

# Screening and Testing for Collusive Conduct in the Absence of a Smoking Gun



By Laila Haider and Graeme Hunter

## Antitrust Insights

### From the Editor

That competition and consumers are harmed by horizontal price fixing and bid rigging should come as no surprise. What might be astonishing to many is how difficult it can be to detect such conduct. Can analyses of market data on prices and sales alone be useful in testing and screening for collusive conduct?

In this issue of *Antitrust Insights*, Laila Haider and Graeme Hunter discuss the economic tests that have been proposed and used to detect price fixing and bid rigging. Although these tests can be useful, developing screens to detect such conduct is more challenging, particularly in the absence of information provided by an informant or an amnesty applicant. This is because a screen must be able to distinguish collusive conduct from competitive conduct and account for market conditions and costs that may explain the observed behavior. Laila and Graeme also note that while tests and screens may be useful in identifying collusion, data on prices and sales alone can almost never be used to sort tacit collusion from explicit agreements among competitors to restrain trade.

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I hope you enjoy this issue.

Lawrence Wu, Editor

### Introduction

The detection and dismantling of price-fixing, bid-rigging, and market allocation agreements among competitors is a key enforcement priority for the Antitrust Division of the Department of Justice (DOJ). To that end, the DOJ made significant revisions to its leniency program in 1993, aiming to uncover illegal agreements among competitors—a goal that the DOJ claims to have achieved.<sup>1</sup> Moreover, the sanctions for collusive activity have grown exponentially in recent years, as evidenced by higher corporate fines and longer jail sentences. As a result, the DOJ obtained over \$1 billion in criminal antitrust fines in fiscal year 2009 as compared to \$152 million in fiscal year 2000.<sup>2</sup>

It is not controversial that collusive schemes such as price fixing, bid rigging, or market allocation mechanisms are harmful to competition and consumers. Indeed, this is why these antitrust violations are deemed *per se* illegal in the United States. But as a matter of enforcement policy, can one detect *per se* illegal conduct or identify questionable conduct for further investigation absent the proverbial smoking gun provided by an informant or an amnesty applicant?



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The primary hurdle is that when explicit agreement-making among competitors is not known or easily observed, we must resort to searching for patterns or changes in economic variables such as prices and unit sales that are inconsistent with competitive conduct—an analysis that is likely to be complicated by a multitude of possible supply and demand factors. In the absence of a smoking gun, are there empirical economic screens or tests that may enable an enforcement agency to identify markets or firms that should be investigated for collusion? Moreover, can these screens and tests separate, with a reasonable degree of certainty, firms that are colluding from firms that are competing, but are able to set prices unilaterally above competitive levels (i.e., tacit collusion)?<sup>3</sup>

### **What are the Attributes of a Useful Screen or Test for Anticompetitive Conduct?**

A screen or test analyzes patterns in pricing and/or output or other economic variables for the purpose of determining whether the underlying conduct is anomalous or potentially inconsistent with competition. There are a number of economic tests that have been developed to detect the presence of price-fixing or bid-rigging activity. These tests, however, generally require information about the suspected conduct, the customers who may have been affected, and the time period(s) during which prices may have been above competitive levels. Detecting price-fixing and bid-rigging conduct when such information is not readily available is more challenging. A screen for such conduct can be developed based on existing tests for collusive activity, but as we discuss below, the search for useful and informative screens continues.

What are some of the characteristics that would render a screen or test useful and informative? First, the screen or test should be able to distinguish competitive from anticompetitive conduct and control for the effects of other actions and events in the marketplace that may have affected prices, sales, and total output. For example, an observed increase in market-wide prices could be due to an attempt to fix prices or to an increase in the price of a common input.

Second, the screen or test ought to minimize false positives and false negatives. Too many false positives would lead

to investigations or complaints when there was no such conduct. Too many false negatives would mean that many instances of anticompetitive conduct could go undetected and unchallenged.

Third, a screen or test must be based on information that is available and objective such as prices, costs, bids, or market shares. In general, email communications, telephone records, diary entries, and notes taken by business personnel may be informative, but because these types of information are typically observed or found after a criminal investigation or litigation is already underway, they are unlikely to be useful as a way to screen for collusive conduct. Moreover, in some circumstances, there may not be any email communications or documents that help to confirm or establish an explicit agreement among competitors to restrain trade.

