FACTORS INFLUENCING THE MAGNITUDE OF CARTEL OVERCHARGES: AN EMPIRICAL ANALYSIS OF FOOD INDUSTRY CARTELS

Yuliya Bolotova, John M. Connor, and Douglas J. Miller*

This is a preliminary draft of one of the chapters of the forthcoming Ph.D. dissertation of Bolotova

PLEASE, DO NOT QUOTE

Selected Paper

The Second Biennial FSRG Research Conference
University of Wisconsin-Madison
Madison, Wisconsin, June 16-17, 2005

Abstract

Using the overcharge estimates for 395 cartel episodes, we evaluate econometrically the impact of different cartels characteristics on the size of overcharges imposed by cartels on different geographic markets and during different antitrust law regimes starting from the 18th century. We analyze the overcharges imposed by food industry cartels relative to those imposed by other industry cartels. The results of our study have important policy implications. We find that the average overcharge imposed by cartels in our sample is 29 percent with a median of 19 percent. Food industry cartels impose lower overcharges than cartels in other industries. International cartels impose higher overcharges than domestic cartels. Longer cartel episodes generate higher levels of overcharges. Bid-rigging cartels impose approximately the same levels of overcharges than other cartels.

Key words: antitrust, cartels, food, overcharges

---

* The authors are Ph.D. Candidate, Professor, and Assistant Professor, respectively, in the Department of Agricultural Economics, Purdue University, West Lafayette, IN. Contact author is Yuliya Bolotova ybolotov@purdue.edu. Research for this paper was supported in part by the Edmund S. Muskie Ph.D. Fellowship Program, a program of the Bureau of Educational and Cultural Affairs (ECA), U.S. Department of State, administered by the American Councils for International Education (ACTR/ACCELS). The opinions expressed in the paper are those of the authors and do not necessarily express the views of either ECA or American Councils.

Introduction

During recent decades antitrust authorities of many developed and developing countries started paying more attention to collusive behavior than ever before. There exist at least two explanations of this fact. First, many known cartels were considered to be legal in earlier times. In some cases governments were directly involved as participants in the cartels, as in the OPEC situation. In other cases different government polices encouraged cartel formation, such as producers associations and boards in agricultural sectors and export cartels. Second, there was little research available evaluating the effect of cartel activity on the market and consumer welfare. This was mostly because of the lack of data, as many cartels remained hidden from regulators.

Over time, more data became available from court records, uncovered cartels that had terminated earlier, and different public sources. Researchers in the rapidly developing area of industrial organization used available data and new econometric techniques to study cartels behavior and evaluate their impact on net social and consumer welfare. During the last decades this made an important contribution to the literature on cartels and collusion.

Cartels can be found in any industry, and the food industry is no exception. The structure of some sectors of the food industry made possible existing cartels in different forms: legal and illegal, domestic and international, bid rigging and not bid rigging. For example, illegal bid-rigging cartels for milk have existed for several decades in different countries. International food and feed ingredients cartels are known for their global reach that imposed enormous damages on consumers all over the world. The conspirators were punished with considerable fines and treble damages by antitrust and court authorities in the US, Canada, EU and some other countries. As a part of the Webb-Pomerene agreement a group of food industry cartels was allowed to collude legally as long as their collusion on the export markets did not affect the domestic, US market.

During the last century the antitrust laws of many developed and developing countries have gone through remarkable changes that allow more effective detection and punishment of cartels. For example, the 2001 Federal Sentencing Guidelines follow established US antitrust law and consider the agreements intending to restrict output and/or raise prices to be illegal per se[1]. Also, the Federal Guidelines establish a base offence level for overcharges equal to ten percent or twenty percent of the volume of affected commerce. Similar laws in Canada and the European Union impose penalties comparable to the US benchmark (Connor, 2004). The recently created US Antitrust Modernization Commission aims to determine whether there is need to modernize antitrust law. This decision may be influenced by empirical evidence of the effectiveness of the antitrust law during preceding decades.

Many individual cases and several groups of cartels have been extensively studied in the theoretical and empirical literature[2]. To the best of our knowledge there is no study that has analyzed the magnitude of overcharges for a relatively large group of cartels operating during a long period of time. In our opinion, this analysis would support the goals of the domestic and international antitrust and competition policies.

The objective of our study is to analyze a relatively large group of unrelated cartels that existed in different historical periods and operated on different geographic markets in order to evaluate econometrically the impact of organizational cartel characteristics and the market environment on the magnitude of overcharge. The characteristics we consider include international or domestic, legal or illegal, bid-rigging or not, and whether cartels operate in the food industry or in other industries. Different geographic markets and different antitrust law regimes represent the market environment of cartel operation. Our

[1] Paragraph 2R1.1 "Bid-Rigging, Price-Fixing or Market Allocation Agreements Among Competitors".
[2] Survey of numerous studies analyzed cartels overcharges during more than last two centuries are presented in Connor (2005).

study analyzes private cartels that would be subject to sanctions of antitrust law[3]. The overcharge estimates are taken from previously published sources such as monographs, chapters in edited books, working papers, and court decisions and are summarized by Connor (2005).

Our paper is organized as follows. A literature review is presented in the next section and is followed by a methodology section, which covers the empirical model and hypotheses tested. The next section presents the data set description and the discussion of the estimation results. Finally, the conclusion of the research is presented.

Literature Review

Cartels, groups of independent companies binding themselves with an agreement on prices or quantities, are more likely to operate in heavily concentrated or oligopolistic markets. In most cases cartels are self-enforced agreements, and may be legal or illegal. Assuming that the behavior of the firms acting in oligopolistic markets is profit maximizing, they have an incentive to collude in order to increase their joint level of profit (Stigler, 1961 and 1964). If their collusion is successful, the collusive firms may achieve a monopolistic level of profit if they manage to act as a multiplant monopolist[4]. According to microeconomic theory, firms may achieve this goal by reducing output, which results in an increase in the market price. In practice, the firms may control output, or prices, or both. In terms of implementation the easiest strategy to use is price control.

As it turns out not all cartels pursue joint profit maximization by the means of direct price increase as the main strategy. Another strategy is to reduce the variance of prices by homogenizing firms' business practices as in the case of the Sugar Institute (Genesove and

[3] For example, the Webb-Pomerene cartels were allowed to collude legally on export markets only. If this collusion affected the domestic, US market, it was considered illegal. So, cases like this are included in our analysis.

[4] The first order maximization condition outcomes are the same for a multiplant monopolist and for a cartel (proved in Besanko and Braeutigam, 2001).

Mullin, 2001). A reduction in price variance could lead to an increase in the joint profits of colluding firms as well. Finally, colluding firms may implement a cost efficiency strategy as in the case of some Webb-Pomerene export cartels (Dick, 1996).

