)	(0.482)	(0.125)	
D_Cl4	2.314	8.719	0.995	0.0001
	(0.476)	(0.105)	(0.996)	(0.935)
D_Cl3	2.087	12.564	1.870	0.0002
	(0.466)	(0.039)**	(0.468)	(0.952)
D_Cl2	3.557	9.362	1.820	0.0001
	(0.235)	(0.065)*	(0.482)	(0.949)
D_Cl1	3.100	2.334	0.394	0.00003
	(0.337)	(0.643)	(0.441)	(0.940)
Number of obs	118	130	156	60
LR chi2	18.01	45.60	49.06	35.42
Prob > chi2	0.262	0.0001	0.000	0.002
Pseudo R2	0.122	0.309	0.236	0.426
Log likelihood	-64.382	-50.849	-79.407	-23.846

Note: a. The Number in Paraphrase Shows the P Value.

b. ***, **and * Denotes Significance at the 1, 5 and 10 Percent Level, Respectively.

c. In Estimating Region_n, Raterd3 = 0 Predicts Success Perfectly.

d. In Estimating Region_s, Natpol and Raterd1 2 3 and 4 = 0 Predict Success Perfectly.

From table 4.16, it focuses on the probability of winning project in the same province or Winraten_p. The results show that the numbers of firm bidding (LnNbid) in three regions are still significance except for the northeastern region. However, the explanatory variables of northeast could explain the chance of winning project in the same area, i.e., D_Locpol and D_Bigcity.

For D_Locpol, we found that it is significance at 10 percent level and the odd ratio is 2.346. The odd ratio is greater than 1 or implies that the event is more likely for winning project in the same province. Consequently, we could interpret that in the northeastern region if firm has the relationship with local politician, the probability of winning project in the same area increases about 2.3 times as compared to other firms. In other words, a bidding firm in the northeast which related with local politician has a chance to be the winner in the same area. This study found that 50 from 156 firms in the northeast which related to the local politicians. (See in appendix) Like the local politician in the north, we discuss that these local politicians in the northeast might have influence on the reducing probability of detecting collusion in their areas. For this reason, it could decrease collusion cost of firms. Likewise, each firm will decide to collude when its sharing benefit from collusion is larger than cost of collusion. In our conceptual framework, we consider the cost of collusion as another cost of collusive firm. Thus, if this cost decreases, a firm decides to collude in its area.

In central region, we found that D_Cl3 and D_Cl2 are significance at 5 percent and 10 percent level, respectively. Their odd ratios equal to 12.564 and 9.362 which are greater than 1 or imply that the event is more likely for winning project in the same province. Accordingly, we could interpret that in the central region if firm is in the second and third class, the probabilities of winning project in

the same area increase about 9.3 to 12.5 times as compared to the extra class. In other words, bidding firms in the second and third class tend to be the winner in the same area.

Actually, the numbers of bidding firms in both classes is most of bidders in this dataset. Under the competitive bidding, all firms attempt to win the rural road project since they expected the profit and the opportunity of moving on higher class. Likewise, if a firm is in the second contractor class, it tries to win the project for job experienced in order to be the first contractor class in the future. However, if these firms decide to collude, they must compare the benefit and cost form collusion. All firms decide to collude when their sharing benefits are larger than their cost of collusion. In addition, firms from lower class still have an opportunity cost of moving to higher class. Thus, from table 4.16 in the central region it could be possible that a bid rigging scheme is bid rotation in both classes because the bidding rings in this region attempt to preserve their market share by allocating project for each members through rotating winners in their area.

Table 4.17 Logit Regression of Firm Level in Each Contractor Class (Reporting Odd Ratio)

| Variable | Winrate_5m and Odd ratio | | | | |
	Extra class (D_Cl5)	Class_1 (D_Cl4)	Class_2 (D_Cl3)	Class_3 (D_Cl2)	Class_4 (D_Cl1)
LnNbid	1.085 (0.841)	18.999 (0.065)*	4.886 (0.000)***	3.223 (0.000)***	1.873 (0.580)
D_Natpol	0.153 (0.121)	0.039 (0.139)	1.678 (0.519)	2.265 (0.147)	1.261 (0.921)
D_Locpol	5.524 (0.116)	7.226 (0.234)	5.486 (0.022)**	1.288 (0.526)	3.698 (0.563)
D_Bigcity	0.542 (0.526)	2.479 (0.597)	0.829 (0.780)	1.531 (0.273)	1.196 (0.914)
Lnage	4.825 (0.170)	11.610 (0.310)	0.345 (0.177)	1.116 (0.808)	0.001 (0.047)**
D_Mfirm			0.682 (0.808)	2.082 (0.226)	30.169 (0.298)
D_Lfirm		26.312 (0.115)	1.294 (0.677)	2.120 (0.091)*	0.602 (0.848)
Lnmwage	6.699 (0.725)	5174563 (0.249)	5332773 (0.043)**	0.052 (0.351)	52.804 (0.833)
Raterd1	3.42e-56 (0.571)	337351.1 (0.597)	7.1e+189 (0.006)***	0.00002 (0.914)	
Raterd2	5.16e-56 (0.585)	11843.97 (0.678)	7.5e+190 (0.006)***	0.00007 (0.923)	5.93e-30 (0.000)***

Variable	Winrate_5m and Odd ratio				
	Extra class (D_Cl5)	Class_1 (D_Cl4)	Class_2 (D_Cl3)	Class_3 (D_Cl2)	Class_4 (D_Cl1)
Raterd3	2.65e-50 (0.626)	1.39e+14 (0.246)	1.0e+195 (0.006)***	7.06e-06 (0.905)	
Raterd4	1.26e-55 (0.587)	7.78e+07 (0.450)	9.2e+190 (0.006)***	0.00008 (0.925)	
D_Region_n	8.73e-10 (0.000)***	195541.1 (0.149)	0.130 (0.028)**	0.119 (0.001)***	2.45e+37 (0.445)
D_Region_c	1.08e-09 (0.000)***	20073.79 (0.190)	0.028 (0.010)***	0.219 (0.013)**	1.72e+37 (0.455)
D_Region_ne	4.01e-09 (0.000)***	20548.86 (0.214)	0.815 (0.818)	0.212 (0.003)***	4.36e+37 (0.442)
Number of obs	51	37	102	217	49
LR chi2	16.12	23.17	50.11	59.59	19.77
Prob > chi2	0.243	0.057	0.000	0.000	0.071
Pseudo R2	0.233	0.452	0.362	0.205	0.423
Log likelihood	-26.493	-14.049	-44.048	-109.594	-13.482

Note: a. The number in paraphrase shows the p value.

b. ***, **and * denotes significance at the 1, 5 and 10 percent level, respectively.

c. In estimating Class_5, Mfirm = 0 predicts success perfectly. Sfirm dropped because of collinearity.

d. In estimating Class_4, Sfirm = 0 predicts failure perfectly.

e. In estimating Class_1, Raterd1 and Raterd3 = 0 predict failure perfectly. Raterd4 dropped because of collinearity.

From table 4.17, initially a firm in the extra contractor class (D_Cl5) the results show that three explanatory variables of region (D_Region_n , D_Region_c, and D_Region_ne) are highly significance at 1 percent level; however, these odd ratios are so small and less than 1. We could imply that if a firm is in the highest class and located on north, central and northeast, the probabilities of winning large project decrease slightly as compared to the south firm. These results verify that a firm in the south still has more chances to be the winner in the large project. Likewise, the estimated result of the third class (D_Cl2) which these explanatory

variables of region are highly significance at 1 percent level and odd ratios are less than 1.

However, a firm in the second contractor class (D_Cl3) the results show that D_Locpol is significance at 5 percent level and the odd ratio is 5.486. We imply that if a firm is in the second class and related with the local politicians, the probability of winning large project increase about 5.5 times as compared to other firms in this class. This result could explain that the influence of local politician in the second class might reduce the probability of detecting collusion. This dropping chance of detecting collusion could decrease collusion cost of firms. Thus, if all firms in this class decide to collude, they decide on that sharing benefit from collusion is larger than their cost of collusion.

On the other hand, the estimated results of the second class show the relationship between types of rural road and the probability of winning large project. These results show that all types of rural road (Raterd1-4) are highly significance at 1 percent level and these odd ratios are higher than 1 considerably. These relationships might explain that if the ratio of firm bidding in all types of road increases the probability of winning large project increase very much. However, under a competitive bidding these results might show the expertise in road construction of each firm. For example, if the Raterd1, a reinforced concrete pavement, increases, the chance of winning large project increases, too. The firm might be more expertise in construction of concrete rural road. Thus, it has a chance to be winner in the larger project.

Table 4.18 Logit Regression of Firm Level in Each Contractor Class (Reporting Odd Ratio)

Variable	Winraten_p and Odd ratio				
	Extra class (D_Cl5)	Class_1 (D_Cl4)	Class_2 (D_Cl3)	Class_3 (D_Cl2)	Class_4 (D_Cl1)
LnNbid	1.255	5.1e+117	1.157	2.767	1.873
	(0.755)	(0.989)	(0.581)	(0.000)***	(0.254)
D_Natpol	0.617	3.28e-96	1.053	2.724	6.664
	(0.762)	(0.997)	(0.938)	(0.069)*	(0.231)
D_Locpol	3.731	1.06e+92	2.307	0.962	0.653
	(0.398)	(0.998)	(0.137)	(0.921)	(0.734)
D_Bigcity	0.013	2.49e+57	1.828	1.723	12.279
	(0.099)*	(0.998)	(0.276)	(0.149)	(0.028)**
Lnage	0.109	8.7e+106	0.671	1.427	0.073
	(0.286)	(0.000)***	(0.517)	(0.421)	(0.031)**
D_Mfirm			0.698	2.055	1.832
			(0.746)	(0.209)	(0.711)
D_Lfirm			0.687	1.705	0.688
			(0.465)	(0.210)	(0.818)
Lnmwage	48.375	0.000	0.041	0.0002	2.04e-08
	(0.700)	(0.947)	(0.554)	(0.017)**	(0.209)
Raterd1	2204.091	4.4e-239	7.32e+42	26.655	0.000
	(0.717)	(0.995)	(0.399)	(0.770)	(0.989)
Raterd2	5.94e-09	8.12e+42	1.50e+43	10.310	0.000
	(0.498)	(0.000)***	(0.397)	(0.834)	(0.989)
Raterd3			1.98e+48	35.265	
			(0.346)	(0.747)	
Raterd4		2.6e+307	1.00e+43	27.910	0.000
		(0.990)	(0.398)	(0.766)	(0.989)
D_Region_n	2.58e-09	0.000	0.356	0.289	1.253
	(0.000)***	(0.994)	(0.166)	(0.027)**	(0.910)
D_Region_c	3.19e-11	9.7e+118	0.450	0.314	6.653
	(0.000)***	(0.996)	(0.398)	(0.050)**	(0.480)
D_Region_ne	4.73e-08	1.4e+103	0.320	0.251	0.331
	(0.000)***	(0.994)	(0.155)	(0.007)***	(0.616)
Number of obs	43	37	102	217	58
LR chi2	20.76	49.96	18.94	57.21	19.40
Prob > chi2	0.036	0.000	0.217	0.000	0.150
Pseudo R2	0.445	1.000	0.136	0.197	0.314
Log likelihood	-12.942	-1.56e-06	-59.97	-116.226	-21.159

Note: a. The number in paraphrase shows the p value.

b. ***, **and * denotes significance at the 1, 5 and 10 percent level, respectively.

c. In estimating Class_5, Mfirm = 0 predicts success perfectly. Sfirm and
    Raterd3 dropped because of collinearity. Raterd4 =0 predicts failure
    perfectly.

d. In estimating Class_1, Mfirm = 0 predicts success perfectly. Sfirm and
    Raterd3 dropped because of collinearity

e. In estimating Class_3, Raterd3 = 0 predicts failure perfectly.

From table 4.18, a firm in the third class (D_Cl2) the result shows that the relationship between firms and national politicians (D_Natpol) could explain the probability of winning project in the same province. The estimated result shows that D_Natpol is significance at 10 percent level and the odd ratio is **2.724**. We could imply that if a firm is in the third class and related with the national politicians, the probability of winning project in the same area increase nearly 3 times as compared to other firms in this class. From bidding firm data, we found that 21 of 217 firms or 10 percent of all winning firms are related with the national politician through their surnames. (See appendix) Therefore, these firms might obstruct the detecting collusive practice in the procurement market by using their political influences. This decreasing probability of detecting collusion could reduce the collusive cost of firms. Thus, if all firms in this class decide to collude, they decide on that sharing benefits from collusion is larger than their cost of collusion.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the first section focuses on the application of results under the conceptual framework in this study which attempts to propose the screening method for project and firm level. Though the estimated results could not point out particular projects or firm bidders, the screening method is still useful for anti-competitive bodies like National Anti Corruption Commission, Office of the Auditor General, Trade Competition Commission, Department of Special Investigations even Royal Thai Police. Further, we attempt to relate the screening method and empirical results for the policy recommendation as mentioned in the second section. Finally, we discuss about issues for further studies.

5.1 Conclusions

This study constructs the conceptual framework for screening collusive practices in rural road procurement market under bidders' decision to collude. In the public procurement market, all bidders decide to collude or not to collude by comparing the benefit from collusion and the cost of collusion. If the benefit from collusion is larger than the cost of collusion, they will gather as a bidding ring. Initially, a bidding ring will designate the winner before open tender. Thus, all members in the ring will agree informally in order to determine the winner firm and bid prices of members. However, the designated winner must allocate sharing benefit for other which the pattern of sharing benefit could be in forms of rotating winner or subcontracting scheme.

Under competitive bidding, the lowest cost firm will be the winner and obtain profit from the competition. However, the lowest cost firm may desire to achieve more benefit beyond a competitive bidding. Hence, it conspires with other firms when

the benefit from collusion is higher than the profit from competition. Though it could get more benefit from collusion, it still has costs of collusion. For this study, we assume that costs of collusion consist of four components as follows; 1) the probability of detected collusive behavior by government agency; 2) the probability of detected collusive firm will be prosecuted in the court and the imprisonment for highest sentence or being the offender; 3) the probability of offender will get the fine penalty; and 4) the probability of offender will be blacklisted which represents the opportunity cost of losing revenue for the next project.

For this reason, the main concept of this study is the bidders' decision under comparing the benefit from collusion and costs of collusion. However, a bidding ring must allocate sharing benefit for all members under their expectations. Thus, the number of bidders in the ring will be influence to share benefit from the collusion. Likewise, more members tend to cheat in the ring. Hence, the bidding ring will restrict the number of bidders.

This study proposes two models for screening bid rigging behavior of rural road projects and characteristics of rural road bidders. We utilize the probit and logit estimations to test the 350 rural road projects and 468 bidding firms in the rural road procurement market during 2006-2009.

The first model suggests the screening method from project level by using the engineers' estimated cost. Under the conceptual framework, we suspect that if the winning bid is close to the engineers' estimated cost; it has a tendency of bid rigging in the procurement process. Initially, our hypothesis is that rural road project with the difference between engineers' estimated cost and winning bid is less than or equal to 5 percent tend to be a suspicious bid rigging project. Hence, the dependent variable is the difference between engineers' estimate cost and winning bid which we tested its robustness by stating the difference from 0-10 percent. However, this study chose the difference at 5 percent as a proxy of dependent variable (Perdiff_5.0) which this difference level coincided with the survey study of Visuth Chorvichien et al., (2002: 4-7).

If the engineers' estimated cost could signal the collusive projects, we could observe the difference between the engineer's estimated cost and winning bid price. If the winning bid price is closely to the engineer's estimated cost, the rural road project tends to be collusive.

Initially, the results showed that the winner firms of rural road projects in the big city tend to bid far away from the engineers' estimated cost as compared to the project in the small city. The reason is that the supply of public works constructions or private project in the big city is higher than in small town. As compared to the small city, firms in the big city have a higher chance to win many projects both public works and private constructions. For this reason, they might not necessarily to collude since they have more chance to win various projects. Another reason is that the costs of collusion in the big city is higher than in the small city because the anti competitive bodies like auditor general or polices keep an eye on more projects in the big city than in the small city. Likewise, the investigator often focuses on detecting collusive projects in the big city because it has more cost effective to investigate. Meanwhile, if the investigator focuses on detecting bid rigging behavior in the small city; it might not worth to detect. Thus, the cost of collusion in the small city is lower than the big city which could lead to the increasing chance of bid rigging.

