

Original



Great School Milk Conspiracies Revisited

FRANK A. SCOTT, JR.*

Department of Economics, University of Kentucky, Lexington, KY 40506-0034, U.S.A.

Abstract. This paper revisits a particular case involving two dairy processing companies accused of rigging bids in northern Kentucky school districts during the 1980s. Evidence and arguments presented to support a conclusion of overt collusion are reassessed. Analyses of incumbency rates, market shares, bid levels, bid dispersions, bid distance relationships, exact bidding differentials, and “bids from hell” indicate that the two dairies may have been engaged in tacit collusion instead of overt collusion.

Key words: Bid rigging, dairy industry, price fixing, sealed-bid auctions.

I. Introduction

An ongoing challenge to antitrust economists is distinguishing between tacit and overt collusion. In the absence of direct evidence, it is often very difficult to determine whether firms have fixed prices or otherwise rigged the market outcome.¹ This paper revisits a particular case that was described in detail by Lanzillotti (1996) in this *Review*. It involved two dairies in the Cincinnati, Ohio area that were charged with rigging bids on school district milk contracts in northern Kentucky and southwestern Ohio in the 1980s. According to Lanzillotti (pp. 430–431),

the northern Kentucky milk case provides an excellent test of the now-typical defense argument that a price-fixing conspiracy cannot be inferred from bidding patterns or other such circumstantial evidence. The special evidentiary value of the northern Kentucky milk case is that although the Trauth-Meyer bidding/pricing patterns at first blush might appear to satisfy the abstract Turner “tacit collusion” test, as set forth in *Monsanto-Matsushita*, the subsequent affidavits of conspirators Knasel, D. E. Meyer, and D. R. Meyer instruct us that apparently purely tacit behavior, in fact, had developed much firmer collusive underpinnings. In short, the bidding/pricing patterns

* The author benefited from discussions with Jack Donson, Mike Rickman, and Bob Stevenson.

¹ Funderburk (1974) provides an early discussion of this issue. Blair and Romano (1990) proposed an output and market share test for distinguishing participants from non-participants in a price-fixing conspiracy. See also the exchange between Karaaslan (1997) and Blair and Romano (1997). Porter and Zona (1993) conducted an ex post analysis to distinguish between participants and non-participants in a bid rigging scheme.

are entirely too complicated to be exonerated on a theory of oligopolistic interdependence.

He concluded that Trauth Dairy and Meyer Dairy consciously and collectively developed and implemented bid-rigging and market-division agreements. Since his analysis and conclusions are at odds with the decisions of juries in three separate trials, a further examination of the bidding behavior of Trauth Dairy and Meyer Dairy is appropriate.²

Lanzillotti analyzed market shares, incumbency rates, and bid levels and patterns in thirteen northern Kentucky school districts during the 1980s. Principals of Meyer Dairy testified that a bid-rigging conspiracy existed during this period. Since principals of Trauth Dairy denied that a conspiracy existed, we are confronted with a puzzle – did the two dairies overtly collude? Answering this question requires us to distinguish between tacit and overt collusion. There are several possible approaches. We might make use of firms other than those involved in the alleged conspiracy, regions other than those where the conspiracy was alleged to have occurred, or time periods other than those when the firms were allegedly colluding. This paper takes the third approach. Given the conflicting testimony, we cannot know for certain whether an overt conspiracy existed during the mid-1980s between Trauth and Meyer. We can compare their market behavior both before and after the alleged conspiracy period, however, to see whether Lanzillotti's proposed tests have any power to discern overt from tacit collusion.

II. The Market for School Milk in Northern Kentucky and Southwestern Ohio

Dairy products are supplied by firms that buy raw milk from farmers and manufacture milk, cheese, and ice cream products. Public schools and other institutional customers purchase dairy and other products from private vendors. Usually bids are solicited and contracts are awarded on an annual basis. Schools buy a range of products from dairies, however, the bulk of purchases are half-pint containers of whole white milk, lowfat white milk, whole chocolate milk, and lowfat chocolate milk. In addition to the types of products, bid solicitations usually specify delivery requirements and other attributes of service.

In a typical school district the food service director solicits bids during the summer preceding the start of a new school year in the fall. Dairy processors and food distributors who want to bid then fill out their bid sheets and deliver the sealed bids

² *United States of America v. Louis Trauth Dairy and David E. Trauth*, (Criminal Case No. CR 1-94-52 in the U.S. District Court, Southern District of Ohio, Western Division), *Commonwealth of Kentucky et al. v. Louis Trauth Dairy, Inc.*, (Civil Case No. 92-50 in the U.S. District Court, Eastern District of Kentucky, Covington Division), and *State of Ohio v. Louis Trauth Dairy, Inc., et al.* (Civil Case No. Ci-93-553 in the U.S. District Court, Southern District of Ohio, Western Division). Lanzillotti served as expert witness for plaintiffs and the author served as expert witness for the defendant in the northern Kentucky case.

theory of oligopolistic

iously and collectively
n agreements. Since his
juries in three separate
rauth Dairy and Meyer

and bid levels and pat-
g the 1980s. Principals
sted during this period.
xisted, we are confron-
nswering this question
ion. There are several
than those involved in
conspiracy was alleged
ie firms were allegedly
onflicting testimony, we
d during the mid-1980s
ehavior both before and
r Lanzillotti's proposed

and Southwestern

om farmers and manu-
s and other institutional
vendors. Usually bids
Schools buy a range of
half-pint containers of
k, and lowfat chocolate
usually specify delivery

its bids during the sum-
mary processors and food
l deliver the sealed bids

uth, (Criminal Case No. CR
1 Division), *Commonwealth*
in the U.S. District Court,
ouis *Trauth Dairy, Inc., et al.*
of Ohio, Western Division).
d as expert witness for the

at the specified time and place. Bids are usually then opened and read aloud on the spot, although sometimes bids are not opened and read aloud until the next school board meeting. The contract is normally awarded to the dairy with the lowest bid, although sometimes it goes to the dairy with the "lowest and best" bid.

In the geographic market area that it serves, Trauth Dairy bids at approximately one hundred school districts each year. The bidding season gets started in April and runs through the first few weeks in August. Trauth Dairy and Meyer Dairy bid against one another well over fifty times each bid season during the 1980s. Trauth and Meyer bid day after day, week after week, on essentially the same product line - whole white, whole chocolate, lowfat white, and lowfat chocolate half pints of milk. These two dairies have engaged in this head-to-head competition every year beginning back in the late 1970s. Since the early 1980s Trauth and Meyer have been the only two bidders in the large majority of school districts in northern Kentucky and southwestern Ohio.³ Each of these two dairies have bid against other dairies outside of the greater Cincinnati area as well, but far less often and never for such an extended period of years. The upshot is that the northern Kentucky-southwestern Ohio school milk market provides a laboratory-like setting for the study of duopolists playing a repeated prisoner's dilemma game.

