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**A REEXAMINATION OF THE PROFITABILITY OF PRICE FIXING  
USING STOCK PRICE MOVEMENT  
HAS NEW ANTITRUST  
LEGISLATION BEEN A MORE  
EFFECTIVE DETERRENT OF  
PRICE FIXING?**

by

Joshua Dean Detre and Alla Gollub  
Staff Paper #04-03  
February 2004

**Dept. of Agricultural Economics**

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### **Abstract**

The Department of Justice (DOJ) antitrust penalties have become harsher for violating individuals and firms, and the criminal enforcement of cases has become increasingly important during the last 20 years. In this study we investigate whether these changes in antitrust law led to improved effectiveness of antitrust actions with respect to price-fixing over 1981-2001. We measure effectiveness by suppressed stock market values of offending firms after successful Section 1 of the Sherman Act indictment, by duration of the deterrent effect and by the rate of recidivism. We use effectiveness of antitrust enforcement documented by Bosch and Eckard (1991) and Thompson and Kaserman (2001) for 1962-80 as a basis for comparison. Our results show that the changes in antitrust law do improve the effectiveness as measured by changes in market valuations of offenders, but the durability of deterrent effect and the rate of recidivism are left unaffected suggesting that Section 1 of Sherman Act enforcement has very little lasting effect.

Keywords: Antitrust, price fixing, recidivism, stock market.

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# **A REEXAMINATION OF THE PROFITABILITY OF PRICE FIXING USING STOCK PRICE MOVEMENT: HAS NEW ANTITRUST LEGISLATION BEEN A MORE EFFECTIVE DETERRENT OF PRICE FIXING?**

by

Joshua Dean Detre and Alla Golub

## **Introduction**

In a frequently cited article, Bosch and Eckard (1991) studied the capital market impacts of federal price fixing indictments that occurred during 1962-80 and found that \$2.18 billion in equity was lost for their sample of offenders around the Wall Street Journal (WSJ) announcement of the indictments; only a small portion of this equity lost was attributed to legal costs. They interpreted the remainder of the equity lost as the present value of monopoly profits lost because of conspiracy dissolution. Thus, the antitrust enforcement does provide consequences in the form of suppressed stock market values after a successful Section 1 indictment. Nevertheless, Bosch and Eckard (1991) also point out that price fixing is a profitable deal because the profits from price fixing exceed expected fines plus treble damage settlements and awards, implying that the deterrent effects of antitrust enforcement actions are small. The question then becomes how long does this deterrent effect last, and how often do previously indicted firms return to collusive behavior. Using the same dataset, Thompson and Kaserman (2001) investigate these questions and find that the stock prices of 85 percent of the firms in the sample returned to their pre-indictment levels within one year of the antitrust action, which suggests the conclusion that Section 1 of Sherman Act enforcement has little lasting effect, at least for the considered set of firms during 1962-80.

With the various changes in price-fixing penalties and DOJ antitrust enforcement policies since 1980, we thought it would be desirable to analyze the temporal sensitivity of studies conducted by Eckard and Bosch (1991) and Thompson and Kaserman (2001). In our study, we examine those horizontal per se violations that occurred from 1981 to 2001. This study follows the methodology set forth by Bosch and Eckard (1991) for the selection of DOJ cases and adopts their procedure to estimate market reaction to announcements of indictments in price fixing, and then uses the Thompson and Kaserman (2001) methodology to determine the length of time necessary for a firm's stock price to recover to its pre announcement level.

The purpose of this study is to compare the effectiveness of antitrust actions during 1981-2001 with effectiveness documented by Bosch and Eckard (1991), Thompson, and Kaserman (2001) for the period 1962-80. The measures of effectiveness of antitrust actions are threefold. The first measure is the stock market's reaction to the announcement of an indictment in a price-fixing case. Second, we examine the length of time that is required for the price of the offender's stock to recover to the pre-indictment level, which is interpreted as a return to offensive behavior. The third and final measure is the observed rate of recidivism, which is how often the offenders return to collusive behavior. The recidivism issue is crucial to any evaluation of the deterrent effect of enforcement because the beneficial effects of enforcement ultimately disappear when offending firms return to their collusive behavior.

The paper is organized into seven sections. In the second section, the evolution of U.S. antitrust laws and enforcement policies is described. In the third section, we give an overview of previous research. Section four is devoted to the methodology used in our model; section five describes the data; section six provides estimation results, and section seven is the conclusion.

## History of Antitrust Enforcement Actions

The Sherman antitrust act<sup>1</sup> was made law in the United States in July 1890. Until 1955, the fines on corporations were modest because the violations were considered misdemeanors, and maximum fines the court could impose were \$5,000 per count (Connor 1997). Some creative prosecutors found ways in serious cases to surpass the \$5,000 limit, but the total fine that could be proposed by public prosecutors was typically much smaller than the additional profits earned by the companies from their illegal actions. Prior to 1960, the average corporate fine in federal price-fixing cases was less than \$100,000 (Posner 1976). The courts could impose additional penalties in the form of consent decrees that restricted a company's conduct for several years and might require monitoring by federal antitrust agencies. While violation of these decrees, if detected, could lead to quite serious fines, companies considered the fines and decrees miniscule (Fuller 1962). Moreover, corporations were frequently allowed to plea *nolo contendere*<sup>2</sup> ("no contest") rather than "guilty." In such situations, the company's exposure to civil suits was reduced because it was not *prima facie* evidence of a crime having been committed that could be used in follow-up civil proceedings. After complaints by government prosecutors and antitrust experts, the fines were revised and the maximum fines for Sherman Act violations were increased. In 1974, the maximum fine for individuals was raised to \$100,000 and for corporations or other legal entities to \$1 million (Wiley 2001).

According to Gallo (1997) criminal enforcement of price fixing dominated civil cases filed from 1975 through 1994. Criminal enforcement of such cases has become increasingly important since 1980 as both individuals and firms have been held accountable for criminal antitrust violations (Gallo, 1997). This is seen as a shift by the DOJ from the earlier viewpoint that only the firms responsible should be prosecuted criminally to the current policy that individuals along with the firms should be subject to criminal prosecution. As a result of this shift in focus by the DOJ to criminal enforcement, legislation began to change and harsher penalties for violations of the antitrust laws were developed. A major step occurred on December 24, 1974, when violations of the Sherman Act became a felony and carried a three-year maximum prison term per count, triple the previous maximum (Kitner, 1978). Prior to 1974, imprisonment was imposed in only eight price-fixing cases, and very few convicted offenders served more than 30 days. Since 1974, about half of all individuals convicted of criminal price fixing receive prison sentences and the average length of imprisonment has tripled.

Again, in 1984, with the passage of the Criminal Fine Enforcement Act (CFEA) and the Sentencing Reform Act, legislation made the penalties for antitrust violations more severe. The CFEA increased the maximum fine for individuals found guilty of an antitrust infringement to \$250,000 per violation, while the Sentencing Reform Act established sentencing guidelines for federal judges and gave them the freedom to fine up to twice the gross pecuniary gain/loss of the

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<sup>1</sup> Today **§ 1 Sherman Act** is different from the 1890 version only in fines: *Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding \$10,000,000 if a corporation, or, if any other person, \$350,000, or by imprisonment not exceeding three years, or by both said punishments, in the discretion of the court.*

<sup>2</sup> *Nolo contendere* (Latin, "I do not wish to contend") is a plea in a criminal trial by the defendant. It is equivalent to a plea of guilty in the criminal action, i.e. the defendant is still subject to punishment by the court but it allows the defendant the opportunity to deny guilt in other proceedings, such as civil case.

defendant/victim. The Sentencing Reform Act was designed to combat long-term conspiracies or those with a large amount of affected commerce (Gallo, 1997). The last of the major amendments to the Sherman Act was designed to prevent anticompetitive behavior from being profitable was the Antitrust Amendment Act of 1990. This act raised the statutory maximum fine for individuals to \$350,000 and the firm to \$10 million per count (though multiple counts are unlikely for single conspiracies) for a violation after November 16, 1990. In 1998, the Assistant Attorney General for Antitrust testified before the Senate Judiciary Committee that the size of the economic injuries being caused by cartels in the 1990s required another increase in the statutory maximum (Klein 1998). He proposed that the maximum fine be set at \$100 million per company.