The result showed that the winning bid price of rural road projects in the northeastern region tends to be far away from the engineers' estimated cost as compared to the rural road project in the south. However, when we compare the average number of bidder in both regions, we might conclude that as compared to the average number of bidders in the south the higher average number of bidders in the northeast could support the competitive condition in the procurement market. Further, if the number of bidders per project is less, all firms tend to collude in order to obtain more benefit. The result showed that a few average numbers of bidders in the south may assemble easier than the northeast.

In contrast, the rural road projects in the central region had a tendency to be collusive more than the projects in the south. In this case, the average number of bidders in the central was still higher than the south. Though this number is high, it could not conclude like the previous case of rural road projects in the northeast. We deduce that whether the cost of collusion in the central area might lower than in the

south. Thus, the rural road projects in the central tend to be more collusive than the projects in the south.

For this reason, the number of bidders in the open tender is the important factor which could affect to the probability of bid rigging. This study found the opposite relationship between the number of bidders and the probability of collusion. This relationship means that more bidders could reduce the opportunity of collusion in the procurement market. More bidders in the open tender could affect the shared benefit of a bidding ring. If all members in the ring decide to collude, they will compare the benefit and costs of collusion. However, the total benefit from collusion must allocate for all members. Thus, if the number of bidder increases, each member will obtain decreasing benefit. However, if the sharing benefit decreases till it equals to the cost of collusion, the firm will not collude. Additionally, if a bidding ring is large or has more bidders in the ring, it has a chance to cheat among members because these firms do not agree formally to collude. Thus, the probability of betray always occurs.

Hence, the first recommendation of this study is that the government must give the importance of increasing the number of bidder which could support competitive environment in the procurement market

Likewise, this study found that the project value is an important factor which might influence on the chance of bid rigging. The results showed that Factor F which is another component of calculation of engineers' estimated cost as the indirect cost. The Factor F consists of the overhead cost, VAT and profit. Thus, if Factor F increases, the probability of collusive practice will increase aggressively because the winning bid tends to converge to engineers' estimated cost. The increasing Factor F has an effect on the raising of engineers' estimated cost. Thus, if the engineers' estimated cost increases, the profit will increase. However, the increasing engineers' estimated cost reflects the value of project. If the project value increases, all bidders will expect the increasing profit. On the other hand, the increasing engineers' estimated cost will attract bidders to collude as a bidding ring because the ring desires more benefit from collusion. Hence, the implementation of proper Factor F involves

not only the accuracy of engineers' estimated cost but also decreasing tendency of collusive bidding.

Therefore, our recommendation is to ensure the accuracy of engineers' estimated cost which the government should revise and update the standard calculation of engineer' estimated cost regularly.

However, the result confirmed that the large project of rural roads tends to be collusive bidding as compared to the small project. The reason is that a large project provides more benefit which all bidders tend to collude for sharing benefit. Under collusive decision, the bidding ring decides to collude when the benefit form collusion is larger than the costs of collusion. Hence, if the large rural road project gives more benefit, it tends to be collusive practice in the procurement market.

Accordingly, the government should improve the probability of detecting collusive behavior which emphasizes the audit of bidding process or contract of large projects.

Moreover, we found that the winner firms which came from the second and third contractor class tended to be less collusive bidding as compared to the extra contractor class. Firms from extra contractor class concern more benefit from collusion also high costs of collusion. Actually, they have high costs of collusion especially the loss of reputation and a chance of blacklisted or an opportunity cost of losing revenue for the next project. However, the detecting and prosecuting of collusive behavior in Thailand still has a few cases which decrease the cost of collusion of bidding firms. Finally, the decreasing cost of collusion will increase the chance of collusion in the public procurement market. Hence, this result showed that the winner firms from the extra contractor class may not concern the cost of collusion but they focus more on benefit from collusion.

However, the results pointed out that the local winner firm tended to collude as compared to the non local winner firm. We discussed that local bidder firms could gather as a local bidding ring easier than non local bidder firms because they located in the same area. However, the local bidding ring decides to collude when the benefit from collusion is greater than the cost of collusion. In addition, a local bidding ring will try to preserve the local procurement market. Thus, if non local bidder firms participate in the local procurement market, the local bidding ring will obstruct them

to compete. The reason of obstruction is that the local bidding ring could not obtain enough information of non local firms. If non local firms compete in the open tender, it might be risky for winning of local bidding ring.

Thus, the guideline of detecting id rigging should emphasize the audit of contract which a local firm award in its area.

For the second model, we proposed the screening method from firm level. Initially, a firm has a chance to win the large project which is more than 5 million baht. However, this study employed the ratio between the numbers of winning contract which is more than 5 million baht and total winning of firm as a dependent variable in the first test. Likewise, the second test is that a firm has a probability to win in its area or the local winner firm which we utilized the ratio between the numbers of winning contract in the same province and total bidding of firm as a dependent variable.

The results showed that a firm had a chance to be the winner when it bid increasingly. Actually, this result coincides with intuitive concept of competitive bidding, that is, more number of firm biddings will lead to the probability of winning large project. However, more number of firm biddings could not reflect only the competitive bidding but also it might be in the rotating winner scheme which is another pattern of bid rigging.

However, we found that a firm which located on the southern region had a chance to be winner in the large project. In addition, each year the average number of bidder in the south was less than other regions. Hence, a firm in the south had a chance to win the large project because of few competitors.

This result suggested our recommendation that the government should increase the cost of collusion by the audit of bidding and contract which has few competitors.

The results showed that a firm which related with the local politicians had a chance to be the winner firm on the large project. However, we discussed that the local politicians might use their influence on the intervention of detecting bid rigging in their areas. Hence, the probability of detecting bid rigging behavior will decrease which it will reduce the cost of collusion of firm. Thus, if the cost of collusion is low

from the local politician intervention in the detecting process, it may facilitate for collusion in the rural road procurement market.

Hence, in the audit of rural road contract the government auditor or special investigator should focus on the contract which might have a relationship between the winner firm and local politician.

In the second test, we found that the increasing of number of firm bidding affected the raising of probability of winning project in the same province. Like the same reason, all local firms could collude as a local bidding ring when they compare the benefit from collusion is larger than the cost of collusion. Though more number of firm bidding will lead to the chance of winning local project, more number of firm biddings could not reflect only the competitive bidding but also it might be in the rotating winner scheme.

For that reason, the government auditor or public procurer should observe the bidding pattern especially the rotation bidding or rotating winner.

This study found that the data of region relates to the probability of winning project in the same province. As compared to other regions, a few average numbers of bidders in the southern region could form as the local bidding ring in their local areas. Thus, a local bidding ring will try to preserve market share in its province. Also, it will hinder other firms from different areas because the local bidding ring could not obtain enough information of non local firms.

Moreover, a firm in the big city had a chance to be the winner firm in its area. The reason is that a firm of big province could get the high technology or efficient equipment easily as compared to a firm of small province. Hence, the construction firm in big province might have lower cost than a firm in small province. Though all firms in the big city might have low cost, they may decide to collude when they obtain more benefit from collusion and total benefit must cover cost of collusion and sharing benefit. Hence, the probability of firm in the big city to be the winner firm might not only lower cost than other firms but also it might desire more benefit from collusion, too.

Finally, this study found that a firm from the second and the third contractor class had a chance to be the winner in its area as compared to the extra contractor class. The first reason is that the numbers of bidding firms from both classes were

almost 70 percent of total firms which had probability to be the winner in the same province. Actually, all firms in both classes need to move on higher class in order to bid more volume of rural road projects. Thus, if they compete truly, the lowest firm cost has a chance to be a winner and accumulate job experience for shifting to higher class. However, if these firms decide to collude, they will compare the benefit and costs from collusion. Another cost of collusion is the probability of blacklisted or the opportunity cost of losing revenue for the next project. Likewise, the cost of contractor may include the opportunity cost of lower class to move on higher class, too. Thus, if the opportunity cost to shift on higher class is low, a chance of collusion among bidders in lower class may increase.

5.2 Recommendations

From the results of this study, we propose the recommendations and policy tools in order to reduce the bid rigging behavior in the public procurement market as following.

5.2.1 The Importance of Increasing the Number of Bidder Could Support Competitive Condition in the Procurement Market.

The result confirmed that more number of bidders could promote the competitive bidding. Though the bidding ring still exists, more number of bidders in the ring will reduce sharing benefit from collusion also push the incentive to cheat among members. The increasing number of bidders could support that bid prices diverge from the engineers' estimated cost. So it encourages more competitive bidding in the procurement market. However, the method for increasing number of bidders should enhance transparency in open tendering. Actually, the public procurement law and regulation of Thailand support the transparency bidding. However, the increasing of number of bidders still depends on several factors which the main factor is the process of project specification. If the government restricts the project specification particularly characteristic of firm bidders, the numbers of bidders might be few. If the numbers of bidders are few, it will make a chance to be collusive

practice. A few firms could negotiate easily to form as the bidding ring. Likewise, the restricted project specification is another barrier to entry of public procurement market. Thus, if the government will decrease bid rigging behavior in the public procurement, it must encourage the transparency bidding in procurement market especially in the process of project specification.

5.2.2 To Increase the Cost of Collusion by Enforcement the Trade Competition Act of 1999 with the Anti-Collusion Law of 1999

Since 1999 the legislation that has the status of a parliamentary law is the Act on Offences Relating to the Submission of Bids to State Agencies B.E. 2542 (1999) or Anti-Collusion Law of 1999. This law, administered by the National Anti Corruption Commission, criminalizes bid rigging behavior and imposes sanctions in politicians, public officials, and private entities for criminal offense. In this law, section 4-8 issues liable of private entities to imprisonment for highest term five years and a fine of fifty percent of the value of the contract that has been entered into with the State agency. However, Sirilaksana Khoman (2011: 7) reported that only about 15 cases have been prosecuted under this law in the eleven years of its existence. Meanwhile, the backlog receiving complaints alleging violations of Act are more than 700 cases. (NACC, 2007: 42) These numbers may reflect the ineffective enforcement law which firm bidders or private entities consider as low cost of collusion.

However, another law which never enforce for collusive practices is the Trade Competition Act B.E. 2542 (1999) or TCA of 1999. The TCA of 1999 specially prohibits various practices that have been deemed anti-competitive. Particularly, the collusive practices in section 27 (4) are explained that

"Any business operator shall not enter into an agreement with another business operator to do any act amounting to monopoly, reduction of competition or restriction of competition in the market of any particular goods or any particular service in any of the following manners:

(4) Fixing an agreement or condition in collusive manner in order to enable one party to win a bid or tender for goods or services or in order to prevent one party from participating in a bid or tender for the goods and services.

The TCA of 1999 provides for three types of general enforcement measures: 1) criminal lawsuits; 2) administrative orders; and 3) actions for damage and loss.

Enforcement actions may be taken against firms or individual who referred to in the Act as "business operators". (Paul and Kallaya Laohaganniyom, 2004: 2)

Nevertheless, this law mentions to the TCA vested authority for enforcement of the Act with Thai Trade Competition Commission or TCC. (See section 6 and 8 of TCA of 1999 in appendix) In the criminal context, the Office of Trade Competition Commission or OTCC is charged and monitoring anticompetitive activity and practices, and is responsible for receiving complaints alleging violations of Act. The OTCC is required to report complaints to TCC for consideration. After receiving the report from OTCC, the TCC will either conduct an investigation. However, if the TCC found that there is a violation of the Act by any firm, it will send its opinion advocating prosecution to the Attorney General. If the Attorney General agrees with the TCC, the case will be assigned to the public prosecutor to proceed with a criminal lawsuit. (Paul and Kallaya Laohaganniyom, 2004: 3)

For liable of offender, any violation of the substantive provision of section 25-29 of TCA is punishable by imprisonment for term of not more than three years, and a maximum fine of six million baht. During 1999-2012 OTCC received only 21 complaints which abuse conduct of restrictive agreement in section 27. (See statistic of complaints received in appendix) However, these complaints never involved collusive practices in the public procurement market.

Thus, the anti collusion policy should enforce the TCA of 1999 together with the Anti collusion law of 1999. If the anti competitive bodies could enforce both laws rigorously, it leads to increase the cost of collusion of firm.

5.2.3 To Ensure the Accuracy of Engineers' Estimated Cost

This study proposed the screening method from project level by using the engineers' estimated cost. However, if the engineers' estimated cost is higher than the actual cost, it may lead to collusive practice in the open tender. Thus, the anti collusion policy should emphasize the audit of calculation of engineers' estimated cost. Likewise, the government should always revise and update the standard calculation of engineers' estimated cost.

However, the calculation of engineers' estimated cost should be transparency especially give more detail in calculation process which the NACC has recommended that the government should reveal the information about engineer's estimated cost in state agency procurement public. However, the cabinet has declined to follow its suggestion.

5.2.4 To Improve the Probability of Detecting Collusive Behavior in the Public Procurement Process.

The results showed that bid rigging still exists in the public procurement process because firm bidders view that the cost of collusion is lower than the benefit from collusion. For example, the winning firms in the small city will decide to collude because the probability of detecting bid rigging is low. Thus, if this probability is low, it will decrease the cost of collusion. However, this study proposes the policy consideration to improve the probability of detecting collusive practices in the public procurement process.

To increase the probability of detecting bid rigging by using more audit. From our results, we found that the probability of collusive behavior may appear in the large project, the local winner, the small city and the region which has few average numbers of bidders as the south. In Thailand, the Regulation of the Office of Prime Minister on Procurement 1992 (ROMP of 1992) issues that all agencies must advertise their procurements on the government's central procurement websites and relevant agencies websites. In addition, they must notify to the Office of Auditor General of Thailand. (Article 45 of ROMP of 1992 and its amendment) However, the public procurement audit could enhance the integrity of procurement system and reduce risk of corruption and collusion in open tender. Generally, the Auditor General audits the legality and value of procurement which the audit report will be provided to the parliament, the senate, the cabinet and the audited agency. It is also publicly available. (Chulasingh Vasantasingh, 2008: 41) Thus, the role of anti competitive body like the Auditor General should focus on the bidding process in order to increase the probability of detecting bid rigging before open tendering. For example, the government auditor should improve the probability of detecting collusive practices by audit of project bidding in small cities. Likewise, the audit guideline should emphasize

the audit of bidding which has a few bidders in the open tender. However, the ROMP of 1992 issues that a copy of all contracts valued at one million baht or above has to be submitted to the Auditor General Office. (Article 135 of ROMP of 1992 and its amendment) Thus, the audit guideline should emphasize the audit of contract especially the large project. In addition, our result showed that the suspicious collusive project might observe from the local winner firm. Hence, the auditor should select audit of public contract which local firms award in their area.

5.2.5 To Increase the Cost of Collusion by Auditing the Bidding Process and Contract Procedure of Large Project or Local Winner.

Actually, the cost of collusion could rise when the anti competitive bodies keep on eye the suspicious collusive project. Presently, in Thailand the anti competitive bodies consist of National Anti Corruption Commission (NACC), Office of the Auditor General (OAG), Department of Special Investigation (DSI), Trade Competition Commission (TCC), and Royal Thai Police (RTP). However, only OAG has the authority to audit the procurement process before open tender. Meanwhile other bodies will investigate the suspicious collusive project when they receive the compliant. Hence, the role of audit is importance especially in the bidding process and contract procedure.

The audit of bidding process and contract procedure could increase the cost of collusion. Our results pointed that we could observe the suspicious collusive bidding which has a few competitors. Likewise, the bidding pattern as rotation bidding or rotating winner could be another sign of bid rigging which the auditor should focus on audit this bidding pattern. Accordingly, we found that if a firm had a relationship with the local politician, the probability of winning large project or in the same area will increase. Therefore, the audit of contract procedure should emphasize a contract which might be the relationship between the winner and the local politician.

5.3 Issues for Further Studies

5.3.1 How to analyze the effect of bid rigging behavior from the project beginning to the project meets its own objective?

5.3.2 Has the analysis of incentives for collusion lead to amend any specific law as TCA of 1999 or Anti Collusion law of 1999?