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Economic screens or tests can be useful, but there are limits to what they can uncover. Depending on the available data, a screen may be able to flag likely collusion for further review, but not prove or establish that collusion actually occurred. Furthermore, it is unlikely that an analysis of market prices, sales, and output may be able to distinguish explicit collusion—one that resulted from an agreement among competitors—from tacit collusion, which reflects unilateral, non-collusive pricing. Thus, in the absence of evidence of an explicit agreement among competitors to restrain trade, a screen that is based on economic data will probably be of most use in identifying situations that require further study and not as standalone proof of illegal conduct.



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### Economic Approaches to Detecting Collusive Conduct

Economists have used a variety of screens or tests to detect collusive conduct.<sup>4</sup> Some tests rely on historical information about prices alone; others rely on detailed information about pricing, bidding behavior, costs, capacity utilization, and various firm and industry characteristics. We focus our discussion on a select set of screens or tests that economists have recently proposed to detect price-fixing and bid-rigging conduct.

#### Price Fixing

Price fixing refers to an agreement or conspiracy among competing firms to raise, fix, or maintain the price of the good or service they are selling.<sup>5</sup> There are a myriad of ways in which firms may conspire to fix prices, such as the adherence to price schedules, adherence to formulas for setting prices, the elimination or reduction of discounts, and agreements not to lower prices or to start a price war. Not surprisingly, the pricing patterns that could trigger a DOJ investigation include the following:<sup>6</sup>

- *Identical prices may indicate a price-fixing conspiracy, especially when:*
  - *Prices stay identical for long periods of time.*
  - *Prices previously were different.*
  - *Price increases do not appear to be supported by increased costs.*
- *Discounts are eliminated, especially in a market where discounts historically were given.*
- *Vendors are charging higher prices to local customers than distant customers. This may indicate local prices are fixed.*

The pricing patterns described above suggest one potential test for collusive behavior—a test that focuses on whether pricing in a market is particularly stable.

There are many ways to implement such a test, and one economic approach is to evaluate whether the variance in prices over time is or has been relatively stable. Under this approach, highly variable pricing over time would be inconsistent with collusive pricing, and stable pricing

over time would be consistent with collusive pricing. The economic foundation for a price variance test is that collusion will dampen price movements because competing firms are (a) coordinating prices and (b) less likely to react to changes in their costs of production for fear of disturbing the collusive arrangement.

Use of a variance test requires a determination of the variation in price that would be expected in a competitive market. This is because the analysis involves a test of whether the actual price variation observed in the industry at hand is significantly less than the expected variation. If the price variation in a particular period of time is significantly less than expected, then the screen would have identified a situation consistent with potential price-fixing behavior. Such a test is easier to implement when a clearly defined period of collusion is suspected in an industry. In such instances, it is possible to use the observed variation in prices during the competitive period as the competitive benchmark and to compare it to the level of price variation observed during the period of suspected collusion.

