Buyers' Cartels

An Empirical Study of Prevalence and Economic Characteristics

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1 Introduction

1.1 Objective

The objective of this paper is to measure the frequency of buyers' cartels across industry and time, and to determine whether buyers' cartels have any distinctive economic characteristics compared to sellers' cartels. Ultimately, this study may contribute to an improved understanding of the economic functioning of price-fixing conduct and of public policies to control illegal cartel behaviors.

1.2 Justification

The subject of buyers' cartels is most often discussed in the economic literatures at a theoretical possibility, but it is only rarely studied as an empirical phenomenon or policy problem. Even looking into some textbooks on "industrial organization" or "industrial economics", theories of the buyers' cartel are seldom discussed; if they are discussed, the analysis is very brief. In fact, most industrial organization models have traditionally focused on sellers' strategies and theoretically taken buyers' cartels as the mirror image of sellers' side. A literature search found few empirical studies of buyers' cartels.

As voices on farmers' being exploited position on both inputs and outputs sides have never stopped, the public interests now turn to competition issues in agricultural sector. A recent publican on antitrust policy proposals addressed to the 44th U.S. President referred to concerns about buyer power as "the new kid on the block" (AAI, 2008b). In early 2010, U.S. DOJ Antitrust Division and USDA held a serious of joint workshops to address competition issues in agriculture industry including buyer power.

Frequently involved in procurement auction, the bid rigging against government

procurement is another concern. Empirical studies find that bid rigging against government tend to suffer heavier punishments. (Connor, 2009) From this point of view, the 40 buyers' cartel undercharge observations involved with bid rigging provided in Appendix Table may provide evidence for whom who has further interests.

1.2.1 Definition and Economics of Cartels

Connor (2007: 21) defined cartel as "an association of two or more legally independent firms that explicitly agree to coordinate their prices or output for the purpose of increasing their collective profits." In this definition, cartels are *overtly* collusive groups, that is, their members make explicit agreements or contracts to cooperate, but keep their agreements secret from their customers and from competition-law authorities. The agreement is explicit when it is established through the firms' directly communicating about price changes or output levels, typically in the form of a written or verbal contract. Members in the group attempt to raise and share the joint profits that incentivize each member to remain in the group. This behavior is called joint-profit maximization.

At the same time, *individual* profit maximization provides an incentive for each cartel member to deviate from ("cheat") the agreement on price or output targets. According to Greer (1980), cartelization is likely to occur only when it is feasible to achieve the joint-profit maximization. "Feasibility" refers to the condition when firms' joint-profits overweight the cost of private enforcement of an agreement. It is usually infeasible when there is large number of small firms selling standardized product, and it costs too much to form or implement an explicit agreement relative to the monopoly-profits benefit to the group.

Figure 1 illustrates the economics of a perfect competitive market. Consumers'

willingness to buy is reflected in the demand curve. It comes with the idea of consumer

sovereignty, the way in which consumers choose to purchase or not. The demand curve is

downward sloping because usually products are normal goods, and only at diminishing prices

would consumers like to demand more units of a commodity, which is consistent with the law

of diminishing marginal utility. Assuming each individual household has the same demand (d_i)

for one good (Figure 1, c), the market demand (D) is the horizontal sum of the demand of

individual households (Figure 1, b). On the supply side of a market, a producer's ability to

make and sell is reflected in the supply curve. It is either flat or upward sloping. Assuming

that all sellers have the same cost of mc_i (Figure 1, a), the market supply curve S (Figure 1, b)

is the total marginal costs of the production for the industry.

In a perfect competitive market, the market supply and demand functions decide the

long run equilibrium market outcome (P_c, Q_c) (Figure 1, b). However, individual firms in the

perfect competitive market as price takers passively accept the market price (P_c) as their

demand function (p_c), which also equals to the marginal revenue of production. In industrial

structures of all types (competition, oligopoly, and monopoly), sellers maximize economic

profits by following the same rule: MR=MC. Thus in perfect competition, individual sellers

maximize profit with the optimum output (p_c, q_c) obtained where mc equals to mr (Figure 1,

a)

Figure1. Market Equilibrium in Perfect Competition

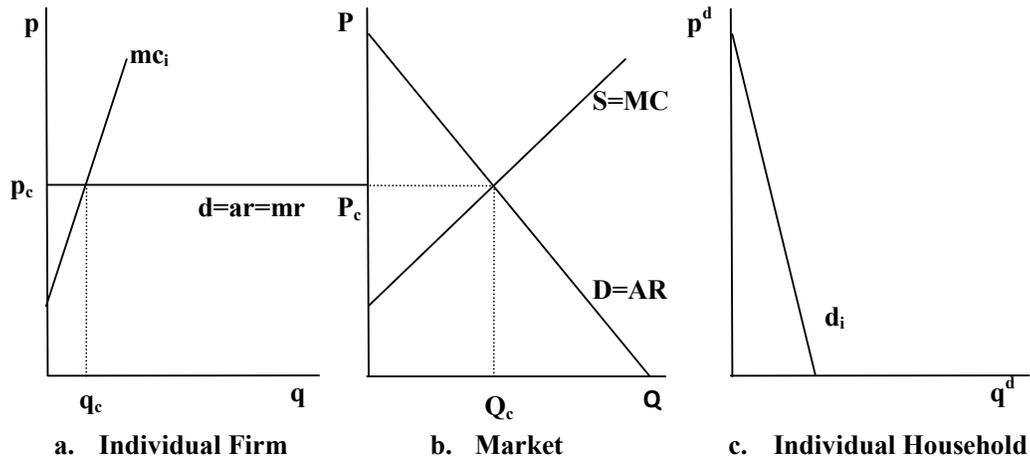a. **Individual Firm**   b. **Market**   c. **Individual Household**

Figure 2 interprets how a buyers' cartel would set price to make monopoly profits. A monopoly market consists of a single seller and many buyers. The vision of the seller then changes from taking the price as given, to owning the entire market demand. The buyer with market power is able to set price and maximize its profit. Since the monopolist sets both quantity and price, the firm's supply schedule cannot be determined, in other words, a monopolist does not have a supply curve. When a sellers' cartel is formed in the industry, it will apply the profit maximizing rule of MC=MR and set the price to what a monopolist would charge at P_m, where consumers would to consume Q_m. As producers are not able to force consumers to purchase more than Q_m, suppliers have to squeeze their output from Q_c to Q_m as well. At the same time, the marginal cost moves from MC_c to MC_m. This gives the market participants a new level of revenue from $P_c * Q_c$ in perfect competition to $P_m * Q_m$ in collusion periods. So the sellers' profits will increase from zero in the competitive market to the rectangle (A+B) at where the monopoly profits are achieved.

Figure 2. Profit Maximization by a Monopolist
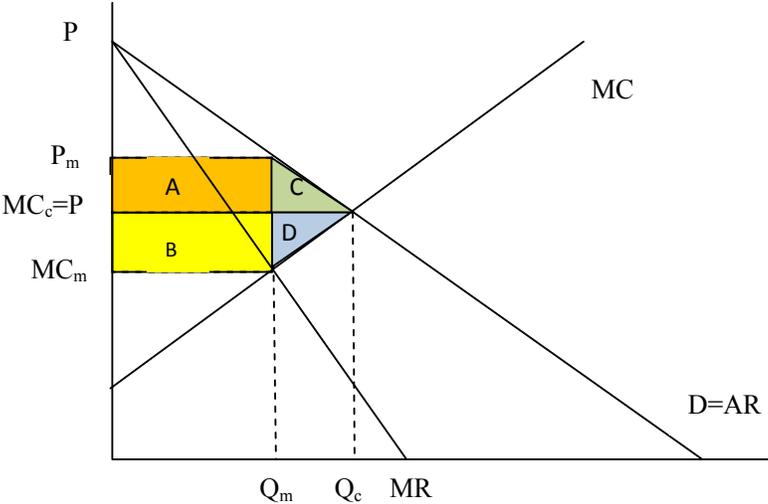
Cartel formation changes the industry structure from an oligopoly to a monopoly (Figure 3). A cartel's marginal cost MC_T equals to the sum of each cartel members (firm1 and firm2). Applying the profit maximizing rule of MR=MC, a cartel would fix the price at P_T with the total output of Q_T, a sum of each firm's output (Q_1+Q_2). The profit created by cartelization is still the rectangular (A+B).

Figure 3. Profit Maximization by a Cartel
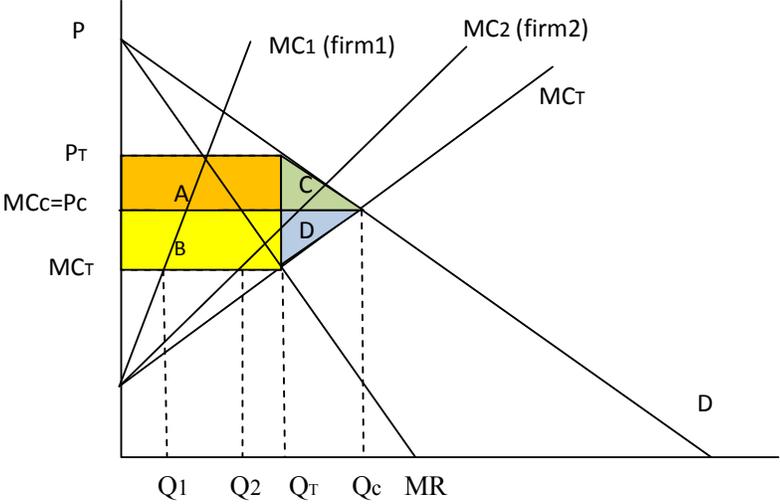
In theory or under ideal conditions, a cartel's profit will be equal to the profit of a hypothetical monopolist in that market. Empirically, however, cartels typically generate somewhat lower profits. As Dr. Connor (1997:44) discussed, "In actual market, a cartel may fail to attract all the suppliers, may fear impending entry, or may miscalculate. If so, the market price will be somewhat below P_m. Similarly, the cartel may incur additional costs in policing its agreement, which would raise its costs above MC_m and cause some reduction in profits." Similarly, even monopolists sometime do not capture all of their potential monopoly profits because of rent-seeking behavior. Rent seeking is the capture of economic rent through manipulation, whereby the economic rent refers to an excess of the opportunity cost of a resource. A monopoly rent example is that if the monopoly rents are captured through lobbying, then the resources spent in pursuit of the monopoly rent received from consumers to monopolist would be wasted as social costs. This is because no production added to the society. (Tollison, 1982)

Another effect of cartelization is that it changes the social welfare of buyers. As indicated in both Figure 2 and Figure 3, consumer surplus decreases with (A+C), producer surplus increase with (A-D), thus the deadweight loss is (C+D). The deadweight loss is caused by withdrawing buyers' from the market for unacceptable prices, and sellers' reduced use of input resources as they squeeze the output level below Q_c.

