

Lectures on Collusive Practices

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Defining Collusion

- **Collusion** is when some or all firms in a market coordinate to restrain competition. This coordination is typically done with the intent of raising price and earning higher profit.
- “Cartels are cancers on the open market economy ...” [Mario Monti, former European Commissioner for Competition, Sept 2000]
- “... negotiation between competitors may facilitate the supreme evil of antitrust: collusion.” [U.S. Supreme Court Justice Antonin Scalia, *Verizon Communications, Inc. v. Law Offices of Curtis V. Trinko LLP*, 2004]

Defining Collusion

Laws

- Section 1 of the Sherman Act (1890, U.S.): "Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal."
- Article 101 of the Treaty of the European Communities (1999) - "The following shall be prohibited as incompatible with the common market: all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the common market," and include:
 - ▶ fixing selling prices or any other trading conditions
 - ▶ controlling production, markets, technical development, or investment
 - ▶ sharing markets or sources of supply

Defining Collusion

Note: Legal statements pertain to the U.S. but are of some relevance in many other jurisdictions (including the EU)

- It is not unlawful for firms to
 - ▶ charge high prices (exception: excessive pricing laws)
 - ▶ act in a parallel manner
 - ▶ use collusive pricing rules (e.g., price high but price low in retaliation to a rival firm not pricing high)
- It is unlawful for firms to have an *agreement* to suppress competition (that is, unreasonably restrain trade)
 - ▶ Liability: What is an agreement?
 - ▶ Evidentiary standards: What is sufficient evidence to conclude that firms have an agreement?

Defining Collusion

- U.S. Supreme Court has developed the doctrine that an *agreement* to restrain trade is unlawful and has defined an agreement as or as requiring
 - ▶ a "unity of purpose or a common design and understanding, or a meeting of minds" (*American Tobacco Co. v. United States*, 1946)
 - ▶ "a conscious commitment to a common scheme designed to achieve an unlawful objective" (*Monsanto Co. v. Spray-Rite Serv. Corp.*, 1984)
 - ▶ "mutual consent" (*Esco Corp. v. United States*, 1965)
- E.U. General Court has defined an agreement as or as requiring
 - ▶ "joint intention" (*ACF Chemiefarma*, 1970)
 - ▶ "concurrence of wills" (*Bayer v. Commission*, 2000)

Defining Collusion

- An unlawful agreement requires that firms
 - ▶ have engaged in an exchange of assurances or
 - ▶ have expressed intent (to coordinate) and achieved necessary reliance (in order to coordinate)
- Concerted action (W. Page, *Loyola University Chicago Law Journal*, 2007)
 - ▶ "[Firms] need not have exchanged promises of assurances of their actions; it is enough that they have communicated their intent to act and their reliance on others to do so."
 - ▶ *Interstate* (1939) - "[A]cceptance by competitors, without previous agreement, of an invitation to participate in a plan, the necessary consequence of which, if carried out, is restraint of interstate commerce, is sufficient to establish an unlawful conspiracy under the Sherman Act."

Defining Collusion

Governments (through the courts and administrative bodies) have recognized three forms of collusion:

- ① Explicit (or express) - unlawful
- ② Tacit - problematic
- ③ Conscious parallelism - lawful

Defining Collusion

Explicit collusion - firms acquire mutual understanding through direct means requiring minimal inferences (other than perhaps veracity)

- Example: Managers of rival firms meet in a hotel room and engage in unambiguous communication

Lysine Cartel, Meeting in Maui, March 10, 1994



- "Cases that speak of 'express' agreements ordinarily involve 'direct,' readily observable proof that the defendants have exchanged assurances that they will pursue a common course of action." - W. Kovacic, *Antitrust Bulletin*, 1993

Defining Collusion

Tacit collusion - firms acquire mutual understanding through means that, while indirect, involve distinct identifiable actions

- Example: *United States v. Foley* (1979)
 - ▶ Jack Foley hosted a dinner party where the guests were nine competing realtors.
 - ▶ Foley announced that his firm was raising its commission rate from 6 to 7%.
 - ▶ In the following months, all defendants adopted a 7% rate.
- "No formal agreement is necessary to constitute an unlawful conspiracy." *American Tobacco* (1946)
- European Court of Justice defines "concerted practices" as "a form of coordination between undertakings which, without having reached the stage where an agreement properly so-called has been concluded, knowingly substitutes practical cooperation between them for the risks of competition."

Defining Collusion

Conscious parallelism - firms are "endowed" with mutual understanding

- A process "not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests." *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.* (1993)
- "Today pure market 'parallel behavior' without any attempt from the firms involved to communicate with each other or establish practices which help sustain collusion would probably not be judged by the Court of First Instance and the European Court of Justice as a concerted practice within the meaning of Article [101]." [M. Motta, *Competition Policy*, 2004]

Facts about Cartels

Cartel duration

TABLE 1
CARTEL DURATION: CROSS-SECTION STUDIES

| | Eckbo— Sample 1 ^a | Eckbo— Sample 2 ^a | Griffin/ Marquez ^b | Suslow | Posner | Dick | Gallo et al. | Jacquemin et al. | Levenstein & Suslow |
|--------------------------------------|---------------------------------|---------------------------------|----------------------------------|--------------------------------|--|--|---------------------------------|---|----------------------------|
| Number of Cartels | 23 | 29 | 54 | 71 | 989 | 125 | 1348 | 40 | 42 |
| Sample | Int'l Cartels, 1819–1964 | Int'l Cartels, 1819–1964 | Int'l Cartels, 1888–1984 | Int'l Cartels, 1920–1939 | U.S. DOJ cases, 1890–1969 ^f | Webb- Pomerene Export Assocs., 1918–1965 | U.S. DOJ cases, 1955–1997 | Japanese export cartels, 1967–1972 | Int'l Cartels, 1990s |
| Average Duration (years) | 3.8 ^c | 4.6 ^c | 7.3 | 3.7 ^e | 7.5 | 5.3 ^g | 5.4 | 10 | 5 |
| Standard Deviation of Duration | 2.4 | 4.7 | 6.3 | 3.0 | | | | 4.5 | 4.5 |
| Duration Range (years) | 1–18 | 0–18 ^d | 1–29 | 1–13 | | | | 1–19 | 0–20 |
| % less than 5 years | 60% | 57% | 43% | 40% | | 39% | | 12.5% | |
| % 10 or more years | 12% | 18% | 32% | 37% | | 24% | | 37.5% | |

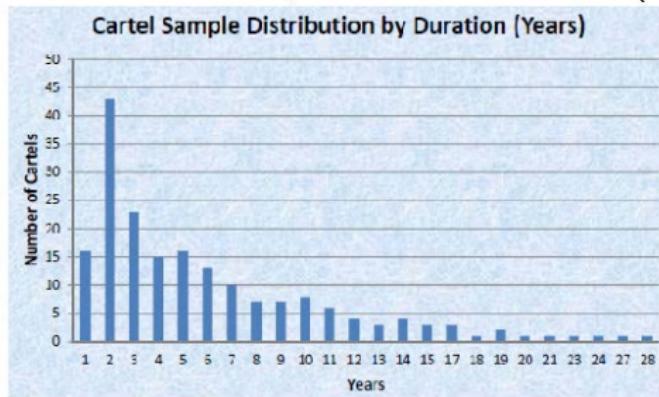
Levenstein and Suslow (*Journal of Economic Literature*, 2006)

Facts about Cartels

Cartel duration

- Average duration of *discovered* cartels is 5-8 years (depending on the data set)
- Estimated annual probability that a cartel dies: 0.174
 - ▶ Data: 1961-85 cohorts (U.S. DOJ convictions), 224 discovered cartels over 1961-2004
 - ▶ Source: Harrington and Wei (*Economic Journal*, 2017)

U.S. Department of Justice, Antitrust Division (1961 - 2012)



Facts about Cartels

Cartel frequency

- OECD Secretariat - "Serial Offenders" (Oct 2015):

Cartel studies generally conclude that only about 10 to 30 percent of all such conspiracies are discovered and punished. (Quoting from Connor, 2010)

- These claims are incorrect and are based on a misinterpretation of estimates.
- We do NOT know how many cartels go undiscovered.

IN THE UNITED STATES COURT OF APPEALS
FOR THE SEVENTH CIRCUIT

MOTOROLA MOBILITY LLC,

Plaintiff and Appellant,

vs.

AU OPTRONICS CORPORATION, et al.,

Defendants and Appellees.

On Appeal from an Order of
the United States District Court
for the Northern District of Illinois
Case No. 09-cv-6610

AMICUS CURIAE BRIEF OF
ECONOMISTS AND PROFESSORS IN
SUPPORT OF APPELLANT'S
PETITION FOR REHEARING EN BANC

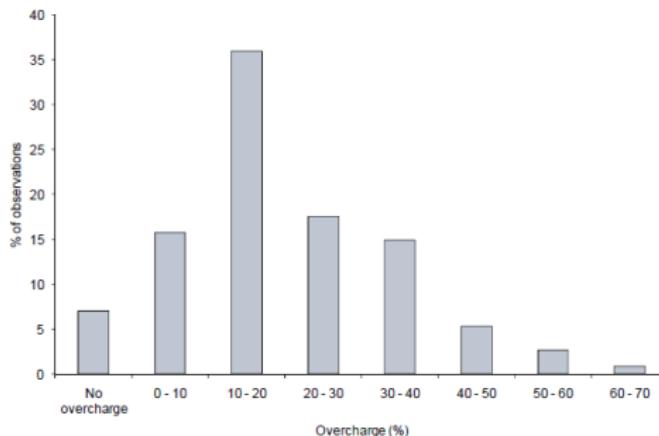
"A focus on deterring formation of international cartels is particularly important in view of estimates suggesting that more than two-thirds of conspiratorial activity goes undetected and unpunished."

Facts about Cartels

Cartel overcharges

Overcharge = percentage increase in price due to collusion

Figure 4.1 Distribution of cartel overcharges in empirical studies of past cartels: indicative results from new sample selected by Oxera, based on Connor and Lande (2008)



Source: Oxera analysis based on underlying Connor and Lande data described above and selection criteria applied by Oxera.

Facts about Cartels

Organizational structure and managerial involvement

Data: 74 international cartels, European Commission, 1990-2009 (Ashton and Pressley, 2012)

| # of Managerial Levels Participating in the Cartel | Frequency |
|---|-----------|
| 1 level | 35.7% |
| 2 levels | 39.3% |
| 3 levels | 12.5% |
| 4 levels | 5.4% |
| > 4 levels | 1.8% |

Facts about Cartels

Organizational structure and managerial involvement

Data: 74 international cartels, European Commission, 1990-2009 (Ashton and Pressley, 2012)

| Level | Frequency | Examples |
|--------------------------|-----------|--|
| Leader | 46.6% | CEO, managing director, chairman, president |
| Senior managers | 29.3% | Vice-president, head of sales and/or marketing |
| Senior middle managers | 6.9% | Regional manager, divisional manager |
| Middle managers | 3.4% | Product, project, key account production managers |
| Junior marketing & sales | 13.8% | Sales representatives, assistant marketing mgrs |

Facts about Cartels

Organizational structure and managerial involvement

Organizational Structure (Vitamins, 1990-99)

| Level | Employees |
|--------------------|--------------------------|
| Summit | Senior managers |
| Budget | Marketing heads |
| Global marketing | Operations managers |
| Regional marketing | Regional marketing heads |

- 11 vitamins and two carotenoids
- 18 manufacturers

Facts about Cartels

Data issues

- Biased sample because we only observe *discovered* cartels.
- Suppose only the less effective cartels are caught.
 - ▶ Cartel duration has been underestimated.
 - ▶ Welfare losses have been underestimated.
- Suppose only the more effective cartels are caught because the less effective ones collapse before being discovered.
 - ▶ Cartel duration has been overestimated.
 - ▶ Welfare losses have been overestimated.
- Policy challenge: *How can we measure the efficacy of cartel enforcement policies, when we cannot measure the number of cartels in an economy?*

Overview of Lectures

- ① Theory of collusion
- ② Coordinating practices
- ③ Identifying market conditions conducive to collusion
- ④ Imperfect monitoring
- ⑤ Firm asymmetries
- ⑥ Some underexplored collusive practices
- ⑦ Facilitating practices
- ⑧ Competition policy
- ⑨ Detecting cartels
- ⑩ Case: Text Messaging Antitrust Litigation (U.S.)

Theory of Collusion

Theory of Collusion

- Challenges faced by firms that want to collude.
- Challenge #1: Existence of a profitable and stable collusive agreement.
 - ▶ Market conditions must be consistent with the existence of a collusive agreement that is profitable (all colluding firms earn higher profit than under competition) and stable (each colluding firm chooses to abide by the collusive agreement).
 - ▶ Whenever collusion is an equilibrium, so is competition.
- Challenge #2: Achieving mutual understanding among firms concerning the collusive agreement
 - ▶ Explicit collusion - communicate using the spoken and written word.
 - ▶ Tacit collusion - how do you coordinate beliefs without talking?

Theory of Collusion

- Role of economic theory
 - ▶ If firms achieve mutual understanding regarding a collusive agreement, then economic theory identifies market conditions whereby the collusive agreement will persist over time.
 - ▶ (Equilibrium) economic theory does not address *how such mutual understanding is achieved*.
 - ▶ Economic theory does not show when collusion *will* occur, only when collusion *can* occur.
- Some questions that the economic framework can address.
 - ① When is collusion feasible?
 - ② What factors facilitate collusion?
 - ③ What does collusion look like?
 - ④ How do you distinguish collusion from competition?

Theory of Collusion

What problems must a cartel solve to be successful?

- ① Coordination on a collusive agreement
 - ▶ Communication
 - ▶ Bargaining
- ② Compliance with a collusive agreement
 - ▶ Monitoring for compliance
 - ▶ Punishing for non-compliance
 - ▶ Controlling the expansion of non-cartel supply
- ③ Eluding detection by customers and the competition authority
- Example: international steel cartel agreement (1926)

Theory of Collusion

Insert steel agreement

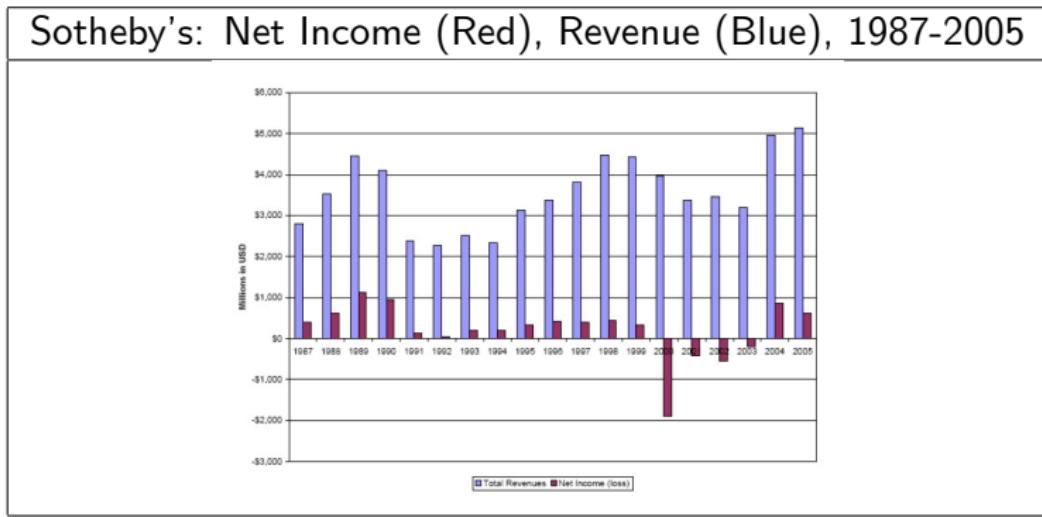
Theory of Collusion

Insert steel agreement

Theory of Collusion

Fine arts auction houses cartel

- Auction houses sell fine art objects, antiques, etc. as the agent of the owner, in exchange for a percentage of the price it sells at auction.
- Companies: Christie's, Sotheby's.
- Cartel duration: April 1993 to February 2000.



Theory of Collusion

Fine arts auction houses cartel

Meeting between Sir Anthony Tennant (Chairman, Christie's) and Alfred Taubman (Chairman, Sotheby's) at Taubman's London flat on April 30, 1993:



Tennant: "We're getting killed on our bottom line. I feel it's time to increase pricing."



Taubman: "I agree. But it's your turn to go first this time. We took the risk on the buyer's premium."

Source: Testimony of Dede Brooks (Chief Executive, Sotheby's) at the trial of Alfred Taubman

Theory of Collusion

- "Price" is the commission rate or the percentage of the final bid price.

Commission Rates - 1995 (Christie's)

| Annual Sales | Commission |
|-------------------------|------------|
| Up to \$99,999 | 10% |
| \$100,000-\$249,999 | 9% |
| \$250,000-\$499,999 | 8% |
| \$500,000-\$999,999 | 6% |
| \$1,000,000-\$2,499,999 | 5% |
| \$2,500,000-\$4,999,999 | 4% |
| \$5,000,000 and above | 2% |

- Assume possible (constant) commission rates: 2%, 4%, 6%, 8%.

Theory of Collusion

- Profit table (first number in a cell is Christie's profit)

| | | Sotheby's | | | |
|------------|----|-----------|---------|---------|----------|
| | | 2% | 4% | 6% | 8% |
| Christie's | 2% | -20,-20 | 60,0 | 140,-60 | 220,-200 |
| | 4% | 0,60 | 100,100 | 220,60 | 140,-60 |
| | 6% | -60,140 | 60,220 | 180,180 | 320,80 |
| | 8% | -200,220 | -60,300 | 80,320 | 230,230 |

- Christie's and Sotheby's anticipate interacting repeatedly over time.

Theory of Collusion

- Non-collusive equilibrium: Both houses charge 4%.

| | | Sotheby's | | | |
|------------|----|-----------|---------|---------|----------|
| | | 2% | 4% | 6% | 8% |
| Christie's | 2% | -20,-20 | 60,0 | 140,-60 | 220,-200 |
| | 4% | 0,60 | 100,100 | 220,60 | 300,-60 |
| | 6% | -60,140 | 60,220 | 180,180 | 320,80 |
| | 8% | -200,220 | -60,300 | 80,320 | 230,230 |

Theory of Collusion

- Non-collusive equilibrium: Both houses charge 4%.

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| | 8% | -200,220 | -60,300 | 80,320 | 230,230 |

Theory of Collusion

- Non-collusive equilibrium: Both houses charge 4%.

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| | 6% | -60,140 | 60,220 | 180,180 | 320,80 |
| | 8% | -200,220 | -60,300 | 80,320 | 230,230 |
| | | | | | |

- Basis for collusion

- Both auction houses are better off with a commission rate of 6% or 8%.
- They can agree that it is mutually beneficial to raise rates. But is such an agreement self-enforcing?

Theory of Collusion

- A strategy for sustaining a collusive commission rate of 8%.
 - ▶ In the initial period, each auction house charges 8%.
 - ▶ In any future period,
 - ★ each charges 8%, if both auction houses charged 8% in all previous periods.
 - ★ each charges 4%, otherwise.
- Conditions ensuring stability of the collusive agreement.
 - ▶ Assume each auction house values next period's profit only 90% of this period's profit.
 - ▶ Collusive price of 8% yields a value to an auction house of

$$230 + 230 \times .9 + 230 \times .81 + 230 \times .73 + \dots = 2300$$

- ▶ Cheating yields a firm value of

$$320 + 100 \times .9 + 100 \times .81 + 100 \times .73 + \dots = 1220$$

- ▶ Stability is achieved because

$$\text{payoff to colluding} = 2300 > 1220 = \text{payoff to cheating}$$

Theory of Collusion

- Reward-punishment scheme supports collusion.
- Cheating yields a current period gain of 90 ($= 320 - 230$) and a future loss of 130 ($= 230 - 100$) in all ensuing periods.
- If Christie's is "nice" and charges 8% then Sotheby's responds in kind by charging 8% in the next period.
- If Christie's is "nasty" and charges below 8% then Sotheby's responds aggressively by lowering its commission rate to 4% in the ensuing periods (in response to which Christie's can do no better than to charge 4% as well).

Theory of Collusion

- Suppose the auction houses are more focused on near term profits (less patient).
- They attach lower weight to future profits: next period's profit is worth 40% of this period's profit.
- Collusive price of 8% yields a value to an auction house of

$$230 + 230 \times .4 + 230 \times .16 + \dots = 383$$

- Cheating yields a value of

$$320 + 100 \times .4 + 100 \times .16 + \dots = 387$$

- Stability is *not* achieved because

$$\text{payoff to colluding} = 383 < 387 = \text{payoff to cheating}$$

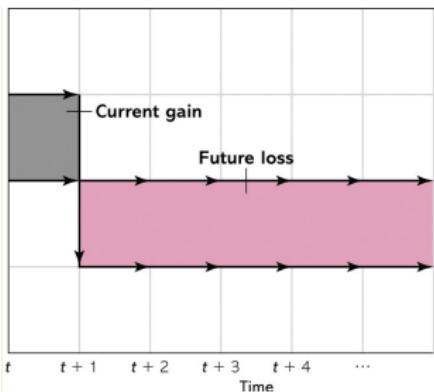
- A lower collusive price of 6% *can* be sustained.

$$\text{payoff to colluding} = 180 + 180 \times .4 + 180 \times .16 + \dots = 300$$

$$\text{payoff to cheating} = 220 + 100 \times .4 + 100 \times .16 + \dots = 287$$

Theory of Collusion

- Cheating yields higher short-run profit but lower long-run profit.



- A colluding firm must attach sufficient weight to future profits to find it optimal not to cheat.
 - ▶ When firms are relatively patient (90% case), a commission rate of 8% can be sustained.
 - ▶ When firms are relatively impatient (40% case), only a commission rate of 6% can be sustained.

Theory of Collusion

- One-period punishment: Revert to (4%, 4%)
- Each auction house values next period's profit 60% of this period's profit.
- In the initial period, each auction house charges 8%.
- In any future period,
 - ▶ each charges 8%, if both auction houses charged 8% or 4% in the previous period.
 - ▶ each charges 4%, otherwise.
- Conditions ensuring firms want to set the collusive rate.
 - ▶ Collusive price of 8% yields a value to an auction house of
$$230 + 230 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 575$$
 - ▶ Cheating yields a firm value of
$$320 + 100 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 587$$
 - ▶ Stability is not achieved because
$$\text{payoff to colluding} = 575 < 587 = \text{payoff to cheating}$$

Theory of Collusion

- One-period punishment: Revert to (2%, 2%) - price war more intense than non-collusive outcome.
- In the initial period, each auction house charges 8%.
- In any future period,
 - ▶ each charges 8%, if both auction houses charged 8% or 2% in the previous period.
 - ▶ each charges 2%, otherwise.
- Conditions ensuring firms want to set the collusive rate.
 - ▶ Collusive price of 8% yields a value to an auction house of

$$230 + 230 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 575$$

- ▶ Cheating yields a firm value of

$$320 - 20 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 515$$

- ▶ Stability is achieved because

$$\text{payoff to colluding} = 575 > 515 = \text{payoff to cheating}$$

Theory of Collusion

- Conditions ensuring firms want to participate in the price war.

- ▶ Collusive price of 2% yields a value to an auction house of

$$-20 + 230 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 325$$

- ▶ Cheating yields a firm value of

$$0 - 20 \times .6 + 230 \times .36 + 230 \times .22 + \dots = 195$$

- ▶ Stability is achieved because

$$\text{payoff to punishing} = 325 > 195 = \text{payoff to cheating}$$

- A more severe punishment can sustain collusion, when reverting to the non-collusive outcome cannot.

Theory of Collusion

What is collusion?

- From the economics perspective, collusion is defined by the
 - ▶ outcome: are prices suprarecompetitive?
 - ▶ mechanism: are prices sustained by the threat of a future punishment?
- Much of economic theory tells us when firms *can* collude but not when firms *will* collude.
- Equilibrium requires mutual understanding among firms regarding their strategies but the economic definition does not address how that mutual understanding was achieved:
 - ▶ express communication? (explicit collusion)
 - ▶ non-express communication? (tacit collusion)

Theory of Collusion

What is collusion?