5.3.3 Which preparations have been used after bid rigging cases to enhance competition in the public procurement market?

5.3.4 Is the blacklisting effective to prevent collusive practices in Thailand?

BIBILOGRAPHY

Abaratez-Metz, R. and Bajari, P. 2009. Screening for Conspiracies and Their Multiple Applications. **Antitrust.** 24, 1 (Fall): 66-71.

Acts and Regulations. 1890. **The Sherman Anti Trust Act.** Retrieved August 2, 2012 from http://en.wikipedia.org/wiki/Sherman_Act

Aoyagi, M. 2003. Bid Rotation and Collusion in Repeated Auctions. **Journal of Economic Theory.** 112 (1): 79-95.

Asker, J. 2009. **Bidding Rings: An entry for New Palgrave Dictionary of Economic.** Retrieved May 28, 2010 from http://pages.stern.nyu.edu/jasker/PalgraveBidding Rings091028.pdf

Athey, S. and Bagwell, K. 2004. **Collusion With Persistent Cost Shocks.** Retrieved September 28, 2011 form http://econ.columbia.edu/repec/pdf/DP0405-07.pdf

Auriol, E.; Straub, S. and Flochel, T. 2011. **Public Procurement and Rent Seeking: the Case Study of Paraguay.** Retrieved April 1, 2011 form http://idei.fr/doc/wp/2011/ wp_idei_664.pdf

Bajari, P. and Summers, G. 2000. Detecting Collusion in Procurement Auctions: A **Selective Survey of Recent Research.** Retrieved March 27, 2009 from http://www.siepr.stanford.edu/workp/swp01014.html

Bajari, P. and Linxin, Ye. 2003. Deciding Between Competition and Collusion. **The Reviewof Economics and Statistics.** 85 (4): 971-989.

Barrus, D. 2011. **Firm Bidding Behavior in Highway Procurement Auctions: An Analysis of Single Bid Contracts, Tacit Collusion, and the Financial Impact of Kentucky.** Doctoral dissertation, University of Kentucky.

Bierens, Herman J. 2008. **The Logit Model: Estimation, Testing and Interpretation.** Retrieved April 28, 2012 from http://econ.la.psu.edu/hbierens/MLLOGITPDF

The Canada Competition Act. 1985. **A Step From Substantive Competition Policy Convergence: The International Implications of Leegin Creative Leather Products.** Retrieved August 2, 2012 from http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/h_00148.html

Chawdhury, J. 2008. **The Basic of Bid Rigging.** Retrieved June 1, 2011 from
        http://www.cuts-international.org/pdf/CCIER-7-2008.pdf

Chulasingh Vasantasingh. 2008. **Corruption Control in Public Procurement.**
        Retrieved March 27, 2009 from http://www.unafei.or.jp/english/pdf/
        2nd_Regional_Seminar.pdf

The Comptroller General Department. 2007. **The Engineer Estimating Guidelines**
        for Roadway Construction Projects. Retrieved August 2, 2012 from
        http://www.rctlma.org/trans/documents/consulting/services/estimate_
        guide/engineer_estimate_guide.pdf (In Thai)

Coviello, D. and Gagliarducci, S. 2009. **Political Longevity and Collusion in Public**
        Procurement Auctions. Retrieved April 1, 2011 from
        http://www.cepr.org/meets/wkcn/6/6685/papers/Coviello.pdf

Depart Of Rural Roads. 2004-2012. **Public Procurement Data.** Retrieved August
        22, 2012 from http://www.drr.go.th

De Silva, Dakshina G; Timothy D. and Georgia K. 2003. An Empirical Analysis of
        Entrant and Incumbent Bidding in Road Construction Auctions. **The**
        Journal of Industrial Economics. 51 (3): 295-316.

Engineer Estimating Guideline. 2007. **Rules of Engineering Estimated Cost of**
        Government Construction In. Bangkok: The Comptroller General
        Department. (In Thai)

Estrada, E. and Vazauez, S. 2011. **Bid Rigging in Public Procurement of Generic**
        Drugs In Mexico. OECD: Manuscript of Federal Competition.

Feinstein, J. S.; Block, M. K. and Nold, F. C. 1985. Asymmetric Information and
        Collusive Behavior in Auction Markets. **The American Economic Review.**
        75 (3): 1443-1489.

Goldberg, Anderson M. and Aubertine, A. 2004. **Bid Rigging Detection in**
        Government Construction Contract. Retrieved March 27, 2009 from
        http://www.osbar.org/docs/sections/antitrust/attr_cle_bid_rigging.pdf

Gupta, S. 2001. The Effect of Bid Rigging on Prices: A Study of the Highway
        Construction Industry. **Review of Industrial Organization.** 19 (4): 451-465.

Haider, L. and Hunter, G. 2010. **Screening and Testing for Collusive Conduct in the Absence of a Smoking Gun: Insight in Economics.** Retrieved October 1, 2011 from http://www.nera.com/nerafiles/NL_AT_ Insights_1010.pdf

Harrington, J. 2005. **Detecting Cartel.** Retrieved October 1, 2011 from http://www.econ2.jhu.edu/People/Harrington/DetectingCartels-10.8.05.pdf

Hendricks, K. and Porter, Robert H. 1989. **Collusion in Auctions.** Retrieved March 27, 2009 from http://www.kellogg.northwestern.edu/research/math/ papers/817.pdf

Hendrickson, C. 1998. **Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders.** Pittsburgh: Carnegie Mellon University:

Hyytinen,A.; Lundberg, S. and Toivanen, O. 2007. **Politics and Procurement**: **Evidence From Cleaning Contracts.** Retrieved August 29, 2009 from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1082817

Institute of Investigator. 2010. **The Gathering Evidence In Bid Rigging Cases.** Document for Teaching Inquiry Official. Bangkok: Royal Thai Police.

Ishii, R. 2007. Detecting Collusion through Exchange of Favors in Repeated **Procurement Auctions.** Retrieved March 27, 2009 from http://www2.econ.osaka-u.ac.jp/library/global/dp/0715.pdf

Jakobsson, M. and Eklof, M. 2003. **Bid Rigging In Swedish Procurement Auctions.** Retrieved March 27, 2009 from http://www.kkv.se/ upload/Filer/Forskare-studenter/projekt/Bid_rigging.pdf

The Japanese Fair Trade Commission. 1947. **The Japanese Anti-Monopoly Act.** Retrieved August 2, 2012 from http://www.jftc.go.jp/en/legislation_ guidelines/index.html

Jofre-Bonet, M. and Pesendorfer, M. 2003. Estimation of a Dynamic Auction Game. **Econometrica.** 71 (5): 1443-1489.

Khemani, R. and Shapiro, D. 1993. **Glossary of Industrial Organization and Competition Law.** Paris: OECD.

Lambert, A. and Konstantin, S. 2003. **Corruption and Collusion in Public Tenders.** Retrieved March 27, 2009 from http://www.cefir.ru/ download.php?id=79

Lee, I. and Hahn, K. 2002. Bid Rigging in Auction for Korean Public Works Contracts and Potential Damages. **Review of Industrial Organization.** 21 (1): 73-88.

Lengwiler,Y. and Wolfstetter, E. G. 2005. **Bid Rigging: An Analysis of Corruption in Auctions.** Retrieved March 27, 2009 from http://epub.ub.uni-muenchen.de/13509/1/39.pdf

McAfee, R. P. and McMillan, J. 1992. Bidding Rings. **The American Economic Review.** 82, 3 (June): 579-599.

McMillan, P. R. 1991. Dango: Japan's Price Fixing Conspiracies. **Economics and Politics.** 3: 201-218.

Maci, Marsela. 2011. **Bid Rigging in the EU Public Procurement Markets.** Doctoral dissertation, University of London.

National Annti Corruption Commision. 1999. **The Act on Offences Relating to Submission of Bids to State Agencies B.E. 2542.** Retrieved August 29, 2009 from http://www.nacc.go.th/download/en_load/BidOffencesAct.pdf

National Anti Corruption Commission. 2007. **Annual Report: An Inspection Report and A Report on the Performance of Duties.** Bangkok: National Anti Corruption Commission.

Office Of The Auditor General of Thailand. 2009. **Office of the Auditor General of Thailand and Bureau of Budget.** Retrieved November 22, 2011 from http://procruement-org.in.th/login/

Office Of Trade Competition Commission. 1999. **The Trade Competition Act.** Retrieved August 1, 2012 from http://siteresources.worldbank.org/ INTCOMPLEGALDB/EastAsiaandPacific/21152340/TRADECOMPETIT IONACT.pdf (In Thai)

Okatani, Naoaki. 1995. Regulations on Bid Rigging in Japan, The United States and Europe. **Pacific Rim Law &Policy Association.** 4 (1): 252-257.

Organisation For Economic Co-operation and Development. 2001. **Competition Law In Thailand.** Paris: OECD.

Organisation For Economic Co-operation and Development. 2008. **Competition in The Construction Industry.** Paris: OECD.

Organisation For Economic Co-operation and Development. 2010. **Roundtable on Collusion and Corruption in Public Procurement.** Paris: OECD.

Organisation For Economic Co-operation and Development. 2005. **Public Procurement in OECD, Fighting Corruption and Promoting Integrity in Public Procurement.** Paris: OECD.

Organisation For Economic Co-operation and Development. 2007. **Competition in Bidding Markets.** Paris: OECD.

Organisation For Economic Co-operation and Development. 2008. **Public Procurement The Role of Competition Authorities in Promoting Competition.** Paris: OECD.

Parker, Howard J. and Maher, L. n.d. What You Should Know about Detecting and Preventing Antitrust Violation. In **United States Department of Justice Antitrust Division.** San Francisco: The Anti Trust Division United State Department of Justice.

Paul, George L. and Kallaya Laohaganiyom. 2004. **Thai Competition Law.** Retrieved May 12, 2011 from http://www.whitecase.com/files/ Publication/b29ae69f-c3d2-484f-9b5a-49bde68ad16b/Presentation/ Publication/Attachment/a5dd9d43-9f25-4ea1-97aa-4c90a362d5b0/Thai_ Competition_Law.pdf

Pesendorfer, M. 2000. A Study of Collusion in First Price Auctions. **The Review of Economic Studies.** 67 (3): 381-411.

Porter, Robert H. and Zona, J. D. 1993. Detection of Bid Rigging in Procurement Auctions. **The Journal of Political Economy.** 101, 3 (June): 518-538.

Porter, Robert H. and Zona, J. D. 1999. Ohio School Milk Markets: An Analysis of Bidding. **The Rand Journal of Economics.** 30 (2): 263-288.

The Prime Minister's Office. 1992. **Regulation of the Office of the Prime Minister on Procurement and Its Amendment.** Bangkok: The Prime Minister Office. (In Thai)

Rubushe, Mziwodumo. 2010. **Harful Effects of Bid Rigging.** Retrieved June 12, 2011 from http://www.acfesa.co.za/event_files/Harmful%20Effects% 20of%20BidRigging%20[Compatibility%20Mode].pdf

Schumann Laurence. 2011. **Measuring Market Concentration.** Retrieved August
  19, 2012 from http://www.adbi.org/files/2011.05.10

Sirilaksana Khoman. 2011. **Combating Procurement Conspiracies: Some Lessons**
  from Thailand. Retrieved June 1, 2012 from
  http://www.apsac.com.au/2011conference/ 2011/2011papers.html

Thanathip Nawarattanaworakul. 2009. **Law Enforcement Problems on the Offense**
  of the Government Procurement Fraud Act 1999: A Case Study of the
  Department of Special Investigation. Master thesis, Sripatum
  University. (In Thai)

Thanin Prempree. 2009. **Criminal Liabilities of Juristic Person under the Act**
  Concerning Offences Relating to the Submission of Bids to
  Government Agencies B.E. 2542 (1999). Master thesis, Dhurakij Pundit
  University. (In Thai)

Tong, L. and Xiaoyong Z. 2009. Entry and Competition Effects in First-Price
  Auctions: Theory and Evidence from Procurement Auctions. **The Review**
  of Economics Studies. 76 (4): 1397-1429.

Tramer, M. and Elloit, M. 2008. **Binary Logistic Regression.** Retrieved March 2,
  2012 from http://www.ccsr.ac.uk/publications/teaching/blr.pdf

Tukiainen Janne. 2008. **Participation Screen for Collusion Auctions.** Retrieved
  March 27, 2009 from http://ethesis.helsinki.fi/julkaisut/eri/hecer/
  disc/213/particip.pdf

The UK Competition Act. 1998. **Competition Act Law.** Retrieved August 2, 2012
  from http://www.legislation.gov.uk/ukpga/1998/41/contents

United Nations Conference on Trade and Development. 2012. **Competition Policy**
  and Public Procurement. Geneva: UNCTAD

Visuth Chorvichien et al. 2002. **The Evaluation of Measure 10 Percentage**
  Reduction of Engineers' Estimated Cost. Bangkok: Research Submitted
  To Bureau of Budget.   (In Thai)

Voravit Thipthamthara. 2010. Problems Related to Authority of the National Anti-
  Corruption Commission in Accordance with the Act of Offense on
  Submission of Bids to the State Agencies B.E. 2542. **Journal of**
  Dhurakij Pundit University. 4 (1): 45-56. (In Thai)

Welsh, J. and Furth, H. F. 1983. **Suggestion for the Detection and Prevention of the Detection and Prevention of Construction Contract Bid Rigging.** http://www.fhwa.dot.gov/gov/programadmin/contracts/dotjbid.cfm

Woodall, B. 1996. **JapanUunder Construction: Corruption, Politics, and Public Works.** Berkeley, Calif.: University of California Press.

Woodridge, J. M. 2009. **Introductory Econometrics: A Modern Approach.** 4th ed. Mason, OH: South Western, Cengage Learning.

APPENDENCIES

APPENDIX A

Examples Cases of Bid Rigging in the Public Procurement

<u>Hungary</u>

In 2010, the Hungarian road construction market has witnessed a series of bid rigging cases. The biggest anti trust fine (approximately EUR 27.7 million) was imposed a bid rigging case involving highway construction. The contract was valued at EUR 630 million. The Hungarian competition authority found that the bidders had previously agreed among them on who was going on to win the tender and also on the competing bidder to which the general contract would offer a subcontract in the construction works. The press has repeatedly reported that that road construction projects may have provided an ideal environment for corruption, and suspected that the illegal gains from bid rigging were a major source for financial political campaigns.

Source: OECD (2010:25)

<u>Canada</u>

In 2012,together with the Unité permanente anticorruption (UPAC) in Quebec, it has laid 77 charges against 11 individuals and 9 companies in relation to a broad range of allegations that include corruption in municipal affairs, breach of trust, influencing municipal officers, fraud upon the government, production and use of counterfeit documents, accepting reward, advance or benefit, extortion and conspiracy. With respect to allegations of competition law violations, the Bureau has announced that bid-rigging charges were also laid under section 47 of the *Competition Act*. According to the Bureau, this newly announced case is the result of an investigation that ran for more than two years, which uncovered "evidence of a sophisticated collusion scheme giving preferential treatment to a group of contractors to obtain municipal contracts, mainly for infrastructure projects in Saint-Jean-sur-Richelieu and surrounding areas."

Source: Canadian Regulatory Law: News Rules Trends

Netherland

In 2002, after a whistleblower revealed that a major construction company was keeping secret financial accounts, the Dutch government began investigations that exposed rampant collusion throughout the Netherlands' construction industry. 481 leniency applicants came forward and overall approximately 650 companies were implicated. A parliamentary enquiry committee concluded that government agencies were defrauded by an average of 8.8percent in public construction projects as a result of collusion. The government imposed a total of EUR 239 million in fines.

Source: OECD (2008:18)

United Kingdom

In 2007, the UK's Office of Fair Trading announced that it had such extensive, high quality evidence against a construction cartel that it was no longer offering leniency to participants. In 2008, following one of the largest investigations in the agency's history, it issued a Statement of Objections charging 112 British construction firms with conspiring to rig bids in thousands of tenders. The affected projects included publicly funded schools, hospitals, and housing developments.

