PARIS SCHOOL OF ECONOMICS
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Mergers

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Introduction

- Prediction of the likely effect of a merger.
- Merger simulation models.
- A merger simulation exercise will provide credible results if certain best practices are followed.
  - Choice of assumptions
  - Data used
  - Framing of the results within a broader analysis.
- Example: CD industry
  - Advertising instead of price competition.
  - Important diffusion effects, static models limited.
  - Industry where the consumers care about the identity of the seller.
  - Cournot would perform poorly.

Introduction to unilateral effects

Introductory model: Cournot

- Simulating a merger involves calculating the best responses for both the pre and post merger scenarios and solving for the corresponding equilibrium prices and quantities.
- 2 firms selling the same good.
- Pre-merger model:

$$\max_{q_j} \Pi_j(q_1, q_2) = \max_{q_j}(P(q_1 + q_2) - \mathrm{mc}_j)q_j$$

$$P(q_1 + q_2) - \mathrm{mc}_j + \frac{\partial P(q_1 + q_2)}{\partial q_j} q_j = 0.$$

$$P(q_1 + q_2) = a - b(q_1 + q_2)$$

Introduction to unilateral effects

Hence:

$$q_1 = \frac{a - bq_2 - \mathrm{mc}_1}{2b} \quad \text{and} \quad q_2 = \frac{a - bq_1 - \mathrm{mc}_2}{2b}.$$

$$q_i = \frac{a + \mathrm{mc}_j - 2\mathrm{mc}_i}{3b}.$$

$$Q = \frac{2a - \mathrm{mc}_1 - \mathrm{mc}_2}{3b}.$$

$$P = \frac{a + \mathrm{mc}_1 + \mathrm{mc}_2}{3}.$$

Introduction to unilateral effects

- Post-merger model: the firms form a monopoly.

$$\max_{q_1,q_2} \Pi_1(q_1,q_2) + \Pi_2(q_1,q_2)$$
$$= \max_{q_1,q_2} (P(q_1+q_2) - \text{mc}_1)q_1 + (P(q_1+q_2) - \text{mc}_2)q_2.$$

- One must decide what happens to differences across firms when they merge, in particular marginal costs. Shut down the most inefficient firm.

$$\max_{q_1,q_2} (P(q_1+q_2) - \text{mc}_1)(q_1+q_2) = \max_{Q} (P(Q) - \text{mc}_1)Q$$

$$P(Q) + P'(Q)Q = \text{mc}_1.$$

Introduction to unilateral effects

- Replacing demand:

$$a - bQ - bQ = \text{mc}_1$$

$$Q = \frac{a - \text{mc}_1}{2b} \quad \text{and} \quad P = \frac{a + \text{mc}_1}{2}.$$

- Note that

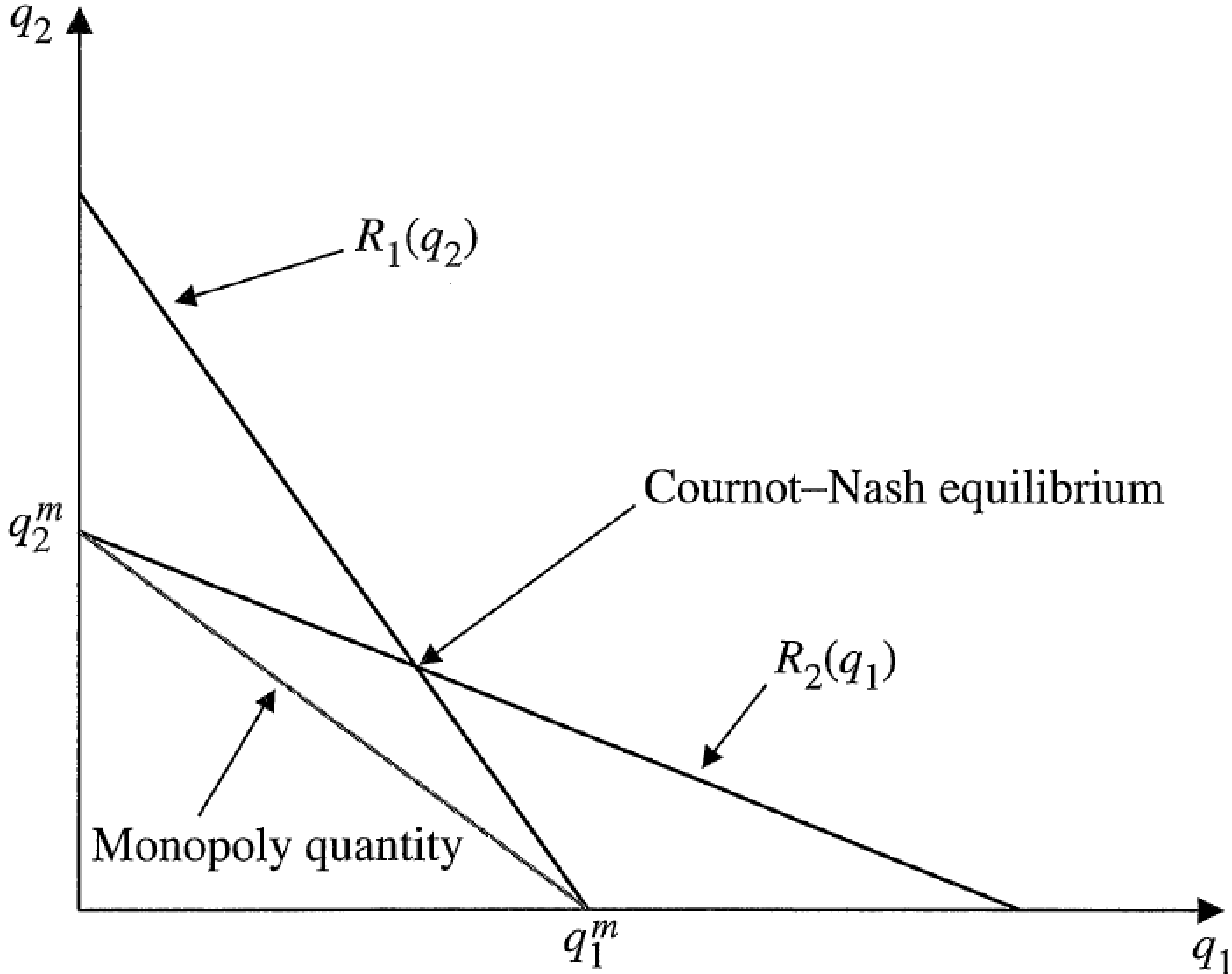
$$Q^{\text{Pre}} = \frac{2a - \text{mc}_1 - \text{mc}_2}{3b} \geqslant \frac{a - \text{mc}_1}{2b} = Q^{\text{Post}}$$