- From the legal perspective, collusion is defined by the "presence of an agreement" which means
 - ▶ the manner in which mutual understanding is achieved
 - ▶ the form of communication
- The law cares about the *process* by which firms arrived at that mechanism and outcome
 - ▶ "[A]ntitrust law clarified that ... an agreement describes a process that firms engage in, not merely the outcome that they reach. Not every parallel pricing outcome constitutes an agreement because not every such outcome was reached through the process to which the law objects: a negotiation that concludes when the firms convey mutual assurances that the understanding they reached will be carried out." - J. Baker, *Antitrust Bulletin*, 1993

Theory of Collusion

Cartel collapse

Collusion is stable if and only if

$$\text{Collusive payoff} = \pi^c + \delta \times V^c \geq \pi^{dev} + \delta \times V^p = \text{Deviation payoff}$$

- π^c is collusive profit
- π^{dev} is deviation profit
- V^c is the expected present value of future profits with collusion
- V^p is the expected present value of future profits with punishment (e.g., competition)
- δ is the weight a firm gives to future profits

Theory of Collusion

Cartel collapse

Igami and Sugaya (working paper, 2017)

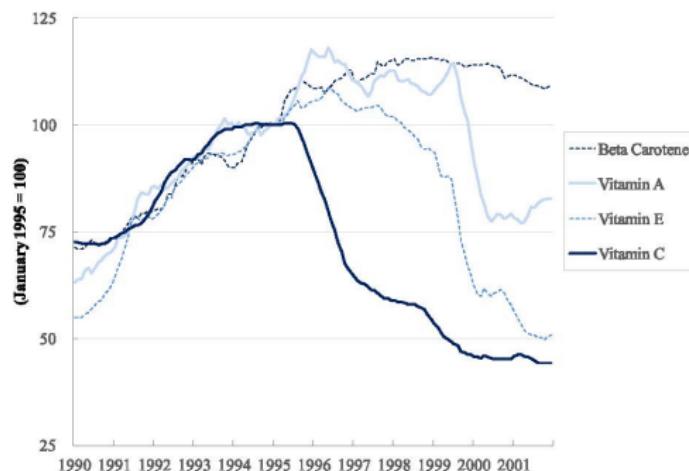
- 16 vitamins cartels
 - ▶ Cartels were born over 1990-91
 - ▶ 6 cartels internally collapsed over 1994-95
 - ▶ 10 cartels collapsed due to government investigations over 1998-99
- Can we explain why (and when) those 6 cartels collapsed and the other 10 cartels did not?

Theory of Collusion

Cartel collapse

- Empirical analysis examines four vitamin markets: A, C, E, Beta carotene
- A, E, Beta carotene - did not internally collapse
- C - did internally collapse

Prices in four vitamin markets

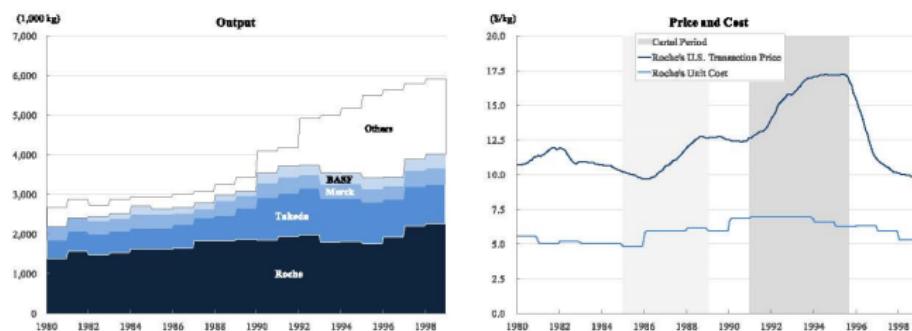


Theory of Collusion

Cartel collapse

- Collapse is most likely due to the growth of fringe supply by Chinese suppliers
- But can we explain *when* it collapsed?

Vitamin C



Theory of Collusion

Cartel collapse

- Collapse occurs when collusion is expected to be unstable in the current period or a future period.
- Collapse occurs in period t' when, for some $t (\geq t')$, Collusive payoff < Deviation payoff or

$$\Delta_{t'}(t) = E_{t'} [\pi^c(t) + \delta \times V^c(t)] - E_{t'} [\pi^{dev}(t) + \delta \times V^p(t)] < 0$$

- Empirical approach is to estimate $\Delta_{t'}(t)$ for $t' \in \{1991, \dots, 1999\}$ and $t \in \{t', \dots, 1999\}$
- Note: This approach could be used to quantify the coordinated effects of a merger.

Theory of Collusion

Cartel collapse

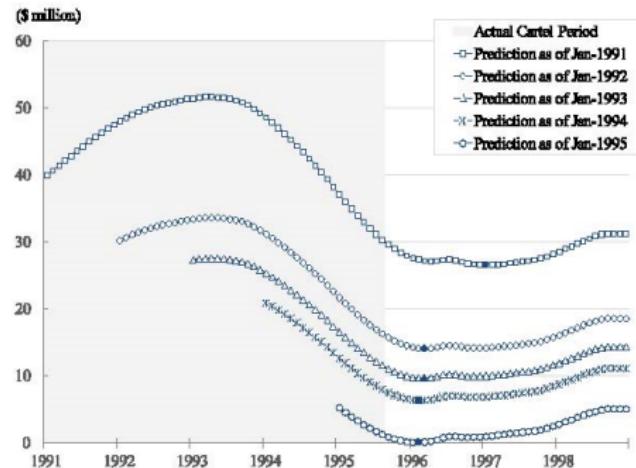
- Estimating $\Delta_{t'}(t)$ requires an estimate of
 - ▶ collusive profits
 - ▶ deviation profits
 - ▶ competitive profits (assumed that punishment is permanent reversion to competition)
 - ▶ discount factor
- Profit function is estimated to yield profit measures and uses
 - ▶ estimated market demand (with homogeneous goods)
 - ▶ observed cost
 - ▶ static expectations on fringe supply
- Various discount factors are assumed

Theory of Collusion

Cartel collapse

- For vitamins A, E, Beta carotene, $\Delta_{t'}(t) > 0$ for all years
- For vitamin C, $\Delta_{t'}(t) > 0$ for $t' \in \{1991, \dots, 1994\}$ but $\Delta_{1995}(1996) < 0$.

Collusive Payoff - Deviation Payoff



Theory of Collusion

Testing for collusion

Chassang and Ortner (working paper, 2017)

- First-price sealed-bid procurement auction with a minimum bid \underline{b} and a maximum bid \bar{b} .
- Raising the maximum bid causes winning bids to increase under competition and collusion.
- Raising the minimum bid
 - ▶ causes winning bids to increase under competition
 - ▶ may cause winning bids to *decrease* under collusion

Theory of Collusion

Testing for collusion

Collusion theory

$$\text{Collusive payoff} = \pi^c + \delta \times V^c \geq \pi^{dev} + \delta \times V^p = \text{Deviation payoff}$$

$$\text{Deviation loss} = \delta \times (V^c - V^p) \geq \pi^c - \pi^{dev} = \text{Deviation gain}$$

- Suppose punishment entails several periods of very low bids.
- Raising the minimum bid weakens the punishment $\Rightarrow V^p$ rises so $\delta \times (V^c - V^p)$ is smaller.
- For collusion to still be stable may require lowering the collusive bids so as to reduce $\pi^c - \pi^{dev}$.

Theory of Collusion

Testing for collusion

- Data: Bidding rings in Japanese construction procurement auctions (2007-16)
- Compared the bid distribution for a city that introduced a minimum bid to a city that did not
- Introduction of a minimum bid
 - ▶ did not affect winning bids for cities that did not have a documented bidding ring
 - ▶ lowered winning bids for cities that did have a documented bidding ring
- Estimated effect of introducing a minimum bid when there is a bidding ring
 - ▶ Winning bids decreased by about 1.2%
 - ▶ Benchmark
 - ★ Having an auction lowered prices by 5% compared to a take-it-or-leave-it offer using the auction reserve price.
 - ★ Minimum bid increased effectiveness of collusion by 24%.

Coordinating Practices

Coordinating Practices

Object → Coordinating Practices → Mutual Understanding → Effect

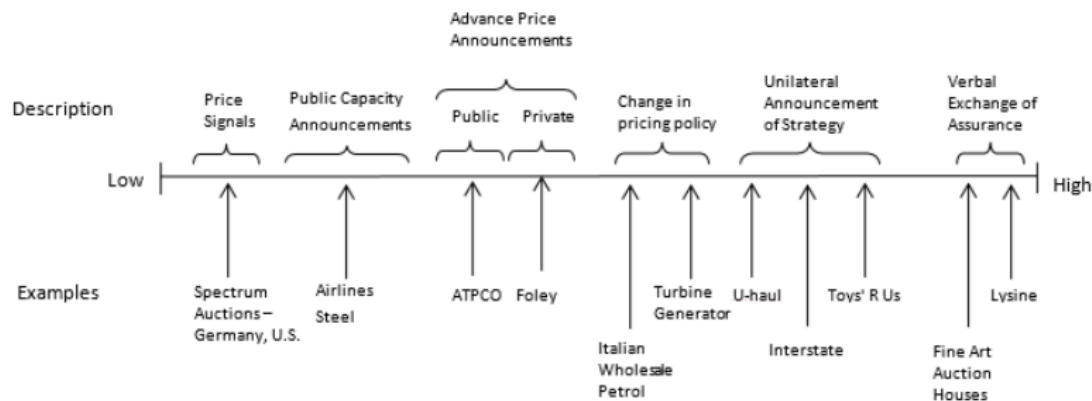
- *Object* is when a firm assumes the objective of changing other firms' expectations to those consistent with collusion rather than competition.
- *Coordinating practices* serve to change firms' expectations; they facilitate the creation of mutual understanding among firms that they will collude.
- *Mutual understanding* is with respect to firms using collusive strategies.
- *Effect* is the product of mutual understanding as reflected in prices, quantities, etc.

Coordinating Practices

- Suppose firms are of a mind to collude, not compete. What might prevent them from achieving mutual understanding?
 - ▶ Miscommunication
 - ▶ Disagreement
- Failure of communication
 - ▶ Lack of clarity - When the medium is not a natural language, the receiving firm may not infer the intended content of the message from the sending firm.
 - ▶ Lack of veracity - Even when the intended content of a message is clear, it may not be believed.
- Failure of bargaining
 - ▶ Even if messages are correctly interpreted and believed, there may be disagreement as to the collusive arrangement.

Coordinating Practices

Range of Coordinating Practices



Coordinating Practices

Public Announcements of a Collusive Plan

Firm announces a strategy that, if adopted, would produce collusive prices.

- Free-standing newspaper inserts (FSIs) are multi-page booklets inserted into newspapers and contain discount coupons for products sold by various firms.
- Two suppliers: Valassis Communications and News America Marketing.
- 2002-04: Valassis engaged in a price war in an announced attempt to achieve a 50% market share.

Coordinating Practices

Public Announcements of a Collusive Plan

July 2004 earnings call by Valassis' CEO

- Described a strategy to increase FSI prices:
 - ▶ abandoning its 50 percent market share goal
 - ▶ aggressively defending its existing customer base and market share
 - ▶ submitting price bids at levels substantially above current market prices for current News America customers
 - ▶ monitoring News America's response to its new business strategies.
- Proposed restoring the pre-price war price level of \$6.00 per FSI page per thousand booklets.
- If News America continued to compete for Valassis customers and market share, then the price war would resume.

Coordinating Practices

Change in pricing policy

Turbine generators (US DOJ, 1975)

- Two suppliers: General Electric (GE) and Westinghouse.
- Practices (starting May 1963)
 - ▶ GE released a pricing book that permitted customers (and Westinghouse) to compute the book price of any GE generator.
 - ▶ GE announced a standard multiplier it would apply to the book price to generate a price for a customer.
 - ▶ Announced that it would not offer discounts.
- Outcome
 - ▶ GE acted as a price leader.
 - ▶ Firms had identical multipliers and book prices for the next 12 years.
- Coordinating practice: Posted pricing achieved mutual understanding regarding collusion.

Coordinating Practices

Change in pricing policy

Harrington (*Journal of Competition Law and Economics*, 2011)

- Adoption of posted pricing is not in a firm's interest if it expect firms to compete.
 - ▶ If GE posts price then Westinghouse can undercut the price and take a large share of business.
- Adoption of posted pricing is in a firm's interest if it expect firms to collude.
 - ▶ Posted pricing is a facilitating practice that makes coordination and monitoring easier
- Adoption of posted pricing produced mutual understanding of collusion.
 - ▶ GE's adoption of posted pricing was optimal *only if* it believed coordinated pricing would ensue.
 - ▶ Westinghouse's response of posted pricing was optimal *only if* it believed coordinated pricing would ensue.

Coordinating Practices

Advance price announcements

Airline Tariff Publishing Company (US DOJ, 1994)

- Airlines submitted fare changes to the Airline Tariff Publishing Company (ATPCO) which were then disseminated to airlines and consumers (through computer reservation systems).
- A fare change with a future first ticket date was an announcement of a future price change in that a consumer could not buy a ticket at that price until the first ticket date.
- If other airlines matched the announcement then it was enacted.
- If other airlines did not match then it was retracted.

Coordinating Practices

Price signals

Judge Richard Posner (*High Fructose Corn Syrup*, 7th Cir. 2002):

Section 1 of the Sherman Act ... is broad enough ... to encompass ... an agreement made without any actual communication. ... If a firm raises price in the expectation that its competitors will do likewise, and they do, the firm's behavior can be conceptualized as the offer of a unilateral contract that the offerees accept by raising their prices.

Coordinating Practices

Price signals

Spectrum Auctions (Germany)

- German government auction of ten blocks of spectrum.
- Rule: Any bid must be at least 10% higher than the current bid.
- Mannesman's initial bids:
 - ▶ Blocks 1-5: 20 million DM/megahertz
 - ▶ Blocks 6-10: 18.18 million DM/megahertz
- As a bid of 20 is a 10% increase on 18.18, was Mannesman signaling to T-Mobil that each should win 5 blocks at 20 million?
- In the next round, T-Mobil bid 20 million on blocks 6-10. There were no subsequent bids.

Coordinating Practices

Price signals: Focal point

- Do price caps provide a focal point for collusive pricing?
 - ▶ Interest rates - U.S. (Knittel and Stango, *American Economic Review*, 2003)
 - ▶ Fruits and vegetables - Greece (Genakos, Koutroumpis, and Pagliero, working paper, 2017)
- Greece: maximum markup regulation for fruits and vegetables
 - ▶ 8-12% for the wholesale market
 - ▶ 20-35% for supermarkets
 - ▶ 17-32% for street markets and grocery stores
- 2011 - markup regulation was repealed

Coordinating Practices

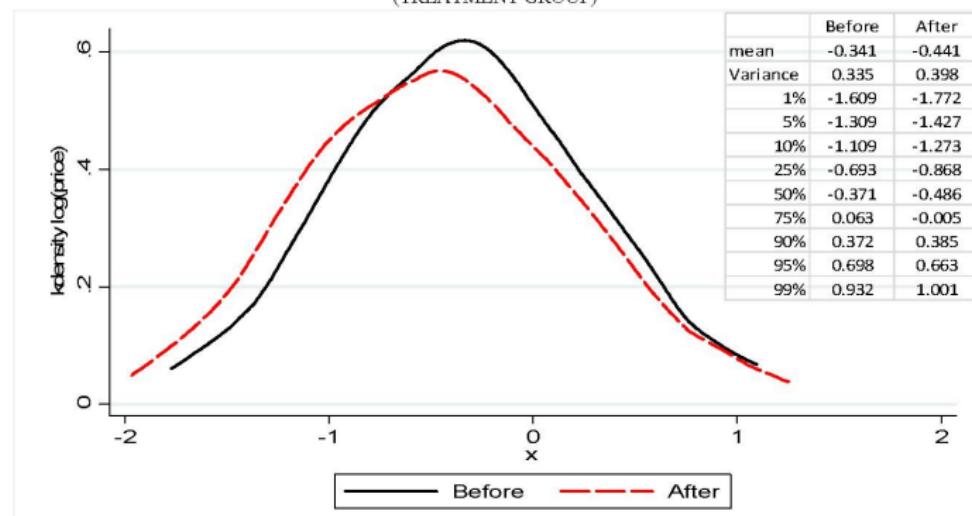
Price signals: Focal point

- Empirical strategy (difference-in-difference)
 - ▶ Five products - apples, lemons, mandarins, oranges, pears - were exempt from maximum markup regulation.
 - ▶ Compare prices of products affected by regulation before and after the policy change, using unregulated products as a control group.
- Data: Jan 2010 - Dec 2012 (18 months before and after deregulation)
- Repeal of max markup regulation *lowered* prices
 - ▶ 6% decline in average retail prices for affected products compared to unaffected products.
 - ▶ Decline was largely due to fall in wholesale prices.

Coordinating Practices

Price signals: Focal point

FIGURE 2B: THE DISTRIBUTION OF WHOLESALE PRICES BEFORE AND AFTER DEREGULATION
(TREATMENT GROUP)



Identifying Market Conditions Conducive to Collusion

Identifying Market Conditions Conducive to Collusion

What factors are relevant to collusion?

- Market concentration
- Product differentiation
- Entry conditions
- Demand volatility
- Firm asymmetries
- Excess capacity
- Price transparency and information exchange
- Buyer concentration
- and more

Identifying Market Conditions Conducive to Collusion

These factors are relevant because they can affect

- the incentive to cheat
 - ▶ by affecting the short-run profit from cheating
 - ▶ by affecting the future foregone profit from cheating
- the ability to monitor compliance
- the ability to elude detection
- the ability to adjust the collusive outcome to changing market conditions
- the ability to prevent non-cartel supply from expanding
- the ease with which firms can agree on an outcome

Identifying Market Conditions Conducive to Collusion

Market concentration

- Theory is unambiguous: more firms/lower market concentration makes collusion more difficult.
- When there are more firms, the short-run gain from cheating is greater.
 - ▶ With more cartel members, a firm's allocation of cartel supply is smaller.
 - ▶ The smaller is a firm's allocation, the larger is the incremental increase in sales from undercutting the collusive price.
- When there are more firms, the long-run loss from cheating is greater.
 - ▶ With more firms, the non-collusive outcome is more competitive.
- Generally, the rise in the gain from cheating is larger than the rise in the loss from cheating so, on net, the incentive to cheat is greater.
- Collusion is then more difficult with more firms, as reflected in
 - ▶ fewer environments in which a stable collusive equilibrium exists
 - ▶ the highest sustainable collusive price is lower.

Identifying Market Conditions Conducive to Collusion

Market concentration

- Empirical evidence is mixed.
- Levenstein and Suslow (*Journal of Economic Literature*, 2006):
"There is no simple relationship between industry concentration and the likelihood of collusion. Most cartels in our case study sample were in relatively concentrated industries [and] most contemporary international cartels are in highly concentrated industries."
- Fraas and Greer (*Journal of Industrial Economics*, 1977)
 - ▶ 606 cartels, 1910-1972.
 - ▶ Median number of firms in an industry with a cartel is 8 (for manufacturing industries, it is 7).
 - ▶ Median number of firms for all industries is 18.

Identifying Market Conditions Conducive to Collusion

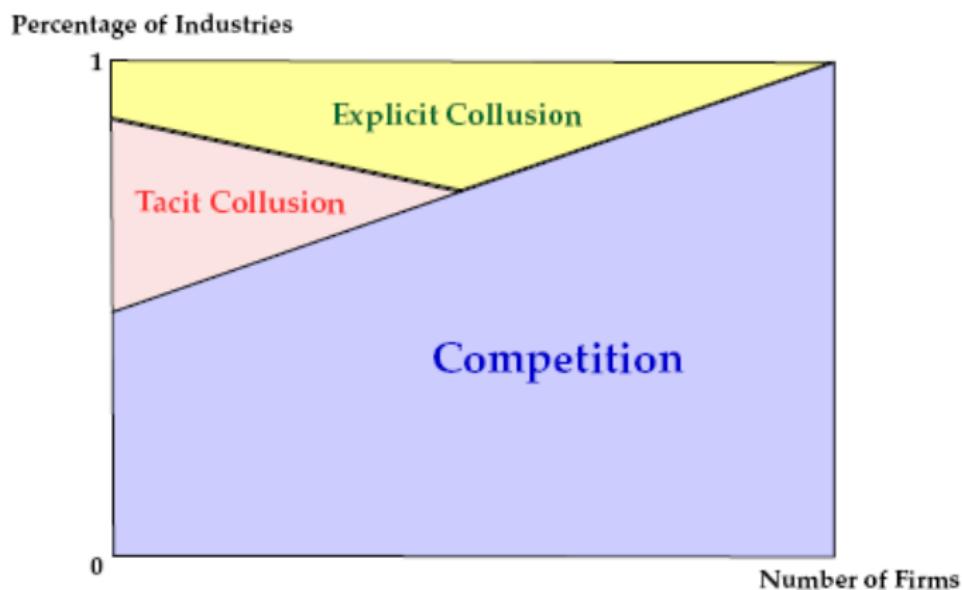
Market concentration

Why might the empirical evidence be mixed?

- Data problem: Market concentration could be correlated with the coordinating practice which could be correlated with detecting collusion.
 - Suppose firms prefer to avoid express communication as a coordinating practice.
 - Suppose a market
 - ▶ with only a few firms can coordinate without express communication ("tacit collusion")
 - ▶ with more firms must use express communication ("explicit collusion").
 - Suppose we are more likely to detect explicit than tacit collusion.
- ⇒ Collusion may be more common with fewer firms and, at the same, it is more commonly observed when there are more firms

Identifying Market Conditions Conducive to Collusion

Market concentration



Identifying Market Conditions Conducive to Collusion

Market concentration

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Identifying Market Conditions Conducive to Collusion

Market concentration

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Identifying Market Conditions Conducive to Collusion

Market concentration

- Experimental evidence - Fonseca and Normann (*European Economic Review*, 2012)
- Oligopoly model
 - ▶ Demand is fixed at 300 with a maximum reservation price of 100.
 - ▶ Cost is zero.
 - ▶ There are n ($= 2, 4, 6, 8$) subjects and each subject chooses a price from $\{0, 1, 2, \dots, 100\}$.
 - ▶ Homogeneous products
 - ★ If m subjects have the lowest price p' then each has a payoff of $(300/m) \times p'$.
- Oligopoly solutions
 - ▶ Monopoly: All subjects price at 100.
 - ▶ Competition: At least two subjects price at zero.

Identifying Market Conditions Conducive to Collusion

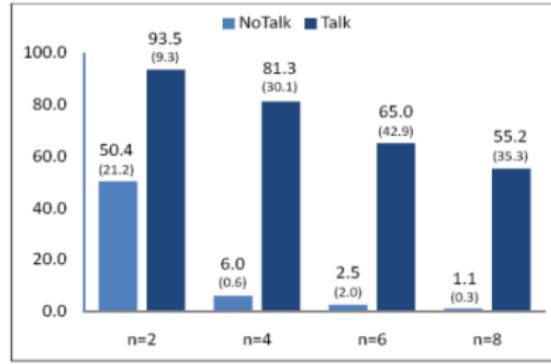
Market concentration

- Horizon
 - ▶ Play occurs for 20 periods for sure.
 - ▶ Starting with period 21, the experiment continues with probability 5/6.
- Treatments
 - ▶ No Talk: In each round, subjects simultaneously choose prices.
 - ▶ Talk: Subjects communicate using an instant-messenger program for one minute, after which they simultaneously choose prices.
- Each market structure/communication treatment was run six times.

Identifying Market Conditions Conducive to Collusion

Market concentration

- Average price
 - ▶ declines with the number of subjects/firms (though no statistical difference among markets with 4, 6, or 8 subjects)
 - ▶ is higher with communication.
- Tacit collusion (price >> cost without communication) is common with 2 subjects and very rare with 4 or more subjects.
- Incremental value of communication is maximized with 4 subjects.



