AJAE Appendix: The Matching Problem (and Inventories) in Private Negotiation

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Appendix A – Inventory Loss Risk and Matching Risk

Inventory Loss Risk

Sellers face a risk of inventory loss when units produced in advance of sale are not sold or sold below cost at the end of a trading period. We demonstrate this risk by thinking of production and trading as a two-stage game. The first stage is the production decision (N units brought to the market) and the second stage is bilateral bargaining. Each unit is sold sequentially to a distinct buyer, so in producing the nth unit, the producer must consider the possibility of the unit selling at a loss.

Let f(N) be the probability the nth unit sells at a loss, where N is the total production up to and including the nth unit. The probability of a loss is increasing in N. We represent the loss as some proportion α_n of the unit's cost C_n. If $\alpha_n = 1$, the cost of the unit is completely lost. Hence $0 < \alpha_n \leq 1$. The loss $\alpha_n C_n$ is generally a function of N. The expected profit function (π_n) of producing the nth unit can be written as

(1) $\pi_n = [1 - f(N)]\,(P_n - C_n) + f(N)\,[-\,\alpha_n(N)C_n]$,

where P_n is the negotiated price of the nth unit and is a parameter in stage I of the game. Differentiating π_n with respect to N and setting equal to zero yields

(2) $[1 - f'(N)]\,(P_n - C_n) - f'(N)\,[\alpha_n(N)C_n] - f(N)\,[\alpha_n'(N)C_n] = 0$.

This first order condition offers an implicit solution for N.

For illustration let f(N) = (N-1)/N, then the first order condition becomes

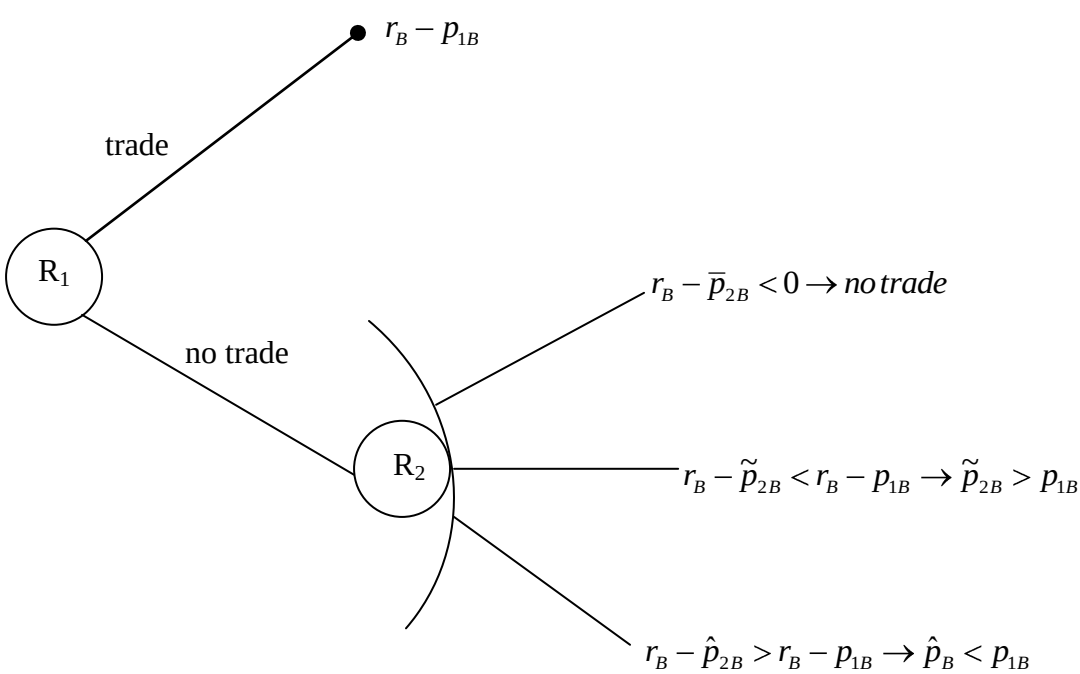
(3) $(P_n - C_n) + \alpha_n C_n + N(N-1)\alpha_n' C_n = 0$ and

(4) $P_n = C_n(1 - \alpha_n - N(N-1)\alpha_n')$.

The term – (α_n + N(N-1)α_n') represents the risk of inventory loss. It causes a seller to produce less and the more risk averse the seller, the less produced. Risk aversion enters the model through the subjective evaluation of f(N) and α_n . If the negotiated price for the nth unit P_n is parametric (as it may be if buyers seek the monopsony price on each unit sold), then a producer will not produce up to the point where $C_n = P_n$, but will stop at a smaller quantity, reflecting the risk of loss and risk aversion.

Matching Risk

The matching risk for buyers and sellers in private negotiation can be demonstrated with two rounds of bargaining (R1 and R2). Consider a buyer who purchases at most one unit and has a reservation price of r_B. In round 1 the buyer can complete a trade at r_B - p_{1B}, where p_{1B} is the negotiated price, or reject the deal (no trade) and wait until round 2. In round 2, three random events are possible as shown in the extensive form of the game.



If the buyer is unable to find a seller who will sell at a price above r_B no trade occurs. In the two other scenarios a trade may take place, and it could be better or worse than the round 1 deal. Probabilities can be assigned to the outcomes in round 2 that would make expected payoffs lower than $r_B - p_{1B}$, and these expected payoffs could be sufficiently low that the buyer would agree to a trade in round 1 at a higher price.

Appendix B – Starting Level Estimates

Appendix B Table 1. Starting Level Coefficients (Standard Errors) and [Starting Levels] – for Trades and Prices – Competitive, Cournot and Monopsony Bases

Treatment Asymptotes	Competitive Trades	Competitive Prices	Cournot Trades	Cournot Prices	Monopsony Trades	Monopsony Prices
Predicted Base	20	80	19.56	86.11	16	60
5M	-1.07a	-16.47*a	-0.63a	-22.84*a	3.29*a	3.24a
	(0.86)	(2.03)	(0.86)	(2.03)	(0.79)	(2.03)
	[18.93]	[63.53}	[18.93]	[63.27]	[19.29]	[63.24]
3M	-4.98*b	-9.98*b	-4.54*b	-16.14*b	-0.93b	9.96*b
	(0.62)	(1.41)	(0.62)	(1.41)	(0.62)	(1.41)
	[15.02]	[70.02]	[15.02]	[69.97]	[15.07]	[69.96]
2B5M	-6.27*b	-9.16*b	-5.83*b	-15.43*b	-2.13*b	10.67*b
	(0.53)	(1.80)	(0.53)	(1.80)	(0.52)	(1.80)
	[13.73]	[70.84]	[13.73]	[70.68]	[13.87]	[70.67]
2S5M	-4.99*b	-11.39*ab	-4.55*b	-17.98*ab	-0.93b	8.12ab
	(0.53)	(3.13)	(0.53)	(3.13)	(0.53)	(3.13)
	[15.01]	[68.61}	[15.01]	[68.13]	[15.07]	[68.12]

Note: * denotes estimated starting level significantly different from the base value, $\alpha = 0.01$.

Note: a, b, c, d – same letter indicates no significant difference between estimated starting levels in the respective equations. Different letters indicate a significant difference between estimated starting levels, $\alpha = 0.01$.