THIBAUD VERGÉ

CREST-LEI

ENSAE 3A / Master APE (2009-2010)
Outline

1. Introduction
2. Cournot Mergers
3. Mergers with Differentiated Products
4. Some Practical Issues For Merger Analysis
Some Statistics (to end of November 2009)

- 4250 notified (i.e. proposed) mergers
- Most cleared after phase I (preliminary investigation) with or without commitments
- 191 phase II proceedings initiated (in depth investigation)
- 20 prohibition decisions (only 2 since January 2002, latest one in June 2007, proposed acquisition of Aer Lingus by Ryanair)
- Remark: some of these prohibition decisions overturned in appeal

Most phase II mergers cleared with commitments

- Structural remedies (divestment of assets) as in Air France / KLM or Carrefour / Promodes
- Behavioral remedies (as in Vivendi / Canal + / Seagram or recently in France in CanalSat / TPS)
Merger Control: Procedure

- Mergers (large enough and with European scope) have to be notified to the European Commission.
- The DG Competition has one month to decide whether to clear the merger (with or without commitment) or launch a phase II investigation.
- Phase II investigation lasts another four months.

Merger Analysis

- **Market definition** (product and geographical markets)
- **Substantial Lessening of Competition Test**
  - Single dominance (unilateral effects)
  - Joint or collective dominance (risk of tacit collusion)
- Evaluation of efficiency gains
- Remedies (structural and / or behavioral)
US Merger Control and Use of HHI

- Preliminary analysis of mergers should involve the following use of the HHI
  - Compute the pre-merger market shares \((\text{requires to properly define the relevant market})\)
  - Using these market shares, compute an estimated post-merger HHI (HHI’) and the change in concentration \(\Delta HHI\)
  - \textbf{Assumes that the market shares are not affected by the merger}

**Decision Algorithm**

- \(HHI’ < 1000 \implies \text{Approve}\)
- \(1000 \leq HHI’ \leq 1800\) and
  - \(\Delta HHI \leq 100 \implies \text{Approve}\)
  - \(\Delta HHI > 100 \implies \text{Investigate (significant competitive concerns)}\)
- \(HHI’ > 1800\) and
  - \(\Delta HHI \leq 50 \implies \text{Approve}\)
  - \(\Delta HHI > 50 \implies \text{Investigate (significant competitive concerns)}\)
Cournot Mergers are Rarely Profitable

Reminder about Cournot Oligopoly
- $n$ identical firms with marginal cost $c$
- Linear inverse demand function $P(Q) = a - bQ$
- Individual profit writes as $\pi^C(n) = \frac{(a-c)^2}{b(n+1)^2}$

Merger between $m + 1$ firms

$$\Delta \pi^C = \pi^C(n - m) - (m + 1)\pi^C(n) = \frac{(a-c)^2}{b} \left( \frac{1}{(n - m + 1)^2} - \frac{m + 1}{(n + 1)^2} \right)$$

$$= \frac{(a-c)^2}{b(n - m + 1)^2(n + 1)^2} \left( (n + 1)^2 - (m + 1)(n - m + 1)^2 \right)$$

$$= -\frac{(a-c)^2}{b(n - m + 1)^2(n + 1)^2} \left( n^2 - (m + 1)^2 - (m - 1)^2 \right)$$
Cournot Mergers are Rarely Profitable
Salant, Switzer and Reynolds (Quarterly Journal of Economics, 1983)
Bertrand Mergers are rarely profitable

Symmetric Situations
- Zero profit when firms are identical
- Only a merger to monopoly can be profitable

Asymmetric situations
- Mergers which do not involve the most efficient firms are pointless
- Only profitable mergers are mergers
  - To monopoly
  - Involving the two most efficient firms
### Solutions (i.e. more realistic frameworks)

#### Cournot Mergers
- **Increasing marginal costs**
- McAfee and Williams (*Journal of Industrial Economics*, 1992)

#### Bertrand Mergers
- **Differentiated products**
- Davidson and Deneckere (*Rand Journal of Economics*, 1985)
  - *Logit demand model (widely used for econometric analysis)*

#### Efficiency gains
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Cournot Oligopoly with Assets

Perry and Porter (American Economic Review, 1985)

See also McAfee and Williams (Journal of Industrial Economics, 1992)