Traditionally, industrial economists view buyers' cartel as the mirror image of sellers' cartel (Table 1). A buyers' cartel may therefore aim to maximize the profits that a monopsonist would attain.

Table 1. Monopoly vs. Monopsony as Mirror Images

Sellers' Cartel	Buyers' Cartel
Monopoly profits	Monopsony profits
Marginal Revenue	Marginal Expenditure
Marginal Cost	Marginal Revenue Product
MR=MC	MRP=ME

The economics of the monopsonist's profit maximized condition is indicated in Figure 4. With the assumption that a vegetable processing firm's output depends on the single input of tomatoes (T), the marginal revenue product of tomato (MRPT) is the additional revenue created by each additional unit of tomato employed. Marginal expenditure on tomato (MET) is the rate of the change of firm's total cost over the unit change of tomatoes:

$$ME_T=\Delta TC/\Delta T= (S_T\Delta T+T\Delta S_T)/ \Delta T= S_T+T(\Delta S_T/\Delta T)$$

The tomato supply S_T(T) is upward sloping. As $\Delta S_T/\Delta T >0$, therefore MET$>S_T$ (T), that is, the marginal expenditure curve lies above the tomato supply curve. Similar to the monopoly's profit maximization condition of MR=MC, a monopsonist will achieve the maximized profit where MRP=ME, or MRPT=MET in this case. This is because when MRPT>MET, the firm would input more tomatoes to earn higher profits; when MRRT<MET, the firm would be better off if stopped tomato processing.

Figure 4. Market Equilibrium at Monopsony
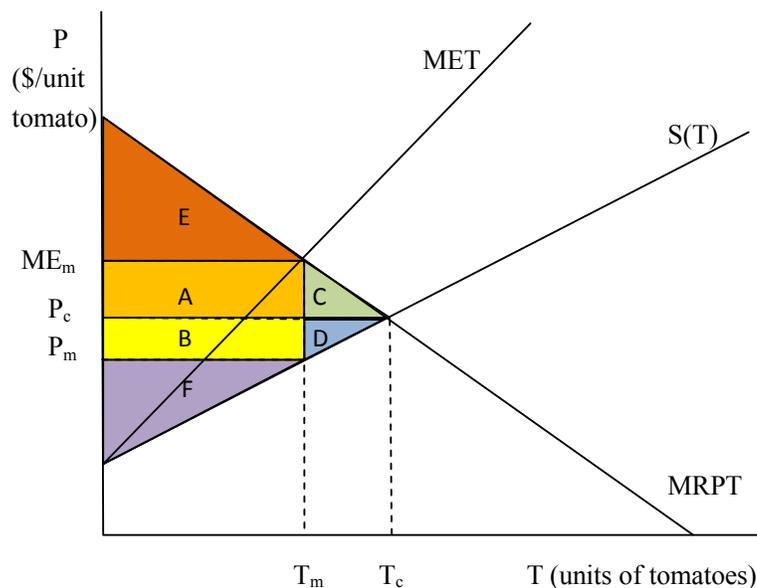
As the monopoly changes the social welfare, the monopsony condition also incurs social deadweight loss. Consumer surplus goes up from (A+C+E) under perfect competitive market to (A+B+E) in monopsony, while producer surplus goes down from (B+D+F) in perfect competition to only F with monopsony power. Thus there is a welfare transfer of B from sellers to buyers. The total social welfare ends up with a deadweight loss of (C+D).

1.2.2 Textbook Survey of Cartel Studies

Most economists directly view buyers' cartels as the mirror image of sellers' cartel. In fact, for the list of industrial economics textbooks I have searched (Table 2), either by looking through Subject Index and book chapters on market power and collusive strategies, or using search tools in Google Books with keywords such as "monopsony", there is only one textbook citing an empirical study on a buyers' cartel, that of professional sports leagues (Katz, 1994). Most textbooks instead, allocate relatively very short paragraphs to discuss bid

rigging, buyer power, countervailing power, monopsony, and oligopsony.

Table 2. Textbook Survey on Cartel Studies List

	Authors/Sources	Buyer power	Monopsony	Oligopsony	Buyer Cartel
1	David A. Besanko, Ronald R. Braeutigam	1	1	1	0
2	Nicolas Boccard (2006)	1	1	0	0
3	Edgar K. Browning, Mark A. Zupan (1996)	1	1	0	1
4	Luis M. B. Cabral (2000)	0	0	0	0
5	Carton and Perloff	0	1	0	0
6	Roger Clarke (1985)	1	1	0	0
7	John M. Connor (2007)	1	0	0	1
8	Douglas F. Greer (1984)	1	0	0	1
9	Richard E.Just, Darrell L. Hueth, Andrew Schmitz (1982)	0	1	1	0
10	Katz (1997)	1	1	1	1
11	H. W. de Jong, and William G. Shepherd (2007)	1	1	0	0
12	Stephen Martin (2010)	0	0	0	0
13	Thomas A. Pugel (2009)	0	1	0	0
14	Ivan Png, and Dale Lehman (2007)	1	1	0	0
15	F.M.Scherer (1990)	1	1	1	0
16	Oz Shy (1996)	0	0	0	0
17	Jean Tirole (1988)	0	1	0	0
18	Elmar Wolfstetter (1999)	1	0	0	0

Note: 0= topic does not appear in the textbook, 1=topic appears in the textbook.

"Buyer power" is often included when introducing the market power chapter into

textbooks, but only in eleven out of eighteen cases. Moreover, discussion of market power on buyers' side is very superficial compared to sellers' power. Similarly, monopsony theory, if developed at all, is also taken as a supplemental component under monopoly chapter. Only four out of eighteen textbooks address the topic of oligopsony, which is the theory required to discuss buyer's cartels. For monopsony power, Wal-Mart's supply chain is often the example being used (Besanko and Braeutigam, 2009). In my survey, there are only two textbooks spending significant space discussing buyer power in terms of inputs competition (Tirole, 1988) and vertical integration (Scherer, 1990). Overall the textbook survey shows that theoretical discussions of strategic market conduct are mainly focused on sellers. More importantly, with respect to empirical treatments of buyer power, most textbooks are silent on the subject. A leading expert says that:

> "A quantitative picture of how much buyer concentration exists is difficult to secure, for there are no statistical series analogous to the abundant data on seller concentration." (Scherer, 1990: 517).

I have not found a generally accepted definition of buyer power. Perhaps the best one is the American Antitrust Institute's view: buyer power is "the ability of a buyer to depress the price it pays a supplier or to induce a supplier to provide more favorable nonprice terms". (AAI, 2008b) Most other definitions of buyer power omit references to terms of trade. An example of a more favorable condition of sale is the coverage of transaction costs such as deliver fees.[1] Effects of buyer power can be different from whether it is exercised through monopsony power or countervailing power. According to Chen (2007), monopsony power occurs when buyers facing powerless suppliers with competitive selling price, while

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[1] The data used in this thesis generally do not permit addressing terms of trade.

countervailing power occurs when buyers are charged the selling price above the competitive price that and the few suppliers have a high degree of seller power. Monopsony power always has negative effects for social welfare, but how countervailing power affects the social welfare is complex. Whether it is beneficial or harmful to the social welfare depends on the particular market settings (AAI, 2008a).   Based on my survey, buyer power issues are more likely to be discussed in publications on "antitrust economics" or "law and economics" compared to scholarly literatures. In practice, however, there is lack of standard guidelines, for instance, buyer size and magnitude of buyers' concentration levels to counteract the seller power, for U.S. courts to make juridical decisions (Ruffle, 2005).

In conclusion, the economic literature contains a gap between attention to the sellers' side of markets and the buyers' side. Both on the theoretical and empirical levels, treatments of buyer power are absent or underdeveloped. As this thesis concentrates on a sample of buyers' cartels, my findings may to some extent fill the void in this gap, and hopefully provide implications for policy decision makers as well.