III. Economic and Statistical Evidence Offered to Support Charges of Bid Rigging

Testimony by the principals of Meyer Dairy establish three distinct periods to use in analyzing the interaction between Meyer Dairy and Trauth Dairy. David E. Meyer was president of Meyer Dairy until 1983, and Ren Knasel was his sales manager. They claimed that they had openly colluded with Trauth Dairy during the late 1970s up until 1982, and that the arrangement had been somewhat informal, with occasional meetings and phone calls and a general agreement to stay away from one another's customers. Precipitated by Meyer Dairy's loss of a large government account and by an aggressive early bid by Trauth Dairy, 1983 turned into an all-out price war. David R. Meyer, who took over as president in 1983, claimed that the two dairies patched up their differences at a restaurant lunchtime meeting in 1984, and coordinated each bid by telephone that year. He testified that in each of the following years from 1985 to 1988, he and Ren Knasel followed the same procedure, setting up a lunchtime meeting at the beginning of the bid season and telephoning president David Trauth or sales manager Dan Smith at Trauth Dairy before each due date to coordinate their bids. Between the 1988 and 1989 bid seasons, Meyer Dairy won a major wholesale account from Trauth Dairy, precipitating another price war in the 1989 bid season. The northern Kentucky lawsuit was filed prior to the 1990 bid season, and the dairies were under close scrutiny. All parties agree that no overt collusion occurred after 1989.

³ Coors Dairy, a very small local Cincinnati processor, bid very sporadically on school accounts in the greater Cincinnati area during the 1980s but never won a bid in northern Kentucky.

This creates a natural experiment for evaluating the discriminatory power of Lanzillotti's approach to analyzing overtly collusive behavior. We are presented with three distinct periods, with two price war years in between. The period 1977 to 1982 was characterized by overt collusion, if David E. Meyer and Ren Knasel are to be believed. 1983 was a price war year. Bid rigging was back in effect between 1984 and 1988, if David R. Meyer and Ren Knasel are telling the truth.⁴ 1989 was another price war year. From 1990 until 1993 no overt collusion occurred, and any parallel behavior could only have arisen tacitly.

Lanzillotti (1996) analyzes data from the 1984–1988 period and the preceding and following price war years and concludes that overt collusion occurred between Trauth Dairy and Meyer Dairy. For Lanzillotti, the evidence for bid rigging in the northern Kentucky school districts consists of (a) market share stability; (b) markedly higher incumbency rates; (c) high correlation between low dispersion of bids and high bid levels; (d) significantly higher bid prices in core conspiracy areas than in adjacent competitive markets; (e) a clear tendency for bids to vary inversely with delivery distances; (f) distinctly different relationships between bid prices and other costs; (g) exact bidding differentials; and (h) "bids from hell". I now evaluate each of these arguments.

1. MARKET SHARE ANALYSIS

Lanzillotti (p. 432, Figure 3a) presents evidence of Trauth's and Meyer's market shares between 1983 and 1990, showing that during the alleged conspiracy period of 1984–88 the two dairies each had half of the market, but that both before and after market shares deviated from these levels. There are two problems with this argument. First, in examining market characteristics it is critical to correctly define both the product and the geographic scope of the market. The product, school milk, is clearly defined. The geographic scope of the market, however, is obviously much larger than the thirteen northern Kentucky school districts. Trauth Dairy and Meyer Dairy bid against one another in over fifty school districts each year during the 1984–88 period. Even the criminal indictment charged that the market area over which the two dairies conspired included school districts in southwestern Ohio as well as northern Kentucky. Therefore any economic analysis of market shares

⁴ It is natural to ask why David R. Meyer might claim to have conspired with Trauth Dairy if he did not actually do so. Prior to 1993 Meyer Dairy faced only the Kentucky civil lawsuit and fairly limited liability for damages. Up to that point Meyer denied fixing prices. In August 1993 the Ohio Attorney General filed a civil lawsuit against Trauth and Meyer, claiming damages of \$26 million. The threat of criminal charges against both dairies and their principals also loomed. By agreeing to admit to a bid rigging conspiracy Meyer avoided the sure expense of contesting all three lawsuits, plus the potential expenses of civil damages in the Kentucky and Ohio lawsuits. Perhaps even more importantly, in cooperating with the U.S. Department of Justice he avoided personal criminal liability. At the same time he placed his primary rival in a precarious position. David Trauth was put in real danger of a jail term and Trauth Dairy faced tens of millions of dollars in fines and damages.

discriminatory power of
 vior. We are presented
 ween. The period 1977
 yer and Ren Knasel are
 back in effect between
 ng the truth.⁴ 1989 was
 sion occurred, and any

riod and the preceding
 sion occurred between
 nce for bid rigging in
 ket share stability; (b)
 ween low dispersion of
 n core conspiracy areas
 r bids to vary inversely
 between bid prices and
 m hell". I now evaluate

t's and Meyer's market
 eged conspiracy period
 ut that both before and
 wo problems with this
 tical to correctly define
 ie product, school milk,
 ever, is obviously much
 Trauth Dairy and Meyer
 s each year during the
 at the market area over
 in southwestern Ohio
 nalysis of market shares

ired with Trauth Dairy if he
 ucky civil lawsuit and fairly
 ss. In August 1993 the Ohio
 ng damages of \$26 million.
 also loomed. By agreeing to
 ontesting all three lawsuits,
 lawsuits. Perhaps even more
 d personal criminal liability.
 David Trauth was put in real
 n fines and damages.

should not be restricted to just the thirteen school districts involved in the northern Kentucky case.

Even if we restrict the analysis of market shares to the thirteen northern Kentucky school districts, examining a longer time period illustrates the weakness of the test. Figure 1 presents market shares in northern Kentucky from 1978 to 1993. From 1978 until 1982, a period when David E. Meyer and Ren Knasel claimed a market sharing conspiracy existed, both Trauth's and Meyer's shares varied considerably. This contrasts with 1984 to 1988, the second alleged conspiracy period, when market shares were fairly stable. The price war years of 1983 and 1989 both resulted in big changes in market shares.⁵

2. INCUMBENCY ANALYSIS

It was alleged that Trauth and Meyer developed a protocol of protecting one another's incumbencies. In other words, if one dairy were serving a particular school district, then the other dairy would submit a higher bid than the incumbent when the contract came up for bid again. High incumbency rates are thus presented as evidence of overt collusion. Lanzillotti (p. 432, Figure 3b) finds a suspicious pattern in the northern Kentucky market where one firm serves a particular customer for an extended period of time. From the high incumbency rates in thirteen school districts between 1984 and 1988 he infers illegal behavior.

