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**Price Fixing and Problems of Proof: The Computer Lends a Hand**

Allen W. Blair

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PRICE FIXING AND PROBLEMS OF PROOF: THE COMPUTER LENDS A HAND

I. Proof Problems in Price-Fixing
   A. Introduction

Combinations and conspiracies to fix prices in interstate commerce have been condemned by the Supreme Court as a violation of the Sherman Act. In the past, prosecution of price-fixing cases has been a priority matter in the Department of Justice, and recent budget requests by the Antitrust Division suggest that the prosecution of price-fixing will increase and that the serious nature of the offense will become magnified.

Although conspiring to fix prices is clearly illegal, it is often difficult to prove that such a conspiracy exists or has existed because of attempts by the price-fixing group to eliminate or conceal evidence which suggests an agreement. Uniform behavior among alleged conspirators may suggest that an agreement to fix prices has been made. However, the degree of uniformity sufficient to sustain a conspiracy verdict is unclear.

The need for sources of proof to provide for adequate enforcement of the antitrust laws has led to the development of a new technique to produce evidence in conspiracy cases. This technique, developed by Professor John M. Kuhlman of the University of Missouri-Columbia, utilizes a computer to analyze the past pricing behavior of competitors within a given industry. The product of this analysis is made available in the form of a computer printout. In this way theories about pricing behavior may be tested and inferences from such behavior may be drawn.

B. Conscious Parallelism and Proof

If competitors price their products identically, it strongly suggests collusion to fix prices. However, conspiring competitors usually behave more subtly in order to conceal the fact that a price-fixing arrangement exists. They may act in similar or uniform ways without following exactly the same pricing strategies. They may conceal price-fixing while allocating market shares and stabilizing prices. On the other hand, similar or uniform behavior within a market may be due to causes other than price-fixing. If the costs of a product are standardized and the product of each competitor may be easily substituted for that of the others, similar prices may be a natural occurrence.

In the majority of cases of suspected price-fixing, the prices are not so identical as to clearly suggest collusion. However, they are so similar and uniform as not to be completely explained by market forces. It is usually clear that each competitor is aware of the others' conduct, but it is not clear whether an agreement exists between the competitors. This situation has been labeled by the courts as conscious parallel behavior.

Both judges and economists have been reluctant to accept conscious parallel behavior as evidence sufficient in itself to uphold a price-fixing verdict. For those who advocate such an attitude, the Supreme Court's famous edict in Theatre Enterprises, Inc. v. Paramount Film Distributing Corp. has long served as their banner: "Circumstantial evidence of consciously parallel behavior may have made heavy inroads into the judicial attitude toward conspiracy; but 'conscious parallelism' has not yet read conspiracy out of the Sherman Act entirely." 8

The principal reason for this attitude is that oligopolistic market forces foster similar pricing behavior in most cases in which price-fixing is alleged. Thus, it is difficult to determine whether similar pricing strategies are the product of market forces or the product of collusion. The goal of utilizing computer techniques is to find relationships among alleged price-fixers that cannot be explained by mere conscious parallelism or market forces. Whether computer-generated evidence serves this function requires a consideration of the role market forces play in pricing behavior.

6. In FTC v. Cement Inst., 333 U.S. 683 (1948), the defendants' prices were identical to one-millionth of a cent. The court agreed with the FTC and rejected the defendants' contention that prices were controlled by the market.

7. See Turner, The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal, 75 Harv. L. Rev. 655 (1962). Turner suggests that in an oligopoly sellers will take into account the probable reactions of their competitors in setting prices. As a result, the pricing behavior is interdependent and similar, but without an agreement to conspire. See also Turner, The Scope of Antitrust and Other Economic Regulatory Policies, 82 Harv. L. Rev. 1207, 1226-27 (1969).

C. The Oligopoly and Price Interdependence

In the perfectly competitive model there are many buyers and sellers; a change in the pricing strategy of one seller will not have a significant impact upon any other seller. In contrast, an oligopoly is characterized by the existence of only a few sellers. A change in price by one seller will have a substantial impact upon the others. In the perfectly competitive model the effect of a price change will be spread among many sellers; in an oligopoly a price change affects the competitors more sharply because there are fewer of them. Thus, the seller in an oligopolistic market must respond sharply to any significant change in a competitor's price in order to preserve his market share, and sellers in an oligopoly become interdependent on one another's pricing strategies and production. The interdependence dictates that price adjustments be made regularly in response to competitors' price changes in order to preserve the seller's market share.

The oligopolistic competitor could choose to lower his prices in an attempt to sell more and increase profits. However, there are reasons why he would choose not to do so. He may be content to preserve his market share and profits, or he may be unable to produce more. Further, the selection of the exact price which would enable him to increase both sales and profits may be difficult. There is also the possibility that his competitors will retaliate against him through collective action. A rational alternative may be an agreement with competitors to stabilize prices. Such an agreement would reduce the market forces which cause sellers within the oligopoly to act and react to price changes. All sellers in an oligopoly have an incentive to collude to establish market shares and guaranteed prices because of fear of retaliation by others if they refuse.

Price-fixing is also facilitated in an oligopoly because there are fewer parties to the agreement. Agreement is easier to reach and to conceal than where there are many parties. Indeed, in most cases where price-fixing is successful, the oligopoly has been a necessary condition for the formation of the price-fixing conspiracy. 

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13. One economist suggests three principal reasons for collusion or conspiracy within an oligopoly: 1) it avoids the unpleasant contingencies posed by unrestricted competition; 2) there is little interference by the Department of Justice which is concerned with more flagrant violations of the antitrust laws; and 3) it is simple to coordinate by mutual agreement. Asch, Collusive Oligopoly: An Antitrust Quandary, 2 Antitrust L. & Econ. Rev. 53, 54 (Spring 1969).
14. Posner, supra note 9, at 1572.
In a market composed of many sellers and buyers, the economic pressures resulting from interdependence are absent. Thus, if price uniformity occurs in a normal marketplace the inference of collusion is strengthened because the oligopolistic forces are not in effect.\textsuperscript{15} Collusion is easier to detect and adherence to the price-fixing agreement is more difficult to enforce because there are a larger number of participants.