1.2.3 Perceptions on Farmers' Exploitation

"Peasants and farmers are the good guys while traders and middlemen are the bad guys."
-- Ellis (1996: 119)

Farmers as suppliers of agricultural raw materials historically have been in inferior positions in agricultural and food markets, especially when buying inputs or selling products in vertical food-supply chains. Scholarly studies show that agricultural markets in both supply side and production side have become more concentrated, so farmers and ranchers are facing exploitative strategies from both input suppliers and output buyers. (AAI, 2008b)

From the traditional social science scholars' view, the market power forces farmers to be vulnerable to both inputs and outputs market (Simmons, 1986).The sellers' power on inputs market makes seed and fertilizer more expensive for farmers to purchase, while the buyers' power on output side suppresses the price of farm products. First, agricultural products as perishable commodities impose high storage and transportation costs. This makes it possible for traders to exert oligopoly power. Second, farmers' illiteracy in low income countries and asymmetric access to information lead them to a weak position in negotiating subcontracts with intermediaries (Simmons, 1986; Ellis, 1996). Third, farmers are risk takers. They are subject to variable harvests and unfavorable institutional factors such as imperfect markets for labor and land. Moreover, trade is often conducted on credit so most farmers are both risk takers and creditors, which also makes them vulnerable to fluctuations in interest rates (Simmons, 1986). Forth, agricultural supply is inelastic in the short run. Pigs and chickens take time to mature, and wheat and fruits take seasons to grow. Thus, buyers always face a potentially large supply, while the producers bear substantial sunk capital, which attracts buyers to depress prices as farm products supply cannot change in short run (AAI, 2008a).

> "I want to do it… because there is a direct correlation between their concentrated market power and the record low prices that our producers are receiving…We ought not have just a few conglomerates that control all phases of this food industry from seed all the way to grocery shelf."
> -- Wellstone (1999)

Voices that complain about farmers and ranchers' weak position in agricultural and food markets spoken on this topic for ages, especially the emerging voices complaining about the unfair price manipulation on both suppress of famers' output prices and increase in consumers' purchasing prices for final products. During the past several years, antitrust

enforcement has largely failed to effectively regulate the substantial market structure changes in Agricultural market. USDA to some extent has ameliorated some agricultural industry problems such as exploitation, but "consistently failed to use its authority to facilitate efficient market practices" (AAI, 2008b).

The U.S. policy environment on buyers' power may be shifting. In 2009 the DOJ and USDA announced a series of joint workshops to examine market-concentration effects on farmers, ranchers, producers, and consumers. The workshops were designed to address concerns about the food chains and the agricultural issues of the buyer power (monopsony), vertical integration, and forward contracting, etc. Five workshops were held, and each with its own focus: "issues of concern to farmers" in particular with topics on seed technology, vertical integration, market transparency, and buyer power; "poultry industry" that focus on production contracts, concentration and buyer power; "dairy industry" with relate to concentration, marketplace transparency, and market dynamics; "livestock industry" with the discussion of concentration, buyer power, and the enforcement of Packers and Stockyards Act; and "margins" between the price received by farmers and price paid by consumers in agricultural sector (DOJ, 2011).

The on-going discussions have been involved with a vast number of concerns and comments on agricultural competition issues. In general, DOJ is expected to be more active and forceful with respect to competition issues on both inputs and outputs side in agricultural markets. They are expected to seriously take the buyer power that may explain the output side problems, which were deemed as a failure in the past. USDA is anticipated to use its power to by making rules to remedy its older system and regulate a fair, open and

efficient agricultural market (Carstensen & Young, 2010). In fact, a very recent antitrust lawsuit is to file against a national dairy processor Dean Foods Co. for its merger purchase and to seek payment ($30 million) to some northeast dairy farmers (Rathke, 2011).

Overall, both theories on buyers' cartels and public regulations to reduce buyers' collusions are fairly weak. The lack of theoretical guidelines such as evaluation of buyers' concentration and measure of harm levels in buyers' collusion, might explain the historical reluctance of courts to oppose mergers and disband buyers' cartels.

1.2.4 Concerns about Bid-Rigging against Government

When governments are buyers, the policy situation is different. Economic studies indicate the criminal cases of bid rigging are most often involved with government, and antitrust agencies have at times vigorously prosecutes bid riggers. "Over the past five years, 70% of the criminal cases involved bid-rigging rather than price fixing, and a government agency was the purchaser in the bulk of them." (Froeb, Koyak, & Werden, 1993:420). Zona (1993) pointed out over half of the criminal cases filed by Antitrust Division of DOJ dealt with bid rigging or price fixing; and in bid rigging cases, government agency was typically the victim. Such phenomenon can be explained by the inefficiency of bid riggings against public agencies (Newmark, 1998), or the higher possibility of being detected and prosecuted if government is the victim (Hay & Kelley, 1974).

An empirical study conducted by Connor (2009) found that the penalties of cartels in which the bid-rigging against the government procurement were significantly higher than against the purchase of private firms or consumers in all regions of the world. In this study,

the median fines in U.S are nine times higher for cartels members who rig bids against the government than for cartel participants against private buyers; median penalties to cartels in EU NCAs are three times higher for the involvement in government sector than in private business and consumers; and the median fines for bid-rigging outside of Europe are 16% higher if the victims are public agencies.

This raises concerns on the neutrality of antitrust enforcement against illegal collusion, or whether the antitrust agencies give special attention and severer penalties if the government is the victim compared to when the buyers are private companies.

1.3   Thesis Structure

This paper starts with a brief introduction of the data source. The first step in preparing the data was an attempt to distinguish buyers' cartels from sellers' cartels among the 384 cartels included in Connor (2010). Then the thesis introduces the methods used in this study, which includes identification of buyers' cartels and an explanation of their economic characteristics. The results section mainly focuses on descriptive tabular analysis and statistic tests of frequencies of buyers' cartels across industry and time, and economic characteristics. After an explanation of some of the significantly distinctive characteristics of buyers' cartels compared to sellers' cartels, I will examine three well documented historical case studies of behaviors of buyers' cartels to see how the statistical results are reflected in the case studies and to gain a deeper understanding of buyers' collusive strategies. Finally, I am going to give some implications to both economists and public decision maker for the further study on the topic of price fixing on buyers' cartels.

2 Data Source

The data set of this study comes from Connor (2010), which contains an "Appendix Tables for Price-Fixing Overcharges: Legal and Economic Evidence", a compilation of 1165 overcharge/undercharge observations with records of dates, characteristics, and sources of each observation. Connor (2009) attempted to collect and report all serious studies containing quantitative information on the price effects of hard-core cartels. If a range was given by the source, he coded the lower figure or the midpoint of the range of the reported overcharge/undercharge statistics. Two major sources were used to support the data: social science studies and decisions of antitrust authorities; he also mentioned some limitations in the sources consulted:

"With very few exceptions, this paper reports on every scholarly or serious study that contained quantitative information on the price effects of hard-core private cartels. Writing by economists, political scientists, economic historians, and legal scholars are included. Written decisions or detailed reports of decisions of antitrust authorities everywhere in the world were examined. While no time limit was placed on the literature search, the large majority of the sources consulted were written after 1945.

"I have examined more than 500 English-language books, journal articles, working papers, reports, and other short analyses of cartel price effects. Many were written primarily as historical case studies or are focused on demonstrating a new method. Some mention price effects only in passing. The great majority of short cartel studies were written by economists. Nearly all economic articles are written by North American academics using cartel episodes that affected commerce in the United States or Canada. The absence of empirical studies by European or Asian academics is striking.

"Few overcharge claims appearing in newspapers, magazines, and newsletters are included because such assertions are usually from anonymous sources who may not be disinterested parties in an ongoing law suit or in some public policy debate, roles that may color their assertions. In some cases, overcharge estimates may originate from articles in industry trade journals, but if they were cited by economists, historians, or legal scholars with some background in cartel studies, such estimates

are reported in the present survey. We did include estimates appearing in a few book-length cartel studies by journalists, public servants, or other professional writers of nonfiction."

   --Connor (2009): 15-16.

In terms of price fixing overcharges,

"I aimed at collecting the largest possible body of quantitative estimates of monopoly overcharges, and avoided applying some sort of quality screening. In the vast majority of cases, the writers themselves provided the overcharge calculations. In a small minority of cases, I made inferences from price data contained in the works; the bases for my inferences are briefly outlined in Connor (2004b: Appendix Table 2)," --Connor (2009): 16.

   In my work, I have used two parts of Connor's (2010) data collections. The first part of data is "Appendix Table 2. Summary of Price-Fixing Damages", which gives the summarized description of cartel type, location, and date, as well as overcharge/undercharge statistic and its analysis methods[2]. This information helps me to identify the buyers' cartels. These data were transcribed to an Excel spreadsheet, in which I coded a dummy variable for sellers' cartel, and developed the tables on economic characteristics of cartel observations. A complete list of the buyers' cartels is displayed in the Appendix Table.

3   Methods

3.1   Buyers' Cartel Identification

   Based on the previous discussion on economics of buyers' cartels and the textbook survey of cartel studies, the buyers' cartels to be examined are generally identified from scenarios in which processors suppressed the prices paid to the input suppliers; courts

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[2] Working paper (Draft), John M. Connor, Appendix Tables for Price Fixing Overcharges: Legal and Economic Evidence (April 28, 2010), *available at*
http://www.agecon.purdue.edu/staff/connor/papers/Price_Fixing_Overcharges_Appendix_Tables.pdf

sentenced guilty of procurement contracts; many small growers sold to a large processor; and bid rigging against buyers in procurement auctions.

To identify the buyers' cartels, I mainly referred to the summarized facts in each cartel episode are included in the column of "Cartel Type, Location, and Dates" in Connor's (2010) Appendix Table 2. A dummy variable for sellers' cartel (1=buyers' cartel, 0=sellers' cartel) is created for the identification. Observations with descriptions that directly take in signal words of "monopsony" and "oligopsony" are coded as "1"; observations that connect with any of the above four price-fixing scenarios are also coded as "1". Following this process, 30 cartels were identified as buyers' cartels among the 389 cartels in total (Appendix Table).

3.2   *Characteristics*

In order to distinguish the economic features that uniquely exist in buyers' cartels, I have compared some characteristics in both sellers' cartels and buyers' cartels with tabular analysis and statistical tests. The characteristics include frequencies across time (cartel episode end date) and industry, bid rigging or not, international cartel memberships, geographic location, duration, size of average overcharge/undercharge, and episodes. In the descriptive tables, the numbers and proportions of overcharge/undercharge observations and cartels are counted separately based on their characteristics.