The problem, however, is that analyzing incumbency rates does not permit one to discriminate between legal tacit collusion and illegal overt collusion. To see why, we examine incumbency rates in the thirteen plaintiff school districts in northern Kentucky for a longer period of time. From school records available in the case it is possible to determine which dairy served each school district from 1978 until 1993. Table 1 presents these data. The next-to-the-last row of the table indicates the proportion of school districts that switched suppliers from the previous year. The time line indicates the two alleged conspiracy periods, the two price war years, and the non-conspiracy period.

It is instructive to compare the first alleged conspiracy period, 1978-1982, with the second alleged conspiracy period, 1984-1988. As Lanzillotti points out, very little turnover occurred in the thirteen plaintiff school districts between 1984 and 1988. If the principals of Meyer Dairy were telling the truth about when they were conspiring with Trauth Dairy, and if high incumbency rates go along with overt collusion, then we would expect to see very little turnover between 1978 and 1982. That is not the case. Instead we see turnover rates that are of the same magnitude as and that are not significantly different from those in the years when price wars were occurring. It is also instructive to compare the second alleged conspiracy period

⁵ Stable market shares in and of themselves do not permit one to discriminate between overt and tacit collusion. Schmalensee (1989, p. 999) argues that unstable market shares and ranks are inconsistent with effective collusion. If there are side payments, however, then Pesendorfer (1996) argues that under some circumstances market shares can be unstable.

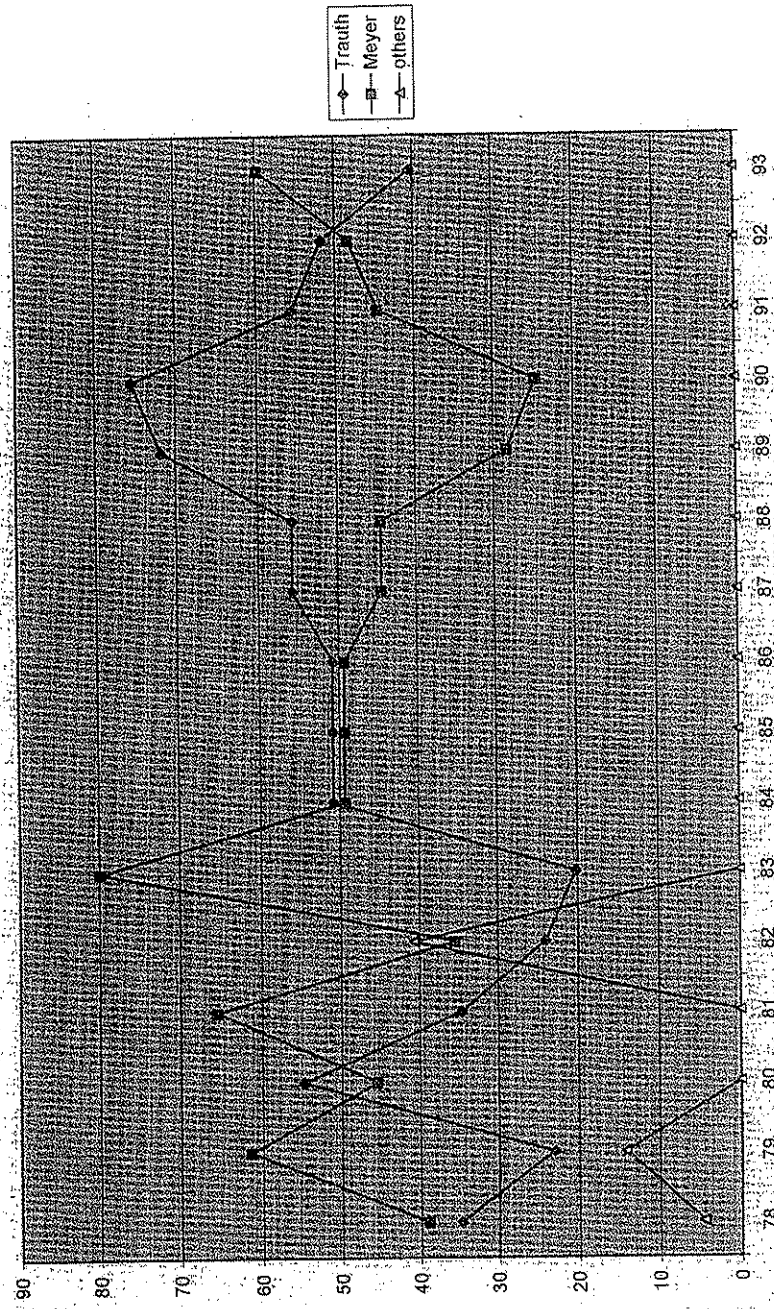


Figure 1. Market shares in Northern Kentucky, 1978-1993.

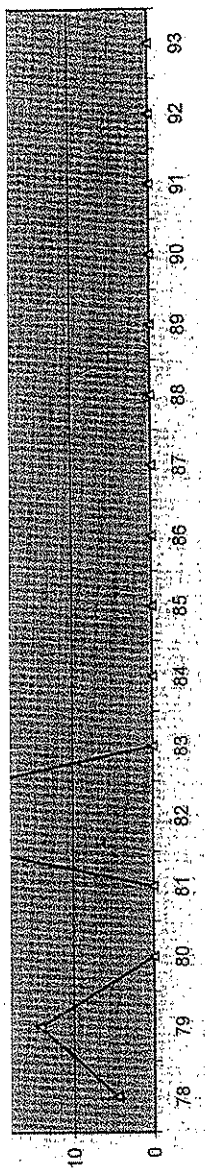


Figure 1. Market shares in Northern Kentucky, 1978-1993.

