Downstream Mergers When Firms Negotiate Input Prices

Serge Moresi, *Charles River Associates*
Steven Salop, *Georgetown University Law Center*

February 2004

Motivation

- **In many industries, prices are negotiated between the buyer and the seller**
- **Industrial policy has typically relied on oligopoly models that assume that sellers set take-it-or-leave-it prices**
- **Recently, antitrust economists have used bargaining models to analyze a variety of competitive issues:**
  - O’Brien (2002), O’Brien-Shaffer (2003)
  - Raskovich (2001), Adilov-Alexander (2002)
  - Bykowsky et al. (2002)
  - DOT’s proposed regulation of CRS’s
  - FCC’s review of News Corp./DIRECTV
- **We need to better understand bargaining models and how predictions might differ from standard oligopoly theories**

Outline

- **Brief review of the basic bargaining concepts**
  – Axiomatic vs. strategic models
- **Bilateral monopoly model**
  – Non-linear vs. linear prices
- **Upstream-downstream market model**
  – Monopoly vs. negotiated (linear) input prices
  – Downstream mergers

Axiomatic (Cooperative) Bargaining Models

John Nash's Theory

- **1 class of bargaining problems:** $\{S, U_1, U_2, D_1, D_2\}$
- **4 axioms:** Symmetry, Pareto-efficiency, IEUR, IIA
- **1 solution:** The (symmetric) Nash Bargaining Solution

$$x^* = \arg\max_{x \in S} [U_1(x) - D_1][U_2(x) - D_2]$$

Axiomatic (Cooperative) Bargaining Models

Variants

- Kalai-Smorodinsky (1975) replace IIA with "monotonicity"
- Drop "symmetry" ⇓ Asymmetric Nash Bargaining Solution

$$x^* = \arg\max_{x \in S} [U_1(x) - D_1]^{\alpha} [U_2(x) - D_2]^{1-\alpha}$$

where α measures the relative bargaining power of player 1

Strategic (Non-Cooperative) Bargaining Models

- There is no explicit bargaining procedure in Nash's theory
- Economists have constructed non-cooperative game-theoretical models that capture the details of a particular bargaining process
  - **Alternating-offer bargaining game**

    Rubinstein (1982), Binmore et al. (1986), Muthoo (1999)
- These models specify a variety of parameters, including:
  - **Delay costs (discount rates, fixed monetary costs)**
  - **Probabilities that negotiations may break down**
  - **Payoffs obtained while bargaining**
  - **Payoffs obtained in the event that negotiations break down**

Strategic (Non-Cooperative) Bargaining Models

- The strategic solution of an alternating-offer bargaining game "converges" to the axiomatic solution of a properly defined Nash bargaining problem
  - symmetric game ✹ symmetric NBS
  - asymmetric game ✹ asymmetric NBS
- Given an alternating-offer game, it is usually possible (although not always obvious) to determine how the parameters of the equivalent Nash bargaining problem depend on the parameters of the alternating-offer game
- Examples

Bargaining Over Prices

Illustrative Example

- **One Seller and One Buyer**
  - Assume they can agree on a two-part tariff, $\{p, T\}$
  - Buyer's demand is $D(p) = 1 - p$
  - Buyer's indirect utility is $V(p,T) = (1-p)^2/2 - T$
  - Seller's costs are zero
  - Seller's profit is $R(p,T) = (1-p)p + T$
  - Symmetric NBS is:

$$p^* = 0 \qquad T^* = 1/4 \qquad R^* = 1/4 \qquad V^* = 1/4$$

Bargaining Over Prices

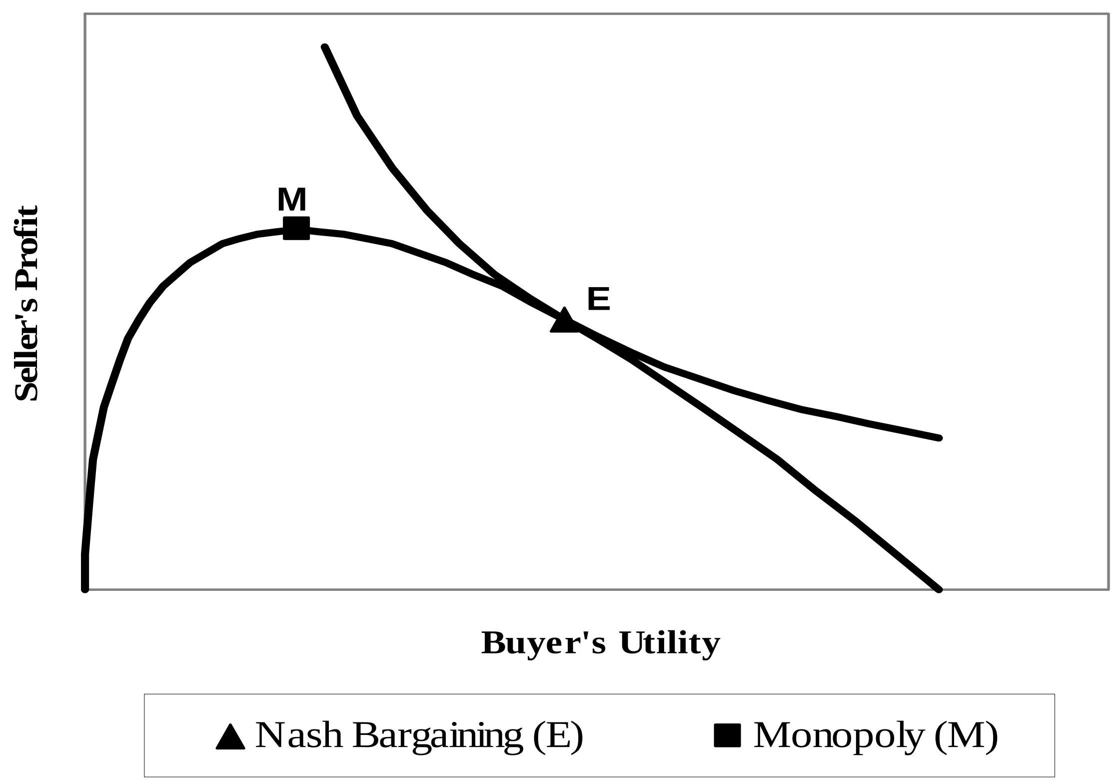
Illustrative Example

- **One Seller and One Buyer**
  - Assume they can only agree on a linear price, p
  - Buyer's indirect utility is $\tilde{V}(p) = (1-p)^2/2$
  - Seller's profit is $\tilde{R}(p) = (1-p)p$
  - Symmetric NBS is:

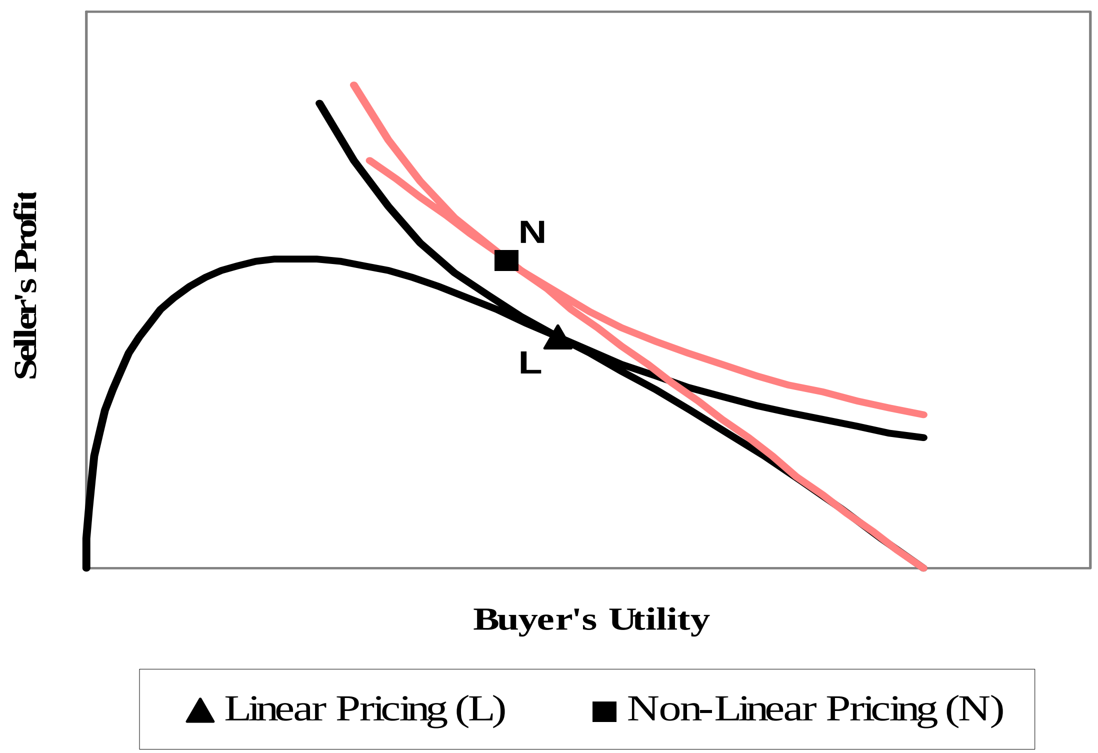
$$\tilde{p}^* = 1/4 \qquad \tilde{R}^* = 3/16 \qquad \tilde{V}^* = 9/32$$