A model of oligopoly with assets / capacities

- Linear Inverse demand function $P(Q) = 1 - Q$
- $N$ firms each endowed with a quantity $k_i$ of assets
- Common cost function $C(q, k) = cq + \frac{\gamma q^2}{2k} + kF$
- To simplify assume no fixed costs ($F = 0$) and normalize $c = 0$
- Quantity competition
Cournot Model with Assets

Define $\beta(k) = \frac{k}{\gamma + k}$ and $B(k) = \sum_{i=1}^{n} \beta(k_i)$

Equilibrium price and quantities are given by:

$$P^*(k) = \frac{1}{1 + B(k)}, \quad Q^*(k) = \frac{B(k)}{1 + B(k)} \quad \text{and} \quad q^*_i(k) = \frac{\beta(k_i)}{1 + B(k)}$$

Individual equilibrium profit is:

$$\pi^*_i(k) = \frac{\beta(k_i)(1 + \beta(k_i))}{2(1 + B(k))}$$
Impact of mergers in this framework

Particular feature of this cost function

\[ C(q, k' + k'') = \min_{q' + q'' = q} \left( C(q', k') + C(q'', k'') \right) \]
\[ = \min_{q_i + q_j = q, k_i + k_j = k' + k''} \left( C(q_i, k_i) + C(q_j, k_j) \right) \]

- No synergies (see Farrell and Shapiro (AER, 1990)) only efficient use of the assets
- Well suited to analyze Cournot mergers and structural remedies

Questions

- When are mergers profitable for the merging firms?
- When are mergers good for the consumers?
- When are mergers welfare improving?
Mergers without synergies always raise prices

**Impact on price**

Remark that:

\[
\Delta B = \beta (k_i + k_j) - (\beta (k_i) + \beta (k_j))
\]

\[
= -\frac{k_i k_j (k_i + k_j + 2\gamma)}{\gamma + k_i + k_j} < 0
\]

- The merged entity reduces output after the merger
- The rivals increase output but not enough to compensate

**Merger Control and Consumer Surplus**

If consumer surplus is the welfare standard, mergers without synergies should always be blocked
A merger between firms 2 and 3 is profitable.
Welfare Improving Mergers

A merger between firms 2 and 3 is welfare improving.
Welfare Improving Mergers and HHI
From McAfee and Williams (JIE, 1992)
Cournot Mergers with Efficiency Gains

Pre-merger Framework

- Linear inverse demand function $P(q) = 1 - Q$
- Pre-merger, $n$ identical firms with constant marginal cost $c$
- Equilibrium price and (individual profits) are therefore:

$$P^* = \frac{1 + nc}{n+1} = c + \frac{1 - c}{n+1} \quad \text{and} \quad \pi^* = \frac{(1 - c)^2}{(n+1)^2}$$

Merger with Efficiency Gains

- 2 of the $n$ firms merge
- Efficiency gains (for the insiders): $c_I = c - \gamma$
- Nothing changes for the outsiders: $c_O = c$
Merger with Efficiency Gains

Post-merger price and profits

- **Equilibrium quantities:**
  \[ q_i^{**} = \frac{1 - c + (n - 1)\gamma}{n} \quad \text{and} \quad q_O^{**} = \frac{1 - c - \gamma}{n} \]

- **Equilibrium price:**
  \[ Q^{**} = \frac{(n - 1)(1 - c) + \gamma}{n} \quad \leftrightarrow \quad P^{**} = c + \frac{1 - c - \gamma}{n} \]

- **Equilibrium profits:**
  \[ \pi_I^{**} = \frac{(1 - c - \gamma)(1 - c + (n - 1)\gamma)}{n^2} \quad \text{and} \quad \pi_O^{**} = \frac{(1 - c - \gamma)^2}{n^2} \]
Some Remarks

- A merger can be beneficial for consumers if the efficiency gains are large enough.

- If a merger lowers (raises) the equilibrium price then it is bad (good) news for the outsiders.

- Mergers involving two firms only can be profitable.

- **More generally small and large mergers can be profitable** (but not intermediate mergers).
Profitable (small) Cournot Mergers

All mergers are welfare improving.