There are 384 cartels and 1107 overcharge/undercharge observations recorded in an Excel spreadsheet containing the above-mentioned data. According to Connor (2009), there are more overcharge/undercharge observations than the number of cartels because of three reasons: first, a number of cartels went through multiple episodes. "If a cartel had more than

one episode, then each episode is marked by changes in membership composition, the terms of the collusive agreement, method of management, geographic focus, or other major change." (Connor, 2009: 22) Second, some unique episodes were studied by more than one author. Third, the same author in the same publication might provide different estimation to a given episode.

To see whether the buyers' cartels are significantly different from sellers' cartel in terms of any specific economic features, a series of statistical tests will follow: Z test for percentage differences; and χ^2 test for median average of overcharges/ undercharges. Since only 30 buyers' cartels are identified, a 90% confidence level will be accepted for such relative small size of sample.

4 Results

4.1 *Frequency*

4.1.1 Frequency of overcharge/undercharge observations, by time

Six time periods (see in Table 3) have been distributed based on Connor's (2009) judgments about significant differences in anti-cartel enforcement. First, prior to 1890, there were no effective antitrust laws. Then in 1890 the Sherman Antitrust Act, the first Federal statute to limit agreements in restraint of trade (Section 1) and conduct of monopolization (Section 2) was enacted. The next point is at 1919 because during the World War I (1914 to 1919), nearly all of the international cartels ceased operating. The third break point is 1945, which also because the wartime (World War II) ended the international cartels operating. Furthermore, "wartime price controls and cost-plus government contracts made cartels

superfluous. Scores of U.S. criminal prosecutions of international cartels during 1940-1945 clarified the illegality for U.S. firms of many more subtle forms of cartel participation, such as patent pools, cross-licensing of technologies, and the creation of overseas subsidiaries as loci for cartel for participation." (Connor, 2009: 24) During the immediate post-war period (1945-1973), three significant changes followed: Germany, Japan, the UK and the European Economic Communities (EEC) for the first time wrote the antitrust idea into their laws. European Commission (EC) began to prosecute cartel conduct in 1969; the U.S. strengthened its price fixing enforcement through a 1974 law and major modifications in federal court rules on class actions. The last break point is 1990 that "all the present criminal sanctions available to the U.S. government were in place" (Connor, 2009:25).

Based on the rules discussed above, the sample overcharge/undercharge observations can be summarized as in Table 3, and more intuitively, in Figure 5. The number of sellers' overcharge observations is overwhelmingly larger than that of the buyers' undercharge observations in any of the historical periods. Besides, there were no buyers' cartels being detected before the end of the World War I. In fact, the earliest undercharge observation in the available data set is a bidding ring that operated in a 1919 UK rare book auction. The next buyers' cartel in the sample is the U.S. sugar beet procurement case, which followed twenty years later in 1939. Both cases will be studied with details in Section Five. Finally, cartels with available documentation that ended up after 1991 take the largest proportion over the entire history, on both sellers' (40%) and buyers' (64.52%) sides. This is the result of the evolving collusive strategies, and more importantly, the strengthening antitrust enforcement.

Table 3. Numbers and Frequency of Overcharge/Undercharge Observations, by Time

Cartel Episode End Date	Number		Percentage	
	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel
1780-1890	84	0	7.50%	0.00%
1891-1919	152	1	13.57%	1.61%
1920-1945	204	5	18.21%	8.06%
1946-1973	112	5	9.91%	8.06%
1974-1990	118	11	10.54%	17.74%
1991-2009	450	40	40.00%	64.52%
Total	1120	62	99.73%	100.00%

Note: Sellers' cartel observation 68 K, 68L, and 387 do not mention the episode end date.

Source: Total of 1182 observations from Appendix Table 2 dated 2010.
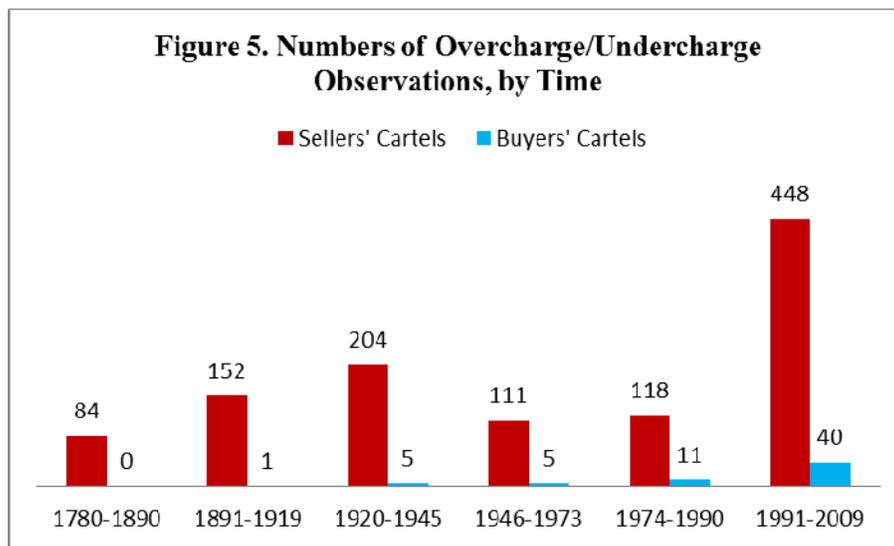
Source: Total of 1182 observations from Appendix Table 2 dated 2010.

To investigate whether the percentage of buyers' undercharge observations is statistically different from the percentage of sellers' overcharge observations during the same classified time period, I have conducted a serious of Z tests with the null hypothesis of equality between the proportions π_{1j} and π_{2j} of elements from two population, sellers' overcharge episodes and buyers' undercharge episodes. Each time period is represented by j (Table 4). The available two samples, one for each population, are sufficiently large (i.e.

$n_1=1120>30$, $n_2=62>30$) to justify the normal distribution. p_{ij} (i=1,2; j=1,2,3,4,5,6), the estimate of π_{ij}, reflects the percentage that the number of observations during j period takes out of the total overcharge (i=1) or undercharge (i=2) observations. The test statistic is

$$Z = \frac{(p_{1j} - p_{2j})}{\sqrt{P_j(1-P_j)(1/n_1 + 1/n_2)}},$$

where

$$P_j = \frac{p_{1j}n_1 + p_{2j}n_2}{n_1 + n_2}.$$

Under $H_0: \pi_{1j} = \pi_{2j}$, $H_a: \pi_{1j} \neq \pi_{2j}$ with critical value $Z_\alpha(0.10) = \pm 1.64$, the hypothetical test results are shown in Table 4. With a 95% confidence level, the proportion of the sellers' overcharge observations over its entire observations before 1946 is significantly larger than that of the proportion on buyers' side; between 1946 and 1973, there are no statistically significant percentage differences in two types of cartel observations; after 1974, the percentage of the undercharge observations over its total significantly surpasses the proportion of the sellers' cartels in reverse. These test results indicate an increasing tendency for buyers' cartels to be discovered and studied after 1945.

Table 4. Z Test for Percentages of Overcharge and Undercharge Observations, by Time.

time code, j	p_{1j}	p_{2j}	Z_j	test results
1=1780-1890	7.50%	0.00%	2.18	reject the null
2=1891-1919	13.57%	1.61%	2.68	reject the null
3=1920-1945	18.21%	8.06%	2.03	reject the null
4=1946-1973	9.91%	8.06%	0.48	do not reject the null
5=1974-1990	10.54%	17.74%	-1.75	reject the null
6=1991-2009	40.00%	64.52%	-3.81	reject the null

4.1.2 Frequency of buyers' and sellers' cartels, by industry

Industry is another factor to be considered in study of the pattern of buyers' cartels. In this study, cartels are generally classified into four main industry categories: raw materials, processed food and tobacco, other manufactures, and services (industry code seen in Appendix Table).

Cartels in services industry take the most (44.83%) of the buyers' cartels sample, and most of them are of wholesale and retail services, insurance and banking services, and auction house services. Second, the forestry, agriculture and food industry sectors possessed a notable proportion of buyers' cartels. In fact, except for the 1933 U.S. Vanadium Ore cartel, all the other buyers' cartels found in raw materials industry are agriculture and forestry related. Moreover, most of them were found to be domestic in cartel membership apart from the international 1939 Sugar Cane Cartel. Buyers' cartels appear to be relatively uncommon in the non-food manufacturing industries.

Table 4. Numbers and Frequency of cartels, by industry

Industry	Number		Percentage	
	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel
Raw Materials	25	8	6.94%	26.67%
Processed Food and Tobacco	36	6	10.00%	20.00%
Other Manufactures	191	3	53.06%	10.00%
Services	108	13	30.00%	43.33%
Total	360	30	100.00%	100.00%

Source: Total of 389 cartels from Appendix Table 2 dated 2010.[3]

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[3] Total of 389 cartels consist of 360 sellers' cartels and 30 buyers' cartels is because in Japan Construction Cartel (Observation 213), there involves both sellers' cartel of Water Purification Plant, and buyers' cartel of Public Projects and Materials Procurement.