Table 1. Incumbency rates in Northern Kentucky, 1978-1993

District	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Beechwood	?	?	M	T	M	T	T	T	T	T	T	M	M	M	M	M
Bellevue	T	T	T	M	M	T	T	T	T	T	T	M	M	M	M	M
Boone Co	?	M	T	M	RC	M	M	M	M	M	M	T	T	T	M	M
Campbell Co	M	M	M	T	T	M	T	T	T	T	T*	T	T	T	T	T
Covington	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Dayton	M	M	M	M	M	M	M	M	M	M	T	T	T*	T	T	T
Erl./Elsmere	M	M	M	M	M	M	M	M	M	M	M	M	M	T	M	M
Fort Thomas	CL	M	M	M	M	T	T	T	T	T	T	T	T	T	T	T
Kenton Co	T	T	T	T	RC	M	T	T	T	T	T	T	T	T	T	T
Ludlow	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Newport	T	FB	T*	M	T	T	T	T	T	T	T	T	T	T	T	M
Silver Grove	?	CL	M	T	T	M	M	M	M	M	M	M	M	M	M	T
Wal./Verona	FB	FB	M	T	T	T	T	T	T	T	T	T	T	T	T	T
Turnover	0.20	0.33	0.54	0.54	0.31	0.54	0.15	0	0	0.08	0	0.23	0.08	0.08	0.08	0.15
	Alleged Conspiracy		Alleged Conspiracy		PW	Alleged Conspiracy	Alleged Conspiracy	PW	Alleged Conspiracy	Alleged Conspiracy	PW	PW	Non-Conspiratorial	Non-Conspiratorial	Non-Conspiratorial	Non-Conspiratorial

M denotes that the school district was served by Meyer Dairy, T denotes Trauth Dairy, CL denotes Cloverleaf Dairy, FB denotes French Bauer Dairy, and RC denotes Royal Crest Dairy. Both Cloverleaf and French Bauer were acquired by Meyer Dairy in the late 1970s. Royal Crest, a Dayton, Ohio dairy, went bankrupt in 1983. The asterisks indicate that the dairy served the contract for less than the entire year. The last row of the table indicates those years that were allegedly conspiratorial, admittedly non-conspiratorial, or had a price war (PW) going on. The question marks indicate that the supplier could not be determined from available records.

with the admittedly non-conspiratorial period from 1990 to 1993. By similar logic to that above, if incumbency analysis is useful for discriminating between illegal overt collusion and legal tacit collusion, then we would expect to see high rates of turnover in the non-conspiratorial period. Comparing 1984-1988 with 1990-1993, we see that very little turnover occurred in either period. There is no statistically significant difference in the incumbency rates between the two periods. Incumbency analysis does not permit one to identify overt collusion nor does it permit one to discriminate between overt and tacit collusion.

3. BID LEVELS

Evidence was presented in the northern Kentucky case that the level of bids in the plaintiff school districts during the alleged conspiracy period of 1984-1988 exceeded the level in surrounding markets as well as the level in 1983 and 1989 in the same school districts. From this Lanzillotti (p. 431, Figure 3c) infers illegal overt collusion. To determine the discriminatory power of a simple analysis of bid levels it is again instructive to examine and compare alleged conspiracy periods with price war and admittedly non-conspiratorial periods. This comparison is contained in Table II.

The average winning bid price for low-fat white milk in the thirteen northern Kentucky school districts during the 1984-1988 period was \$0.1394 per half pint. This clearly exceeds the preceding and following years, 1983 and 1989, when the two dairies engaged in price wars and average winning bids were \$0.1098 and \$0.1240, respectively. That comparing price-war years and non-price-war years does not permit one to infer illegal overt collusion, however, is demonstrated when one examines the average winning bid during 1990-1993. The average winning bid during that period was \$0.1453 per half pint, even higher than when the two dairies were alleged to be rigging bids.⁶ Not only were average bid levels higher during the 1990-1993 period, but perhaps more critically, so were profits. David R. Meyer testified under oath that Meyer Dairy's profits from school milk business during 1990-1993 were between 10 and 15 percent, while during the 1984-1988 period profits from school milk business were between 5 and 10 percent.

It is also instructive to examine average winning bid levels in the earlier allegedly conspiratorial period. Bid data are less complete during the early 1980s, but enough data are available from 1981 and 1982 to see the general trend. Principals of Meyer Dairy claimed that they overtly colluded with Trauth Dairy in 1981 and 1982. That claim is not evident from the average winning bids from those two years, however. 1981 resembles a price war year, and is not significantly different from either 1983 or 1989. Average bids in 1982 are similar to the allegedly conspiratorial period of 1984-1988 and are slightly lower than the admittedly non-conspiratorial period of 1990-1993. Tests of statistical significance confirm

⁶ The differences in average bid levels between price-war years and non-price-war years are statistically significant at the one percent level.

Table II. conspirac

District
Beechw
Bellevu
Boone (
Campbe
Covingt
Dayton
Erl./Els
Fort Th
Kenton
Ludlow
Newpor
Silver C
Wal./Ve
Average

The last i
conspirat
not be de
average t
non-cons

that obs
distingu

4. BID
Another
that Tra
milk co

⁷ Othe
tion costs
area eithe
forward ?
the bigge
which rel
milk price
prices an
years are
margins i

1993. By similar logic relating between illegal periods to see high rates of -1988 with 1990-1993. There is no statistically significant difference between the two periods. Incumbent firms in 1988 nor does it permit

that the level of bids in the period of 1984-1988 exceeded in 1983 and 1989 in the period 1984-1988. This inference (3c) infers illegal overt collusion. The analysis of bid levels during the alleged conspiracy periods with the comparison is contained

in the thirteen northern districts is \$0.1394 per half pint. In 1983 and 1989, when the average bids were \$0.1098 and \$0.1240, and non-price-war years, it is demonstrated when the average bid is higher. The average winning bid is higher than when the two average bid levels higher than so were profits. David Smith's school milk business during the 1984-1988 period increased by 10 percent.

Bid levels in the earlier period, during the early 1980s, but in general trend. Principals at Trauth Dairy in 1981 and 1989 bid from those two periods are not significantly different. Bid levels are similar to the allegedly illegal period. The analysis of bid levels during the alleged conspiracy periods with the comparison is contained

and non-price-war years are

Table II. Average winning bid prices (dollars per half-pint) for low-fat white milk during alleged conspiracy periods and admittedly non-conspiratorial periods in Northern Kentucky school districts

District	1981	1982	1983	1984-1988	1989	1990-1993
Beechwood	\$0.116	\$0.1515	\$0.1064	\$0.1479	\$0.1275	\$0.1434
Bellevue	0.1255	0.1397	0.1113	0.1394	0.13	0.1456
Boone Co	?	0.1285	0.1074	0.1383	0.118	0.1383
Campbell Co	0.142	0.1545	0.126	0.1451	0.1288	0.1573
Covington	0.127	0.1405	0.1094	0.1375	0.122	0.1447
Dayton	?	?	0.107	0.1329	0.1134	0.1392
Erl./Elsmere	0.10	0.11	0.0987	0.1376	0.1175	0.154
Fort Thomas	0.115	0.1397	0.101	0.1372	0.1175	0.1444
Kenton Co	0.1214	0.1185	0.1026	0.1357	0.1185	0.1464
Ludlow	?	0.14	0.1095	0.1492	0.122	0.1451
Newport	0.111	0.1395	0.1215	0.1323	0.13	0.1401
Silver Grove	?	?	?	0.1413	0.122	0.1444
Wal./Verona	0.1144	0.141	0.1165	0.1380	0.145	0.1466
Average	0.1191	0.1367	0.1098	0.1394	0.1240	0.1453
	Alleged conspiracy	Alleged conspiracy	Price war	Alleged conspiracy	Price war	Non-Conspiratorial