Because market forces play a more vital role in the pricing strategies of oligopolistic sellers, economists disagree over the question whether uniformity of pricing behavior within the oligopoly is itself evidence of collusion.\textsuperscript{16} This attitude is also reflected by the courts’ reluctance to accept uniform behavior as sufficient evidence of price-fixing and requirement that some other evidence of conspiracy be present.\textsuperscript{17}

D. The Sealed Bid Market

The practice of many buyers in taking sealed bids both assures price-fixing sellers of the continued vitality of their arrangement and provides additional incentive to fix prices. This practice is a key factor in facilitating price-fixing in oligopolistic industries.\textsuperscript{18} Potential sellers submit a sealed bid to the potential buyer, usually a government agency. Ideally, the bidders will attempt to underbid each other and be awarded a lucrative contract. However, once a winning bid is accepted, the prices of both the winner and the losers are published. If interdependent behavior is already facilitated by an oligopolistic market structure, the publication of bids serves as a mechanism to check the prices of competitors and to enforce any agreement to fix prices by allowing competitors to compare bids and detect “cheaters.” Bid publication enables competitors to determine whether one of their number is cutting prices; this knowledge permits retaliation against the transgressor by reducing prices within the entire group. “A bid opening disseminates information that a price cutter does not want known by his rivals; that information, readily dispensed, becomes useful in maintaining an oligopolistic understanding on price among the suppliers.”\textsuperscript{19}

The use of sealed bids is ineffective to encourage lower prices and in fact tends to promote collusion and enforcement of price-fixing agree-
mements.\textsuperscript{20} Identical bidding in government procurement contracts has often been associated with the practice of taking sealed bids.\textsuperscript{21} In the presence of an oligopolistic market, sealed bidding is even more likely to involve price-fixing arrangements.\textsuperscript{22}

It should be noted that the sellers did not create the sealed bid market; it is the purchaser who dictates that sealed bids be made. The entrenchment of procuring agencies in this practice is thus a source of encouragement to price-fixers.

E. Delivered Pricing

Delivered pricing is another practice permitted by buyers in the sealed bid industry which facilitates price-fixing. In a delivered pricing system, the bid price includes the cost of transportation; bids do not reveal the cost of transportation which has been added to the price of the item being purchased. The purchaser has no idea what the transportation costs are, and there is no way of ascertaining the basic price without the transportation cost.

Delivered prices ensure competitors that they can make a bid which will not reflect transportation costs. In the case of an agreement to fix prices at the delivered sealed bid price, competitors are assured of a reciprocal opportunity to bid at a geographic location where a competitor with lower transportation costs otherwise would have a significant advantage. The purchaser is forced to pay a higher price than he would if he could purchase the product where the transportation costs are lower, \textit{i.e.}, he is forced to pay for "phantom" freight costs because the price-fixing agreement has fixed the price where transportation costs are highest.\textsuperscript{23}

Oligopolistic market forces, sealed bidding, and delivered pricing all contribute to the formation and continuation of price-fixing rings. The oligopoly induces interdependent pricing behavior among competitors

\textsuperscript{20} Kuhlman, \textit{Nature and Significance of Price Fixing Rings}, 2 Antitrust L. & Econ. Rev. 69, 72 (Spring 1969).

\textsuperscript{21} See U.S. ATT\'Y General, \textit{Identical Bidding in Public Procurement}, Report of the Attorney General Under Executive Order 10936. This yearly report published since 1961 includes details of instances of identical bids on government contracts. The publication is designed to discourage identical bids and collusion. Identical bidding occurred in $16.8$ million of advertised bids in 1975, $19.2$ million in 1974, and $17.9$ million in 1973. These figures have decreased from an all-time high in 1971 of $32.6$ million.


\textsuperscript{23} See Comment, \textit{Price Systems and Competition: The Basing Point Issues}, 58 Yale L.J. 426 (1949). This now out-of-date article is still the best authority for the causes and effects of delivered pricing systems.
and may lead to the establishment of a conspiracy. Sealed bidding provides a mechanism for the enforcement of the conspiracy and delivered pricing serves as a tool for its operation. However, even where such factors exist and behavior is substantially uniform, courts have been likely to classify the uniformity of conduct as conscious parallelism. This attitude is best represented by one jurist who expressed the view that conscious parallel behavior "does not prove or tend to prove that it was done by agreement ... anymore than proof that a hound is chasing a fox is evidence that the chase is by agreement with the fox."  

II. Computer-Generated Evidence  

A. Theoretical Considerations  

Because of the reluctance to uphold conspiracy verdicts on the basis of mere circumstantial evidence of parallel behavior, enforcers of the antitrust laws have sought new ways to analyze market structures in order to present evidence which raises a stronger inference of conspiracy. One such method of analysis involves the use of a computer to analyze, organize, and summarize data. The computer can search, make comparisons, and print the results in a logical manner that would otherwise take substantial time if done by human physical and mental processes. The information to be processed is selected on the premise that in an industry where certain characteristics exist it is likely that price-fixing will occur, and that those characteristics will allow the existence of price-fixing to be detected. Such characteristics include the existence of a homogenous product, inelastic demand for the product, relatively stable technology and little product innovation, sealed bids, and substantial entry barriers to newcomers in the industry.  

24. The history of this judicial attitude may be traced to a time in American history when the Supreme Court adopted a laissez-faire attitude toward the regulation of business. The trade association cases in the 1920's are representative. See Maple Flooring Mfrs' Ass'n v. United States, 268 U.S. 563 (1925); Cement Mfrs' Protective Ass'n v. United States, 268 U.S. 588 (1925). In both cases the Court was concerned primarily with the rights of trade associations. Despite substantial uniformity of prices, the Court was inclined to believe the defendants' evidence that pricing was independent and dependent on supply and demand. See also United States v. International Harvester Co., 274 U.S. 693 (1927).  


The data to be assimilated are information concerning the sellers, the buyers, the bids, and the winning bids within the industry. This information may be obtained through the bid-letting public agency or through the discovery process in litigation. All information is placed on computer cards, read by the computer, and organized as the programmer directs. Certain programs are utilized to detect activities characteristic of price-fixing. These programs are not overly complicated, but they do require the direction of an expert economist prepared to interpret the data and explain its significance in the courtroom. The search for specific characteristics among the alleged price-fixing group includes detection of (a) geographic market division; (b) periodicity in bidding behavior or the observation of bidding behavior that follows a systematic pattern over time; (c) price relationships between bidders; (d) price relationships between the prices of subproducts; (e) price relationships over space; and (f) price relationships over time.

An example of this process and its application to a specific case will be illustrated in this comment. The data presented was gathered from an antitrust suit filed in 1969 by a number of cities against the sellers of a standardized product. Because the traditional discovery process yielded no incriminating evidence or “hot documents,” the only information which proved to be useful was a compilation of bid tabulation reports for the period from 1964 to 1970. As a result, the case, scheduled for 1975, was to be tried solely on computer-processed economic data. The suit was settled shortly before trial. However, the techniques used to develop the evidence and the evidence itself can serve as models for future litigation.