Figure 6. Numbers of Cartels, by Industry
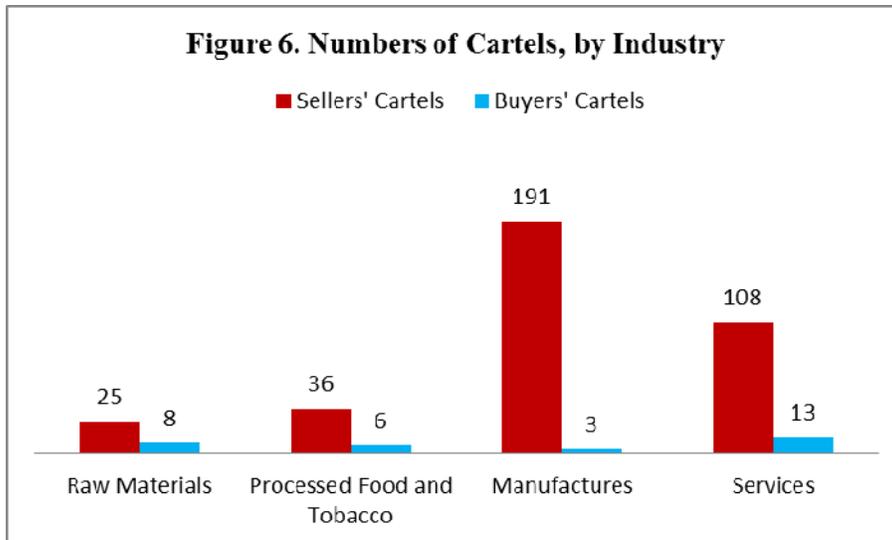
Source: Total of 389 cartels from Appendix Table 2 dated 2011.

A similar method has been applied in testing the percentage differences between overcharge and undercharge observations by time, and Table 6 indicates the result of the percentage differences between the two types of cartels by industries. pij (i=1,2; j=1,2,3,4,5,6), estimate of π_{ij}, calculates the sample percentage that j industry takes of i type of cartels. The samples are sufficiently large (i.e. n1=360>30, n2=30) to justify assuming a normal distribution.

The Z test with $H_0 : \pi_{1j} = \pi_{2j}$, $H_a : \pi_{1j} \neq \pi_{2j}$, and critical value $Z_\alpha(0.10) = \pm 1.64$ suggests buyers' cartels possesses a significant higher proportion in raw materials, and a significant lower proportion in manufactures industry. The storability of most inputs used in other manufactured products may explain the infrequency of buyers' cartels in those industries, as this puts buyers in an unfavorable condition to employ market power. However, at 90% confidence level, the test results imply there are no significant differences between cartels in processed food and tobacco, and service industries.

Table 6. Z Test for Percentages of Overcharge and Undercharge Observations, by Industry

industry code, j	p_{1j}	p_{2j}	Z_j	test results
1=Raw Materials	6.94%	26.67%	-1.97	reject the null
2=Processed Food and Tobacco	10.00%	20.00%	-1.01	do not reject the null
3= Other Manufactures	53.06%	10.00%	2.77	reject the null
4=Services	30.00%	43.33%	-0.92	do not reject the null

The incentives for using buyer power can be vary depending on the goals of the participants, while the success of a buyers' cartel also depends on the nature of the supply market. (Carstensen, 2010) For market of agricultural raw materials, the geographic boundaries are very confined, thus it faces less elastic demand and a favorable condition to form a buyers' cartel. The colluding buyers have a stronger incentive to drive down the price because it will not affect output level of inputs. In contrast, for inelastic markets such as manufactured products that can be transported to meet global demand if they are final products, hence less facilitating conditions are permitted as the price suppression will result in insufficient supply.

The possibility of buyers' cartelization of coordinators referred by Carstensen (2010) can be an explanation for prevalence of buyers' cartel in service industry. The coordinator (or agent) can either bargain to force down the input price, or demand sellers to provide extra compensation. Such an agent's role is frequently played in high-end service business such as liability insurance market where agents induce the insurers to form a seller cartel, and then employ buyer power to allocate their business and collect extra benefits from the cartel overcharges.

4.2   Characteristics

4.2.1 Bid Rigging

I have examined several cartel characteristics, as summarized in Table 7. An important form of price fixing among buyers' group is bid rigging. Members in an organized purchasing group may determine who is going to win the bid in advance by following a market-share agreement. Alternatively, the economic rents acquired from the winning bidder could be calculated and redistributed subsequently within the ring.

Over half of buyers' cartels or undercharge observations involves bid rigging，while less than twenty percent of the sellers' cartels incur bid rigging. To statistically support such sharp contrast in term of bid rigging, the same Z test will follow. j represents whether the cartels members bid or not (1= bid rigging, and 2= not bid rigging). The result reveals significant differences of bid rigging proportions in both overcharge/undercharge observations and cartels at a 90% confidence level (Table 8). This indicates bid rigging to be a common and effective method in depressing buyers' purchase prices. Despite its popularity in procurement of agricultural raw materials, processed food and tobacco, and insurance and other services, where buyers' cartels are most likely to exist, the only three buyers' cartels observed in other manufactures achieved monopsony profits through bid rigging as well.

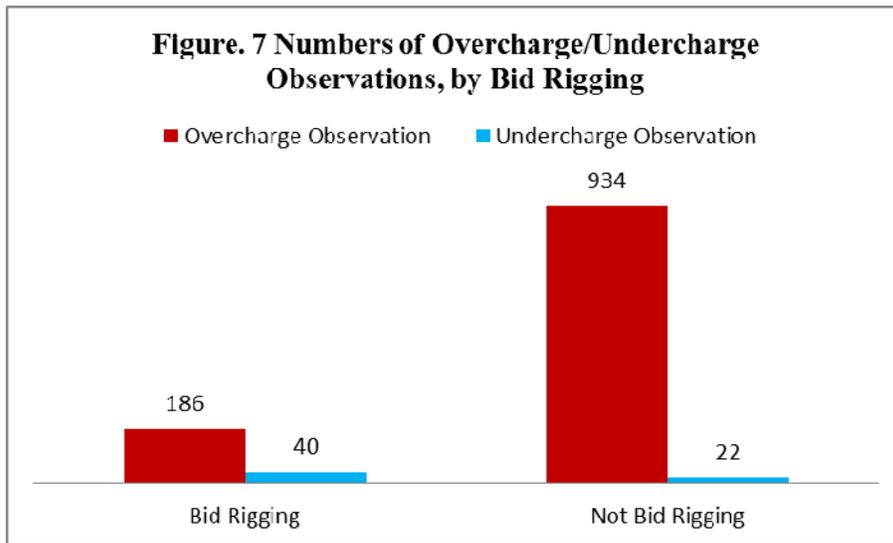**Table 7**. Numbers of Overcharge/Undercharge Observations and Cartels, by Type

	Overcharge/Undercharge Observations				Cartels			
	Number		Percentage		Number		Percentage	
	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel
Bid Rigging								
Bid Rigging	186	40	16.61%	64.52%	93	19	25.83%	63.33%
Not Bid Rigging	934	22	83.39%	35.48%	267	11	74.17%	36.67%
Total	1120	62	100.00%	100.00%	360	30	100.00%	100.00%
International Cartel Membership in a particular publication								
International	607	24	54.20%	38.71%	133	7	36.94%	23.33%
Domestic	513	38	45.80%	61.29%	227	23	63.06%	76.67%
Total	1120	62	100.00%	100.00%	360	30	100.00%	100.00%
Geographic Location								
US and CA	321	29	28.66%	46.77%	124	19	34.44%	63.33%
EU(Several EU countries)	171	0	15.27%	0.00%	39	0	10.83%	0.00%
W.European nations(single-country cartel)	216	14	19.29%	22.58%	92	4	25.56%	13.33%
Asia and Oceanea	95	6	8.48%	9.68%	59	4	16.39%	13.33%
Global(INTL)2+countries	276	13	24.64%	20.97%	33	3	9.17%	10.00%
Other (Africa, Lat.Am., E.Europe)	41	0	3.66%	0.00%	13	0	3.61%	0.00%
Total	1120	62	100.00%	100.00%	360	30	100.00%	100.00%

Source: Total of 1182 observations/384 cartels from Appendix Table 2 dated 2011.
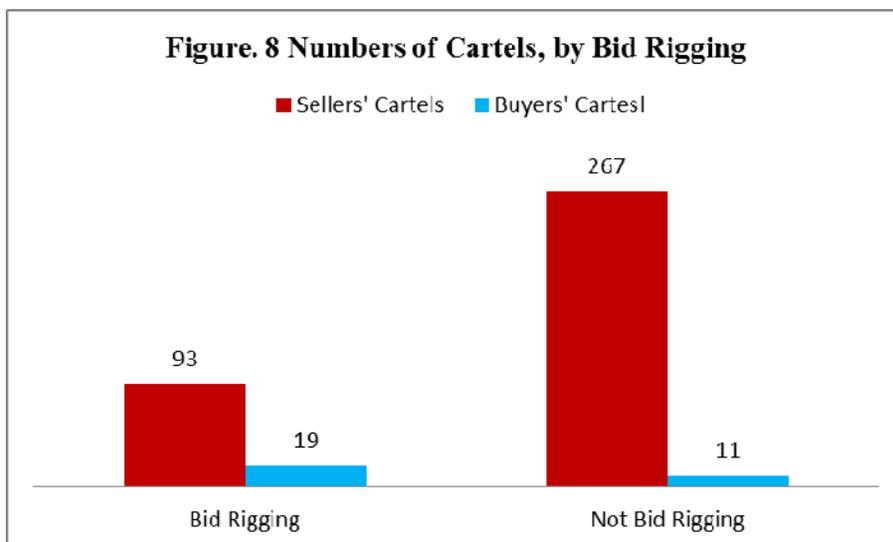
Table 8. Z Test for Percentages of Overcharge/Undercharge Observations and Cartels, by Type