Identifying Market Conditions Conducive to Collusion

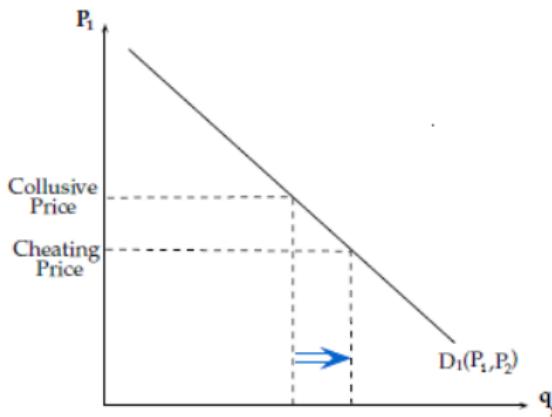
Product differentiation

- Theory is mixed.
- When products are more homogeneous, the short-run gain from cheating is greater.
 - ▶ A small price cut delivers a larger increase in market share and profit.
[See figure on next slide.]
- When products are more homogeneous, the long-run loss from cheating is greater.
 - ▶ Because firm demand is more responsive to price, each firm has a tendency to price lower.
 - ▶ Non-collusive price is closer to cost.
- Net effect varies with how product differentiation is modelled.

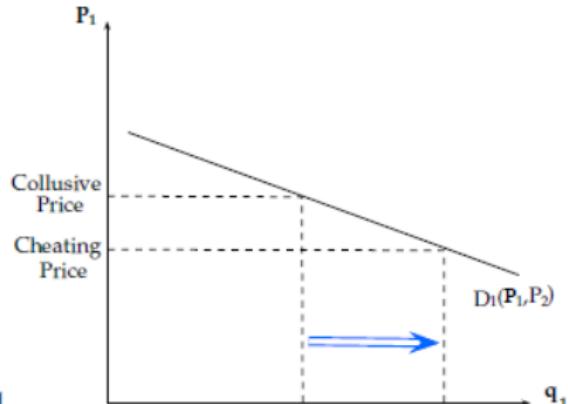
Identifying Market Conditions Conducive to Collusion

Product differentiation

High Product Differentiation



Low Product Differentiation



Identifying Market Conditions Conducive to Collusion

Product differentiation

- Empirical evidence is unambiguous
 - ▶ High fraction of cartels involve products that are commodities.
 - ▶ Collusion when products are highly differentiated is rare.
- Harrington (2006): 14 out of the 23 cartels examined had products that were commodities and most of the other cartels involved highly similar products.
- Symeonidis (*Journal of Industrial Economics*, 2003): A comprehensive study of cartels in the U.K. in the 1950s found cartels to be more likely in "low-advertising industries" (low advertising is associated with low product differentiation).
- Dick (*Managerial and Decision Economics*, 1996)
 - ▶ Legal U.S. export cartels, 1920-1965.
 - ▶ Data: 250 exporting industries, half of which had export cartels.
 - ▶ An industry was less likely to register a cartel when it exported consumer goods, which tend to be more differentiated.

Identifying Market Conditions Conducive to Collusion

Price transparency

- Consider a practice which results in price information being more quickly and more widely distributed among sellers.

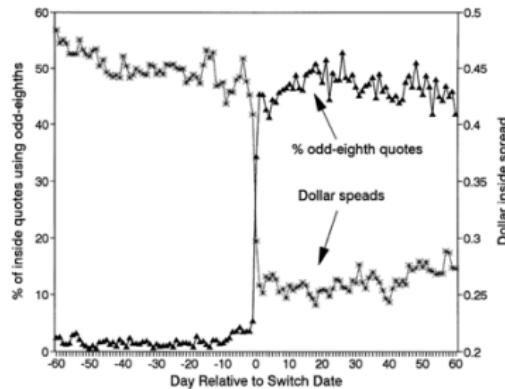
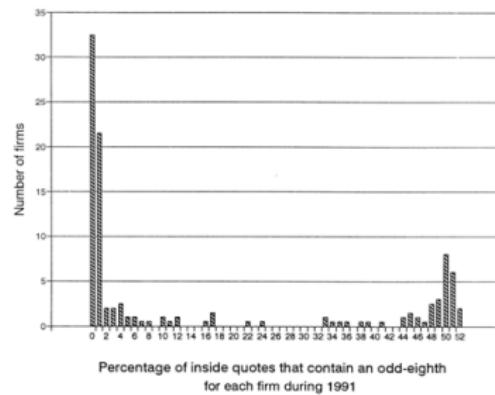
| Information | Example |
|----------------|---|
| Past prices | Trade association reports average transaction price |
| Current prices | Online pricebot |
| Future prices | Advanced notice of price changes |

- Does this make collusion easier?
- Suppose the price information is also distributed among consumers. Is there an efficiency benefit?
- What is the net effect of greater price transparency?

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

- Market is for a security such as Microsoft or Intel.
- Firms are market-makers who buy and sell shares.
- Price-cost margin is, approximately, the bid-ask spread.
- Collusive practice: Do not quote in odd-eighths.



Switch date is to competition

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

- n firms sell homogeneous goods which are produced at a cost c .
- Compete by choosing price and consumers buy from the firm(s) with the lowest price.
- $D(p)$ is market demand when the transaction price is p .
- $0 < \delta < 1$ is a firm's discount factor (i.e., weight attached to next period's profit)
- Competitive solution: Unique symmetric static equilibrium is for all firms to price at c .

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

- Consider colluding at price p^* where $c < p^* \leq$ monopoly price.
- Collusive strategy
 - ▶ Period 1: price at p^*
 - ▶ Period $t (\geq 2)$:
 - ★ price at p^* if all firms have priced at p^* in all past periods
 - ★ price at c otherwise

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

Deriving condition for the collusive arrangement to be an equilibrium

- Firm's payoff if it colludes:

$$(p^* - c) \left(\frac{D(p^*)}{n} \right) + \delta \times (p^* - c) \left(\frac{D(p^*)}{n} \right)$$

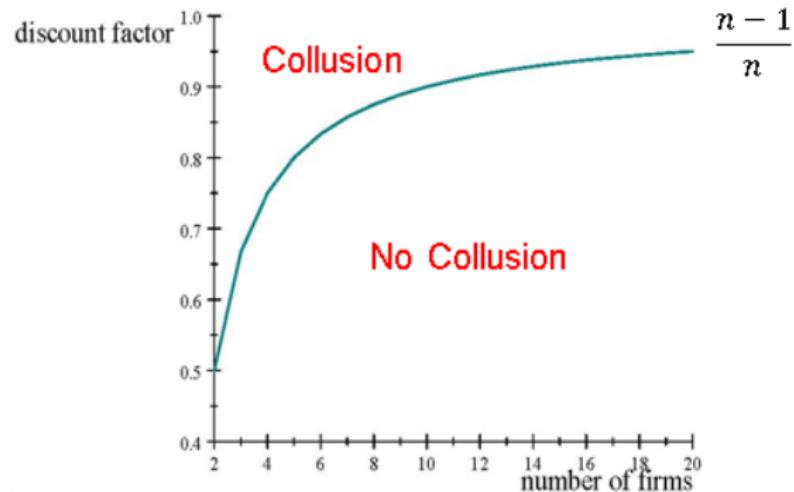
$$+ \delta^2 \times (p^* - c) \left(\frac{D(p^*)}{n} \right) + \dots = (p^* - c) \left(\frac{D(p^*)}{n} \right) \left(\frac{1}{1 - \delta} \right)$$

- If a firm deviates, it should price just below p^* and earn $(p^* - c) D(p^*)$.
- It is optimal to collude if and only if

$$(p^* - c) \left(\frac{D(p^*)}{n} \right) \left(\frac{1}{1 - \delta} \right) \geq (p^* - c) D(p^*) \Rightarrow \delta \geq \frac{n - 1}{n}$$

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq



Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

- Why was collusion so stable in Nasdaq, despite the fact that the market had as many as 60 firms?
- With $n = 60$, the equilibrium condition is $\delta \geq 0.983$.
- Shorter is the time until rival firms can respond to an episode of cheating, the closer is δ to 1.
- In Nasdaq markets, the reaction time is probably in hours if not minutes. Thus, a deviation could be punished very quickly.
- Therefore, a high restriction on the discount factor is easy to satisfy, and collusion could then be stable even with many firms.

Identifying Market Conditions Conducive to Collusion

Price transparency: Nasdaq

- Conditions conducive to collusion
 - ▶ Homogeneous service
 - ▶ High level of transparency allowed for monitoring of market-makers' bids and asks in real time.
 - ▶ Simplicity of collusive practice made coordination easy.
- Aftermath: In private litigation, Nasdaq market makers settled out of court for \$1.027 billion.

Imperfect Monitoring

Imperfect Monitoring

Introduction

- A key feature to an effective collusive agreement is that non-compliance - low price or high quantity - is observed and punished.
- An anticipated punishment deters firms from cheating.
- In practice, monitoring of firms' behavior is difficult for many cartels.
 - ▶ When a firm's quantity choice is not easily observed by other firms.
 - ▶ When buyers are large, price is often negotiated in which case a firm's price is not observed by other firms.
- Objectives
 - ▶ Characterize collusion when monitoring is imperfect. What does collusion look like?
 - ▶ Expand the set of behavior that can be explained.
 - ★ With perfect monitoring, we can explain collusion but not price wars.
 - ★ With imperfect monitoring, we can explain price wars.

Imperfect Monitoring: Price Model

- Porter (*Journal of Economic Theory*, 1983)
- Duopoly model (Cournot)
- Firm i chooses its quantity, q_i ($i = 1, 2$).
- Inverse demand is $110 - Q$ and is the price such that demand equals market supply of Q .
- Given firms' quantities, price is set to equate supply and demand:

$$P = 110 - (q_1 + q_2).$$

- A firm's cost function is $20q$.
- Firm 1's profit is

$$(110 - q_1 - q_2) q_1 - 20q_1.$$

Imperfect Monitoring: Price

Model

- Non-collusive equilibrium
 - ▶ Each firm produces 30.
 - ▶ Price is 50 ($= 110 - 30 - 30$)
 - ▶ Firm profit is 900.
- Joint profit maximum
 - ▶ Each firm produces 22.5.
 - ▶ Price is 65.
 - ▶ Firm profit is 1012.5.
- Informational assumptions
 - ▶ Assume each firm's quantity is not observed by its rival.
 - ▶ Market price is observed by both firms.

Imperfect Monitoring: Price

Collusive agreement

- Description of strategy or collusive agreement
 - ▶ Each firm produces 22.5 as long as price is never lower than 65.
 - ▶ If price falls below 65 then firms stop colluding and each produces 30.
- Stability of the collusive agreement
 - ▶ A firm that cheats will produce 33.75 and earn current profit of 1139.
 - ▶ Cheating yields a short-run profit gain of 126.5.
 - ▶ Cheating results in a future profit loss of 112.5 per period.
 - ★ When the firm cheats, the price is 53.75, which is below the collusive price of 65.
 - ★ This low price triggers a punishment - its rival raises future supply from 22.5 to 30.
 - ★ Future profit is reduced from 1012.5 to 900.
 - ▶ A firm does not cheat if it sufficiently values future profit.

Imperfect Monitoring: Price

Collusion with stochastic demand

- Assume inverse demand is

$$P = 110 + x - (q_1 + q_2)$$

- ▶ x is a "demand shock" that is randomly determined each period and unobserved by firms.
- ▶ Average value of x is 0.
- Re-evaluate the efficacy of the collusive agreement
 - ▶ Suppose price is below the collusive level of 65.
 - ★ Is it because a firm cheated by selling more than 22.5?
 - ★ Is it because there was a low demand shock that depressed price?
 - ▶ Incentive to cheat is stronger
 - ★ A firm can cheat a little bit - produce slightly above 22.5 - and is no longer assured of being caught.
 - ★ If the demand shock is big enough then price will remain above 65.
- Monitoring of compliance with the agreement is problematic.

Imperfect Monitoring: Price

Modified collusive agreement

- Collusive quantity of 25 for each firm.
- Key price levels
 - ▶ 60 is the (average) collusive price.
 - ▶ 55 is the "price war" trigger price.
 - ▶ 50 is the (average) non-collusive price.
- If the cartel was in the *cooperative phase* in the previous period and last period's price was
 - ▶ at least 55 then each firm produces the collusive quantity of 25 and the cartel remains in the cooperative phase.
 - ▶ less than 55 then each firm produces the non-collusive quantity of 30 and the cartel shifts to the punishment phase.
- If the cartel was in the *punishment phase* last period then
 - ▶ with probability 1/2, each firm produces 30 and the cartel remains in the punishment phase
 - ▶ with probability 1/2, each firm produces 25 and the cartel returns to the cooperative phase

Imperfect Monitoring: Price

Stability of the collusive agreement

- In response to a low price, there is a price war of random length, after which there is a return to the collusive outcome.
- Suppose the cartel is in the cooperative phase.
 - ▶ Firm 1 expects firm 2 to produce 25.
 - ▶ If firm 1 produces q then the probability of a price war starting next period is the probability that

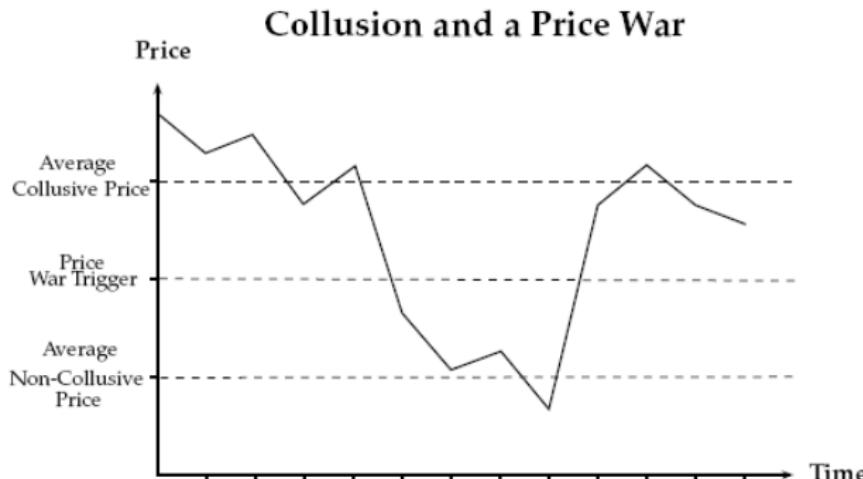
$$55 > 110 + x - (25 + q) \text{ or } q - 30 > x.$$

- ▶ The higher is firm 1's quantity, the more likely is x to take a value such that a price war is triggered.
- ▶ Trade-off between producing a little higher - and realizing a bigger market share and higher profits today - and increasing the probability of triggering a price war - and reducing future profit.

Imperfect Monitoring: Price

Theory of price wars

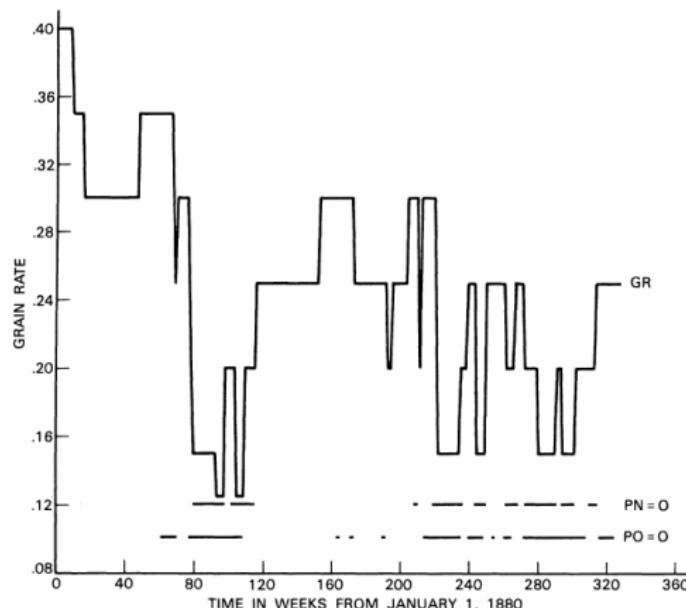
- A price war is a temporary reduction in price that is not due to changes in demand or cost.
- Price wars are a collusive phenomenon, not a competitive one.



Imperfect Monitoring: Price

Examples of price wars

- Rail rate for transporting grain (U.S., 1880-86)
- Railroads formed the Joint Executive Committee (JEC) in 1879.
- JEC set the rail rate of eastbound freight shipments from Chicago to the Atlantic coast.



Imperfect Monitoring: Sales

Lysine (1992-95)

Coordination

- Ajinomoto and Sewon preferred having exclusive geographic markets but the group ultimately decided on a market sharing arrangement.
- Wilson of ADM told the cartel that volume limitations did not mean dividing up the market by captive consumers. A "don't touch [each other's] customers policy" could create suspicions.

Market Allocation (tons)

| Company | Global | Europe |
|-----------|--------|--------|
| Ajinomoto | 73,500 | 34,000 |
| ADM | 48,000 | 5,000 |
| Kyowa | 37,000 | 8,000 |
| Sewon | 20,500 | 13,500 |
| Cheil | 6,000 | 5,000 |

Imperfect Monitoring: Sales

Lysine (1992-95)

Monitoring

- Kanji Mimoto of Ajinomoto was assigned the task of preparing monthly "scorecards" for the cartel.



Kanji Mimoto
Ajinomoto



Terry Wilson
Archer Daniels Midland

- Each company telephoned or mailed their sales volumes to Mimoto.
- Mimoto prepared a spreadsheet that was distributed at the quarterly maintenance meetings.

Imperfect Monitoring: Sales

Lysine (1992-95)

- Enforcement

- ▶ "Guaranteed buy-ins" - A company that sold more than its quota would have to buy product from producers who were below quota.

- Cheating

- ▶ Cheil claims that it reported "misleading" sales information to the other companies.
 - ▶ Ajinomoto hid 3,500 tons of lysine from the cartel's auditors; for example, an internal memo read: "Hide 1,000 tons in Thailand internal business."

Imperfect Monitoring: Sales

Citric acid cartel (1991-95)

- Structure of meetings

- ▶ Discuss the latest cartel sales reports.
- ▶ Discuss price levels and decide whether to raise prices.
- ▶ Share information about non-cartel competitors.
- ▶ Discuss "problems affecting the group" (cheating).

- Timing and frequency of meetings

- ▶ Meetings were usually set to coincide with those of the trade association.
- ▶ About 25 formal meetings plus a dozen or so bilateral meetings.

Imperfect Monitoring: Sales

Citric acid cartel (1991-95)

- Prices

- ▶ Agreed to "floor" and "target" prices to be implemented.
- ▶ Five major consumers could be offered a discount of up to 3% off of the list price.
- ▶ No discounts to all other customers.

- Quantities

- ▶ Sales quotas were allocated to each firm and fixed on a worldwide basis.
- ▶ Quotas were based on the average of the previous three years' sales (1988-90).

Allocation of Market Shares

| Company | Market Share |
|----------------------|--------------|
| Haarman & Reimer | 32.0% |
| ADM | 26.3% |
| Jungbunzlauer | 23.0% |
| Hoffman LaRoche | 13.7% |
| Cerestar Bioproducts | 5.0% |

Imperfect Monitoring: Sales

Citric acid cartel (1991-95)

- Monitoring of volume agreement
 - ▶ Monthly, each company's sales was reported to an executive of Hoffmann-La Roche.
 - ▶ Data was assembled and then reported back to the members by telephone.
 - ▶ Annual checking by independent Swiss auditors.
 - ▶ Actual production by each member adhered very closely to the cartel's planned production.
- Enforcement
 - ▶ Buy-back system: If a company went over its assigned quota in any one year, it would be obliged to purchase product from the companies with sales below their quota during the following year.
 - ▶ At the meeting on 14 November 1991 in Brussels, it was determined that Haarmann & Reimer needed to buy 7,000 tons of citric acid from ADM.

Imperfect Monitoring: Sales

Summary of cartel case studies

- Demand is largely from industrial buyers.
- Price is set bilaterally between seller and buyer and is generally not public information.
- Collusive agreement is monitored in terms of sales compared to quotas.
- Source: Harrington (*How Do Cartels Operate?*, 2006)

Imperfect Monitoring: Sales

Harrington and Skrzypacz (*RAND Journal of Economics*, 2007)

- Two firms make simultaneous price decisions in each period.
- A firm incurs a cost of c to produce one unit.
- Demand
 - ▶ Market demand is fixed.
 - ▶ A firm's demand (or market share) is stochastic.
 - ▶ A firm's expected demand is decreasing in its price and increasing in its rival's price.
- Information structure
 - ▶ Each firm's price is not observed by its rival.
 - ▶ Firms' sales are publicly observed.

Imperfect Monitoring: Sales

Collusion: Symmetric Punishments

Result The threat of a price war is ineffective at supporting collusion.

- Consider a strategy profile in which there is a "price war" if either firm has a market share exceeding some threshold, $\hat{s} > 1/2$.
- If firm 1 undercuts the collusive price,
 - ▶ it *increases* the probability that firm 1's market share exceeds \hat{s} which makes a price war *more* likely.
 - ▶ it *decreases* the probability that firm 2's market share exceeds \hat{s} which makes a price war *less* likely.
- These offsetting effects cancel each other out so a firm's price does not impact the probability of a price war.
- A firm then cheats as there is no future profit loss \Rightarrow collusive agreement is not stable.

Imperfect Monitoring: Sales

Collusion : Asymmetric Punishments

- Two-tier punishment.
- Penalties for overproduction sustain higher prices.
 - ▶ A firm makes a payment of z to its rival for each unit it sells.
 - ▶ If a firm expects to transfer z euros to the other firm for each unit it sells, it will price higher because its marginal cost is effectively $c + z$.
 - ▶ Transfers can be consummated through inter-firm sales.
- Threat of collapse of collusion ("price war")
 - ▶ If firms do not honor the compensation scheme then collusion collapses.
 - ▶ Firms then find it optimal to make these transfers.
- If firms are sufficiently patient, this collusive agreement is an equilibrium.

Imperfect Monitoring: Sales

Harrington and Skrzypacz (*American Economic Review*, 2011)

- Assume sales are not public information and firms must self-report (as in citric acid, lysine, vitamins)
- Stable collusion requires that firms find it optimal to
 - ① set the collusive price
 - ② truthfully report sales (which proves to be the binding condition)
 - ③ make transfers
- How is a firm induced to report it has high sales?
 - ▶ Price war is made more likely when the aggregate sales report is lower.
 - ▶ A firm that reports higher sales makes a higher transfer but then it reduces the chances of a price war.

Imperfect Monitoring: Sales

Communication is a critical component of cartels

Frequency of Meetings
(Source: European Commission Decisions)

| Market | Monitoring | Allocation |
|-------------------|------------|------------|
| Choline chloride | 2-3 weeks | 6 months |
| Zinc phosphate | monthly | 3 months |
| Citric acid | monthly | 6 months |
| Organic peroxides | 3 months | 3-6 months |
| Sorbates | 6 months | 6 months |

Imperfect Monitoring: Sales

- Private monitoring setting
 - ▶ Firms' prices and sales are private information.
 - ▶ Sales are stochastic due to unobserved demand shocks.
 - ▶ Consider equilibria with and without a communication (cheap talk) phase.
 - ▶ Cheap talk can be used to share sales data (Do firms have the incentive to provide accurate reports?)
- Questions
 - ▶ When is profit higher by communicating?
 - ▶ What types of communication schemes are effective?
 - ▶ What is the optimal frequency of information sharing (meetings)?

Imperfect Monitoring: Sales

Spector (working paper, 2015)

- Firms learn their own sales at a high frequency (e.g., monthly)
 - ▶ If firms use these signals to provide incentives, there are inefficiencies due to the noise.
 - ▶ Punishment is quick but is used too inappropriately.
- Firms learn all firms' actual sales at a low frequency (e.g., annually)
 - ▶ If firms use these signals to provide incentives, inefficiencies are reduced because of less noise.
 - ▶ Punishment is delayed.
- If firms share those private signals through cheap talk messages then they can have precise public signals at high frequency.
 - ▶ Messages are truthful because the truth will be revealed in the future and it can be harshly punished at no cost (perfect monitoring)

Result Firms can more effectively collude by sharing their private sales information.