B. The Evidence

An assumption basic to the use of the computer to assimilate evidence is that collusive sellers will generate visible traces of their conspiracy which can be discovered and interpreted through various relationships. The computer serves as a vehicle for testing hypothetical relationships

29. Required information specifically includes: (a) the agency letting the individual bid and its address, including zipcode; (b) the shipping destination of the product, including zipcode; (c) the point of origin, including zipcode; (d) a code for each product and subproduct; (e) report of bid prices; and (f) the winning bid. Kuhlman, A Proposal for the Detection of Price Fixing, 7 ANTITRUST L. & ECON. REV., No. 2, at 97 (1974-1975).
30. See text accompanying notes 39-55 infra.
33. See Kuhlman, supra note 5.
34. Posner, supra note 9, at 1587.
and for depicting such relationships in the form of computer printouts. The types of relationships that can be discovered are illustrated by the information compiled in the settled case.

The product was sold in a nationwide market and there were some 50,000 bids let by cities in forty-nine states. There were only five principal sellers or producers and thus the market structure was oligopolistic. The product was required to meet a minimum standard of specifications and each firm's product was fungible, i.e., one firm's product of a given size would substitute for another firm's product of the same size. There were several product sizes, but the most commonly purchased were the four smallest sizes. Finally, the product was sold through sealed bids on a delivered pricing basis; the price included all transportation costs. Because of the uniformity in the way the product was manufactured and offered for sale, the products could be compared on a price basis.\(^{35}\)

Several relationships were discovered among the pricing behaviors of the defendants that indicated that much more than competition or market forces were affecting the prices charged by each firm. These relationships have been somewhat simplified in this text and the reader should understand that some of the materials are a sample of the actual data. In an actual case, each defendant's behavior would be analyzed and compared. For the sake of brevity, data on all defendants has not been provided.

Figure 1 is a computer printout of bid prices for the five largest firms within the industry. It is basically a picture of the price behavior of the industry during the period from 1964 to the end of 1970 and illustrates the distribution of bid prices during that period.\(^{36}\) The horizontal axis represents bid-lettings on a chronological basis. The vertical axis represents each bid as a percentage of the bidder's list price. Each dot represents a bid by a given company and in that same column will be bids on the same contract by the four other firms. For example, the first entries in the far left-hand column might represent bids submitted to a buyer in St. Louis. The second column could represent a buyer in another city in the same time period. Although the clusters of bids do not allow accurate selection of each column and place at a given date, it is possible to draw inferences from the overall picture. The expert economist who was prepared to testify had separated the figures into four distinct time periods. During period I and the succeeding period II, the pricing behavior of the sellers was clustered and the economist was prepared to testify that this is an indication of similar pricing strategies. The pricing

\(^{35}\) These factors may make an industry prone to price fixing. See text accompanying notes 27-28 supra.

\(^{36}\) Bid prices were available for January 1, 1964 through December 31, 1970, plus a relatively small number for the periods 1971 through 1974. Kuhlman, supra note 5.
strategy indicated could be described as parallel behavior. In period III, there is a slight dispersion in pricing behavior as compared to the earlier periods. This might be explained by the fact that new firms had entered the industry resulting in increased competition.

It is period IV which shows a substantial change in the firms' pricing behavior. The pricing strategies dispersed markedly. This dispersal is significant because period IV marks the commencement of the antitrust suit against the sellers. The industry was characterized thereafter by vigorous competition.

The dramatic change in behavior raises an inference that the filing of the antitrust suit caused the firms to change their pricing behavior from collusion to competition. The behavior also suggests that the firms tacitly admitted their guilt by changing their pricing after the suit was filed.

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**Figure I**

### Mean, Standard Deviation and Coefficient of Variation for Bids by Firm on Smallest Size Units

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<tr>
<td>5</td>
<td>136</td>
<td>28.99</td>
<td>0.88</td>
<td>3.0</td>
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</tr>
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</table>

**Table I**

Figure 1 was supported by other evidence which strengthens the inference of collusion. The mean, standard deviation, and coefficient of variation were computed for prices of the smallest size product during the same time periods. An examination of those values indicates the same pricing relationships illustrated in Figure 1. During the period from 1964 to mid-1969, the standard deviation from the mean and the coefficient of variation of each firm's bids did not differ substantially from that of any other firm. See Table I, Columns A-C. Furthermore, prices on successive bids could be predicted to be within those values. However, in the middle of 1969, which correlates to the commencement of the suit, each firm began to alter its pricing behavior and the differences between the mean, standard deviation, and coefficient of variation for each firm increased significantly. See Table I, Columns D-E.

Table II illustrates the average bid prices for the smallest size product by geographic area for several time periods from 1964 to 1970.\footnote{37} In

<table>
<thead>
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<th>Location (first digit of zip code)</th>
<th>Time Period</th>
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37. One might hypothesize that because the firms were located in different parts of the contiguous United States, their bidding would reflect differences in transportation costs. The entire Table of which Table II is only a part indicated that transportation costs were not reflected in bid prices. For example, the average bid in the West generally did not differ from the average prices bid in the Northeast. Kuhlman, supra note 5.
the far right-hand column the range between the highest and lowest average bid between firms was computed. The ranges for all areas shown was slight for the first three time periods. However, in the period after the suit was filed (1969-70), the range of all average bid prices increased significantly. Again, the data suggests a change in behavior due to the commencement of the suit.

A further comparison of firm against firm is made in Table III. In constructing this table the bids of all firms for the smallest size product

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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.04</td>
<td>1.49</td>
<td>2.39</td>
<td>.93</td>
<td>1.73</td>
<td>—</td>
</tr>
<tr>
<td>1.59</td>
<td>1.07</td>
<td>1.10</td>
<td>.75</td>
<td>1.81</td>
<td>—</td>
</tr>
<tr>
<td>1.28</td>
<td>.94</td>
<td>1.30</td>
<td>1.64</td>
<td>1.15</td>
<td>—</td>
</tr>
<tr>
<td>5.37</td>
<td>1.86</td>
<td>2.86</td>
<td>4.47</td>
<td>8.45</td>
<td>—</td>
</tr>
<tr>
<td>8.63</td>
<td>1.65</td>
<td>10.65</td>
<td>2.78</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

### Table II

were placed in pairs. The smaller bid was subtracted from the larger and
the difference was divided by the smaller and computed as a percentage.
Thus, the figures in each horizontal row are the percentage of bids
which differed by 0%, less than 1%, less than 2%, and so on. A compari-
son of these percentages shows the same change in behavior occurring at
the commencement of the suit. For example, if the first three percentage
columns in line 1 are added together, they indicate that in 1964 a total
of 68.2% of the bids differed by less than 2%. If the same procedure is
followed in line 6, the figures indicate that in the six-month period be-
fore the suit was filed in 1969, almost 50% of the bids differed by less
than 2%. However, the same calculation for the six-month period after
the suit was filed (line 7) indicates that the percentage of bids differing
by less than 2% fell to 30.7%. Again, this change in behavior after suit
was filed suggests that the firms were engaged in collusive price-fixing in
the prior periods.