$$\iff \quad 4a - 2\text{mc}_1 - 2\text{mc}_2 \geqslant 3a - 3\text{mc}_1$$

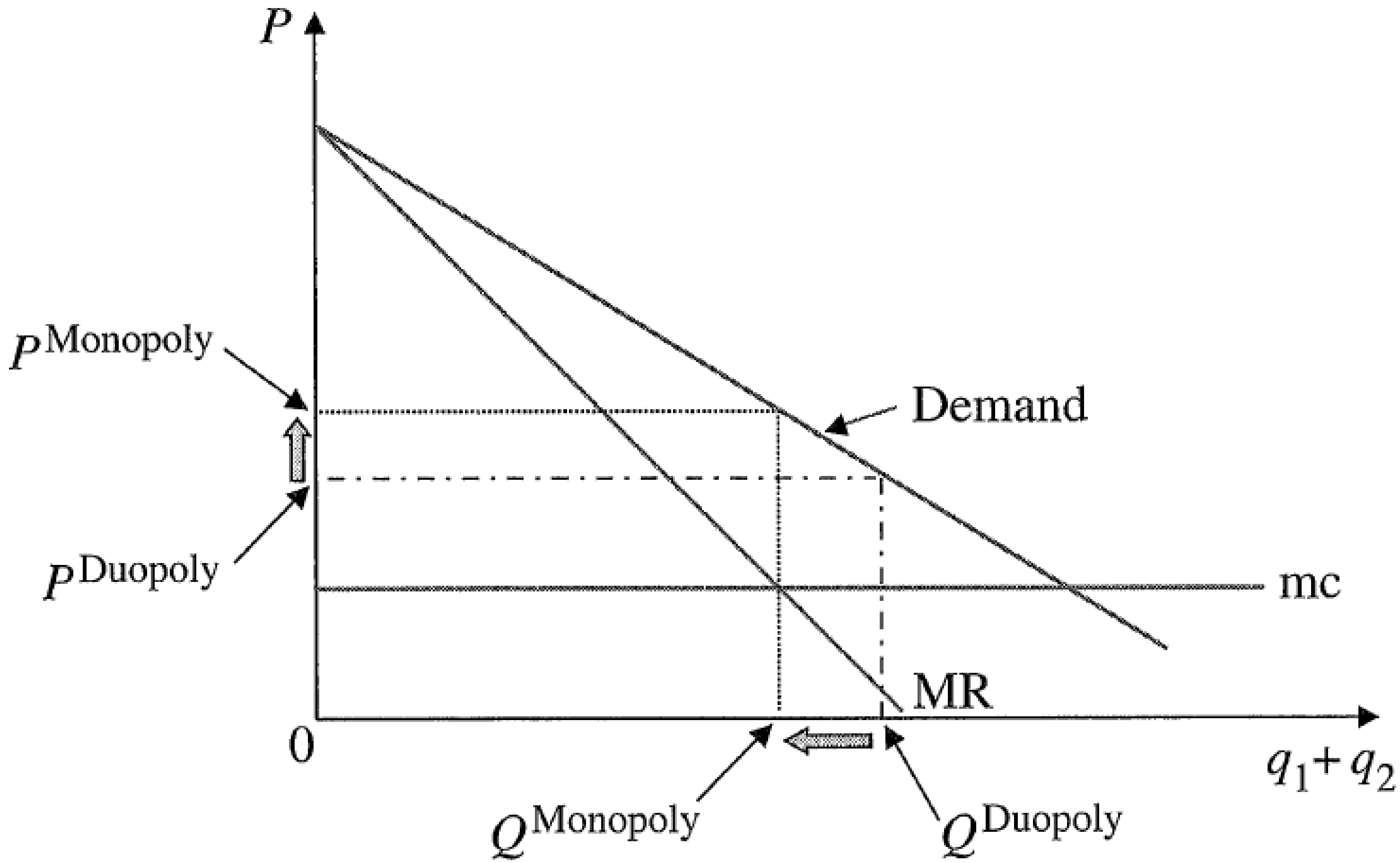
$$\iff \quad a \geqslant 2\text{mc}_2 - \text{mc}_1$$

- Cost reductions arising from a merger can reverse the general result that mergers result in higher prices and lower output.

Introduction to unilateral effects



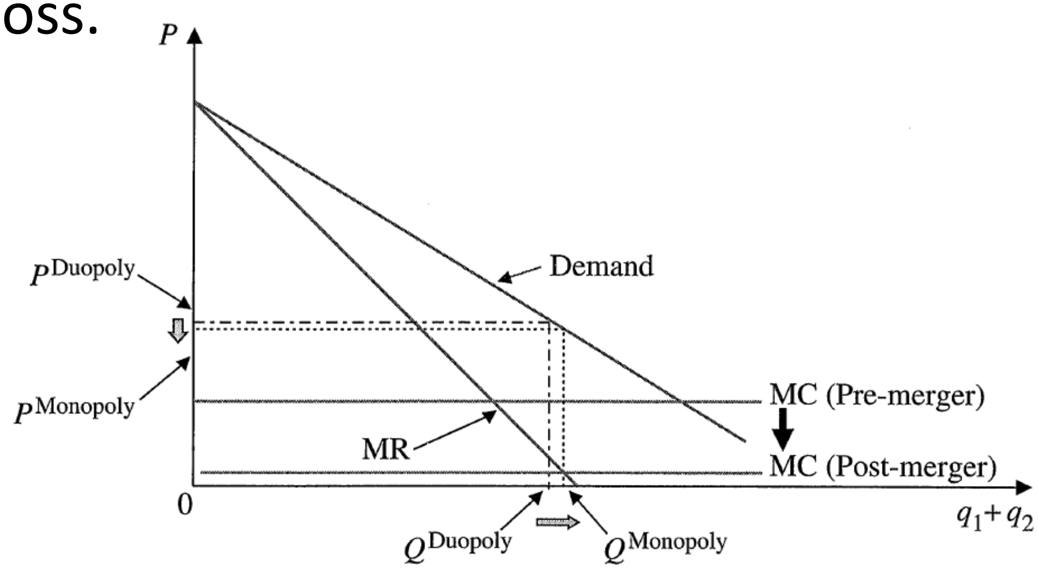
Introduction to unilateral effects



Introduction to unilateral effects

Mergers efficiencies

- Joint productions can create synergies, allow the exploitation of economies of scale, and facilitate the better use of expertise.
- Hence, merges may create production efficiencies and reduce costs, thus counterbalancing the simultaneous competition loss.