The last row of the table indicates those years that were allegedly conspiratorial, admittedly non-conspiratorial, or had a price war going on. The question marks indicate that the bid price could not be determined from available records. Average bids during price wars are significantly less than average bids during either the 1984-1988 alleged conspiracy period or the 1990-1993 admittedly non-conspiratorial period at the one-percent level.

that observation. Again, an analysis of bid levels does not seem to permit one to distinguish between overt and tacit collusion.⁷

4. BID DISPERSION

Another argument offered by Lanzillotti (pp. 431-435, Figures 4a-f) as evidence that Trauth Dairy and Meyer Dairy illegally conspired to fix prices for school milk contracts is a high correlation between low dispersion of bids and high bid

⁷ Other factors, such as changes in the competitive structure of the market or changes in production costs, might cause bid levels to differ over time. Several dairy processors in the greater Cincinnati area either went out of business or were acquired by Meyer Dairy in the late 1970s, so that from 1982 forward Trauth Dairy and Meyer Dairy faced only each other in most school districts. Raw milk is the biggest cost component for dairy processors like Trauth and Meyer and is the one cost factor for which reliable data are available. It comprises roughly half of the selling price. When data on raw milk prices from the late 1970s to the early 1990s are collected and differences between winning bid prices and raw milk costs are calculated, the results do not change. The margins during price war years are significantly lower than during either the 1984-1988 period or the 1990-1993 period. The margins in 1990-1993 exceed those of 1984-1988.

price levels. There is no theoretical reason to expect either a positive or negative relationship between bid level and bid dispersion. Successful collusion, overt or tacit, will by definition result in higher bid prices than if firms are unsuccessful at achieving any sort of cooperation, either overt or tacit. The dispersion of bids, however, will depend on the nature of the collusion. If firms collude overtly but communicate only infrequently, then we would expect widely dispersed bids. To see why, suppose two dairies communicated at the beginning of each bid season and agreed to live and let live, i.e., not to aggressively pursue one another's customers. In order to make the conspiracy work, each dairy would have to be careful not to bid too low when bidding on a school district served by the other dairy. Without knowing what the incumbent was going to bid, the non-incumbent would have to leave enough of a cushion so that the incumbent was sure to win the bid. On the other hand, if firms collude overtly and communicate frequently, then we might expect a narrower dispersion of bids. If, for example, two dairies such as Trauth and Meyer communicated prior to each bid, then the non-incumbent dairy would know what the incumbent dairy was going to bid. It could then go just above to give the appearance of close and competitive bidding, without unintentionally taking away any of its co-conspirator's customers. The nature of the conspiracy determines what sort of bid dispersion pattern we would expect.⁸

The dispersion of bids in the northern Kentucky school districts can be determined from evidence presented in the case. The difference between Trauth Dairy's and Meyer Dairy's bids for lowfat white half pints was calculated in each district where data are available between the years of 1983 and 1993. Table III presents summary statistics for each year's bid differences. The years 1984, 1985, and 1991 stand out. Bid differences in 1984 and 1985 are significantly smaller than bid differences in any of the other years. Bid differences in 1991 are significantly larger than bid differences in any of the other years. No statistically significant pairwise differences exist between any of the other years in the sample. The dispersions of bids in the alleged conspiracy years of 1986-1988 do not differ from the dispersions of bids during price war years or admittedly non-conspiratorial years (other than 1991).⁹

Bid dispersions played a role in bringing out a key piece of evidence in the northern Kentucky case. In explaining the closeness of the bidding, David R. Meyer and Ren Knasel of Meyer Dairy claimed to have called Trauth Dairy, identified

⁸ Early in the northern Kentucky case, plaintiffs alleged that the conspiracy involved only a loose agreement with infrequent communication. During a deposition in July 1993, the author pointed out that the observed dispersion of bids in the northern Kentucky market was inconsistent with that sort of conspiracy. David R. Meyer was present at that deposition. When he recanted his earlier denials of conspiracy in August 1993, the type of conspiracy that he described involved frequent communication with Trauth Dairy and was thereby consistent with the observed dispersion of bids.

⁹ Lanzillotti (p. 430) asserted that an inverse relationship between bid levels and bid dispersions supports an inference of the existence of a bid-rigging protocol. Contrary to that assertion, bid dispersions in northern Kentucky between 1984 and 1988 were growing at the same time that the average bid level was rising.

a positive or negative collusion, overt or firms are unsuccessful he dispersion of bids, as collude overtly but slyly dispersed bids. To the end of each bid season, firms would have to be careful not to be outbid by the other dairy. A non-incumbent would have to be sure to win the bid. On the other hand, frequently, then we might see firms such as Trauth and Meyer Dairy would know just above to give the bid nationally taking away the conspiracy determines what

districts can be determined between Trauth Dairy's bids submitted in each district in 1983. Table III presents data for 1984, 1985, and 1991. The bid differences are smaller than bid differences in significantly larger years. The dispersions of bids differ from the dispersal in conspiratorial years (other

types of evidence in the bid, David R. Meyer at Trauth Dairy, identified

the conspiracy involved only a loose bid in 1993, the author pointed out that it was inconsistent with that which he recanted his earlier analysis which described involved frequent bid dispersion of bids. The bid levels and bid dispersions are contrary to that assertion, bid at the same time that the

Table III. Summary statistics of differences between Trauth Dairy's and Meyer Dairy's bids for half pints of lowfat white milk in Northern Kentucky school districts

Variable	N	Mean	Std. dev.	Min.	Max.	
1983 bid difference	9	\$0.0053	0.006	0	0.018	Price war
1984 bid difference	12	0.0023	0.002	0.0005	0.008	Alleged
1985 bid difference	11	0.0022	0.001	0.0006	0.0057	conspiracy
1986 bid difference	13	0.0038	0.002	0.001	0.0061	period
1987 bid difference	13	0.0059	0.004	0.0015	0.0125	
1988 bid difference	11	0.0066	0.003	0.0025	0.013	
1989 bid difference	12	0.0050	0.004	0	0.0134	Price war
1990 bid difference	12	0.0070	0.007	0	0.0134	Admittedly
1991 bid difference	12	0.0092	0.006	0.0019	0.019	non-
1992 bid difference	12	0.0044	0.003	0.0015	0.0125	conspiratorial
1993 bid difference	8	0.0056	0.003	0.0015	0.0115	

The far right column of the table indicates those years that were allegedly conspiratorial, admittedly non-conspiratorial, or had a price war going on.

themselves, and talked on the phone with David Trauth and Dan Smith of Trauth Dairy up to 150 times each bid season. They thereby corroborated the hypothesis that tight bidding and frequent communication go together. Their direct testimony and Lanzillotti's analysis of the circumstantial evidence thus were consistent. A problem arose, however, when the defense presented evidence that Trauth Dairy was only served by one telephone line during the entire alleged conspiracy period. Any incoming calls had to go through the company switchboard, and the telephone receptionists who worked the switchboard one after another denied under oath that any telephone calls had been made to anyone at Trauth Dairy by either Ren Knasel or David R. Meyer during the 1984–1988 period.