Comparison of Bid Pairs in Percentage Differences
(1964-74)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Pairs</th>
<th>0</th>
<th>&lt;1%</th>
<th>&lt;2%</th>
<th>&lt;3%</th>
<th>&lt;4%</th>
<th>&lt;5%</th>
<th>&lt;6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1964</td>
<td>6743</td>
<td>1.8%</td>
<td>45.8%</td>
<td>20.6%</td>
<td>12.9%</td>
<td>8.9%</td>
<td>4.4%</td>
<td>2.7%</td>
</tr>
<tr>
<td>2. 1965</td>
<td>6552</td>
<td>1.7%</td>
<td>40.6%</td>
<td>18.9%</td>
<td>12.3%</td>
<td>7.3%</td>
<td>4.2%</td>
<td>2.7%</td>
</tr>
<tr>
<td>3. 1966</td>
<td>6676</td>
<td>1.8%</td>
<td>41.1%</td>
<td>20.6%</td>
<td>11.9%</td>
<td>8.6%</td>
<td>5.2%</td>
<td>2.6%</td>
</tr>
<tr>
<td>4. 1967</td>
<td>7094</td>
<td>1.0%</td>
<td>37.8%</td>
<td>20.1%</td>
<td>14.5%</td>
<td>10.9%</td>
<td>5.9%</td>
<td>3.9%</td>
</tr>
<tr>
<td>5. 1968</td>
<td>6819</td>
<td>0.9%</td>
<td>32.8%</td>
<td>17.2%</td>
<td>12.2%</td>
<td>11.4%</td>
<td>6.6%</td>
<td>4.7%</td>
</tr>
<tr>
<td>1969</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. 1st half</td>
<td>3828</td>
<td>1.0%</td>
<td>33.4%</td>
<td>15.0%</td>
<td>13.6%</td>
<td>10.2%</td>
<td>7.7%</td>
<td>5.4%</td>
</tr>
<tr>
<td>7. 2nd half</td>
<td>1591</td>
<td>0.9%</td>
<td>18.8%</td>
<td>11.0%</td>
<td>5.8%</td>
<td>6.1%</td>
<td>6.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td>8. 1970</td>
<td>5645</td>
<td>0.6%</td>
<td>19.9%</td>
<td>13.4%</td>
<td>8.0%</td>
<td>8.1%</td>
<td>5.5%</td>
<td>5.0%</td>
</tr>
<tr>
<td>9. 1972-74</td>
<td>632</td>
<td>0.6%</td>
<td>1.7%</td>
<td>3.3%</td>
<td>4.0%</td>
<td>2.5%</td>
<td>4.4%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Table III
Adapted from Kuhlman, Inferring Conduct from Performance: An Analysis of a Price Fixing Case, 6 INDUS. ORG. REV. 1 (1978).

One method for price-fixers to establish pricing systems and to con-
tinue setting prices with minimal communication between the parties is
to agree to establish prices based upon a formula. Valuable evidence of a
price-fixing conspiracy might be obtained by establishing the basis of the
pricing scheme, monitoring the scheme, and perhaps discovering the
formula used to establish prices.\textsuperscript{38} A computer can be helpful in this situation because it can make the numerous calculations necessary to detect formula pricing. In this case a formula was hypothesized and tested with the aid of the computer.

Each firm had a basic price list for the several sizes of the product. These list prices were based upon the quantity purchased; the larger the quantity purchased, the lower was the unit price. In addition, each firm had different quantity discounts. Despite the existence of different discount schedules, it was ascertained that every firm based its product price on the formula depicted in Table IV. The price of the smallest size product was the base price. The price for successive sizes in an order of the same quantity was a function of the base price and a multiplier for each successive size. Thus, the price of a size 2 item was 1.5 times the base price, the price of size 3 was 2.2 times the base price, and price of size 4 was approximately 4.1 times the base price. During the period preceding the suit, the firms adhered to these multiples with slight variation.

Price of Seven Smallest Units as a Multiple of Size 1 (1969)

<table>
<thead>
<tr>
<th>Product Size</th>
<th>Firm 1</th>
<th>Firm 2</th>
<th>Firm 3</th>
<th>Firm 4</th>
<th>Firm 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>4</td>
<td>4.1</td>
<td>4.1</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>5</td>
<td>6.2</td>
<td>6.2</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>6</td>
<td>12.5</td>
<td>12.5</td>
<td>12.0</td>
<td>12.0</td>
<td>12.0</td>
</tr>
<tr>
<td>7</td>
<td>20.6</td>
<td>20.6</td>
<td>20.0</td>
<td>—</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Table IV


\textsuperscript{38} See Geiss & Kuhlman, Estimating Price Lists, List Charges, and Market Shares from Sealed Bids, 86 J. Pol. Econ. 193 (1978) (another study of the industry revealing a process upon which behavior of firms can be monitored and pricing behavior predicted).
It can be argued that the price lists were public knowledge and that the relationships were a result of product similarities and price leadership. However, the legality of such pricing behavior is seriously questioned by the fact that the multiplier relationships carried over into sealed bids, which were supposed to be secret. Thus, even in sealed bids, the firms adhered to the base prices in the price lists and the same formula relationships among product sizes existed for all firms.

Indeed, firms failed to lower prices or shade from the price list despite the fact that a given firm would lose several successive bids. It appeared that firms continued to bid high even though they lost the bid at a given locale on prior occasions. This is illustrated in Table V. The left column represents the purchaser in several successive lettings of bids. When Firm 1 lost the first bid to Firm 3, it nevertheless failed to lower its prices in subsequent bids. Similarly, Firms 4 and 5 declined to compete with Firm 3. The data suggests that the other firms did not want to compete with Firm 1 although it appears that lower bids would allow them to sell their product to the purchasing agency.39

<table>
<thead>
<tr>
<th>Successive bids in a single locale</th>
<th>Firm 1</th>
<th>Firm 3</th>
<th>Firm 4</th>
<th>Firm 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$34.72</td>
<td>$33.84</td>
<td>$34.80</td>
<td>(no bid)</td>
</tr>
<tr>
<td>2</td>
<td>34.72</td>
<td>33.84</td>
<td>34.80</td>
<td>$34.60</td>
</tr>
<tr>
<td>3</td>
<td>34.72</td>
<td>33.84</td>
<td>34.80</td>
<td>34.60</td>
</tr>
<tr>
<td>4</td>
<td>34.72</td>
<td>33.84</td>
<td>34.80</td>
<td>34.60</td>
</tr>
</tbody>
</table>

Table V

Adapted from Kuhlman, Inferring Conduct from Performance: An Analysis of a Price Fixing Case, 6 INDUS. ORG. REV. 1 (1978).