As extensively discussed in the literature on collusion, the decision whether firms collude or not totally depends upon the expected increase in profit and the costs associated with enforcement of the collusive agreement. The cost of collusion often deals with the problem of information. It may make collusion impossible for many firms or make collusion to be more efficient in some environments than in others (Stigler, 1961 and 1964). Also, the prisoner's dilemma of the pricing problem might prevent collusion (Asch and Seneca, 1976).

The success of collusion depends on at least three major factors. The first factor is the market environment the firms operate in, i.e. market supply and demand conditions. The second factor is the legal environment of cartel operation. The presence or absence of antitrust regulation and the effectiveness of its enforcement in a country impact the decision to collude or not, and to what degree to increase the market price if firms decide to form a cartel. The third factor is internal enforcement discipline. Failure to enforce a collusive agreement effectively, (i.e. quickly detect deviators, punish them and prevent opportunistic behavior in the future), often leads to termination of collusive agreement.

As pointed out earlier, collusive behavior is common in some food industry markets. Different features of the market environment in some sectors of food industries create incentives to collude. High sunk cost serves as a barrier to entry and cost efficiencies drive collusive behavior in food and feed ingredients markets and in tobacco and soft drink industries. Further, bid-rigging of transactions made possible conspiracies on the milk and frozen fish markets. Below we briefly discuss some of the conspiracies with different features that took place in food industry related markets.

The Sugar Institute did not fix prices or output directly. The members of this cartel organized their business operation in a way that allowed them to make price-cutting as transparent as possible. They used weekly meetings to discuss every possible detail of the transactions taken place during the last week in which they had not had agreed upon earlier. It was realized that even though sugar was a homogeneous product, and contract provisions such as credit terms, storage rates, and delivery time introduced heterogeneity in the transactions and created incentives to cheat (Genesove and Mullin, 2001).

Agricultural and food product cartels represented 30 percent of the total population of the Webb-Pomerene cartels[5]. They operated under the umbrella of the Webb-Pomerene Export Trade Act. Thus, they were legal cartels but with self-enforced discipline. They were allowed to pursue price-fixing strategies legally but on the export markets only. Approximately 45 percent of these cartels identified themselves with the primary goal of a common price and/or market allocation. The rest of them followed a cost efficiency strategy to exercise economies of scales. They usually achieved cost savings by cooperating in joint distribution, warehousing and marketing services (Dick, 1996).

One United States and three Swiss firms pled guilty to fixing prices and output levels of citric acid, an important food ingredient, in the United States and European Union[6]. This conspiracy lasted from the middle of 1991 to the end of 1995. The estimated range of the overcharge imposed by this global conspiracy on the US market is between $116 million and $378 million and represents 14 to 21 percent of the US sales respectively (Connor, 1998, table IV).

Another widely known conspiracy is the global lysine conspiracy. This conspiracy involving ADM and two Japanese and Korean producers started at the beginning of the

[5] These were American Association of Feed Exporters, American Corn Products Export Association, California Dried Fruit Export Association, Flour Millers Export Association, General Milk Company Inc., Pacific Fresh Fruit Export Association, and Vegetable Oil Export Company.

[6] The conspirators are Archer Daniels Midland Co. (USA), Bayer AG, Hoffmann-La Roche AG, and Jungbunzlauer AG (all Swiss companies).

1990s and ended sometime in the mid 1990s. The first civil treble damages suit was settled in April 1996 for $45 million. ADM pled guilty to criminal price-fixing in October 1996 and agreed to pay a $70 million fine. Given his own assumptions on the but-for price and the length of the conspiracy period, Connor (1997) estimated that the overcharge was $155-166 million while the original defendant's estimate was $15 million.

A few of the known bid-rigging conspiracies involved food industry products. Bid-rigging transactions are those organized through a sealed competitive bid process. In most of the known bid-rigging conspiracies a government agency is a party selling these bids. Starting from 1981 through 1989 several firms conspired on rigging bids for the sale of frozen sea food to the Defense Personnel Support Center in Philadelphia. The Center purchased this sea food for the Department of Defense. The conspiring firms coordinated their activity on a weakly basis. They communicated by phone and allocated contracts among them. Five companies pled guilty and were fined. It was found that a fairly typical bid-rigging scheme raised prices by over 20 percent for over four years (Froeb et al, 1993).

These few examples show that collusive agreements may significantly differ from each other. First, colluding firms may pursue different goals, including cost efficiency strategies and criminal price-fixing conduct. Second, collusive behavior may take place in domestic markets or reach a global scale. Third, the nature of the transactions may be used to distinguish bid rigging and other cartels[7]. Finally, a cartel may or may not be successful in achieving its objective, which in many cases is a price increase. Thus, different characteristics of the cartels and the market environment they operate in may have an impact on the magnitude of cartel overcharges.

[7] Conduct, involving non-competitive bids, is one of the specific offence characteristics providing one additional level to the base offence level (2001 Federal Sentencing Guidelines; paragraph 2R1.1).

Methodology

Empirical Model

We specify two models to evaluate econometrically the impact of different cartel characteristics and the market environment of their operation on the size of overcharges.

$$OVRATE_i = \alpha + \phi * FOOD_i + \theta * DUR_i + \boldsymbol{\beta * C_i} + \boldsymbol{\gamma * G_i} + \boldsymbol{\varphi * P_i} + \boldsymbol{\mu * M_i} + \boldsymbol{\delta * S_i} + \varepsilon_i \quad [1]$$

$$OVRATE_i = \alpha + \theta * DUR_i + \boldsymbol{\beta * C_i} + \boldsymbol{\gamma * G_i} + \boldsymbol{\varphi * P_i} + \boldsymbol{\mu * M_i} + \boldsymbol{\delta * S_i} + \varepsilon_i \quad [2]$$

The dependent variable in both models is the overcharge rate (OVRATE) imposed during cartel episode i[8]. Model [1] is applied to the sample including episodes of both food industry and other industries cartels; the sample size is $N = 395$. Model [2] is applied to the sample of episodes of food industry cartels with sample size $N_1 = 94$, and to the sample of episodes of other cartels with sample size $N_2 = 301$. The latter model will be referred as Model [3]. The difference between Model [1] and Model [2] and Model [3] is in the binary variable FOOD, which is included in the general model (Model [1]) but is not included in the industry specific models (Model [2] and Model [3]).

The explanatory variables included in all models are an intercept (α); a discrete variable representing duration of the cartel episode (DUR_i); three sets of binary variables representing different cartel characteristics (***Ci***), different geographic markets (***Gi***), and different periods of antitrust law regimes (***Pi***); two sets of binary variables characterizing eight methods of overcharge estimation (***Mi***) and seven publication sources (***Si***); and an error term (ε_i). A detailed description of all explanatory variables and their expected signs is presented in Table 1.

[8] *OVRATE ={(Price during collusion – Price benchmark)/P during collusion} * 100%.* The benchmark price is the price that would exist in the market if there were no collusion.