Two changes in the federal sentencing rules have allowed prosecutors to seek corporate fines higher than the statutory maximum (an “alternative sentencing” rule). First, beginning in 1987, the courts have been obligated to apply the U.S. Sentencing Guidelines to companies that plead guilty or that are convicted by trial. These guidelines require calculation of “a base fine” equal to 20 percent of the company’s net sales in the cartelized market and more if prosecutors have reason to believe that the cartel raised prices by more than 10 percent of pre-cartel prices. Next, the “base fine” is multiplied by a “culpability score”.<sup>3</sup> However, if the company offered cooperation, prosecutors may and usually do grant discounts. The second change in the federal sentencing rules is that violations of the Sherman Act were declared in 1974 to be felonies rather than misdemeanors. Under the U.S. Sentencing Guidelines, convicted felons are subject to a conceptually simple fine structure: the larger of either twice the harm caused to citizens or twice the illegal gains. In the case of price-fixing, twice the harm is twice the overcharge, and it is always larger than the twice gain because collusion is not a free good. The disadvantage of the twice-the-harm approach is that in a litigation situation, the prosecutor would have to present expert economic testimony concerning the size of the company overcharge during the conspiracy, whereas the 20% rule of the Sentencing Guidelines requires only company sales (usually there is little debate about the amount of sales).

Since these two approaches produce different proposed fines, it is not clear when the courts should implement the felony standard instead of the Sentencing Guidelines in criminal cases, except in those cases where the overcharge is higher than 10 percent. For plaintiffs in civil cases, the twice the harm standard is greatly preferred because evidence accepted in sentencing hearings would be presentable in private civil treble-damage suits. When choosing the optimal method to use as a deterrent effect, the best rule would be to calculate both fines and choose the larger. The first time the alternative fine provision was used was in October 1996 when Archer Daniels Midland Co. agreed to pay a 100-million dollar fine for two price-fixing counts. Between October 1996 and September 2000, fines above the \$10-million statutory level were imposed in 29 price-fixing cases.

Since 1987, alternative fines provision may be applied also to individuals who are convicted of price fixing. Under this rule, fines up to \$25 million can be imposed on individuals if the cartel’s overcharge is large enough. These alternative fine standards have just begun to be applied in the late 1990s to individuals who make guilty plea agreements. The higher fines are difficult to litigate successfully because evidence of the overcharge must be presented to the courts. The first litigated fine above \$350,000 for price-fixing occurred in 2002.

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<sup>3</sup> “Culpability score” rises with the number of aggravating factors such as company acted as a cartel enforcer and falls with mitigating factors such as it left the conspiracy voluntary.

Gallo (1997) reports that each of the aforementioned legislative acts have led to a significant increase in the average and real fines for both individuals and firms, indicating that this should lead to an increase in the deterrence of antitrust violations given that the probability of detection and punishment have remained constant. Nevertheless, there are some tools that “sweeten” the deal for offenders. For example, since 1978, the DOJ has had a leniency policy that offers automatic full amnesty to companies and all its employees that are the first to alert the agency about a cartel. It is available for companies, which did not initiate the cartel and if no government investigation was in progress. A revision of leniency policy in the 1990s extended the amnesty for companies that may not meet the aforementioned requirements but instead offer evidence of a cartel in another line of business for which there is DOJ investigation. Another example concerns the identity of a corporate entity to be named in the plea agreement. Although, according to the DOJ policy, both a parent and its subsidiary should be charged if both were engaged in the conspiracy, the DOJ has flexibility to charge only a subsidiary if it wishes. The DOJ typically rewards a company for its cooperation in an investigation by requesting a large discount on a company’s fine from the court.

In this study, we purpose to determine if the aforementioned changes in antitrust law and increases of penalties for individuals and firms over the 1981-2001 period led to an increase in the deterrence of antitrust violations, compared to the results obtained by Bosch and Eckard (1991) and Thompson and Kaserman (2001) for 1962-80.

### **Previous Research**

Several studies have been undertaken to determine if Section 1 of the Sherman Act in conjunction with the aforementioned penalties provides an effective means of enforcement and if these antitrust actions have any lasting deterrent affect. The previous research shows that enforcement may provide benefits in the form of suppressed stock market values after a successful Section 1 indictment, but the deterrent effect of Section 1 enforcement is short-lived. For example, the penalties may punish the individual offenders, but they do not have any lasting effect on the forces that promote collusion. Part of the debate on deterrence concerns uncertainty and disputes about the typical size of the percentage overcharges by price fixers.

Using monthly data and event-study methodology to study price-fixing indictments, Ellert (1975) finds a statistically significant abnormal return of -1.1% in the indictment month for a sample of 566 firms indicted in horizontal conspiracy cases between 1935 and 1971. Block et al. (1981) have attempted to investigate the deterrent effect of public and private antitrust enforcement on the decision to collude using Bureau of Labor Statistics retail prices in the bread industry to compute bread mark-ups. They conclude that increasing DOJ enforcement capacity or filing DOJ price-fixing complaints had the deterrent effect of reducing mark-ups in the bread industry. They also point out that for their sample period (1964-76), government imposed price-fixing penalties were “trivial” and find support to the proposition that an effective deterrent to price-fixing was the credible threat of large damage awards to private class actions that followed DOJ’s case against the same conspiracy. The study conducted by Newmark (1988) shows that the results obtained by Block et al. (1981) are questionable. The white bread priced by the Bureau of Labor Statistics changed quality over the sample period, and the bread mark-ups are sensitive to the pricing decisions made by grocery retailers. When a proxy for this quality change and a proxy for retail pricing decisions are included in the Block et al. (1981) model specification, the deterrent effects of reducing mark-ups in the bread industry disappear.

Garbade et al. (1982) use daily returns to analyze share price impacts of antitrust suits, including some price fixing suits on 34 firms between 1937 and 1974 and find a statistically significant average sample-wide drop in share price of 6%, although they do not isolate this effect for their price fixing sub sample. Strachan et al. (1983) use the mean-adjusted return approach to examine a portfolio of 47 price fixing firms from the 1970s and find statistically significant negative abnormal returns on the WSJ reporting date and on the day before of about  $-0.8\%$  and  $-0.6\%$ , respectively.

The first study that examines price fixing cases using the market model with daily return data and analyzes the cause of observed value impacts is Bosch and Eckard (1991). They study the stock market impacts of federal price fixing indictments during 1962-80 and find \$2.18 billion lost in equity market value (in \$1982) around the WSJ announcement of indictments for the 127 sample firm observations. They find that only 13% of this value lost may be attributed to various legal costs (e.g. fines and damages) and that the absolute value of individual indicted firm's (negative) abnormal returns is positively related to conspiracy-involved revenues. However, Bosch and Eckard (1991) did not find any effect of federal price-fixing indictments on competitors<sup>4</sup>. While such results are not conclusive, they suggest that a major part of the residual is expected lost monopoly profits from the conspiracy, rather than lost efficiency or goodwill rents. Bosch and Eckard (1991) point out that equity markets expect price fixing to be profitable, thus if these markets are efficient, profitable price fixing is not rare. Since the profits from price-fixing often exceed expected fines plus treble damage settlements and awards, the deterrent effect of this antitrust enforcement mechanism could be small.