Price Lowering Mergers

Profitable Mergers

Measure of Efficiency Gains
Mergers with Efficiency Gains

Initial number of firms varying from 3 to 7

Impact of the merger on insiders’ profits
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A Simple Version of “Brand Portfolio” Models

- Three variants of a given product
- Pre-merger, three identical firms produce a variant each at constant marginal cost $c$
- Consumers have the following (gross) utility function:

$$U = y + a \sum_{i=1}^{3} q_i - \frac{3}{2(1 + \beta)} \left( \sum_{i=1}^{3} q_i^2 + \frac{\beta}{3} \left( \sum_{i=1}^{3} q_i \right)^2 \right)$$
Demand functions

- Demand functions write as:

\[ D_i = \frac{1}{3} \left( a - (1 + \beta) p_i + \frac{\beta}{3} \sum_{j=1}^{3} p_j \right) \]

- \( \beta \) is the parameter of substitutability
- \( \beta = 0 \): products are independent (maximum differentiation)
- \( \beta \to \infty \): products are (almost) perfect substitutes

- Note that: \( p_1 = p_2 = p_3 = p \implies q_1 = q_2 = q_3 = \frac{1}{3} (a - p) \)
- Fixed size of the market (does not depend on \( \beta \) or the number of firms)
- \( a \) is a market-size parameter
Pre-merger outcome

**Pre-merger: Three independent firms**

- Each firm (non-cooperatively) sets its price $p_i$ so as to maximize its profit $\pi_i = (p_i - c) D_i$

**Prices, Quantities and Profits:**

\[
p_i^* = c + \frac{3(a - c)}{2(3 + \beta)}, \quad q_i^* = \frac{(a - c)(3 + 2\beta)}{6(3 + \beta)} \quad \text{and} \quad \pi_i^* = \frac{(a - c)^2(3 + 2\beta)}{4(3 + \beta)^2}
\]

**Consumer Surplus and Total Welfare:**

\[
CS^* = \frac{(a - c)^2(3 + 2\beta)^2}{8(3 + \beta)^2} \quad \text{and} \quad W^* = \frac{(a - c)^2(27 + 24\beta + 4\beta^2)}{8(3 + \beta)^2}
\]
Suppose that firms 1 and 2 merge.

The new firm (I) now owns a portfolio of brands and maximizes its profit

$$\pi_I = \sum_{i=1}^{2} (p_i - c) D_i$$

**Impact of the merger on prices**

$$p_i^{**} = c + \frac{(a - c)(6 + 5\beta)}{2(6 + 6\beta + \beta^2)} > p_o^{**} = c + \frac{(a - c)(3 + 2\beta)}{6\beta + \beta^2} > p_i^*$$

- Merger $\approx$ Collusion between two firms $\implies$ the insiders’ product are priced less aggressively
- Due to strategic complementarity, this lead to less aggressive behavior from the outsider(s)
- All prices thus go up
- But the direct effect dominates, therefore the insiders’ prices increase more
Impact on Price Absent Efficiency Gains

Pre-Merger Equilibrium

Post-Merger Equilibrium

Insiders are less aggressive post merger

Outsider’s Price \( (p_O) \)

Insiders Price(s) \( (p_I) \)

Mergers with Differentiated Products

Linear Demand with Differentiated Products

Horizontal Mergers
Impact on Price With (Large Enough) Efficiency Gains

Pre-Merger Equilibrium

Post-Merger Equilibrium

Merger makes the insiders less aggressive …

… but efficiency gains make them more aggressive
Impact on Profits and Total Welfare

Impact on Profits

- The merger is profitable for the insiders
  - \textit{Rk: It is never profitable for the new entity to stop selling a product}
- The merger increases the outsider’s profit
- However, the merger is more profitable for the outsider than for the insiders

Impact on Welfare

The net effect of the merger on total welfare (unweighed sum of consumer surplus and profits) is negative
Discrete choice models of consumer behavior (McFadden, 1978)

Widely by econometricians and in practice to evaluate mergers (with differentiated products)

Demand Model

- $n$ different products (mutually exclusive alternatives for the consumers)

- Consumer $i$ derives utility $U_{ij} = \alpha_j - \beta p_j + \varepsilon_{ij}$ from consuming good $j$, where:
  - $\alpha_j$: product-specific constant (characteristics)
  - $\varepsilon_{ij}$: random coefficient (i.e. unobservable subjective preferences of consumer $i$ or unobservable product characteristics)
Logit Demand Models

Logit Demand

- Assumption: The random coefficient are i.i.d. according to the extreme value distribution.

