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Market Power, Misconceptions, and Modern Agricultural Markets

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Although microeconomics textbook writers continue to point to agricultural markets as examples of competitive markets, in reality probably none are, especially in light of dramatically increased concentration in food manufacturing (Rogers 2001) and grocery retailing (McCorriston 2002; Reardon et al. 2003), emphasis on many dimensions of product quality and differentiation (Saitone and Sexton 2010), and the rapid increase in vertical coordination through integration and contracts (MacDonald and Korb 2011; Goodhue 2011).

For the basic precept of a competitive market to hold, namely that all buyers and sellers are price-takers, three conditions must be met:

- Buyers and sellers must be small relative to the total size of the market, meaning there must be many of each;
- The products of all sellers must be homogeneous in the eyes of buyers;
- Information in the market place must be perfect, so that all buyers and sellers are aware of the prices being charged and the characteristics of the products being sold.

I don't know of any modern agricultural market that meets all three of these conditions. Most don't meet any of them. For example, consider the classic case of the wheat market offered by Pindyck and Rubinfeld (2009) and many other textbook writers: "Thousands of farmers produce wheat, which thousands of buyers purchase to produce flour and other products. As a result, no single farmer and no single buyer can significantly affect the price of wheat," (p. 8). Yet, the U.S. Department of Justice (1999) sued to prevent the merger of Cargill and Continental Grain Company, alleging that, "Unless the acquisition is enjoined, many American farmers likely will receive lower prices for their grain and oilseed crops, including corn, soybeans, and wheat."[1] Sales from the production of the "thousands" of farmers in Canada, the second-largest wheat exporting country, were until August 1, 2012, under the control of a single state trader, and wheat is a highly differentiated product based upon protein content and other factors (Wilson 1989; Lavoie 2005). Indeed, Lavoie (2005) showed econometrically that the Canadian Wheat Board was able to influence the price of Canadian wheat, which directly contradicts the price-taking claim.

When researchers have pursued imperfect competition issues in agricultural markets, the traditional focus has been food manufacturers' and on occasion retailers' market power over consumers (Connor et al. 1985; Marion 1986). The market-power pendulum has, however, swung increasingly to focus upon processors' and occasionally retailers' roles as buyers from farmers, as reflected in the competition policies proposed, and to some extent implemented, in the 2002 and 2008 farm bills, and now under consideration with the impending 2012 farm bill.

As a profession we have only begun to understand the implications of increasing product differentiation and vertical coordination

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[1] The merger ultimately was allowed to proceed, but only after the firms agreed to divest themselves of 10 grain elevators in seven states (MacDonald 1999).

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among firms for market performance and distribution of benefits among participants. A key point of this paper is that we must not focus on concentration alone when thinking about departures from perfect competition in modern agricultural markets, nor in evaluating their performance. Rather, the trends towards greater concentration and vertical coordination, along with increased emphasis on product quality and differentiation, must be considered and evaluated jointly. Although such an expanded focus can greatly complicate efforts at formal modeling, conclusions generated from such analyses are likely to differ significantly from those based upon traditional market power analyses that have tended to ignore product differentiation and vertical coordination.

In what follows, the recent evolution of agricultural markets in the dimensions of concentration, product differentiation and quality, and vertical coordination and control is discussed. If these developments render the perfect competition model inappropriate, what are the consequences of its application? I provide some answers based upon work I have conducted with colleagues and graduate students over the past several years. However, the core analytical framework for that research, a flexible, homogeneous-product oligopoly/oligopsony model, may itself be too restrictive to capture essential features of modern agricultural markets. I thus offer some key stylized facts that characterize many of today's agricultural markets and arguably will characterize even more in the near future. I argue that these stylized facts are fundamental to how these markets operate, but they are too often ignored in economic analyses. Finally, I sketch ways in which these features might be incorporated into our analysis, and indicate the likely consequences of doing so.

Key Trends in the Structure of U.S. Agricultural Markets

I emphasize market conditions in the United States for the sake of brevity, but the same evolutionary forces are impacting markets worldwide in both developed and developing economies.