The expected fines and penalties arising from being caught in price-fixing conspiracies depend on the probability of being caught. The greater the probability of being caught, the greater should be the expected penalties in the conspirator's calculations, and the less likely they are to collude. Bryant and Eckard (1991) consider this probability of being caught as a measure of the deterrent effect of antitrust enforcement, which should be inversely related to the number of price-fixing conspiracies attempted, and they estimate this probability. In their study, the probability that a price-fixing conspiracy will be indicted by federal authorities is at most between 0.13 and 0.17 in a given year. These ratios are consistent with surveys of antitrust defense lawyers and prosecutors (Connor 2001).

Following the question raised by Bosch and Eckard (1991), Thompson and Kaserman (2001) investigate how long the deterrent effect of antitrust enforcement lasts. Thompson and Kaserman (2001) ask two questions: what percent of previously indicted firms return to collusive behavior and at what speed do the recidivists return to the offensive conduct. To answer these questions, they utilize data on stock price movements (market-adjusted) of firms indicted on price-fixing charges to infer expectations of antitrust recidivism. Their indicted firms are the same firms used by Bosch and Eckard (1991). The methodology is simple: if a drop in a firm's stock market valuation at the time of a price-fixing indictment is handed down is observed, it is then attributed to a decline in monopoly profits that were the result of prior collusive activity; then, a subsequent rebound of that firm's valuation to its pre-indictment level implies either the reemergence of collusion or stockholders' expectations of future collusive behavior. Thompson and Kaserman (2001) find that stock prices of 85 percent of the firms in the sample returned to

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<sup>4</sup> One of the two effects is expected: a negative impact on competitors because the conspiring firms have to return to competitive pricing or a positive if competitors benefit from reductions in the indicted firms' reputational capital and/or efficiency.



their pre-indictment levels within one year of the antitrust action, which suggests the conclusion that Section 1 of the Sherman Act enforcement has little lasting effect.

### **Methodology**

We follow the methodology proposed by Bosch and Eckard (1991) to measure market reaction to an announcement of an indictment in price-fixing. A negative market reaction to the announcement of the indictment in price-fixing might have several sources. First, a price fixing indictment can influence firm value through various legal costs: fines, damage suits, and litigation costs. Second, the indictment reveals that some portion of a firm's profit was due to conspiracy and after the indictment; this portion of the profit is lost. Finally, an indictment in price-fixing may lead to reputation losses: indictment may be interpreted as a sign that the firm might be engaged in other illegal activities, or might affect market expectations regarding further firm profitability and efficiency. All of these are possible consequences of indictment and should lead to negative changes in the value of the firm.

The event-study methodology assumes that the information revealed on announcement day is new information for the capital market and that the capital market reacts appropriately to reflect this new information in the stock prices. The DOJ investigations of price-fixing conspiracies are supposed to remain secret, but the operations of grand juries often assure leakages of information weeks before the formal indictments. The larger the on-going price-fixing case, the more likely that information will be revealed before the indictment. For some firms in our sample, the first news about the DOJ investigation appeared in the Wall Street Journal (WSJ) two years before the actual indictment. In such situations, the information is revealed to the market gradually over the period starting from the first publication in the press about the DOJ investigation and ending with the indictment announcement (note the announcement of the indictment itself may not reveal any new information). Therefore, to determine the event date for each firm in our sample, we searched the WSJ and LexisNexis Academic two years prior to the indictment year for publications about the DOJ price-fixing investigation. Thus, the announcement day  $t=0$  is the date of announcement of the indictment in price-fixing if there were no earlier publications about a DOJ investigation, or the date of the first publication about an on-going investigation. A last point noted by Bosch and Eckard (1991) is that firms, which are traded on the New York Stock Exchange (NYSE), NASDAQ and American Stock Exchange (AMEX) and are eligible for Center for Research and Security Prices (CRSP), are usually large and diversified. The stock price of such firms represents the portfolio of all lines of business in the firm. However, the price-fixing conspiracies usually affect only one line of business, and profitability of other lines is not affected. Thus, when we use a change in the stock price of the firm, we include all other lines of businesses. This causes increases in standard errors and reduces t-statistics developed to test for significance of abnormal returns, which, in turn, increases the chance of incorrectly failing to reject the null hypothesis of zero abnormal returns.<sup>5</sup>

A market model is used to calculate abnormal return  $PE_{it}$  for each firm  $i$  on event day  $t$ :

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<sup>5</sup> Also, Bosch and Eckard (1991) point out that the probability of innocence given the indictment is important to consider. For their sample, this probability is 0.04, which is small. So, they assume that the probability of innocence given the indictment is zero and leave the acquitted firms in the sample. As it will be described below, in this study we remove acquitted firms from our sample to be able to measure the deterrent affect of the antitrust enforcement actions.

$$PE_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad (1)$$

where  $R_{it}$  is the return on security  $i$  for event-day  $t$ , and  $R_{mt}$  is the rate of return on the CRSP value-weighted index on day  $t$ . The coefficients  $\hat{\alpha}_i$  and  $\hat{\beta}_i$  are the OLS estimates of the market model, where the estimation period is from  $t=-171$  to  $t=-21$  (150 days) relative to announcement date  $t=0$ . The ratio of the sample's average to its standard deviation represents the test statistic to determine the statistical significance of the average abnormal return on day  $t$ . This procedure is straight forward, but, as noticed by Bosch and Eckard (1991), two data specific problems may arise. First, the simultaneous indictment of all firms in each conspiracy results in announcement-day clustering. Second, if a conspiracy involves several firms, the affected lines of business of these firms are all in the same product market. These characteristics of the data may lead to cross-sectional dependence among the excess returns and, as a result, the variance of the mean abnormal return will be underestimated, implying too many rejections of the null hypothesis of zero abnormal returns.

To overcome these biases, following Bosch and Eckard (1991) we use a Brown and Warner (1985) procedure. Let  $PE_{it}$  of equation (1) be the abnormal return on day  $t$  for firm  $i$ . The average abnormal return for day  $t$  is calculated as:

$$PE_t = \frac{1}{N} \sum_{i=1}^N PE_{it} \quad (2)$$

where  $N$  is the number of observations in the sample. The test statistic to test for significance of the cumulative abnormal return over the interval  $(t_1, t_2)$  is calculated as follows:

$$t = \sum_{t=T_1}^{T_2} PE_t / \left( \sum_{t=T_1}^{T_2} \hat{S}_t^2 \right)^{1/2} \quad (3)$$

where

$$\hat{S}_t^2 = \left( \sum_{t=d_1}^{d_2} (PE_t - PE)^2 \right) / (d_2 - d_1) \quad (4)$$

$$PE = \left( \sum_{t=d_1}^{d_2} PE_t \right) / (d_2 - d_1 + 1) \quad (5)$$

The variables  $d_1$  and  $d_2$  are the beginning and end days of the estimation period.<sup>6</sup> Under the assumption that  $PE_{it}$ s are independent, identically distributed and normal, the test statistic is distributed as a student-t statistic under the null hypothesis. To check whether our results are robust, we use the non-parametric sign test, which has a binomial test statistic. Under the null hypothesis of no announcement effect, the fraction of positive abnormal returns is assumed to be 50%. This test does not require the assumption of normality of  $PE_t$ . The test statistic  $ZQ$  is calculated using following formula:

$$ZQ = (N - np_0) / [np_0(1 - p_0)]^{1/2}, \quad (6)$$

where  $N$  represents the number of firms with negative abnormal returns on day  $t$ ,  $n = 31$  and  $p_0 = 0.5$ . When  $n$  is large, the distribution of  $N$  is approximately normal by the central limit theorem. Thus, an approximate normal test can be constructed using the test statistic  $ZQ$ .