Firm Asymmetries

Firm Asymmetries

Overview

- ① Types of firm asymmetries
- ② What is the impact of firm asymmetries on the incentives to collude and the collusive outcome?
- ③ In practice, how does the collusive outcome depend on firm traits?

Firm Asymmetries

Types of firm asymmetries

- Cost
- Capacity
- Historical market share
- Product traits
 - ▶ Petrol - location of a station
- Product line
 - ▶ Petrol - ownership of multiple stations
 - ▶ Vitamins cartel
 - ★ 12 vitamin markets with 11 firms
 - ★ Hoffman LaRoche was in all 12 markets, BASF was in 10, Takeda was in 5, the other firms were in 3 or less

Firm Asymmetries

Ability to collude

- Impact on the set of feasible collusive outcomes
 - ▶ Cartel stability requires inducing compliance from the firm with the strongest propensity to cheat.
 - ▶ May require redistributing cartel profit.
 - ▶ May require having a firm remain outside of the cartel.
- Impact on the selected collusive outcome.
 - ▶ Lower cost firms want a lower collusive price.
 - ▶ Firms with more capacity want a bigger market share.
- How can cartel profit be "redistributed" to induce compliance by all firms?
 - ▶ Market allocation (e.g., sales quotas)
 - ▶ Firms charge different prices (with more sales and profit going to the lower priced firms)
 - ▶ Monetary transfers (e.g., inter-firm sales)

Firm Asymmetries

Ability to collude: Different discount factors

- δ_i is the discount factor of firm i and is the weight given to future profit.
- n firms with different discount factors:

$$0 < \delta_1 < \delta_2 < \dots < \delta_n < 1.$$

Firm 1 is the "least cooperative" and firm n is the "most cooperative."

- Firms have homogeneous products and a common cost of c .
- Market demand at a price of p is $100 - p$.
- If all firms charge a price of p and firm i has market share s_i then its profit is

$$(p - c) \times (100 - p) \times s_i.$$

Firm Asymmetries

Ability to collude: Different discount factors

- Collusive strategy of firm i :

- ▶ Price at \hat{p} and sell market share of \hat{s}_i .
- ▶ If any firm deviates from \hat{p} than all firms price at c .

- Collusive agreement is stable if, for all firms,

$$\begin{aligned} & (\hat{p} - c) (100 - \hat{p}) \hat{s}_i + \delta_i (\hat{p} - c) (100 - \hat{p}) \hat{s}_i \\ & + \delta_i^2 (\hat{p} - c) (100 - \hat{p}) \hat{s}_i + \dots \\ & \geq (\hat{p} - c) (100 - \hat{p}) \end{aligned}$$

$$\begin{aligned} \left(\frac{1}{1 - \delta_i} \right) (\hat{p} - c) \hat{s}_i (100 - \hat{p}) & \geq (\hat{p} - c) (100 - \hat{p}) \\ \hat{s}_i & \geq 1 - \delta_i \end{aligned}$$

- Each firm's market share must be sufficiently large, and it is must be larger when the firm is "less cooperative."

Firm Asymmetries

Ability to collude: Different discount factors

Harrington (*International Journal of Industrial Organization*, 1989)

- Suppose the cartel cannot control each firm's market share: $\hat{s}_i = 1/n$.
 - ▶ Condition for cartel stability is

$$\frac{1}{n} \geq 1 - \delta_i \text{ or } \delta_i \geq \frac{n-1}{n} \text{ for all } i.$$

- ▶ The discount factor of all firms must be at least $\frac{n-1}{n}$.
- Suppose the cartel can control each firm's market share
 - ▶ Condition for cartel stability is

$$\left(\frac{1}{n}\right) (\delta_1 + \delta_2 + \dots + \delta_n) \geq \frac{n-1}{n}.$$

The average discount factor must be at least $\frac{n-1}{n}$.

- ▶ Firms that are more cooperative give up market share to firms that are less cooperative.

Firm Asymmetries

Ability to collude: Different discount factors

- Example: $n = 2$, $\delta_1 = .4$, $\delta_2 = .8$.
- If firms could not reallocate market share then collusion is not sustainable because of firm 1.
- If firms can reallocate market share then collusion is sustainable as long as

$$s_1 \geq .6 \text{ and } s_2 \geq .2, \text{ or } .8 \geq s_1 \geq .6$$

- If firm 2 gives firm 1 an additional 10% of the market (so that $s_1 = .6$) then collusion is sustainable.

Firm Asymmetries

Ability to collude: Different capacities

Bos and Harrington (*RAND Journal of Economics*, 2010)

- n firms produce identical products at a common and constant marginal cost.
- Each firm is endowed with a capacity which limits how much it can produce.
- Capacities differ across firms.
- Non-collusive outcome
 - ▶ Each firm prices at cost.
 - ▶ Firms have excess capacity.

Firm Asymmetries

Ability to collude: Different capacities

- Cartel is composed of m firms, where $2 \leq m \leq n$.
- Pricing
 - ▶ m colluding firms set the collusive price.
 - ▶ $n - m$ non-colluding firms (optimally) undercut the collusive price.
- Sales
 - ▶ A colluding firm's share of collusive supply equals its share of collusive capacity; each of them produces below its capacity.
 - ▶ Non-colluding firm has excess demand and produces at capacity.

Firm Asymmetries

Ability to collude: Different capacities

- Each firm individually decides whether or not to join the cartel.
- Open membership
 - ▶ A non-colluding firm produces at capacity, while it produces below capacity as a colluding firm \Rightarrow lower supply benefits colluding firms.
 - ▶ Colluding firms always want to include another firm as then more capacity is controlled by the cartel.
- Trade-off faced by a firm in deciding whether to join the cartel.
 - ▶ More capacity is brought under the control of the cartel, which leads to a higher collusive price.
 - ▶ Collusion requires constraining supply as a firm produces below its capacity.
 - ▶ In sum, a firm realizes a higher price but lower sales by becoming a cartel member.

Firm Asymmetries

Ability to collude: Different capacities

- Who colludes?

- ▶ Firms with large capacity join the cartel - rise in collusive price is large.
- ▶ Firms with small capacity do not join the cartel - rise in collusive price is small, reduction in supply is not.
- ▶ Firms with moderate capacity may or may not join the cartel.

- Firm asymmetries can then affect

- ▶ whether firms are able to collude
- ▶ the collusive outcome in the event they can collude
- ▶ which firms are members of the cartel.

Firm Asymmetries

Ability to collude

- Many cartels are not all inclusive.
- Global citric acid cartel
 - ▶ Controlled 60% of global production
 - ▶ Controlled 67% of EU production
- European industrial tubes cartel
 - ▶ Controlled 75-85% of total production.
 - ▶ Excluded at least two significant producers.

Firm Asymmetries

Practices: Market allocation

- Historical market share
 - ▶ Organic peroxides cartel set sales quotas for 1971 based on sales over 1969-70.
 - ▶ Citric acid cartel set sales quotas for 1991 based on sales over 1988-90.
- Caveat to historical market share: new capacity
 - ▶ Choline chloride cartel
 - ★ Chinook built a new plant and demanded an increase in its allocation.
 - ★ Unsatisfied with its new allocation, Chinook left the cartel.
 - ▶ Case of Archer Daniels Midland in the lysine cartel
 - ★ ADM upset a pre-existing cartel by entering the market with a large low cost production facility.
 - ★ ADM priced aggressively and grew its global market share to around 33%.
 - ★ ADM then approached the other suppliers and suggested forming a cartel with ADM's market share allocation equal to 33%.
 - ★ ADM settled on an allocation of 26%.

Firm Asymmetries

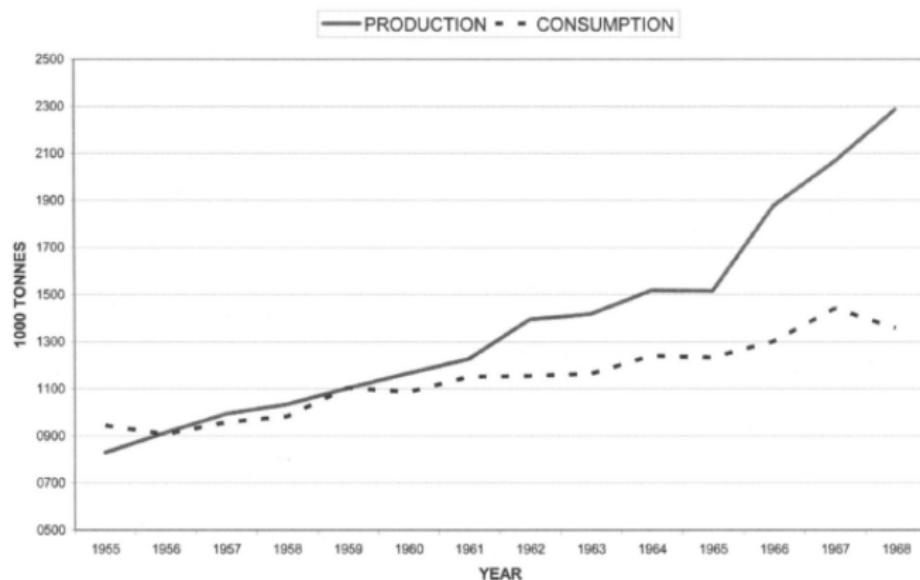
Practices: Market allocation

Röller and Steen (*American Economic Review*, 2006)

- Norwegian cement industry: Three cement manufacturers cartelized over 1923-68.
- Collusive practices
 - ▶ Common sales office determined domestic cement supply to (presumably) maximize industry profit.
 - ▶ Domestic supply was allocated across the three manufacturers according to a member's share of capacity.
 - ▶ Any excess supply was sold in the world market.
- Over-investment in capacity
 - ▶ Each additional unit of capacity
 - ★ produced one more unit to be sold on the world market (assuming capacity > domestic demand)
 - ★ increased a firm's domestic sales by increasing its share of domestic demand
 - ▶ Production increasingly exceeded domestic demand.

Firm Asymmetries

Practices: Market allocation



Firm Asymmetries

Practices: Market allocation

- Procurement contracts
 - ▶ Road maintenance
 - ▶ School milk
- Allocation schemes
 - ▶ Bid rotation across time (when few contracts are up for bid simultaneously)
 - ▶ Allocation of contracts (when many contracts are up for bid simultaneously)
 - ▶ Monetary transfers

Firm Asymmetries

Practices: Market allocation

- Efficient collusive mechanism

- ▶ Suppose cost differs across time and across firms.
- ▶ Cartel profit is maximized by having the firm with the lowest cost win the contract.
- ▶ Scheme has cartel members reveal their costs and then only the lowest cost firm bids for the contract (or the other firms submit higher bids to ensure they lose).

- Incentive problems

- ▶ If a firm is less efficient on average, it might not win enough contracts to find participation optimal. It might then deviate by undercutting the designated winner's bid.
- ▶ If side payments are not allowed then less efficient firms will need to win some of the time, which reduces cartel profit.
- ▶ If side payments are allowed then the most efficient firm always wins and "buys off" the other firms.

Firm Asymmetries

Practices: Market allocation

Pesendorfer (*Review of Economic Studies*, 2000)

- School milk cartel
- Bidding procedure is a first price sealed bid auction with the lowest bidder winning the contract.
- Hundreds of contracts allow for many allocations to be implemented.
- Data: 1980-91 - Florida and Dallas-Fort Worth, Texas
- Legal evidence of side payments in Florida, but not in Texas.
- With side payments, the predicted variance of contracts for a firm is larger.
 - ▶ Variance of contracts for a firm in Florida exceeds that for Texas.
 - ▶ % of contracts won by the incumbent bidder
 - ★ 79% in Texas
 - ★ 41% in Florida

Firm Asymmetries

Practices: Price

Clark and Houde (*American Economic Journal: Microeconomics*, 2013)

- Cartel among petrol stations in Victoriaville and Thetford Mines in Quebec province of Canada, 2005-06

| Firm | Characteristic | Number of Stations | |
|----------------|-----------------------|--------------------|---------------|
| | | Thetford Mines | Victoriaville |
| Bilodeau-Shell | Cartel Organizer | 4 | 4 |
| Canadian Tire | Hardware store | 0 | 1 |
| Couche-Tard | Convenience store | 2 | 3 |
| Maxi | Grocery store | 0 | 1 |
| Petro-T | Wholesaler | 2 | 1 |
| Ultramar | Vertically integrated | 3 | 2 |
| Other | Independent | 12 | 12 |
| Total | | 23 | 25 |

Firm Asymmetries

Practices: Price

Firm asymmetries:

- Network size: # of stations controlled by a firm.
- Station size - # of pumps, volume of petrol pumped
- Cost of petrol
 - ▶ Ultramar is vertically integrated with its own refinery.
 - ▶ Larger firms may have negotiated lower wholesale prices.
- Selling complementary products which may make petrol a loss-leader
 - ▶ Canadian Tire (hardware chain) and Loblaws (supermarket chain)
 - ▶ Couche-Tard (chain of convenience stores)

Firm Asymmetries

Practices: Price

Table 3: Summary statistics on the characteristics of stations in the three markets between 2001 and 2006

| VARIABLES | Sherbrooke | | | Thetford-Mines | | | Victoriaville | | |
|--------------|------------|------|-------|----------------|------|------|---------------|------|-------|
| | Mean | S.D. | Max | Mean | S.D. | Max | Mean | S.D. | Max |
| Volume | 6.53 | 3.51 | 19.74 | 4.27 | 1.85 | 8.96 | 5.83 | 4.03 | 21.35 |
| Share | 0.02 | 0.01 | 0.06 | 0.09 | 0.04 | 0.22 | 0.05 | 0.03 | 0.18 |
| Nb. Pumps | 10.39 | 6.94 | 32 | 6.48 | 3.06 | 12 | 8.07 | 4.19 | 18 |
| Nb. Islands | 2.40 | 1.15 | 6 | 1.96 | 1.01 | 5 | 1.97 | 0.88 | 6 |
| Conv. Store | 0.51 | 0.50 | 1 | 0.41 | 0.49 | 1 | 0.64 | 0.48 | 1 |
| Self service | 0.54 | 0.50 | 1 | 0.49 | 0.50 | 1 | 0.25 | 0.43 | 1 |
| Carwash | 0.22 | 0.41 | 1 | 0.10 | 0.30 | 1 | 0.16 | 0.36 | 1 |
| 24 Hours | 0.31 | 0.46 | 1 | 0.08 | 0.27 | 1 | 0.21 | 0.40 | 1 |
| Major brand | 0.75 | 0.43 | 1 | 0.82 | 0.39 | 1 | 0.47 | 0.50 | 1 |

Volume is measured in thousands of liter per day. Conv. Store is an indicator variable equal to one if the station has a large convenience-store. Major brand is an indicator variable equal to one if the station sells branded gasoline (i.e. Esso, Petro-Canada, Shell, Irving, or Ultramar).

Firm Asymmetries

Practices: Price

- Possible effects of heterogeneity on collusion
 - ▶ Different preferences over price: Firms with lower cost and that sell complementary products want a lower collusive price.
 - ▶ Different incentives to cheat: A firm with fewer stations will gain more by undercutting price as there is less cannibalization of other stations.
- How to give a bigger share of cartel profits to firms with a stronger incentive to cheat?
 - ▶ Market allocation will not work as market share is a function of store amenities and locations, and not directly controlled by firms.
 - ▶ Price differences: allow less cooperative firms to charge a lower price
 - ★ Permanently lower price could be difficult to control as station demand is so elastic (estimated to be around -10 to -15).
 - ★ Periodic sales
 - ★ Delay in implementing price increases

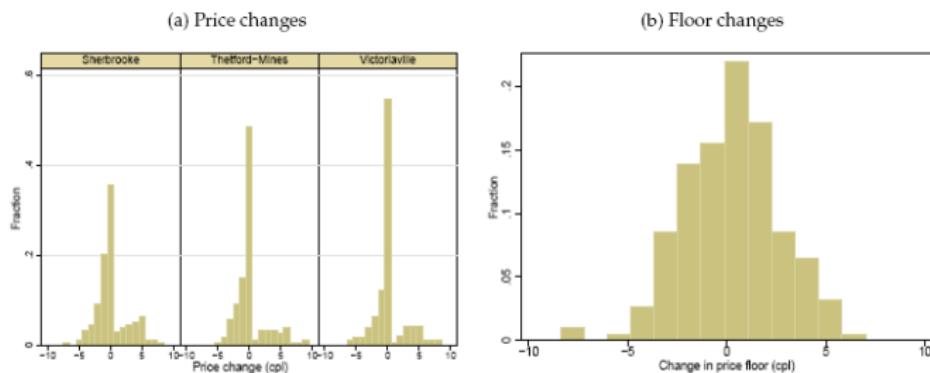
Firm Asymmetries

Practices: Price

Price patterns ("rockets and feathers")

- Price increases are large and infrequent.
- Price decreases are small and more common.
- Long periods of no price change
- In response to rising cost, price is held fixed until, at some point, price is subject to a large increase.

Figure 2: Distribution of price and cost changes in the three markets



Firm Asymmetries

Practices: Price

Coordinated order of play for which price increases were enacted.

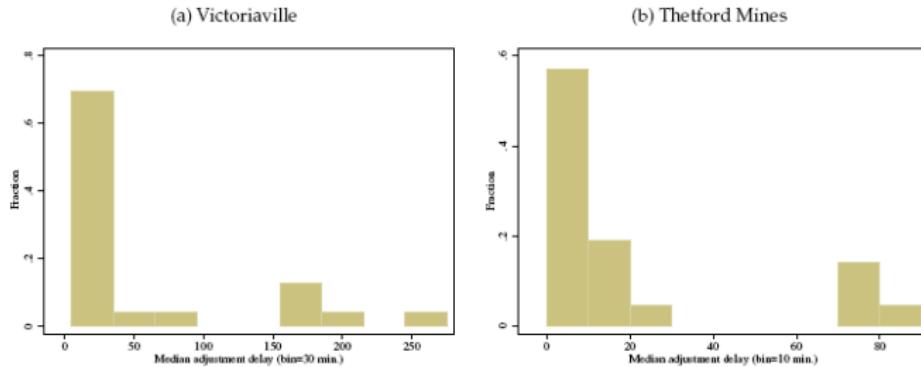
- Communication protocol
 - ▶ Price increases are initiated by the cartel leader.
 - ▶ Cartel leader contacts and negotiates with a subset of firms.
 - ▶ Once a price is agreed upon, the cartel leader communicates with the low-cost stations, who may negotiate a smaller price rise.
 - ▶ Communications go on for 1-2 hours prior to price being increased.
- Extent of communication
 - ▶ Implementation of a price increase required, on average, 65 phone calls.
 - ▶ Implementation of a price decrease required, on average, 27 phone calls. Many occurred after some station had already lowered price and served to inform other firms of the price decrease.

Firm Asymmetries

Practices: Price

- Cartel leader raises price.
- On average, 13 (30) minutes later a group of "follower" stations enacted it in Thetford Mines (Victoriaville).
- On average, 66 (145) minutes later low-cost stations enacted it in Thetford Mines (Victoriaville).

Figure 4: Distribution of median price adjustment delays during successful price increase episodes



Firm Asymmetries

Practices: Price

Is this coordinated order of play a scheme to maintain cartel stability?

- Two hour delay is estimated to increase daily sales by 25-50%.
- How much additional profit this delivers depends on the frequency of price increases.
- Is the additional profit "commensurate" with the extent of firm heterogeneity?

Some Underexplored Collusive Practices

Some Underexplored Collusive Practices

- Practices

- ▶ Collusion in surcharges but not total price
- ▶ Collusion in list prices, not transaction prices
- ▶ Price signalling: Advance price announcements serve to coordinate on price
- ▶ Hub and spoke: Upstream (downstream) firm orchestrates collusion among downstream (upstream) firms

- Questions

- ▶ How does collusion work?
- ▶ What market conditions are conducive to collusion with these practices?

Some Underexplored Collusive Practices

Surcharges

Price-fixing has occurred or been suspected in several transportation markets in which firms coordinated on a common surcharge

- Fuel surcharge - Air freight (global), 2000-06
 - ▶ Over 40 air cargo companies
 - ▶ Damages > \$1.2 billion
- Fuel surcharge - Air passenger (U.K.), 2004-06
 - ▶ Virgin Atlantic admitted to colluding with British Airways.
- Fuel surcharge - Rail freight (U.S.), 2003-07
 - ▶ On-going private litigation against four rail companies, with guilt not yet determined
- Lead surcharge - Batteries (Belgium), 2004-11
 - ▶ Six battery manufacturers found guilty

Some Underexplored Collusive Practices

Surcharges

- Air freight
 - ▶ Surcharge was per kilogram; independent of origin, destination, and distance
 - ▶ British Airways increased fuel surcharge from 4 cents/kilogram to 72 cents/kilogram
- Air passenger
 - ▶ Surcharge was per ticket
 - ▶ For a transatlantic round-trip, it rose from \$10/ticket in 2004 to \$110/ticket in 2006
- Rail freight
 - ▶ Dec 2003: Association of American Railroads announced a new cost index that excluded fuel costs.
 - ▶ Surcharge was a % of the rail freight transport base rate.
 - ▶ Surcharges increased 55% more than the rise in fuel costs

Some Underexplored Collusive Practices

Surcharges

How can collusion in one (arbitrary) component of price be effective? How was it monitored?

- Why couldn't an air cargo company reduce its base rate in order to get more business?
 - ▶ Could they monitor sales?
- Why couldn't BA and VA cut its base rate by 50% of the surcharge? With many flights and many pricing schemes, it would be difficult to detect.
 - ▶ Could they monitor it in terms of average fare?

Some Underexplored Collusive Practices

Surcharges

How can collusion be effective when firms coordinate on only one component of price?

- Bargaining (air cargo, rail freight)
 - ▶ A firm-specific fuel surcharge may not be credible to buyers.
 - ▶ A **common** fuel surcharge may credibly signal a component to cost that buyers accept as non-negotiable.
 - ▶ This could result in higher prices emerging through bargaining.
- Internal organization - collusion is typically among high-level executives, while final prices are set by lower-level employees.
 - ▶ Pricing complexity (passenger airline) - With complicated pricing formulas, could it be difficult to adjust prices to offset a surcharge?
 - ▶ Delegation - Is it difficult (or would it create suspicions) to instruct personnel not to treat a surcharge as "true" cost?

Some Underexplored Collusive Practices

List prices

Consider an intermediate goods markets in which firms announce list prices and routinely offer privately-negotiated discounts.

- Collusion in such markets often involves
 - ▶ coordination on transaction prices
 - ▶ market allocation in terms of sales, territories, or customers
 - ▶ monitoring of sales or customers
- But there are cases in which colluding firms
 - ▶ coordinate on list prices
 - ▶ do not coordinate on discounts
 - ▶ do not monitor sales.

Some Underexplored Collusive Practices

List prices

Reserve Supply v. Owens-Corning Fiberglas (7th Circuit, 1992)

[Plaintiff] Reserve asserts that [list prices] have no independent value because no buyer in the industry pays list price for insulation. Instead, it claims that the price lists are an easy means for producers to communicate and monitor ... by providing a common starting point for the application of percentage discounts. ...

[Defendants] Owens- Corning and CertainTeed counter by arguing that the use of list prices to monitor pricing would not be possible because the widespread use of discounts in the industry ensures that list prices do not reflect the actual price that a purchaser pays.

Some Underexplored Collusive Practices

List prices

Reserve Supply v. Owens-Corning Fiberglas (7th Circuit, 1992)

The 7th Circuit Court expressed skepticism with regards to the plaintiffs' claim:

[T]he industry practice of maintaining price lists and announcing price increases in advance ... would be ... an awkward facilitator of price collusion because the industry practice of providing discounts to individual customers ensured that list price did not reflect the actual transaction price.