Characteristics	Overcharge/Undercharge Observations				Cartels			
J	p_{2j}	p_{2j}	Z_j	test result	p_{1j}	p_{2j}	Z_j	test result
Bid Rigging								
1=Bid Rigging	16.61%	64.52%	-6.34	reject the null	25.83%	63.33%	-3.19	reject the null
2=Not Bid Rigging	83.39%	35.48%	5.82	reject the null	74.17%	36.67%	2.74	reject the null
International Membership in a particular publication								
1=International	54.20%	38.71%	1.49	do not reject the null	36.94%	23.33%	0.73	do not reject the null
2=Domestic	45.80%	61.29%	-1.85	reject the null	63.06%	76.67%	-1.30	do not reject the null
Geographic Location								
1=US and CA	28.66%	46.77%	-2.04	reject the null	34.44%	63.33%	-2.41	reject the null
2=EU(Several EU countries)	15.27%	0.00%	---	---	10.83%	0.00%	---	---
3=W.European nations(single-country cartel)	19.29%	22.58%	-0.30	do not reject the null	25.56%	13.33%	0.55	do not reject the null
4=Asia and Oceanea	8.48%	9.68%	-0.10	do not reject the null	16.39%	13.33%	0.16	do not reject the null
5=Global(INTL)2+countries	24.64%	20.97%	0.30	do not reject the null	9.17%	10.00%	-0.05	do not reject the null
6=Other (Africa, Lat.Am.E.Europe)	3.66%	0.00%	---	---	3.61%	0.00%	---	---

For buyers' cartels that involved bid rigging, eighty percent were found to be in violation of antitrust laws; seventy-five percent are domestic in cartel membership; and fifty percent are occurred in the service sector. Most available studies on buyers' cartels with bid rigging come from monograph, dissertation, or book (65%), unpublished working paper (27.5%), and decisions from a court of antitrust authority (17.5%).

Figure. 7 Numbers of Overcharge/Undercharge Observations, by Bid Rigging

Source: Total of 1182 observations from Appendix Table 2 dated 2010.

**Figure. 8 Numbers of Cartels, by Bid Rigging**

Source: Total of 389 cartels from Appendix Table 2 dated 2010.

1.1.1 International Membership

The "international" and "domestic" describe the cartel membership composition and do not necessarily relate to the geographic spread of cartel effects. Cartel members in the international cartels are composed of firms from more than one country. (Levenstein & Suslow, 2003) In the pattern of international cartel membership, Z test indicates a higher proportion of buyers' undercharge observations in domestic membership. However, with a 90% confidence level, there are no statistical differences between the two types of cartels. Moreover, the proportion of international overcharge/undercharge observations is much higher than the proportion of international cartels. This means international cartels tend to experience more episodes than the domestic cartels.
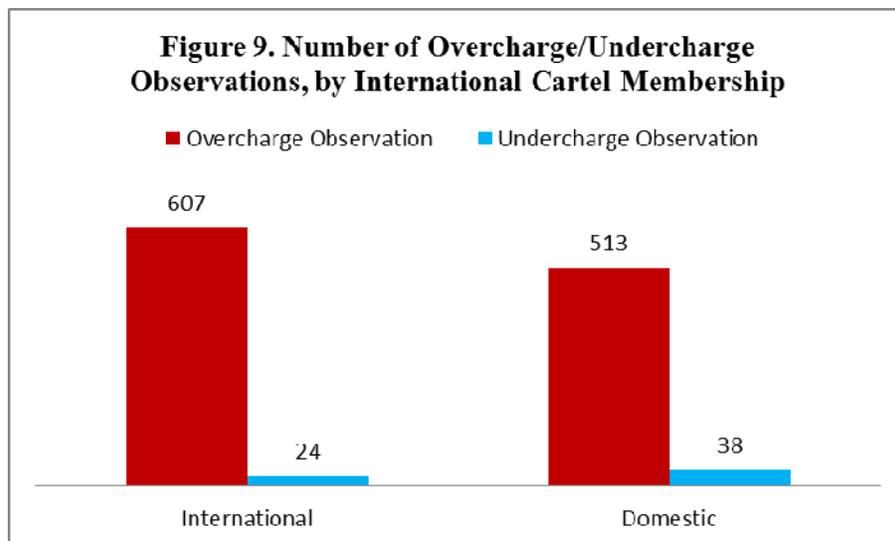
Figure 9. Number of Overcharge/Undercharge Observations, by International Cartel Membership

Source: Total of 1182 observations from Appendix Table 2 dated 2010.

Figure 10. Numbers of Cartels, by International Cartel Membership

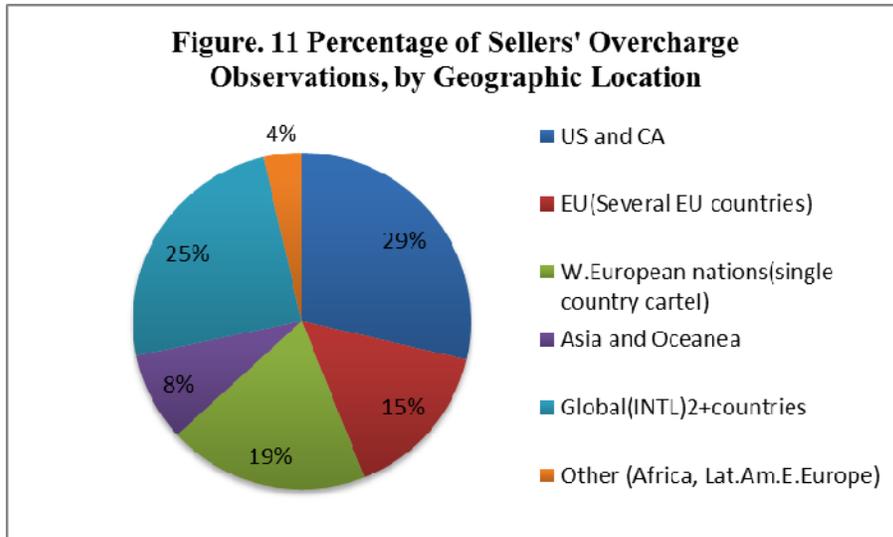■ Sellers' Cartels　■ Buyers' Cartels
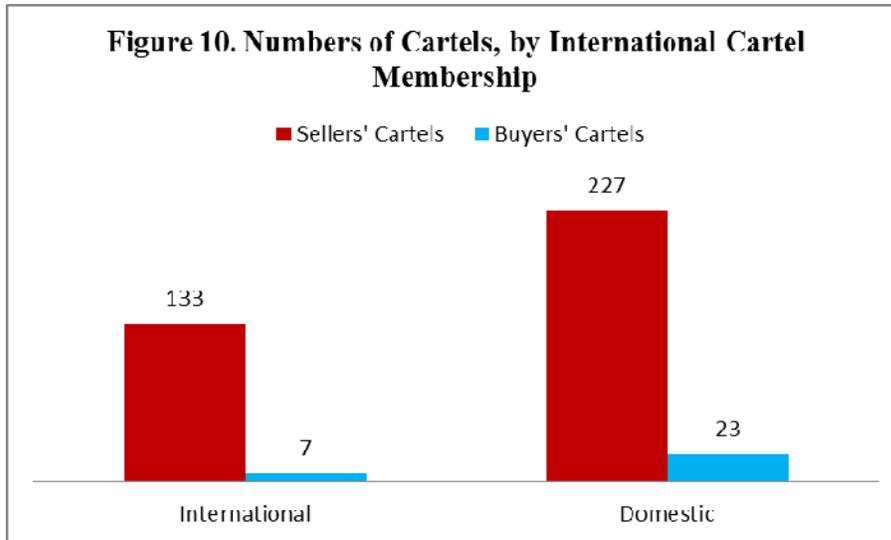
Source: Total of 389 cartels from Appendix Table 2 dated 2010.
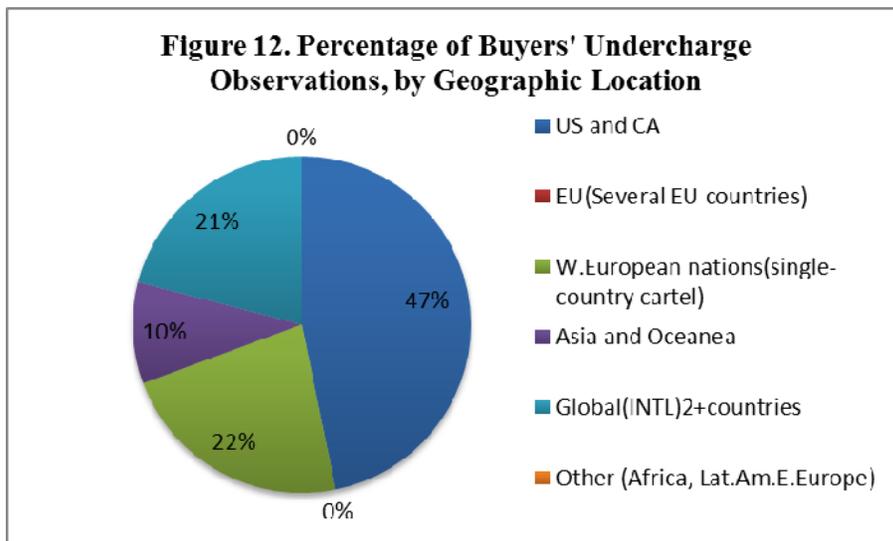
1.1.2 Geographic Location

The geographic location character summarized here refers to the place where the members of the cartels had their headquarters, not the geographic markets where the cartel groups fixed prices. There are six geographic location categories as shown in Figures 11 and 12.

