

Behavioral Screening

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Introduction

Case of Nasdaq

- Nasdaq is a stock exchange with electronically posted prices
- A market is a "market for a security" (e.g., Microsoft stock).
- A firm is a "market maker" who is required to post quotes at which it is willing to buy ("bid" price) and sell ("ask" price).
- A market maker's profit comes from the inside spread = lowest ask – highest bid (proxy for price-cost margin).
- Incoming market orders trade at the best bid or ask price offered by market makers.
- Bid and ask prices can only be quoted in 1/8ths (up until 1997)



Introduction

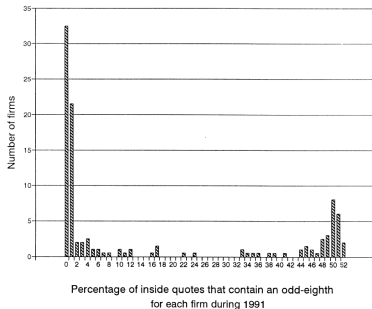
Case of Nasdaq

- William Christie and Paul Schultz (Vanderbilt) discovered an anomalous property in these markets.
- In 71 out of 100 markets examined, market makers very infrequently quoted bid and ask prices in odd-eighths.
 - Quotes would end with 0, $1/4$, $1/2$, $3/4$ but not with $1/8$, $3/8$, $5/8$, $7/8$

THE JOURNAL OF FINANCE • VOL. XLIX, NO. 5 • DECEMBER 1994

Why do NASDAQ Market Makers Avoid Odd-Eighth Quotes?

WILLIAM G. CHRISTIE and PAUL H. SCHULTZ*

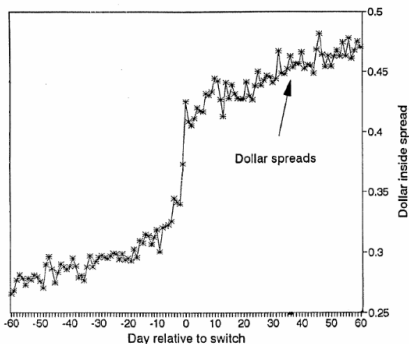


Introduction

Case of Nasdaq

- Those markets that went from making odd-eighth quotes to avoiding odd-eighth quotes experienced an increase in their price-cost margin (as proxied by the bid-ask or dollar spread).

"Price-cost margin" averaged across markets



Time 0 - Day at which "avoid odd-eighths"
practice was adopted

Introduction

Case of Nasdaq

- Market makers coordinated on a practice of not quoting in odd-eighth quotes.
- Practice raised the minimum bid-ask spread to 1/4 which increased the price-cost margin.



Department of Justice

WEDNESDAY, JULY 17, 1996 (excerpts)

JUSTICE DEPARTMENT CHARGES 24 MAJOR NASDAQ SECURITIES FIRMS WITH FIXING TRANSACTION COSTS FOR INVESTORS

WASHINGTON, D.C. — The Department of Justice and 24 major Nasdaq securities firms reached a settlement today that will stop the firms from following an industry-wide practice that fixes transaction costs for investors who buy and sell stocks on the Nasdaq market.

The Department's investigation began in the summer of 1994, shortly after the publication of an economic study by Professors William Christie of Vanderbilt University and Paul Schultz of Ohio State University about the Nasdaq market.

- Private litigation settlement: \$1.5 billion (2015 U.S. dollars)

Los Angeles Times | Business



You are here: LAT Home > Articles > 1998 > November > 10 > Business

Archive for Tuesday, November 10, 1998

Record Settlement OKd in Nasdaq Price-Fixing Suit

November 10, 1998 in print edition C-5



Introduction

Case of Nasdaq

This case highlights several points.

- 1 Certain market conditions are conducive to collusion
 - Homogeneous product or service.
 - Buyers' decisions are almost exclusively determined by price.
- 2 Collusion often entails simple rules
 - Practice: "Avoid quoting in odd-eighths".
 - With high level of price transparency, 50+ firms could collude with minimal express communication.
- 3 Collusion can be detected using market data
 - Case was discovered based *only* on market data.
 - After discovery, very little non-economic evidence.