Hypotheses

We expect that a longer duration of a cartel episode leads to a higher level of overcharge imposed by a cartel. If a cartel is successful in maintaining its price discipline, it can impose a higher price increase by means of a direct price increase or variance control than an unsuccessful cartel[9]. Therefore, successful cartels can operate longer than unsuccessful cartels, which have members that do not follow established price discipline. A longer duration of a conspiracy episode may lead to a higher level of overcharge imposed by a cartel. One example is the previously mentioned Sugar Institute case (Genesove and Mullin, 2001). The members of this cartel organized their business operation in a way that allowed them to make price-cutting as transparent as possible. They used weekly meetings to discuss every possible detail of the transactions completed during the last week in which they had not had agreed upon earlier. An effectively enforced discipline resulted in the price increase due to its variance control, although price or output was not fixed directly.

Cartels that were found or pled guilty probably impose lower overcharges than those not prosecuted because they were not subject to antitrust law existing during the time of their operation, they were discovered after they had stopped their activity, or they operated legally. It should be noted that some small overcharge rates, up to 5 percent, might be too difficult to distinguish from purely random movements in prices (Connor, 2005). Probably, the illegal price-fixing agreements generate lower overcharges than legal agreements. Legal cartels do not have to mask their price-fixing activity from antitrust authorities. Conversely, the overcharges imposed by legal cartels may be the same as overcharges imposed by illegal price-fixing agreements or even lower. Legal cartels are legal because they are required to be registered with a government authority, but they are also self-enforced agreements with an internal mechanism of discipline supervision. If the

[9] All hypotheses are discussed under the assumption that all other factors are kept constant, i.e. we discuss a marginal impact of each individual factor on the magnitude of overcharge rate.

members of legal cartels do not follow this discipline, they are not able to raise prices to higher level despite their legal status. Thus, opportunistic behavior of legal cartel members may result in lower rates of overcharge than illegal cartels with strongly enforced discipline. A well-known example of legal cartels is the Webb-Pomerene cartels that operated under the umbrella of the Webb-Pomerene Export Trade Act and were self-enforced agreements (Dick, 1996). Approximately 45 percent of these cartels followed a price-fixing strategy, and they could have the same problem with internal discipline as illegal cartels. Thus, the effect of the discipline on the overcharge actually could be the same for both legal and illegal cartels.

International cartels[10] are expected to generate higher overcharges relative to domestic cartels because geographic price/overcharge discrimination is possible. Also, international cartels do not have import competition that domestic cartels may face. Connor (2004b) emphasizes that international cartels are more difficult to convict, and as a group they bring more harm to consumer welfare than domestic cartels. In addition, international cartels are difficult to deter because domestic antitrust authorities examine collusive activity in domestic markets only (Evenett et al, 2001). Therefore, due to the bounded legal power of domestic antitrust enforcement, international cartels have more favorable conditions to exercise their price-fixing activity than domestic cartels.

The potential for bid-rigging[11] of transactions is another factor that may impact the magnitude of the overcharge rate. The 2001 US Federal Sentencing Guidelines (FSG) consider bid-rigging conspiracies to be more harmful than other conspiracies. The 2001 US FSG increase the base offence level of overcharge by 1 if a cartel submitted non-

[10] In this study, international cartels are those with participants from two or more countries.

[11] Bid-rigging transactions are those organized through a sealed competitive bid process. In most of the known bid-rigging conspiracies a government agency is a party selling these bids.

competitive bids. Therefore, bid-rigging cartels are expected to have a higher level of overcharge than other types of cartels.

The geographic location of cartel operation may impact the magnitude of the overcharge as well. The markets with strong antitrust law enforcement may have lower levels of overcharges than markets with relatively new antitrust law history or without it at all. Clarke and Evenett (2003) found evidence of such price discrimination in the global vitamins cartel.

As mentioned above strongly enforced antitrust law should have a deterrent effect, i.e. decrease the rate of overcharge and prevent illegal price-fixing behavior in the future. Connor (2005) distinguishes six different antitrust law regimes that existed during the last two centuries. It is assumed that each subsequent regime has stronger antitrust regulations and enforcement than the previous regime as antitrust law evolved all over the world. Therefore, under the assumption that each following regime is more effective, it is expected that the magnitude of overcharge becomes smaller in each subsequent period.

Cartels can be found in any industry. Given that industries differ due to market structure, including demand and supply conditions, barriers to entry and exit, technology, and other factors, the overcharge levels may vary significantly across different industries. Based on the assumption that many food industry products have relatively inelastic demand in comparison with demand for other industry products, we may expect that the overcharge is higher relative to the benchmark of perfectly competitive outcome (if the firms did not collude) in the case of the food industry cartels. However, if the benchmark case is not perfectly competitive, then the degree of market concentration may impact the level of the benchmark price. The latter is also influenced by supply conditions, i.e. production technology, entry and exit conditions, sunk costs and others. If the benchmark price is

higher in the food industry relative to the benchmark price in other industries, then this may decrease the size of overcharge imposed by food industry cartels.

Finally it is important to note that the overcharge estimates used in our empirical analysis were collected from different publication sources and were estimated using different methods. Consequently, differences among publication sources and estimation methods may contribute to the variability in the overcharge estimates as well. For example, econometric modeling methods may generate higher overcharges and historical case studies may generate lower overcharges in comparison with all other methods. Overcharges estimated using the "price before conspiracy" method are believed to be higher than overcharges estimated using the "price after conspiracy" method. This is because the conspiracy effect stays on the market for a certain period of time after the conspiracy has been terminated (Connor, 1998). Overcharge estimates published in peer-review journals and edited book chapters may be higher, on average, than the overcharge estimates appearing in other sources due to editors' willingness to publish more economically significant results.

Data Set Description

The data set we use in our study is quite different from the data usually employed in economic analysis. To conduct empirical analysis of the overcharges imposed by different cartels during different periods of history and in different geographic markets, we use part of the data set compiled by J. Connor (Connor, 2005). The data set consists of approximately 900 overcharge estimates for approximately 270 different product markets. The estimates are available for different geographic markets and for different time periods starting from the 18th century. The overcharge observations in the data set were estimated using different methods and were published in different published sources starting as early

as 1888. Also the data set has information on different characteristics of the cartels associated with each overcharge estimate. From the description of the episode and estimation method, in most of cases it is possible to form a judgment on episode duration and on the geographic market for which overcharge was estimated. Given the product market, we can distinguish between food industry cartels and cartels in other industries. For our study we compile a sub-set of this data set[12]. We used the following procedure while selecting overcharge estimates for this study. First, two types of estimates were available: average (low and high) and peak (low and high) overcharges. We decided to analyze the average low level of overcharge to conduct the most conservative analysis. Second, some episodes were represented by more than one overcharge estimate. This happened because the same episode was analyzed in different studies and/or different methods of overcharge estimation were used. Finally, in addition to research reported in the academic literature, overcharge estimates became available from court decisions. So, we had to eliminate all redundant estimates to form a data set for this study. Again, to follow the most conservative approach, we included in our data set the lowest overcharge estimate among available alternatives for each episode. As a result, the data set for this study includes 395 observations[13]. Each observation represents a cartel episode, which in most cases is an uninterrupted period of collusion with a corresponding set of rules and membership.