Buyers' undercharge observations are absent in EU and other countries (Africa, Latin America and Eastern Europe). Based on the same Z test, the result indicates that in the region of U.S. and Canada, buyers' cartel proportion is significantly higher than sellers' cartel proportion at the 90% confidence level (Table 8). However, this result may not accurately reflect the real geographic spread of cartels, especially on the buyers' side. No laws in EU were against price fixing conduct until 1958, thus most of the empirical work on collusive behavior in the EU mainly started after the 1960s. Since in most case cartels cannot be studied until they are prosecuted, the forty years' lag of the EU's industrial organization studies from U.S. and the asymmetric spread of interests by economists may result in a biased geographic spread. Moreover, antitrust enforcement in Asian countries is relatively weak and less developed compares to western world, and anticompetitive policies

towards buyers' power are not as heavy as the sellers' collusive behavior. Thus, the findings

in this study reflect where prosecutions took place.

Figure. 11 Percentage of Sellers' Overcharge Observations, by Geographic Location

Source: Total of 1182 observations from Appendix Table 2 dated 2010.

Figure 12. Percentage of Buyers' Undercharge Observations, by Geographic Location

Source: Total of 1182 observations from Appendix Table 2 dated 2010.

1.2 Duration

Duration measures the time length of a cartel, or an episode (if multiple episodes are involved in a cartel). It is often used to measure the effectiveness of a cartel and potential economic damages to markets. Duration as an important estimate of the success of cartels (Levenstein & Suslow, 2006), one may suppose it to be shorter in buyers' cartels, which may be intuitively regarded as less sustainable to sellers' cartels. However, a surprising result is that at a 90% confidence level, the Z tests have not shown any significant differences between the two types of cartels.[4]

Table 9. Duration of Overcharge/Undercharge Observations

Duration	Number		Percentage	
	Sellers' Cartel	Buyers' Cartel	Sellers' Cartel	Buyers' Cartel
1 year or less	169	12	15.13%	19.35%
2 to 5 years	460	26	41.18%	41.94%
More than 5 years	488	24	43.69%	38.71%
Total	1117	62	100%	100%

Source: 1179 of 1182 observations from Appendix Table 2 dated 2010.

Table 10. Z Test for Percentages of Overcharge/Undercharge Observations, by Duration

Duration j	p_{1i}	p_{2i}	Z_i	test result
1=1 year or less	15.13%	19.35%	-0.39	do not reject the null
2=2 to 5 years	41.18%	41.94%	-0.08	do not reject the null
3=More than 5 years	43.69%	38.71%	0.48	do not reject the null

1.3 Size of Overcharges/Undercharges

Price overcharge is the increase in market transaction price achieved by a sellers' cartel relative to a more competitive benchmark price. When the benchmark is instead the marginal cost of production, the rate of the price increase is the Lerner Index of monopoly power. An analogous concept of undercharge is used in measure of the monopsony power, which is the value difference between the observed price and benchmark price. The market price effect is one of the most important parameters to evaluate the financial success of a

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[4] I have attempted different ways to classify duration length into different groups, and calculated the percentages each group take. But no statistical differences in percentages have been detected under each criteria.

cartel. Moreover, the monetary value of overcharge/undercharge is positively related to welfare changes of cartel victims and is used for judicial assessment of conspiracy damages.

There are nine main analytical methods that have been used in estimating cartel overcharges/undercharges (Appendix Table). In several publications, the author refers to more than one method in calculating the overcharge/undercharge. These methods may yield systematically different overcharge calculations.[5] Both Average price effects and peak price effects are available in the sample, where the average overcharges/undercharges estimate the average price increase/decrease over a proportion or the entire episode; and the peak overcharges/undercharges estimate the highest/lowest prices that have reached over several years. The peak overcharges/undercharges also indicate the potential maximum harm of a cartel. Cartels with nonzero overcharges/undercharges are referred to as effective or successful cartels. Here I choose the average overcharges/undercharge of effective cartels for further discussion (Table 11). In the table, the absolute value of average undercharges appears to be lower than overcharges. As there may be a wide variance and no maximum value for price effects of cartels, I prefer to report the median average.

To see whether the two samples, the median of average overcharges in sellers' cartels and the median average undercharges in buyers' cartels, have the possibility to come from the two populations with the same frequency of distribution, I conducted a χ^2-test for the median of the mean average overcharge/undercharge.

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[5] "Nevertheless, there are some differences. The before-and-after method produces overcharge estimates that are quite a bit higher than econometric models applied to the same data. What this result seems to suggest is that authors of traditional before and after analyses are failing to adjust for all the competitive factors that might drive up the competitive benchmark price. Second, compared with the before and after, the cost-based and yardstick techniques yield relatively high overcharge estimates. This suggests that the methods that use costs or profits fail to fully account for all competitive industry costs, perhaps those related to product marketing or overhead, or that indirect geographic spillovers from cartel activity may be more common than most analysts anticipate. If the yardsticks are product substitutes, analysts may have underestimated quality differences." Lande, Robert H. and Connor, John M., Cartel Overcharges and Optimal Cartel Fines (November 12, 2007). Available at SSRN: http://ssrn.com/abstract=1029755

The test statistic is $\chi^2_{calc} = \dfrac{\left\{ |ad-bc| - \dfrac{1}{2}I \right\}^2 I}{(a+b)(a+c)(b+d)(c+d)}$

$$= \dfrac{\left\{ |466.5*29 - 28*535.5| - \dfrac{1}{2}*1059 \right\}^2 1059}{(466.5+28)(466.5+535.5)(28+29)(535.5+29)} = 0.058$$

(Table 12)

The null hypothesis H_0 is: the overcharge in sellers' cartels and undercharge in buyers' cartels have the same frequency distribution; and the alternative hypothesis H_a is: the two populations have different frequency of distribution. Under a 90% confidence level, with one degree of freedom, the critical value $\chi^2_{1;0.05}$ equals to 2.71. As χ^2_{calc} (0.058) is less than $\setminus \chi^2_{1;0.05}$, the null hypothesis is not rejected. Thus, there are no statistical differences between sellers' cartels and buyers' cartels in price effects.

Table 11. Summary of Average Overcharges/Undercharges

Overall Overcharges/Undercharges	Sellers' Cartels			Buyers' Cartels		
	Average High	Average Low	Mean Average	Average High	Average Low	Mean Average
Mean	42.42	49.31	45.87	33.04	37.88	35.46
Median	21.85	25.00	23.43	17.60	18.85	18.23
Effective Overcharges/Undercharges	Sellers' Cartels			Buyers' Cartels		
	Average High	Average Low	Mean Average	Average High	Average Low	Mean Average
Mean	42.46	49.35	45.91	33.04	37.88	35.46
Median	22.00	25.00	23.50	17.60	18.85	18.23

Table 12. Elements in χ^2 Calculation.

	Sellers' Cartels	Buyers' Cartels	Total
Left of median	a=466.5	b=28	a+b=494.5
Right of median	c=535.5	d=29	c+d=564.5
Total	n1=1002	n2=57	N=n1+n2=1059

1.4 Episodes

A cartel may collusive and break in different stages due to changes in collusive

agreement such as the cartel membership or interior penalty structure, and each of the stages can be called an episode. Different episodes in a cartel may be adjacent or have a long break in time. The number of episodes to some extent reflects the sustainability of a cartel. A cartel with multiple cartel episodes appears to be more sustainable with agreement adjustments. This should not be confused with stability of a cartel, which by Zimmerman and Connor (2005), mean a low variability in prices or overcharge rate within an episode.

A Z test is employed to investigate the percentage difference between overcharge and undercharge observations by number of episodes (Tables 13 and 14). With a 90% confidence level, there is no significant difference, neither in single episode nor in multiple episodes, between the two samples.

Table 13. Numbers of Observations and Cartels, by Episodes

		Numbers		Percentage	
		Sellers' Cartels	Buyers' Cartels	Sellers' Cartels	Buyers' Cartels
Single Episode		275	25	76.39%	83.33%
Multiple Episodes		85	5	23.61%	16.67%
	Total	360	30	100.00%	100.00%

Source: Total of 1165 observations/384 cartels from Appendix Table 2 dated 2010.

Table 14. Z Test for Percentages of Overcharge/Undercharge Observations, by Episode

j, by episode	p1i	p2i	Zj	Results
1=single episode	76.39%	83.33%	-0.79	accept the null
2=multiple episode	23.61%	16.67%	0.36	accept the null

5 Case studies

This section will focus on three buyers' cartel overcharge cases, two of which dated from before 1939. These case studies can supplement the statistical analysis above. With greatly recorded details, they will help to enhance the understanding the manner of buyers' cartel operations and the harm of such conducts measured by price undercharges.

The Real Estate Auction at Washington DC, 1989 and Rare Books at Ruxley Lodge, UK, 1919, occurred in auction settings. Both cartels are in the services sector and both fixed

prices through bid rigging; and the undercharges are measured by the yardstick method. In the Sugar Beets Procurement case, 1939, the price of growers of sugar beets was depressed through contract with sugar refineries; and the undercharge is measured using the before-and-after method. All of them are domestic in cartel membership and within a confined geographic boundary.

5.1 Real Estate Auction, Washington. DC, US, 1989

In a real estate auction, Washington, DC, Kwoka (1997) examined the price effects of bid rigging of government auctions of houses with unpaid taxes. Unlike other auction cases having difficulties in judging the price value that absent the conspiracy, this case involves with the so-called knockout prices. After the public bidding ring that secured a house at a below-market price, there followed a second ring within the cartel group to redistribute the profits. This re-auction can be used to deduce the competitive prices.

The recorded price data is publicly available from 1980 to 1988 of thirty properties, of which nineteen were mortgage foreclosure sales, and eleven involved with *nisi* proceedings.[6] The small and stable cartel group consisting of twelve to fifteen investors generally selected one person to bid for the group in the public auction, and after that they secretly hold a knockout auction to determine the ultimate ownership of their secured property. Newcomers to the auctions were rare, and if there were, the conspirators would create entry-deterrence by paying them for not bidding, or seldom allowing them to buy a particular property.