<sup>6</sup> As it will be described further, we take  $d_1 = -5$  and  $d_2 = 5$ .

To quantify market reaction with respect to announcement of indictment in price-fixing, we compute the average abnormal returns occurring on the each of the five days before and after the announcement and on the announcement day  $t=0$ . Then, we aggregated these returns into the cumulative abnormal returns over windows  $[-5, t]$ , where  $t$  runs from

$-4$  to  $5$ .<sup>7</sup> This analysis will allow us to answer whether the antitrust enforcement provides consequences in the form of suppressed stock market values of those firms violating the Sherman Act. The analysis will also allows to quantify these changes in market values for firms in our sample over the period 1981-2001, and to compare the magnitude of these changes with the ones determined by Bosch and Eckard (1991) for period 1962-80.

Next, we determine how long the deterrent effect of antitrust enforcement lasts and how often previously indicted firms return to collusive behavior during 1981-2001 sample period. We also compare our results with the results obtained by Thompson and Kaserman (2001) for 1962-1980. If we attribute the drop in the firm's stock market value at the time of the price-fixing indictment to a decline in monopoly profits that were the result of prior collusive activity, then the subsequent rebound of the firm's value to the pre-announcement level is interpreted as a return to collusive behavior or as a stockholder's expectation of future collusive behavior. In addition, as Thompson and Kaserman (2001) noted, the stock price fall at the time of price-fixing indictment may reflect the market's reaction to the uncertainty introduced by the announcement of the indictment. These interpretations are not mutually exclusive, and the observed market reaction to the announcement of an indictment is attributable to the DOJ enforcement actions anyway.

To answer whether a firm's value rebounds to the pre-announcement level, and if it does, how long does it takes to rebound, we use the following procedure: for each firm-observation<sup>8</sup> in our sample, we consider the price level on day  $t=-2$  as the pre-announcement level price. Next, using the abnormal returns for each day over the window  $[-1, 5]$  and then calculating abnormal returns forward for each day over the window  $[6, 300]$ , we construct a time series of abnormal returns for the period  $[-1, 300]$  for each firm-observation.

We define recovery as the following: the stock price recovers on the day  $k$  after the announcement if the cumulative abnormal return over period  $[-1, k]$  is 0 where  $k$  runs from 0 to 300. Thus, the number of day  $k$  is our measure of how long the deterrent effect of antitrust enforcement lasts, and the percentage of firms in our sample with zero cumulative abnormal returns over the period  $[-1, k]$  for some  $k$  between 0 and 300 is our measure of recidivism.<sup>9</sup>

## **Data**

The firms used in this study have been subjects of price-fixing investigations by the DOJ and were eventually indicted by the grand jury during 1981-2001. The firms were selected using the Commerce Clearing House (CCH) Internet Research Network website. The CCH website

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<sup>7</sup> All considered days in this study are business days.

<sup>8</sup> We use "firm-observation" term because the same firm may appear several times in our sample due to involvement in different price-fixing cases. For example, Coca-Cola Bottling Co. participated in 11 conspiracies during 1981-2001.

<sup>9</sup> Our detailed description of the procedure to quantify the deterrent effects differs from the one provided by Thompson and Kaserman (2001) on page 333 of their paper, but it yields the same measure of how long the deterrent effect of antitrust enforcement lasts.

contains an online version of the Trade Regulation Reporter (commonly known as the Blue Book). Only U.S. Antitrust Cases in which there has been some type of federal enforcement and action were used to build dataset. These cases were further limited to only those corresponding to price-fixing cases since 1981. This search method resulted in 385 cases, involving more than 600 firms. Some of the firms were indicted more than once for involvement in separate conspiracies. The Trade Regulation Reporter contains a summary description of each of these cases with the following information: the firms indicted for price fixing, the day of indictment, the good that had its prices fixed, the ruling on the case, and the fines if there were any.

After the list of price fixing cases was determined from the CCH website, these companies were further screened. We used the CRSP dataset, accessed through the Wharton Research Data Services (WRDS) database, to determine whether we have sufficient stock market data for each firm involved in price-fixing cases. Some of the companies were privately held and/or were not traded on one of the following exchanges: NYSE, NASDAQ, and AMEX. These companies were eliminated from the sample, which left us with 62 price-fixing cases providing 72 firm-observations.

Further, only those firms whose cases were mentioned in the WSJ were allowed to remain in the data set. To answer which of these 62 cases were mentioned in the WSJ and to determine the first announcement dates, the Dow Jones Interactive website was used. The WSJ was then searched to determine if a company was mentioned in the WSJ as part of a price-fixing investigation and/or was indicted by the DOJ. As mentioned earlier, investigations by the DOJ are supposed to remain private until a formal indictment is announced by a grand jury; however, this is not all always the case. For example, in the Archer Daniels Midland Co. (ADM) lysine price fixing case, first mention of the beginning of DOJ price-fixing investigation appeared in the press in June 1995,<sup>10</sup> more than one year before the announcement of ADM pleaded guilty on October 1996.<sup>11</sup> In the NASDAQ dealers' price fixing case, the first WSJ announcement appeared in almost two years before the announcement of the indictment.

Having determined announcements dates, we were the able to determine the market model estimation period and event window periods for each firm-observation. Next, we checked whether we had sufficient stock market data for each firm-observation to estimate a market model and abnormal returns over a [-5, 300] event window. Very few of the firms were not publicly traded during the event windows or market model estimation period, and were eliminated from our sample. These last two screenings cut our price-fixing sample down to 38 cases involving 46 firm-observations. To overcome lack of the announcements in the WSJ and return at least some observations into the sample, we used Business Industry & Markets search forms in the LexisNexis Academic to determine if any of the previously determined 72 firm-observations with CRSP data were mentioned as a part of the beginning price fixing investigation and/or were indicted by the DOJ. Unfortunately, this search did not give us any additional information in terms of announcements. LexisNexis Academic confirmed announcements that we had found in the WSJ already, but did not provide us with anything new.

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<sup>10</sup> For ADM case July 10, 1995, is taken as the announcement date. On this day the WSJ published announcement that president of one of ADM's divisions had been leading a double life: he was also an undercover operative for the FBI. This announcement led to immediate 11% decrease in ADM's stock value.

<sup>11</sup> ADM and several Asian producers of the livestock-feed additive lysine were involved in this case. Among them, two Japanese and one Korean firm pleaded guilty in the lysine conspiracy in September 1996. Also, the defendants offered to settle the private case in April 1996, well before the guilty pleas (Connor, 2001).