[12] The data set for this study was formed using information presented in Table 2 of Connor (2005), which currently is confidential information by request of J. Connor. All variables were formed by Y. Bolotova using information presented in Table 2 and Table 1 (the latter is available as a part of Staff Paper). In the majority of cases (approximately 85-90 percent of all observations) Bolotova was able to obtain all necessary information from Table 2 to construct the model. In the remaining episodes with missing or ambiguous information Bolotova used all available information presented in Table 1, Table 2 and Staff Paper by Connor (2005) and her own judgment to form a proxy for missing information. These questionable cases were not excluded in order to form a data set that is as large and representative as possible. In addition, if some information was missing or was ambiguous, the variables formed by assumption represent a relatively small share of the total number of the covariates. For example, Model [1] has 27 independent variables (excluding intercept). If the exact duration period was unknown the authors' best judgment was used to construct a proxy for it. Therefore, only the DURATION variable and some of the different antitrust law regimes variables are affected. Under the most conservative approach (in case of a relatively long duration episode), only 4 variables out of 27 for this observation were affected by these judgment calls.

[13] We did not include three observations that should have been included according to the methodology of selection process because they were obvious outliers: 450, 787 and 800 percent.

Descriptive statistics for all cartels, the food industry group, and the group of cartels in other industries are represented in Table 2, Table 3, and Table 4, respectively. The data we use were collected through literature survey, and this may introduce additional noise. Given that the total sample size for this study consists of 395 observations, the food industry cartel group represents 24 percent of the total sample (94 observations) and the other industries cartel group represents 76 percent of the total sample (301 observations).

The mean overcharge of the total sample is 28.88 percent and the median is 19 percent[14]. The minimum value of overcharge is –10 percent, and the maximum value is 322 percent. The mean overcharge for food industry cartels is 20.71 percent, which is approximately 8 percentage points lower than the mean overcharge for the overall sample. Food industry overcharges fall in the range of -5 to 60 percent with the median of 17.10 percent. The mean overcharge for non-food industry cartels is 31.43 percent, which is approximately 2.55 percentage points higher than the mean overcharge for the overall sample. The other industry cartel overcharges take values from -10 to 322 percent, and the median is 19.50 percent. These three distributions show that food industry cartels on average impose a lower level of overcharge than cartels in other industries.

The mean duration of food industry cartel episodes is approximately 7 years; the range of this variable is from three months to 36 years. The mean duration of other industries cartel episodes is approximately 9 years; this variable falls in the range of one month to 98 years. As with the level of overcharges, the mean duration of food industry cartels episodes is shorter than the mean duration for the overall sample, while the mean duration of other industry cartels is longer than the mean duration for the overall sample.

Domestic cartels represent 47 percent of total sample, 40 percent of the food industry cartels sample, and 49 percent of the other industries sample. Bid-rigging cartels

[14] There are three negative overcharge (undercharge) estimates in the sample of 395 cartel episodes. These undercharges are equal to -10, -5, and –1 percent. There are 38 zero overcharges out of 395 observations.

constitute 18 percent of the total sample, 7 percent of food industry cartels sample, and 22 percent of other industries cartels. In the total sample approximately 65 percent of cartels were found or pled guilty. Approximately 82 percent of food cartels and 59 percent of others cartels were found or pled guilty. Cartels that were not guilty are represented by those not prosecuted, not found guilty and legal cartels.

In all samples most of overcharge estimates are available for the United States (including Canada), Europe and the world market rather than for Asian markets (including Australia) and the markets of the rest of the world (ROW)[15]. This is because antitrust law has been enforced in the US, Canada and European countries for a longer period of time than in other countries, thus, making more information available. Some Asian counties started enforcing antitrust regulation recently. However, many other countries either do not have antitrust law or similar regulation at all, or have it but do not enforce it. Therefore, overcharge estimates are very rare for these markets.

As for the distribution of cartels episodes across the different antitrust law regimes, the episodes are distributed relatively evenly across six periods covering 1770-2004 with 32 percent belonging to last 14 years. Food industry cartels are not very prominent during the first two regimes covering 1770-1919, but 61 percent of the food industry cartel sample operated during the 6th regime covering 1991-2004. Other industry cartels distribution follows the trend of the overall sample with more uniform allocation across the six regimes.

Most of the overcharges included in all three samples were estimated using the price before conspiracy method, other methods, and econometric modeling. For example, in the case of food industry cartels these estimates represent 53, 11, and 11 percent of the sample respectively. Most overcharge estimates were collected from monographs and

[15] Further we use the abbreviation EU for the group of overcharges estimated for any European country. The majority of these estimates actually belong to EU country-members. But some of the estimates were calculated for cartels that had operated before the European Union was formed and their operation affected European market.

books, court decision, peer reviewed and academic journals, and working papers. For example, these estimates constitute 17, 27, 22, and 32 percent of the food industry cartels sample respectively.

Results

Given the survey nature of our data set, we do not make any strong assumptions about the error distribution, and we estimate the models with the ordinary least squares estimator (OLS) as semi-parametric linear regression models. We do not conduct any formal tests for the presence of autocorrelation. As the data come from different periods of time, and the overcharges are estimated for different episodes with different length, we cannot organize the data to easily capture dynamics in the time dimension. Using a Breusch-Pagan test for heteroscedasticity we fail to reject homoscedasticity at the 10 percent level of significance in each of the three models[16]. The ordinary least square estimation results for the overall sample, food industry group, and other cartels along with the LM statistics are represented in Table 5.

The estimation results for the overall sample of cartels (Model [1]) show that most of the estimated coefficients have the expected signs and at least half of them are statistically significant at an acceptable level of the probability of type 1 error[17]. In this model the explanatory variables explain approximately 11.7 percent of the variation in dependent variable, the size of overcharge. Using a Wald statistic we test whether all explanatory variables (except intercept) are jointly significant. We reject the null

[16] We conducted a Breusch-Pagan Test for heteroscedasticity for each model by regressing the OLS squared residuals obtained from Model [1], [2], and [3] on all explanatory variables included in each of these models. Resulting LM statistic = N*R2, where N is the sample size and R2 is a goodness-of-fit statistic from the OLS regression of the squared residuals on a set of explanatory variables that are believed to cause heteroscedasticity. LM has the Chi-Squared distribution with the number of degrees of freedom equal to the number of explanatory variables included in the regression (excluding intercept).

[17] When discussing the results, we present p-values to allow the readers to form their own opinions about statistical significance of the estimated coefficients or test statistics in each individual case.

hypothesis of no joint effect of all explanatory variables at a p-value equal to 0.0065 (Table 5).