Table V is only a small sample of the behavior of Firm 1; other data indicated similar indifference to competition by Firm 1, as well as identical behavior by the other defendants in other markets. Although such a

39. Repeated unsuccessful bidding suggests an unwillingness to compete for a particular agency's letting of bids. If this was frequent and if similar behavior occurred in relation to other bidders in other markets, some type of horizontal territorial allocation could be inferred. By allocating market shares, the firms could bid noncompetitively and maintain higher prices.
theory was never tested, it suggests that some type of market division existed between the defendants.

Importantly, the multiplier relationship was prevalent during the period preceding the antitrust suit. After the suit was commenced, the relationships fell apart and competition flourished. The firms began to shade their bids from their price list and the multiplier relationship did not dictate the price between the size of the products.

Much of the information which has been presented indicates the role the computer can play in compiling statistical information. It can serve as a tool to test relationships among statistical data and reveal patterns of behavior. Figure 1 is an example of how these relationships may be displayed graphically.

III. DISCOVERY, ADMISSIBILITY, AND SUBMISSIBILITY OF COMPUTER-GENERATED EVIDENCE

A. Discovery

Thorough pretrial discovery is essential for both parties if technical evidence is sought to be admitted at trial. As a general rule, the proponent of computer-generated evidence should disclose his intention to use such evidence to both his adversary and the court well in advance of trial. Such disclosure facilitates discovery and allows the opponent to familiarize himself with the nature of computer-generated evidence in order to prepare objections and cross-examination at trial. It also allows the judge to familiarize himself with computer evidence and the applicable law before trial.40

All the underlying data, proposed exhibits, and the substance of testimony to be given should be made available to opposing counsel in advance of trial.41 The reason for such complete disclosure is fairness; whenever technical or scientific data are to be used as evidence, fairness within the framework of the adversary system requires that the opposition have a reasonable opportunity to prepare a response.42 An opponent of such evidence could not properly prepare for trial without disclosure. Disclosure supplemented by discovery also may serve to avoid lengthy, technical issues43 and permit objections to be raised and possibly resolved before trial.44 Pretrial familiarization of all parties with the

44. Manual, supra note 41, § 2.711.
technical aspects of computer-generated evidence may allow issues to be
more narrowly defined and permit complex antitrust litigation to be
shortened.

In criminal cases in which computer evidence has been prepared, de-
fense counsel have been allowed access to the prosecution's computer
data,\textsuperscript{45} as long as the party opposing the evidence has not unduly de-
layed requesting discovery.\textsuperscript{46} By analogy, those considerations should
apply to computer-generated evidence in civil or criminal antitrust cases.

The Federal Rules of Civil Procedure provide adequate discovery
reasons for the party against whom computer evidence is offered. Rule 34 allows a party to request documents or data compilations in the
possession of the opposing party.\textsuperscript{47} This rule arguably should allow the
discovery of computer evidence which will be offered at trial. The sig-
nificance and interpretation of such evidence may be discovered by re-
quiring the proponent to reveal the identity of experts to be called at
trial, the subject matter upon which they will testify, and the substance
and basis of the experts' opinions.\textsuperscript{48}

The expert to be called at trial in an antitrust case will be an
economist. Although his expertise may be involved in the preparation of
the evidence for trial, he probably will not be the computer pro-
grammer. Undoubtedly, the party against whom computer evidence, if admit-
ted, will be used will need to know the manner in which the computer
was programmed and the underlying documents used in the programs.
However, the computer programmer probably will not be called at trial
and the federal rules permit the discovery of facts and opinions of such
an expert only upon a showing of "exceptional circumstances."\textsuperscript{49}

The issue whether facts and opinions known by a "nontrial" computer
expert are discoverable in an antitrust action was litigated in Pearl Brew-
ing Co. v. Jos. Schlitz Brewing Co.\textsuperscript{50} The court ordered the proponent of
computer evidence to make its computer programmers available for de-
positions and to provide documentation revealing the details of its com-
puter programs. The court justified its decision by saying that the use of
the specialized computer evidence constituted the exceptional cir-
mstance required by the rule.\textsuperscript{51}

\textsuperscript{45} See United States v. Liebert, 519 F.2d 542 (3d Cir.), cert. denied, 423 U.S.
985 (1975); United States v. Dioguardi, 428 F.2d 1033 (2d Cir.), cert. denied, 400
U.S. 825 (1970); United States v. De Georgia, 420 F.2d 889 (9th Cir. 1969).

\textsuperscript{46} United States v. Greenlee, 517 F.2d 889 (3d Cir.), cert. denied, 423 U.S.
985 (1975).

\textsuperscript{47} FED. R. CIV. P. 34(a), Notes of Advisory Committee. See Ewald, Discovery
and the Computer, 1 Litigation 27 (Spring 1975).

\textsuperscript{48} FED. R. CIV. P. 26(b) (4). See also Manual, supra note 41, § 260.

\textsuperscript{49} FED. R. CIV. P. 26(b) (4) (B).

\textsuperscript{50} 415 F. Supp. 1122 (S.D. Tex. 1976).

\textsuperscript{51} Id. at 1134-40.
Discovery is also important to the proponent of computer evidence to obtain the basic bid data to be processed by the computer. Although the plaintiff may have such information already in his possession, it is preferable to require the defendants to produce it through discovery. This method establishes the bids as admissions, and as a result the defendants will be more likely to insure the accuracy of the documents produced. The documents furnished by the defendants also can be crosschecked with the bid-letting agencies’ documents for accuracy. If the defendant holds business records within computer files, discovery also may be used to obtain the computer tapes and develop circumstantial evidence from the computerized business records. Of course, discovery is not unlimited. Discovery may be limited by the court to relevant issues and further limited by weighing the burden of production against the importance of the information sought. For example, in *Pearl Brewing* the court refused to order the proponent of the computer evidence to provide information about alternative computer programs, input data, and calculations constructed by the plaintiff but rejected in favor of the systems in use. In addition to those protections, a court also may make appropriate provision for the protection of original computer data and for the expense of duplication.

B. Admissibility

There are significant evidentiary problems involved in the use of computer-generated evidence. Hearsay problems are inherent because the computer printout is based upon the defendants’ bidding data and thus the bids, in one form or another, will be offered to prove the truth of their contents. Therefore, the question whether the bids are in fact those of the defendant is raised. An additional problem is laying an adequate foundation for the admission of computer evidence.