Some Underexplored Collusive Practices

List prices

In Re: Urethane Antitrust Litigation (10th Circuit, 2014)

Plaintiffs claimed:

[T]hroughout the alleged conspiracy period, the alleged conspirators announced identical price increases simultaneously or within a very short time period. ... [P]urchasers could negotiate down from the increased price. But the increase formed the baseline for negotiations.

Some Underexplored Collusive Practices

List prices

In Re: Urethane Antitrust Litigation (10th Circuit, 2014)

10th Circuit Court quoted the District Court in supporting this assessment:

The court reasoned that the industry's standardized pricing structure - reflected in product price lists and parallel price-increase announcements - "presumably established an artificially inflated baseline" for negotiations. Consequently, any impact resulting from a price-fixing conspiracy would have permeated all polyurethane transactions, causing market-wide impact despite individualized negotiations.

Some Underexplored Collusive Practices

List prices

Cement (United Kingdom, 2016)

- Annually, suppliers sent letters to their customers announcing price increases.
- Prices were individually negotiated so the full price increase was rarely implemented.
- Competition and Markets Authority stated that "price announcement letters served to coordinate on list prices and soften customer resistance to price increases."
- Justin Coombs (Compass Lexecon): *How do price announcements help firms coordinate on prices if prices are ultimately individually negotiated?*

Some Underexplored Collusive Practices

List prices

Harrington and Ye (working paper, 2017)

- When are list prices informative of transaction prices?
 - ▶ Suppose list price is set for the quarter based on a firm's expected cost.
 - ▶ Suppose final price is set for a customer based on cost at that time.
- Trade-off from setting a low list price *when it signals low expected cost*
 - ▶ Attracts more buyers to negotiate with it ("inclusion" effect).
 - ▶ Induces buyers to negotiate more aggressively ("bargaining" effect).
- Equilibrium can exist so that list prices are informative of a firm's expected cost and thus can impact expected final prices.
 - ▶ Only a firm with low expected cost is willing to have buyers bargain more aggressively in exchange for having more buyers.

Some Underexplored Collusive Practices

List prices

- Suppose sellers can be competing or colluding.
 - ▶ Under competition, a seller posts a low (high) price when it is a low (high) cost type (separating)
 - ▶ Under collusion, a seller always posts a high list price (pooling)
- Assume buyers are uncertain about whether sellers are competing.
- By coordinating on high list prices, sellers cause buyers to assign a higher probability that sellers are high cost types.
- Collusion results in higher final prices
 - ▶ even though sellers do not coordinate on final prices
 - ▶ because buyers bargain less aggressively.

Some Underexplored Collusive Practices

Price signalling

- Advance price announcements may "reduce strategic uncertainty" and thereby promote coordination on higher prices
 - ▶ A firm announces a future price increase through some public medium
 - ▶ If rivals respond with similar announcements then proposed price increases are implemented.
 - ▶ If rivals do not respond in kind then the initial firm retracts the proposed price increase before any transactions occur
- Advance price announcements can have an efficiency benefit
 - ▶ Consumers may benefit from knowing what future prices might be
 - ▶ But these are only intentions and actual future prices could be different.
- Policy challenge: *How do we distinguish between announcements intended to inform consumers and announcements intended to coordinate with other firms?*

Some Underexplored Collusive Practices

Price signalling

European Commission - Container liner shipping (16 February 2016)

- Since 2009, 15 container liner shipping companies regularly publicly announced their future General Rate Increase of freight prices
 - ▶ GRI announcements are made typically 3-5 weeks before their intended implementation date.
 - ▶ Some or all of the other carriers typically responded by announcing similar intended rate increases.
 - ▶ Sometimes, announced GRIs were modified by some carriers, possibly aligning them with the GRIs announced by other carriers.
- EC: "this practice may allow the companies to signal future price intentions to each other and may harm competition and customers by raising prices."

Some Underexplored Collusive Practices

Price signalling

European Commission - Container liner shipping (16 February 2016)

- Carriers agreed to the following for a period of three years:
 - ▶ Stop publishing and communicating GRIs (i.e., price changes expressed solely as an amount or percentage of the change)
 - ▶ Price announcements will be binding as maximum prices for the announced period of validity.
 - ▶ Price announcements will not be made more than 31 days before their entry into force.

Some Underexplored Collusive Practices

Price signalling

- Australia (2012): Implemented policy - It is illegal for banks to
 - ▶ disclose prices to competitors in private where doing so is not in the ordinary course of business (per se prohibition)
 - ▶ disclose information (in public or private) for the purpose of substantially lessening competition in a market (general prohibition)
- Israel (2014 - proposed): Firms will be prohibited from public statements when
 - ▶ they influence the business conduct of another competitor as part of an agreement.
 - ▶ the information delivered is clear and accurate enough so as to promote collusion.

Some Underexplored Collusive Practices

Price signalling

- Policy issues

- ▶ Is the prohibition clear enough to firms? Will firms know when they are violating the law?
- ▶ How does one take account of the potential value for consumers?

- Theoretical issues

- ▶ Derive market conditions for which
 - ★ public announcements will have little value to consumers so the efficiency benefit can be dismissed
 - ★ collusive equilibria exist
- ▶ Multiple audience cheap talk model where a firm may be communicating with other firms and/or customers

Some Underexplored Collusive Practices

Capacity discipline

Steel producers (U.S. private litigation, on-going)

- At a series of industry venues, senior executives conveyed a message of curtailing supply and reducing capacity.
 - ▶ Mittal executive: "If we are going to see improved conduct and thus improved performance, it will only be because the consolidation we have undergone encourages a change in behavior to match the industry structure. This means ... a focus on profits rather than on tons ..."
 - ▶ Steel Dynamics CEO: "I've been around the industry for 20 years. And I haven't seen this kind of discipline ... everybody is, to some degree, giving that pint of blood."
- Plaintiffs claim that these public announcements were followed with output reductions and the shuttering of capacity in spite of projections of demand growth.

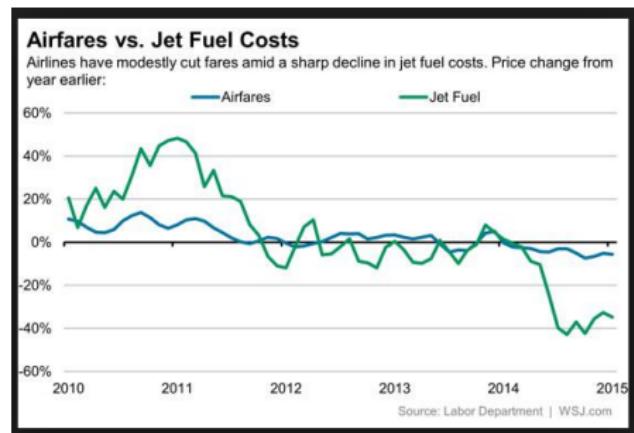
Some Underexplored Collusive Practices

Capacity discipline

Airlines (U.S., 2015)

- 2002-2014: Load factor on U.S. passenger planes to U.S. airports went from 71.78% to 83.43%.
- Fares have not fallen in spite of drastically declining jet fuel prices.

Why has capacity not increased?



Some Underexplored Collusive Practices

Capacity discipline

- July 2015 - U.S. Dept of Justice opened an investigation into collusion among airlines because:
 - ▶ airlines seem to have decided to limit their capacities at roughly the same time.
 - ▶ airline executives have expressed in public statements (such as at investor conferences and trade shows) their commitment to their new business model and the hope that other airlines will adopt it.
 - ★ June 2015 annual meeting of the International Air Transport Association - numerous airlines executives independently endorsed "capacity discipline."
 - ▶ Closed investigation in early 2017 for lack of evidence.
- Private litigation remains active.
- *Should firms be prohibited from commanding/chastising, recommending, or forecasting the conduct of rival firms' conduct?*

Some Underexplored Collusive Practices

Capacity discipline

Aryal, Ciliberto, and Leyden (working paper, 2017)

- When carriers publicly communicate about capacity discipline, does capacity decline?
- Earnings calls are teleconferences in which a publicly traded company discusses its performance and future expectations with financial analysts and news reporters.
- Collected transcripts of these calls for 11 airlines from 2002:Q4 to 2016:Q4.
- Used natural language processing techniques and manual review to identify a list of words or phrases that are potentially indicative of managers communicating their intention to cooperate with others in restricting their capacity.

Some Underexplored Collusive Practices

Capacity discipline

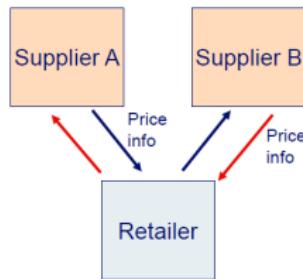
- Example: US Airways 2012:Q1 earnings call from CFO: "passenger revenue was ... up 11.4% as a result of the strong pricing environment and continued industry capacity discipline."
- Legacy airlines "communicated" when all of those that serve a non-monopoly market use "capacity discipline" phrases in the same quarter (8.7% of observations)
- When all legacy carriers (which excludes low-cost carriers) operating in an airport-pair market communicated, the average number of seats offered in those markets
 - ▶ decreased by 1.45% in the next quarter (note: average quarterly change in capacity is 3.78%)
 - ▶ decreased by 4.21% in smaller markets

Some Underexplored Collusive Practices

Hub and spoke

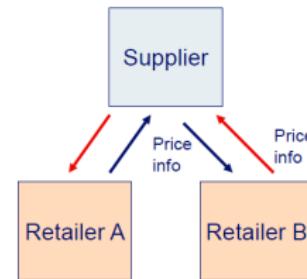
- Consider upstream firms (e.g., manufacturer) and downstream firms (e.g., retailers)
- Hub and spoke collusion is when competitors at one level collude by communicating and coordinating through a firm at another level. Competitors do not directly communicate.

Supplier to Retailer to Supplier



Toys "R" Us (FTC, 1998)

Retailer to Supplier to Retailer



Hasbro (OFT, 2003)

Source - M. Bennett, Office of Fair Trading, Dec 2010

Some Underexplored Collusive Practices

Hub and spoke

Toys "R" Us (U.S. Federal Trade Commission, 1998) - retailer as hub, manufacturers as spokes

- Toys R Us coordinated a boycott among manufacturers of certain toys to low-priced warehouse club stores.
- If a manufacturer sold a toy to Toys R Us than it could not sell it to clubs.
- Objective was for Toys R Us to have exclusivity over certain toys so that it would not be competing with the clubs.
- A manufacturer was concerned that other manufacturers may supply the discount retailers.
- Toys R Us entered into a vertical agreement with each manufacturer with assurances that other manufacturers would have the same contractual obligation: "We communicated to our vendors that we were communicating with all of our key suppliers, and we did that ... at Toy Fair 1992."

Some Underexplored Collusive Practices

Hub and spoke

Hasbro (UK Office of Fair Trading, 2003) - manufacturer as hub, retailers as spokes

- Toy manufacturer Hasbro organized a price-fixing agreement between retailers Argos and Littlewoods with respect to Hasbro's products.
- Starting in 1999, Hasbro introduced two initiatives:
 - ▶ "pricing initiative" - increase retail margins by persuading retailers to charge a recommended retail price (RRP)
 - ▶ "listing initiative" - offered rebates in return for the listing of certain Hasbro products where they were threatened to be delisted
- Monitoring: account managers were to undertake audits of toy retailers to ensure pricing at RRP.
- Coordination
 - ▶ Hasbro assured each retailer that the other retailers would go along
 - ▶ Information about retailers' pricing intentions went through Hasbro; no evidence of direct communication between retailers

Some Underexplored Collusive Practices

Hub and spoke

Challenges to a theory of hub and spoke collusion

- ① How can an upstream firms earn higher profit when downstream firms collude?
- ② How can an upstream firm assist downstream firms in colluding?

Some Underexplored Collusive Practices

Hub and spoke

In re Mid-Atlantic Toyota Antitrust Litigation (1983)

- Hub: Mid-Atlantic Toyota (MAT) was a wholesale distributor of cars
- Spokes: Toyota dealers that bought cars from MAT
- Collusive outcome
 - ▶ MAT coordinated retailers to buy and install sealant products (e.g., rustproof shielding and undercoating) from MAT at \$113 per car (MAT cost = \$78)
 - ▶ Dealers would raise the suggested retail price by \$533.00 and have \$420.00 ($= 533 - 113$) of "bargaining room". If buyers pay more than \$113 (and demand is not too price-elastic) then dealers' profits increase.
- Evidence
 - ▶ Consumers paid, on average, between \$172 and \$249 more per car
 - ▶ Dealers' average profit per car increased by \$136
 - ▶ MAT's profit increased by $\$35 \times (\# \text{ of sealant products sold})$

Facilitating Practices

Facilitating Practices

- A *facilitating practice* is an activity that makes it easier for firms to collude which means it either helps them
 - ▶ coordinate on a collusive arrangement and/or outcome
 - ▶ stabilize a collusive arrangement by
 - ★ reducing the gains from a deviation
 - ★ improving monitoring for compliance
 - ★ enhancing the ability to punish for deviations
- As typically used by lawyers, it refers to practices that facilitate collusion *in the absence of an explicit agreement.*

Facilitating Practices

- Some facilitating practices
 - ▶ advance notice of price changes
 - ▶ information exchange of current prices, of past prices and sales
 - ▶ base point pricing
 - ▶ posted pricing
 - ▶ resale price maintenance
 - ▶ most favored customer and meet the competition clauses
 - ▶ invitation to collude
 - ▶ product standardization
- Market conditions must be suitable for the existence of a profitable and stable collusive arrangement if a practice is to be facilitating
 - ▶ high concentration
 - ▶ low product differentiation
 - ▶ high entry barriers
 - ▶ excess capacity

Facilitating Practices

- Facilitating practice may be "a factual predicate for the inference of an agreement" (P. Areeda and H. Hovenkamp, *Antitrust Law*, 2010)
 - ▶ *Todd v. Exxon Corp.* (2nd. Cir. 2001) - "Information exchange is an example of a facilitating practice that can help support an inference of a price-fixing agreement."
- Facilitating practice may be prohibited because of its anti-competitive tendencies
 - ▶ *Todd v. Exxon Corp.* (2nd. Cir. 2001) - The violation may "lie in the information exchange itself - as opposed to merely using the information exchange as evidence upon which to infer a price-fixing agreement. This exchange of information is not illegal per se, but can be found unlawful under a rule of reason."

Facilitating Practices

- A practice may be prohibited because it facilitates collusion.
- Evaluation is based on the rule of reason in balancing off anti-competitive effects with any efficiencies.
- Some examples
 - ▶ Price transparency: sharing current prices
 - ▶ Information exchange of past prices and quantities, especially through trade associations
 - ▶ "Post and hold" laws
 - ▶ Product standardization

Facilitating Practices

Price transparency

Petrol stations (Brazil)

- Shortly after the deregulation of fuel retail prices, a regulation was enacted requiring retailers to post their prices on signs that are clearly visible by drivers from the road.
- Increased price transparency has
 - ▶ pro-competitive effects: consumer search is easier
 - ▶ anti-competitive effects: monitoring of compliance with a collusive price is easier



Facilitating Practices

Price transparency

Petrol stations (Brazil)

- Cartel in Florianópolis
 - ▶ Established a committee to drive around the city looking at price signs in order to identify retailers who had not set the collusive price.
 - ▶ When non-compliance was detected, the president of the trade association of gasoline retailers would contact the defecting station owner and try to persuade him to comply.
- Increased price transparency that has the substantive benefit of reducing search costs for consumers should not be prohibited.



Facilitating Practices

Price transparency

Albæk, Møllgaard, and Overgaard (*Journal of Industrial Economics*, 1997)

- Government-mandated price reporting in ready-mixed concrete market (starting in 1993)
 - ▶ Suppliers had to report transaction prices to the Danish competition authority.
 - ▶ Published average price and average of the five lowest prices for the first month of each quarter.
 - ▶ Publication occurred with a three month lag.
- After mandate,
 - ▶ price levels increased by 15-20% in the first year of the publication of prices (cost changes could not explain the price increase)
 - ▶ price variation reduced from as much as 30% from the average price to 2-4%.
- Did enhanced price transparency promote monitoring and thereby collusive pricing?

Facilitating Practices

Price transparency

U.S. v. Container Corporation of America (1969)

- Background

- ▶ Cardboard cartons in southeastern U.S. with 6 firms having 60% of sales.
- ▶ Evidence of excess capacity and falling prices.

- Information sharing agreement

- ▶ Involved 18 companies supplying 90% of sales.
- ▶ No centralized information exchange.
- ▶ Companies informed each other about prices currently or last quoted to particular customers.
- ▶ Prices were subsequently matched by competitors.

Facilitating Practices

Price transparency

U.S. v. Container Corporation of America (1969)

- An agreement to exchange price information was inferred because, absent anticipation of reciprocity, such exchange would not occur.
 - ▶ "[A]ll that was present was a request by each defendant of its competitor for information as to the most recent price charged or quoted ... Each defendant on receiving that request usually furnished the data with the expectation that it would be furnished reciprocal information when it wanted it."
 - ▶ Absent collusion, it is rarely in a firm's best interests to share price information with a competitor, especially in markets for which there could be competitive bidding.
- Such a practice is not *per se* illegal
 - ▶ "I do not believe the agreement [to exchange prices] is so devoid of potential benefit or so inherently harmful that we are justified in condemning it without proof that it was entered into for the purpose of restraining price competition or that it actually had that effect."

Facilitating Practices

Price transparency

U.S. v. Container Corporation of America (1969)

- But a violation was found because it was shown that it had the effect of raising price.
 - ▶ "In this case, the probability that the exchange of specific price information led to an unlawful effect upon prices is buttressed by evidence in the record."
- Supreme Court concluded that the practices violated the Sherman Act.
 - ▶ "[T]he exchange of prices made it possible for individual defendants confidently to name a price equal to that which their competitors were asking. The obvious effect was to stabilize prices by joint arrangement ... I cannot see that we would be justified in reaching any conclusion other than that defendants' tacit agreement to exchange information about current prices to specific customers did in fact substantially limit the amount of price competition."

Facilitating Practices

Information exchange

- What information might firms exchange through a trade association?
 - ▶ Facts and forecasts regarding demand and cost
 - ▶ Historical data: past prices, sales, investment, etc.
 - ▶ Current prices, capacities, etc.
 - ▶ Future plans: prices, investment, etc.
- Why would firms exchange information?
 - ▶ Allows them to make more informed decisions by having better information about demand and cost
 - ▶ Public announcement provides information to consumers which can increase demand
 - ▶ Facilitates collusion

Facilitating Practices

Information exchange

Firms are better able to coordinate on a collusive outcome by

- exchanging future pricing intentions
- exchanging demand and cost data so that firms have a more common set of beliefs (which makes it more likely that, without express communication, they can settle on the same collusive price)
- current prices being more easily observable (enhances price leadership)

Facilitating Practices

Information exchange

- *American Column and Lumber Co. v. U.S. (1921)*

- ▶ Supreme Court found trade association members' exchange of information on sales, production and inventories to be in violation of Section 1.
- ▶ Focused on the exchange of price and output information, particularly, "suggestions as to both future prices and production."
- ▶ "[G]enuine competitors do not make daily, weekly and monthly reports of the minutest details of their business to their rivals"
- ▶ Hardwood prices had increased "to an unprecedented extent."

- *U.S. v. American Linseed Oil Co. (1923)*

- ▶ Supreme Court struck down information exchange program concerning price lists, price variations and the names and addresses of buyers who received special prices.
- ▶ The association kept the information confidential within the membership; customers did not benefit from the information exchange.

Facilitating Practices

Information exchange

- *Maple Flooring Mfrs Ass'n v. U.S. (1925)*
 - ▶ Supreme Court upheld this information exchange program on the grounds that
 - ★ data was aggregated and involved past transactions
 - ★ data was publicly available and was actually read by buyers
 - ★ there was no uniformity in prices
 - ★ shared data had "a useful and legitimate purpose in enabling members to quote promptly a delivered price on their product."
 - ▶ Though detailed information on individual sales and monthly information on production and new orders was collected, only aggregated numbers were disseminated.
- Information exchanges are not a *per se* violation because "such practices can in certain circumstances increase economic efficiency and render markets more, rather than less, competitive." *U.S. v. U.S. Gypsum Co. (1978)*

Facilitating Practices

Information exchange

Firms are better able to monitor compliance with a collusive outcome when past prices and sales are

- common to firms (so firms can coordinate on a punishment)
- learned with shorter lag (as it reduces the time between a deviation and a punishment)
- more accurate and disaggregated
 - ▶ Expands the set of allocation schemes
 - ▶ More effective monitoring

Facilitating Practices

Information exchange

- Aggregating sales data from firm to market level makes it more difficult to
 - ▶ implement the common collusive practice of setting sales quotas with monitoring of individual firm sales.
 - ▶ implement firm-specific punishments such as inter-firm sales and targeted low prices.
- Carlton, Gertner, and Rosenfield (1997): "... aggregating the data largely removes the value of information in facilitating collusion."
 - ▶ No theoretical justification for this claim.
 - ▶ If there are two firms then no information is lost with aggregation.
- *Does the aggregation of firms sales to the industry level make the information ineffective for sustaining collusion?*

Facilitating Practices

Information exchange

Some cartels chose to aggregate sales and were able to collude.

- Plasterboard and copper plumbing tubes (EC) reported their individual data to an intermediary which then returned only aggregate statistics.
- Cement (South Africa) - Firms submitted monthly sales data to Deloitte which aggregated the data and disseminated it to firms.
- Isostatic graphite cartel (EC) used "pass the calculator" to share only industry sales.

Recent economic theory shows that industry sales can be sufficient (and might actually be preferable)

Facilitating Practices

Information exchange

Sugaya and Wolitsky (working paper, 2016)

- Sharing individual firm sales can affect collusion through
 - ① monitoring: more information makes it easier to detect deviations
 - ② collusive conduct: more information helps the cartel tailor collusive prices to current market conditions
 - ③ *deviation conduct: more information helps individual firms tailor deviations to current market conditions*

Facilitating Practices

Information exchange

- Consider cartels that use the "home market principle": each cartel member is the exclusive supplier of its primary market.
- Monitoring only requires information on own sales.
- Home market demand is independent of demand for other markets so optimal collusive price is not informed by sales in other markets.
- Sharing firms' sales informs rival firms when demand is stronger and deviation is more profitable.

Sharing individual firm sales can make collusion /less effective.

Facilitating Practices

Information exchange

Procedures for Evaluating Information Exchange Practices

- ① Is the market suitable for collusion?
 - ▶ Are market conditions conducive to collusion?
 - ▶ Is there evidence of collusion?
 - ▶ Burden of proof is on the plaintiffs.
- ② How would the information exchange practices make a difference in the likelihood or extent of collusion?
 - ▶ What is the theory of collusion for this particular market?
 - ▶ How do the information exchange practices fit into that theory?
 - ▶ Is there an agreement among firms to share information?
 - ▶ Burden of proof is on the plaintiffs.
- ③ Are there efficiencies from the information exchange practices?
 - ▶ How do efficiencies compare with anti-competitive effects?
 - ▶ Burden of proof is on the defendants to establish the presence and magnitude of efficiencies.

Facilitating Practices

Prohibition: "Post and Hold" laws

Wholesalers of alcohol are required to "post" their prices with a state authority for the coming period and they must "hold" these prices for the duration of the period.

"Post and hold" law in New York

- Wine and spirits wholesalers must file by the fifth day of each month the prices they intend to charge for the next month.
- Within ten days (by the 15th), the State Liquor Authority (SLA) posts these prices online.
- Within three days (by the 18th), wholesalers can change their postings to meet lower prices.
- Prices posted on the 18th go into effect on the 1st of the next month for 30 days

Facilitating Practices

Prohibition: "Post and Hold" laws

- Challenges to wholesalers colluding
 - ▶ coordination: firms coordinating on prices without express communication
 - ▶ monitoring: prices between wholesalers and retailers are not easily observed
- "Post and hold" law is a facilitating practice
 - ▶ coordination: a leader can set prices and other stores can match those prices
 - ▶ monitoring: any deviation is immediately detected when the SLA posts prices
 - ▶ punishment: immediate as firms can match any low price in the three days after the initial posting
- 9th Circuit Court found the "post and hold" law in the state of Washington to be a *per se* offense.