The estimated coefficient for FOOD is -11.84 and is statistically significant with a p-value equal to 0.0190. This coefficient shows that food industry cartels on average impose lower overcharges than other industries cartels, holding all other factors constant. This difference, 11.84 percentage points, is consistent with the descriptive statistics discussed earlier in the paper. The marginal effect for FOOD is opposite to what we expected. There are a few possible explanations of this outcome. First, as mentioned earlier, the benchmark markets in the food industries may be more concentrated than the benchmark markets in other industries. Industries producing food and feed ingredients such as citric acid or lysine are known to have high exit and entry barriers. Second, the products included in the food industry group may have more substitutability among them than the products included in other industry group. These may reduce the overcharge level in the food industry cartel group. Finally, food industry cartels may be less durable than other industries cartels. Descriptive statistical analysis shows that the average duration of food industry cartels is 6.87 years while the average duration of other cartels is 9.16 years. Also, our estimation results indicate that longer cartel episodes generate higher overcharges. Thus, this may partially explain why lower overcharges are imposed by food industry cartels relative to other industry cartels. In addition, the estimation results show that each five additional years of food industry cartel operation increase the overcharge by 2.17 percentage points while other industry cartels manage to raise the overcharge by 3.89 percentage points during the same period of time. This suggests that food industry cartels are less effective in comparison with other industry cartels. One of the reasons is that food industries are more often affected by demand shocks caused by population growth. It is known that during demand shocks there are incentives for cartel participants to deviate, and

this may result in a price war, or lapse or termination of a collusive agreement. This suggests that it may be more difficult for a food industry cartel to reach a monopolistic price level than for other industry cartels.

The signs of the estimated coefficients for DURATION, DOMESTIC and GUILTY are as expected, and the sign of the estimated coefficient for BIDRIG is opposite to what we expected. The estimated coefficients for DURATION and DOMESTIC are statistically significant with p-values equal to 0.0430 and 0.0250 respectively. Each additional 5 years of cartel operation increase the overcharge by 3.86 percentage points on average. Domestic cartels on average impose overcharges 11.81 percentage points lower than international cartels. The estimated coefficient for BIDRIG is -0.96, indicating that bid-rigging cartels impose slightly lower overcharges than cartels that are not bid rigging. This coefficient is not statistically significant and has a p-value equal to 0.8700. The estimated coefficient for GUILTY is -5.99. It indicates that the cartels found or pled guilty imposed lower overcharges than legal cartels and those cartels that were not prosecuted. This coefficient is not statistically significant with a p-value equal to 0.2340.

As for the hypothesis on geographic price/overcharge discrimination the marginal effects for US, EU and ASIA are –5.98, –11.05, and –4.61 respectively and indicate that cartels impose lower overcharges in the markets of the US (including Canada), Europe and Asia (including Australia) in comparison with the reference group of average world overcharges. The overcharges are also lower in Europe than in the US (including Canada) if compared to the reference world market. Only the estimated coefficient for EU is statistically significant with a p-value equal to 0.0740. US and ASIA have p-values equal to 0.3420 and 0.6200 respectively. In contrast, overcharges imposed in the countries of the ROW are 0.47 percentage points higher than the world overcharges. This coefficient is not statistically significant and has a p-value equal to 0.9650. These results support the idea

that there is at least some geographic price/overcharge discrimination exercised by cartels. In addition, cartels impose lower levels of overcharges, in comparison to the reference world market, on markets with a strongly enforced antitrust law, such as the US (including Canada), European countries, and some Asian countries (including Australia).

Two of the time coefficients, P4 and P6 are statistically significant with p-value equal to 0.0800 and 0.0570. The marginal effects for P1, P4 and P5 are not statistically significant with p-values equal to 0.3870, 0.1880, and 0.1440 respectively. Given that the reference period is the 2nd period (1891-1919), the overcharges in all other periods of history were lower than the overcharges for this reference group, holding all other factors constant. The marginal effects estimated for different antitrust law regimes provide mixed evidences about the impact of different antitrust law regimes on the size of overcharges, or, in other words, about the effectiveness of antitrust law enforcement. For example, the overcharges imposed during 1920-1945 were 8.14 percentage points lower than overcharges imposed in 1891-1919. The overcharges imposed in 1946-1973 were 12.08 percentage points lower than the reference period overcharges. These two coefficients show that antitrust law enforcement during the 4th period may have been more effective than during the 3rd period relative to the 2nd period. But the overcharges during 1974-1990 and 1974-1990 were 9.60 and 13.73 percentage points lower than the reference group overcharges. Thus, the most recently imposed overcharges were approximately at the same level as the overcharges imposed in 1946-1973. In summary, there is a general tendency that the level of overcharges decreases as antitrust enforcement becomes stronger in a subsequent period, but that it is not always the case when a longer time horizon is considered.

As the estimation results show, differences in the estimation methods as well as in publication sources explain some variability in overcharge estimates. The

intercept/reference group for the estimation methods is represented by PAFTER. Only the marginal effect for YARDSTICK is statistically significant at an acceptable Type 1 error probability. Overcharge estimates recovered using YARDSTICK are on average 12.57 percentage points higher than the overcharge estimates recovered using PAFTER and this effect has a p-value equal to 0.1230. Overcharges estimated as a result of historical case studies are 24.03 percentage points lower and overcharges estimated using PBEFORE and ECON are 7.20 and 9.69 percentage points higher respectively than the reference group overcharges. But these marginal effects are not statistically significant with p-values equal to 0.2190, 0.2710 and 0.2860 respectively.

Only overcharge estimates obtained from government official reports and court and antitrust authorities' decisions are statistically different from the reference group overcharges represented by MONOGR. Overcharges presented in government official reports are on average 21.43 percentage points lower than overcharges of the reference group. In contrast, the overcharges determined as a result of court or antitrust authority decisions are on average 16.51 percentage points higher than those of the reference group. GOVREP and COURT are statistically significant with p-values equal to 0.0670 and 0.0200.

To evaluate the magnitude of overcharges imposed by food industry cartels and by other industries cartels we estimated Model [2] for the sample of food industry cartels and for the sample of other industry cartels (Model [3]). The OLS estimation results for Model [3] applied to the sample of other industries cartels in general are similar to the estimation results characterizing the full sample discussed earlier (Table 5). Also, the overall pattern of statistical significance of the coefficients is very similar in these two models. In the case of the food industry sample (Model [2]), some of the coefficients are similar to those of Model [1] discussed above, and some are quite different. In general, the differences arise

for coefficients that were not statistically significant at an acceptable Type 1 error probability in Model [1].

The estimation results of Model [2], applied to food industry cartels, show that the explanatory variables explain approximately 28.50 percent of the variation in dependent variable, the level of overcharge imposed by food industry cartels. Using a Wald statistic we fail to reject the null hypothesis of no joint effect of all explanatory variables included in this model (except intercept) at a p-value equal to 0.1659 only. Looking at the estimated coefficients for different estimation methods and different publication sources, we notice that only EDITBOOK is statistically significant with a p-value equal to 0.0660. Using a Wald Statistic we fail to reject the null hypothesis of no joint effect of differences in the estimation methods and the publication sources included in the model at a p-value equal to 0.2575[18]. While using the same test statistic we reject the null hypothesis of no joint effect of different cartel characteristics and environment of their operation at a p-value equal to 0.0467[19]. Thus, we discuss the latter group of the explanatory variables in greater detail.