Introduction to unilateral effects

- Numerical example

  3 symmetric firms, market share = 1/3

$$P = a - b(q_1 + q_2 + q_3) = 1 - (q_1 + q_2 + q_3).$$

$$\text{mc} = 0$$

$$q_i = \frac{a - \text{mc}}{b(N+1)}$$

$$q_i = \frac{1-0}{1(3+1)} = \frac{1}{4}.$$

$$Q^{\text{Pre}} = 3 \times \tfrac{1}{4} = \tfrac{3}{4}. \qquad P^{\text{Pre}} = 1 - \tfrac{3}{4} = \tfrac{1}{4}.$$

Introduction to unilateral effects

$$\mathrm{HHI}^{\mathrm{Pre}} = 10{,}000 \sum_{i=1}^{N} s_i^2 = 10{,}000((\tfrac{1}{3})^2 + (\tfrac{1}{3})^2 + (\tfrac{1}{3})^2) = 3{,}333$$

A quick HHI calculation after merger of 2 firms would be

$$\mathrm{HHI}^{\mathrm{Post}}_{\mathrm{Noneq}} = 10{,}000 \sum_{i=1}^{N} s_i^2 = 10{,}000((\tfrac{1}{3})^2 + (\tfrac{2}{3})^2) = 5{,}555$$

Now, if we compute the post merger equilibrium:

$$q_i^{\mathrm{Post}} = \tfrac{1}{3}, \quad Q^{\mathrm{Post}} = \tfrac{2}{3}, \quad P^{\mathrm{Post}} = 1 - (\tfrac{1}{3} + \tfrac{1}{3}) = \tfrac{1}{3}.$$

$$\mathrm{HHI}^{\mathrm{Post}}_{\mathrm{Equ}} = 10{,}000((\tfrac{1}{2})^2 + (\tfrac{1}{2})^2) = 5{,}000.$$

General model for merger simulation

The general framework

- Demand. The nature of consumer demand may have very important impacts on the results of the merger simulation.
  - Set of options considered by consumers
  - Sequence of decisions
  - Differences across consumers
- Costs. Capture the technological characteristics of the production process.
  - Diseconomies of scale?
  - Constant marginal costs?
- Strategic variables. Prices, quantities, advertising, and product quality.

General model for merger simulation

- Nature of competition: Usually, firms set strategies separately. One needs to define the equilibrium, which is a way of fitting the various competing objectives together.

  Merger simulation in price-setting competition

- Single product firms with heterogeneous products:

  For each firm, one demand and one cost function is relevant.

  There will be one pricing equation for each product in the market.

  If *J* goods in the market, need to solve the set of *J* pricing equations.

General model for merger simulation

- Each firms solves

$$\max_{p_j} \Pi_j(p_j, p_{-j}) = \max_{p_j}(p_j - \text{mc}_j(w_j; \theta_1)) D_j(\underline{p}; \theta_2)$$

- FOC

$$D_j(\underline{p}; \theta_2) + (p_j - \text{mc}_j(w_j; \theta_1)) \frac{\partial D_j(\underline{p}; \theta_2)}{\partial p_j} = 0$$

- Rearranging

$$\frac{p_j - \text{mc}_j(w_j; \theta_1)}{p_j} = \frac{1}{\eta_j(p_1, \ldots, p_J; \theta_2)},$$

$$\eta_j(\underline{p}; \theta_2) \equiv -\frac{\partial \ln D_j(\underline{p}; \theta_2)}{\partial \ln p_j}$$

General model for merger simulation

- System of *J* equations.
- Pre-merger actual prices are observed. What needs to be estimated are the parameters (θ_1, θ_2).
- Need for observations on quantities, prices, and marginal costs.
- If good estimates of the demand system are available, marginal costs can be retrieved from the system of equations.
- In a second step, the post-merger equilibrium prices can be obtained by plugging the estimates of the cost and demand functions into the pricing system that corresponds to the new post-merger ownership structure.

General model for merger simulation

- Merger effects on the prices of differentiated goods: Assume the market has two goods *i* and *j*, duopoly firms merge into a monopoly. The new firm considers

$$\max_{\underline{p}} \Pi(p_i, p_j) = \max_{\underline{p}} (p_i - \mathrm{mc}_i) D_i(\underline{p}) + (p_j - \mathrm{mc}_j) D_j(\underline{p}).$$

- FOC

$$\frac{\partial \Pi(p_i, p_j)}{\partial p_i} = D_i(\underline{p}) + (p_i - \mathrm{mc}_i)\frac{\partial D_i(\underline{p})}{\partial p_i} + (p_j - \mathrm{mc}_j)\frac{\partial D_j(\underline{p})}{\partial p_i} = 0,$$

$$\frac{\partial \Pi(p_i, p_j)}{\partial p_j} = D_j(\underline{p}) + (p_j - \mathrm{mc}_j)\frac{\partial D_j(\underline{p})}{\partial p_j} + (p_i - \mathrm{mc}_i)\frac{\partial D_i(\underline{p})}{\partial p_j} = 0.$$