Facilitating Practices

Product standardization

C-O-Two Fire Equip. Co. v. United States
(1952)

- 3rd Circuit Court not only inferred a price-fixing agreement but also an agreement to standardize fire extinguishers.
- Firms' products had identical size, red color, and appearance of components such that they were indistinguishable without their labels.



Facilitating Practices

Product standardization

C-O-Two Fire Equip. Co. v. United States
(1952)

- Such standardization is not in a firm's interest but for collusion. Under competition, firms want to differentiate their products because
 - customers base their decisions more on price when non-price characteristics are more similar across products
 - less product differentiation intensifies price competition



Competition Policy

Competition Policy

Introduction

- Stages in fighting cartels
 - ① Discovery
 - ② Prosecution
 - ③ Penalization
 - ④ Evaluation (of policies and programs)
- Developing evidence (discovery, prosecution)
 - ▶ Reports by customers, competitors
 - ▶ Leniency programs, Whistleblowers
 - ▶ Dawn raids
 - ▶ Economic analysis, screening

Competition Policy

Introduction: Penalties

- Corporate
 - ▶ Government fines
 - ▶ Customer damages
- Individual
 - ▶ Government fines
 - ▶ Incarceration
 - ▶ Unemployment
- Ideally, penalties should be set so that collusion is unstable.
 - ▶ But what is the probability that a cartel ends up being caught and convicted?
 - ▶ Corporate bankruptcy limits the size of corporate penalties.
 - ▶ How is incarceration valued?

Government Penalties

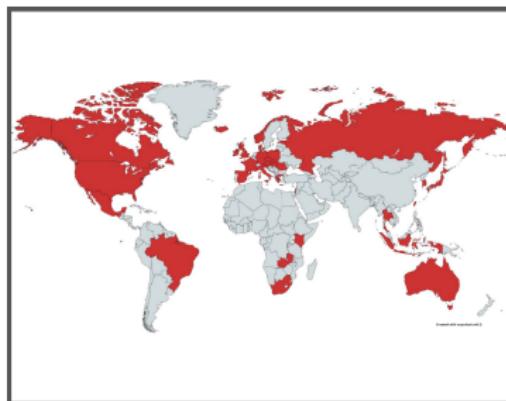
Corporate Fines

- 2006 revision of European Commission guidelines for corporate fines
- Basic Amount = $S \times a \times T + S \times b$
 - ▶ S = value of the firm's sales in the last full business year of the firm's participation in the cartel
 - ▶ a = percentage of the values of sales up to 30 percent ("gravity")
 - ▶ T = number of year's of a firm's participation
 - ▶ $S \times b$ = fixed portion where b is 15-25 percent
- If a penalty is to deter cartel formation, it should be tied to the incremental profit from colluding. So why does the fine depend on revenue, not profit?
- Analysis of EC system of fines: Katsoulacos and Ulph (*Economic Journal*, 2013)

Government Penalties

Incarceration

- 35 countries have criminalized cartel participation.
- U.S. Dept of Justice
 - ▶ Defendants going to prison: 37% (1990-99) to 70% (2010-13)
 - ▶ Average prison sentence: 8 months (1990-99) to 25 months (2010-14)
- But incarceration is rarely used outside of the U.S.



Customer Damages

- What is the purpose of customer damages?
 - ▶ Compensation to harmed consumers.
 - ▶ Deterring and disabling cartels
 - ★ additional financial penalties to fines levied by the government.
 - ★ creates added incentives for customers to monitor, report, and investigate.
- Customer damages - U.S.
 - ▶ Treble damages
 - ★ Multiplier serves deterrence since the probability of being caught and paying penalties is well below one.
 - ★ In practice, settlements are closer to single damages.
 - ▶ Indirect purchasers cannot sue for damages except in some states.
 - ▶ Class action suits for when many customers each incur a small loss.

Customer Damages

Defining damages

- Customer damages - EU
 - ▶ Single damages.
 - ▶ Indirect purchaser suits are allowed.
 - ★ If an illegal overcharge is passed on to consumers who are not direct buyers then those consumers are harmed.
 - ★ Those harmed consumers can claim compensation.
- Comparison of US and EU
 - ▶ EU is focused on compensation.
 - ▶ US is primarily concerned with deterring and disabling cartels.
- Allowing indirect purchasers to sue weakens enforcement.
 - ▶ Direct purchasers have the best information when it comes to detecting collusion. Weakening their incentives will reduce the likelihood that they report and sue, thereby reducing enforcement.
 - ▶ Damage calculation becomes more difficult and could effectively reduce penalties.

Customer Damages

Defining damages

Damages inflicted by firm i from colluding in period t are calculated to be

$$\left[P_i^c(t) - P_i^{bf}(t) \right] Q_i^c(t)$$

- $P_i^c(t)$ is the observed (collusive) price charged by firm i in period t .
- $Q_i^c(t)$ is the number of units sold by firm i in period t
- $P_i^{bf}(t)$ is the "but for" (or counterfactual) price for firm i in period t .
- $P_i^c(t) - P_i^{bf}(t)$ is the *overcharge*.

Two sources of damages are missed:

- Output reduction: Damages associated with some consumers buying less because of the higher price.
- Umbrella effect: Damages associated with non-cartel members raising prices.

Customer Damages

Defining damages

Output Reduction

- \tilde{P} = collusive price, \hat{P} = but for price, C = unit cost.
- Overestimates profit gain to firms by rectangle B.
- Underestimates loss to consumers by rectangle C.
- Discrepancy is less when market demand is more inelastic.
- A customer who chooses not to buy at all cannot collect damages.
- Example: Cartel of manufacturers of fire engines with turntable ladders (Germany, 2011)

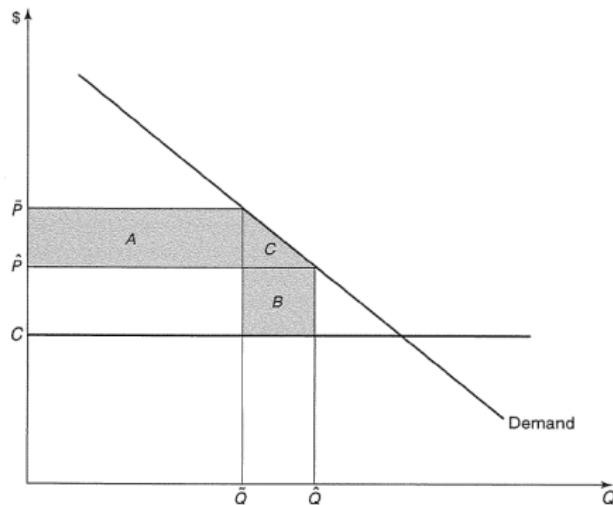


Figure 5.13
Calculating Damages in a Price-Fixing Case

Customer Damages

Defining damages

Umbrella Effect

- Consider a non-all-inclusive cartel such as the vitamin B1 cartel:
 - ▶ Primary cartel members: Roche (44%), Takeda (31%)
 - ▶ Non-cartel: Chinese manufacturers
- Profit-maximizing response of non-cartel members is to raise their prices, while undercutting the collusive price and gaining market share.
- Vitamin B1: Chinese supply gained almost 20% of market share over 1992-94.
 - ▶ Higher prices paid to Chinese manufacturers is attributable to collusion.
 - ▶ Volume is significant because of the large shift in demand.
- European Court of Justice (June 2014) ruled that
 - ▶ member states cannot "categorically and regardless of the particular circumstances" exclude civil liability for losses from umbrella pricing.
 - ▶ victims may obtain compensation when the cartel is shown to be "liable to have the effect of umbrella pricing being applied by third parties acting independently."

Customer Damages

Defining damages

- Primary challenges to calculating damages
 - ▶ Dating the cartel - identifying the time during which firms were colluding and thus damages were incurred.
 - ▶ Estimating the but for price.
- Dating the cartel
 - ▶ End of collusion - one may be confident that communications stopped, but did tacit collusion replace explicit collusion?
 - ▶ Start of collusion
 - ★ Evidence of meetings (memos, testimony, etc.) is evidence of collusion. Lack of evidence doesn't mean there wasn't collusion.
 - ★ Older evidence is more likely to have been destroyed or missing.
 - ▶ Methods used in "Detecting Cartels" are pertinent.
 - ▶ Official dates of the cartel by the competition authority are often the product of negotiation and thus are not definitive.

Customer Damages

Estimating the but for price

- Before and After approach - use price data from this market for periods in which these firms were not colluding:
 - ▶ non-collusive periods prior to the beginning of cartel activity
 - ▶ periods during the time of collusion in which collusion broke down
 - ▶ periods after the end of cartel activity.
- Yardstick approach - use price data from comparable markets (where collusion is not suspected)
 - ▶ Price for same product in other geographic markets.
 - ▶ Price for related products

Customer Damages

Estimating the but for price

Market structure-based approach

- Specify a non-collusive model (e.g., Bertrand or Cournot)
- Estimate market demand and cost functions
- Using those estimates in the non-collusive model, project what prices would have been during the conspiracy period.
- Special case: cost-based approach
 - ▶ Estimate cost for the conspiracy period.
 - ▶ Assume the but for price is cost plus some fixed markup
- Two model approach
 - ▶ Specify models for both the counterfactual (non-collusive) and factual (collusive) scenarios.
 - ▶ Use the factual model and data for the conspiracy period to estimate market demand and cost functions.
 - ▶ Project but for prices.

Damages

Before and After approach: Dummy variable version

Common approach is to control for demand and supply conditions by running a reduced-form regression:

$$P(t) = \alpha + \beta X(t) + \gamma v(t) + \varepsilon(t)$$

- $P(t)$ is the observed price.
- $X(t)$ is a collection of demand and cost factors.
 - ▶ Prices of substitutes (example: prices for beef, pork, and turkey for the processed chicken cartel)
 - ▶ Input prices - raw materials, labor, energy
 - ▶ Consumer disposable income, producer price index
- $v(t)$ is a dummy variable that equals one in those periods that firms were colluding.
- $\varepsilon(t)$ is the residual error.
- α , β , and γ are parameters to be estimated.

Damages

Before and After approach: Dummy variable version

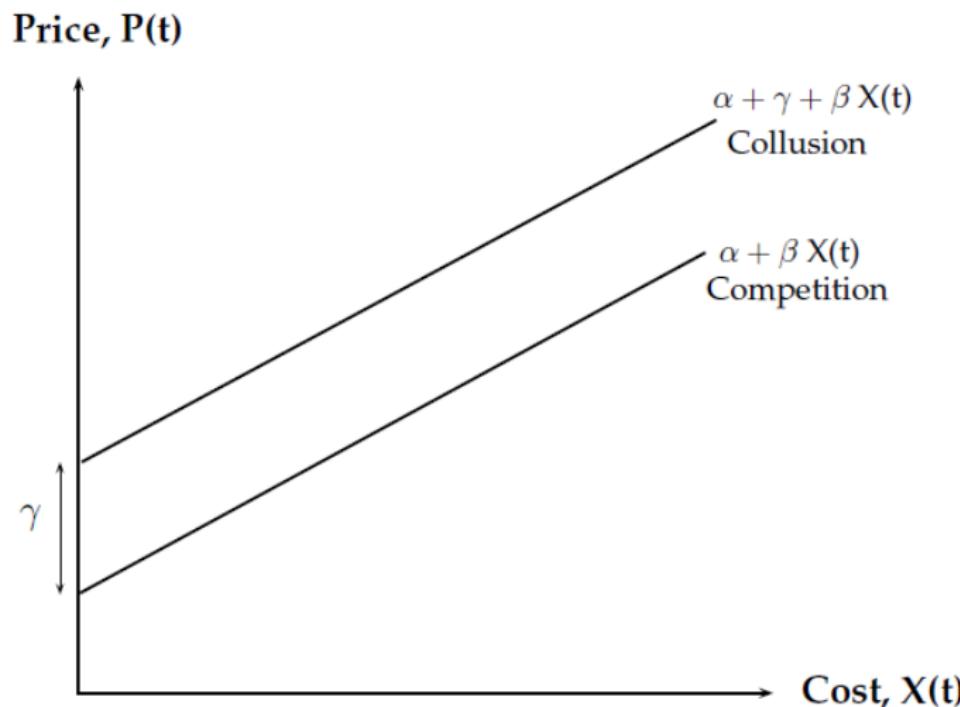
- Specification

- ▶ How price responds to demand and cost shifts is assumed to be the same under collusion and competition.
- ▶ Collusion just causes an upward shift in the price function.
- ▶ If $\hat{\alpha}$ and $\hat{\beta}$ are parameter estimates, the but for price for period t is then estimated to be:

$$P^{bf}(t) = \hat{\alpha} + \hat{\beta}X(t).$$

Damages

Before and After approach: Dummy variable version



Damages

Before and After approach: Forecasting version

Vitamins (Bernheim, 2002)

- Benchmark price model,

$$P(t) = \alpha P(t-1) + \beta X(t) + \varepsilon(t)$$

estimated the relationship between a vitamin's price and

- ▶ current demand and cost factors, $X(t)$
- ▶ lagged price $P(t-1)$ (takes account of gradual adjustment of price to a change in cost and demand)
- Demand factors
 - ▶ U.S. population, per capita income
 - ▶ demand drivers for animal nutrition products (pounds of slaughtered beef, chicken, etc.)
 - ▶ U.S. prices of potential vitamin complements and substitutes

Damages

Before and After approach: Forecasting version

- Cost factors

- ▶ Raw materials (ammonia, hydrochloric acid, methanol, sugar, etc.)
- ▶ U.S. wage index for chemical industry workers
- ▶ U.S. dollar exchange rates (as companies were located abroad and sold in the U.S.)
- ▶ U.S. interest rates

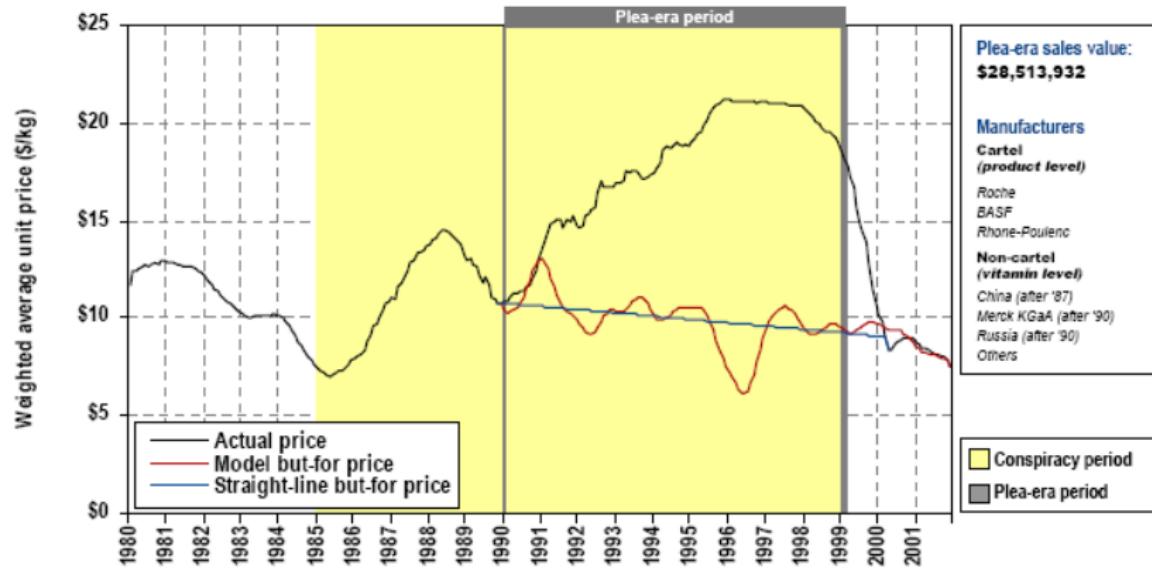
- Price data

- ▶ Pre- and/or post-cartel time periods.
- ▶ Monthly, 1980-2001

Damages

Before and After approach: Forecasting version

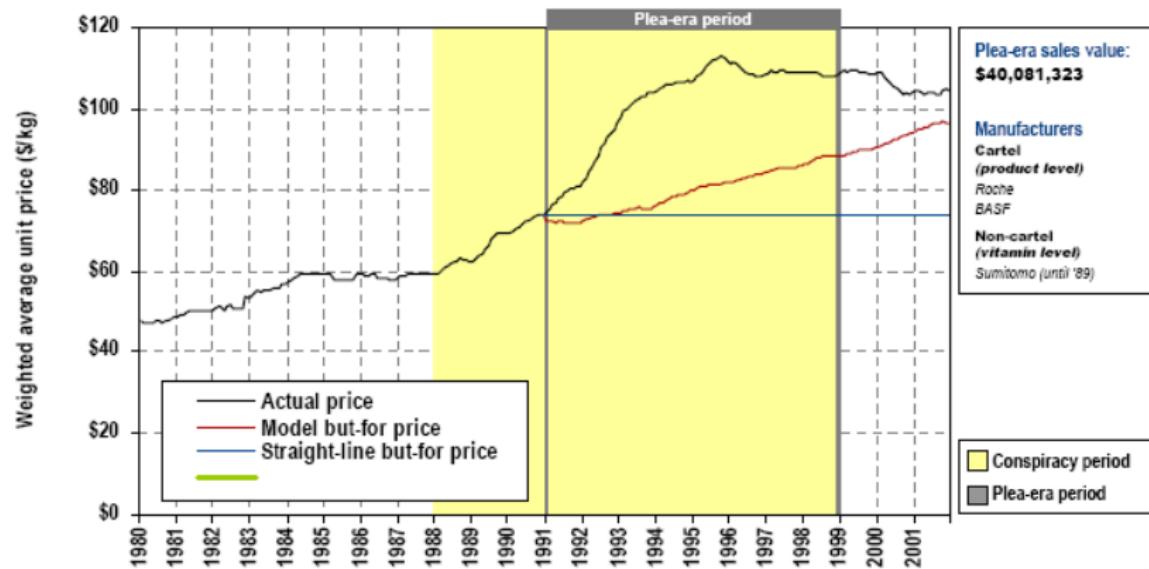
Figure 12-1: Vitamin E Acetate 50% Spray-Dried Feed Grade price and but-for price



Damages

Before and After approach: Forecasting version

Figure 12-18: Beta Carotene 10% Cold Water Soluble USP price and but-for price



Customer Damages

Vitamins

Table 12A. Real Global Sanctions Relative to Real Overcharges, 1999-2005

| Product Market | United States | | | Other Jurisdiction | | | World ^a |
|-------------------------------------|---------------|-------------|--------------------|---------------------|-------------|------------|--------------------|
| | Govt. | Private | Total ^a | Canada ^b | EU | Other | |
| <i>Percent of 2005 U.S. dollars</i> | | | | | | | |
| Beta carotene | 37.9 | 85.9 | 123.8 | 82.3 | 27.2 | 0 | 54.7 |
| Canthaxanthin | 4.3 | 10.1 | 14.4 | 9.8 | 48.9 | 0 | 13.5 |
| Biotin (vitamin H) | 0 | 138.8 | 138.7 | 0 | 0 | 0 | 42.6 |
| Choline chloride | 1.3 | 22.4 | 23.6 | 27.9 | 22.2 | 0 | 13.4 |
| Folic Acid (B9) | 0 | 208.5 | 208.5 | 0 | 0 | 0 | 44.5 |
| Vitamin A | 23.4 | 72.8 | 96.2 | 69.6 | 16.5 | 1.9 | 39.5 |
| Vitamin B1 | 0 | 131.0 | 131.0 | 0 | 0 | 0 | 42.0 |
| Vitamin B2 | 51.0 | 99.4 | 150.3 | 90.0 | 59.1 | 0 | 74.4 |
| Vitamin B3 | 46.3 | 62.2 | 108.5 | 86.7 | 0 | 0 | 39.7 |
| Vitamin B5 | 30.9 | 75.4 | 106.3 | 89.4 | 57.4 | 0.3 | 66.1 |
| Vitamin B6 | 0 | 84.8 | 84.8 | 0 | 0 | 0 | 15.8 |
| Vitamin B12 | 0 | 5.1 | 5.6 | 202.4 | 0 | 0 | 2.7 |
| Vitamin C | 38.1 | 74.4 | 112.4 | 87.6 | 19.1 | 0.8 | 39.7 |
| Vitamin D3 | 0 | 0 | 0 | 0 | 252.4 | 0 | 75.8 |
| Vitamin E | 26.6 | 67.0 | 93.6 | 59.5 | 13.4 | 1.2 | 42.8 |
| Premixes | 23.6 | 48.9 | 72.5 | 110.9 | 0 | 0 | 23.4 |
| Total | 24.8 | 61.3 | 86.0 | 74.0 | 15.4 | 0.5 | 33.7 |

Sources: Tables 14A and 17A

Damages

Before and After approach: Comparison of dummy variable and forecasting versions

DV approach isolates the effect of collusion by controlling for other factors that impact price.

- Assumes relationship between price and cost and demand factors is stable over time and across conduct regimes.
- May have less accurate estimates because it presumes the relationship between price and cost and demand shifters is the same in the cartel and competitive periods
 - ▶ Collusive price tends to be less responsive to cost shocks than competitive price.
 - ▶ Can use Chow test to assess the maintained hypothesis in the DV approach
 - ▶ Also, can have dummy variables interact with cost and demand factors.

Damages

Before and After approach: Comparison of dummy variable and forecasting versions

Forecasting approach isolates the effect of collusion by estimating the relationship between price and cost and demand factors under competition.

- Assumes relationship between price and cost and demand factors under competition is stable over time.
- May have less accurate estimates because it does not use all of the data.

Damages

Before and After approach: Critique

- Pre-cartel price data is old
 - ▶ Some studies find that around 20% of discovered cartels lasted more than ten years.
 - ▶ Estimates in the later years of the cartel may be inaccurate because of changes in unobserved market conditions.
- Pre-cartel price data may not be an appropriate benchmark.
 - ▶ Some cartels are preceded by a sharp price decline.
 - ▶ Firms may have cartelized in response to an *abnormally* intense bout of competition; e.g., a price war during tacit collusion.
 - ▶ But for explicit collusion, would the intensity of competition remained at that level?
- Post-cartel price data may not be an appropriate benchmark.
 - ▶ Post-cartel prices may be above true but for prices because tacit collusion replaced explicit collusion.
 - ▶ Strategic pricing during litigation (see below).

Customer Damages

Difference-in-Differences approach

Erutku and Hildebrand (2010)

- Cartel among petrol stations in Sherbrooke in Quebec province of Canada; 53 of 66 stations participated.
- Data: May 31, 2005 - May 22, 2007
 - ▶ Weekly retail prices - Sherbrooke, Quebec City, Montreal
 - ▶ Weekly wholesale prices (cost) - Quebec City, Montreal
 - ▶ 52 weeks before the Competition Bureau publicly announced its investigation and 52 weeks after it.

Customer Damages

Difference-in-Differences approach

Empirical model

$$P_{i,t} = \gamma_0 + \gamma_1 Sherbrooke_{i,t} + \gamma_2 Post_{i,t} + \gamma_3 Post_{i,t} \times Sherbrooke_{i,t} \\ + \beta_t w_{i,t} + \cdots + \beta_{t-n} w_{i,t-n} + \lambda Q_{i,t}$$

- $P_{i,t}$ = retail price in city i in period t
- $Sherbrooke_{i,t} = 1 (0)$ if the city is Sherbrooke (Montreal or Quebec City)
- $Post_{i,t} = 1(0)$ if period t is after (before) the announcement
- $w_{i,t}$ = wholesale price (current and lagged n weeks)
- $Q_{i,t}$ = quarterly fixed effects

Customer Damages

Difference-in-Differences approach

- Interpretation of parameters

- ▶ γ_1 measures the average difference between retail prices in Sherbrooke and Montreal (or Quebec City)
- ▶ γ_3 measures the change in the Sherbrooke price (compared to the Montreal or Quebec City price) after the announcement.