Overview

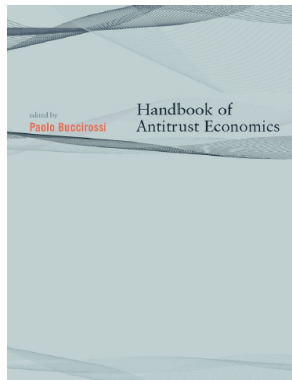
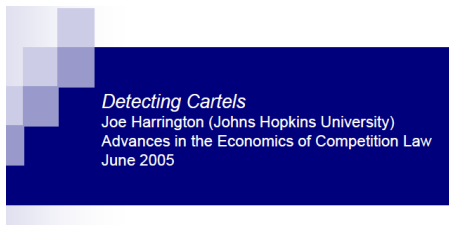
- 1 Screening markets for cartels.
 - Detecting cartels at birth and death
 - Detecting cartels in operation
- 2 Screening procurement auctions for bidding rings.
- 3 Screening and leniency programs.

Screening Methods

Screening is the analyzing of market data for the purpose of discovering collusion.

- Screening is
 - intended to provide evidence to justify an investigation
 - **not** intended to deliver the evidence to prosecute a case
- Screening can disable cartels
 - by discovering them
 - by making them less stable (as firms adjust their behavior to avoid being discovered).
- Screening can deter cartels by increasing the probability of discovery and reducing expected duration.

"Advances in the Economics of Competition Law" Conference in Rome - June 2005



Screening Methods

Who should engage in cartel detection?

- Competition authorities - screening can be the basis for an investigation
- Plaintiff law firms - screening can be the basis for litigation to recover customer damages
- Companies
 - Screening can determine if any suppliers are colluding.
 - Screening can determine if any employees are colluding.
 - Industrial bulk vinegar cartel (2001-2012) - Upon an employee's departure from Kühne, an internal audit revealed irregularities that proved to be evidence of price-fixing. Kühne applied for and received amnesty from the European Commission.

Screening Methods

Who should engage in cartel detection?

- Companies
 - Screening can be part of the due diligence process before a merger or acquisition.
 - After acquiring Hoechst's chemicals business, Clariant discovered Hoechst had been engaged in the price fixing of MCAA.
 - Pre-merger discovery of collusion means identifying a latent liability and not overpaying for an unlawfully-inflated profit stream.
- Deutsche Bahn created a cartel detection team to detect collusion among their suppliers (but they should also use it internally as they have been accused of collusion!)

Screening: Methods

Screening methods

- Structural
 - Identifying industry traits conducive to collusion.
 - Small number of firms, homogeneous products, excess capacity, stable demand, etc.
 - Based on data which makes it more likely that a cartel *will form*.
 - Probably suffers from too many false positives due to omitted variables
- Behavioral
 - Identifying collusive behavioral patterns in prices and quantities.
 - Uses data that may itself be evidence that a cartel *has formed*.

Screening: Methods

Why do I think that behavioral screening can work?

- Operating a cartel is difficult!
 - Collusion imposes a unique set of challenges and constraints which manifests itself in terms of firm behavior.
 - Colluding firms leave a trail.
- Even if cartelists are strategic, they will be unable to beat some screens because it is costly for them to do so.

Screening: Methods

Behavioral screening methods

- 1 Is behavior inconsistent with competition?
- 2 Is there a structural break (that is, statistically distinguishable change) in behavior?
- 3 Does the behavior of firms differ from that of a competitive benchmark?
- 4 Does a collusive model fit the data better than a competitive model?

Focus here is on cost-effective methods of screening which means easy to implement using readily available data.

Screening of Markets

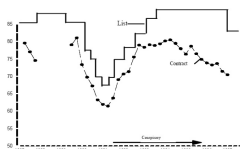
Detecting cartels at birth and death

- Collusion must mean a change in the price-generating process which, in principle, can be identified.
- There are certain regularities associated with birth and death (collusive markers).

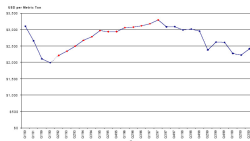
Screening of Markets

Detection at Cartel Birth

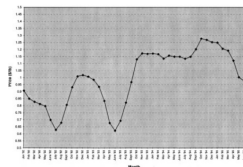
- Cartel formation is often preceded by price decline (V-shaped pattern to prices)
- Transition phase in which price gradually rises.