Source: OECD (2008:18)

Japan

In 2005, the Japanese Fair Trade Commission (JFTC) ordered 45 Japanese steel bridge builders to stop rigging for government contracts. More than 70% of the steel projects for steel bridges given out between 1999 and 2004 by the Japan Highway Public Corporation were won by 47 companies which belonged to two bid-rigging associations. Their bids were almost exactly the same as the public corporation estimates. In one of the largest bid rigging cases in Japanese history, the JFTC also ordered the Japan Highway Public Corporation to improve its bridge contract procurement practices, alleging that 20 former public officials had been involved bid rigging practices to secure future jobs with the 45 companies. According to one tally nearly 60% of former bureaucrats involved in road work got jobs after they retired with one of the top 10 corporate bodies that do road work

Source: OECD (2010:25)

Thailand

In 2012, National Anti Corruption Commission (NACC) decided case of a bid collusion and bid corruption in rural road and bridge construction of Wang Prachuap Subdistrict Administration Organization (SAO) at Tak province. However, the bid corruption was that the deputy of SAO committed an offence under Act on Offences Relating to Submission of Bids to State Agencies B.E.2542 (1999) with the purpose of preventing fair competition by favoring any bidder as the person entitled or enter into a contract with SAO. (Section 12) Meanwhile, the bid collusion showed that the local contractor in Tak province pretended or constituted a cause for another person's inability to bid fairly or for such person to bid under a misunderstanding. (Section 7)

Source: The Red case no 1141855

National Anti Corruption Commission

In 2011, National Anti Corruption Commission (NACC) decided case of bid collusion in rural road construction of Nong Bua Tai Subdistrict Administration Organization at Tak province. The bid collusion involved the local politician as President of Subdistrict Administration Organization which committed an offence under Act on Offences Relating to Submission of Bids to State Agencies B.E.2542 (1999). The local politician performed any function in relation to a bid in order to induce the acceptance of bid that involved the bid rigging behavior. (Section 13) However, the local firm pretended a cause for another person's inability to bid fairly or for such person to bid under a misunderstanding. (Section 7)

Source: The Red case no 12338554

National Anti Corruption Commission

APPENDIX B

Examples of Anti-Collusion Law of Other Countries

APPENDIX B

Examples of Anti-Collusion Law of Other Countries

France

    The French Penal Code; Paragraph 4

    IV Interference with the Freedom of Auction

Article 412

       Any person who, in the auction of ownership, usufruct or lease of immovable or movables, of any enterprise, of supplies, rights of exploitation, or services, impedes, or disturbs, or attempts to impede or disturb, the freedom of auction or bidding by violence or threats, before or during the auction or bidding, shall be punished by jailing for no less than fifteen days nor more than three months and by fine of 1,500 to 150,000 francs.

       Any person who, by gifts, promises or fraudulent agreements, eliminates or attempts to eliminate bidders or limits or attempts to limit the auction or bidding, or receives such gifts or promises, shall be subject to like punishment.

       Any person who, after public auction, conducts a reduction, or participates in such, without assistance of appropriate ministerial off, shall be subject to like punishment

Italy

    The Italian Penal Code

Article 353 Interference with Auctions

       Whoever, by violence or threats, or by gifts, promises, collusion or other fraudulent means, prevents or disrupts the bidding public auctions or private sales conducted on behalf Administration, or turns bidders away therefore, shall be by imprisonment for up to two years and by a fine of form 40,000 to 400,000 lire.

       If the offender is the person appointed by law or by the authorities to be in charge of the said auction or sale, imprisonment shall be for from one to five years and the fine of from 200,000 to 800,000 lire.

The punishment prescribed in this Article shall also apply in the case of a private sale on behalf or private persons conducted by one-half.

Article 354 Abstention from Auctions

Whoever, for money which has been given or promised to him or another, or for any other thing of which has been given or promised to him or another, refrains from participating in the bidding at the auctions or sales specified in the preceding Article, shall be punished by imprisonment for up to six months or by a fine of 200,000 lire.

Japan

The Japanese Penal Code

Obstruction of Auction and Collusive Acts

Article 96-3

A person, who commits an act prejudicial to the fair proceeding of auction or bid by means of fraudulent stratagems or threat, shall be punished with penal servitude for not more than two years or a fine of not more than five thousand yen.

The same shall apply to persons who consult together for the purpose of impairing fair prices or obtaining illicit profit.

Singapore

The Penal Code of Singapore

Article 184

Whoever intentionally obstructs any sale of property offered for sale by the lawful authority of any public servant as such, shall be punished with imprisonment for which may extend to one month, or with fine which may extend to $500,or with both.

Article 185

Whoever, at any sale of property held by the lawful authority of a public servants as such, purchased or bids for any property on account of any person, whether himself or any other, whom he knows to be under a legal incapacity to

purchase that property at that sale, or bids for such property not intending to perform to obligation under which he lays himself by such bidding, shall be punished with imprisonment for a term which may extend to one month, or with fine which may extend to $200, or with both

APPENDIX C

New Tools for Preventive Bid Rigging

APPENDIX C
New Tools for Preventive Bid Rigging

1. Self- Certifications

Certifications of compliance with the law by bidders and by procurers alike have proved to be very useful. In some countries, for example, bidders are required to submit a **Certificate of Independent Bid Determination (CIBD)** as a requirement for bidding. CIBDs typically require each bidder to certify under oath that it has not agreed with is competitors about bids, that has not disclosed bid prices to any of its competitors and that is has not attempted to convince a competitor to rig bids. CIBDs not only inform bidders about illegality of bid rigging, but they also make prosecution of bid riggers easier, and they said additional penalties, including possibly criminal penalties for the filing of false statement to the government. Similarly, in some countries such as the United States and Canada, government officials involved in procurement are required to certify that they have no know knowledge of or did not improperly release procurement information and that they have attended specific training courses. In some cases, they are asked to provide on voluntary basis personal financial information to rule out possible conflict of interest.

Source: OECD (2010:30)

2. Bid Rigging Indicator Analysis System (BRIAS)

In 2006, The Korean Fair Trade Commission or KFTC suggested the screening program namely **Bid Rigging Indicator Analysis System (BRIAS)** automatically and statistically analyses bid-rigging indicators based on data concerning bids placed by public institutions. With the data delivered online from the public institutions, the analysis system calculates the probability of bid rigging by giving weightings to various indicators like bid-winning probability, the number of bidders, bid prices, competition methods, the number of unsuccessful bids and hikes in reserve prices, transition into private contracts, etc.

Source: OECD (2007:38)

APPENDIX D

The Number of Firms Which Related with the Political Sector

Through the Same Surnames (Classified by Province)

APPENDIX D

The Number of Firms Which Related with the Political Sector Through the Same Surnames (Classified by Province)

Province	Region	Number of firms which related with political sector
Bureeram	Northeast	10
Nakorn ratchasima	Northeast	9
Srisaket	Northeast	9
Ubonratchatanee	Northeast	8
Udornthani	Northeast	8
Chiangrai	North	8
Petchaboon	North	8
Suphanburi	Central	8
Pitsanulok	North	7
Ratchaburi	Central	7
Chiangmai	North	7
Surin	Northeast	6
Bangkok	Central	5
Pichit	North	5
Lopburi	Central	5
Prajeenburi	Central	4
Yasothorn	Northeast	4
Roi-et	Northeast	4
Kamphangphet	North	3
Chaiyabhumi	Northeast	3
Phranakornsri Ayuthaya	Central	3
Phang- gha	South	3
Nong Bua Lampoo	Northeast	3
Kanchanaburi	Central	2
Nakorn Sri Dhammarat	South	2
Prachuapkirikhan	Central	2
Mahasarakam	Northeast	2
Ranong	South	2
Sakaew	Central	2
Singhaburi	Central	2

Appendix D (Continued)

Suratthani	South	2
Udtradit	North	2
Mae Hongson	North	1
Kalasindhu	Northeast	1
Khonkean	Northeast	1
Chainat	Central	1
Chumporn	South	1
Trang	South	1
Tak	North	1
Pattani	South	1
Payao	North	1
Mukdahan	Northeast	1
Yala	South	1
Songkla	South	1
Samutsongkram	Central	1
Amnat chareon	Northeast	1
Nakornsawan	North	1
		170

Source: The author collected from several sources such as www.tdw.polsci.chula.ac.th, www.parliament.go.th

Appendix E

Estimation of Binary Probit Model of the Percentage of Difference

Between Estimate Cost and Winning Price

Appendix E

Estimation of Binary Probit model of the percentage of difference between estimate cost and winning price

Variables	Binary Probit Model											
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx
	Perdiff00	Perdiff0.5	Perdiff1.0	Perdiff1.5	Perdiff2.0	Perdiff2.5	Perdiff3.0	Perdiff3.5	Perdiff4.0	Perdiff4.5	Perdiff5.0	Perdiff5.5
Lnrdlength	2.58e-06	-0.0971	-0.7156	-0.0489	-0.0489	-0.0582	-0.0673	-0.0683	-0.0623	-0.0623	-0.0481	-0.0481
	(0.242)	(0.142)	(0.211)	(0.360)	(0.360)	(0.257)	(0.186)	(0.173)	(0.199)	(0.199)	(0.318)	(0.318)
Rd_2		0.0775	0.1720	0.0677	0.0677	0.0939	0.1001	0.1039	0.1108	0.1108	0.1091	0.1091
		(0.514)	(0.123)	(0.524)	(0.524)	(0.375)	(0.339)	(0.318)	(0.279)	(0.279)	(0.278)	(0.278)
Rd_3		0.1151	0.1586	0.1010	0.1010	0.1001	0.0976	0.0973	0.0942	0.0942	0.0852	0.0852
		(0.478)	(0.181)	(0.451)	(0.451)	(0.415)	(0.423)	(0.417)	(0.407)	(0.407)	(0.462)	(0.462)
Rd_4		0.0538	0.0517	-0.050	-0.0506	-0.0601	-0.0070	-0.0132	-0.0097	-0.0097	-0.0135	-0.0135
		(0.704)	(0.663)	(0.711)	(0.711)	(0.655)	(0.955)	(0.915)	(0.935)	(0.935)	(0.909)	(0.909)
Bigcity	**0.0001**	**-0.1354**	**-0.1899**	**-0.1732**	**-0.1732**	**-0.1848**	**-0.1896**	**-0.2044**	**-0.1952**	**-0.1952**	**-0.1939**	**-0.1939**
	(0.045)**	(0.058)*	(0.004)***	(0.005)***	(0.005)***	(0.002)***	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Rural		**-0.1421**	-0.0577	-0.0197	-0.0197	-0.0071	-0.0043	0.0064	0.0103	0.0103	0.0262	0.0262

Variables	mfx Perdiff00	mfx Perdiff0.5	mfx Perdiff1.0	mfx Perdiff1.5	mfx Perdiff2.0	mfx Perdiff2.5	mfx Perdiff3.0	mfx Perdiff3.5	mfx Perdiff4.0	mfx Perdiff4.5	mfx Perdiff5.0	mfx Perdiff5.5
		Binary Probit Model										
		(0.059)*	(0.407)	(0.771)	(0.771)	(0.915)	(0.949)	(0.923)	(0.873)	(0.873)	(0.288)	(0.288)
Locwin	4.83e-07	**0.2266**	**0.2637**	**0.2454**	**0.2454**	**0.2661**	**0.2475**	**0.2267**	**0.2418**	**0.2418**	**0.2284**	**0.2284**
	(0.384)	**(0.004)*****	**(0.000)*****	**(0.001)*****	**(0.001)*****	**(0.000)*****	**(0.000)*****	**(0.001)*****	**(0.000)*****	**(0.000)*****	**(0.001)*****	**(0.001)*****
Lndist	-1.31e-07	0.0504	0.0457	0.0242	0.0242	0.0319	0.0294	0.0243	0.0289	0.0289	0.0262	0.0262
	(0.883)	(0.112)	(0.111)	(0.368)	(0.368)	(0.217)	(0.252)	(0.342)	(0.245)	(0.245)	(0.288)	(0.288)
Natpol	-1.20e-06	0.0183	-0.0386	-0.0193	-0.0193	-0.0040	-0.0012	-0.0014	-0.0088	-0.0088	-0.0125	-0.0125
	(0.384)	(0.803)	(0.575)	(0.759)	(0.759)	(0.947)	(0.984)	(0.981)	(0.879)	(0.879)	(0.825)	(0.825)
Locpol	4.83e-07	0.0231	0.0711	0.0709	0.0709	0.0580	0.0584	0.0552	0.0667	0.0667	0.0628	0.0628
	(0.838)	(0.710)	(0.194)	(0.166)	(0.166)	(0.240)	(0.230)	(0.251)	(0.153)	(0.153)	(0.171)	(0.171)
Region_n	0.0002	0.0473	0.0500	0.0090	0.0090	0.0084	-0.0089	-0.0099	-0.2152	-0.2152	-0.4302	-0.4302
	(0.341)	(0.583)	(0.527)	(0.907)	(0.907)	(0.911)	(0.907)	(0.895)	(0.777)	(0.777)	(0.585)	(0.585)
Region_c		**0.2128**	**0.1454**	**0.1301**	**0.1301**	**0.1537**	**0.1430**	**0.1429**	**0.1209**	**0.1209**	0.1033	0.1033
		(0.010)***	**(0.051)***	**(0.068)***	**(0.068)***	**(0.020)****	**(0.035)****	**(0.032)****	**(0.071)***	**(0.071)***	(0.134)	(0.134)

Variables	Binary Probit Model											
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx
	Perdiff00	Perdiff0.5	Perdiff1.0	Perdiff1.5	Perdiff2.0	Perdiff2.5	Perdiff3.0	Perdiff3.5	Perdiff4.0	Perdiff4.5	Perdiff5.0	Perdiff5.5
Region_ne	-2.72e-06	-0.0945	-0.6196	-0.1023	-0.1023	-0.0720	-0.0819	-0.639	-0.0985	-0.0985	**-0.1231**	**-0.1231**
	(0.447)	(0.276)	(0.436)	(0.181)	(0.181)	(0.324)	(0.262)	(0.376)	(0.176)	(0.176)	**(0.098)***	**(0.098)***
Inf_p	-5.14e-07	-0.0120	-0.1020	-0.0135	-0.0135	-0.0075	-0.0060	-0.0052	-0.0052	-0.0052	-0.0068	-0.0068
	(0.240)	(0.290)	(0.310)	(0.146)	(0.146)	(0.420)	(0.521)	(0.573)	(0.557)	(0.557)	(0.436)	(0.436)
Numbid	**-1.51e-06**	**-0.1729**	**-0.0190**	**-0.0174**	**-0.0174**	**-0.0181**	**-0.0177**	**-0.1842**	**-0.0168**	**-0.0168**	**-0.0166**	**-0.0166**
	(0.016)**	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****	**(0.000)*****
Cl_4	-9.18e-07	0.0071	-0.0542	-0.0047	-0.0047	-0.0105	-0.0131	-0.1760	-0.0129	-0.0129	-0.0433	-0.0433
	(0.544)	(0.943)	(0.585)	(0.958)	(0.958)	(0.903)	(0.878)	(0.836)	(0.875)	(0.875)	(0.617)	(0.617)
Cl_3	0.0001	-0.1599	**-0.1972**	**-0.2018**	**-0.2018**	**-0.1768**	**-0.1722**	**-0.1650**	**-0.1678**	**-0.1678**	**-0.2028**	**-0.2028**
	(0.082)	(0.103)	**(0.043)****	**(0.028)****	**(0.028)****	**(0.057)***	**(0.049)****	**(0.055)***	**(0.047)****	**(0.047)****	**(0.022)****	**(0.022)****
Cl_2	4.54e-06	-0.1321	**-0.1853**	**-0.1557**	**-0.1557**	**-0.1457**	**-0.1426**	**-0.1307**	-0.1126	-0.1126	**-0.1429**	**-0.1429**
	(0.334)	(0.157)	**(0.041)****	**(0.063)***	**(0.063)***	**(0.072)***	**(0.074)***	**(0.095)***	(0.138)	(0.138)	**(0.068)***	**(0.068)***
Cl_1		-0.0511	-0.1540	-0.1606	-0.1606	-0.1493	-0.0253	-0.0149	-0.0260	-0.0260	-0.0592	-0.0592
		(0.783)	(0.403)	(0.366)	(0.366)	(0.384)	(0.868)	(0.920)	(0.859)	(0.859)	(0.706)	(0.706)