The hearsay problems are not insurmountable. A plaintiff in a price-fixing case will request the defendants to produce documents or records providing basic bidding data. Therefore, this data initially may be classified as the defendants’ business records or admissions of a party op-

52. See text accompanying notes 56 & 57 infra.
55. 415 F. Supp. at 1134-40.
56. Fed. R. Civ. P., 26(b) (4) (C). *See* United States v. Davey, 543 F.2d 996 (2d Cir. 1976), in which the court required the taxpayer pay for duplication of tapes sought by the Internal Revenue Service. Apparently the court believed he could better afford it than the IRS. The Internal Revenue Code has a provision which covers the production of computer data. 26 U.S.C. § 7602 (1970).
ponent, both of which are exceptions to the exclusionary rule against hearsay. However, the bidding data changes form as it is processed and finally takes the form of computer printouts. For example, the defendants’ bidding data will be recorded on cards punched by a machine, stored on magnetic tape, and eventually processed within the computer before being presented upon a computer printout. As a result, when the process of computer analysis has been completed, there are two evidentiary problems. The business records or admissions of the defendant may be characterized as one level of hearsay, but the computer transforms the defendants’ business records or admissions into another level of hearsay; the change in form may involve double-hearsay or a violation of the original writing requirement.

Such difficulty may be overcome by an assertion that computer-generated evidence in a price-fixing case is basically a summary of economic evidence prepared from the defendants’ bidding data. Summaries of evidence are necessary to streamline complex antitrust litigation and may "materially reduce the burden of analyzing a mass of complex factual data." The Federal Rules of Evidence provide for the admission of summaries of voluminous writings or records as an exception to hearsay and the original writing requirement. The summaries may be presented in the form of a chart, summary, or calculation. Thus, under the federal rule, both the bidding data and the calculations used in the analysis of the data are admissible.

Before the evidence may be admitted, a proper foundation for the computer data must be laid. This requires that the system which generated the evidence be established as reliable and accurate. Cases involving authentication of computer evidence have been concerned with the admission of business records stored within computers.

58. Fed. R. Evid. 801(d) (2). This hearsay exception includes statements made by co-conspirators during the course and in furtherance of the conspiracy.
62. Fed. R. Evid. 1006. The court may order production of the underlying documents. See also Manual, supra note 41, § 2.711.
63. Fed. R. Evid. 1006.
64. Fed. R. Evid. 901(b) (9), Notes of Advisory Committee.
65. See cases collected in United States v. Russo, 480 F.2d 1228 (6th Cir. 1973), cert. denied, 414 U.S. 1157 (1974); United States v. De Georgia, 420 F.2d 889 (9th Cir. 1969). The new federal rules permit the introduction of computer evidence after an adequate foundation is laid. Fed. R. Evid. 901(b) (9). See also the accompanying Notes of Advisory Committee. Business records are admissible.
computer-generated evidence in price-fixing cases is different in that it is not a business record itself but is a summary or reorganization of the defendants' business records or their admissions. The reason for authentication is clear in both situations. When a party offers computer evidence generated from his own computer, it is as if the computer were testifying before the court. Although the rules of evidence provide a theory for admissibility, absent safeguards the computer could lie just as a witness could and there is no way for the judge or jury to gauge its credibility. Furthermore, information in a computer can be lost or manipulated to favor or injure either party.

To lay the proper foundation, an expert familiar with the computer used to generate the evidence must testify for the accuracy of the process. One author has suggested that accuracy and reliability of computer evidence may be proved by: (1) studying the way the information entered the system for human or computer error; (2) evaluating the program to ascertain whether the evidence has been altered; (3) investigating the safeguards used to make sure no alterations have occurred; and (4) judging the credibility of the witness who presents the evidence in court.

This process may be divided into several steps. First, the expert must be qualified through testimony regarding education, training, experience, and familiarity with the use of computers. Second, the expert must testify that the nature of the input information and the mechanics of input control insure accuracy during the computer's operation. This is to insure that correct information is fed into the computer.


68. Id. at 563.
69. Id. at 562.
71. The supervisor of the computer center where the information was processed should not be required to testify as long as the individual testifying is sufficiently familiar with the computer system. See D & H Auto Parts, Inc. v. Ford Marketing Corp., 3 COMPUTER L. SERV. REP. 856 (E.D.N.Y. 1973); Endicott Johnson Corp. v. C. M. Golde, 190 N.W.2d 752 (N.D. 1971).
Third, the expert must testify that the computer retained accurate information during processing and did not alter or lose information during the computer’s operation. The probability of computer error also should be evaluated, with mention of the size and type of the computer installation. The expert should give his opinion of the accuracy of machine computations and also should state his opinion to the effect that the program did not alter the data, but merely reorganized and summarized it.72 Finally, the expert should discuss the control of printouts to prevent printing error.

Laying the foundation may take substantial time; it is often appropriate and desirable to do so outside the hearing of the jury.73 The trial also may be facilitated by requiring objections to the computer evidence to be litigated prior to trial.74 One case suggests that once an aura of reliability for computer business records has been established, only specific objections to the evidence’s reliability may be presented at trial.75 The effect of such a ruling would be to force the opponent of the computer data to produce evidence to show that the computer records are prejudicial or unreliable.76 This shift in the burden of producing evidence is also appropriate in the situation in which the computer is used to develop circumstantial evidence, because many of the questions of reliability can be resolved before trial through discovery and cooperation between the parties.77

Once the foundation has been laid and the computer evidence has been admitted, the court may order the underlying documents or original business records to be produced.78 Admission of the underlying documents allows the court or the jury to examine the credibility of the evidence by cross-checking the computer evidence with the documents.

The computer data or summaries may be reproduced in the form of charts or tables to emphasize certain facts.79 To be admissible, such

72. A simple but time consuming method is to check the data obtained from the computer against the underlying documents. If the computer has made simple calculations, they may also be checked by hand. This process enables the expert to testify that data within the computer has not been altered. It also should be noted that by allowing the party against whom such evidence will be admitted to examine the printouts before trial, the proponent’s attention will be called to errors prior to trial if he asks, through discovery, for any objections to the proposed evidence.

76. See Tapper, supra note 63, at 562 (regarding business records).
77. See DeHetre, Data Processing Evidence — Is It Different?, 52 Chi.-Kent L. Rev. 567 (1976), for an examination of the process by which an adversary can investigate the reliability of computer information to be used against him.
78. Fed. R. Evid. 1006.
79. Id.
presentations must satisfy the court that they accurately represent the data as generated by the computer. Once the court is assured that the nature of the evidence is trustworthy, its weight and credibility may be scrutinized through the direct and cross-examination of an expert economist familiar with the evidence, or by the opponent's own expert witness.