General model for merger simulation

- To simulate the merger effect, the additional information that is needed is

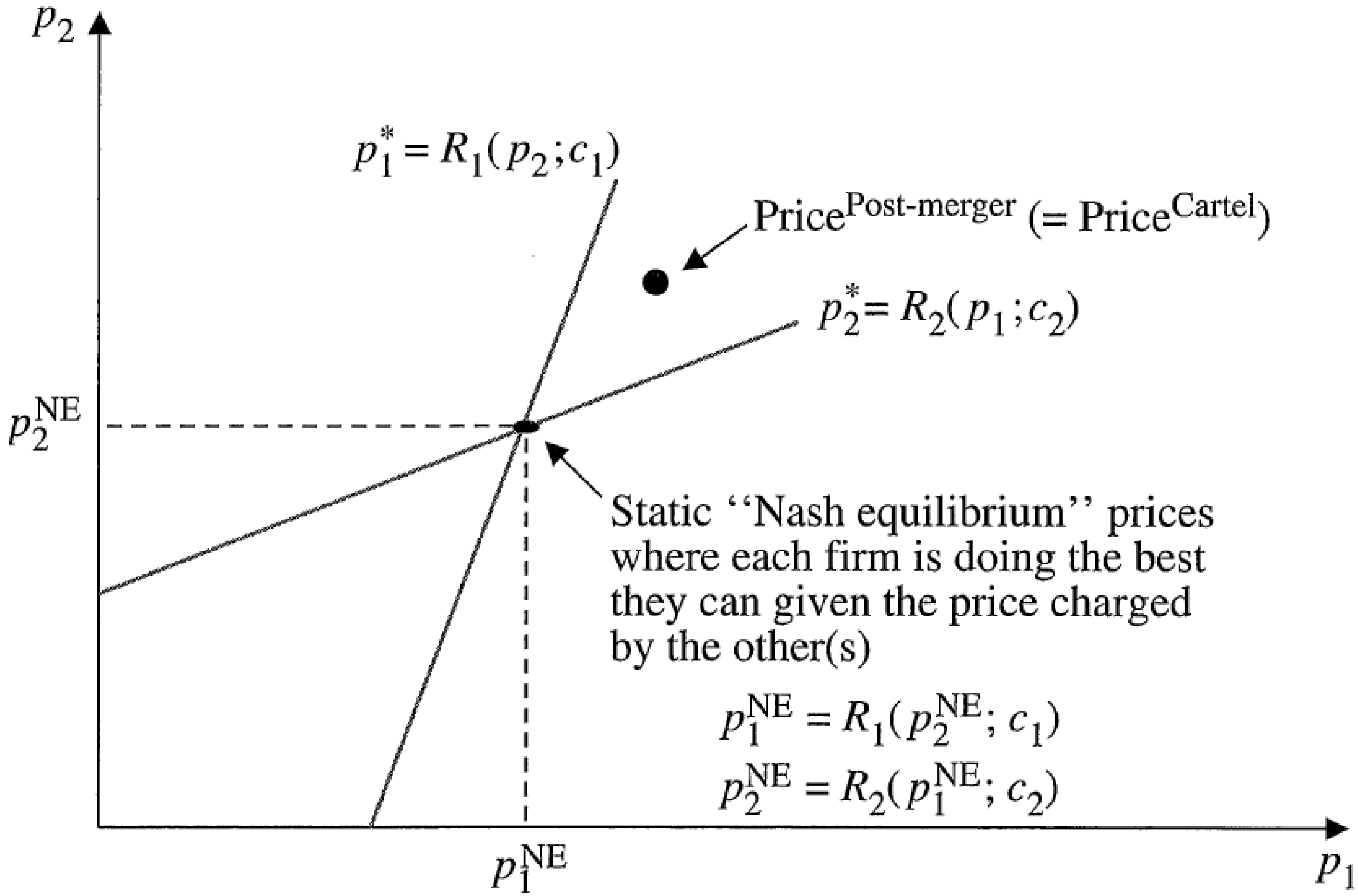
$$\frac{\partial D_1(\underline{p})}{\partial p_2} \quad \text{and} \quad \frac{\partial D_2(\underline{p})}{\partial p_1}$$

- Estimate a demand function with cross effects:

$$D_2(\underline{p}) = a_2 + b_{21} p_1 + b_{22} p_2$$

- If the two products are substitutes, $\partial D_i(\underline{p})/\partial p_j > 0$, hence, prices are higher compared to the duopolistic equilibrium.

General model for merger simulation



General model for merger simulation

- Multiproduct firms

  pre-merger firms produce several products.

  The number of goods over which the post-merger firm maximizes profits changes relative to the pre-merger situation.
- Firm *f* produces a set of products $\Im_f \subseteq \Im = \{1, \ldots, J\}$.
- The firm maximizes

$$\max_{\underline{p}_f} \sum_{j \in \Im_f} \Pi_j(\underline{p}_f, \underline{p}_{-f}) = \max_{\underline{p}_f} \sum_{j \in \Im_f} (p_j - \mathrm{mc}_j) D_j(\underline{p}).$$

- The first order conditions system for *f* are then

General model for merger simulation

$$D_k(\underline{p}) + \sum_{j \in \Im_f} (p_j - \text{mc}_j) \frac{\partial D_j(\underline{p})}{\partial p_k} = 0 \quad \text{for all } k \in \Im_f .$$

- Once again, we must solve a system of *J* equations to obtain the Nash equilibrium in prices.
- It is convenient to construct a $J \times J$ matrix Δ where

$$\Delta_{jk} = \begin{cases} 1 & \text{if same firm produces } j \text{ and } k, \\ 0 & \text{otherwise.} \end{cases}$$

- Hence, the first order condition can be rewritten as

$$D_k(\underline{p}) + \sum_{j=1}^{J} \Delta_{jk}(p_j - \text{mc}_j) \frac{\partial D_j(\underline{p})}{\partial p_k} = 0 \quad \text{for all } k \in \Im_f$$

General model for merger simulation

- The matrix Δ changes with the ownership pattern of products in the market.
- Simultaneously, to estimate demand parameters, a demand system needs to be constructed:

$$q_k = D_k(p_1, p_2, \ldots, p_J) = a_k + \sum_{j=1}^{J} b_{kj} p_j \quad \text{for } k = 1, \ldots, J.$$