The description of each of the 38 cases and information contained in the corresponding announcements revealed that 15 of the remaining 46 firm-observations could not be used in the analysis. Three firms among these fifteen were acquitted.<sup>12</sup> Three other firms involved in price-fixing conspiracies had stopped conspiring several years before the beginning of the DOJ investigation; and during the investigation and indictment period, these firms were subsidiary units of some larger firms, i.e. larger firms acquired them sometime after their conspiracy period and before the beginning of the DOJ investigation. In such cases, we cannot measure market reaction to an announcement of the indictment in price-fixing directly, because these firms are not independent businesses anymore and do not have traded shares. One might argue that parent company's stock prices might be used to measure market reaction to the announcement. However, the effects of investigations on parent companies were limited, because they bought these units after the end of the conspiracies. The only way in which a parent company could be affected is by the price-fixing fines paid by the subsidiary unit. There was no monopoly profits lost because of DOJ antitrust actions, which could be reflected in the parent company's stock prices. Since we attribute the largest part of drop in the firm's stock market value at the time of price-fixing indictment to a decline in monopoly profits that were the result of prior collusive behavior, we exclude these three observations from our sample.

In eight other price-fixing cases, which we excluded from the sample, firms were not charged or prosecuted, but the former CEOs of these firms were charged. Finally, one more firm-observation was excluded from the sample because from the CCH information and the WSJ announcement, and we could not determine whether this firm was found guilty or acquitted. Our final dataset consists of 24 price-fixing cases involving 31 firms, which were not only indicted but eventually were convicted or entered *nolo contendere* pleas in criminal cases.<sup>13</sup> The information about these cases and firms involved is presented in Table 1 of the Appendix. For these companies, daily returns for 171 days prior to the earliest announcement until 300 days after the announcement date along with the CRSP value-weighted returns for that period were obtained from the CRSP dataset. The number of different firms is 29, since Coca-Cola Bottling Co. and Waste Management Inc. appeared twice in our sample. In addition, there were conspiracies with two, three and four firms involved.

### **Empirical Results**

The estimated market model parameters for each firm in each price-fixing case are given in Table A.2 of the Appendix. Abnormal returns on each day in  $[-5, 5]$  window for each firm are given in Table A.3 of the Appendix. We compute the abnormal returns occurring on the ten days surrounding announcement day  $t=0$  and on the announcement day itself. The results are presented in Table 1 below, which includes average abnormal returns, cumulative average abnormal returns and test statistics corrected for clustering-related biases.

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<sup>12</sup> Following Thompson and Kaserman (2001) we removed acquitted firms from our sample to quantify duration of the deterrent effect of antitrust enforcement and the rate of recidivism.

<sup>13</sup> Following Bosch and Eckard (1991) and Thompson and Kaserman (2001), we don't consider firms entered *nolo contendere* pleas separately.

Table 1. Summary of average excess returns and test statistics for the days in the [-5, 5] window around the WSJ announcement.<sup>14</sup>

A. Time-Series of Daily Returns:					
Event day	Average Excess Return, %	t-statistic for Average Excess Return	Cumulative Average Excess Return, %	Percentage Negative	Sign Test Statistic (ZQ)
-5	-0.31	-0.34	-0.31	45.16	-0.54
-4	-0.08	-0.09	-0.39	48.39	-0.18
-3	-0.05	-0.06	-0.45	38.71	-1.26
-2	-0.30	-0.32	-0.74	61.29	1.26
-1	-1.23	-1.35	-1.97	61.29	1.26
0	-2.18	-2.39**	-4.15	70.97	2.33**
1	-1.52	-1.66*	-5.67	67.74	1.98**
2	0.49	0.54	-5.18	41.94	-0.90
3	-0.41	-0.45	-5.60	48.39	-0.18
4	0.95	1.04	-4.65	25.81	-2.69
5	0.19	0.21	-4.45	41.94	-0.90

B. Cumulative Excess Returns:				
Period	CAR	t-statistic	Percentage Negative	Sign Test Statistic (ZQ)
[-1, 0]	-3.41	-2.65***	70.97	2.33**
[1, 5]	-0.30	-0.15	41.94	-0.90

\*\*\* Significant at 1% level.

\*\* Significant at 5% level.

\* Significant at 10% level.

On the day -1, average abnormal return is -1.23 but insignificant. The day 0 average abnormal return is -2.18 with t-test statistic  $t = -2.39$ , significant at the 5% level. The day 1 abnormal return is negative and significant at 10% level. The two-day [-1, 0] cumulative abnormal return is -3.41, with  $t = -2.65$ , significant at the 5% level. A sign test supports the results for announcement day  $t = 0$  and for day  $t = 1$  implying that the majority of observations are negative on days  $t = 0$  and  $t = 1$ . Both tests show that the cumulative average abnormal returns for the period [1, 5] following the announcement are insignificant.

The finding that the announcement day is associated with a significant negative abnormal return repeats what Bosch and Eckard (1991) obtained. The difference is that we do not find a significant abnormal return on day  $t = -1$ . Bosch and Eckard (1991) provided the following explanation for the significant abnormal return on day  $t = -1$  for their sample: for the majority of the conspiracies in their sample, the filing of an indictment by the DOJ occurs on the first trading day preceding a publication in the WSJ. In our sample 12 of the 24 total cases, the first information about the DOJ investigation appeared a several days or even months before an actual indictment was filed by the DOJ. Thus, there is a time gap between announcement day  $t = 0$  and the DOJ filing day in half of the cases examined in our study. Half of the cases in our

<sup>14</sup> All significance tests reported in this study are two-tailed. We understand that one-tailed tests might be more appropriate here, because we expect negative stock market reaction to the announcements. However, we report two-tailed tests to be able compare our results with Bosch and Eckard (1991) ones.

sample are cases where day  $t=-1$  is not the DOJ filing day, this fact explains why we do not find any significant market response at a 5% level on day  $t = -1$ .

Another important difference between our results and Bosch and Eckard (1991) is in the magnitude of the negative market response. Bosch and Eckard (1991) report a -0.75% average abnormal return on day  $t = 0$ , while we find -2.18% average abnormal return (note this figure is three times larger than the one determined by Bosch and Eckard (1991)). The cumulative abnormal return over the  $[-1, 0]$  window for our study is also three times larger than cumulative abnormal return over the  $[-1, 0]$  found by Bosch and Eckard (1991)). A negative market reaction to the announcement of indictment in price-fixing may be perceived as measure of effectiveness of antitrust actions. If so, the increase in the magnitude of average market response to the announcement supports the view that the quantitative financial impact of antitrust actions has risen over last 20 years.

Next, we determined how long the deterrent effect of antitrust enforcement lasts and how often previously indicted firms return to collusive behavior. The results are presented in the last row of Table A.3 in the Appendix. We found that, of the 31 observations in our sample, 27 firm's stock prices recovered within 300 days after the initial announcement of the price-fixing investigation. These 27 firms represent 87 percent of our sample. For 2 of the 27 firms, there was no negative market reaction. For 10 firms, their stock prices recovered within 10 days of announcement. The longest recovery time in the 300-day window was 171 days. For 25 of the firms, on average, it took 34 days for their stock prices to return to their full pre-announcement level. Of the remaining 4 firms, 3 had prices that had not fully recovered during the 300-day window, while the fourth firm only had stock data available for 264 days following the announcement. It should be noted that on day 264 the cumulative abnormal return for the previously mentioned firm was -70%, which implies that the price of this stock would not recover within the 300-day window.

The results from our study are very similar to those obtained by Thompson and Kaserman (2001) for the 1962-1980 period. In their sample, 85 percent of the firms recovered the full value of their stock prices during the 300 days window. Also 85 percent of the sample firms took on average 19.15 days for stock prices to recover. If the number of days needed for stock prices to recover is our measure of how long the deterrent effect of antitrust enforcement lasts, than the deterrent effect determined for the 1981-2001 period lasts a touch longer than it did during the 1962-1980 period. With respect to the rate of recidivism, our results mimic those of Thompson and Kaserman (2001). Thus, the rate of recidivism in price fixing has remained constant over the last 40 years at approximately 85 percent. The result indicates that the harsher antitrust penalties for violating individuals and firms have no effect on the rate of recidivism.