In Model [2] the estimated coefficients for the variables representing different cartel characteristics, such as DURATION, DOMESTIC, GUILTY have the same sign and approximately the same magnitude as those in Model [1]. The estimated coefficient for DURATION is 2.17 and is not statistically significant in Model [2] with a p-value equal to 0.3350. The marginal effect for DOMESTIC is –12.45 and is statistically significant with a p-value equal to 0.0950. The estimated coefficient for BIDRIG is 1.70 and is not statistically significant at an acceptable Type 1 error probability level suggesting that there is no statistically significant difference in the overcharges imposed by bid-rigging and not bid-rigging cartels. The estimated coefficient for GUILTY is -6.62 and is not statistically significant with a p-value equal to 0.3820. This indicates that there is no statistically

[18] The Wald statistic is equal to 11.2778 and has the Chi-Square distribution with 7 degrees of freedom.
[19] The Wald statistic is equal to 22.6349 and has the Chi-Square distribution with 6 degrees of freedom.

significant difference between the cartels that pled or were found guilty and a group of legal cartels and those not prosecuted in the food industry cartels sample. It should be mentioned here that those cartels that pled guilty paid treble damages and fines calculated using the lower level of overcharge. Given that the actual overcharge was possibly larger, this suggests that in reality this coefficient would be greater.

In Model [2] only the marginal effect for EU is statistically significant among the estimated coefficients for different geographic variables, US, EU, ASIA, and ROW as in the case of Model [1]. This suggests that there is some geographic price/overcharge discrimination exercised by food cartels. The lowest levels of overcharges are imposed in Europe. They are approximately 12.14 percentage points lower than the reference world overcharges. The estimation results suggest that overcharges imposed in the US (including Canada), Asia (including Australia) and the ROW are –5.24, -9.31 and –4.78 percentage points lower than average world overcharges. These marginal effects are not statistically significant with p-values equal to 0.3240, 0.3270 and 0.6860 respectively.

In the case of antitrust law regimes we observe different outcomes from the overall sample results. The estimated coefficients for all time period variables, P1, P3…P5, are positive. This suggests that as antitrust law becomes stricter the overcharges increase relative to the reference period represented by P2 in the sample of the food industry cartels. Only one of these marginal effects, P5, is statistically significant with a p-value equal to 0.0570 and equal to 14.56. Thus, overcharges imposed during 1974-1990 were 14.56 percentage points higher than overcharges imposed during 1891-1919. In general, this group of variables behaves opposite to expected. This suggests that in the case of food industry cartels only, the recent antitrust regimes were not as effective as the regimes that existed before the middle of the last century.

Conclusion

The results of our study reveal several tendencies characterizing collusive behavior of private cartels starting from 1770s and ending today. We used overcharge estimates for 395 cartel episodes that were collected from different publication sources along with cartel characteristics. Using econometric estimation we quantified an impact of three sets of variables on the size of overcharges imposed by cartels with different characteristics, on different geographic markets, and during different regimes of antitrust law. In the analysis we also accounted for the impact of different estimation methods used to calculate the overcharges and for publication sources. In addition, we analyzed the food industry cartels group relative to other industries cartels and overall sample. The results of our study have important policy implications.

The average level of overcharge imposed by all cartels in the sample is 29 percent with the median overcharge of 19 percent. Food industry cartels, on average, impose lower overcharges, and cartels in other industries impose higher overcharges than the mean overcharge of the full sample. It should be noted that in all cases mean and median overcharges are considerably higher than the base offence level established in 2001 US Federal Sentencing Guidelines.

Domestic cartels, on average, impose approximately 12 percentage points lower overcharges than domestic cartels. Each additional 5 years of cartel operation result in an approximately 4 percentage points increase in overcharge level. In contrast to the presumption of 2001 Federal Sentencing Guidelines, our overall sample evidence indicates that there is no statistically significant difference between overcharges imposed by bid-rigging cartels and other cartels. We did not find statistically significant evidence that cartels operating illegally had imposed lower overcharges than legal cartels or those not prosecuted. We found some evidence of price/overcharge discrimination exercised by

cartels, but the evidence was very limited. The explanation may be found in the approach of selecting different geographic markets for this study. We used our own judgment based on available information about the method of overcharge estimation to assign each observation to a certain market. In the case of international cartels, prices were often available for transactions traded on a Board of Trade for a certain product. We assigned such observations to the market where this Board of Trade was situated, but the firms could have served a much larger market. Food industry cartels and other industries cartels estimation results exhibit approximately the same tendency as the full sample evidence.

In the overall sample model we found mixed support for the proposition that stronger antitrust enforcement over time would decrease the magnitude of overcharges. In our models we included six antitrust law regimes covering 1770-2004 and assumed that each subsequent regime was characterized by stronger rules and enforcement. We find that taking two or three subsequent regimes we may find evidence of some decrease in overcharge level while moving from one regime to another. But taking all six regimes together, we found that the overcharges imposed recently may be about the same magnitude as those imposed before the middle of the last century. Opposite to expected results were found in the case of food industry cartels. Overcharges increase as antitrust regimes become stricter. In general, these results did not exhibit ~~a~~ statistical significance.

The different estimation methods used to calculate overcharges and different publication sources where overcharge estimates were published had some impact on the magnitude of overcharges in the full sample. Overcharges estimated as a result of historical case studies are lower and overcharges estimated using “price-before conspiracy”, yardstick, and econometric methods are higher than overcharges calculated using “price-after conspiracy” method. As for publication sources, overcharge estimates found in official government sources are lower and overcharge estimates obtained from official

court and antitrust authorities decisions are higher than the overcharge estimates reported in monographs. In the sample of the food industry cartels the estimation methods and publication sources do not exhibit a statistically significant contribution to the variability in cartel overcharges.

While selecting overcharge estimates for our analysis we used the most conservative approach. We selected the observations with the lowest overcharge estimate if more than one estimate for the same cartel episode was available. We also note that most of the variation in the dependent variable, overcharge rate, remains unexplained. Thus, attempts to expand the model by including new explanatory variables or interaction effects may change the estimation results. Finally, we emphasize that if one is interested in overcharges above some positive threshold, or in the distribution of overcharges, then a different model has to be built or different econometric procedures must be used to answer these questions.

References

2001 Federal Sentencing Guideline Manual. §2R1.1. Bid-Rigging, Price-Fixing or Market-Allocation Agreements Among Competitors. http://www.ussc.gov/2001guid/2r1_1.htm (visited 03/21/2005).

Besanko, D. and R.R. Braeutigam. Microeconomics: an Integrated Approach. John Wiley & Sons, Inc. 2002.