- The first order conditions become then

$$a_k + \sum_{j=1}^{J} b_{kj} p_j + \sum_{k=1}^{J} \Delta_{jk}(p_j - \mathrm{mc}_j) b_{jk} = 0$$

$$\text{for all } k \in \Im_f \text{ and for all } f = 1, \ldots, F.$$

General model for merger simulation

- In this case, a simultaneous system of 2*J* demand and pricing equations need to be estimated.
- The problem is more tractable if expressed in matrix form

$$B' = \begin{bmatrix} b_{11} & \cdots & b_{1j} & \cdots & b_{1J} \\ \vdots & & \vdots & & \vdots \\ b_{k1} & \cdots & b_{kj} & \cdots & b_{kJ} \\ \vdots & & \vdots & & \vdots \\ b_{J1} & \cdots & b_{Jj} & \cdots & b_{JJ} \end{bmatrix}$$

General model for merger simulation

- The system of equations can be written as

$$\begin{bmatrix} q_1 \\ \vdots \\ q_k \\ \vdots \\ q_J \end{bmatrix} = \begin{bmatrix} a_1 \\ \vdots \\ a_k \\ \vdots \\ a_J \end{bmatrix} + \begin{bmatrix} b_{11} & \cdots & b_{1j} & \cdots & b_{1J} \\ \vdots & & \vdots & & \vdots \\ b_{k1} & \cdots & b_{kj} & \cdots & b_{kJ} \\ \vdots & & \vdots & & \vdots \\ b_{J1} & \cdots & b_{Jj} & \cdots & b_{JJ} \end{bmatrix} \begin{bmatrix} p_1 \\ \vdots \\ p_j \\ \vdots \\ p_J \end{bmatrix}$$

  i.e., $q = a + B'p.$

- For the pricing system, define the Hadamard product $\Delta \cdot B$.

General model for merger simulation

$$\Delta \cdot B = \begin{bmatrix} \Delta_{11}b_{11} & \cdots & \Delta_{j1}b_{j1} & \cdots & \Delta_{J1}b_{J1} \\ \vdots & & \vdots & & \vdots \\ \Delta_{1k}b_{1k} & & \Delta_{jk}b_{jk} & & \Delta_{Jk}b_{Jk} \\ \vdots & & \vdots & & \vdots \\ \Delta_{1J}b_{1J} & \cdots & \Delta_{jJ}b_{jJ} & \cdots & \Delta_{JJ}b_{JJ} \end{bmatrix},$$

where $b_{jk} = \partial D_j(p)/\partial p_k$.

- The vector of the *J* first order conditions can be expressed as

$$a + B'p + (\Delta \cdot B)(p - c) = 0$$

General model for merger simulation

where

$$c = \begin{bmatrix} \mathrm{mc}_1 \\ \vdots \\ \mathrm{mc}_J \end{bmatrix} \quad \text{and} \quad a = \begin{bmatrix} a_1 \\ \vdots \\ a_J \end{bmatrix}.$$

General model for merger simulation

- Hence

$$\begin{bmatrix} (\Delta \cdot B) & I \\ -B' & I \end{bmatrix} \begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} (\Delta \cdot B) & 0_{(J \times J)} \\ 0_{(J \times J)} & I_{(J \times J)} \end{bmatrix} \begin{bmatrix} c \\ a \end{bmatrix},$$

or

$$\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} (\Delta \cdot B) & I \\ -B' & I \end{bmatrix}^{-1} \begin{bmatrix} (\Delta \cdot B) & 0_{(J \times J)} \\ 0_{(J \times J)} & I_{(J \times J)} \end{bmatrix} \begin{bmatrix} c \\ a \end{bmatrix}.$$

- This expression gives an analytical solution for all prices and quantities for any ownership structure that can be represented in Δ.

Example of merger simulation

- Consider a market of 6 products produced by 6 different firms.
- The demand system has been previously estimated as

$$q_j = 10 - 2p_j + 0.3 \sum_{k \neq j} p_k \quad \text{for } j = 1, 2, \ldots, 6.$$

- We assume that the marginal costs of all products is one, and that the merger generates no efficiency.
- The pricing first-order condition of each firm is

$$\frac{\partial \Pi(p_j)}{\partial p_j} = D_j(\underline{p}) + (p_j - c_j)\frac{\partial D_j(\underline{p})}{\partial p_j} = 0$$

Example of merger simulation

- Which simplifies to

$$q_j = (p_j - c_j)(2).$$

- Hence, the system to be solved is made of 12 equations:

$$\begin{bmatrix} (\Delta^{\text{Pre}} \cdot B) & I \\ -B' & I \end{bmatrix} \begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} (\Delta^{\text{Pre}} \cdot B) & 0_{(J\times J)} \\ 0_{(J\times J)} & I_{(J\times J)} \end{bmatrix} \begin{bmatrix} c \\ a \end{bmatrix},$$

where Δ^{Pre} is the identity matrix and

$$B' = \begin{bmatrix} -2 & 0.3 & 0.3 & 0.3 & 0.3 & 0.3 \\ 0.3 & -2 & 0.3 & 0.3 & 0.3 & 0.3 \\ 0.3 & 0.3 & -2 & 0.3 & 0.3 & 0.3 \\ 0.3 & 0.3 & 0.3 & -2 & 0.3 & 0.3 \\ 0.3 & 0.3 & 0.3 & 0.3 & -2 & 0.3 \\ 0.3 & 0.3 & 0.3 & 0.3 & 0.3 & -2 \end{bmatrix},$$

Example of merger simulation

$$(\Delta^{\text{Pre}} \cdot B) = \begin{bmatrix} -2 & 0 & 0 & 0 & 0 & 0 \\ 0 & -2 & 0 & 0 & 0 & 0 \\ 0 & 0 & -2 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 & 0 \\ 0 & 0 & 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & 0 & 0 & -2 \end{bmatrix},$$

$$c = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \qquad a = \begin{bmatrix} 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \end{bmatrix}.$$

Example of merger simulation

- We can solve for prices and quantities:

$$\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} (\Delta^{\text{Pre}} \cdot B) & I \\ -B' & I \end{bmatrix}^{-1} \begin{bmatrix} (\Delta^{\text{Pre}} \cdot B) & 0_{(J \times J)} \\ 0_{(J \times J)} & I_{(J \times J)} \end{bmatrix} \begin{bmatrix} c \\ a \end{bmatrix}.$$