The alternative explanation, which is hypothesis that has to be tested, is also possible and based on the antitrust compliance programs, which might be adopted by firms in order to decrease probability of the involvement into conspiracies in the future, and which become more and more popular during last years. The harsher antitrust penalties for violating individuals and firms do have effect on the rate of recidivism, so that less proportion of firms recovers the full value of their stock prices during the 300 days window. Nevertheless, after the trials these firms adopt antitrust compliance programs, which improve reputation capital, decrease the probability of future involvement in price fixing and, as a result, reduce future uncertainty introduced by the indictment, the stock prices recover faster. Therefore, from the alternative explanation one can

conclude that harsher penalties decrease the rate of recidivism, but we do not observe this decrease because the negative effect of harsher penalties is compensated by the positive effect of antitrust compliance programs on shareholders' perceptions.

## **Conclusions**

This study was undertaken to update the results obtained by Bosch and Eckard (1991) and Thompson and Kaserman (2001), and to determine whether the changes in antitrust law and the increases in penalties for individuals and firms over the 1981-2001 period led to an increase in the deterrence of antitrust violations, compared to results obtained by Bosch and Eckard (1991) and Thompson and Kaserman (2001) for the 1962-80 period.

First, it is important to notice that we were able to include in our final data set only 24 price-fixing conspiracies with 31 firm-observations, while Bosch and Eckard (1991) had 57 price-fixing conspiracies with 127 firm-observations, and that we initially had 385 price-fixing cases while Bosch and Eckard (1991) had only 200. Bosch and Eckard (1991) pointed out that most of the cases during the 1962-80 period are local involving small firms not listed on the CRSP tapes. Similar conclusion can be done for 1981-2001. Of the initial 385 price-fixing cases involving more than 600 firms, 323 cases involving approximately 528 firms were removed because these firms were not listed in the CRSP database, which implies that most of the violating firms were small local firms or firms that are traded on non-U.S. exchanges.

Since we were able to gather almost two times as many price fixing cases as Bosch and Eckard (1991) the following consequences may be reached. One might argue that firms became less likely to comply with anti-trust law during the 1981-2001 period and that all of the changes in antitrust law changes and increased penalties had no effect. However, the total number of firms in the economy may have more than doubled over the 1981-2001 period. If this is the case, the rate of price-fixing violations has remained relatively constant or decreased slightly for the 1981-2001 period compared with the rate of violations during the 1962-1980 period. Based on results of this study, we cannot provide a definitive conclusion. What we can say is that the number of large public firms among those who violated anti-trust law has decreased.

Secondly, we found a negative market reaction to the announcement of the indictment in price-fixing for the 1981-2001 period was three times larger than the one obtained by Bosch and Eckard (1991) for the 1962-80 period. As described in section 2 of this paper, the price-fixing fines have risen dramatically over the past 20 years. Since these fines are paid by the offending firm, the fine payments should be reflected in the firm's present value, and then it is no surprise that we observe at least some changes in the market reaction to announcement. This result supports the view that the effects of antitrust actions have become stronger over the previous 20 years, and this increase might be attributed to the aforementioned changes made in antitrust law, particularly the penalties for individuals and firms who violate antitrust laws. However, other explanations may be plausible.

Our results of the deterrent effect of antitrust actions, for the 1981-2001 period is a bit improvement over the one obtained by Thompson and Kaserman (2001): on average, the number of days needed for stock prices to recover in our sample is twice as large the number of days for the 1962-1980 period. However, the rate of recidivism that we obtained is nearly identical to Thompson and Kaserman (2001) rate of recidivism, this suggests the conclusion that the rate of recidivism in price-fixing has remained constant over the last 40 years and is about 85 percent.



The changes in antitrust law along with the increased penalties have improved the effectiveness of antitrust actions when dealing with the effect immediately after an indictment. Here, effectiveness is measured by a magnitude of market reaction with respect to the announcement of an indictment in price-fixing. Furthermore, our results show that antitrust enforcement of Section 1 of the Sherman Act does not have any lasting effects as a deterrent or on the rate of recidivism. As pointed out by Thompson and Kaserman (2001), “Because the remedies applied to price fixing violations are fundamentally behavioral in nature..., the basic underlying structural conditions in the effected markets are left unaltered by enforcement actions”. Thus, the larger fines and harsher penalties made legal and enforced during the 1981-2001 period have not affected the structural conditions of the markets.

Finally, Bosch and Eckard (1991) interpret their results to mean that most of the value either lost, at the time of publication in WSJ or announced indictment in price-fixing case, as expected lost monopoly profits from the conspiracy. However, reading the CCH cases’ description for our sample and for some of the cases used by Bosch and Eckard (1991)<sup>15</sup>, we noticed that in many of price-fixing cases the conspiracies had been dissolved a long time (up to three years) before the first announcement in the WSJ of a DOJ investigation or an indictment had been issued. From the CCH descriptions, it is not clear whether such conspiracies ceased because of DOJ investigation or for other reasons independent of the DOJ investigation.<sup>16</sup> If a conspiracy was dissolved a long time prior to the announcement and this is made explicit in the announcement, then there should be no value losses due to the expected lost monopoly profits. This result may help explain weak market reaction to the announcements for many cases in our sample. In addition, it is important to notice that in such cases the prosecution of price fixers does not produce consumer benefits in terms of broken up conspiracies, but only in terms of fines (potentially distributed to suffered consumers) and preventing action from occurring again.

We recognize that factors such as homogeneity of the good, concentration of buyers, organizational structure of the cartel, and the ability of the cartel to detect and control cheating, also affect the rate of recidivism, and that there may be interdependence among these factors and DOJ enforcement, but these factors are beyond the scope of this study. However, we do realize that our examination of price-fixing cases brought by the DOJ against cartels is limited because the study only looks at those firms with stock market returns data on the CRSP database. Smaller firms are more specialized. Thus, effects for them could well be bigger. The analysis of returns data belonging to firms that are traded on non-U.S. exchanges will improve the understanding of what effect enforcement by the DOJ has on the rate of recidivism by non-US multinational corporations. This analysis may also help in determining why in our sample there is an increasing occurrence of larger international cartels (vitamins and graphite electrodes) as well as local and regional cartels (bid-rigging), relative to cartels that operate on a national level and are traded on US stock exchanges. Do firms that operate in the United States on a national level find that it is more difficult to succeed in price-fixing conspiracy compared to local and international firms? Which factors are responsible for this? Do large national public firms find that price-fixing conspiracies become too costly for them in cases where they are caught? These

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<sup>15</sup> Using CCH Internet Research Network website we were able to find description of only 9 cases used by Bosch and Eckard (1991), because CCH website doesn’t have description of all antitrust cases which took place before 1980.

<sup>16</sup> For example, one of the reasons might be offers of settlements in private cases that precede the DOJ’s actions. Such situations are unusual, but happen.

three questions remain open. We may suggest that the DOJ may find that enforcement of antitrust laws is easier when dealing with national firms rather than with local and multinational because of the characteristics of the industry, reliable data about structural variables that lead to concentration, and the type and size of the customer base affected. Our examination of recidivism by firms involved in price fixing firms has provided insight to the effectiveness of changed DOJ penalties and enforcement over last the 20 years, but the study has also posed several new questions concerning the effect of the DOJ on the price-fixing cartels.