Citric Acid

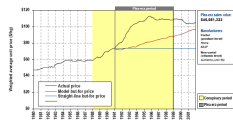


Graphite Electrodes



Lysine

Figure 12-19. Beta Carotene 10% Cold Water Soluble USP price and bid-for price



Vitamins (Beta Carotene)

Screening of Markets

Detection at Cartel Birth

- Cartel could try to reduce the power of the screen by adjusting price more slowly
- But that comes at a cost in terms of lower profit.
- As long as reducing the power of a screen is costly to a cartel, the screen will have power to detect collusion.

Screening of Markets

Detection at Cartel Death

- Death of a cartel may be easier to detect because it is not "managed" by the cartel.
- At cartel death, sharply lower prices and more price variability

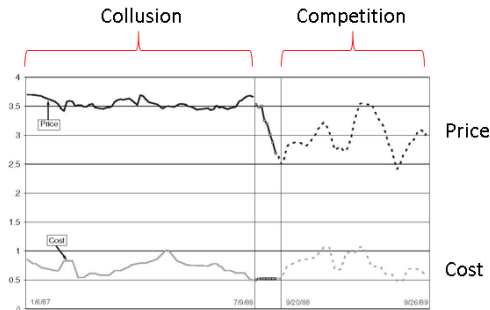


Fig. 1. Frozen perch prices and costs: 1/6/87-9/26/89.

Frozen Perch (Abrantes-Metz, Froeb, Geweke, and Taylor, 2005)

Screening of Markets

Detection at Cartel Death

Gradual price increase at birth, sharp price decrease at death.

Figure 8-7: Worldwide Vitamin C production shares

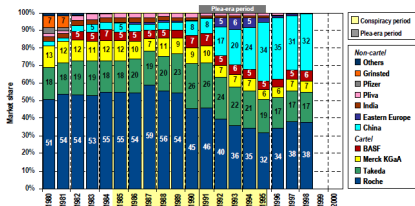
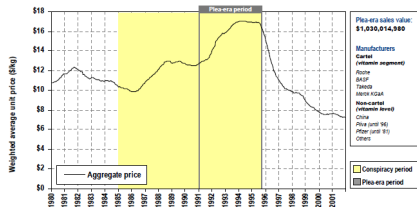


Figure 8-9: Vitamin C Human Grade aggregate price index



Vitamin C

Collapse due to expansion by non-cartel suppliers
Bernheim Expert Report (2002)

Screening of Markets

Detection between Birth and Death

- What do we look for?
 - ① Patterns in the data inconsistent with competition
 - ② Patterns in the data consistent with collusion
- Pattern inconsistent with competition: Price is *decreasing* in cost
 - Porter and Zona (1999)
 - Milk suppliers bid on annual contracts to supply milk to school districts
 - Found that a firm's bid was *decreasing* in the distance between a milk supplier and a school district

Screening of Markets

Detection between Birth and Death

- Reality check: Can we tell a coherent story as to why colluding milk suppliers would bid lower when distance is higher?
- Collusion will be effective only in those districts/markets for which non-colluding firms are neither numerous nor have a significant cost advantage (such as being the closest suppliers).
- Colluding firms may then be submitting
 - high bids in close markets for which they are able to collude (by virtue of having a distance advantage)
 - low bids in distant markets where they are forced to compete (by virtue of having a distance disadvantage)

Screening of Markets

Detection between Birth and Death

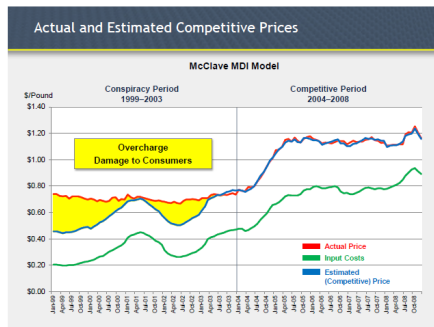
Pattern inconsistent with competition: Fuel surcharges that are common across firms and not related to fuel costs in an economically-sensible manner

- Air freight (global), 2000-06
 - Surcharge was per kilogram but independent of distance
 - British Airways increased fuel surcharge from 4 cents/kilogram to 72 cents/kilogram
- Rail freight (U.S.), 2001-07
 - Surcharge was a percent of the rail freight transport base rate.
 - Surcharges increased 55% more than the rise in fuel costs

Screening of Markets

Detection between Birth and Death

Pattern consistent with collusion: Low price variability (and insensitivity to cost)



