Chapter 5:
Simulation Methods

Quantitative Methods for Regulation and Competition

Standard Approach to Merger Assessment

- Define the market, taking into account potential entry
- Compute market shares and other measures of concentration pre- and post-merger
- Apply judgment on dominance and likely effects of the merger

Difficulties

- Delineation of market may not be easy
- Market shares may not tell the whole story
- Different degrees of substitution
- Difficult to obtain quantitative estimates of price increases and welfare changes
- How do we measure efficiency gains?

Merger Simulation

- Technique used for and against mergers
- Combine market elasticities with assumption of nature of competition
- Direct estimation of the effects of a merger, quantitative measures of changes!

- However, technically demanding
- Here, assume that at least data on market shares and prices are available

Merger Simulation in Four Steps

1. Specification of demand model: elasticities
2. Specification of supply model: cost functions & behaviour
3. Model selection: which type of competition?
4. Run conterfactuals: what is the effect of a merger?

- Robustness check: alternative scenarios & assumptions
- Follows Ivaldi et al. (2003) (formal expressions derived in Ivaldi and Verboven (2002))

Step 1: Specification of a Demand Model

- Objective: approximate consumer behaviour and obtain estimates of own and cross-price elasticities
- Specification of a particular demand model:
  - Duopoly i and j, each producing one product (substitutes) and there is also an outside good o
  - E.g: i (apple juice) j (orange juice) and o (other beverages)
  - Suppose market share of i (s_i) is proportional to the market share of o (s_o) by a factor w_i: $s_i = w_i s_o$
  - Assume that w_i is a function of the price and a monetary value of the "quality": $\ln w_i = b_i - ap_i$
  - Combining these two equations: $\ln s_i = \ln s_o + b_i - ap_i$ (a particular demand function)

Step 1: Specification of a Demand Model

- Estimate the previous model and find a, b_i and b_j
- From here, one can obtain…
  - The own price elasticity:

$$e_{i,i} = -ap_i(1-s_i)$$

  - The cross price elasticity:

$$e_{i,j} = -ap_j s_j$$

  - The diversion ratio:

$$D_{i,j} = \frac{p_i s_i}{p_j(1-s_j)}$$

Example

Table 1: Numerical example

		Firm/Product i		Firm/Product j	
		Share	Price	Share	Price
Observations	Observation #1	15%	7.0	10%	5.0
	Observation #2	10%	8.4	8%	5.5
Estimation	Parameters	$a = 0.372$	$b_i = -0.208$	$b_j = 1.005$	

Table 2: Elasticities and diversion ratios (Numerical example)

	Observation #1	Observation #2
Own price elasticity of demand for product i	-2.22	-2.81
Own price elasticity of demand for product j	-1.68	-1.88
Cross price elasticity of demand for product i with respect to price of product j	0.19	0.16
Cross price elasticity of demand for product j with respect to price of product i	0.39	0.31
Diversion ratio from product i to product j	0.13	0.07
Diversion ratio from product j to product i	0.16	0.13

Step 2: Specification of a Supply Model. Part (a): Costs

- Objective: obtain estimates of marginal costs
- Cost function:
  - Economic description of firm's technology
  - (More on the Regulation chapters)
  - Example: assume fixed cost and constant marginal cost:

$$C_i = c_i y_i + F_i$$

Step 2: Specification of Supply Model. Part (b): Behaviour

- Bertrand (price setting)
  - Firms set prices, given prices and characteristics of other firms
  - Simple equilibrium formula: $\frac{P_i - c_i}{P_i} = \frac{1}{e_{i,i}}$
  - In our example, $m_i = P_i - c_i = \frac{1}{a(1-s_i)}$
- Collusive (joint price setting):
  - Two firms set prices maximising joint profit
  - They choose: $\frac{\tilde{P}_i - c_i}{\tilde{P}_i} = \frac{1}{-\tilde{e}_{i,i}} + \frac{\tilde{P}_j - c_j}{\tilde{P}_j}\tilde{D}_{j,i}\frac{\tilde{P}_j}{\tilde{P}_i}$
  - In our example, $\tilde{m}_i = \tilde{P}_i - c_i = \frac{1}{as_o}$
- Alternatives:
  - Cournot Nash equilibria (quantity setting) or Stackelberg

Numerical Example

Table 3: Estimates of marginal costs and margins (numerical example)

		Firm/product *i*		Firm/product *j*	
		Bertrand	Collusion	Bertrand	Collusion
Marginal cost	Observation #1	3.84	3.42	2.02	1.42
	Observation #2	5.41	5.13	2.58	2.23
Price-cost	Observation #2	0.45	0.51	0.60	0.72
	Observation #2	0.35	0.39	0.53	0.60

Source: Ivaldi et al. 2003

Step 3: Model Selection

- Objective: Select the adequate model. Were firms competing a la Bertrand or Cournot?
- Option (a): Compare estimated mc with observed ones:
  - Data often not available
- Option (b): Use econometric techniques:
  - See Ivaldi et al. (2003)

Alternatives

- Bertrand (price setting)
  - Relevant for differentiated products
  - Firms set prices, given prices and characteristics of other firms
- Curnot Nash equilibria (quantity setting):
  - Most relevant for homogenous product and capacity decisions
  - Choose output to max. profits, holding other firms' outputs fixed
- Stackelberg models:
  - One firm selects before the other

Step 4: Run Counterfactuals

- Objective: Simulate changes in conduct and evaluate changes in prices or welfare
- Case (1): Analyse merger effects
  - Suppose Bertrand model was selected
  - Use estimates of costs obtained from the Bertrand equation into the collusion equation
- Case (2): Consequences of collusion
  - Suppose collusive model was selected
  - Use estimates of costs from the collusive equation into the Bertrand equation

Numerical Example: Case 1

Table 5: Change in consumer surplus and market power due to a merger (numerical example)

	Price		Margin		Consumer
	Product *i*	Product *j*	Product *i*	Product *j*	surplus
Observed conduct: Bertrand	7.00	5.00	45%	60%	0.76
Simulated conduct: Merger	7.30	5.47	47%	63%	0.68

Source: Ivaldi et al. 2003

Numerical Example: Case (2)

Table 4: Change in consumer surplus and market power due to collusion

(numerical example)

		Price		Margin		Consumer surplus
		Product *i*	Product *j*	Product *i*	Product *j*	
Observed conduct:	Collusion	7.00	5.00	51%	72%	0.76
Simulated conduct:	Bertrand	6.64	4.44	49%	68%	0.87

Source: Ivaldi et al. 2003

Interpretation and Extensions

- Problems:
  - Critically dependent on a correct demand model
  - Critically dependent on a correctly specified behaviour
- Extensions:
  - One can take into account projected efficiencies
  - One can evaluate effects of divestments

Example cases

- Staples/Office Depot (FTC):
  - FTC predicted 7% increase in prices
  - 15% pass-trough
- WorldCom/Sprint (FCC)
  - Effects on long distance prices
- Volvo/Scania (EU)
  - Price increases of 5% in several EU countries
  - Price increases of 10% in Scandinavia