

# The Welfare Implications of Cartel Network Design

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October 2017

# On the design of the cartel network

- The communication network of a cartel determines its systemic effectiveness and, consequently, its capacity to be born and survive over time.
- The first challenge faced by conspirators is the design of a cartel network that serves to the needs of **maximum profits** and **concealment** at the same time.
- Evidence on discovered cartels reveals multiple network designs, mainly depending on the complexity of the market and antitrust policy.

## My concern for the design of cartel networks:

- What issues govern the network design of cartels? How do these issues relate to each other?  
(cartel objectives, market characteristics, antitrust policies...)
- Does the network strategy of cartels have welfare implications? If so, can the Antitrust Authority bias it towards social purposes?

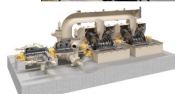
## The 'way of life' in the heavy electrical equipment industry (1950s)

- Even though the collusive agreements in the heavy electrical equipment industry data from 1880', the price-fixing schemes of the 1950' are the most documented.

- The size of the conspiracy:
  - 40 manufacturers.
  - More than 20 product lines.
  - Total annual sales over \$2 billion.
  - Three mayor conspiracies: switchgear, transformers and steam turbine generators.



Steam Turbine Generator



- Antitrust investigations began in 1959. Sentences and fines were quickly imposed a year later.
  - ↳ Companies and individuals were fined in excess of \$1 million and many top executives received jail sentences. Local governments also sued companies for damages resulting from the inflated prices.

## The 'way of life' in the heavy electrical equipment industry (1950s)

	<b>Switchgear &amp; Transformers</b>	<b>Steam Turbine Generators</b>
- Product design	standard	custom-made
- Production process	standardized and prefabricated	custom-made to detailed and extensive specifications
- Production requirements	skilled labor and moderately sophisticated machinery	highly skilled labor, large and sophisticated machine tools and lot of space
- Flow of business	orders were frequent and regular	orders were large, indivisible and irregular
- Sales process	mostly by catalog	face-to-face negotiations
- Lag time between ordering and installation	short (between 1 and 4 months )	long (from 18 months to 3 years)
- <b>Network design</b>	<b>representative at two levels</b>	<b>complete</b>
- Frequency of cartel meetings	frequent	frequent and regular

# The 'way of life' in the heavy electrical equipment industry (1950s)

## The end of the story: On the prosecution, verdicts and condemns...

- 78 people from 13 companies were located as direct participants in the conspiracies

Hierarchy in legal organization	%
- Top executives	35,9
- Middle managers	20,5
- Low-level managers	32,1
- Unknown	11,5

- The **size of the company** did not influence the verdict (guilty or innocent), nor the severity of the sentence (including the fine level).
  - Neither did, the member's **hierarchy in the legal organization**.
  - **Cartel network design** did not influence verdict, nor the severity of the sentence (⇒ the network design may affect the amount of evidence to be created, but not the quality of the one that is created).
- ⇒ Among all individuals suspected of conspiracy, top executives were better able to protect themselves from prosecution when they belonged to a representative conspiracy.

# General Setting and Main Results

## Basic Framework:

- Within a set up of several cartel members (e.g, managers) in each cartel firm, **delegating cartel decisions to some members** is an attractive strategy for concealment. But it may have side effects on profits.
- In an economy coexist cartels with different networks. Some networks are designed giving priority to concealment and others to maximum profits.
- The network distribution of cartels has welfare implications in two aspects: (i) cartel sustainability, and (ii) externalities from collusion.

## Main Results:

- Cartel's possibility of designing the network that best fits its interests and to switch it from one design to another, breaks the standard result that **welfare is monotonic in the level of policy instruments individually considered**  
⇒ Pushing crime detection too much with a single instrument can lead to undesirable outcomes.

# Related Literature

## ⇒ Internal organization of collusion

- Baker & Faulkner (ASR, 1993). Switchgear, transformers and turbines pricing cartels (1950s) designed different network strategies depending on the market structure.
- Belleflamme & Bloch (IER, 2004), Roldan (JEMS, 2012). The optimal number of alliances in market-sharing collusion depends on the antitrust policy.

## ⇒ Perverse effects of antitrust policy

- Aubert, Kovacic & Rey (IJIO, 2006), Aubert (TSE, 2009), Avramovich (REyE, 2013) Perverse effects related to productive inefficiencies.

## ⇒ Endogenous creation of evidence → endogenous prob. of detection

- Aubert *et al.* (IJIO, 2006), Jellal & Souam (2004), Avramovich (REyE, 2013). Why cartels keep evidence of their activities?
- Jellal & Souam (2004), Harrington (RAND JE, 2004 ; IER, 2005 ; IJET, 2011), Harrington & Chen (CIRJE, 2005), Avramovich (REyE, 2013), Harrington & Chang (JEEA, 2009). How the probability of detection depends on firm's behavior and/or antitrust policy?