The ring's economic rent can be reflected through the difference between the public auction price and the knockout price. However, the knockout price itself is not the

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[6] Mortgage foreclosure sales refer to "auctions of properties on which mortgagors had defaulted, the net proceeds of which were intended to repay the lender", while in *nisi* proceeding "real estate belonging to a person under the protection of the court (an orphaned minor, an incompetent individual, etc." or the estate of a deceased person was sold under court supervision." (Kwoka, 1997:505)

competitive price since the distribution mechanism for the losers' payoffs would affect the final knockout price. According to Kwoka (1997), if the payoffs among the "losing" bidders were equally distributed, the property's true value V would equal to {P+ [1/ (N-1)] (K-P)}, where P is the public auction price, K is the knockout price, N is the number of the cartel members, thus (N-1) reflects the "losers". In case the rewarded losers only in pursuit of losers' share without interest in securing the property, an unequal distribution mechanism is also employed, in which the losers' shares depend on the point where the bidders' ceased bidding. Under unequal payoff mechanism, Kowka deduced the knockout price K to be {P+P (m-1) [(N-1)/N]}[7], with the assumption of m being a constant fraction where a property's competitive valuation V takes of the fixed auction price P (i.e. m=V/P). By applying the data of eighteen properties that the mechanism of distribution can be determined, Kwoka concluded that the buyers' cartel attained an average price distortion of 32%.

The buyers' cartel formed in real estate auctions in Washington, DC typically by means of bid rigging affected 680 auctions. Comparing to the average duration of 5.6 years of the selected 62 buyers' cartel undercharge observations in my study, fifteen years (1976-1990) is a notably long lasting time. Finally, ten defendants pleaded guilty.

5.2 Rare Books at Ruxley Lodge, UK, 1919

Porter's (1992) book review[8] describes a ten-day auction of the private book collection at Claygate, a large country house in southern England, in 1919. Around eighty antiquarian book dealers participated and formed a buyers' cartel. Similar to the real estate auction in Washington, DC, the public auction of the rare books was in an ascending-bid ("English") format, followed by rounds of settlements, or knockout sales, to determine final

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[7] The equation K= P+P (m-1) [(N-1)/N is obtained by substituting mP for V in the previous equation V= P+ [1/ (N-1)] (K-P).

[8] *Anatomy of An Auction: Rare Books at Roxley Lodge, 1919.* By Arthur Freeman and Janet Ing Freeman. London: The Book Collector, 1990.

ownership of the secured books. There could be as many as four rounds of settlements after the public bid rigging, and each ended up with an incremental price. Four hundred and forty-seven of the 641 lots of 13,600 volumes were sold in the ring. The original auction in total (3,714 Pounds Sterling) accounted for only less than 19% of the final settlement (19,696 pounds), which is the most severe undercharge case among the selected buyers' cartel sample.

From the author's discussion, some unusual conditions facilitate the success of the bidding conspiracy. First, the seller was an heir to the books and had no idea of the real value of the books. The asymmetric access to the market information can contribute to the undercharge price-fixing. The auctioneers were not experts in antiquarian books, and they did not exercise the power to reject bids in the entire auction process. Second, virtually no private collectors or foreign dealers attended the sale, and for those attended, their winning bids only made up of a small proportion. Third, the British Bidding Agreement law was passed in 1927, thus this bidding ring was legal at the time.

5.3 Sugar Beets Procurement in U.S., 1939

In contrast to the previously mentioned two cases that both involved in the auction markets, the sugar beets procurement in the U.S. in 1939-1941 is in an agricultural-market setting. What distinguishes this case is the computational method used in measure of undercharge. (Adam and Bock, 1980) Also, this case is very unusual because a trial was held and a judicial decision published.

The sugar beet growers in this case filed a complaint against Crystal Sugar, a beet sugar refinery in Clarksburg, California, concerning the procurement contract. In this contract, the sugar beet growers were obliged to accept the price basis as low as the joint net return of the only three beet sugar manufactures, Crystal and its two competitors in Northern California, in 1939, 1940 and 1941. The payment of the Crystal's growers depends on the

contract consisting of two variable factors: the percentage sugar content of the beets grown and Crystal's average net return, which would be divided around fifty-to-fifty percent between the refinery and growers. The single net method measures the net returns of sugar from Crystal's own firm. However, during the three crop years in question, the joint net method was operated by three manufactures in ways that gave them more than 50%. It harms the competition in procurement of sugar beets and depressed the reasonable price the growers would have received.

Since the actual price data in the same market is available in this case, the court employed before-and-after method to calculate damages caused by the conspirators. As a result, the court found that the sugar beets grows' payments under the single net method in 1937 and 1938, was 28 to 50 cents higher per ton than under the joint net method in 1939 and 1940. Moreover, as the competition in the purchase of sugar beets was eliminated, the growers could only receive 25 cents per ton in 1941, which takes one-third the price value that they supposed to obtain under the single net method. Relying upon this calculation, the court affirmed the damage caused by the buyers' cartel was the difference between the amount actually received by the appellee sugar beet growers from 1939 to 1941, and what they should have received absent the price-fixing exercise. The undercharge caused by this cartel is 4.6%.

6 Conclusions

6.1 Empirical Results

First of all, this thesis has examined the prevalence of buyers' cartels based on the existing historical time periods and industries. With a 90% confidence level, buyers' cartels are more prevalent than sellers' cartels after 1974. At the same time, buyers' cartels display an increasing popularity over the historical periods. Among the four main industries: raw materials, processed food and tobacco, other manufactures, and services, buyers' cartels

possess the most proportion (43.33%) in service sector. In comparison with sellers' cartels, buyers' cartels are more prevalent in raw materials industries.

As for bid rigging behavior, buyers' cartels take a significant higher percentage than sellers' cartels. In fact, over half of the buyers' collusive behaviors got involved with bid rigging. A typical form of bid rigging in purchasing can be observed in *Real Estate Auction at Washington DC, 1989* and *Rare Boods at Ruxley Lodge, UK, 1919*. Buyers in a cartel group often designate the bids winner in the public auction in advance, and thereafter hold further bid rigging(s) to decide the owner of the secured product and allocate the benefits for group losers.

A higher prevalence of domestic cartel membership is another empirical result for buyers' undercharge observations. However, there are no statistical differences between the samples of buyers' cartels and sellers' cartels. In terms of cartel membership, international cartels tend to experience more episodes than the domestic cartels.

6.2 Policy Implications

Based on the findings of high frequencies of buyers' cartels across some industries, industry specific antitrust regulations are therefore suggested. First, as buyers' cartels are most often operated in service industry, special attention is needed for buyers' collusive behaviors in wholesale and retail services, and insurance and banking services. Second, this study provides an empirical evidence for the unique existence of buyers' cartels in agricultural sector, and stresses the importance of proper public regulations that has continuously focused on agriculture industry. A symmetrical recognition of buyer power of seller power and a parallel juridical treatment of buyers' collusion to sellers' collusion may not be proper. Instead, agriculture-specific guidelines may be needed to promote the fair and effective competition.

Bid rigging is found to be an effective and prevalent form of buyers' price fixing.

This explains the reasonableness of juridical treatment of the auction-buying cartel as illegal *per se*.[9] However, complex situations exist in each individual case, such as that explicit legal distinction is required between lawful joint bidding and auction conspiracies. According to Kwoka (1997), sometimes in procurement auctions, buyers appear to form a joint bidding,[10] instead of illegal auction conspiracy. The rule of judging whether it is a legal buyer group or an illegal price fixing cartel is not easily applied. Some scholars argue the reasonableness for such collusion as a way to reduce input costs; other scholars concern about the potential risk to competition. (Cartensen, 2010)

6.3 Limitations of the Analysis

I hope to have identified more economic characteristics that differentiate buyers' cartels from sellers' cartels, however based on the selected sample with a 90% confidence level, they do not present much differences. In order to reach a more confident conclusion, this study can be improved through the following methods. First, the data can be expanded by the time scale and study types. Second, the thesis has not taken account into economic features such as market share, guilty or not, and the geographic market where the cartels have been operated. By DOJ Antitrust Division, less than 35% of the purchase share in a relevant market will not lead to investigation under the current antitrust law. In Carstensen's (2010) view, buyer power can even arise from a smaller market share, perhaps less than 20%. Thus market share is an important parameter in judging the legal status of buyers' cartels. Third, the lack of more advanced statistical methods is another limitation. Connor and Bolotova (2005) ran a meta-analysis over 395 cartel overcharges and found that duration, legal environment and organizational characteristics could statistically explain the variation

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[9] Two major benefits of *per se* rule: First, it reduces the administrative burden placed on legal system and the cost by avoiding the extensive analysis of the agreement; Second, it provides legal guidelines to follow. (Martin, 2010)

[10] "Joint bidding may not represent antitrust violation if, by pooling the resources for individual bidders, jointness encourages additional or great bids. When it involves suppression of individual bids, as did agreement in this, it is per se violation of section 1 of the Sherman Act."(Kowka, 1997)

on overcharge rates. Similar method may also apply to the explanations of price fixing undercharge rates. Finally, with respect to geographic location, the sample size is probably too small so reflect the real distribution of cartels. This is because the number of detected and documented cartels is closely related to the development of antitrust policy in different regions.

Some questions are to be answered for those who have further interests. Based on the available sample, this thesis is not able to determine whether the penalties are heavier if buyers' cartels rig bids against government. Moreover, I have only examined the average overcharge/undercharge rates. To evaluate the potential harm of the cartels, the analysis of peak price effects is needed.

7   Appendix Table

(see in excel spreadsheet)

8 References

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