Variables	Binary Probit Model											
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx
	Perdiff00	Perdiff0.5	Perdiff1.0	Perdiff1.5	Perdiff2.0	Perdiff2.5	Perdiff3.0	Perdiff3.5	Perdiff4.0	Perdiff4.5	Perdiff5.0	Perdiff5.5
Factor F	-0.00003	**2.6362**	**2.7421**	**2.6201**	**2.6201**	**3.0310**	**2.9657**	**3.0562**	**3.1047**	**3.1047**	**2.7431**	**2.7431**
	(0.488)	**(0.086)***	**(0.047)****	**(0.041)****	**(0.041)****	**(0.017)****	**(0.019)****	**(0.015)****	**(0.011)****	**(0.011)****	**(0.022)****	**(0.022)****
Lnconcost	5.49e-07	0.0009	-0.0686	-0.0711	-0.0711	-0.407	-0.0343	-0.0308	-0.0316	-0.0316	-0.0600	-0.0600
	(0.865)	(0.992)	(0.461)	(0.412)	(0.412)	(0.629)	(0.683)	(0.709)	(0.693)	(0.693)	(0.453)	(0.453)
Lproject		**0.2300**	**0.2581**	**0.2173**	**0.2173**	**0.1754**	**0.1738**	0.1675	**0.1715**	**0.1715**	**0.1943**	**0.1943**
		(0.047)**	**(0.023)****	**(0.044)****	**(0.044)****	**(0.091)***	**(0.093)***	(0.103)	**(0.089)***	**(0.089)***	**(0.057)***	**(0.057)***
Obs	144[a]	350	350	350	350	350	350	350	350	350	350	350

Table 3 Estimation of Binary Probit model

Of the percentage of difference between estimate cost and winning price

Variables	Binary Probit Model								
	mfx Perdiff6.0	mfx Perdiff6.5	mfx Perdiff7.0	mfx Perdiff7.5	mfx Perdiff8.0	mfx Perdiff8.5	mfx Perdiff9.0	mfx Perdiff9.5	mfx Perdiff10.0
Lnrdlength	-0.0481	-0.0481	-0.0466	-0.0466	-0.0482	-0.0482	-0.0482	-0.0546	-0.0546
	(0.318)	(0.318)	(0.316)	(0.316)	(0.290)	(0.290)	(0.290)	(0.256)	(0.256)
Rd_2	0.1091	0.1091	0.1283	0.1283	0.1450	0.1450	0.1450	0.1446	0.1446
	(0.278)	(0.278)	(0.202)	(0.202)	(0.153)	(0.153)	(0.153)	(0.169)	(0.169)
Rd_3	0.0851	0.0851	0.0828	0.0828	0.0893	0.0893	0.0893		
	(0.462)	(0.462)	(0.438)	(0.438)	(0.420)	(0.420)	(0.420)		
Rd_4	-0.0135	-0.0135	-0.0155	-0.0155	-0.0116	-0.0116	-0.0116	-0.0091	-0.0091
	(0.909)	(0.909)	(0.892)	(0.892)	(0.916)	(0.916)	(0.916)	(0.936)	(0.936)
Bigcity	**-0.1939**	**-0.1939**	**0.1861**	**0.1861**	**-0.1804**	**-0.1804**	**-0.1804**	**-0.1775**	**-0.1775**
	(0.001)*	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.002)***	**(0.002)***
Rural	0.0110	0.0110	0.0136	0.0136	0.0179	0.0179	0.0179	0.0227	0.0227

Variables	Binary Probit Model									
-----------	---------	---------	---------	---------	---------	---------	---------	---------	---------	
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	
	Perdiff6.0	Perdiff6.5	Perdiff7.0	Perdiff7.5	Perdiff8.0	Perdiff8.5	Perdiff9.0	Perdiff9.5	Perdiff10.0	
	(0.863)	(0.863)	(0.825)	(0.825)	(0.769)	(0.769)	(0.769)	(0.723)	(0.723)	
Locwin	**0.2284**	**0.2284**	**0.2106**	**0.2106**	**0.2067**	**0.2067**	**0.2067**	**0.2162**	**0.2162**	
	(0.001)*	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	**(0.001)***	
Lndist	0.0262	0.0262	0.0287	0.0287	0.0269	0.0269	0.0269	0.0288	0.0288	
	(0.288)	(0.288)	(0.221)	(0.221)	(0.245)	(0.245)	(0.245)	(0.237)	(0.237)	
Natpol	-0.1252	-0.1252	-0.0236	-0.0236	-0.3465	-0.3465	-0.3465	-0.0244	-0.0244	
	(0.825)	(0.825)	(0.668)	(0.668)	(0.531)	(0.531)	(0.531)	(0.668)	(0.668)	
Locpol	0.0628	0.0628	0.0622	0.0622	**0.0738**	**0.0738**	**0.0738**	**0.0758**	**0.0758**	
	(0.171)	(0.171)	(0.152)	(0.152)	**(0.084)***	**(0.084)***	**(0.084)***	**(0.038)****	**(0.038)****	
Region_n	-0.0430	-0.0430	-0.0330	-0.0330	-0.0380	-0.0380	-0.0380	-0.0285	-0.0285	
	(0.585)	(0.585)	(0.653)	(0.653)	(0.603)	(0.603)	(0.603)	(0.701)	(0.701)	
Region_c	0.1033	0.1033	**0.1257**	**0.1257**	**0.1237**	**0.1237**	**0.1237**	**0.1326**	**0.1326**	
	(0.134)	(0.134)	**(0.045)****	**(0.045)****	**(0.043)****	**(0.043)****	**(0.043)****	**(0.038)****	**(0.038)****	
Region_ne	**-0.1231**	**-0.1231**	-0.1111	-0.1111	-0.1094	-0.1094	-0.1094	-0.1049	-0.1049	

Variables	Binary Probit Model									
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	
	Perdiff6.0	Perdiff6.5	Perdiff7.0	Perdiff7.5	Perdiff8.0	Perdiff8.5	Perdiff9.0	Perdiff9.5	Perdiff10.0	
	(0.098)*	(0.098)*	(0.114)	(0.114)	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)	
Inf_p	-0.0068	-0.0068	-0.0056	-0.0056	-0.0064	-0.0064	-0.0064	-0.0070	-0.0070	
	(0.436)	(0.436)	(0.504)	(0.504)	(0.438)	(0.438)	(0.438)	(0.415)	(0.415)	
Numbid	-0.01663	-0.01663	-0.0168	-0.0168	-0.0167	-0.0167	-0.0167	-0.0168	-0.0168	
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	
Cl_4	-0.0433	-0.0433	-0.0063	-0.0063	-0.0039	-0.0039	-0.0039	-0.0234	-0.0234	
	(0.617)	(0.617)	(0.936)	(0.936)	(0.960)	(0.960)	(0.960)	(0.784)	(0.784)	
Cl_3	-0.2028	-0.2028	-0.1948	-0.1948	-0.1902	-0.1902	-0.1902	-0.2183	-0.2183	
	(0.022)**	(0.022)**	(0.021)**	(0.021)**	(0.022)**	(0.022)**	(0.022)**	(0.014)**	(0.014)**	
Cl_2	-0.1429	-0.1429	-0.1352	-0.1352	-0.1247	-0.1247	-0.1247	-0.1449	-0.1449	
	(0.068)*	(0.068)*	(0.069)*	(0.069)*	(0.086)*	(0.086)*	(0.086)*	(0.061)*	(0.061)*	
Cl_1	-0.0592	-0.0592	-0.0512	-0.0512	-0.0437	-0.0437	-0.0437	-0.0637	-0.0637	
	(0.453)	(0.453)	(0.730)	(0.730)	(0.762)	(0.762)	(0.762)	(0.680)	(0.680)	
Factor F	2.7431	2.7431	2.4795	2.4795	2.1328	2.1328	2.1328	2.1764	2.1764	

Variables	Binary Probit Model									
	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	mfx	
	Perdiff6.0	Perdiff6.5	Perdiff7.0	Perdiff7.5	Perdiff8.0	Perdiff8.5	Perdiff9.0	Perdiff9.5	Perdiff10.0	
	(0.022)**	(0.022)**	(0.029)**	(0.029)**	(0.057)*	(0.057)*	(0.057)*	(0.061)*	(0.061)*	
Lnconcost	-0.6008	-0.6008	-0.0665	-0.0665	-0.0814	-0.0814	-0.0814	-0.0762	-0.0762	
	(0.453)	(0.453)	(0.387)	(0.387)	(0.284)	(0.284)	(0.284)	(0.334)	(0.334)	
Lproject	0.1943	0.1943	0.1889	0.1889	0.1970	0.1970	0.1970	0.1955	0.1955	
	(0.057)*	(0.057)*	(0.056)*	(0.056)*	(0.045)**	(0.045)**	(0.045)**	(0.052)**	(0.052)**	
Obs	350	350	350	350	350	350	350	338[b]	338[b]	

Note. The number in the paraphrase is p value, ***, **,* means significance at 1, 5 and 10 percent level, respectively

(a)   and (b) are total of 260 and 12observations are lost respectively in the estimations due to collinearity among some of dummy variables.

APPENDIX F

Factor F Table of Road Construction

ตาราง Factor F งานก่อสร้างทาง

เงินล่วงหน้าจ่าย	0 %	ดอกเบี้ยเงินกู้	7 % ต่อปี
เงินประกันผลงานหัก	0 %	ค่าภาษีมูลค่าเพิ่ม (VAT)	7 %

ค่างาน (ทุน)	ค่าใช้จ่ายในการดำเนินงานก่อสร้าง %				รวม ในรูป	ภาษีมูลค่าเพิ่ม	Factor F	Factor F	Factor F
ล้านบาท	ค่า อำนวยการ	ค่า ดอกเบี้ย	ค่า กำไร	รวม ค่าใช้จ่าย	Factor	(VAT)		ฝนตก 1	ฝนตก 2
ไม่เกิน 5	18.2361	1.1667	5.5000	24.9028	1.2490	1.0700	1.3365	1.3574	1.3784
10	14.0410	1.1667	5.5000	20.7076	1.2071	1.0700	1.2916	1.3138	1.3360
20	9.7855	1.1667	5.5000	16.4525	1.1648	1.0700	1.2460	1.2675	1.2889
30	6.9082	1.1667	5.5000	13.5749	1.1357	1.0700	1.2153	1.2341	1.2530
40	6.9899	1.1667	5.0000	13.1565	1.1316	1.0700	1.2108	1.2317	1.2526
50	6.4552	1.1667	5.0000	12.6218	1.1262	1.0700	1.2051	1.2262	1.2474
60	5.5919	1.1667	5.0000	11.7586	1.1176	1.0700	1.1958	1.2158	1.2359
70	5.4048	1.1667	4.5000	11.0715	1.1107	1.0700	1.1885	1.2086	1.2287
80	5.1508	1.1667	4.5000	10.8175	1.1082	1.0700	1.1857	1.2059	1.2260
90	4.7692	1.1667	4.5000	10.4359	1.1044	1.0700	1.1817	1.2012	1.2208
100	4.4639	1.1667	4.5000	10.1306	1.1013	1.0700	1.1784	1.1975	1.2165
110	4.3795	1.1667	4.0000	9.5461	1.0955	1.0700	1.1721	1.1914	1.2107
120	4.3158	1.1667	4.0000	9.4825	1.0948	1.0700	1.1715	1.1909	1.2104
130	4.1221	1.1667	4.0000	9.2887	1.0929	1.0700	1.1694	1.1885	1.2076
140	3.9560	1.1667	4.0000	9.1227	1.0912	1.0700	1.1676	1.1865	1.2053
150	3.8121	1.1667	4.0000	8.9787	1.0898	1.0700	1.1661	1.1847	1.2033
160	3.7934	1.1667	4.0000	8.9601	1.0896	1.0700	1.1659	1.1845	1.2031
170	3.7057	1.1667	4.0000	8.8724	1.0887	1.0700	1.1649	1.1834	1.2018
180	3.6034	1.1667	4.0000	8.7700	1.0877	1.0700	1.1638	1.1821	1.2004
190	3.6301	1.1667	3.5000	8.2968	1.0830	1.0700	1.1588	1.1773	1.1959
200	3.5440	1.1667	3.5000	8.2106	1.0821	1.0700	1.1579	1.1763	1.1947
210	3.4660	1.1667	3.5000	8.1327	1.0813	1.0700	1.1570	1.1753	1.1936
220	3.3951	1.1667	3.5000	8.0618	1.0806	1.0700	1.1563	1.1744	1.1926
230	3.3304	1.1667	3.5000	7.9971	1.0800	1.0700	1.1556	1.1736	1.1916
240	3.2711	1.1667	3.5000	7.9277	1.0794	1.0700	1.1549	1.1729	1.1908
250	3.2165	1.1667	3.5000	7.8831	1.0788	1.0700	1.1543	1.1722	1.1900
260	3.1661	1.1667	3.5000	7.8328	1.0783	1.0700	1.1538	1.1716	1.1893
270	3.1195	1.1667	3.5000	7.7861	1.0779	1.0700	1.1533	1.1710	1.1887
280	3.0761	1.1667	3.5000	7.7428	1.0774	1.0700	1.1528	1.1705	1.1881
290	3.0358	1.1667	3.5000	7.7025	1.0770	1.0700	1.1524	1.1700	1.1875
300	2.9982	1.1667	3.5000	7.6648	1.0766	1.0700	1.1520	1.1695	1.1870
350	2.8896	1.1667	3.5000	7.5562	1.0756	1.0700	1.1509	1.1683	1.1856
400	2.6731	1.1667	3.5000	7.3398	1.0734	1.0700	1.1485	1.1656	1.1827
450	2.5048	1.1667	3.5000	7.1714	1.0717	1.0700	1.1467	1.1635	1.1803
500	2.3701	1.1667	3.5000	7.0368	1.0704	1.0700	1.1453	1.1618	1.1784
เกินกว่า 500	2.3701	1.1667	3.5000	7.0368	1.0704	1.0700	1.1453	1.1618	1.1784

หลักเกณฑ์การใช้ตาราง Factor F

1. กรณีค่างานต้นทุนอยู่ระหว่างช่วงของค่างานต้นทุนที่กำหนด ให้เทียบบัดราส่วนเพื่อหาค่า Factor F หรือใช้สูตรดังต่อไปนี้

ค่า Factor F ของค่างานต้นทุน A = D-[(D-E)X(A-B)/(C-B)]

เมื่อ
ต้องการหาค่า Factor F ของค่างานต้นทุน = A บาท

ค่างานต้นทุนในช่วงนั้นที่ต่ำกว่า A = B บาท

ค่างานต้นทุนในช่วงนั้นที่สูงกว่า A = C บาท

ค่า Factor F ของค่างานต้นทุน B = D

ค่า Factor F ของค่างานต้นทุน C = E

2. กรณีของงานก่อสร้างอาคารและโครงการงานก่อสร้างนั้นเป็นสัญญาเดียว ให้รวมค่างานต้นทุนของงานก่อสร้างอาคารและสิ่งปลูกสร้างรวมทั้งส่วนประกอบอื่นๆ ก่อนหาค่า Factor F ส่วนงานครุภัณฑ์ที่สั่งซื้อหรือจัดซื้อให้แยกค่างานไปคำนวณภาษีต่างหาก

3. งานสะพานและ/หรือท่อเหลี่ยม ทางแยกต่างระดับที่อยู่ในงานก่อสร้างทาง ให้แยกค่างานต้นทุนและใช้ตาราง Factor F งานก่อสร้างสะพานและท่อเหลี่ยม

4. กรณีพื้นที่ก่อสร้างในงานก่อสร้างทางอยู่ในพื้นที่ฝนตกชุกตามจังหวัดที่กำหนด ให้ใช้ค่า Factor F จากตาราง Factor F งานก่อสร้างทาง ในช่อง "Factor F ฝนชุก 1" หรือ ช่อง "Factor F ฝนชุก 2" ดังนี้

4.1 ใช้ค่า Factor F ช่อง "Factor F ฝนชุก 1" สำหรับงานก่อสร้างก่อสร้างในจังหวัดจันทบุรี ชุมพร เชียงราย ตรัง นครพนม นครศรีธรรมราช ปราจีนบุรี ปัตตานี ทั่กุง สงขลา สตูล สุราษฎร์ธานี และ/หรือ หนองคาย