5. BID DISTANCE ANALYSIS

Transportation costs are a real economic cost of supplying a product. Other things the same, it is costlier to supply a customer 80 miles from the plant than a customer 8 miles away. In a perfectly competitive market higher costs will be reflected in higher prices paid by customers located farther from the processing plant. Using that logic, Lanzillotti (pp. 430–431, Figure 3c) argues that bid levels which vary inversely with distance from the plant constitute evidence of an illegal conspiracy, because such a relationship would not exist in a perfectly competitive market. A related but more complicated argument is offered by Porter and Zona (1999). They find that Trauth Dairy and Meyer Dairy were very likely to bid at southwestern Ohio school districts near their plants, and that the levels of the bids tended to be high. From this they conclude that Trauth and Meyer behaved collusively, however, they do not specify whether they think the collusion was tacit or overt.

It is not compelling to compare surrounding market areas with school districts close to Trauth Dairy and Meyer Dairy. As they both attempted to expand their school business in the mid 1980s and bid in school districts farther away from Cincinnati they encountered other dairies. In Jefferson County and in Fayette County, Trauth Dairy bid noticeably lower than it bid in northern Kentucky. These school districts are the two largest in the state of Kentucky. Both are approximately 80 to 90 miles from Trauth's and Meyer's plants. But Jefferson County typically attracted four or five bidders and Fayette County often attracted six or seven bidders. As Meyer Dairy expanded into the Dayton, Ohio area approximately 50 miles to the north, it had to bid aggressively to make inroads. Both Trauth and Meyer attempted to win the Columbus, Ohio contract roughly 100 miles away. In all of these outlying school districts, the dairies submitting bids encountered one another very infrequently in any given bid season. That bid levels were lower in these school districts than in northern Kentucky is not surprising. This, however, does not allow one to discern whether the two dairies' behavior in northern Kentucky was tacitly or overtly collusive.

6. EXACT BIDDING DIFFERENTIALS

Another factor that, according to Lanzillotti (p. 430), indicates illegal overt collusion is the existence of exact bidding differentials between different types of milk products. Not to be confused with identical bids, exact bidding differentials occur when two dairies submit bids such that the difference in price between different categories of milk products is the same for both dairies. For example, in the Fort Thomas school district in 1989, Trauth Dairy bid \$0.1175 per half pint for lowfat white milk and \$0.1225 for lowfat chocolate milk, a one-half cent difference. Meyer Dairy bid \$0.1195 for lowfat white and \$0.1245 for lowfat chocolate, also a one-half cent difference. From the late 1970s until the early 1990s, the difference between lowfat and whole milk was frequently one cent for both Trauth and Meyer. The difference between white and chocolate milk was frequently one-half cent, so bids for half pints of whole chocolate milk were one and one-half cents higher than bids for half pints of lowfat white milk.

The relevant question is whether such exact differentials only arise under illegal overt collusion, or whether they can arise as a result of innocent and legal oligopoly behavior. The differentials that existed in the northern Kentucky school districts fairly closely reflected differences in the costs of producing lowfat vs. whole milk and flavored vs. unflavored milk. These exact differences first arose in the Bellevue and Newport school districts in 1977, 1978, and 1979. There were several other bidders in those auctions besides Trauth and Meyer who were never accused of bid rigging. All of the dairies adopted the same differentials. These particular differences, one cent for butterfat content and one-half cent for flavoring, appear to have

is with school districts attempted to expand their market farther away from Cincinnati and in Fayette County, Kentucky. These school districts are approximately 80 to 100 miles typically attracted by one or seven bidders. As a result, approximately 50 miles to the north and Meyer attempted to move away. In all of these districts, one district was lower in these school districts, however, does not allow that Kentucky was tacitly

illustrates illegal overt collusion. Different types of milk pricing differentials occur. For example, in the Fort Worth market, the price per half pint for lowfat milk is one-half cent difference. In the Cleveland market, lowfat chocolate, also a price differential. In the 1990s, the difference between Trauth and Meyer was only one-half cent, so Trauth's bid was one-half cent higher than

only arise under illegal collusion and legal oligopoly in Kentucky school districts. The difference between lowfat vs. whole milk contracts arose in the Bellevue market. There were several other markets that were never accused of bid rigging. These particular differentials, appearing to have

developed as some sort of focal point.¹⁰ They continued to be used later into the 1980s, both in price war years and in allegedly conspiracy years.

7. "BIDS FROM HELL"

A final argument offered by Lanzillotti (pp. 430–435) as proof that Trauth Dairy and Meyer Dairy conspired to rig bids in northern Kentucky school districts is the presence of bids from hell. Bids from hell apparently are bids that seemingly appear out of nowhere, with no rational economic explanation other than that two dairies are openly conspiring. A surface analysis of bidding in the thirteen plaintiff school districts might cause the casual observer to wonder why one particular bid is higher than another, or why the bidding follows a particular pattern. With a bit of economic forensic detective work, however, it becomes apparent that each of the bids Lanzillotti found to be suspicious has a rational explanation.

Lanzillotti singled out four bids in the 1984 bidding season as bids from hell, Campbell County, Kenton County, Boone County, and Ludlow. Contrary to indicating suspicious behavior, an analysis of these four bids in the context of the bidding competition of 1984 provides an excellent case study of how tacit collusion can arise. In the 1983 bidding season the two dairies had engaged in an extremely fierce price war, with prices dropping on average from \$0.1367 in 1982 to \$0.1098 in 1993 for half pints of lowfat white milk in the thirteen northern Kentucky school districts. Both David Trauth and David R. Meyer testified that they suffered significant economic losses from their school milk business in 1983. They each ended the 1983 season with very passive bids in districts where the other dairy was the incumbent supplier, each one in effect extending an olive branch.

