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Capacity Constraints and Spatial Competition in Agricultural Markets

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Summary

We adopt a game theoretic framework to model key features of agricultural procurement markets in order to explore the interaction between capacity constraints and spatial competition and the implications for input pricing by processing plants. A key finding is that the Lofgren's (1986) equivalence between uniform delivery and FOB pricing for profit-maximizing firms extends to a capacity-constrained monopsonist. Also, capacity constraints can affect optimal pricing strategy for a plant that procures from areas of heterogeneous market structures, as is the case, for example, for many ethanol plants in the U.S.

Background and Contribution

Many agricultural procurement markets are characterized by spatially distributed production with varying density, as well as high transportation costs, a combination that can result in imperfect competition. Agricultural processing firms may operate as spatial monopsonists or oligopsonists. Another defining feature of spatial agricultural markets is the existence of binding capacity constraints. Firms operating at full capacity cannot adjust their short run production in response to an improvement in economic conditions. This, in turn, implies that under such circumstances firms operate as cost-minimizing rather than profit-maximizing agents.

In turn, spatial market structures may influence firms' pricing strategies and production decisions, as well as the level and distribution of economic surplus along the vertical supply chain. While considerable attention has been given to the link between competition and pricing strategies, relatively little work examines the role of capacity constraints on pricing strategies under imperfect competition. **Our first objective is to conduct a systematic analysis of the effect of capacity constraints on pricing strategies under alternative market structures and their implications for market performance.** Our contribution generates comparative statics that can be directly compared to those obtained in previous studies without such constraints.

Another empirically distinctive feature of spatial agricultural procurement markets is the heterogeneity of competition intensity faced by plants in different areas within the procurement region. Figure 1 depicts spatial density of corn supply and location of corn-ethanol plants. For illustration purposes two ethanol plants are indicated by arrows in Figure 1. Take for instance the plant selected to the right. Corn supply density is relatively uniform around the plant and there is little reason to expect uneven transportation cost within the procurement region. This firm faces competition from multiple plants from the east and less intense competition from the west suggesting different market structures in different areas within the plant's procurement region. A similar situation is observed around the plant selected on the left where this plant operates as a monopsonist to the east and as an oligopsonist to the west. The asymmetric nature of competition faced by firms in spatial markets, while frequently arising in the real world, is typically overlooked by theoretical and empirical studies of competition. **The second objective of this paper is to examine how asymmetric market structures affect a firm's pricing strategy and the resulting market performance.**

The two most commonly considered pricing strategies in analyses of spatial competition are *uniform delivered price* (UD) and *free-on-board price* (FOB). Examination of the role of capacity constraints and asymmetric market structures on behavior requires formal derivation of

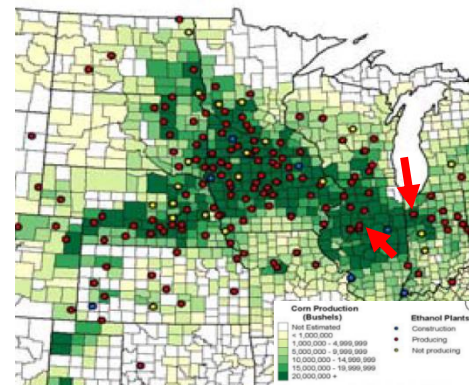


Figure 1. Spatial competition among corn

the *optimal* input price under both FOB and UD strategies. Optimal in this context means profit-maximizing when capacity constraints are not binding and cost-minimizing otherwise. We characterize optimal prices under competition by finding the Nash equilibrium of a 2-firm game. An equilibrium in pure strategies is found under FOB while only an equilibrium in mixed strategies is found when UD is the firms' pricing strategy of choice. In the monopsony context and under linear input supply, Lofgren (1986) demonstrates that both pricing strategies are equivalent to the firm (they yield the same profit) for a wide family of functions describing spatial distribution of input producers. The equivalence demonstrated by Lofgren (1986) is confined to firms that can choose capacity freely. Our analysis shows that the equivalence between pricing strategies holds when the monopsonist faces binding capacity constraints exist; i.e. total production cost is the same regardless of the pricing strategy used by the firm.

In the context of a duopsony, previous studies (e.g. Zhang and Sexton, 2001; Graubner et al., 2011) have found that, under linear supply and homogeneous spatial distribution of input producers, UD pricing tends to be the most attractive strategy as long as competition remains weak. But as competition intensifies due to a reduction of transportation cost relative to supply density a free-on-board pricing strategy becomes more profitable than a UD one. Our analysis reveals that UD is a dominant strategy for a wider range of competition intensities when capacity constraints are binding. Results also show that the increase in total market surplus associated with a reduction in transportation cost relative to input supply density is smaller with a binding capacity constraint than it is without such constraint. Moreover the percentage of that increase in total surplus that is appropriated by producers is larger under binding capacity constraints.

Our results suggest that binding capacity constraints act as an involuntary collusion mechanism. Capacity constraints limit the responsiveness of firms to enhanced profitability. This weakens the degree to which input prices offered by competing firms operate as strategic substitutes creating, in effect, a vehicle for collusion. This has important implications on both efficiency (reduction in total market surplus) and welfare distribution (the producers appropriate a larger share of market surplus). Our results also reveal that binding capacity constraints fundamentally change the pass-through of price shocks resulting from either policies or market displacements. This is an important result as it suggests that perhaps insufficient attention has been paid to binding capacity constraints in agricultural policy assessment.

Our results also show that the relative dominance of alternative pricing strategies and the efficacy of capacity constraints as a collusion mechanism is not impervious to market structure asymmetries. When plants can procure inputs from areas with different market structures, capacity constraints greatly influence the optimal pricing strategy, the total surplus, and the fraction of such surplus appropriated by processing firms. In particular, when operating under binding constraints, firms "escape" competition by procuring more inputs from less competitive areas, while still benefiting from the "collusion-like" benefits of fixed output. Therefore binding constraints and asymmetric market structures reinforce each other to increase the fraction of total surplus appropriated by processing firms.

References

- Graubner, Marten, Alfons Balmann, and Richard J. Sexton. "Spatial price discrimination in agricultural product procurement markets: a computational economics approach." *American Journal of Agricultural Economics* 93.4 (2011): 949-967.
- Löfgren, Karl Gustaf. "The Spatial Monopsony: a Theoretical Analysis." *Journal of Regional Science* 26, no. 4 (1986): 707-730.
- Zhang, Mingxia, and Richard J. Sexton. "FOB or uniform delivered prices: Strategic choice and welfare effects." *The Journal of Industrial Economics* 49, no. 2 (2001): 197-221.