4.2 ใช้ค่า Factor F ช่อง "Factor F ฝนชุก 2" สำหรับงานก่อสร้างในจังหวัดตราด นราธิวาส พังงา ภูเก็ต ยะลา และ/หรือ ระนอง

5. ตาราง Factor F งานก่อสร้างอาคาร และ ตาราง Factor F งานก่อสร้างสะพานและท่อเหลี่ยม ไม่มีการคิด Factor F กรณีฝนตกชุก

6. ตาราง Factor F นี้ ใช้ได้กับค่าน้ำมันเชื้อเพลิงทุกราคา แต่จะแปรเปลี่ยนตามอัตราดอกเบี้ยเงินกู้ อัตราการจ่ายเงินล่วงหน้า อัตราการหักเงินประกันผลงาน และอัตราการคิดมูลค่าเพิ่ม

7. อัตราดอกเบี้ยเงินกู้เป็นค่าเฉลี่ยของอัตราดอกเบี้ยขั้นต่ำในการกู้สำหรับลูกค้าชั้นดี (MLR) ของธนาคารขนาดใหญ่ อย่างน้อย 3 ธนาคาร ซึ่งกระทรวงการคลัง (กรมบัญชีกลาง) เป็นผู้กำหนดและประกาศทุกต้นปีงบประมาณ (เดือนตุลาคมของทุกปี) และระหว่างปีงบประมาณหากอัตราดอกเบี้ยเงินกู้เฉลี่ยฯ เปลี่ยนแปลงถึงร้อยละ 1

8. กรณีใช้เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี ทั้ง 100% ให้ใช้ค่า Factor F ในช่อง "รวมในรูป Factor" (ที่ยังไม่รวม VAT)

9. กรณีใช้เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี และมีเงินงบประมาณสมทบ ให้ใช้ค่า Factor F สำหรับกรณีเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี และเงินงบประมาณตามสัดส่วน ดังตัวอย่างต่อไปนี้

กรณีงานก่อสร้างทาง มีค่างานต้นทุน 100 ล้านบาท ใช้เงินกู้ 70% และเงินงบประมาณสมทบ 30% กำหนดเงินจ่ายล่วงหน้า 15% เงินประกันผลงานหัก 10 % อัตราดอกเบี้ยเงินกู้ 7% ต่อปี และภาษีมูลค่าเพิ่ม (VAT) 7%

- Factor F กรณีใช้เงินกู้ (จากช่อง รวมในรูป Factor) ของค่างานต้นทุน 100 ล้านบาท = 1.0968
- Factor F กรณีใช้เงินงบประมาณ (จากช่อง Factor F) ของค่างานต้นทุน 100 ล้านบาท = 1.2118
- Factor F ที่ใช้ในการคำนวณราคากลาง = (1.0968×0.7)+(1.2118×0.3) = 1.1313

คำอธิบายเพิ่มเติมในบางประเด็น
เกี่ยวกับหลักเกณฑ์การใช้ตาราง Factor F

1. ค่างานต้นทุนอยู่ระหว่างช่วงของค่างานต้นทุนที่กำหนด หมายถึง ค่างานต้นทุน (Direct Cost) ที่ต้องการหาค่า Factor F จากตาราง Factor F นั้น อยู่ในระหว่างช่วงของค่างานต้นทุนที่กำหนดในช่อง "ค่างาน (ทุน)" ของตาราง Factor F (มีหน่วยเป็นล้านบาท) กรณีนี้ให้ใช้วิธีการเทียบบัญญัติไตรยางศ์เพื่อหาค่า Factor F **หรือใช้สูตร คำนวณหาค่า Factor F ดังนี้**

ค่า Factor F ของค่างานต้นทุน A $= D-\{(D-E)\times(A-B)/(C-B)\}$

โดย ค่างานต้นทุน A หมายถึง ค่างานต้นทุนที่ต้องการหาค่า Factor F

B หมายถึง ค่างานต้นทุนขั้นต่ำของช่วงค่างานต้นทุน ที่ค่างานต้นทุนที่ต้องการหาค่า Factor F (ค่างานต้นทุน A) อยู่

C หมายถึง ค่างานต้นทุนขั้นสูงของช่วงค่างานต้นทุน ที่ค่างานต้นทุนที่ต้องการหาค่า Factor F (ค่างานต้นทุน A) อยู่

D หมายถึง ค่า Factor F ของค่างานต้นทุนขั้นต่ำของช่วงค่างานต้นทุน ที่ค่างานต้นทุนที่ต้องการหาค่า Factor F (ค่างานต้นทุน A) อยู่

E หมายถึง ค่า Factor F ของค่างานต้นทุนขั้นสูงของช่วงค่างานต้นทุน ที่ค่างานต้นทุนที่ต้องการหาค่า Factor F (ค่างานต้นทุน A) อยู่

2. ในงานก่อสร้างทาง สะพาน และท่อเหลี่ยม และเป็นการณีที่อยู่ในข้อกำหนดให้ใช้ค่า Factor F จากตาราง Factor F งานก่อสร้างทาง หากงานก่อสร้างทาง สะพาน และท่อเหลี่ยม นั้น ก่อสร้างในพื้นที่จังหวัดใดที่กำหนดเป็นพื้นที่ฝนตกชุก ให้ใช้ค่า Factor F จากตาราง Factor F งานก่อสร้างทาง ในช่อง "Factor F ฝนชุก 1" หรือ ช่อง "Factor F ฝนชุก 2" ดังนี้

2.1 ใช้ค่า Factor F ในช่อง "Factor F ฝนชุก 1" สำหรับการก่อสร้างในเขตพื้นที่ของจังหวัด จันทบุรี ชุมพร เชียงราย ตรัง นครพนม นครศรีธรรมราช ปราจีนบุรี ปัตตานี พัทลุง สงขลา สตูล สุราษฎร์ธานี และ/หรือ หนองคาย

2.2 ใช้ค่า Factor F ในช่อง "Factor F ฝนชุก 2" สำหรับการก่อสร้างในเขตพื้นที่ของจังหวัด ตราด นราธิวาส พังงา ภูเก็ต ยะลา และ/หรือ ระนอง

-2-

3. เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี หมายถึง เงินกู้ตามโครงการเงินกู้ หรือเงินช่วยเหลือจากต่างประเทศ ตามมาตรา 80/1 (4) แห่งประมวลรัษฎากร และตามประกาศอธิบดี กรมสรรพากร เกี่ยวกับภาษีมูลค่าเพิ่ม (ฉบับที่ 28) ลงวันที่ 5 มีนาคม 2535 เรื่อง กำหนดหลักเกณฑ์ วิธีการ และเงื่อนไขการขายสินค้าหรือการให้บริการกับกระทรวง ทบวง กรม ราชการส่วนท้องถิ่น หรือรัฐวิสาหกิจ ตามโครงการเงินกู้หรือเงินช่วยเหลือจากต่างประเทศตามมาตรา 80/1(4) แห่งประมวลรัษฎากร ซึ่งกำหนด ให้ใช้อัตราภาษีร้อยละ 0 ในการคำนวณภาษีมูลค่าเพิ่ม

กรณีการใช้เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษีดังกล่าว เป็นค่าก่อสร้าง ทั้ง 100% ให้ใช้ค่า Factor F ในช่อง "รวมในรูป Factor" (ที่ยังไม่รวม VAT)

4. ในกรณีที่มีการใช้เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี และมีเงินงบประมาณ สมทบเป็นค่าก่อสร้างด้วย ให้ใช้ค่า Factor F สำหรับกรณีจากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษี และค่า Factor F สำหรับกรณีของการใช้เงินงบประมาณ ตามสัดส่วน โดยให้คำนวณค่า Factor F ดังตัวอย่าง ต่อไปนี้

กรณีงานก่อสร้างทาง ใช้เงินกู้จาก JBIC เป็นค่าก่อสร้าง 60% และมีเงินงบประมาณสมทบ 40% รวมค่างานต้นทุน ทุกรายการในกลุ่มงานทาง ได้จำนวน 450 ล้านบาท กำหนดเงินประกันผลงานหัก 10% เงินล่วงหน้าจ่าย 10% อัตราดอกเบี้ย 7% ภาษีมูลค่าเพิ่ม 7% และไม่มีกรณีฝ่าแลกชุก

กรณีนี้ใช้ตาราง Factor F งานก่อสร้างทาง กรณีเงินประกันผลงานหัก 10% เงินล่วงหน้าจ่าย 10% อัตรา ดอกเบี้ย 7% และภาษีมูลค่าเพิ่ม 7%

- กรณีของเงินกู้ : คำนวณที่ค่างานต้นทุน 450 ล้านบาท

  ค่า Factor F จากตาราง Factor F งานก่อสร้างทาง ในช่อง รวมในรูป Factor = 1.0700

- กรณีของเงินงบประมาณ : คำนวณที่ค่างานต้นทุน 450 ล้านบาท

  ค่า Factor F จากตาราง Factor F งานก่อสร้างทาง ในช่อง Factor = 1.1455

- คำนวณหาค่า Factor F ที่ใช้คำนวณราคากลาง

  = (1.0700 × 60/100) + (1.1455 × 40/100)   = 0.6420 + 0.4582

  = 1.1002

ทั้งนี้ การใช้เงินกู้จากแหล่งเงินกู้หรือจากแหล่งอื่นซึ่งไม่ต้องชำระภาษีเป็นค่าก่อสร้างดังกล่าว มีรายละเอียดปรากฏตามหนังสือกระทรวงการคลัง ด่วนที่สุด ที่ กค0421.5/ว 64 ลงวันที่ 28 กรกฎาคม 2552 เรื่อง ซ้อมความเข้าใจหลักเกณฑ์การใช้ตาราง Factor F กรณีการใช้เงินกู้เป็นค่าก่อสร้าง สำหรับ การคำนวณราคากลางงานก่อสร้าง ซึ่งกระทรวงการคลังได้แจ้งเวียนให้ทุกส่วนราชการ รัฐวิสาหกิจ และ หน่วยงานอื่นของรัฐ ทราบแล้ว ตั้งแต่เดือนกรกฎาคม 2552

APPENDIX G

Act on Offences Relating to the Submission of Bids

To State Agencies B.E. 2542 (1999)

Act on Offences Relating to the Submission of Bids to State Agencies,

B.E. 2542 (1999)

BHUMIBOL ADULYADEJ, REX.

Given on the 19th Day of November B.E. 2542;

Being the 54th Year of the Present Reign.

His Majesty King Bhumibol Adulyadej is graciously pleased to proclaim that:

Whereas it is expedient to have a law on offences relating to the submission of bids to State agencies;

Be it therefore, enacted by the King, by and with the advice and consent of the National Assembly, as follows:

Section 1. This Act is called the "Act on Offences Relating to the Submission of Bids to State Agencies, B.E. 2542 (1999)".

Section 2. This Act shall come into force as from the day following the date of its publication in the Government Gazette.*

Section 3. In this Act:

"bid" means the submission of a proposal with the object of acquiring the right to enter into a contract with a State agency pertaining to a purchase, hire, exchange, lease, asset disposal, concession or receipt of other rights;

"State agency" means a Ministry, Sub-Ministry, Department, provincial administration, local administration, State enterprise or other State agencies or agencies exercising functions of the State under the law and receiving contributions or investment properties from the State;

"political position holder" means:

(1) Prime Minister;

(2) Minister;

(3) member of the House of Representatives;

(4) Senator;

(5) other political officials other than (1) and (2) under the law on rules of political officials;

2

(6) National Assembly officials of the political division under the law on rules of National Assembly officials;

(7) local administrators and members of the local assembly.

"NCCC" means the National Counter Corruption Commission.

Section 4. Any person who bids in collusion with others with the object of conferring a benefit to any such persons in the form of a right to enter into a contract with a State agency, by avoiding fair competition or by creating barriers to the offer of other products or services to a State agency or by acquiring an advantage over a State agency in a manner which is not congruous with normal business practice, shall be liable to imprisonment for a term not exceeding three years and a fine of fifty percent of the highest bid price submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher.

Any person who assumes the role of persuading others to participate in the commission of an offence prescribed in paragraph one shall be liable to the penalties under paragraph one.

Section 5. Any person who gives, offers to give or undertakes to give moneys or properties or other benefits to another person for the purpose of a bid, with the object of inducing others to participate in any activity which confers a benefit to any person in the form of a right to enter into a contract with a State agency, or to induce such person to submit a higher or lower bid that is apparently inconsistent with the properties of the product, service or receivable right, or to induce such person to participate in a bid or withdrawal of a bid, shall be liable to imprisonment for a term from one year to five years and a fine of fifty percent of the highest bid price submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher.

Any person who demands, receives or consents to the receipt of moneys or properties or other benefits in connection with the commission of an act under paragraph one shall be deemed as a joint offender.

Section 6. Any person who coerces another person to participate in a bid or not participate in a bid or withdraw a bid or bid as directed, by use of force or any form of threat to incite fear of endangerment to life, body, liberty, reputation or properties of the threatened person or a third party, and as a result thereof the threatened person submits to such coercion, shall be liable to imprisonment for a term from five years to ten years and a fine of fifty percent of the highest bid price 3

submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher.

Section 7. Any person who by deceit or other means constitutes a cause for another person's inability to bid fairly or for such person to bid under a misunderstanding shall be liable to imprisonment for a term from one year to five years and a fine of fifty percent of the highest bid price submitted by the joint offenders or of the value of the contract that has been entered into with the State agency, whichever is the higher.

Section 8. Any person who fraudulently submits a bid to a State agency knowing that the bid price submitted is unusually low such that it is apparently inconsistent with the properties of the product or service, or offers beneficial consideration to the State agency that is much higher than entitled, with the objective of creating a barrier to fair competition, and such act constitutes a cause for an inability to perform properly under a contract, shall be liable to imprisonment for a term from one year to three years and a fine of fifty percent of the bid price or the value of the contract that has been entered into with the State agency, whichever is the higher.

In the case where an inability to perform properly under a contract under paragraph one causes the State agency to incur additional costs in connection with the completion of the objectives of such contract, the offender shall also indemnify the State agency for such expenses.

In the trial and adjudication of cases relating to the submission of bid to a State agencies, if requested, the Court shall also determine the additional costs borne by the State for the State agency under paragraph two.

Section 9. In the case where the commission of an offence under this act is made for the benefit of any juristic person, the managing partner, managing director, executives or authorised personnel in the operation of such juristic person's business or a person responsible for the operations of the juristic person on such matter shall also be deemed as joint principal offenders, unless it can be proven that he/she had no awareness of the commission of such offence.

Section 10. Any official of a State agency having the power or duty to approve, consider or perform any function in relation to a bid on any occasion, and who knows or should have known from the apparent circumstances that an offence under this Act was committed in the bid on such occasion, having failed to act in such manner as to abort proceedings relating to the bid on such occasion, shall have 4

committed an offence of misfeasance in office and shall be liable to imprisonment for a term from one year to ten years and a fine from twenty thousand baht to two hundred thousand baht.

Section 11. Any official of a State agency or any person entrusted by a State agency who fraudulently designs, fixes the price, prescribes conditions or determines benefits that would form the standard in the bid process with the object of preventing fair bid competition, or in order to assist any bidder in unfairly obtaining the right to enter into a contract with a State agency, or in order to prevent other bidders from fairly competing in the bid process, shall be liable to imprisonment for a term from five years to twenty years or life imprisonment and a fine from one hundred thousand baht to four hundred thousand baht.

Section 12. Any official of a State agency who commits an offence under this Act, or commits any act with the purpose of preventing fair competition by favouring any bidder as the person entitled to enter into a contract with a State agency, shall have committed the offence of misfeasance in office and shall be liable to imprisonment for a term from five years to twenty years or life imprisonment and a fine from one hundred thousand baht to four hundred thousand baht.

Section 13. A political position holder or member of a committee or sub-committee in a State agency, not being an official in the State agency, who commits an offence under this Act or commits any act on officials in the State agency having the power or duty to approve, consider or perform any function in relation to a bid in order to induce or compel the acceptance of a bid that involves an offence under this Act, shall be deemed as having committed an offence of misfeasance in office and shall be liable to imprisonment for a term from seven years to twenty years or life imprisonment and a fine from one hundred and forty thousand baht to four hundred thousand baht.