C. Testimony of the Expert Economist

It must be emphasized that it is not the computer which makes the observations or interpretations of behavior. "The computer's contribution . . . is to permit the economist to analyze large amounts of data and obtain a cost and temporal view of the data which would not otherwise be possible." Because the issues in the case may be quite complex, the relative strength or weakness of the expert's opinion may be the most important factor in a jury or judge's determination. The computer is merely a sophisticated tool.

In addition to the expert's role at trial, he must supervise the preparation of the computer data. Thus, the expert's role is to organize the evidence, explain the evidence at trial, and state an opinion upon the facts as perceived by him. The Federal Rules of Evidence permit the expert to testify to those matters of which he has personal knowledge and facts or data which have been made known previous to trial or at trial. Therefore, the expert could testify as to the facts with which he has become acquainted through his research prior to trial as well as those matters of which he has become aware at the trial itself.

80. For an example of charts or tables introduced in antitrust litigation, see United States v. E.I. DuPont de Nemours & Co., 126 F. Supp. 27 (N.D. Ill. 1954). In United States v. Twentieth Century-Fox Film Corp., 137 F. Supp. 78 (S.D. Cal. 1955), defendants introduced statistical charts which the court believed were evidence that a conspiracy did not exist. Statistical evidence can never take the form of mere speculation. Joseph E. Seagram & Sons, Inc. v. Hawaiian Oke & Liquors, Ltd., 416 F.2d 71 (9th Cir.), cert. denied, 396 U.S. 1062 (1969).
81. Kuhlman, supra note 5, at 99.
82. For a general discussion of the role of the economic expert in antitrust litigation, and his testimony as to the structure, conduct, and performance of an industry, see Scanlon, Economics in the Courtroom: The 'Technology' of Antitrust Litigation, 3 ANTITRUST L. & ECON. REV., No. 1, 43, 55-112 (1969). The fact that the computer expert and the economics expert are not the same person requires a somewhat more burdensome foundation problem. However, it also provides an advantage in that the credibility of the evidence is enhanced by the fact that the programmer is independent, and hence the expert could not as readily manipulate the information to favor one party.
83. "The expert may testify in terms of opinion or inference and give his reasons therefor without prior disclosure of the underlying facts or data, unless the court requires otherwise. The expert may in any event be required to disclose the underlying facts or data on cross-examination." Fed. R. Evid. 705.
84. Fed. R. Evid. 602.
85. Fed. R. Evid. 703.
If an expert were to testify in the factual situation described earlier, he would attempt to do several things. The expert's first function would be to explain the evidence in terms of relevance and significance to the issue of conspiracy. He would illustrate the fact that the defendants' behavior mirrored one another over a course of time and would indicate that this parallel behavior took the form of formula pricing. He would relate the behavior of the defendants to the significance of the sealed bid market and delivered pricing within an oligopoly. He also would indicate the fact that the defendants refused to bid competitively. Although technical economic arguments should be avoided, some education of the judge or the jury is necessary so that a verdict can be reached which is based upon some of the fact finder's own inferences. Otherwise, the judge or jury is forced to base much of its decision solely on the expert's opinion.

The desired opinion would be one that asserts that the behavior of the defendants could only be explained by the presence of an agreement to fix prices, or that the only possible explanation for a change in their behavior was the termination of the conspiracy. The expert's opinion could be elicited by several questions. One form could be: "Could the results observed from the computer-generated data be caused by a normally functioning bid market?" An attorney for the plaintiff might want the expert to express his opinion that the behavior of the defendants was explainable only by collusion. A sample question could be: "What in your opinion could be the cause of the observed behavior of the defendants?"

D. Mere Conscious Parallelism?

If the plaintiff has presented his case based soley upon the computer-generated evidence and the expert's opinion, the issue raised is whether the evidence is sufficient to withstand a motion for a directed verdict.

86. "Testimony in the form of an opinion or inference otherwise admissible is not objectionable because it embraces an ultimate issue to be decided by the trier of fact." Fed. R. Evid. 704.

87. In Armco Steel Corp. v. Adams County, 376 F.2d 212 (8th Cir. 1967), an economics expert was permitted to testify that the only possible explanation for a reduction of prices was the termination of the conspiracy. Id. at 214. See United States v. United States Steel Corp., 251 U.S. 417 (1920) (the expert's deduction was not sufficient to overcome testimony of others that competition was vigorous); United States v. American Radiator & Stand. Sanitary Corp., 433 F.2d 174 (3d Cir.), cert. denied, 401 U.S. 948 (1970) (an expert used charts and stated his opinion that pricing behavior was a result of vigorous competition); United States v. Manufacturers Hanover Trust Co., 240 F. Supp. 867 (S.D.N.Y. 1965) (experts in the banking field were permitted to express an opinion on competition in the banking industry).

88. For a general outline of the proof requirements of conspiracy under § 1 of the Sherman Act, see Monroe, Price Fixing-Proof and Inference, 41 Antitrust L.J. 84 (1971).
Even though circumstantial evidence is *admissible* to infer the existence of a price-fixing conspiracy,\(^9\) in order to sustain a submissible case the inference must be so strong that the conduct of the alleged price-fixers could result only from tacit or express agreement.\(^9^0\) The inference may rise from the conduct of the parties rather than from evidence of express communication.\(^9^1\) However, the principal problem with circumstantial evidence is that there may be explanations of parallel behavior other than collusion.\(^9^2\) Just as it is difficult to define the point at which a plaintiff or prosecutor has made a submissible case, it is difficult to define what amount of evidence goes beyond conscious parallelism and is sufficient to infer collusion.

Direct evidence is the easiest way to prove conspiracy. Such evidence may consist of several varieties of interaction between the alleged parties to the conspiracy. Joint, collaborative action by several parties to eliminate a class of competitors is a classic form of conspiracy.\(^9^3\) The conspiracy may take other forms of concerted activity such as licensing requirements coupled with uniformity of price.\(^9^4\) Evidence of an agreement to supply a product to a wholesaler as long as the wholesaler adheres to a minimum price schedule, followed by adherence to such schedule, may be enough evidence to sustain a finding of conspiracy.\(^9^5\) Where uniform action follows an invitation to conspire, there is sufficient evidence of a conspiracy.\(^9^6\) Records of communication\(^9^7\) and a course of dealings\(^9^8\) between the alleged conspirators or discussions of prices within trade associations\(^9^9\) are also substantial evidence. Further-


\(^{92}\) See text accompanying notes 6-17 *supra*.

\(^{93}\) See United States v. General Motors Corp., 384 U.S. 127 (1966), where the defendants conspired to eliminate competition by terminating business dealings.