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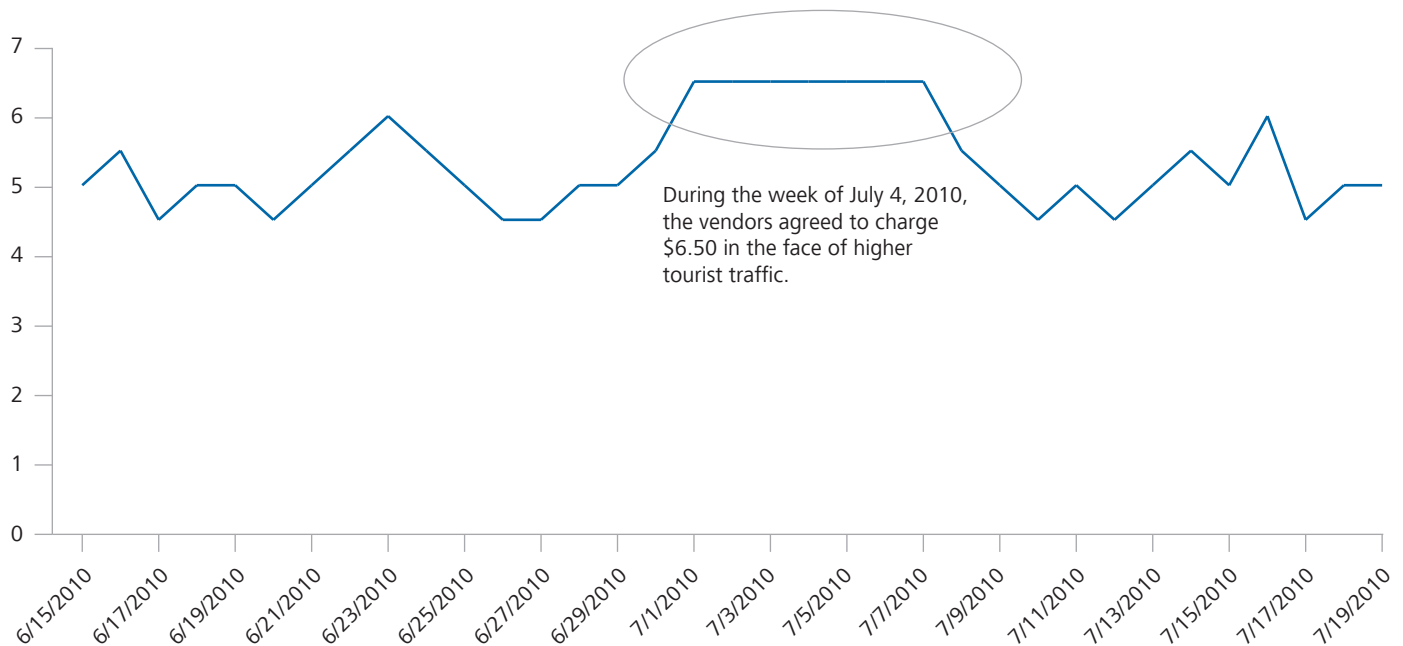
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We illustrate this point with a hypothetical example. Suppose we were to test for collusion in the sale of ice cream in Central Park in New York. The graph below shows the price of an ice cream cone in Central Park during June and July 2010. Prices are expected to fluctuate as competitors react to changes in underlying costs and as they act strategically with respect to one another.



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Figure 1: **Price of an Ice Cream Cone in Central Park**



The graph shows that the price of an ice cream cone fluctuated between \$4.50 and \$6.00 during the month of June and after the first week of July. The fluctuation can be attributed to factors such as changes in the cost of ice cream to the vendors. During the week of July 4, 2010, however, prices did not vary and held steady at \$6.50. A variance test would measure the price variance during this particular week (and find zero variance) and compare that to the price variance before and after the suspected period. Given that the suspected time period (i.e., the week of July 4, 2010) can be characterized as a pocket of relatively low price variance, the test indicates that the ice cream vendors in Central Park potentially engaged in price-fixing conduct.

### *Challenges in Developing a Price-Fixing Screen*

In our example, it is straightforward to apply the variance test because we had prior knowledge that there may have been price fixing in a particular market, and we had information about the time period in which the conduct likely took place. It is far more challenging to apply such a methodology and to develop a screen when we are not armed with suspicions or prior knowledge of price-fixing claims. In this example, given

the relatively long period of absolutely flat prices, it might be possible to spot additional instances of price fixing if given a longer series of pricing data.

The best setting for the price-fixing tests described above use competitive benchmarks such as specific points in time when competition was known to exist in the industry or specific comparable industries that are known to be competitive. However, a screen that can troll for collusion among all industries requires a systematic approach that does not rely on information about known or suspected periods of price fixing. As a result, coming up with an ex ante rule for the minimum required price variation (e.g., relative to average prices) will end up being somewhat ad hoc, and the analysis would ultimately amount to nothing more than spotting spikes in prices and outliers in the data. The problem with this approach is that infrequent outliers are to be expected in even randomly generated data, and some outliers simply result from errors in data collection, implying a high proportion of false positives. Thus, while a variance test has strong theoretical foundations, a screen based on such a test is difficult to develop.



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Other tests for price fixing may involve a comparison of average prices between an alleged collusive period and the corresponding period of non-collusive behavior, or a comparison of how prices move with costs (if cost data are available) over the two time periods. However, these tests also may not be useful for the purpose of screening for price fixing as they presume some prior knowledge of the market at issue and the time period during which prices may have been fixed.

Another way to test for collusive conduct is to survey prices across a variety of industries and identify cases where the observed prices are not explained by cost or demand shocks. As described by the DOJ, price changes that are not supported by changes in costs are consistent with collusive pricing.<sup>7</sup> It may be possible to develop screens based on changes in cost or demand, but the data requirements may be onerous.