# Outline

- 1 Model
  - Benchmark case. The *Complete network design*.
  - The *Representative network design*
- 2 The welfare implications of cartel's network strategy.
- 3 Antitrust policy.
- 4 Leniency programs
- 5 Conclusion



# The Model

- **Continuum of industries.** Each industry has an inelastic demand for 2 units with reservation price  $v$  such that  $v \sim U[\underline{v}, \bar{v}]$ , and two firms,  $i = A, B$ .
- Markets differ in their degree of sophistication:  $\gamma \sim U[0, 1]$ .
- Hence markets can be identified by the pair  $(v, \gamma)$ .
  
- **Firms:**
  - Produce perfect substitutes  $q_i$  at a fix marginal cost  $c$ .
  - Functional-separation mode of organization  $\Rightarrow$  firms have  $j = 2$  separate divisions headed by a single manager each, such that:
    - Each manager has an specific and irreplaceable *expertise*.
    - Managers' expertises are strategic complements.
  
- **The game:** Firms maximize profits over an infinite time horizon and, to this end, they compete or collude on prices.
  - Firms discount time at a fix parameter  $\delta \in (0, 1)$ .
  - Market demand goes to the lowest price firm or, in case of a price tie, firms split demand equally.

## ● Antitrust policy:

- Fines are corporate ( $F$ ) and individually ( $f$ ) established.
- Inspections defined over firms' divisions: at each period the AA visits a firm in an industry with probability  $\rho$  and inspects a single division of it.

Within a firm, inspections across divisions are equally likely.

*Ass. 1: Communication between rival members constitutes **hard evidence** for cartel conviction. Communication between co-conspirators of the same firm is considered as **soft evidence**.*

Delegating cartel decisions to representative managers is **attractive**:

- ↓ Probability of detection.
- ↓ (total) liable fine under detection

*Ass. 2: The more sophisticated the market, the more valuable the expertise of each manager and, so, the higher the profit loss from delegating business decisions to a representative manager.*

Delegating cartel decisions to representative managers is **detrimental**:

- ↓ Net profits from sales.

## ● Alternative Network Designs: **Complete vis-a-vis Representative.**

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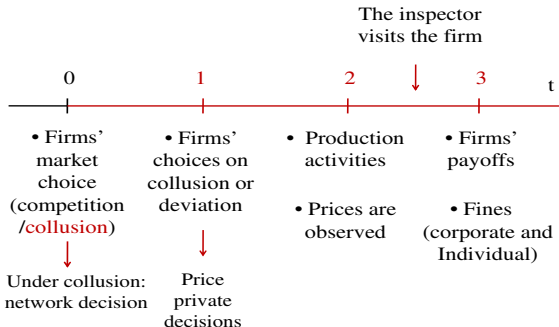
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## Timing of the game:



# Static Game

Firms choose price to maximize current profits:

$$\Pi_i = (p_i - c)q_i \quad \Rightarrow \quad \boxed{p_i = c}$$

## Proposition 1

*There exists a one-shot game NE with both firms obtaining zero profits.*

↔ Since at the static NE firms receive the lowest value of profits that can be credibly driven down to, Nash reversion constitutes the most threatening trigger strategy.

# Dynamic Game

Pricing strategy: firms charge

$$p_{it} = p^c \quad \text{if} : q_{i\tau} = 1 \quad \forall \tau \in \{1, \dots, t-1\}, j = \{1, 2\}$$

otherwise they switch to the static NE giving zero profits to the deviant.

# Pricing and Network Decisions under Collusion

## Complete Network Design

$$\Pi_i = (p_i^c - c) q_i^c - \rho (2 - \rho) (2f + F)$$

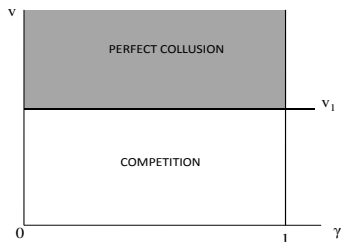
## Representative Network Design

$$\Pi_i = (p_i^c - c) q_i^c (1 - \gamma) - \rho (1 - 1/4\rho) (f + F)$$

# Pricing and Network Decisions under Collusion

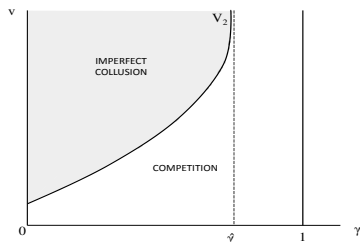
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$$\Pi_i = (v - c) \mathbf{1} - \rho(2 - \rho)(2f + F)$$



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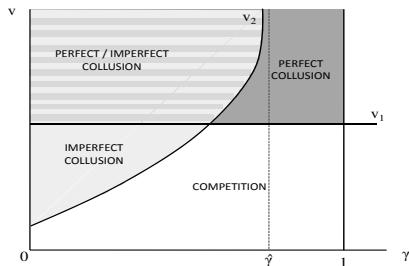
## Proposition 2

*Under collusion:  $p^c = v$  and  $q_i^c = 1$ , and there exist sustainability threshold prices  $v_1$  and  $v_2$  such that collusion is sustainable in all industries with high enough reservation price  $v$ , under the complete and the representative network design, respectively.*