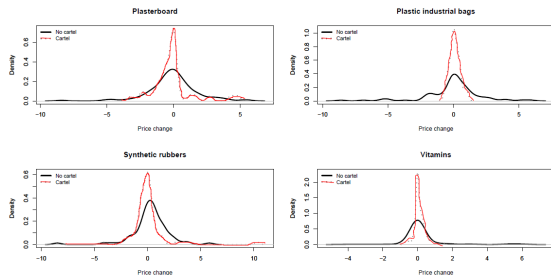
Urethane (Plaintiff's Response Brief, 2014)

Screening of Markets

Detection between Birth and Death

Pattern consistent with collusion: Low price variability

- In 8 out of 11 German cartels, price variability was significantly lower when firms were colluding



Distribution of price changes

Black - competitive periods; Red - collusive periods

von Blackenburg et al (2011)

Screening of Markets

Detection between Birth and Death

Pattern consistent with collusion: Entry has very large price response

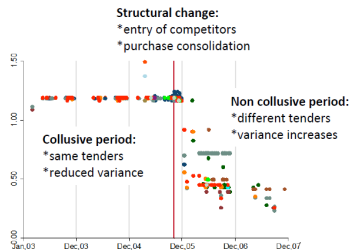
Under competition:

- modest decline in price

Under collusion:

- switch to competition \Rightarrow large decline in price
- switch to exclusionary activities \Rightarrow large decline in price

Figure 1. Medicine 1 average price 1



Mexico: Procurement
auctions for generic drugs
Price went down, Variability went up

Screening of Markets

Takeaways

- Collusion means a change in the price-generating process which leaves an identifiable trail.
- Cartel birth can be associated with a V-shaped price path
- Collusive pricing often means
 - low price variability
 - anomalous properties associated with the use of simple rules
- Cartel death is not "managed" by colluding firms which often means sharply lower and more volatile prices

Screening of Procurement Auctions

Screening for Cartels at Public Procurement Auctions

Joe Harrington (Johns Hopkins University)

3rd Annual Competition Commission, Competition Tribunal and
Mandela Institute Conference on Competition Law, Economics and Policy
Pretoria, South Africa

September 3-4, 2009

Screening for Cartels: The Next Step in Enforcement

Joe Harrington (Johns Hopkins University)

CRA Annual Conference on Economic Developments in Competition Policy
Brussels

9 December 2009

Screening of Procurement Auctions

Why is screening government procurement auctions for bidding rings so compelling?

- 1 Government procurement auctions encompass 45-65% of government expenditure and 13-17% of GDP (International Institute of Sustainable Development, 2008)
- 2 Bidding rings are well-documented for procurement auctions.
- 3 Tacit collusion is rare in procurement auctions.
- 4 Developed set of empirical methods.
- 5 Potentially large reputation effect.
- 6 Data is available.

Screening of Procurement Auctions

Statement from Hungary delegation at OECD Policy Roundtable (2013):

Our second attempt at [screening] was in 2010. Inspired by the presentation (and previous works) of Joe Harrington, an ad hoc working team in the GVH tried to evaluate the issue again focusing on the use of econometric tools. While the team of the Chief Economist was highly capable of applying these highly sophisticated methods, there was a lack of sufficient data.

Go to the data.

Screening of Procurement Auctions

Why do I think that bidding rings cannot avoid detection?

- Suppose there are no competitive benchmark markets.
- If **all** bidders are **always** colluding and bidders are **smart** then their behavior is indistinguishable from competition.
- The reason is that they could scale all competitive bids up in which case these bids would respond to cost, demand, # of bidders, etc. in exactly the same way as under competition.
- But ...
 - bidding rings are not always smart.
 - all bidders are not always colluding. In particular, bidding rings cannot control the disruptive effects of entry.

Screening of Procurement Auctions

Bidding rings are not always smart: Compare lowest bid with non-lowest bids.

- The lowest bid comes from the designated cartel winner and is designed to maximize expected profit.
- The other cartel members' bids are designed to avoid winning.
- Lowest bid (non-lowest) bids may respond to cost and other factors in an economically sensible (non-sensible) way.
- Porter and Zona (1993)
 - Data: 116 auctions for highway construction contracts, 1979-1985.
 - Result: Lowest bid was related to cost; non-lowest bids were unrelated to cost.