In 1996, the Federal Trade Commission (FTC) attempted to use this approach to screen for anticompetitive pricing. The FTC's experience demonstrates the challenges associated with a blind analysis and the likelihood of generating false positives.<sup>8</sup> To carry out their test, the FTC searched for price increases, looking at the end of the most recent business cycle, under the assumption that other explanations for price increases were unlikely to be important (e.g., cost increases or capacity constraints were assumed to be unlikely at the end of a business cycle). The screen identified 600 possible industries that exhibited "odd" behavior. The FTC looked more closely at 25 of the 600 industries and found that only three required further investigation. They uncovered reasonable explanations for the observed price increases in 22 of the 25 industries. Of the three industries that required further investigation, one was already being investigated for collusive conduct, and inquiries into the other two industries were dropped. Thus, the screen produced a rather high proportion of false positives, and apparently did not identify any new price-fixing cases.

### **Bid Rigging**

Bid rigging refers to an agreement or conspiracy among competing firms to coordinate bids and effectively raise prices in an environment where customers acquire goods or services by soliciting bids.<sup>9</sup> As is the case with price fixing, conspiring firms may formulate diverse methods to coordinate bids

including the submission of "complementary" bids by some firms that are purposely higher than the bids of the selected winner, or agreements among competing firms to suppress bids of some potential bidders.

As described by the DOJ, the following unusual bidding patterns may raise suspicion about a bid-rigging conspiracy:<sup>10</sup>

- *The same company always wins a particular procurement. This may be more suspicious if one or more companies continually submit unsuccessful bids.*
- *The same suppliers submit bids and each company seems to take a turn being the successful bidder.*
- *Some bids are much higher than published price lists, previous bids by the same firms, or engineering cost estimates.*
- *Fewer than the normal number of competitors submits bids.*
- *A company appears to be bidding substantially higher on some bids than on other bids, with no apparent cost differences to account for the disparity.*
- *Bid prices drop whenever a new or infrequent bidder submits a bid.*
- *A successful bidder subcontracts work to competitors that submitted unsuccessful bids on the same project.*
- *A company withdraws its successful bid and subsequently is subcontracted work by the new winning contractor.*

Tests can be developed to detect any of the unusual bidding patterns highlighted above. An effort to uncover some of these anomalous bidding patterns would involve a review of the historical bidding behavior of the competing firms. For example, an economic investigation would likely involve an analysis of which firms submitted bids and which firms did not, what the level of each submitted bid was, and what the final outcome was (i.e., which firm won the bidding process and which firm ultimately supplied the good or service). For some of the other unusual bidding patterns described above, the analysis would require additional information on cost factors and underlying costs, and other firm and market-related characteristics that may influence bidding behavior. Given the detailed nature of this information, this type of analysis requires significant prior information about the location and timing of the conduct at issue.



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Some bid-rigging tests that have been developed and applied by economists and proposed for possible use as a screen in a variety of industries are based on the economic intuition that bids should appropriately reflect costs in competitive markets.<sup>11</sup> In markets where distance is an important determinant of costs, for example, one would expect that bids would be an increasing function of distance owing to transportation costs. If an investigation into bidding patterns reveals that such a relationship does not hold, the test would raise a red flag about the conduct at hand.

Consider the following example. Suppose two firms are located near Dallas and each submits bids for contracts in Dallas and Houston. An economic inquiry into the bidding behavior of the two firms reveals that the firms submitted higher bids for contracts in nearby Dallas relative to contracts in Houston, which is further away. The firms' respective bids in the two cities in a given week are shown in the table below.

Table 1: **A Hypothetical Example of the Bidding Behavior of Two Firms**

		Dallas	Houston
Bid 1	Firm A	\$115	\$95
	Firm B	\$120	\$90
Bid 2	Firm A	\$120	\$95
	Firm B	\$115	\$95
Bid 3	Firm A	\$118	\$90
	Firm B	\$116	\$95

Here, the bidding behavior of the firms does not appear economically sensible—the firms' bids are not an increasing function of distance (and transportation costs). Rather, they bid higher on closer projects (and alternate winning from one to the next). This evidence raises the suspicion that there may have been a collusive agreement between the two firms in Dallas—they could have raised prices (and shared higher profits) in Dallas, but not in Houston, where competition from

other suppliers kept prices at competitive levels. Of course, further investigation is warranted to determine whether there was, in fact, an agreement between the two firms.