- We can then show that the demand for good $j$ (i.e. the probability that consumer $i$ will buy good $j$) writes as:

\[
\pi_j = \frac{\exp(\alpha_j - \beta p_j)}{\sum_{k \in J} \exp(\alpha_k - \beta p_k)}
\]

- Note that $\pi_j$ is also the market share of product of product $j$.

- Once the demand are computed, it is possible to solve for the Nash-equilibrium of price competition game.

- Nested Multinomial Logit
How to use logit demand models for merger analysis?

- Use the available data on prices and market shares to evaluate the various coefficients of the model (i.e. $\alpha_j$ and $\beta$).

- Use the estimated demand model to solve for the post-merger equilibrium.

- Evaluate consumer surplus (pre- and post-merger) and/or total welfare.

- Optimally we would like to estimate the supply side of the model as well (i.e. cost functions) to take potential efficiency gains into consideration.

- Possibility to take relocation (change of product characteristic, product removal, ...) into account.
Some Practical Issues For Merger Analysis

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Factors affecting market power

Concentration

- The larger the number of independent firms operating after the merger, the less likely it is that the merger will be detrimental to consumers
- Rationale for the use of concentration indices (e.g. HHI)

Market Shares and Capacities

- The lower the market shares of the merging firms, the less detrimental the effect on prices
- Productive capacities (i.e. if rivals can increase production after the merger, it is likely that the price will raise)
Factors affecting market power

Entry

- The firms’ ability to raise price is limited by the existence of potential entrants
- Necessity to evaluate existing barriers to entry in the industry (i.e. sunk costs, ...)
- Difficult assessment: need to evaluate if firms are likely to enter and when (uncertainty)

Other important factors

- Demand variables (e.g. price elasticity)
- Buyer power (can go in both directions)
- Failing firm defence
- **What are the alternatives?**
Coordinated Effects

Risk of joint-dominance

- See chapter 11 (Collusion): what are the factors that make collusive outcomes (i.e. tacit collusion) more likely to arise in equilibrium.

- E.g. See Compte, Jenny and Rey (EER, 2002) and the Nestlé / Perrier merger.
Nature and Assessment of Efficiency Gains

Theory: Variable or Fixed Costs?

- Variable cost savings are likely to have an impact on prices.
- However, output rationalization is not enough to lead to lower prices post-merger (see oligopoly with assets).
- I.e. real synergies (in the sense of Farrell and Shapiro) are required.
- Fixed cost savings (e.g. avoiding duplication of fixed costs) have no impact on prices.

Practice: Important to Identify the Nature of the Efficiency Gains
Assessment of Efficiency Gains

- Only efficiency gains that could not be achieved without the merger should be taken into account

Asymmetric information between firms and competition authorities

- Firms have strong incentives to overstate efficiency claims
- Genuine tendency to overstatement (merging parties are often too optimistic, do not foresee difficulties to create synergies between different cultures, . . .)
- Rival firms (outsiders) have a tendency to understate efficiency claims
- Need for specialized independent auditors
Efficiency Offence

- If efficiency gains are too large, it is possible that the merger would force some outsiders to exit the market.

- This might then be detrimental for the consumers (higher prices) or even for total welfare.

- Note that it might be efficient to have fewer, bigger and more efficient firms than more, smaller inefficient ones.

- However, we should then expect outsiders to react and merge in order to survive (see for instance Motta and Vasconcelos, *IJIO*, 2003).
Divestitures (i.e. Structural Remedies)

Types of Divestitures

- Capacities or Assets: *Carrefour / Promodès, Total Fina /Elf, …*
- Brands: *Unilever / Bestfoods, …*

Problems with divestitures

- Asymmetric information
- Possibility for the merging parties to divest unprofitable assets or decrease the value of the divested assets
- Identifying the right buyer
- Risk of collusion (more symmetric situations, multi-market contact, …)
Behavioral Remedies

Types of Remedies

- Licensing agreements (Astra / Zeneca)
- Non-discriminatory access to “essentiel facilities” (Vivendi / Canal+ / Seagram)
- Giving up important exclusivity agreements (Lufthansa / SAS)

Problems with behavioral remedies

- Require ongoing regulation or constant monitoring
- Easier to “evade” (asymmetric information between firms and the authorities)
- Might require a (transitory) period of collaboration between the merging parties and the entrant / licensee (risk of collusion, incentives not to collaborate effectively, . . . )