- Difference-in-differences approach

- ▶ Before and After: Compares Sherbrooke prices during and after the conspiracy period
- ▶ Yardstick: Compares Sherbrooke prices with those of other markets - Montreal or Quebec City - for which there is no evidence of collusion.

Customer Damages

Difference-in-Differences approach

Empirical estimates: Control is Montreal

- Price in Sherbrooke
 - ▶ was 2.8 cents per litre higher over the entire time period, compared to Montreal
 - ▶ fell by 1.75 cpl in response to the announcement, compared to Montreal
- Average overcharge was $2.7\% = 1.75/64$ (where 64 is average post-announcement price)
- Markups (58.8 is average post-announcement wholesale price)
 - ▶ Collusive: $11.8\% = (65.75 - 58.8)/58.8$
 - ▶ Non-collusive: $8.8\% = (64 - 58.8)/58.8$
 - ▶ Markup increased by $= 34\% (.118 - .088)/.088$

Customer Damages

Difference-in-Differences approach

Table 6
Differences-in-Differences Estimates on Retail Prices P_t

| | Montreal | | Quebec City | |
|---|-------------|-------------|-------------|-------------|
| | Coefficient | t-Statistic | Coefficient | t-Statistic |
| Constant | 1.35 (1.94) | .70 | 2.58 (1.95) | 1.32 |
| Sherbrooke _{it} | 2.80 (.57) | 4.94** | -.32 (.58) | -.55 |
| Post _{it} | .21 (.56) | .37 | -1.84 (.58) | -3.17** |
| Post _{it} × Sherbrooke _{it} | -1.75 (.80) | -2.19* | .26 (.82) | .31 |
| Wholesale _{it} | .73 (.05) | 16.19** | .62 (.04) | 15.08** |
| Wholesale _{it-1} | .30 (.05) | 5.87** | .35 (.04) | 7.83** |
| Wholesale _{it-2} | .01 (.04) | .31 | .12 (.04) | 2.81 |
| ρ | .09 (.07) | 1.25 | .20 (.07) | 2.68** |

Note. Sherbrooke is the treatment city for both comparisons. Standard errors are in parentheses. Fixed quarterly effects are not reported. For the specification in which Montreal is the control city, $R^2 = .91$ and the Durbin-Watson statistic (DW) = 2.00. For the specification in which Quebec City is the control city, $R^2 = .92$, DW = 2.03. N = 208.

*Significant at the 5% level.

**Significant at the 1% level.

Customer Damages

Difference-in-Differences approach

- Empirical estimates: Control is Quebec City
 - ▶ Prices in Sherbrooke were not statistically different from those in Quebec City.
 - ▶ Does this refute the yardstick approach for this case?
 - ▶ Or is this evidence of collusion in Quebec City?
- German wholesale paper (German Federal Court of Justice, 2007)
 - ▶ Dismissed the use of yardstick approach comparing cartelized market with other regional market on the concern that there was some evidence of cartels existing in all or most of the regional markets.

Customer Damages

Strategic post-cartel pricing

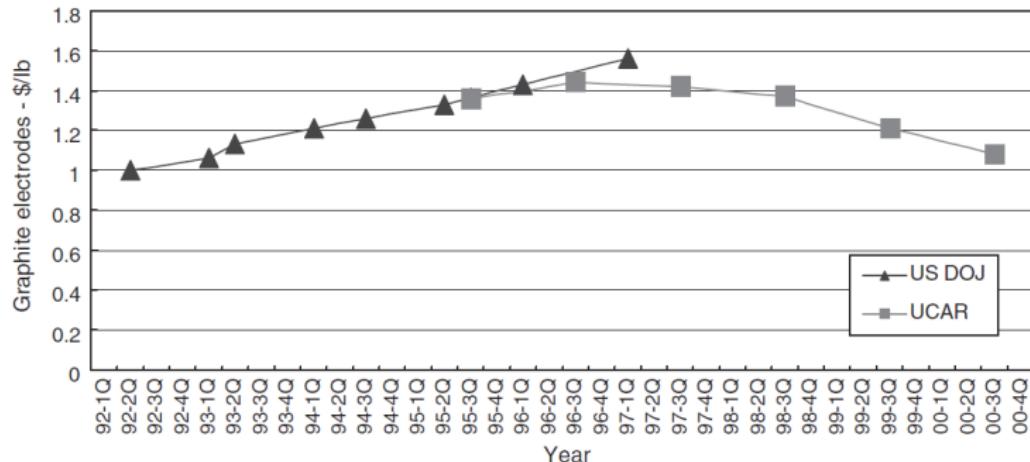
Harrington (*Journal of Industrial Economics*, 2004)

Graphite electrodes cartel

- Price-fixing conspiracy, 1992-97
- During the time of the cartel, price increased more than 50%.
- Post-cartel price path
 - ▶ No big price drop but instead a gradual decline over several years.
 - ▶ Two years after the cartel had ended, price was 20% above its pre-cartel level
 - ▶ Changes in input prices cannot explain why the post-cartel price exceeded the pre-cartel price.

Customer Damages

Strategic post-cartel pricing



Source: The US DOJ series is from court documents (United States of America v. Robert J. Hart, 10/19/99) and the UCAR series is from UCAR Annual Reports (1997, 1999, 2000).

Customer Damages

Strategic Post-Cartel Pricing

- But for price is determined according to the formula:

$$P^{bf} = \alpha P^{post} + (1 - \alpha) P^{pre}.$$

- P^{pre} and P^{post} denote the average pre-cartel and post-cartel price, respectively.
- α is the weight given to post-cartel price data.
- Assume we have controlled for difference in demand and cost conditions across these regimes.

Customer Damages

Strategic Post-Cartel Pricing

- Determination of the post-cartel price.
- Each of the n colluding firms expects to pay damages equal to:

$$\theta \left(Q^c / n \right) [P^c - \alpha P^{post} - (1 - \alpha) P^{pre}]$$

- P^c denotes price during the cartel regime.
- Q^c denotes sales during the cartel regime.
- $\theta \geq 1$ is a multiplier applied to per period damages.
 - ▶ θ is bigger if there are treble not single damages.
 - ▶ θ is bigger if the cartel regime was longer.

Customer Damages

Strategic post-cartel pricing

- $\pi_1(p_1, \dots, p_n)$ denotes the profit of firm 1.
- Each of the n firms chooses the post-cartel price to maximize profit less expected penalties:

Choose p_1 to maximize

$$\pi_1(p_1, \dots, p_n) - \theta(Q^c/n) [P^c - \alpha P^{post} - (1 - \alpha) P^{pre}]$$

where

$$P^{post} = \left(\frac{1}{n}\right)(p_1 + \dots + p_n)$$

is the average post-cartel price.

Customer Damages

Strategic post-cartel pricing

- Incentives

- ▶ A firm's price during the post-cartel regime forms part of the data set that is used to estimate the but for price.
- ▶ By pricing higher, a firm raises the estimated but for price and lowers estimated damages.

- Properties of the post-cartel price

- ▶ After the dissolution of the cartel, price is set above the (standard) non-collusive price. (Note: Firms are no longer colluding!)
- ▶ The estimated but for price is an overestimate of the true but for price.

- The upward bias in the estimated but for price is higher when

- ▶ the cartel was of longer duration (as then θ is higher)
- ▶ there are fewer firms
 - ★ An individual firm's price has a bigger impact on the estimated but for price.
 - ★ A firm is more willing to sacrifice profit to reduce damages.

Structural Remedy

Harrington (*Antitrust Law Journal*, forthcoming)

- Fines are a deterrent and damages are compensatory but neither is a remedy in the sense of making future collusion less likely.
- **Proposal:** In some cases, a competition authority requires cartel member(s) to sell productive assets to an entrant, a non-cartel member (if the cartel was not all-inclusive), or another cartel member.
- Divestiture should be designed to make the market more competitive and make collusion more difficult.
- Divestiture is fully consistent with merger enforcement
 - ▶ It would be used if a proposed merger *might* result in collusion (coordinated effects)
 - ▶ In the case of a cartel, the current market structure *did* result in collusion.

Structural Remedy

Benefits

- Corrective
 - ▶ Makes future collusion less likely
 - ★ As collusion is more difficult with more firms, cartel members could be required to divest assets in order to create a new competitor.
 - ★ Transferring assets from cartel members to other firms results in less capacity being controlled by firms that have shown themselves willing and able to collude.
 - ▶ Avoids continuance of the current collusive arrangement through tacit means.
- Deterrent
 - ▶ Reduces competitive prices and profits
 - ▶ Reduces firm size
- Compensatory
 - ▶ Consumers benefit from lower competitive prices
 - ▶ Indirect purchasers may not be compensated through damages but would be compensated through lower future prices.

Structural Remedy

Costs

- Evaluation and implementation costs (comparable to those associated with a merger)
- Error costs - How easy is it to find an asset reallocation that will make the market more competitive? less collusive?

When to use divestiture?

- When collusion was highly effective as measured by the length of duration and the magnitude of the overcharge. The past performance of a cartel is the most compelling evidence that a market is susceptible to collusion.
- When collusion involved senior executives, who will understand the potentially high cost of divestiture.
- When some or all of the cartel members are repeat offenders.

Structural Remedy

Cement (Brazil)

- Cement cartel was convicted in 2014.
- Collusive practices
 - ▶ Fixed prices and used a market-sharing scheme that operated at the level of the region and allocated customers.
 - ▶ Acquired concrete plants which prevented other competitors from accessing raw materials
- CADE required "assets divestment" to correct for the exclusionary acquisitions made by members of the cement cartel
 - ▶ Divest any shareholding interest acquired by the cartel's cement and concrete companies.
 - ▶ Divest 20% of the concrete production capacity in the regions in which they owned more than one concrete plant.
 - ▶ These assets can be sold to any buyer that did not participate in the cartel.

Structural Remedy

Retail pharmacies (Chile)

- Cruz Verde (512 stores), Fasa (347 stores), and Salcobrand (295 stores) - largest retail pharmacies in Chile
- Convicted of price fixing over 2006–2008.
- Possible divestiture
 - ▶ Each chain divests 25% of their stores.
 - ▶ Acquiring firm would have had 289 stores.
 - ▶ Stores could have been sold to create a new firm, to one of the small chains in Chile, or to a retail pharmacy chain in a nearby country, such as InkaFarma in Peru.

Structural Remedy

Airlines (U.S.)

- Recent evidence of collusion through "capacity discipline"
- Collusion may have been promoted through mergers
 - ▶ Currently, four airlines—American Airlines, Delta Air Lines, Southwest Airlines, and United Airlines—control approximately 80% of domestic air traffic.
 - ▶ With some of these mergers, concerns were expressed about possible coordinated effects; e.g., the merger of American Airlines and US Airways.
- Divestiture could be justified on the grounds that mergers created a market structure conducive to collusion and thus the mergers should be reversed.
 - ▶ Assets could either go to low-cost carriers or to a new firm - corrective
 - ▶ If merging firms recognize that post-merger collusion could result in the reversal of the merger, they will be less inclined to collude - deterrent

Leniency Program

Description

- A *leniency program* offers reduced penalties to corporations and/or individuals involved in collusion, in exchange for cooperating with enforcement authorities.
- U.S. Dept of Justice
 - ▶ 1993: Revised corporate and individual leniency program.
 - ▶ Three major revisions:
 - ★ amnesty is automatic if there is no pre-existing investigation
 - ★ amnesty may still be available even after an investigation has started
 - ★ all officers, directors, and employees who cooperate are protected from criminal prosecution.
 - ▶ Annual number of leniency applications increased 20-fold.
- European Commission - introduced leniency program in 1996, revised 2002.
- More than 50 jurisdictions have leniency programs

Leniency Program

Comparison of leniency programs

| Before an Investigation | U.S. | EU | Japan |
|-------------------------|------|--------|-------|
| First firm | 100% | 100% | 100% |
| Second firm | Plea | 30-50% | 50% |
| Third firm | Plea | 20-30% | 30% |
| Fourth or later firm | Plea | 0-20% | 0 |

| After an Investigation | U.S. | EU | Japan |
|------------------------|------|---------|-------|
| First firm | 100% | 30-100% | 30% |
| Second firm | Plea | 20-30% | 30% |
| Third firm | Plea | 0-20% | 30% |
| Fourth or later firm | Plea | 0-20% | 0 |

Plea - Reduced fine from plea bargaining (In the U.S., the second cartel member to plead guilty received a mean discount from the maximum recommended sentence of 75% - Connor, 2007.)

Leniency Program

Using leniency in the post-cartel environment

- Scenario

- ▶ Collusion has stopped.
- ▶ Does a firm apply for leniency?

- Model

- ▶ f is the penalty avoided by receiving leniency (government fine)
- ▶ d is the penalty not avoided by receiving leniency (customer damages)
- ▶ ρ is the probability of a conviction when neither firm applies for leniency.
- ▶ Each auction house chooses the option that minimizes expected penalties.

| | | Sotheby's | |
|------------|--------------|------------------------------------|----------------------------|
| | | Apply | Do not apply |
| Christie's | Apply | $d + \frac{f}{2}, d + \frac{f}{2}$ | $d, d + f$ |
| | Do not apply | $d + f, d$ | $\rho(d + f), \rho(d + f)$ |

Leniency Program

Using leniency in the post-cartel environment

Sotheby's

| | | | |
|------------|--------------|------------------------------------|----------------------------|
| | | Apply | Do not apply |
| Christie's | Apply | $d + \frac{f}{2}, d + \frac{f}{2}$ | $d, d + f$ |
| | Do not apply | $d + f, d$ | $\rho(d + f), \rho(d + f)$ |

- Equilibria when the probability of being convicted is low:
 $\rho(d + f) < d$ or $\rho < \frac{d}{d+f}$.
 - ▶ Equilibrium: Both apply for leniency.
 - ▶ Equilibrium: Both do not apply for leniency.
 - ▶ It is a coordination game. (Firms want to coordinate on "do not apply".)
- Equilibria when the probability of being convicted is high:
 $\rho(d + f) > d$ or $\rho > \frac{d}{d+f}$.
 - ▶ Unique equilibrium: Both apply for leniency.
 - ▶ It is a Prisoners' Dilemma game. (Dominant strategy is "apply".)

Leniency Program

Using leniency in the post-cartel environment

An objective of competition policy is to turn a coordination game into a Prisoners' Dilemma by

- increasing the fraction of penalties avoided through leniency (decreasing $\frac{d}{d+f}$).
 - ▶ Example: U.S. Antitrust Criminal Penalty Enforcement and Reform Act (2004) expanded leniency so that a firm receiving amnesty is only liable for single (not treble) customer damages.
- raising the probability of a conviction without use of the leniency program (increasing ρ).
 - ▶ Example: whistleblower programs

Leniency Program

Whistleblower programs

- South Korea (2005) - Rewards of up to 1 billion Korean won (approx. US\$1,000,000)
- United Kingdom (2008) - Rewards of up to £100,000 (approx. US\$125,000)
- Hungary (2010) - at least 1% of government fine up to a maximum of 50 million forints (approx. US\$175,000)
- Taiwan (2015) - 5-20% of gov't fine up to 5 million Taiwanese dollars (approx. US\$160,000)

Leniency Program

Whistleblower programs

- U.S. Dept of Justice - Antitrust Division has expressed opposition because “jurors may not believe a witness who stands to benefit financially from successful enforcement action against those he implicated.” (GAO Report, 2011)
- Concern seems misplaced because
 - ▶ rewards are paid only upon conviction and the standards for conviction are high.
 - ▶ very small percentage of cases go to trial.
 - ▶ an investigation initiated by a whistleblower is likely to induce a leniency application if there is a cartel.
- *Recommendation:* Allow a whistleblower's company to apply for leniency.
 - ▶ If it induces a leniency application then the whistleblower's credibility is substantiated.
 - ▶ Enhances an employee's incentive to report.

Leniency Program

Leniency to destabilize collusion

- Motta and Polo (*International Journal of Industrial Organization*, 2003), Harrington (*Journal of Industrial Economics*, 2008)
- Scenario
 - ▶ Firms are currently colluding.
 - ▶ Does a firm want to collude or cheat and, if it cheats, apply for leniency?
 - ▶ How does leniency affect the stability of the collusive agreement?
- Duopoly model: $\pi^d > \pi^c > \pi^{nc} > \pi^x$.

Duopoly model (profits)

| | | Firm 2 | |
|--------|---------|----------------|----------------------|
| | | Collude | Compete |
| Firm 1 | Collude | π^c, π^c | π^x, π^d |
| | Compete | π^d, π^x | π^{nc}, π^{nc} |

Leniency Program

Leniency to destabilize collusion

Sequence of moves in each period:

- ① Firms learn the value of ρ which is the likelihood of being discovered and convicted.
 - ▶ ρ randomly changes over time.
- ② Each firm decides whether to *collude* or *compete*, and whether or not to apply for leniency.
- ③ Discovery of the cartel
 - ▶ Suppose at least one firm applied for leniency.
 - ★ Collusion stops, the firm receiving amnesty pays a reduced fine of θF (where $0 \leq \theta < 1$), and the other firm pays a fine of F .
 - ▶ Suppose no firm applied for leniency.
 - ★ With probability ρ , the cartel is caught, collusion stops, and each firm pays a fine of F .
 - ★ With probability $1 - \rho$, collusion continues.

Leniency Program

Leniency to destabilize collusion

- If a firm colludes, its payoff is

$$\pi^c + \delta \times [(1 - \rho) \times V^c + \rho \times (V^{nc} - F)]$$

- ▶ π^c is collusive profit.
 - ▶ V^c is the value of future profits from continuing to collude.
 - ▶ V^{nc} is the value of future profits when firms do not collude.
 - ▶ δ is the weight attached to future profit, where $0 < \delta < 1$.
 - If a firm cheats and does not apply for leniency, its payoff is
- $$\pi^d + \delta \times V^{nc} - \delta \times \rho \times F.$$
- ▶ π^d is the profit from cheating.
 - If a firm cheats and applies for leniency, its payoff is

$$\pi^d + \delta \times V^{nc} - \delta \times \theta \times F.$$

Leniency Program

Leniency to destabilize collusion

- It is optimal to collude when

$$\pi^c + \delta \times [(1 - \rho) \times V^c + \rho \times (V^{nc} - F)] \geq \pi^d + \delta \times V^{nc} - \delta \times \min \{\rho, \theta\} \times F.$$

- How does more leniency (lower θ) affect the condition for a stable collusive agreement?
- Deviator Amnesty Effect - leniency reduces penalties when a firm cheats.
 - ▶ When a firm cheats, leniency reduces the penalty when $\theta < \rho$.

Leniency Program

Leniency to destabilize collusion

- It is optimal to collude when

$$\pi^c + \delta \times [(1 - \rho) \times V^c + \rho \times (V^{nc} - F)] \geq$$

$$\pi^d + \delta \times V^{nc} - \delta \times \min \{\rho, \theta\} \times F.$$

- Cartel Amnesty Effect - leniency can either raise or lower future expected penalties.
 - ▶ In the event of cartel collapse (which occurs when ρ is sufficiently high), firms may apply for leniency.
 - ▶ Expected penalties can be higher (then V^c is lower) or lower (then V^c is higher).
 - ▶ If $\rho > \theta$ then firms will apply but if $\frac{n-1+\theta}{n} > \rho$ then expected penalties are higher.
- Generally, net effect is that *leniency makes collusion less stable*.

Leniency Program

Measuring the effect of a leniency program: Experimental evidence

Bigoni, Fridolfsson, Le Coq, and Spagnolo (*RAND Journal of Economics*, 2012)

- Two subjects decide
 - ▶ whether to communicate
 - ▶ what price to set
 - ▶ whether to apply for leniency (if they communicated)
- Stage 1 (communication): Each subject decides whether to push a button to express a desire to communicate.
 - ▶ If both pressed the button then they communicate about prices through the simultaneous choice of a "minimum acceptable price".
 - ▶ Communication lasts for 30 seconds.
 - ▶ Communication makes them liable for penalties.

Leniency Program

Measuring the effect of a leniency program: Experimental evidence

- Stage 2 (price and leniency): Subjects choose prices from $\{0, 1, \dots, 12\}$ and, if they communicated, decide whether to apply for leniency.
- Stage 3 (leniency): Prices are revealed and, if they communicated and no one applied for leniency, they again decide whether to apply for leniency.
- Stage 4 (detection): If they communicated and no subject applied for leniency then a fine is levied with some probability.
- A firm with leniency pays no fine; the other firm pays the full fine.

Leniency Program

Measuring the effect of a leniency program: Experimental evidence

- Competition solution: price = 3. Monopoly solution: price = 9
- Price is higher when subjects communicate (form a cartel).

Effect of communication on prices

| Fine | Probability of Fine | Average Price | |
|------|------------------------|------------------|---------------|
| | | No communication | Communication |
| 200 | 0.10 | 3.6 | 5.7 |
| 1000 | 0.02 | 3.5 | 7.2 |
| 300 | 0.20 | 3.2 | 6.1 |
| 1000 | 0.00 | 3.9 | 7.9 |

Leniency Program

Measuring the effect of a leniency program: Experimental evidence

- Treatments: No Leniency Program, Leniency Program
- A leniency program reduced the likelihood of communication (cartel formation)

Effect of leniency program on the amount of communication

| Fine | Probability of Fine | Rate of Communication | |
|------|------------------------|-----------------------|----------|
| | | No leniency | Leniency |
| 200 | 0.10 | .590 | .344 |
| 1000 | 0.02 | .378 | .251 |
| 300 | 0.20 | .452 | .436 |
| 1000 | 0.00 | .538 | .280 |

Leniency Program

Measuring the effect of a leniency program: Experimental evidence

| Fine | Probability of Fine | Expected Fine | Rate of Communication | Average Price |
|------|------------------------|------------------|--------------------------|------------------|
| 200 | 0.10 | 20 | .344 | 5.7 |
| 1000 | 0.02 | 20 | .251 | 7.2 |

- With a leniency program, higher fines (holding per period expected fine fixed)
 - reduce communication (cartel formation)
 - raise collusive price conditional on communication (forming a cartel)
- Higher fines are
 - reducing "trust" and shifting the equilibrium?
 - allowing for a more severe (credible?) punishment for undercutting price?

Detecting Cartels

Detecting Cartels

Stages in the detection and proof process

- ① Screening - identifying markets where there might be collusion; limited data, simple empirical analysis
 - ▶ Methods
 - ▶ Government procurement auctions
- ② Verification - determining that there is collusion (or not); more data, more sophisticated empirical analysis.
- ③ Prosecution - developing economic evidence to prove there is collusion.

Screening for Cartels

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

- *Structural screening* identifies markets conducive to collusion (Grout and Sonderegger, 2005).
- Factors conducive to collusion include:
 - ▶ small number of firms
 - ▶ homogeneous products
 - ▶ stable demand
 - ▶ excess capacity
- Problem of too many false positives due to omitted variables
 - ▶ Imagine the "ideal" market for collusion: two firms, homogeneous products, stable demand, etc.
 - ▶ In practice, probably only a small fraction of such markets have cartels.
 - ▶ Problem is that there are many omitted (unmeasured) factors that determine whether a cartel forms.

Screening for Cartels

- *Behavioral screening* identifies collusive patterns in firm conduct and outcomes (prices, sales, etc.)
- Comparison of screening methods
 - ▶ A structural approach seeks to identify markets for which it is more likely that a cartel *will form*.
 - ▶ A behavioral approach seeks to identify markets for which a cartel *has formed*.

Screening for Cartels

Behavioral screening can work because ...

- ① ... collusion must mean a change in the price-generating process which, in principle, can be identified.
- ② ... collusion is difficult and leaves an evidentiary trail.
 - ▶ Collusion imposes a unique set of challenges and constraints which manifests itself in terms of firm behavior.
 - ▶ Even if cartelists are strategic, they will be unable to beat some screens because it is costly for them to do so.
- ③ ... *it has worked!*

Screening for Cartels

Structural and behavioral screens have discovered cartels and resulted in convictions in

- Generic drugs (Mexico)
- Subway construction (Korea)
- Retail gasoline (Brazil)
- Shrimp (The Netherlands)
- LIBOR (global)
- Cement (South Africa)
- Ampoules (Chile)
- Road construction (Switzerland)
- Electronic stock exchange Nasdaq (United States)

Screening produced evidence ⇒ Dawn raid ⇒ Leniency application ⇒ Conviction: Ampoules (Chile), Cement (South Africa), Road construction (Switzerland)

- Deutsche Bahn has a cartel detection unit.