The 1984 season then started out with very tentative bids from each dairy. Table IV contains a summary of the first eleven bids for lowfat white and lowfat chocolate half pints in the six Kentucky and Ohio counties of the greater Cincinnati market area.¹¹ The first bid was Clermont County, Ohio, where in 1983 Trauth had started the price war by bidding very aggressively to win a large contract away from Meyer. Trauth's opening bid in 1984 was fairly nonaggressive, and it followed that up in Norwood, Ohio with a very similar bid. In the first Kentucky district, Newport, where Trauth was the incumbent supplier, Meyer mimicked Trauth's nonaggressive bids. Trauth cautiously kept its bid under the level bid by Meyer in winning the two Ohio contracts. In Sycamore, Ohio, a district served by Trauth in 1983, Meyer bid the same as it had in 1983, and Trauth bid just below that level to win the contract.

¹⁰ Scherer and Ross (1990, pp. 265–268) discuss focal points and give examples of how they arise in oligopoly markets, especially in sealed bid auctions.

¹¹ Bids also were usually submitted for whole half pints, whole chocolate half pints, and other items, but for most school districts lowfat white and lowfat chocolate were typically the biggest part of the contract.

Table IV. Analysis of Trauth Dairy's and Meyer Dairy's bids in the 1984 bidding season

Date	District	Lowfat white		Lowfat chocolate		Comments
		Trauth	Meyer	Trauth	Meyer	
4/9	Clermont Co. OH	\$0.13	\$0.1245	\$0.14	\$0.1315	Meyer is the incumbent. Trauth opens with a nonaggressive bid.
6/4	Norwood OH	0.1295	0.1245	0.1365	0.1315	Meyer is the incumbent. Meyer does not change from its Clermont Co. bid level.
6/20	Newport KY	0.1225	0.1305	NB	NB	Trauth is the incumbent. Trauth bids below Meyer's first two bids for lowfat white half pints.
6/27	Sycamore OH	0.111	0.124	0.121	0.13	Trauth is the incumbent. Trauth bids just below the level of Meyer's 1983 bids in this district.
7/2	Lockland OH	0.133	0.135	0.139	0.14	Trauth is the incumbent. Meyer bids the same as in 1983, but Trauth keeps it below that level.
7/5	Great Oaks OH	0.126	0.1235	0.132	0.1305	Meyer is the incumbent. The lowfat chocolate is 1% butterfat, not the usual 2%. Trauth's bid is very similar to Meyer's 6/27 Sycamore OH bid.
7/11	Madeira	0.133	?	0.139	?	Meyer is the incumbent. Meyer wins this bid, but bid records are incomplete.
7/16	Campbell Co. KY	0.1395	0.141	NB	NB	Meyer is the incumbent. Specifications call for a blended bid, and whole chocolate is 77% of the volume.
7/17	Kenton Co. KY	0.1289	0.1302	0.1289	0.1302	Meyer is the incumbent. Specifications call for a blended bid, and lowfat chocolate is 84% of the volume.
7/27	St. Bernard-Elmwood Elmwood OH	0.114	0.135	0.121	0.14	Trauth is the incumbent. Trauth's bids are very low, as if it expected retaliation from Meyer after the raid on Campbell and Kenton Counties.
7/27	Boone Co. KY	0.1395	0.139	0.1395	0.139	Meyer is the incumbent. Specifications call for a blended bid, and whole chocolate is 66% of the volume.
There were nine intervening bids in the six-county greater Cincinnati market area prior to the Ludlow, KY bid on August 10.						
8/10	Ludlow KY	0.1475	0.1462	NB	NB	Meyer is the incumbent. Specifications call for a blended bid, and whole chocolate is 85% of the volume.

Bid prices are in dollars per half pint. NB indicates that the item was not bid, because the school district does not use the item. The question marks indicate that bid records are incomplete. Bold rows indicate "bids from hell".

4 bidding season

nts

s the incumbent. Trauth opens
on aggressive bid.

s the incumbent. Meyer does
nge from its Clermont Co.

l.
is the incumbent. Trauth bids
Meyer's first two bids for
white half pints.

is the incumbent. Trauth bids
ow the level of Meyer's 1983
this district.

is the incumbent. Meyer bids
e as in 1983, but Trauth keeps
that level.

is the incumbent. The lowfat
ite is 1% butterfat, not the usual
uth's bid is very similar to
6/27 Sycamore OH bid.

is the incumbent. Meyer wins
, but bid records are
lete.

**is the incumbent. Specifications
a blended bid, and whole
ite is 77% of the volume.**

**is the incumbent. Specifications
a blended bid, and lowfat
ite is 84% of the volume.**

is the incumbent. Trauth's bids
low, as if it expected
on from Meyer after the raid
upbell and Kenton Counties.

**is the incumbent. Specifications
a blended bid, and whole
ite is 66% of the volume.**

sa prior to the Ludlow,

**is the incumbent. Specifications
a blended bid, and whole
ite is 85% of the volume.**

bid, because the school district
ncomplete. Bold rows indicate

After three more Ohio bids, we come to the first bid from hell. Trauth Dairy had served Campbell County in 1981 and 1982, but lost this fairly sizable contract to Meyer in the 1983 price war. Trauth bid \$0.1395 for lowfat white half pints, and Meyer bid \$0.141. Both bids appear to be out of line with other lowfat white bids submitted to that point. Where did such a high bid come from, if not conspiracy? And was Meyer behaving as a charitable conspirator, letting Trauth regain some market share? For an answer to the first question, one must examine the Campbell County bid specifications. Campbell County required bidders to submit a blended bid, meaning that one common price was required for all categories of milk. The dairies had to examine usage levels of each type of milk, and then calculate a weighted average price for all four categories. Whole chocolate half pints comprised approximately seventy-seven percent of the Campbell County contract, so the levels of both Trauth's and Meyer's bids are not out of line with previous bids for lowfat white, but instead reflect the preponderance of more costly whole chocolate in the weighted average. For an answer to the second question, we try to reconstruct how both Meyer and Trauth might have come up with their bids. If one takes the prices for lowfat white, lowfat chocolate, whole white, and whole chocolate that Meyer had been bidding in districts where it was the incumbent and constructs a weighted average bid based on the Campbell County percentages, one gets a number just above 14 cents. Meyer actually bid \$0.141. An attentive rival that wanted to win the contract would bid just under that level, which is what Trauth did with its bid of \$0.1395.