Clarke, J.L. and S.J. Evenett "The Deterrent Effects of National Anticartels Laws: Evidence from the International Vitamins Cartel," *Antitrust Bulleting.* 48, 2003: 689-726.

Connor, J. M. "Price-Fixing Overcharges: Legal and Economic Evidence." Staff Paper No. 04-15, February 2005. Department of Agricultural Economics, Purdue University, West Lafayette, IN. Also, November 2004 version is available on the web-site of American Antitrust Institute: http://www.antitrustinstitute.org/recent2/355.pdf (visited 02/13/2005).

_____. Global Cartel Redux: The Amino Acid Lysine Antitrust Litigation (1996), in John E. Kwoka and Lawrence White (eds), *The Antitrust Revolution (Forth Edition).* Oxford: Oxford University Press, 2004a.

_____. "Global Antitrust Prosecutions of Modern International Cartels," *The Journal of Industry, Competition, and Trade.* No.4, September 2004b: 239-267.

_____. "Our Customers are Our Enemies": The Lysine Cartel of 1992-1995." *Review of Industrial Organization.* 18, 2001: 5-21.

_____. "The Global Citric Acid Conspiracy: Legal-Economic Lessons." *Agribusiness.* Vol. 14, No. 6, 1998: 435-452.

Dick, A.R. "When are Cartels Stable Contracts?" *Journal of Law and Economics*, 26, No. 1, April 1996: 241-283.

Evenett, S.J., M.C. Levenstein, and V.Y. Suslow. "International Cartel Enforcement: Lessons from the 1990s," *The World Economy*. Vol. 24, 2001: 1221-1245.

Froeb, L.M., R.A. Koyak, and G.J Werden. "What is the Effect of Bid-rigging on Prices?" *Economics Letters*. 42, 1993: 419-423.

Genesove, D. and W.P. Mullin. "Rules, Communication, and Collusion: Narrative Evidence from the Sugar Institute Case," *The American Economic Review.* June 2001: 379-398.

Mittelhammer R.C., G.G. Judge, and D.J. Miller. Econometric Foundations. Cambridge University Press. 2000.

Stigler, George J. "The Economics of Information." *The Journal of Political Economy* LXIX (June 1961), No 3: 213-225.

_____. "A Theory of Oligopoly." *The Journal of Political Economy*, Vol. 72, No. 1 (Feb., 1964): 44-61.

Table 1. Definition of Explanatory Variables

Explanatory Variable	Definition	Expected Sign
FOOD	Binary variable: =1 if a cartelized product belongs to the food industry.	-
DURATION	Discrete variable in the range of 1 to 4, characterizing duration of episode: = 1 if duration is less or equal to 5 years, = 2 if duration is from 6 to 10 years, = 3 if duration is from 11 to 15 years, = 4 if duration is greater than 16 years.	+
Binary variables representing different cartel characteristics		
DOMESTIC	= 1 if a cartel is international.	-
BIDRIG	= 1 if a cartel is bid-rigging.	+
GUILTY	= 1 if a cartel is found or pleads guilty.	-
Binary variables representing different geographic markets		
US	= 1 if overcharge is for the U.S. and Canadian markets.	-
EU	= 1 if overcharge is for the E.U. or any of European countries markets.	-
ASIA	= 1 if overcharge is for any Asian country or Australia.	+
ROW	= 1 if overcharge is for the ROW including Latin America.	+
WORLD	= 1 if overcharge is for world market.	reference
Binary variables representing different antitrust law regimes		
P1	= 1 if cartel episode belongs to the period of 1770-1890.	+
P2	= 1 if cartel episode belongs to the period of 1891-1919.	reference
P3	= 1 if cartel episode belongs to the period of 1920-1945.	-
P4	= 1 if cartel episode belongs to the period of 1946-1973.	-
P5	= 1 if cartel episode belongs to the period of 1974-1990.	-
P6	= 1 if cartel episode belongs to the period of 1991-2004.	-
Binary variables, representing different estimation methods		
OTHER	= 1 if no explanation, others.	?
HISTOR	= 1 if no explanation, historical case study.	-
PBEFORE	= 1 if price before conspiracy.	+
PWAR	= 1 if price during price war or laps of collusion.	?
PAFTER	= 1 if price after conspiracy.	reference
YARDST	= 1 if yardstick.	?
COST	= 1 if normal profit or total cost.	+
ECON	= 1 if econometric methods.	?
Binary variables, representing different publications sources		
JOURNAL	= 1 if peer reviewed journals, including academic journals.	?
EDBOOK	= 1 if chapters in edited books.	?
MONOGR	= 1 if monographs or books.	reference
GOVREP	= 1 if official government report.	-
COURT	= 1 if court or antitrust authorities source.	?
WORKP	= 1 if unpublished working paper.	+
SPEECH	= 1 if speech or conference presentation proceedings.	+

* "?" means that we are uncertain about the direction of the effect

Table 2. Descriptive Statistics for All Cartels

Variable	Mean	Standard Deviation	Minimum	Maximum
OVRATE	28.88 (19.00)*	1.874	-10	322
FOOD	0.24	0.021	0	1
DURATION**	8.62	0.567	0.08	98
DOMESTIC	0.47	0.025	0	1
BIDRIG	0.18	0.020	0	1
GUILTY	0.65	0.024	0	1
US	0.38	0.025	0	1
EU	0.31	0.023	0	1
ASIA	0.09	0.014	0	1
ROW	0.04	0.010	0	1
P1	0.13	0.017	0	1
P2	0.14	0.018	0	1
P3	0.23	0.021	0	1
P4	0.15	0.018	0	1
P5	0.17	0.019	0	1
P6	0.32	0.023	0	1
OTHER	0.21	0.021	0	1
HISTOR	0.01	0.005	0	1
PBEFORE	0.33	0.024	0	1
PWAR	0.02	0.007	0	1
PAFTER	0.11	0.016	0	1
YARDST	0.11	0.016	0	1
COST	0.06	0.012	0	1
ECON	0.15	0.018	0	1
JOURNAL	0.20	0.020	0	1
MONOGR	0.08	0.013	0	1
EDITBOOK	0.28	0.023	0	1
GOVRET	0.03	0.009	0	1
COURT	0.24	0.022	0	1
WORKP	0.17	0.019	0	1
SPEECH	0.01	0.004	0	1