- Suppose now that firm Firm 1 merges with Firm 5. The ownership matrix changes to

$$(\Delta^{\text{Post-merger}} \cdot B) = \begin{bmatrix} -2 & 0 & 0 & 0 & 0.3 & 0 \\ 0 & -2 & 0 & 0 & 0 & 0 \\ 0 & 0 & -2 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 & 0 \\ 0.3 & 0 & 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & 0 & 0 & -2 \end{bmatrix}.$$

Example of merger simulation

since the first order condition for Product 1 is now

$$\frac{\partial \Pi(p)}{\partial p_1} = D_1(\underline{p}) + (p_1 - c_1)\frac{\partial D_1(\underline{p})}{\partial p_1} + (p_5 - c_5)\frac{\partial D_5(\underline{p})}{\partial p_1} = 0$$

or $q_1 = (p_1 - c_1)(2) - (p_5 - c_5)(0.3).$

- New equilibrium prices and quantities are easily calculated as

$$\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} (\Delta^{\text{Post-merger}} \cdot B) & I \\ -B' & I \end{bmatrix}^{-1} \begin{bmatrix} (\Delta^{\text{Post-merger}} \cdot B) & 0_{(J\times J)} \\ 0_{(J\times J)} & I_{(J\times J)} \end{bmatrix} \begin{bmatrix} c \\ a \end{bmatrix}.$$

Example of merger simulation

Prices under different ownership structures.

	Market structure $(n_1, \ldots, n_F)$					
Product	(1, 1, 1, 1, 1, 1)	(2, 2, 2)	(3, 3)	(4, 2)	(5, 1)	6 (Cartel)
1	4.8	5.3	5.9	6.62	7.87	10.5
2	4.8	5.3	5.9	6.62	7.87	10.5
3	4.8	5.3	5.9	6.62	7.87	10.5
4	4.8	5.3	5.9	6.62	7.87	10.5
5	4.8	5.3	5.9	5.77	7.87	10.5
6	4.8	5.3	5.9	5.77	5.95	10.5

Profits under different ownership structures.

	Market structure $(n_1, \ldots, n_F)$					
Firms	(1, 1, 1, 1, 1, 1)	(2, 2, 2)	(3, 3)	(4, 2)	(5, 1)	6 (Cartel)
1	28.88	63.39	105	139	188.54	270.8
2	28.88	63.39	105	77.6	48.99	
3	28.88	63.39				
4	28.88					
5	28.88					
6	28.88					
Industry profits	173	190	210	217	238	270.8

Example

- Mergers and Market Power: Evidence from the Airline Industry.
- Corporate acquisitions via mergers are wealth-increasing events for shareholders.
- The combined firm value in successful mergers in-creases significantly, by 7-8 percent (Michael Bradley et al., 1988).
- This increase in the stock-market value of the merging firms may represent either value creation or wealth transfers from other stakeholders of the firm.
  - Value creation may arise from economies of scale or scope, increases in managerial efficiency, improvements in production techniques, or other synergistic gains.
  - Wealth transfers may include loss of jobs by employees or a reduction in wages, reduction in prices paid to suppliers, or higher prices paid by consumers due to the exercise of increased market power.

Example

- The purpose of this study is to reexamine the question of whether mergers increase market power and lead to wealth transfers from consumers.
  - investigate the extent to which airline mergers have affected airfares.
  - Changes in the product prices of merging firms reflect the joint effect of increased efficiency, and the exercise of increased market power.
  - The direction of price changes will indicate which of these two effects dominate.
- Examine all airline mergers during 1985-1988 and all routes affected by those mergers
  - Study the relation between fare changes and changes in the degree of concentration, and,
  - the pricing behavior of rival firms operating in the same markets.

Example

- In the airline industry, each route can be considered a separate market.
- The routes not affected by mergers can serve as a control group to capture industry-wide factors such as changes in fuel costs, labor costs, and seasonal variations in demand, as well as economy-wide factors that influence airfares.
  - There are, on average, 196 unaffected routes for each route affected by a merger.
  - The sample of routes is obtained from 14 airline mergers that were initiated during the period 1985-1988.
  - 21,351 affected routes.

TABLE 1—THE SAMPLE OF AIRLINE MERGERS

	Passengers (thousands)		Dates			
Acquired firm-acquirer	Acquired firm	Acquirer	First bid for acquired firm	First bid by acquirer	Final bid	Completion
Muse Air-Southwest	1,980	10,698	85/03/11	85/03/11	85/03/11	85/06/25
Empire-Piedmont	1,084	14,274	85/09/26	85/10/03	85/10/03	86/02/01
Frontier-People	7,068	9,100	85/09/20	85/10/09	85/10/09	85/11/22
Republic-Northwest	17,465	14,539	86/01/24	86/01/24	86/01/24	86/08/12
Eastern-Texas	41,662	19,640	86/02/24	86/02/24	86/02/24	86/11/25
Ozark-TWA	5,541	20,876	86/02/28	86/02/28	86/02/28	86/09/12
People-Texas	11,907	19,640	86/07/03	86/07/03	86/09/16	86/12/30
Jet America-Alaska	774	3,132	86/08/07	86/08/07	86/09/08	86/09/30
Western-Delta	9,062	39,804	86/09/10	86/09/10	86/09/10	86/12/17
Air Cal-American	4,451	41,165	86/11/18	86/11/18	86/11/18	87/04/30
Horizon-Alaska Air	942	3,132	86/11/20	86/11/20	86/11/20	86/12/29
Pacific SW-US Air	9,049	19,278	86/12/09	86/12/09	86/12/09	87/05/29
Piedmont-US Air	22,800	21,725	87/01/28	87/02/18	87/03/06	87/11/05
Florida Ex-Braniff	1,415	2,557	87/10/23	87/10/23	87/12/15	88/06/15[a]

Notes: The numbers of passengers given are for the year prior to the merger. Dates are shown as year/month/date. Completion date refers to the date when the acquirer obtained control.