- **NBS price < monopoly price (buyer has bargaining power)**
- **The buyer prefers to bargain over a linear price (as opposed to a non-linear price) because that gives the buyer more bargaining leverage (lower price ⬇ higher quantity)**

Figure 1: Nash Bargaining vs. Monopoly



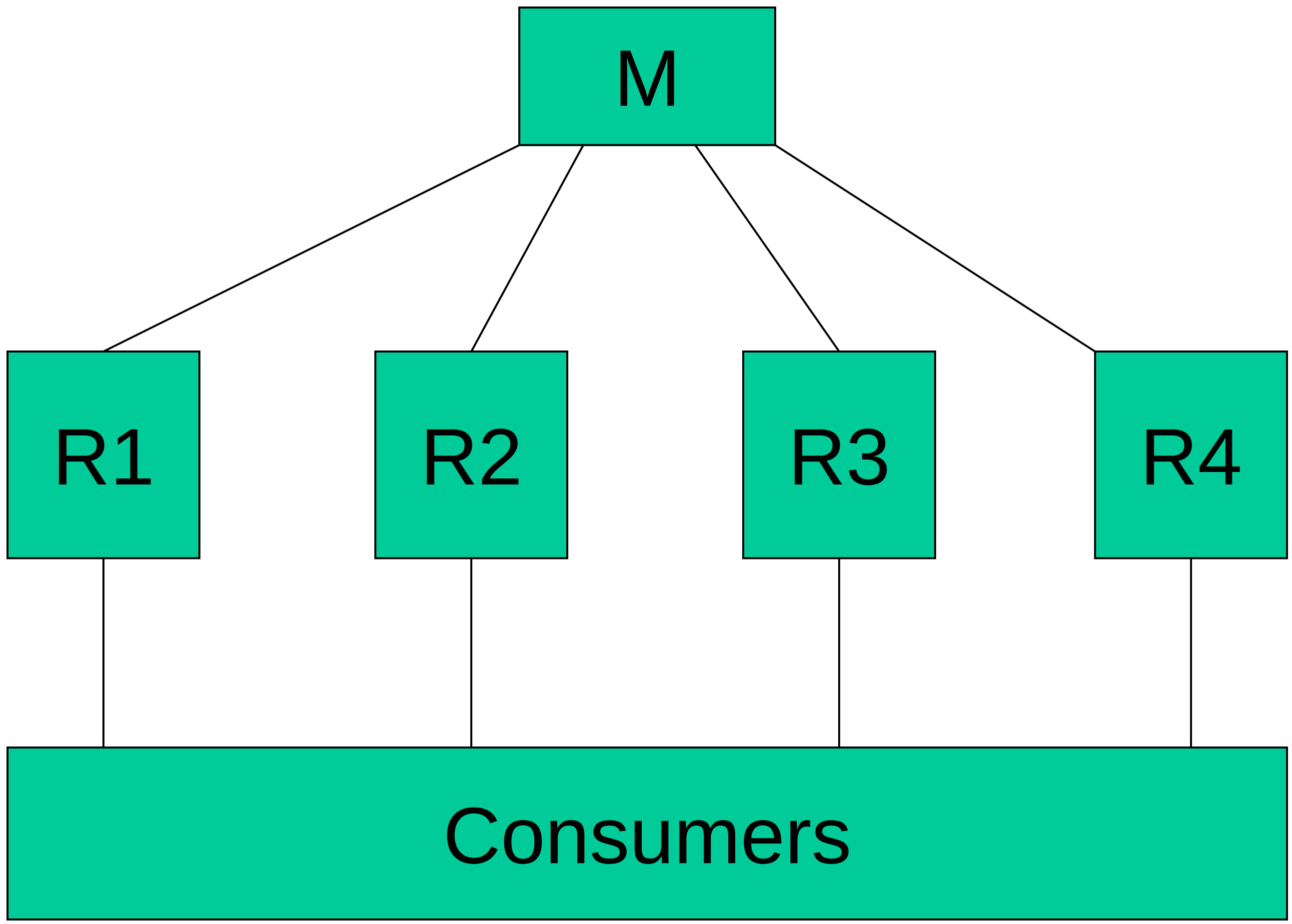
<u>Figure 2</u>: Linear vs. Non-Linear Pricing