* the median overcharge is in the parentheses

** in years

Table 3. Descriptive Statistics for Food Industry Cartels

Variable	Mean	Standard Deviation	Minimum	Maximum
OVRATE	20.71(17.10)*	1.540	-5	60
DURATION**	6.87	0.572	0.25	36
DOMESTIC	0.40	0.051	0	1
BIDRIG	0.07	0.027	0	1
GUILTY	0.82	0.040	0	1
US	0.50	0.052	0	1
EU	0.22	0.043	0	1
ASIA	0.05	0.023	0	1
ROW	0.03	0.018	0	1
P1	0.06	0.025	0	1
P2	0.06	0.025	0	1
P3	0.11	0.032	0	1
P4	0.09	0.029	0	1
P5	0.15	0.037	0	1
P6	0.61	0.051	0	1
OTHER	0.11	0.032	0	1
HISTOR	0.00	0.000	0	0
PBEFORE	0.53	0.052	0	1
PWAR	0.00	0.000	0	0
PAFTER	0.11	0.032	0	1
YARDST	0.10	0.031	0	1
COST	0.05	0.023	0	1
ECON	0.11	0.032	0	1
JOURNAL	0.22	0.043	0	1
MONOGR	0.17	0.039	0	1
EDITBOOK	0.02	0.015	0	1
GOVRET	0.00	0.000	0	0
COURT	0.27	0.046	0	1
WORKP	0.32	0.048	0	1
SPEECH	0.00	0.000	0	0

* the median overcharge is in the parentheses

** in years

Table 4. Descriptive Statistics for Other Cartels

Variable	Mean	Standard Deviation	Minimum	Maximum
OVRATE	31.429 (19.50)*	2.395	-10	322
DURATION**	9.16	0.718	0.08	98
DOMESTIC	0.49	0.029	0	1
BIDRIG	0.22	0.024	0	1
GUILTY	0.59	0.028	0	1
US	0.35	0.028	0	1
EU	0.33	0.027	0	1
ASIA	0.10	0.017	0	1
ROW	0.05	0.012	0	1
P1	0.15	0.021	0	1
P2	0.17	0.021	0	1
P3	0.27	0.026	0	1
P4	0.17	0.021	0	1
P5	0.18	0.022	0	1
P6	0.23	0.024	0	1
OTHER	0.24	0.025	0	1
HISTOR	0.01	0.007	0	1
PBEFORE	0.27	0.026	0	1
PWAR	0.02	0.009	0	1
PAFTER	0.11	0.018	0	1
YARDST	0.12	0.019	0	1
COST	0.06	0.014	0	1
ECON	0.16	0.021	0	1
JOURNAL	0.19	0.023	0	1
MONOGR	0.31	0.027	0	1
EDITBOOK	0.09	0.017	0	1
GOVRET	0.04	0.011	0	1
COURT	0.23	0.024	0	1
WORKP	0.12	0.019	0	1
SPEECH	0.01	0.006	0	1

* the median overcharge is in the parentheses
** in years

Table 5. Ordinary Least Square Estimation Results

Estimated Coefficient	All cartels	Food Industry Cartels	Other cartels
	N=395	N=94	N=301
Intercept	**41.92**	**34.86**	**41.85**
st.error	9.19	13.56	11.09
p-value	0.0000	0.0120	0.0000
FOOD	**-11.84**		
st.error	5.05		
p-value	0.0190		
DURATION	**3.86**	**2.17**	**3.89**
st.error	1.90	2.24	2.41
p-value	0.0430	0.3350	0.1080
DOMESTIC	**-11.81**	**-12.45**	**-11.91**
st.error	5.25	7.36	6.68
p-value	0.0250	0.0950	0.0760
BIDRIG	**-0.96**	**1.77**	**-0.04**
st.error	5.85	7.31	7.09
p-value	0.8700	0.8090	0.9960
GUILTY	**-5.99**	**-6.62**	**-6.68**
st.error	5.02	7.53	6.11
p-value	0.2340	0.3820	0.2750
US	**-5.98**	**-5.24**	**-8.98**
st.error	6.28	5.28	8.46
p-value	0.3420	0.3240	0.2890
EU	**-11.05**	**-12.14**	**-13.31**
st.error	6.17	6.69	8.00
p-value	0.0740	0.0740	0.0970
ASIA	**-4.61**	**-9.31**	**-5.11**
st.error	9.28	9.43	11.81
p-value	0.6200	0.3270	0.6660
ROW	**0.47**	**-4.78**	**-1.60**
st.error	10.70	11.80	13.61
p-value	0.9650	0.6860	0.9070
P1 (1770-1890)	**-6.31**	**1.76**	**-5.88**
st.error	7.30	9.81	8.83
p-value	0.3870	0.8580	0.5060
P3 (1920-1945)	**-8.14**	**8.05**	**-9.02**
st.error	6.16	9.24	7.41
p-value	0.1880	0.3870	0.2240
P4 (1946-1973)	**-12.08**	**9.94**	**-13.39**
st.error	6.88	8.55	8.51
p-value	0.0800	0.2490	0.1170
P5 (1974-1990)	**-9.60**	**14.56**	**-14.40**
st.error	6.56	7.52	8.25
p-value	0.1440	0.0570	0.0820

Table 5 (cont.)

P6 (1991-2004)	**-13.73**	**0.94**	**-14.50**
st.error	7.20	10.06	9.32
p-value	0.0570	0.9260	0.1210
OTHER	**-0.40**	**-10.52**	**-0.42**
st.error	7.27	8.90	9.23
p-value	0.9560	0.2410	0.9640
HISTOR	**-24.03**		**-22.58**
st.error	19.52		22.41
p-value	0.2190		0.3140
PBEFORE	**7.20**	**-5.25**	**11.23**
st.error	6.54	7.28	8.47
p-value	0.2710	0.4740	0.1860
PWAR	**8.52**		**10.85**
st.error	15.76		18.33
p-value	0.5890		0.5550
YARDSTICK	**12.57**	**2.94**	**12.14**
st.error	8.13	8.62	10.74
p-value	0.1230	0.7340	0.2590
COST	**0.89**	**-4.44**	**-0.89**
st.error	10.05	11.44	13.25
p-value	0.9290	0.6990	0.9460
ECON	**9.69**	**-4.85**	**14.15**
st.error	9.07	9.24	11.51
p-value	0.2860	0.6020	0.2200
JOURNAL	**-2.36**	**-5.79**	**-3.08**
st.error	6.42	6.58	8.30
p-value	0.7130	0.3820	0.7110
EDITBOOK	**-5.27**	**-29.58**	**-5.70**
st.error	9.71	15.85	11.53
p-value	0.5880	0.0660	0.6210
GOVREP	**-21.43**		**-19.03**
st.error	11.65		13.36
p-value	0.0670		0.1550
COURT	**16.51**	**7.64**	**21.57**
st.error	7.06	7.05	9.48
p-value	0.0200	0.2820	0.0240
WORKP	**5.53**	**-5.63**	**11.85**
st.error	7.91	6.52	11.37
p-value	0.4840	0.3910	0.2980
SPEECH	**8.16**		**13.05**
st.error	23.23		27.21
p-value	0.7250		0.6320
R2	0.1170	0.2850	0.1148
R2 adj.	0.0521	0.0634	0.0309
Wald St. (p-value)	48.64 (0.0065)	28.30 (0.1659)	35.55 (0.1002)
LM St. (p-value)	31.01 (0.2708)	22.79 (0.4139)	22.94 (0.6365)