Example

- For each route in the sample, the authors construct a control group.
  - The control group consists of all routes on which neither of the merging firms operated during the period of analysis and on which the distance falls within 7.5 percent of that of the sample route (i.e., 92.5-107.5 percent of the sample route distance).
  - The average number of routes in the control group is 196.6 for merging-firm routes and 199.1 for rival-firm routes.
  - The fare for the control group is the mean of the fares on the individual routes weighted by passenger-miles.
- Compare the fare change of a route with the average fare change in its control group.
  - Industry- wide changes like fluctuations in fuel prices, changes in labor cost, and seasonal or cyclical variations in demand are likely to have an equivalent effect on routes of a similar distance.
  - Isolate the effect of the merger by comparing routes where a merger has taken place with routes where the merger has not taken place.

Example

- Relative fare changes are computed as:

$$\text{Lfarchg} = \log\left(\frac{\text{Fare}_e^s}{\text{Fare}_b^s}\right) - \log\left(\frac{\text{Fare}_e^c}{\text{Fare}_b^c}\right)$$

- Hypotheses to be tested:
  - If a merger generates efficiency gains, it will reduce the marginal cost of the merged firm.
    - In the absence of a change in market power, the decrease in marginal cost will lead to a lower price.
  - If there are no efficiency gains and the primary effect is the exercise of greater market power, the merger will lead to a higher product price.
  - If both effects are present, then the direction of change in observed prices will indicate which of the two effects dominates.

Example

- Other hypotheses
  - The greater the increase in market concentration resulting from a merger, the greater is the potential for the exercise of market power, and the greater is the increase in airfares.
  - If the merging firms increase their price and the rival firms cooperate, we will observe an increase in the prices of rival firms.
  - If the efficiency gain dominates and the merged firm decreases its price, rival firms are likely to reduce their prices to maintain their market share.
- To separate the effect of efficiency gains from the market-power effect, two subperiods: the announcement period and the completion period.
  - Expect the impact of efficiency gains to prevail only during the completion period.
  - In contrast, exercise of market power does not have to wait until merger completion.

Example

- Fare changes during the announcement period are primarily due to the market-power effect, whereas the fare changes during the completion period reflect the joint, and offsetting, effects of market power and efficiency gains.

TABLE 2—CHANGES IN RELATIVE FARES OF MERGING AND RIVAL FIRMS

	Merging firms			Rival firms		
Variable	All mergers	Mergers between normal firms	Mergers with a failing firm	All mergers	Mergers between normal firms	Mergers with a failing firm
Full period:						
Sample size	11,629	8,511	3,118	8,109	5,578	2,531
Relative fares, beginning	0.9602** (0.8238**)	1.0325** (0.8982**)	0.7626** (0.6883**)	0.9140** (0.8645**)	0.9745** (0.9218**)	0.7807** (0.7588**)
Relative fares, ending	1.0159** (0.8850**)	1.0529** (0.9309**)	0.9148** (0.8015**)	0.9831** (0.9287**)	1.0085 (0.9472**)	0.9272** (0.8944**)
Relative fare changes: Lfarchg (percentage)	9.44** (9.75**)	3.25** (3.76**)	26.35** (20.66**)	12.17** (11.20**)	5.94** (4.42**)	25.90** (23.71**)
Announcement Period:						
Sample size	7,214	5,832	1,382	4,891	3,730	1,161
Relative fares, beginning	0.9792** (0.8575**)	0.9855** (0.8636**)	0.9530** (0.8376**)	0.9444** (0.8945**)	0.9499** (0.9093**)	0.9268** (0.8487**)
Relative fares, ending	1.0270** (0.8947**)	1.0754** (0.9440**)	0.8228** (0.7337**)	0.9807** (0.9208**)	1.0345** (0.9634**)	0.8079** (0.7882**)
Relative fare, changes: Lfarchg (percentage)	5.54** (3.81**)	11.32** (10.38**)	−18.85** (−17.66**)	5.06** (3.77**)	12.64** (9.73**)	−19.28** (−14.80**)
Completion Period:						
Sample size	7,557	6,140	1,417	5,304	4,105	1,199
Relative fares, beginning	0.9874** (0.8657**)	1.048** (0.9273**)	0.7247** (0.6528**)	0.9496** (0.8938**)	1.0201** (0.9507**)	0.7081** (0.7046**)
Relative fares, ending	0.9640** (0.8683**)	0.9652** (0.8724**)	0.9590** (0.8541**)	0.9764** (0.9296**)	0.9776** (0.9286**)	0.9725** (0.9332**)
Relative fare changes: Lfarchg (percentage)	0.21 (3.31**)	−9.00** (−6.82**)	40.11** (38.36**)	6.10** (7.13**)	−5.36** (−3.72**)	45.34** (43.24**)

Example

- Effect of a change in market concentration:

$$\text{Lfarchg}_i = \alpha + \beta_1 \text{Normal}_i \times \text{Lhhichg}_i + \beta_2 \text{Fail}_i \times \text{Lhhichg}_i + \beta_3 \text{Ldist}_i + \varepsilon_i$$

Period and model	Regression coefficient (t statistic) Constant	Normal× Lhhichg	Fail× Lhhichg	Ldist	R^2_{adj}	Sample size
A. *Merging Firms:*						
Full period						
Model (2)	−0.6864 (−23.22)	0.0942 (7.14)	0.2331 (6.99)	0.1154 (25.00)	0.051	11,629
Model (3)	0.0855 (21.78)	0.1072 (8.09)	0.2438 (7.10)	—	0.013	11,629
Announcement period						
Model (2)	−0.2409 (−8.03)	0.2178 (10.44)	0.0094 (0.19)	0.0437 (9.28)	0.030	7,214
Model (3)	0.0511 (12.86)	0.2364 (11.16)	0.0220 (0.45)	—	0.022	7,214
Completion period						
Model (2)	−0.3173 (−10.75)	−0.0118 (−1.08)	0.4233 (7.06)	0.0465 (10.06)	0.035	7,557
Model (3)	−0.0046 (−1.10)	−0.0179 (−1.69)	0.4233 (6.92)	—	0.026	7,557
B. *Rival Firms:*						
Full period						
Model (2)	−0.7311 (−18.56)	0.1203 (6.47)	0.2253 (6.89)	0.1233 (20.64)	0.052	8,109
Model (3)	0.1098 (22.85)	0.1455 (7.76)	0.2333 (6.92)	—	0.016	8,109
Announcement period						
Model (2)	−0.3523 (−8.49)	0.3293 (12.05)	0.0210 (0.38)	0.0571 (9.14)	0.052	4,891
Model (3)	0.0378 (7.10)	0.3509 (12.65)	0.0409 (0.76)	—	0.042	4,891
Completion period						
Model (2)	−0.2132 (−5.32)	−0.0193 (−1.19)	0.3967 (6.31)	0.0387 (6.41)	0.028	5,304
Model (3)	0.0528 (9.85)	−0.0214 (−1.36)	0.3928 (6.18)	—	0.024	5,304