Why Assume Bargaining Over Linear Prices?

- **Several reasons, including:**
  - Unrestricted non-linear pricing is rarely observed
  - Linear pricing may also capture other transaction costs
  - Linear pricing makes it easier to compare bargaining models and standard oligopoly models
- **The buyer may have an incentive to limit his ability to use lump-sum transfers**
  - Drazen-Limão (2003)
  - Is this a good rationale for assuming linear pricing in certain bargaining models?

Upstream-Downstream Market Model



Upstream-Downstream Market

Illustrative Example

- **1 Manufacturer and 4 Retailers**
  - M supplies each R with an input
  - Each R sells a differentiated product
- **Stage 1: Wholesale Prices**
  - Monopoly pricing vs. bilateral bargaining
- **Stage 2: Retail Prices**
  - Bertrand (linear) price competition

Assumptions

- **Symmetric linear downstream demand and cost functions**
- **Simultaneous bilateral Nash bargaining**
  - M has 4 “agents” and each agent bargains with one of the R’s
  - “Passive” beliefs (McAfee-Schwartz (1994), Rey-Vergé (2002))

  Chipty-Snyder (1999), Raskovich (2001), Adilov-Alexander (2002), O’Brien-Shaffer (2003)
- **Linear wholesale prices**

  Horn-Wolinsky (1988), O’Brien (2002)
- **Observable wholesale contracts**

  Rey-Vergé (2002) (non-linear pricing, no bargaining)

Ownership Scenarios

4 Alternative Ownership Structures

- **Four Downstream Retailers**
  - R1, R2, R3 and R4 are independent firms
- **Two Downstream Retailers**
  - R1 and R2 merge into F1
  - R3 and R4 merge into F2
- **One Downstream Retailer**
  - F1 and F2 merge into F
- **Zero Downstream Retailers (vertical integration)**
  - M acquires F

Notation (4 independent retailers)

w_1	Wholesale price between M and R1
w^*	Symmetric equilibrium wholesale price
$p_1(w_1, w^*)$	Equilibrium price function of R1
$p_{-1}(w_1, w^*)$	Equilibrium price function of R1's rival(s)
$\pi_M(w_1, w^*, p_1(w_1, w^*), p_{-1}(w_1, w^*))$	Agreement profit of M
$\pi_1(w_1, p_1(w_1, w^*), p_{-1}(w_1, w^*))$	Agreement profit of R1
$\pi_M(\infty, w^*, \infty, p_{-1}(\infty, w^*))$	Disagreement profit of M
0	Disagreement profit of R1

Nash Bargaining Equilibrium (4 independent retailers)

w^* *is a Nash Bargaining symmetric equilibrium price if*

$w_1 = w^*$ *maximizes the following objective function:*

$$\left[\pi_M(w_1, w^*, p_1(w_1, w^*), p_{-1}(w_1, w^*)) - \pi_M(\infty, w^*, \infty, p_{-1}(\infty, w^*))\right]^{\alpha}$$

$$\times \quad \pi_1(w_1, p_1(w_1, p^*), p^*)^{1-\alpha}$$

where:

$\alpha = 0.5$ corresponds to the symmetric NBS

$\alpha = 1$ corresponds to monopoly pricing

Simulation Results

- Monopoly Pricing

Simulation Results

- Bilateral Bargaining