Section 14. The NCCC shall have the power to investigate facts relating to acts which are offences relating to the submission of bids to State agencies under this Act.

In the case where circumstances appear to the NCCC or a petition has been filed that a purchase, hire, exchange, lease, asset disposal, concession or grant of any rights of a State agency on any occasion involves an act which constitutes an offence under this Act, the NCCC shall expediently conduct an investigation, and if the NCCC considers that there is substance in the case, the following proceedings shall be taken: 5

(1) in the case where the offender is a State official or political position holder under the organic law on counter corruption, the NCCC shall instigate proceedings on such person pursuant to the organic law on counter corruption;

(2) in the case of persons other than (1), the NCCC shall file a complaint against such person to the investigation officer in order to take further proceedings; the fact-finding investigation report of the NCCC shall form the basis of proceedings taken by the investigation officer;

(3) in the case where the commission of an offence under this Act is an act of a State official or political position holder under (1) or other persons in connected cases of identical offences, whether as a principal, agent provocateur or aid and abettor, if the NCCC considers it appropriate to conduct an investigation for further proceedings on all such related persons at one time, the NCCC shall have the power to conduct an investigation of the persons related to the commission of the offence, and upon completion, a documentary report and opinion shall be submitted to the Office of the Attorney-General in order for a case to be filed at the court which has competent jurisdiction over such offenders; in this regard, the report of the NCCC shall be deemed as an investigation file under the law on criminal procedure; however, if the NCCC considers it appropriate for the investigation of such offence to be taken by an investigation officer under the law on criminal procedure, the NCCC shall submit the result of fact-finding investigation to the investigation officer who will take further proceedings.

Proceedings of the NCCC shall not abrogate the rights of persons or State agencies that have suffered losses as a result of an offence in the bid to file petitions or complaints under the law on criminal procedure.

Section 15. In an investigation for criminal proceedings against an offender under this Act, the NCCC shall have the following powers:

(1) to search for facts and compile evidence in order to acquire facts or prove an offence as well as to instigate legal proceedings to implicate the offender;

(2) to issue an order for government officials, officers or employees of State agencies to perform as necessary for the compilation of evidence by the NCCC, or summon documents or evidence relating to any person, or summon any person to give a testimony for the purpose of the investigation;

(3) to file motions at the court of competent jurisdiction for a warrant to enter a place of residence, place of business or other places, including vehicles belonging to any person, between sunrise and sunset or during business hours in order to examine, search, seize or attach documents, properties or other evidence relating to the matter which is subject to the factual inquiry, and if not completed within such time period, those acts may be continued until completion; 6

(4) to file motions at the court of competent jurisdiction for an arrest warrant and detention of an alleged offender who appears to be an offender during the factual inquiry or in relation to whom the NCCC resolves that there is substance in the allegations in order that he/she be sent to the Office of the Attorney-General for further proceedings;

(5) to request a police officer or investigation officer to comply with court warrants issued under (3) or (4);

(6) to prescribe rules by publication in the Government Gazette on matters relating to the investigation and inquiry of commission of offences under this Act and coordinate legal proceedings taken by the NCCC, investigation officer and State attorney.

In the exercise of functions under this Act, the President and members of the NCCC shall be administrative officials or senior police officers and shall have identical powers and duties to the investigation officer under the Criminal Procedure Code, and for the benefit of investigations, the NCCC shall have the power to appoint a sub-committee or competent official to exercise the functions of the NCCC. The appointed sub-committee or competent official shall be an investigation officer under the Criminal Procedure Code.

In the case where the NCCC submits an investigation report to the Office of the Attorney-General for further legal proceedings, in relation to proceedings leading to the issue of an order of prosecution or non-prosecution vested in the State attorney under the Criminal Procedure Code, the provisions prescribing powers and duties of the investigation official, National Police Commander or provincial governor shall be deemed as powers and duties of the NCCC.

Section 16. The Prime Minister shall have charge and control of the execution of this Act.

Countersigned by:

Chuan Leekpai
Prime Minister

NB:– The reasons for promulgating this Act are as follows. Whereas the procurement of products and services, whether by means of purchase or hire or other methods, of all State agencies are processes which expend budgetary appropriations, loans, financial assistance or revenues of the State agency, which are State funds, and the fact that the grant of rights to operate certain activities through concessions or other similar cases by the State are activities undertaken in the interest of the public, which are functions of the State; therefore, the procurement of such products and services as well as grant of rights must be conducted in a fair and just manner and by means of free competition for the greatest benefit to the State. However, operations in the past have experienced bid collusions and various circumstances, which were not true competitions to present the greatest benefit to the State agency and have incurred loss to the nation. Moreover, in some cases, political position holders or State officials were involved in or promotes the commission of an offence or fails to exercise their powers and duties, which worsened this problem. It is therefore appropriate that such acts are prescribed as offences in order to suppress such acts as well as prescribe offences and procedures for implicating political position holders and State officials so as to enhance the efficiency of such suppression measures. It is thus expedient to enact this Act.

APPENDIX H

Trade Competition Act B.E. 2542 (1999)

TRADE COMPETITION ACT
B.E. 2542 (1999) *
Bhumibol Adulyadej, Rex.,
Given on the 22nd day of March B.E. 2542;
Being the 54th Year of the Present Reign.

His Majesty King Bhumibol Adulyadej is graciously pleased to proclaim that:

Whereas it is expedient to have a law on trade competition by revising the rules relating to anti-monopoly provided in the law on pricing fixing and anti-monopoly;

Knowing that this law contains certain provisions in relation to the restriction of a person's rights and liberties in regard to which section 29 in conjunction with section 31, section 35, section 36, section 45, section 48 and section 50 of the Constitution of the Kingdom of Thailand so permit by virtue of provisions of law;

Be it, therefore, enacted by the King, by and with the advice and consent of the National Assembly, as follows:

Section 1: This Act is called the "Trade Competition Act, B.E. 2542 (1999)".

Section 2: This Act shall come into force after thirty days as from the date of its publication in the Government Gazette.**

Section 3: In this Act:

"business" means undertaking in agriculture, industry, commerce, finance, insurance, and services and shall include other undertakings prescribed by Ministerial Regulations;

"finance" means commercial banking under the law on commercial banking, finance and credit foncier businesses under the law on operation of finance, securities and credit foncier businesses, and securities business under the law on securities and securities exchange;

"business operation" means a distributor, manufacturer for distribution, orderer or importer into the Kingdom for distribution or purchaser for manufacture or redistribution of goods or a person engaging in the business of service providing;

"goods" means things capable of consumption and shall include documents of title to things; "service" means engaging in the provision of work, providing any right, authorizing the use or exploitation of any property or undertaking in return for remuneration in the form of money or other benefit but shall not include the hire of service;

"price" means a price of goods and shall also include remuneration for services provided;

"business operator with market domination" means one or more business operators in the market of any goods or service who have the market share and sales volume above that prescribed by the Committee with the approval of the Council of Ministers and published in the Government Gazette, provided that the market competition condition shall also be taken into consideration;

"Commission" means the Trade Competition Commission;

"member" means a member of the Trade Competition Commission;

"Secretary-General" means the Secretary-General of the Trade Competition Commission;

"competent official" means a Government official appointed by the Minister to perform activities under this Act;

"Minister" means the Minister having charge and control of the execution of this Act.

Section 4: This Act shall not apply to the act of:

1. Central administration, provincial administration or local administration;
2. State enterprises under the law on budgetary procedure;
3. Farmers' groups, co-operatives or co-operative societies recognised by law and having as their object the operation of businesses for the benefit of the occupation of farmers;
4. businesses prescribed by the Ministerial Regulation, which may provide for exemption from the application of this Act in whole or only in respect of any provisions thereof.

Section 5: The Minister of Commerce shall have charge and control l of the execution of this Act, provided that in respect of financial undertakings, the Minister of Commerce and the Minister of Finance shall jointly have charge and control, and shall have the power to appoint competent officials, issue Ministerial Regulations for the execution of this Act and issue Notifications thereunder.
Such Ministerial Regulations and Notifications shall come into force upon their publication in the Government Gazette.

CHAPTER I
Trade Competition Commission

Section 6. There shall be a Trade Competition Commission consisting of the Minister of Commerce as Chairman, Permanent-Secretary for Commerce as Vice-Chairman, Permanent-Secretary for Finance and not less than eight, but not more than twelve, qualified persons with knowledge and experience in law, economics, commerce, business administration or public administration appointed by the Council of Ministers, provided that at least one-half must be appointed from qualified members in the private sector, as members and the Secretary-General shall be a member and secretary.
The appointment of qualified persons under paragraph one shall be in accordance with the rules and procedure prescribed in the Ministerial Regulation.
Section 7. A qualified person appointed as member must not be a political official, holder of a political position, executive member or holder of a position with the responsibility in the administration of a political party.
Section 8. The Commission shall have the powers and duties as follows:
1. to make recommendations to the Minister with regard to the issuance of Ministerial Regulations under this Act;
2. to issue Notifications prescribing market share and sales volume of any business by reference to which a business operator is deemed to have market domination;
3. to consider complaints under section 18(5);
4. to prescribe rules concerning the collection and the taking of goods as samples for the purposes of examination or analysis under section 19(3);
5. to issue Notifications prescribing the market share, sales volume, amount of capital, number of shares, or amount of assets under section 26 Paragraph two;
6. to give instructions under section 30 and section 31 for the suspension, cessation, correction or variation of activities by a business operator;

7. to issue Notifications prescribing the form, rules, procedure and conditions for an application for permission to merge businesses or jointly reduce and restrict competition under section 35;

8. to consider an application for permission to merge businesses or jointly reduce or restrict competition submitted under section 35;

9. to invite any person to give statements of fact, explanations, advice or opinions;

10. to monitor and accelerate an inquiry sub-committee in the conduct of an inquiry of offences under this Act.

11. to prescribe rules for the performance of work of the competent officials for the purpose of the execution of this Act;

12. to perform other acts prescribed by the law to be powers and duties of the Commission;

13. to consider taking criminal proceedings as in the complaint lodged by the injured person under section 55.

Section 9. The qualified member under section 6 shall hold office for a term of two years. At the expiration of the term under paragraph one, if a new qualified member is not yet appointed, the qualified member who vacates office at the expiration of the term shall continue to hold office for the purpose of the performance of work until a newly appointed qualified member takes office.

The qualified member who vacates office at the expiration of the term may be re-appointed but may not serve for more than two consecutive terms.

Section 10. The provisions of section 75, section 76, section77, section 78, section 79, section 80, section 81, section 82 and 83 of the Administrative Procedure Act, B.E. 2539 (1996) shall apply to the appointment of a qualified member, the vacation of office of a qualified member and a meeting of qualified members mutatis mutandis, and a qualified member shall also vacate office upon being under the prohibitions under section 7.

Section 11. The Commission may appoint a sub-committee to consider and make recommendations on any matter or perform any act as entrusted and prepare a report thereon to the Commission.

Section 12. The Commission shall appoint one or more specialised sub-committees consisting of, for each sub-committee, not less than four and not more than six persons qualified in the matter concerned and having knowledge and experience in various fields such as law, science, engineering, pharmacology, agriculture, economics, commerce, accountancy, or business administration as members, with the representative of the Department of Internal Trade as member and secretary.

The specialized sub-committee shall elect one member as the Chairman.

Section 13. The specialized sub-committee has the duty to consider and give opinions to the Commission on the following matters, as entrusted by the Commission:

1. the matter concerning the conduct indicative of market domination, a merger of businesses, the reduction or restriction of competition under section 25, section 26, section 27, section 28 and section 29;

2. the consideration of an application for permission to merge businesses or initiate a reduction or restriction of competition under section 37;

3. other matters to be considered at the request of the Commission and other acts to be performed as entrusted by the Commission.

For the purpose of this Act, a specialised sub-committee may submit opinions or recommendations to the Commission with regard to the execution of this Act. In carrying out the acts under paragraph one, the specialised sub-committee shall have the power to issue a written summons instructing the persons concerned to give statements or furnish documents or any other evidence for supplementing its consideration.

Section 14. The Commission shall appoint one or more inquiry sub-committees consisting of, for each sub-committee, one person possessing knowledge and experience in criminal cases who is appointed from police officials, public prosecutors and, in addition, not more than four persons possessing knowledge and experience in economics, law, commerce, agriculture, or accountancy, as members, with the representative of the Department of Internal Trade as member and secretary.

The inquiry sub-committee shall have the power and duty to conduct an investigation and inquiry in relation to the commission of offences under this Act and, upon completion thereof, submit opinions to the Commission for further consideration.

The inquiry sub-committee shall elect one member as the Chairman.

Section 15. In the performance of duties under this Act, a member of the Commission and member of an inquiry sub-committee under section 14 shall have the same powers and duties as an inquiry official under the Criminal Procedure Code.

Section 16. In the case where the Commission submits to the public prosecutor the opinion for prosecution, an objection to the public prosecutor's non-prosecution order under the Criminal Procedure Code shall be the power, vested in the Commissioner-General of the Thai Royal Police Force of the Changwad Governor as the case may be, to be instead exercised by the Chairman of the Commission.

Section 17. The provisions of section 9 and section 10 shall apply mutatis mutandis the sub-committee, specialised sub-committee and inquiry sub-committee.

CHAPTER II
Office of the Trade Competition Commission

Section 18. There shall be established the Office of the Trade Competition Commission in the Department of Internal Trade, Ministry of Commerce, with the Director-General, who shall be the superior official responsible for the official affairs of the Office, with the powers and duties as follows:

1. to carry out administrative tasks of the Commission, Appellate Committee and sub-committees appointed by the Commission;
2. to prescribe regulations for the purpose of the work performance of the Office of the Trade Competition Commission;
3. to monitor the movement and oversee conduct of business operators and report the same to the Commission;
4. to conduct studies, analyses and research into goods, services, and conduct in the operation of business and make recommendations and give opinions to the Commission on the prevention of market domination, mergers of businesses, reduction and restriction of competition in the operation of businesses;

5. to receive complaints by which it is alleged by any person that violation of this Act has been committed and to consider the same for submission to the Commission for its consideration, in accordance with the regulations prescribed and published in the Government Gazette by the Commission;

6. to co-ordinate with Government agencies or agencies concerned with the performance of duties under this Act;

7. to perform activities in the implementation of Notifications, regulations and resolutions of the Commission and perform such acts as entrusted by the Commission, Appellate Committee or sub-committees appointed by the Commission.

Section 19. In the execution of this Act, the competent official shall have the following powers:

1. to issue a written summons requiring any person to give statements, facts or written explanations or furnish accounts, records, documents or any evidence for examination or supplementing his consideration;

2. to enter a place of business, manufacture place, distribution place, purchasing place, warehouse, or service place of the business operator or any person or other place reasonably suspected to accommodate the imminent commission of an offence under this Act for the purpose of examining and ensuring the compliance with this Act or searching for and attaching evidence or property capable of forfeiture under this Act or arresting offenders under this Act without warrant in the following circumstances: (a) a fragrant offence is apparently being committed in the premises; (b) the person having committed a fragrant offence has entered, while being pursued, or is reasonably and firmly suspected to have hidden in the premises; (c) it is reasonably suspected that the evidence or property susceptible of forfeiture under this Act in the premises provided that it must also be reasonably suspected that the delay in the process of securing a warrant will result in the evidence or property being moved, hidden, destroyed or transformed from its original state; (d) the person to be arrested is the owner of the premises and such arrest is one under a warrant or can be carried out without warrant; For these purposes, the competent official shall have the power to inquire into facts or summon accounts, records, documents or other evidence from the business operator or from the persons concerned and instruct such persons in such premises to perform such act as is necessary;

3. to collect or take goods, in a reasonably quantity, as samples for an examination or analysis without payment of the prices of such goods, in accordance with the rules prescribed by the Commission in the Government Gazette;

4. to attach documents, accounts, records or evidence for the purpose of examination and taking legal proceedings under this Act .

Section 20. In the performance of duties of the competent official, a person concerned shall render reasonable assistance.

Section 21. In the performance of duties, the competent official shall produce an identity card to the persons concerned.

The identity card shall be in accordance with the form prescribed by the Minister in the Government Gazette.