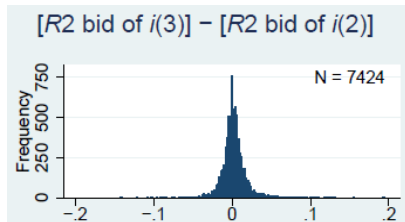
Screening of Procurement Auctions

Bidding rings are not always smart: Look for anomalies.

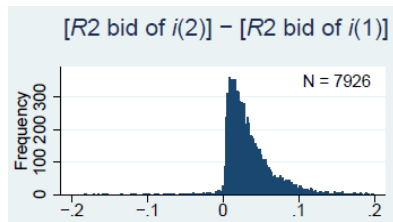
- Japanese procurement auctions for construction projects (Kawai and Nakabayashi, 2014)
- First-price sealed bid auction in which the lowest bid wins the project
- If the lowest bid $>$ secret reserve price then there is a second auction (30 minutes after the first auction)
- Consider those auctions that went to a second round and the difference between the lowest and next-lowest bids is very small ($<$ 1% of reserve price)
 - Under competition, each bidder should have similar probabilities of winning in the second round
 - In practice, the lowest bidder from the first round submitted the lowest bid in **96.7% of auctions!**

Screening of Procurement Auctions

Frequency of the difference in the 2nd round bids of the third lowest and second lowest bidders from the 1st round.



Frequency of the difference in the 2nd round bids of the second lowest and first lowest bidders from the 1st round.



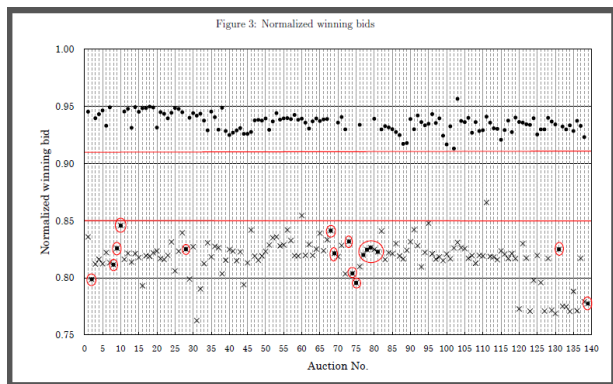
- Pattern is consistent with a scheme in which there was a bidding ring which designated one member to always submit the lowest bid.

Screening of Procurement Auctions

Bidding rings do not control non-colluding bidders: Look for big changes in the winning bid due to some bidders.

- Mexico: Procurement auctions for generic pharmaceutical products
- Japan: Procurement auctions for road paving contracts (Ishii, 2008)
 - Government sets a maximum bid (reserve price) and a minimum bid
 - 123 (out of 139) auctions - winning bids are around 93% of the reserve price
 - Other 16 auctions
 - Winning bid = minimum price (77-85% of the reserve price).
 - Bidding wars largely occurred when two particular firms were present

Screening of Procurement Auctions



- denotes the winning bid (divided by the reserve price)
- × denotes the minimum bid (divided by the reserve price) set by the government

Screening of Procurement Auctions

Takeaways

Using data from government procurement auctions, screen by

- 1 comparing how lowest bid and non-lowest bids respond to different factors.
- 2 assessing whether a few particular bidders having a large downward effect on bid/reserve price.
- 3 determining whether there is a strong correlation in some bidders' bids.
- 4 looking for anomalous patterns inconsistent with competition.

Screening and Leniency Programs

Who needs screening when there is a leniency program?

- A leniency program
 - does not always mean leniency applications.
 - may attract dying cartels and leave stable cartels in place.
 - is more effective when there is screening (and a leniency program makes screening more effective).

Screening and Leniency Programs

Screening and leniency programs are complements

- *Screening enhances the efficacy of a leniency program*: The more likely a cartel member believes it'll be caught, the more apt it is to apply for amnesty.
 - An inactive leniency program might be jump-started through the use of screening.
- *A leniency program enhances the efficacy of screening*: If a competition authority discovers a suspected cartel, an investigation might induce a firm to apply for amnesty.

Concluding Remark

Former Deputy Assistant Attorney General Scott Hammond of the U.S. Department of Justice once claimed:



- But, through screening, you may be able to **discover** that a theft (collusion) occurred with an economist,
- And, through screening, you may be able to **scare** a thief with an economist and that could be enough to induce them to apply for leniency.