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Table A.1: Data description						
Type of conspiracy	Date of indictment	Criminal No.	The WSJ announcement	Civil No.	Defendant, as it was said in the WSJ announcement	Enforcement action fines, \$ mill
1	International	October 5, 2000	00-CRM-1084 (SD N.Y.)	January 31, 2000	Sotheby's Holdings, Inc.	45
2	International	July 19, 1999	99-0276 (ND Cal.)	July 20, 1999	Pfizer, Inc.	20
3	International	September 30, 1998	98-00302 (ND Cal)	October 1, 1998	Eastman Chemical Co.	11
4	International	October 15, 1996	96CR640	July 10, 1995	Archer Daniels Midland Co	100
5	US	September 28, 2001		October 1, 2001	Computer Associates International Inc	0,638
6					Merril Lynch&Co	
7	US	July 17, 1996		December 7, 1994*	Salomon Brothers Inc Morgan Stanley Group Inc.	consent decrees
8						N/A
9	US	June 14, 1994	94-120-CR-T-24C	June 15, 1994	Premdor Corp	6
10	International	June 27, 2001	CR 01-0242 (ND Cal.)	June 4, 2001	Akzo Nobel Chemicals BV	12
11	International	May 5, 2000	3:00 CR-189 (ND Tex.)	March 29, 1999**	Merck KGaA	14

Table A.1: Data description						
Type of conspiracy	Date of indictment	Criminal No.	The WSJ announcement	Civil No.	Defendant, as it was said in the WSJ announcement	Enforcement action fines, \$ mill
12	International	April 7, 1998	98-177 (ED Pa.)	June 6, 1997	UCAR International, Inc	110
13	US	July 24, 1990	90-00318	July 25, 1990	Critical Industries, Inc.	0,2
14	US	October 29, 1987	87-781	06 May, 1987	Waste Management Inc.	1
15	US	October 15, 1986	86-0352	October 16, 1986	General Cinema Corp	1
16	US	December 21, 1992	June 28, 1990	92-2854	Alaska Air Group	consent decree
17					Delta Airlines	
18					UAL Corp's United Airlines	
19	USAir					
20	US	May 22, 1990	90-92CR{R}	May 23, 1990	The Stanley Works	6
21	US	November 17, 1999	99-734 (ED Pa.)	November 18, 1999	Nippon Carbon Co.	2,5
22	US	June 6, 1984	84-00349	June 7, 1984	Supermarkets General Corporation	0,35
23					Waldbaum Inc.	0,4
24	US	April 8, 1982	February 25, 1982	82-338 CIV-5	Ashland-Warren inc	consent decree
25	US	May 8, 1989	89-6097-CR	May 9, 1989	Coca-Cola Bottling Co. of	1,8
						1mill per each of 7 counts is mentioned
						1,8

Table A.1: Data description					
Type of conspiracy	Date of indictment	Criminal No.	The WSJ announcement	Civil No.	Defendant, as it was said in the WSJ announcement
					Charges or fines as it was mentioned in the WSJ announcement, \$ mill
					Miami Inc
26	US	October 22, 1993	CRH 93-266	September 10, 1993***	Smith International, Inc.
					0,675
					19,5
27	US	December 17, 1992	92-0454	December 18, 1992	Bolar Pharmaceutical Co.
					1
					1
28	International	May 5, 1999		June 16, 1999	Hoechst AG
					36
					N/A
29	US	December 28, 1989	CR 89-1277T	June 10, 1987	Waste Management Inc.
					0,50
					At least 1 mill
30	US	April 12, 1988	88-39	June 26, 1987	Coca-Cola Bottling Co.
					1
					N/A
31	US	April 12, 1988	88-38	April 13, 1988	All-American Bottling Co
					0,3
					N/A

\* First news about the beginning of the DOJ investigation of price fixing on NASDAQ stock market appeared in the WSJ on October 20, 1994. According to the news, the Justice Department looked into allegations contained in private lawsuits and in two academic studies that market makers on the NASDAQ system collude to rig prices. The announcement is also first WSJ announcement of civil lawsuits that we could find. However, this announcement doesn't point out on particular NASDAQ dealers. We took December 7, 1994, as announcement date, because on this day WSJ published information that DOJ demanded records on NASDAQ trading of 24 market makers going back nearly 10 years.

\*\*For this conspiracy, relevant event is announcement of private antitrust suit, which preceded the DOJ indictment. Merck KGaA was named in a private suit reported in the WSJ on 03.29.1999.

\*\*\* For this conspiracy, relevant event is private antitrust suit, which preceded the DOJ indictment.

**Table A.2:** The estimated market model parameters and abnormal returns on days  $t=-1$  and  $t=0$ .

	The WSJ announcement	Defendant firm	Market model alfa	Market model beta	Abnormal return on $t=-1$	Abnormal return on $t=0$
1	January 31, 2000	Sotheby's Holdings, Inc.	-0,0016	1,0006	-0,0055	-0,1591
2	July 20, 1999	Pfizer, Inc.	-0,0020	1,4128	-0,0052	-0,0045
3	October 1, 1998	Eastman Chemical Co.	-0,0006	0,6174	-0,0067	0,0171
4	July 10, 1995	Archer Daniels Midland Co	-0,0002	0,3941	-0,0619	-0,1062
5	October 1, 2001	Computer Associates International Inc	0,0019	1,7680	0,0026	-0,0359
6	December 7, 1994	Merrill Lynch&Co	0,0000	1,9180	-0,0241	-0,0245
7		Salomon Brothers Inc	0,0000	0,6750	-0,0213	-0,0079
8		Morgan Stanley Group Inc.	-0,0005	1,5215	0,0114	-0,0193
9	June 15, 1994	Premdor Corp	0,0007	1,3348	-0,0375	-0,0945
10	June 6, 2001	Akzo Nobel Chemicals BV	0,0006	0,2024	-0,0164	0,0201
11	March 29, 1999	Merck KGaA	0,0017	0,8586	-0,0242	-0,0012
12	June 6, 1997	UCAR International, Inc	0,0001	0,5463	-0,1346	0,0074
13	July 25, 1990	Critical Industries, Inc.	-0,0022	1,6158	0,0013	-0,0875
14	May 6, 1987	Waste Management Inc.	0,0007	1,3908	0,0147	-0,0119
15	October 16, 1986	General Cinema Corp	-0,0015	1,2974	0,0152	-0,0297
16	June 28, 1990	Alaska Air Group	-0,0005	0,8893	0,0058	0,0001
17		Delta Airlines	0,0008	0,7694	0,0044	-0,0127
18		UAL Corp's United Airlines	-0,0011	1,2481	0,0047	0,0037
19		USAir	-0,0028	1,2090	-0,0004	-0,0101
20	May 23, 1990	The Stanley Works	-0,0002	1,0998	-0,0124	0,0053
21	November 18, 1999	Nippon Carbon Co.	0,0035	0,4930	-0,0172	-0,0001
22	June 7, 1984	Supermarkets General Corporation	0,0003	0,9963	-0,0015	-0,0007
23		Waldbaum Inc.	-0,0013	1,1436	0,0087	0,0084
24	February 25, 1982	Ashland-Warren inc	-0,0005	0,9555	-0,0185	-0,0092
25	May 9, 1989	Coca-Cola Bottling Co. of Miami Inc	-0,0011	0,5676	-0,0152	0,0020