## Optimal Network Strategy

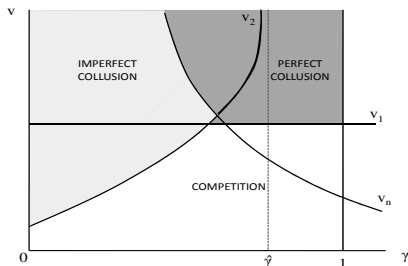
- For  $v > \max\{v_1, v_2\}$  collusion is sustainable under both network designs. Cartel firms implement the one with the highest return ( $\Pi^C$  vis-a-vis  $\Pi^R$ )



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### Market equilibrium and optimum network design



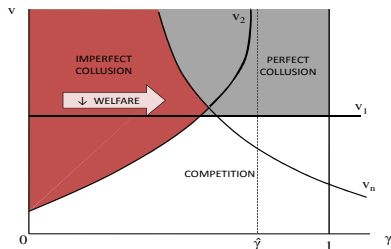
#### Lemma 1

Given  $v_1$ ,  $v_2$  and  $v_n$ :

- Firms play collusion if  $v \geq \min \{v_2, v_1\}$ . Within this context, if  $v \in (v_2, v_n)$  firms set the representative network design; otherwise they set the complete one.
- If, instead,  $v < \min \{v_2, v_1\}$  competition takes place.

# Social Welfare

- Collusion creates a welfare loss *iff* it is implemented through the **representative network design**. Otherwise it only redistributes welfare between consumers and producers.

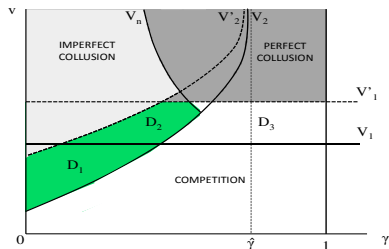


The welfare loss from collusion increases with  $\gamma$ : the more sophisticated the market, the higher the social loss from implementing the *representative* network design.

- The antitrust policy improves welfare *iff* prevents collusion with the *representative* network design:
  - ⇒ by deterring collusion with this network design (**Deterrence Effect**)
  - ⇒ by inducing surviving cartels to switch their *representative* network for the *complete* design (**Network-distortion Effect**).

# Antitrust policy

- 1- **Deterrence effect:** higher fines and/or more inspections raise expected costs from detection  $\Rightarrow$  Thresholds prices  $v_1$ ,  $v_2$  are increasing in  $f$ ,  $F$  and  $\rho$ .



*A more severe antitrust policy improves deterrence and welfare.*

**Deterrence effect ( $D_1 + D_2 + D_3$ )**

**Welfare gain ( $D_1 + D_2$ )**

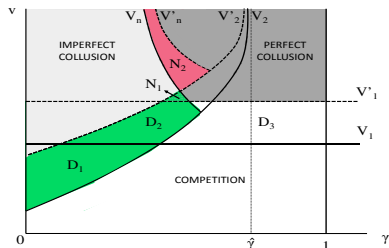
# Antitrust policy

## 2- Network-distortion effect:

$$\Pi_i^R = (v - c)(1 - \gamma) - \rho(1 - 1/4 \rho)(f + F) > (v - c) - \rho(2 - \rho)(2f + F) = \Pi_i^C$$

↪ Higher fines increase the attractiveness of the *representative* design  $\Rightarrow \nabla$  Welfare.

### Undetermined welfare effect





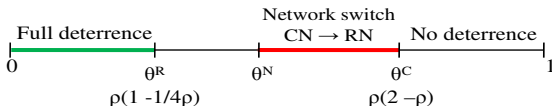
# Leniency programs (LP)

- Consider a LP that offers a fine amnesty to the first cartel firm to come forward with hard evidence of the cartel.

Defining the amnesty parameter  $\theta \in [0, 1] \Rightarrow$  the fine amnesty is  $(1 - \theta) F$ .

- Following standard implementation, applications are public  $\Rightarrow$  The cartel breaks after a report and, therefore, these only take place under deviation.
- For a deviant, the introduction of a LP implies two strategies to choose from:  
**(A)** deviation with report,                      **(B)** deviation without report.

$\Rightarrow$  A deviant applies for leniency *iff.* the fine payed after reporting is lower than the expected fine to be paid without it (i.e, *iff.*  $\theta < P(\text{detection})$ ).



# Main messages

- In an economy coexist cartels with different types of network.
- Cartel's possibility of setting alternative networks has economic implications:
  - It allows for cartel sustainability in industries where it is not foreseen by standard models of collusion.
  - It introduces inefficiencies on cartel decisions that reduce welfare.
- Fighting collusion is not only about deterrence, but also about the network distribution of cartels. A policy that contributes to deterrence:
  - may not have welfare implications.
  - may induce surviving cartels to adopt an inefficient network design.
- Antitrust policy must be carefully designed. Fines, inspections and amnesties are instruments that properly combined can improve welfare, but improperly done can reduce it through highly inefficient surviving cartels.
  - More severe antitrust policies assure a welfare gain when implemented through more inspections within a context of high  $F$  and  $\rho$ .
  - A Leniency program only increases welfare for very high amnesties.



**Thanks for your attention!**