One day later the same script was reenacted in Kenton County. Trauth's and Meyer's bids for lowfat white half pints were \$0.1289 and \$0.1302, respectively. Why the difference from the previous day, since the two counties are adjacent and of roughly the same volume? The bid specifications again called for a blended bid, however, eighty-four percent of Kenton County's volume was lowfat chocolate, considerably cheaper to produce than whole chocolate. Meyer's bid was predictable based on its established bidding pattern, in that a weighted average price using the Kenton County proportions comes out to just over thirteen cents. By going under thirteen cents, Trauth won back another sizable contract that it had lost to Meyer in the 1983 price war.

The next bid in the 1984 season is also informative. St. Bernard/Elmwood, Ohio was a Trauth incumbency. If Meyer had overtly agreed to let Trauth win the Campbell and Kenton County bids as part of a market sharing conspiracy, then we would expect the established pattern and level of bids to continue. On the other hand, if no overt conspiracy existed and Trauth was expecting Meyer to retaliate for its sharp moves in Campbell and Kenton Counties, then we would expect a very cautious bid from Trauth. Trauth dropped its St. Bernard/Elmwood bid to \$0.114 for lowfat white, more than two cents below Meyer's bid.

The third 1984 bid from hell, Boone County, occurred on the same day as St. Bernard/Elmwood. Lanzillotti questions why Meyer raised its bid to \$0.1390 from its Kenton County level of \$0.1302, just beating Trauth's apparently accommodat-

ing bid of \$0.1395. Boone County also required dairies to submit blended bids, and just like Campbell County the largest portion of the volume was whole chocolate half pints. Thus the relevant comparison for Boone County is Campbell and not Kenton County. Trauth stayed at the same level in Boone as it had bid earlier in Campbell, \$0.1395 per half pint. Boone County had been a Meyer customer, unlike Campbell and Kenton Counties, so Trauth's bid did not further escalate the level of aggression. Meyer, apparently paying attention to Trauth's prior bids and desiring to retain the Boone County contract, went under Trauth's Campbell County price with a bid of \$0.1390.

The last bid from hell in 1984 occurred in Ludlow later in the season. Lanzillotti notes that both Trauth's and Meyer's bids for lowfat white half pints, \$0.1475 and \$0.1462, were the highest of the entire summer. Without knowing that Ludlow required a blended bid and that eighty-five percent of the contract was whole chocolate milk, one would be hard-pressed to explain the levels of the bids. A decomposition of the bid based on those facts, however, puts the Ludlow bid at the same level as other bids that were occurring in other districts at that point in the 1984 season. Far from being inexplicable events with no other rationale than conspiracy, the bids in question upon closer examination seem to have normal and natural explanations.

IV. Summary and Conclusions

Price fixing, bid rigging, and allocating customers or market areas are *per se* illegal activities under §1 of the Sherman Act. All that is necessary for a guilty verdict is to establish that the activity occurred. Often circumstantial evidence is presented in lieu of or in support of direct evidence in price fixing cases. Economic experts are asked to opine whether overt collusion has occurred based on circumstantial evidence. This paper has analyzed economic and statistical arguments offered as evidence in support of charges of bid rigging in a series of lawsuits involving school milk contracts in the southeastern United States. These arguments have included analyses of incumbency rates, market shares, bid levels, bid distance relationships, bid dispersions, and exact bidding differentials.

This paper has shown that an analysis of incumbency rates does not permit one to distinguish between overt and tacit collusion. High incumbency rates occur naturally in oligopolistic markets where clearly there is no illegal collusion going on. Stable market shares also have little probative value, since stable market shares are the norm rather than the exception in mature oligopoly markets. High bid levels are consistent with an allegation of bid rigging. High bid levels also occur, however, in tight oligopoly markets where firms are independently pursuing their own best interests in a perfectly legal fashion. Any analysis of the geographic pattern of bidding must take into account the spatial nature of competition. Firms with spatial monopoly or oligopoly power may submit bids that are inversely related to distance from their plant. The dispersion of bids may have some value in determining what

omit blended bids, and
 was whole chocolate
 is Campbell and not
 as it had bid earlier in
 feyer customer, unlike
 er escalate the level of
 prior bids and desiring
 Campbell County price

the season. Lanzillotti
 half pints, \$0.1475 and
 knowing that Ludlow
 e contract was whole
 levels of the bids. A
 uts the Ludlow bid at
 istricts at that point in
 io other rationale than
 m to have normal and

areas are *per se* illegal
 for a guilty verdict is
 evidence is presented
 ses. Economic experts
 used on circumstantial
 arguments offered as
 suits involving school
 uments have included
 distance relationships,

rates does not permit
 incumbency rates occur
 illegal collusion going
 e stable market shares
 arkets. High bid levels
 ls also occur, however,
 rsuing their own best
 geographic pattern of
 ion. Firms with spatial
 sely related to distance
 e in determining what

sort of price fixing arrangement, if any, existed. Finally, exact bidding differentials can arise naturally as a focal point, and perhaps are more indicative of legal tacit collusion rather than illegal overt collusion.

References

- Blair, Roger D., and Richard E. Romano (1990) 'Distinguishing Participants from Nonparticipants in a Price-Fixing Conspiracy: Liabilities and Damages', *American Business Law Journal*, 28, 33-57.
- Blair, Roger D., and Richard E. Romano (1997) 'Identifying Participants in a Price-Fixing Conspiracy: Output and Market Share Tests Reexamined - Reply', *Review of Industrial Organization*, 12, 291-294.
- Funderburk, Dale R. (1974) 'Price Fixing in the Liquid-Asphalt Industry: Economic Analysis versus the "Hot Document"', *Antitrust Law and Economics Review*, 7, 61-74.
- Karaaslan, Mehmet E. (1997) 'Identifying Participants in a Price-Fixing Conspiracy: Output and Market Share Tests Reexamined', *Review of Industrial Organization*, 12, 279-290.
- Lanzillotti, Robert F. (1996) 'The Great Milk Conspiracies of the 1980s', *Review of Industrial Organization*, 11, 413-458.
- Pesendorfer, Martin (1996) 'A Study of Collusion in First Price Auctions', Mimeo, Yale University.
- Porter, Robert H., and J. Douglas Zona (1993) 'Detection of Bid-Rigging in Procurement Auctions', *Journal of Political Economy*, 101, 518-538.
- Porter, Robert H., and J. Douglas Zona (1999) 'Ohio School Milk Markets: An Analysis of Bidding', *RAND Journal of Economics*, 30, 263-288.
- Scherer, F. M., and David Ross (1990) *Industrial Market Structure and Economic Performance*. Boston: Houghton Mifflin Company.
- Schmalensee, Richard (1989) 'Inter-Industry Studies of Structure and Performance', in Richard Schmalensee and Robert D. Willig, eds., *Handbook of Industrial Organization*. Amsterdam: North Holland.