**Table A.2:** The estimated market model parameters and abnormal returns on days  $t=-1$  and  $t=0$ .

	The WSJ announcement	Defendant firm	Market model alfa	Market model beta	Abnormal return on $t=-1$	Abnormal return on $t=0$
26	September 10, 1993	Smith International, Inc.	0,0005	0,4403	-0,0271	-0,0041
27	December 18, 1992	Bolar Pharmaceutical Co.	-0,0005	1,9591	-0,0320	-0,0320
28	June 16, 1999	Hoechst AG	-0,0004	0,7716	0,0173	-0,0382
29	June 10, 1987	Waste Management Inc.	0,0011	1,4393	0,0259	-0,0589
30	June 26, 1987	Coca-Cola Bottling Co.	-0,0018	0,3877	-0,0214	0,0105
31	April 13, 1988	All-American Bottling Co	0,0002	0,7618	0,0027	-0,0068



**Table 3.A:** Abnormal returns on each day in [-5, 5] window and recovery analysis results for each firm in the sample.

Event day	Ashland-Warren, Inc., 82-338-CIV-5	Supermarkets General Corp., 84-00349	General Cinemas Beverages of Washington, Inc., 87-781 D. C., Inc., 86-0352	Waste Management, Inc., 89-1277T	Coca-Cola Bottling Co. 88-39	All-American Bottling Co., 88-38	Coca-Cola Bottling Co., 89-6097-CR	The Stanley Works, 90-92CR {R}	Critical Industries Inc., 90-00318		
-5	0,0043	0,0055	0,0208	0,0092	-0,0032	0,0124	0,0148	-0,0167	0,0019	-0,0097	-0,1177
-4	0,0046	-0,0177	0,0069	0,0166	-0,0162	-0,0099	-0,0076	-0,0026	0,0010	-0,0132	-0,0771
-3	-0,0117	0,0148	0,0374	0,0084	0,0110	0,0115	0,0029	-0,0215	0,0012	-0,0010	0,0150
-2	-0,0028	0,0129	-0,0136	0,0089	0,0151	-0,0280	0,0103	0,0039	0,0008	-0,0065	0,0313
-1	-0,0185	0,0087	-0,0015	0,0013	0,0147	0,0259	-0,0214	0,0027	-0,0152	-0,0124	0,0013
0	-0,0092	0,0084	-0,0007	-0,0054	-0,0119	-0,0589	0,0105	-0,0068	0,0020	0,0053	-0,0875
1	-0,0181	-0,0006	0,0261	-0,0396	-0,0059	0,0091	0,0014	0,0276	0,0289	-0,0173	-0,3579
2	0,0078	0,0069	0,0166	0,0003	0,0063	-0,0292	-0,0086	0,0073	0,0087	0,0025	0,1551
3	-0,0058	-0,0012	0,0367	0,0148	0,0111	-0,0513	0,0025	0,0002	-0,0137	0,0225	-0,1275
4	-0,0055	0,0016	-0,0158	0,0168	0,0150	0,0066	0,0065	0,0147	0,0019	-0,0118	0,0710
5	-0,0314	0,0125	-0,0066	0,0288	0,0278	0,0321	0,0022	0,0048	0,0112	-0,0046	0,0045
How many days it took to recover	64	no negative impact	1	5	2	96	59	1	1	3	26

**Table 3.A:** Abnormal returns on each day in [-5, 5] window and recovery analysis results for each firm in the sample.

Event day	Alaska Airgroup Inc., 92-2854	Delta Airlines, Inc., 92-2854	UAL Corp., 92-2854	USAir, 92-2854	Smith International inc., CRH 93-266	Premdor inc., 94-120-CR-T-24C	Merrill Lynch&Co., 96 CIV 5313	Solomon Brothers, 95 CIV 5313	Morgan Stanley Gr., 95 CIV 5313	Archer Daniels Midland Co., 96CR640	UCAR International, Inc., 98-117 (ED Pa.)
-5	-0,0019	-0,0191	0,0010	-0,0004	0,0497	-0,0011	0,0131	0,0011	0,0138	0,0195	-0,0260
-4	0,0094	-0,0162	0,0065	0,0243	-0,0126	0,0169	-0,0208	0,0065	0,0048	0,0123	-0,0001
-3	0,0020	0,0020	-0,0106	-0,0199	0,0028	0,0017	-0,0173	0,0064	-0,0190	-0,0204	0,0084
-2	-0,0042	-0,0102	-0,0306	-0,0056	-0,0453	-0,0132	0,0222	0,0106	-0,0009	0,0161	-0,0004
-1	0,0058	0,0044	0,0047	-0,0004	-0,0271	-0,0375	-0,0241	-0,0213	0,0114	-0,0619	-0,1346
0	0,0001	-0,0127	0,0037	-0,0101	-0,0041	-0,0945	-0,0245	-0,0079	-0,0193	-0,1062	0,0074
1	-0,0070	-0,0042	-0,0041	-0,0288	-0,0261	0,0507	-0,0165	0,0093	-0,0071	-0,0064	0,0091
2	-0,0023	-0,0049	-0,0094	-0,0009	0,0149	-0,0305	0,0008	-0,0011	0,0503	0,0118	0,0106
3	0,0044	-0,0142	-0,0004	0,0105	-0,0150	-0,0552	-0,0185	-0,0026	0,0055	0,0312	0,0034
4	-0,0074	-0,0054	0,0192	-0,0198	0,0005	0,0115	0,0217	0,0099	0,0267	0,0008	0,0015
5	0,0062	-0,0073	0,0117	0,0157	-0,0396	0,0088	0,0023	-0,0070	-0,0006	0,0137	-0,0048
How many days it took to recover	3	hadn't recovered within 300 days after the announcement	no negative impact	78	13	on 264 <sup>th</sup> day CAR=-70%; further sock prices data isn't available	58	171	2	119	hadn't recovered within 300 days after the announcement

**Table 3.A:** Abnormal returns on each day in [-5, 5] window and recovery analysis results for each firm in the sample.

Event day	Eastman Chemical Co., 98- 00302 (ND Cal)	Hoechst AG., 99- 0144 (ND Cal.)	Pfizer, Inc., Merck KGaA, 99-0276 3:00 CR-189 (ND Cal.)	Sotheby's Holding, 00-CRM- 1084 (SD N.Y.)	Akzo Nobel Chemicals BV, CR 01- 0242 (ND Cal.)	Computer Associates International, Inc., 1:01CV02062 (DC)	Nippon Carbon Co., 99-734 (ED Pa.)	Bolar Pharmaceutical Co., Inc., 92-0454
-5	-0,0170	0,0058	0,0041	0,0008	-0,0340	-0,0200	-0,0010	-0,0112
-4	-0,0122	0,0118	-0,0098	0,0056	-0,0049	0,0133	0,0258	0,0485
-3	0,0370	0,0088	0,0071	-0,0223	0,0147	-0,0036	0,0048	-0,0531
-2	-0,0092	0,0079	-0,0011	-0,0267	0,0064	-0,0019	-0,0146	-0,0082
-1	-0,0067	0,0173	-0,0052	-0,0055	-0,0164	0,0026	-0,0172	-0,0320
0	0,0171	-0,0382	-0,0045	-0,1591	0,0201	-0,0359	-0,0001	-0,0515
1	-0,0201	-0,0010	-0,0016	-0,0502	0,0206	-0,0163	-0,0198	-0,0143
2	0,0202	-0,0168	0,0046	-0,0202	-0,0130	0,0200	0,0283	-0,0641
3	0,0400	0,0085	-0,0059	-0,0104	0,0011	0,0298	0,0124	-0,0322
4	0,0317	0,0141	0,0320	0,0201	-0,0312	0,0385	0,0542	0,0148
5	-0,0183	-0,0040	-0,0192	-0,0012	0,0043	0,0087	0,0080	0,0020
How many days it took to recover	1	7	4	hadn't recovered within 300 days after the announcement	105	1	3	24