\(^{97}\) See, e.g., Rea v. Ford Motor Co., 497 F.2d 577 (3d Cir. 1974). There was also economic evidence of price uniformity unrelated to supply and demand.


\(^{99}\) Safeway Stores, Inc. v. FTC, 366 F.2d 795 (9th Cir. 1966). *But cf.* Cement Mfrs.' Protective Ass'n v. United States, 268 U.S. 588 (1925); Maple Floors Mfrs.' Ass'n v. United States, 268 U.S. 563 (1925) (indicating an earlier reluctance by the Court to condemn communications within trade associations).
more, a reciprocal agreement to exchange prices with the effect of stabilizing prices is highly probative of a conspiracy. The common element in all the above situations is that there is direct evidence of collusion.

In the absence of direct evidence, there have been situations in which courts have refused to allow an inference of conspiracy on the basis of circumstantial evidence. For example, one trial court determined that a conspiracy existed when it believed evidence that identical prices were charged as a result of a conspiracy. The appeals court reversed, noting that government regulation, standardized major costs, economic factors, and uniformity in the product contributed to uniformity of price. The court concluded that the circumstantial evidence in the form of uniform pricing was not sufficient to sustain a finding that a conspiracy existed.

There are other situations in which the courts have concluded that the evidence is not sufficient as a matter of law to prove the existence of a conspiracy. The classic situation is that in which there is evidence only of uniform prices. Uniform unreasonably high prices are not acceptable as evidence of a conspiracy. The mere exchange of price information is also not sufficient evidence of conspiracy, nor is an individual decision to follow a price leader sufficient. Courts are likely to reject an inference of conspiracy if similar market behavior can be explained by economic pressure and price explained by supply and demand. Similarly, interdependence and national business decisions may coerce conscious parallel behavior. Courts also have noted that uniform action without evidence that the alleged conspirators were acting against their

own self interest in order to better the group weakens any inference of conspiracy.\(^\text{108}\)

Moreover, some circuits have overturned district court rulings which sustained conspiracy verdicts despite the trial courts' factual findings of the existence of more than conscious parallelism.\(^\text{109}\) This raises an important question related to computer-generated evidence: whether computer-generated economic evidence is sufficient to support a conspiracy verdict when such evidence is merely circumstantial or inferential? Assuming that all the evidence mentioned above has been admitted,\(^\text{110}\) the question can be answered by analysis and comparison with cases in which economic evidence has been successfully used.

Economic evidence has essentially two functions; it can demonstrate a motive for entering into an agreement and it can demonstrate occurrences which at some point lead to the conclusion that a conspiracy took place. The principal motive is economic self-interest. In an oligopoly there is substantial interdependence and the motive to stabilize prices is strong. Thus, interdependence is a motive to maintain uniform prices\(^\text{111}\) although interdependence alone has never been held to be evidence of collusion.\(^\text{112}\) A motive to fix prices also may exist within an industry which has been characterized by past price-cutting forced by declining demand.\(^\text{113}\) Motive also may be demonstrated where the benefit of conspiracy is possible only if all the parties adhere to the agreement.\(^\text{114}\) All these factors are common within an oligopolistic market structure. Thus, the demonstration of these factors within an oligopolistic market arguably presents a motive to fix prices.

Once a motive to fix prices exists, evidence of collusion itself must be demonstrated. Collusion is strongly suggested if individual competitors act in apparent self-contradiction to their own economic or business interests.\(^\text{115}\) This factor may be demonstrated by an example. Competitor


\(^{110}\) This would include charts and tables similar to those reproduced supra relative to each defendant.


A allows Competitor B to successfully win a bid several times in a row despite A’s knowledge of B’s winning bids. A has allowed B to win at the expense of his own interest in winning the bid. If B has acted reciprocally by failing to bid competitively in other markets, an agreement of sorts between the two may be inferred. Competitors refuse to bid competitively because noncompetitive behavior results in higher prices for all bidders as long as each is content with its own market share. It may be observed from Table V that Firm 2 failed to lower its bid despite losing repeatedly on bids within that market. Other samples of this behavior also indicate that the parties acted reciprocally and therefore suggest a stronger inference of collusion.

Thus, the computer-generated evidence may be used to demonstrate both a motive to enter into an agreement and action apparently in contradiction of economic self-interest. In addition, the evidence demonstrates the existence of formula pricing among different sizes of the competitors’ products. It also shows that the competitors’ behavior changed sharply after the commencement of the suit. In summation, the evidence strongly suggests “that the conspirators had a unity of purpose or common design and understanding, or a meeting of minds in an unlawful arrangement...” “Whether this conspiracy was achieved by agreement or by acquiescence... coupled with assistance in effectuating its purpose is immaterial.”

E. A Prima Facie Case

Given a substantial unanimity of motive, contradiction of individual self-interest, adherence to a pricing formula, and a change in behavior subsequent to the initiation of an anti-trust suit, the inference of conspiracy is overwhelming. The expert’s interpretation and opinion based upon such facts add considerable force to the plaintiff’s case. In such a situation the plaintiff certainly has a submissible case and one which might be difficult for the defendants to rebut.

One commentator has suggested that economic evidence of industrial performance should be sufficient to establish a prima facie case; the


116. See Table 4 supra.
119. L. Sullivan, supra note 112, at 322.
effect would be to force the defendants to rebut the economic evidence by casting doubt upon its reliability or force them to explain their behavior in terms other than collusion. Such a shift in the burden of producing evidence is justifiable for both policy and evidentiary reasons. Price-fixing is a serious problem in the American economic system and techniques are needed to combat its practice. Computer technology has been proved to be reliable and, provided that the defendant has sufficient opportunity to question its reliability, the evidence generated from a computer should have substantial weight in the courtroom.

IV. Conclusion

This comment has attempted to introduce the reader to some evidentiary and proof problems involved in antitrust litigation where the charge is conspiracy and to how a novel type of evidence can be utilized to overcome certain problems. Computer-generated evidence can provide the "something more" than conscious parallelism that courts have required for a submissible price-fixing case. The computer allows a party who believes that he has been the victim of an illegal conspiracy to thoroughly analyze the behavior of alleged conspirators and discover the "visible traces" left behind.

The computer can be helpful in analyzing and demonstrating behavior in the market place. As illustrated earlier, it also may be used for graphic presentation of such behavior to a judge or a jury. It may serve to shorten a complex litigation by reducing a plethora of evidence to the most relevant and material facts.

Computer evidence is no panacea to the problems inherent in antitrust law, but it does present a new avenue for the enforcement of the law in particular factual situations. As the courts more widely accept its use in litigation, it may also come to have an in terrorem effect upon past and potential conspiracies.

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