Section 22. The competent official shall send a written summons under section 13 paragraph 3, section 19 (1) or section 44 (3) to a domicile or place of business of the person specified therein between sunrise and sunset of during the working hours of such person or may send the same by registered post requiring acknowledgement of receipt thereof.

In the case when the competent official has sent the summons under paragraph one but the person specified in the summons refused to accept it without justifiable ground, the competent official shall request an administrative or police officer to accompany him as a witness in order to leave the summons at such place. If the person specified in the summons is not found at his domicile or place of business, the summons may be sent to any person who is sui juris and residing at or working in such building or place of business. If no one is found or someone is found but refuses to accept the summons, the summons shall be posted in a conspicuous place at such domicile or place of business before the administrative or police officer so accompanying as a witness.

When the competent official has taken action under paragraph one or paragraph two, it shall be deemed that the person specified in the summons has received such summons, in the case of posting, at the expiration of five days after the date of posting, and, in the case of sending by a registered post requiring acknowledgement of receipt, at the expiration of five days as from the date of its receipt.

Section 23. In the execution of this Act, members, members of the Appellate Committee or sub-committee, Secretary-General, and competent officials shall be the officials under the Penal Code.

Section 24. For the purpose of arresting offenders under this Act, the competent official shall have the same powers as administrative or police officers under the Criminal Procedure Code.

An arrest of an offender may be made without a warrant when there appears the commission of a flagrant offence or other ground on which the administrative or police officer is permitted to make an arrest under the Criminal Procedure Code.

CHAPTER III
Anti-Monopoly

Section 25. A business operator having market domination shall not act in any of the following manners:

    1. unreasonably fixing or maintain purchasing or selling prices of goods or services;

    2. unreasonably fixing compulsory conditions, directly or indirectly, requiring other business operators who are his customers to restrict services, production, purchase or distribution of goods, or restrict opportunities in purchasing or selling goods, receiving or providing services or securing credits from other business operators;

3. suspending, reducing or restricting services, production, purchase, distribution, deliveries or importation without justifiable reasons, destroying or causing damage to goods in order to reduce the quality to that lower than the market demand ;

4. intervening in the operation of business of other persons without justifiable reasons.

Section 26. A business operator shall not merge businesses, which may result in monopoly or unfair competition as prescribed and published in the Government Gazette by the Commission unless the Commission's permission is obtained.

The publication by the Commission under paragraph one shall specify the minimum amount or number of market share, sale volume, capital, shares or assets in respect of which the merge of businesses is governed thereby.

The merger of businesses under paragraph one shall include:

1. a merger made by a manufacturer with another manufacturer, by a distributor with another distributor, by a manufacturer with a distributor, or by a service provider with another service provider, which has the effect of maintaining the status of one business and terminating the status of the other business or creating a new business;

2. a purpose of the whole or part of assets of another business with a view to controlling business administration policies, administration and management;

3. a purpose of the whole or part of shares of another business with a view to controlling business administration policies, administration and management;

The application by a business operator for the permission under paragraph one shall be submitted to the Commission under section 35.

Section 27. Any business operator shall not enter into an agreement with another business operator to do any act amounting to monopoly, reduction of competition or restriction of competition in the market of any particular goods or any particular service in any of the following manners:

1. fixing selling prices of goods or services as single price or as agreed or restrict the sale volume of goods or services;

2. fixing buying prices of goods or services as single price or as agreed or restrict the purchase volume of goods or services;

3. entering into an agreement to have market domination or control;

4. fixing an agreement or condition in a collusive manner in order to enable one party to win a bid or tender for the goods or services or in order to prevent one party from participating in a bid or tender for the goods or services;

5. fixing geographical areas in which each business operator may distribute or restrict the distribution of goods or services therein of fixing customers to whom each business operator may sell goods or provide services to the exclusion of other business operators from competition in the distribution of such goods or services;

6. fixing geographical areas in which each business operator may purchase goods or services or fixing persons from whom business operators may purchase goods or services;

7. fixing the quantity of goods or services which or to which each business operator may manufacture, purchase, distribute, or provide services with a view to restricting the quantity to be that lower than the market demand;

8. reducing the quality of goods or services to a level below that of previous production, distribution or provision, whether the distribution is made at the same or at a higher price;

9. appointing or entrusting any person as a sole distributor or provider of the same goods or services or those of the same kind;

10. fixing conditions or procedures in connection with the purchase or distribution of goods or services in or order to ensure the uniform or agreed practice.

In the case where it is commercially necessary that the acts under (5),(6),(7),(8),(9) or (10) be undertaken within a particular period of time, the business operator shall submit to the Commission under section 35 an application for permission.

Section 28. A business operator who has business relation, with business operators outside the Kingdom, whether contractual or through policies, partnership, shareholdings or in the form of relation of any other similar description, shall not carry out any cat in order that a person who is in the Kingdom and intends to purchase goods or services for personal consumption will have restricted opportunities to purchase goods or services directly from business operators outside the Kingdom.

Section 29. A business operator shall not carry out any act which is not free and fair competition and has the effect of destroying, impairing, obstructing, impeding or restricting business operation of other business operators or preventing other persons from carrying out business or causing their cessation of business.

Section 30. The Commission shall have the power to issue a written order instructing a business operator who has market domination, with market share of over seventy five percent, to suspend, cease or vary the market share. For this purpose, the Commission may prescribe rules, procedure, conditions and time limit for compliance therewith.

Section 31. In the case where the Commission considers that a business operator violates section 25, section 26, section 27, section 28 or section 29, the Commission shall have the power to issue a written order instructing the business operator to suspend, cease or vary such act. For this purpose, the Commission may prescribe rules, procedure, conditions and time limit for compliance therewith.

The business operator who receives the order under paragraph one and disagrees therewith shall have the right to appeal under section 46.

The business operator may not claim compensation from the Commission by reason that the Commission has issued the order under paragraph one.

Section 32. In the consideration of the case under section 31, the Commission must afford the business operator, members of a specialised sub-committee, members of an inquiry sub-committee or competent officials concerned a reasonable opportunities to give explanations and present supporting evidence.

In issuing an order under section 31, the Commission must specify reasons for such order both in respect of questions of fact and in questions of law, and signatures of the members considering the case shall be entered.

The notification of the order under paragraph two shall be carried out within seven days as from the day the Commission issues the order, and section 22 shall apply mutatis mutandis.

Section 33. The person receiving the order under section 31 must comply with such order unless the Court or the Appellate Committee gives a decision or issues an order suspending the execution thereof or revoking the order of the Commission.

Section 34. In the case where the Court gives a judgment that any business operator is guilty of an offence under section 25, section 26, section 27, section 28 or section 29, the Court shall issue an order instructing the business operators to suspend, cease, rectify or vary such act.

CHAPTER IV
Application for Permission and Consideration of Application

Section 35. Any business operator wishing to apply for permission to carry out the act under section 26 or section 27(5),(6),(7),(8),(9) or (10) shall submit an application in accordance with the form, rules, procedure and conditions prescribed and published by the Commission in the Government Gazette.

The application must at least:
1. contain adequate reasons and specify necessity for the act;
2. specify the intended procedures therefor;
3. specify the duration therefor.

Section 36. The Commission shall complete the consideration of the application under section 35 within ninety days as from the date of its receipt; provided that the business operators, members of the specialized sub-committee and competent officials concerned must be given reasonable opportunities to give explanations and present supporting evidence.

In the case where the consideration cannot be completed within the time specified in paragraph one on account of necessity, the Commission may extend an extension of time for not more than fifteen days, but the reasons and necessity for the extension shall also be recorded therein.

Section 37. When the Commission has made an inquiry and is of the opinion that the application under section 35 submitted by the business operator is reasonably necessary in the business, beneficial to business promotion, has no serious harm to the economy and does not affect material and due interests of general consumers, the Commission shall issue such business operator with a written order granting permission. But if the Commission issues an order rejecting permission, the order shall be notified in writing to the business operator without delay. In granting permission under paragraph one, the Commission may fix the time or any condition for compliance by the business operator to whom permission is granted, and, if it is of the opinion that economic situations, facts or conduct relied on by the Commission in its consideration have changed, the Commission may amend, make addition to or revoke such time or conditions at any time.

The business operators who receives the Commission's order and disagrees with such order shall have right to appeal under section 46.

Section 38. The Commission must specify reasons for the order granting or rejecting permission under section 37 both in questions of fact and in questions of law and the order shall contain signatures of the members considering the application, and section 32 paragraph three shall apply mutatis mutandis.

Section 39. The business operator to whom permission is granted under section 37 must carry out the business within the scope, duration and conditions permitted by the Commission.

In the case where there is a violation of or failure to comply with paragraph one, the Commission shall have power to revoke the permission order under section 37 in whole or in part and may also fix the time within which compliance is required.

CHAPTER V
Initiation of an Action for Compensation

Section 40. The person suffering injury as a consequence of the violation of section 25, section 26, section 27, section 28 or section 29 may initiation an action for claiming compensation from the violator.

In initiating an action for claiming compensation under paragraph one, the Consumer Protection Commission or an association under the law on consumer protection has the power to initiate an action for claiming compensation on behalf of consumers or members of the association, as the case may be.

Section 41. If the action for claiming compensation under section 40 is not submitted to the Court within one year as from the day the person suffering the injury has or ought to have had the knowledge of the ground thereof, the right to submit the case to the Court shall lapse.

CHAPTER VI The Appeal

Section 42. There shall be an Appellate Committee consisting of not more than seven qualified persons having knowledge and experience in law, economics, business administration or public administration appointed by the Council of Ministers as members.

The member of the Appellate Committee shall elect one member among themselves as Chairman. The Director-General of the Department of Internal Trade shall appoint Government officials within the Department of Internal Trade to act as secretary and assistant secretaries.

Section 43. The person appointed as member of the Appellate Committee must not be under the prohibitions under section 7 and shall not be a member of the Commission.

Section 44. The Appellate Committee shall have the following powers and duties:

1. to prescribe the rules and procedure for the appeal under section 47 paragraph one;
2. to consider and decide on the appeal against an order of the Commission under section 31 or section 37;
3. to issue a summons requiring the persons concerned to give statements or furnish documents or evidence for supplementing the consideration of the appeal;

4. to issue an order suspending the execution of the order of the Commission under section 31 or section 37.

Section 45. A member of the Appellate Committee shall hold office for a term of four years. In the initial period, at the expiration of two years, three members of the Appellate Committee shall vacate office by drawing lots and such vacation of office by drawing lots shall be deemed as the vacation of office at the expiration of term.
Section 9 paragraph three and section 10 shall apply to the Appellate Committee mutatis mutandis.
Section 46. The appeal against the order of the Commission under section 31 and section 37 shall be submitted to the Appellate Committee by the person receiving the order within thirty days as from the date of the knowledge of the Commission's order.
Section 47. The rules and procedure for the appeal shall be as prescribed and published in the Government Gazette by the Appellate Committee.
The Appellate Committee shall consider and decide on the appeal within ninety days as from the date of the receipt thereof and notify the decision in writing to the person submitting the appeal, and section 36 and section 38 shall apply mutatis mutandis.
The decision of the Appellate Committee shall be final.
When the Appellate Committee has decided upon the appeal, the Commission and business operators shall comply with such decision.

CHAPTER VII
Penalties

Section 48. Any person who fails to comply with the summons issued by a specialised sub-committee, competent officials or the Appellate Committee under section 13 paragraph 3, section 19(1) or section 44(3), as the case may be, shall be liable to imprisonment for a term not exceeding three months or to a fine not exceeding five thousand Baht or to both.
Section 49. Any person who obstructs the performance of duties by the competent officials under section 19(2), (3) or (4) or section 22 shall be liable to imprisonment for a term not exceeding one year or to a fine not exceeding twenty thousand Baht or to both.
Section 50. Any person who fails to render assistance to the competent officials under section 20, shall be liable to imprisonment for a term not exceeding one month or to a fine not exceeding two thousand Baht or to both.
Section 51. Any person who violates section 25, section 26, section 27, section 28 or section 29 or fails to comply with section 39 shall be liable to imprisonment for a term not exceeding three years or to a fine not exceeding six million Baht or to both, and, in the case of the repeated commission of the offence, shall be liable to the double penalty.
Section 52. Any person who fails to comply with the order of the Commission under section 30 or section 31 or with the decision of the Appellate Committee under section 47 shall be liable to imprisonment for a term of one year to three years or to a fine of two million to six million Baht, and to a daily fine not exceeding fifty thousand Baht throughout the period of such violation.
Section 53. Any person discloses information concerning the business or operation of a business operator which, according to the ordinary course of dealing of the business

operator, is the restrictive and confidential information and which such person has acquired or knew on account of the performance under this Act shall be liable to imprisonment for a term not exceeding one year, or to a fine not exceeding one hundred thousand Baht or to both, unless it is the disclosure in the performance of Government service or for the purpose of investigation or trial.

Any person who acquires or has the knowledge of any fact from the person under paragraph one and discloses such information in the manner likely to cause damage to any person shall be liable to the same penalty.

Section 54. In the case where the offender who is liable to the penalty under this Act is a juristic person, the managing director, managing partner, or person responsible for the operation of the juristic person in that particular matter shall also be liable to the penalty provided for such offence unless he can prove that such act was committed without his knowledge of consent or that he already took appropriate precaution in preventing such offence.

Section 55. The injured person in the offences under section 51 and section 54 may not institute a criminal action on his own motion but shall have the right to loge a complaint with the Commission for consideration under this Act.

Section 56. All offences under this Act which are punishable by fine or imprisonment for a term not exceeding one year shall be under the power of the Commission to settle the cases. In exercising such power, the Commission may entrust a sub-committee, the Secretary-General or a competent official to act for him. When the offender has paid the fine in the amount settled within the specified period, the case shall be deemed settled under the provision of the Criminal Procedure Code.

Transitory Provision

Section 57. In the case where a business operator is under necessity and has carried on the acts specified in section 27(5), (6), (7), (8), (9) or (10) on the day this Act comes into force, such person shall submit an application within ninety days as from the date of the entry into force of this Act, and when the application has been submitted, such business operator may continue to carry out the acts under section 27(5), (6), (7), (8), (9) or (10) until he receives the notification of the result of the consideration of the application.

*Tentative Translation by Dr. Pinai Nanakorn, Legal Officer of the Foreign Law Division, Office of the Council of State. The translation is, at this stage, hurriedly prepared in the translator's personal capacity and on a non-remunerative basis in favour to the Department of Interior Trade for use in its seminar and for academic purposes.

** Published in Government Gazette, Vol. 116, Part 22b, dated 31st March 1999.

```
┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
         Competition    Authority
└─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
```

Trade Competition Commission-TCC

Ex-Officio Commissioners (3)	Qualified Commissioners Appointed by the Council of Minister (8-12 qualified persons)

• **Chairman** Minister of Commerce • **Vice Chairman** Permanent Secretary Ministry of Commerce • **Secretary** Secretary-General Office of TCC (Director-General, Dept. of Internal Trade)	**Qualifications** • **With knowledge & experience** Laws, Economics, Commerce, Business administration, Public administration • **Not a political officials,** Holder of a political position Executive members or holder of a position with theresponsibilities in the administration of a political party

Powers and Duties of the Trade Competition Commission
- To issue the Ministerial Regulations under the Act.
- To issue Notification prescribing market share, sales volume, amount of capital, number of shares, or amount of assets of which a business operator is required to comply with the Act.
- To issue Notification prescribing the form, rules, procedure and conditions for the merger application and restrictive agreements application.
- To consider merger application and restriction agreement application for permission.
- To consider complaints by which it is alleged by any person that violation of the Act.
- To prescribe rules for the purposes of examination or analysis.
- To give orders for suspension, cessation, correction of the business activities.
- To invite any particular person to give facts, explanations, advice or opinions.

BIOGRAPHY

NAME	Sutthi Suntharanurak
ACADEMIC BACKGROUND	Bachelor of Economics from Thammasat University, Bangkok Thailand in 1998 and Master of Economics (Development Economics) from National Institute of Development Administration (NIDA), Bangkok Thailand in 2001
PRESENT POSITION	Government Auditor, Professional Level Office of the Auditor General of Thailand
EXPERIENCES	Government Auditor of Office of the Auditor General of Thailand since 5th October 1998 1998-2006 Public Procurement Auditor 2006- Present Performance Auditor