Example

- To further separate market-power effects from efficiency effects, divide the sample into four subsamples:
  - If the merging firms have a common hub at the same airport prior to the merger, then all routes to or from the hub are called “Hub” routes.
  - If a route is served by both firms prior to the merger, then that route is called an “overlapping” route.
    - subsample Hub/Overlap consists of overlapping routes with a common hub: “in the air” and “on-the-ground” synergies + maximum increase in market power.
    - subsample Hub Only consists of a common hub with no overlapping routes: “on-the-ground synergies” + some additional market power.
    - subsample Overlap Only contains overlapping routes with no common hub: “in-the-air synergies” + some additional market power.
    - subsample Neither consists of routes which are neither overlapping nor have a common hub.

TABLE 4—ORDINARY-LEAST-SQUARES REGRESSIONS FOR SUBSAMPLES
$\text{Lfarchg}_i = \alpha + \beta_1 \text{Normal}_i \times \text{Lhhichg}_i + \beta_2 \text{Fail}_i \times \text{Lhhichg}_i + \varepsilon_i$

	Mean Lfarchg, percentage [sample size]		Mean Lhhichg, percentage [sample size]		Regression coefficient (t statistic)			
Period and subsample	Merger between normal firms	Merger with a failing firm	Merger between normal firms	Merger with a failing firm	Constant	Normal × Lhhichg	Fail × Lhhichg	R^2_{adj}
A. *Merging Firms:*								
Full period								
Hub/Overlap	−0.33 [193]	48.91** [180]	36.35** [193]	20.13** [180]	0.3174 (9.00)	−0.4891 (−6.69)	0.0920 (1.00)	0.101
Hub Only	−11.01** [291]	40.23** [331]	1.89 [291]	5.81** [331]	0.1604 (6.99)	−0.0461 (−0.45)	0.0837 (0.72)	−0.002
Overlap Only	3.92** [1,205]	40.12** [566]	22.49** [1,205]	19.92** [566]	0.1535 (11.89)	−0.1370 (−4.56)	0.3512 (5.28)	0.044
Neither	3.84** [6,822]	18.28** [2,041]	0.84** [6,822]	4.02** [2,041]	0.0690 (16.59)	0.1945 (12.12)	0.1548 (3.38)	0.016
Announcement period								
Hub/Overlap	7.18** [186]	−13.63** [101]	2.74[a] [186]	−0.69 [101]	−0.0110 (0.61)	0.5359 (4.16)	−0.0329 (−0.31)	0.080
Hub Only	1.15 [278]	−14.96** [147]	−1.67 [278]	−2.30 [147]	−0.0435 (−2.81)	0.0258 (0.21)	0.0507 (0.52)	−0.004
Overlap Only	12.09** [1,106]	−21.88** [311]	3.00** [1,106]	5.30** [311]	0.0430 (4.40)	0.1780 (3.48)	−0.0716 (−0.70)	0.009
Neither	11.96** [4,262]	−19.03** [823]	2.24** [4,262]	−0.47 [823]	0.0649 (13.92)	0.2468 (10.37)	0.0622 (0.87)	0.027
Completion period								
Hub/Overlap	−5.69** [190]	56.52** [110]	31.45** [190]	17.04** [110]	0.2395 (6.17)	−0.4590 (−6.09)	0.3689 (2.42)	0.139
Hub Only	−10.23** [283]	34.92** [144]	3.68* [283]	2.74 [144]	0.0549 (2.71)	−0.1550 (−2.24)	−0.1276 (−0.64)	0.004
Overlap Only	−7.47** [1,143]	55.71** [357]	18.30** [1,143]	15.88** [357]	0.0846 (6.06)	−0.2052 (−7.95)	0.5213 (4.53)	0.071
Neither	−9.45** [4,524]	31.88** [806]	−1.41** [4,524]	6.13** [806]	−0.0346 (−7.94)	0.0374 (2.45)	0.3330 (3.96)	0.015

TABLE 4—*Continued.*

Period and subsample	Mean Lfarchg, percentage [sample size]		Mean Lhhichg, percentage [sample size]		Regression coefficient (*t* statistic)			
	Merger between normal firms	Merger with a failing firm	Merger between normal firms	Merger with a failing firm	Constant	Normal× Lhhichg	Fail× Lhhichg	R^2_{adj}
Hub Only	−0.97 [150]	−17.47** [126]	−0.02 [150]	−1.70 [126]	−0.0831 (−4.10)	0.4019 (2.63)	0.2415 (2.76)	0.043
Overlap Only	12.65** [699]	−23.29** [297]	5.79** [699]	5.29** [297]	0.0049 (0.39)	0.3828 (5.64)	−0.0737 (−0.68)	0.033
Neither	13.44** [2,747]	−17.41** [643]	4.78** [2,747]	0.10 [643]	0.0637 (10.19)	0.3155 (10.16)	0.0414 (0.53)	0.040
Completion period								
Hub/Overlap	−6.25** [131]	62.37** [103]	28.27** [131]	17.03** [103]	0.3091 (6.72)	−0.6046 (−5.86)	0.3483 (2.22)	0.155
Hub Only	−6.11** [169]	43.97** [120]	6.39** [169]	3.32 [120]	0.1522 (5.42)	−0.1151 (−1.47)	−0.0698 (−0.32)	−0.004
Overlap Only	−6.07** [705]	56.99** [343]	8.23** [705]	14.83** [343]	0.1320 (7.85)	−0.1394 (−3.53)	0.4415 (3.69)	0.035
Neither	−5.12** [3,100]	36.51** [633]	−1.18** [3,100]	6.70** [633]	0.0160 (3.07)	0.0176 (0.31)	0.3143 (3.63)	0.015