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Similarly, another way to test for potential bid-rigging activity is to analyze how the competing firms' bids relate to engineering cost estimates. The engineering cost estimates may be produced by customers for the job at hand. The underlying principle here is that the bids submitted by a given firm ought to relate sensibly to engineering cost estimates. If holding all else equal, a firm submits a higher bid for a contract with a lower engineering cost estimate than for one with a higher cost estimate, the test would raise a red flag indicating a pattern of bids that is consistent with collusive activity. A similar test can be developed related to capacity utilization based on the idea that, holding all else equal, one would expect firms to bid more aggressively for jobs when they have idle capacity.

The particular tests described above do not necessarily require that some set of firms, or even a particular time period, serve as a competitive benchmark. This is because the economic test being applied is whether the bid prices are being driven by underlying cost factors. That said, it may be useful to develop a test that compares the bidding behavior of a competitive set of firms to the bidding behavior of firms that are suspected of colluding. The success of such a test obviously depends on the validity of the competitive benchmark that is being used.



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In addition, depending on the findings, it is likely that further investigation would still be required to determine whether there was, in fact, an explicit collusive agreement between the firms under investigation.

Another set of tests that has been developed to detect bid rigging relate to the independence of bids (or how related the bids are).<sup>12</sup> Two bids would be considered independent if information about one bid does not convey information about the other bid. The economic intuition is that bids submitted by competing firms ought to be independent once we have controlled for factors that are observable to the firms when they are submitting bids. These factors may include a variety of cost factors, and relevant firm and market characteristics that capture the supply and demand conditions. If a careful econometric analysis reveals that the bids of certain competing firms are correlated with one another even after controlling for these factors, then it is possible that the observed pricing is consistent with collusive conduct. This type of test has been used to distinguish firms that may be colluding from those that do not appear to be. However, like the other tests described above, it is likely that further scrutiny into the facts is required to determine whether there was, in fact, an explicit agreement between any of the firms suspected of bid rigging.

### *Challenges in Developing a Bid-Rigging Screen*

The tests described above presume considerable prior knowledge of the bid-rigging behavior at issue (e.g., the likely participants, the bids themselves, the bidders' underlying costs, and the time period during which bids may have been rigged). Thus, converting these tests into operable screens that are capable of identifying anticompetitive bid rigging without such information is challenging.

For public bids, data are available to systematically examine bidding situations, but this would require significant effort. Moreover, for each bidding situation, it would also be necessary to control for cost and demand factors that would have affected the bid, and it is unlikely that such data will be easy to collect and integrate systematically into an analysis.

### **Practical Issues in Developing and Applying Screens for Collusive Conduct**

There are significant practical issues in the development and application of screens aimed at detecting collusive conduct. First, to be useful and informative, the screen must accurately account for market conditions and costs. An inadequate understanding of the factors that affect pricing and supply decisions in a particular industry will result in the economist drawing potentially misleading conclusions. Consider the test developed for the example above where Firms A and B submitted bids for contracts in Dallas and Houston. Suppose that the raw material suppliers are located near Houston and the proximity of the job to Houston results in a significant decline in the costs associated with the contract. Not taking this particular cost factor into account, and focusing primarily on distance between the firms' location and the job, may lead to an inference of bid rigging when there was not any.

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Second, a screen should minimize false positives. Consider, for example, the screen imposed by the FTC. As noted above, the likelihood of identifying a false positive is very high in that particular test. This can result from the simple rules used to create a screen such as looking for outliers, a large proportion of which are likely to be data anomalies rather than illegal behavior.

Third, a screen is only as powerful as the economic theory underlying the test being applied. For example, the variance screen that has been proposed as a way of detecting price fixing assumes that prices are more stable under collusion. However, there are economic models that suggest the opposite—that prices may be more variable during the collusive phase. For example, it is possible that colluding



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firms may find a mechanism to more exactly pass through cost increases during a collusive phase than during a competitive phase. Also, economic models that incorporate the possibility that a cartel may have a punishment mechanism in place suggest that there could be very high variance of prices during the alleged cartel period. In both cases, the variance screen would fail to properly identify the collusive conduct. One example of a cartel that exhibited high variance during the collusive period was the citric acid cartel during the early 1990s.