Screening for Cartels

How to Screen

Requirements for behavioral screening

- ① Need data
- ② Need to know what to look for in the data
 - ① Structural break - change in the data-generating process due to cartel birth, death, or disruption
 - ② Collusive markers - patterns more consistent with collusion than competition
 - ③ Anomalies - patterns inconsistent with competition

Screening for Cartels

How to Screen: Structural Break

Structural break is a change in the data-generating process that could be due to cartel birth, death, or disruption

- Cartels can be detected at birth
 - ▶ Collusion must mean a change in the price-generating process which, in principle, can be identified.
- Cartels can be detected when disrupted by non-cartel members or death
 - ▶ Disruptions are not easily "managed" by colluding firms which often means sharply lower and more volatile prices.

Screening for Cartels

How to Screen: Structural Break

- Approaches

- ▶ Search without prior knowledge.
- ▶ Candidate breakpoint: Events conducive to cartel formation.
- ▶ Candidate breakpoint: Events that make collusion more effective.

- Example: Formation of a trade association

- ▶ Trade associations are used as a cover for cartel meetings.
- ▶ Amino Acid Manufacturers International Association was formed by members of the lysine cartel.

Screening for Cartels

How to Screen: Structural Break

- Test: Is there a break in the relationship among firms' prices around the time of the creation of the association?
- Oklahoma Highway Department only started receiving identical bids at procurement auctions some time after the Asphalt Refiners Association was formed.
- Warnings
 - ▶ One might expect structural change even if firms are not colluding.
 - ★ Trade association could lead to enhanced correlation of firms' prices because it promotes the exchange of information which then homogenizes firms' beliefs.
 - ★ Would it result in higher average prices?
 - ▶ Identify various implications of a trade association which are specific to collusion.

Screening for Cartels

How to Screen: Structural Break

Pattern consistent with collusion: Entry has very large price response

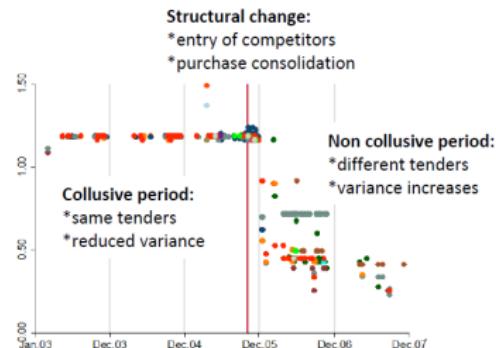
Under competition:

- modest decline in price

Under collusion:

- switch to competition \Rightarrow large decline in price

Figure 1. Medicine 1 average price 1

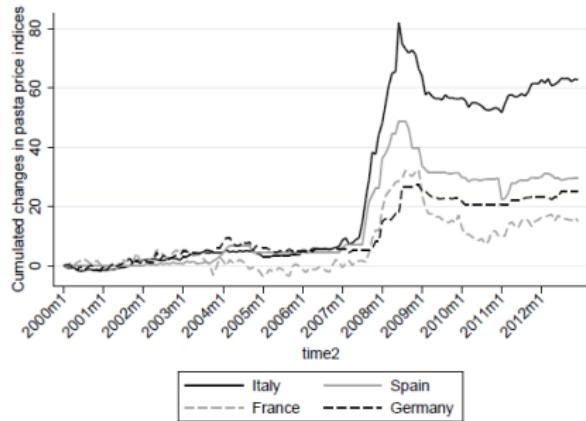


Generic drugs (Mexico)
Price levels went down
Price variability went up

Screening for Cartels

How to Screen: Structural Break

- Pasta markets in
 - ▶ France (no cartel)
 - ▶ Italy (cartel: Oct 2006 - Mar 2008)
 - ▶ Spain (cartel: July - Oct 2007)
- Data (monthly): pasta prices, input prices (durum wheat, labor, energy)
- Structural break was found in Italy and Spain, not France.



Crede (2016)

Screening for Cartels

How to Screen: Collusive Markers

Collusive markers are regularities that distinguish collusion from competition and include:

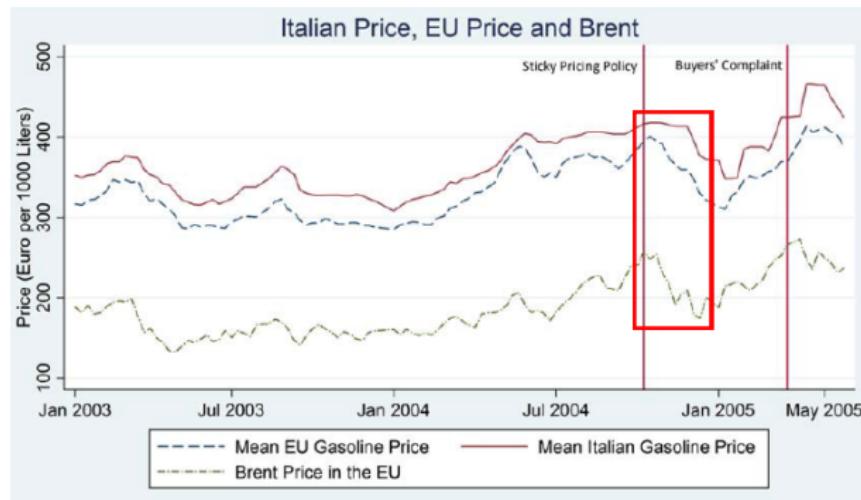
- High prices (compared to some competitive benchmark)
- V-shaped pattern to prices (associated with cartel formation)
- Low price variability (due to need to coordinate price changes)
- Loss of seasonal price cycle (due to coordinated control of supply)
- Regular periodicity to price changes (due to need to coordinate price changes)
- Stable market shares (due to market allocation scheme)

... and others

Screening for Cartels

How to Screen: Collusive Markers

- High prices compared to some competitive benchmark



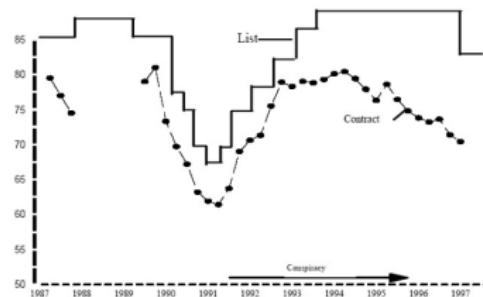
Gasoline (Italy)
Andreoli-Versbach and Franck (2015)

Screening for Cartels

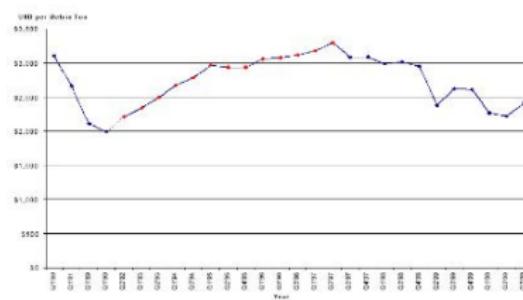
How to Screen: Collusive Markers

- V-shaped pattern to prices

- ▶ Cartel formation is often preceded by price decline
- ▶ Transition phase in which price gradually rises.



Citric Acid (global)

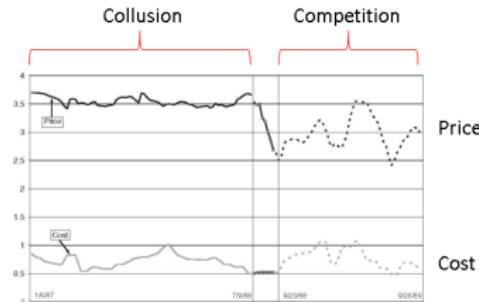


Graphite Electrodes (global)

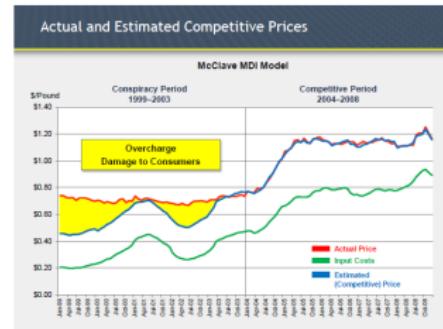
Screening for Cartels

How to Screen: Collusive Markers

- Low price variability
- Unresponsiveness to cost shocks



Frozen Perch (U.S.)
Abrantes-Metz et al (2005)



Urethane (U.S.)
Class Plaintiffs' Response Brief (2014)

Screening for Cartels

How to Screen: Anomalies

- Nasdaq: avoidance of odd-eighth quotes
- Air cargo: common use of a fuel surcharge that is poorly related to fuel expenditure
- More examples in "government procurement auctions"

Screening for Cartels

Where to Screen

- Screen markets for which the probability of finding collusion is highest, which depends on
 - ▶ probability that (illegal) collusion is present
 - ▶ probability of finding evidence of collusion conditional on the presence of collusion
- Screen markets for which there is data on
 - ▶ prices
 - ▶ key input prices (especially when a few inputs are a large fraction of marginal cost)
 - ▶ competitive benchmarks

Screening for Cartels

Where to Screen

- Markets selected by a structural screen.
- Markets for which buyers' decisions are heavily based on price - most striking empirical regularity as to where cartels occur.
 - ▶ Competition has a tendency to drive price down to cost unless capacity is limited.
 - ▶ Markets designed so that buyers' decisions are based only on price
 - ★ Procurement auctions for a standardized product or service - contract goes to the bidder with the lowest price.
 - ▶ Intermediate goods markets with essentially identical products
 - ★ Industrial buyers are not swayed by advertising, have low search costs, are willing and able to bargain, and have high-powered incentives to get as low a price as other buyers.

Screening for Cartels

Where to Screen

- Markets for which illegal collusion has been commonly observed.

Ivaldi et al (2015) - 22 developing countries (1995-2013)

| # of cartels | Markets |
|--------------|---|
| 9 | Petroleum products |
| 8 | Cement, Poultry |
| 6 | Medical & health services, Public transportation, Shipping |
| 5 | Industrial and medical gases |
| 4 | Bakeries, Beer, Concrete products, Insurance, Liquified petroleum gas, Pharmaceuticals |
| 3 | Airlines, Fertilizers, Mobile phone services, |
| | Soft drinks, Sugar |

- Cartels in adjacent countries - toilet (tissue) paper in Chile, Colombia, Peru

Screening for Cartels

Where to Screen

| Class of markets | Relative Data Availability | Relative Cartel Frequency | Relative Efficacy of Markers |
|--------------------|-----------------------------|---------------------------|------------------------------|
| Retail | Moderate (Online - High) | Low | Fair |
| Intermediate goods | Low | High | Good |
| Gov't procurement | High | High | Moderate |

- Screen intermediate and retail markets with commodities.
- Screen online retail markets.
- Screen government procurement auctions.

Screening for Cartels

Where to Screen

Collusion in online retail markets.

- Online market for posters sold through Amazon Marketplace.
- Dept of Justice complaint (April 2015)
 - ▶ Two sellers of posters communicated to "agree to adopt specific pricing algorithms for the agreed-upon prices with the goal of coordinating changes to their respective prices."
 - ▶ "In furtherance of the conspiracy, David Topkins wrote computer code that instructed company A's algorithm-based software to set prices of the agreed-upon posters in conformity with this agreement."
- *Can we develop efficient algorithms to search for coordinated pricing online?*

Government Procurement Auctions

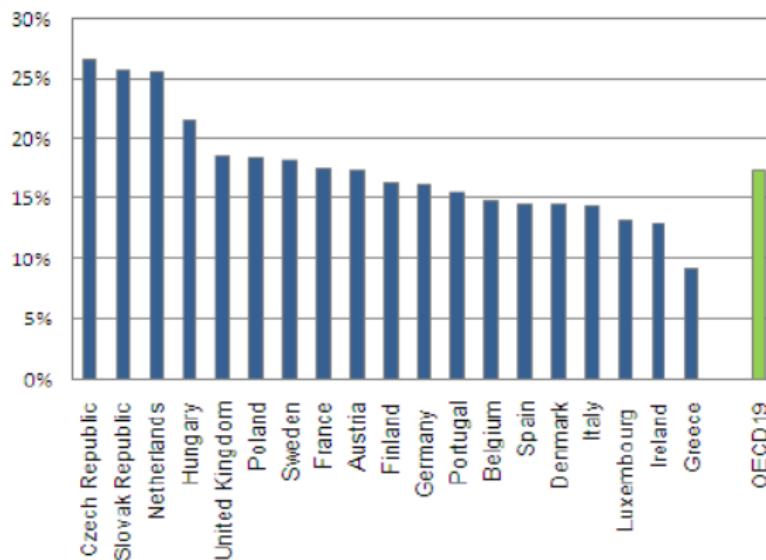
Why is screening government procurement auctions for bidding rings so compelling?

- ① Government procurement auctions are a significant fraction of GDP.
- ② Bidding rings are well documented for procurement auctions.
- ③ Tacit collusion is rare in procurement auctions; collusive markers are very likely to flag illegal collusion.
- ④ Developed set of empirical methods.
- ⑤ Potentially large reputation effect (given so many procurement auctions).
- ⑥ Data is available (though in another government agency).

Government Procurement Auctions

OECD (2010) - "Collusion and Corruption in Public Procurement Auctions"

Figure 1. Public Procurement as a percentage of GDP (2006)



Government 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 participation by non-colluding firms.

Government 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) - highway construction contracts
 - ★ Lowest bid was related to cost; non-lowest bids were unrelated to cost.
- Compare distributions of lowest bid/2nd lowest bid and 2nd lowest bid/3rd lowest bid
 - ▶ Should be similar under competition.
 - ▶ Could be different under collusion.

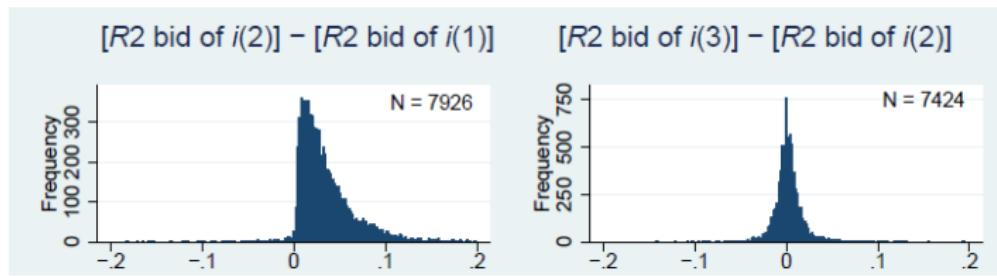
Government Procurement Auctions

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 which 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

Government Procurement Auctions

- Difference in the 2nd round bids of the third lowest and second lowest bidders from the 1st round is symmetric around zero.
- Difference in the 2nd round bids of the lowest and 2nd lowest bidders from the 1st round is almost always positive.



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

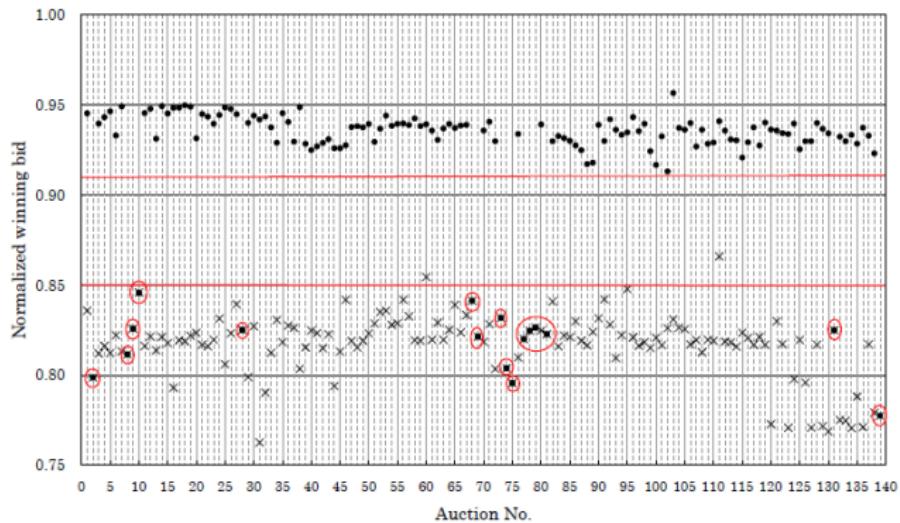
Government Procurement Auctions

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

- 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

Government Procurement Auctions

Figure 3: Normalized winning bids



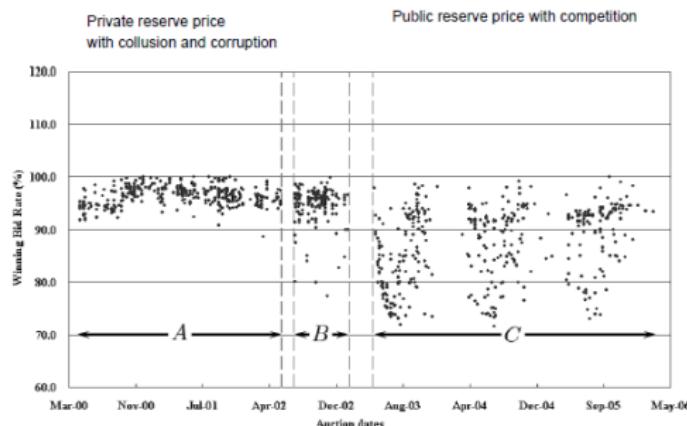
Winning bid as a percent of the (maximum) reserve price

- Winning bid, × Minimum reserve price

Government Procurement Auctions

Bidding rings collapse and reveal themselves.

- Mexico: Procurement auctions for generic pharmaceutical products.
- Japan: Procurement auctions for civil engineering and landscape gardening (Tanno and Hirai, 2013)



Note: Winning bid rate (%) = winning bid price / engineering cost estimate.

Winning bid as a percent of the engineering cost estimate

Government 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 bids and participation among some bidders.
- ④ looking for anomalous patterns inconsistent with competition.

Case: Text Messaging Antitrust Litigation (U.S.)

Case: Text Messaging Antitrust Litigation (U.S.)

Objectives

- Evaluate the illegality of collusion without evidence of direct express communication.
- Distinguish between explicit and tacit collusion.
- Discuss evidentiary standards associated with proving unlawful collusion.

Case: Text Messaging Antitrust Litigation (U.S.)

Legal standards

- Pleading an antitrust claim,
 - ▶ an allegation of parallel conduct and a bare assertion of conspiracy will not suffice.
 - ▶ the plaintiff must present enough facts to state a claim to relief that is plausible (though not required to be "probable").
- Surviving a defendant's request for summary judgement
 - ▶ A plaintiff's evidence must tend to rule out the possibility that the defendants were acting independently.
 - ▶ A plaintiff may prove its price-fixing case through
 - ★ "economic evidence suggesting that the defendants were not in fact competing"
 - ★ "noneconomic evidence suggesting that they were not competing because they had agreed not to compete."

Case: Text Messaging Antitrust Litigation (U.S.)

Legal timeline

Alleged conspiracy in which T-Mobile, Sprint, AT&T, and Verizon agreed to coordinate their pricing on pay-per-use (PPU) text messages from 2005 to 2008.

- U.S. District Court ruled in favor of the defendants that the plaintiffs failed to state a claim (under the Twombly-Iqbal standard).
- In response to a second amended complaint, U.S. District Court ruled against defendants that the plaintiffs failed to state a claim (2010).
- Defendants appealed decision to the U.S. 7th Circuit Court of Appeals which affirmed the lower court's decision (2010).
- Defendants requested summary judgment and the U.S. District Court ruled in favor of the defendants (2014).
- Plaintiffs appealed decision to the U.S. 7th Cir. Court which affirmed the lower court's decision (2015).

Case: Text Messaging Antitrust Litigation (U.S.)

Plaintiffs' claim (District Court, 2014)

Parallel price increases in the face of declining marginal cost

- Pre-August 2005: Sprint and AT&T charged 10 cents, Verizon charged 2 cents for incoming and 10 cents for outgoing, T-Mobile charged 5 cents.
- Move to 10 cents: Verizon (August 2005), T-Mobile (March 2006).
- Move to 15 cents: Sprint (October 2006), AT&T (January 2007), Verizon (March 2007), T-Mobile (June 2007).
- Move to 20 cents: Sprint (October 2007), Verizon (March 2008), AT&T (March 2008), T-Mobile (August 2008).

Case: Text Messaging Antitrust Litigation (U.S.)

Plaintiffs' claim (District Court, 2014)

- Industry structure conducive to collusion
 - ▶ Four defendants had 90% of U.S. text messaging services.
 - ▶ Homogeneous products
 - ▶ Ability to monitor competitors.
- Industry practices that facilitate collusion
 - ▶ High-level officers of the carriers were alleged to have used CTIA-The Wireless Association meetings to coordinate on price.
 - ▶ Companies' announcement of pricing increases.

Case: Text Messaging Antitrust Litigation (U.S.)

Decision of the court (District Court, 2014)

- Missing is direct evidence that the defendants had explicitly agreed to raise price. Allegation is an inference from circumstantial evidence.
- Plaintiffs argue that "the most likely cause" of these price increases "was collusion by the defendants" because "the price changes differed from the price trends" which "cannot be explained by unilateral profit-maximizing decisions by the carriers."
- Defendants argue that the plaintiffs' experts' opinions "are based on second-guessing the contemporaneous business judgment of the defendants."
- Court: Plaintiffs' evidence does not "point toward a meeting of the minds" that takes this case beyond "parallel conduct."

Case: Text Messaging Antitrust Litigation (U.S.)

U.S. Court of Appeals for the Seventh Circuit (2015)

- Challenge to the plaintiffs was to find evidence that the defendants had explicitly agreed to raise prices rather than tacitly ("follow the leader" or "consciously parallel" pricing).
- Plaintiffs' evidence of an agreement is a pair of emails between executives of T-Mobile.
 - Email #1: "Gotta tell you but my gut says raising messaging pricing again is nothing more than a price gouge on consumers. I would guess that consumer advocates groups are going to come after us at some point. I know the other guys are doing it but that doesn't mean we have to follow."
 - Email #2: "At the end of the day we know there is no higher cost associated with messaging. The move [the latest price increase by T-Mobile] was colusive [sic] and opportunistic."
- Court: Emails are consistent with tacit collusion and do not imply an agreement.

Case: Text Messaging Antitrust Litigation (U.S.)

U.S. Court of Appeals for the Seventh Circuit (2015)

- Plaintiffs argue that had any one of the four carriers not raised its price, the others would have significantly lost customers. The price increase was alleged to be rational only because firms had agreed to act in concert.
- Weaknesses to this suggested evidence of express collusion:
 - ▶ Price increases were staggered over months.
 - ▶ Consumers were insensitive to switching
 - ★ Internal T-Mobile email: "For having the lowest messaging rates on the planet, we are not necessarily receiving a more favorable share of the market. I'm thinking we can move to 10 cents with little erosive concerns."
 - ★ It is such a small absolute amount of money. When in 2006 Sprint raised its PPU from 10 to 15 cents, it estimated an average increase of 74 cents/month for most of its customers.
 - ★ As a customer's monthly messaging increases, the alternative of a text messaging bundle plan becomes more attractive.

Case: Text Messaging Antitrust Litigation (U.S.)

U.S. Court of Appeals for the Seventh Circuit (2015)

- Price increases were consistent with unilateral behavior because demand for PPU was becoming more price-inelastic
 - ▶ From 2005 to 2008, volume of text messages rose 12-fold, partly due to the increasing popularity of plans charging a fixed monthly rate for unlimited messaging ("bundles").
 - ▶ As heavy users of text messaging switched from PPU to bundles, the PPU market was left with consumers whose use of text messaging was too limited to motivate them to switch to bundles or to complain about small increases in price per message.
 - ▶ PPU demand became less elastic which made raising price unilaterally optimal.

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