Fourth, screens for anticompetitive conduct rely on the availability of data that can be used to develop an informative competitive benchmark. However, deriving a competitive benchmark typically requires prior information about the alleged price fixing or bid rigging and the timing of the alleged conduct.

Fifth, the screens described above may be useful in identifying tacit collusion, but without additional information, it is unlikely that they can be used to prove that there was an agreement among competitors to restrain trade.

### Conclusions

It might seem straightforward to detect collusive conduct such as price fixing and bid rigging through an empirical investigation designed to ascertain whether prices are, in fact, elevated or if there was, in fact, a reduction in output. As we discussed above, such an investigation is likely to be a complicated one, depending on the variety of supply and demand conditions typically present in an industry and the information that is known about the conduct at issue. Looking for elevated prices is the approach taken to determine liability and damages in litigations involving price fixing and other types of collusion, but due to the information needed to apply these tests, it is a much greater challenge to use these economic tools as a screen to identify collusive conduct in advance of an investigation or legal challenge.

Although the screens and tests that have been developed to detect price fixing and bid rigging are interesting and potentially useful, it is critical to also acknowledge and understand what these screens cannot do. The screens and tests described above cannot prove explicit collusion or an agreement among competitors to restrain trade. Nor can they distinguish between explicit collusion and tacit collusion. A screen can, however, flag potentially suspicious conduct. To determine whether there was, in fact, an agreement among competitors to restrain trade, further careful and in-depth investigation is typically warranted.

*The opinions expressed herein do not necessarily represent the views of NERA Economic Consulting or any other NERA consultant.*



## Notes

- 1 According to the DOJ, there has been a “nearly twenty-fold increase in the leniency application rate” after the revisions to the leniency program were made. Additionally, the DOJ states that since fiscal year 1996, \$5 billion has been collected from companies in fines for antitrust crimes, and over 90 percent of this figure is connected to investigations assisted by leniency applicants. (See Scott D. Hammond, “The Evolution of Criminal Antitrust Enforcement Over the Last Two Decades,” Antitrust Division, Department of Justice, February 2010, pp. 2-3.)
- 2 See Hammond, “The Evolution of Criminal Antitrust Enforcement Over the Last Two Decades,” at 6 (as cited in note 1).
- 3 Tacit collusion, or “conscious parallelism,” as it is sometime referred to, was found to be legal under *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 227 (1993). “[T]he practice, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supra-competitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions.”
- 4 For a survey of approaches to detecting collusion, see, for example, Joseph Harrington, “Detecting Cartels,” Working Paper, Johns Hopkins University, July 2005.
- 5 See US Department of Justice, Antitrust Division, “An Antitrust Primer for Federal Law Enforcement Personnel,” August 2003 (revised April 2005), at 5.
- 6 See US Department of Justice, Antitrust Division, “Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What To Look For,” (available at <http://www.justice.gov/atr/public/guidelines/211578.pdf>.)
- 7 See US Department of Justice, Antitrust Division, “Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What To Look For,” (as cited above in note 6).
- 8 See the comments of Jonathan Baker in “FTC History: Bureau of Economics Contributions to Law, Enforcement, Research, and Economic Knowledge and Policy, Roundtable with Former Directors of the Bureau of Economics,” 4 September 2003, pp. 110-112. (Available at <http://www.ftc.gov/be/workshops/directorsconference/docs/directorstableGOOD.pdf#page=1>.)
- 9 An Antitrust Primer for Federal Law Enforcement Personnel, U.S. Department of Justice, Antitrust Division, August 2003 (revised April 2005) at 8.
- 10 See US Department of Justice, Antitrust Division, “Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What To Look For,” (as cited above in note 6).
- 11 See, for example, Porter, Robert H. and J. Douglas Zona, “Ohio School Milk Markets: An Analysis of Bidding,” *The RAND Journal of Economics*, 1999, Vol. 30, pp. 263-88; and Bajari, Patrick and Lixin Ye, “Deciding Between Competition and Collusion,” *The Review of Economics and Statistics*, 2003, Vol. 85, pp. 971-89.
- 12 See, for example, Porter, Robert H. and J. Douglas Zona, “Detection of Bid Rigging in Procurement Auctions,” *Journal of Political Economy*, 1993, Vol. 101, pp. 518-38; and Bajari, Patrick and Lixin Ye, “Deciding Between Competition and Collusion,” *The Review of Economics and Statistics*, 2003, Vol. 85, pp. 971-89.

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