Concentration

The U.S. food industry is highly concentrated at both the retail and processing stages, and concentration is rising over time (Kaufman 2000; Rogers 2001). For example, the average 4-firm concentration ratio (CR4) in 15 key food-manufacturing industries (comprising 41% of total food-processing sales) in 2002 was 56% compared to 45% in 1982 (U.S. Government Accountability Office [GAO] 2009). Particular concern has been expressed regarding rather dramatic increases in concentration in livestock processing. The leading four firms slaughtered 64% of all U.S. hogs in 2007, compared with 32% in 1985, while CR4 for steer and heifer processing rose from 41% in 1982 to 84% by 2007 (Johnson and Becker 2009).[2] Relevant procurement markets for farm products, depending upon the commodity, may be localized in geographic scope due to high costs of transportation, meaning that national concentration ratios may vastly understate the level of buyer concentration in relevant geographic markets for raw agricultural products.

Leading grocery retailers have emerged as dominant players in the food chain worldwide. In the United States national CR4 in food retailing, only 16.8% in 1992, increased almost continuously, to 35.5% in 2005. However, because consumers are distributed geographically and incur significant transaction costs in traveling to and from stores, relevant retail markets are localized in geographic scope. Average grocery retailing CR4 in 2006 for 229 metropolitan statistical areas based on analysis of Nielsen Market Scope data was 79.4%.

Product Quality and Differentiation

The dimensions of food quality that are valued by consumers have expanded rapidly. In addition to traditional characteristics such as taste, appearance, convenience, brand appeal, and healthfulness, characteristics of the production process (e.g. usage of chemicals, sustainability, location, or confinement conditions of animals), marketing arrangements (in particular, their "fairness"), and implications of production and consumption of the product for the environment also matter increasingly to some consumers.

Empirical studies have demonstrated consumers' willingness to pay for differentiated product attributes such as organic, produced with sustainable practices, produced in

[2] CR4 in cattle processing is now higher due to the JBS acquisition of the Smithfield cattle operations in 2009.

particular geographic locations, certified safe, and marketed under fair-trade practices.

An additional critical dimension of product quality is its consistency. If firms are differentiating themselves based on quality attributes of their products, they must ensure a consistent supply of products capable of attaining the specified quality standards (Goodhue 2011).

Quality differences, product heterogeneity, and meaningful brands are incompatible with the perfect competition axiom of homogeneous products. If firms succeed in truly differentiating their products, they face individualized, downward-sloping demand curves and are not price-takers.

Further, differentiation among firms and products in these modern dimensions of product quality leads inevitably to violation of the competition axiom of perfect information, because a variety of important differentiating attributes of food products, such as presence/absence of genetically modified organisms, ecological characteristics of the production process, treatment of animals, etc., are not readily discernable by consumers through *ex ante* searching or even *ex post* after consumption. In other words, these product features are "credence attributes" (Roe and Sheldon 2007). Credence quality claims by individual firms, in the absence of a verification or enforcement mechanism, are normally not credible.

Vertical Coordination and Control

Increasing vertical coordination and control and use of production and marketing contracts throughout stages of the food chain have been stimulated by concerns about food quality and safety and the need to insure or certify the attributes of food products. The degree of vertical coordination ranges from essentially none in open-market transactions to complete control in the case of vertical integration. Contracts represent intermediate forms of vertical control and have a long history in agriculture. Their use is increasing rapidly in the United States and elsewhere, as is the degree of control exercised through them.[3] Contracts governed at least 39% of the value of U.S. agricultural production in 2008, up from 28% in 1991 and 11% in 1969 (MacDonald and Korb 2011).

Control in food-industry contracts is almost always exercised in the direction of the downstream trading partner restraining the behavior of its upstream suppliers in terms of varieties produced, inputs used, production schedules, handling practices, etc. By controlling the use and application of key inputs, downstream firms address moral hazard issues that could otherwise diminish product quality and increase food safety concerns. Contracts can also specify and reward quality standards and thereby address adverse selection problems that might be caused by the failure of spot markets to adequately recognize and reward quality.

Despite having a clear efficiency rationale,[4] close vertical coordination between farming and downstream marketing stages has long been controversial because of its potential implications for the economic freedom of farmers, the exercise of buyer market power, and the survival of small-scale traditional farms (Breimyer 1965; Barkema and Drabenstott 1995; McEowen, Carstensen, and Harl 2002). Policy focus has increasingly been directed towards regulations and legislation to proscribe certain coordination practices.

The livestock sector has been most widely studied and scrutinized with respect to these trends, where vertical coordination mechanisms are often called "captive supplies." The broiler industry represents the most vertically integrated sector in U.S. agriculture. Nearly all broiler production is marketed through vertically coordinated chains, in most cases through resource-providing production contracts, wherein the grower does not own the live animal, and his/her ability to act independently is severely proscribed (Goodwin 2005).[5]

The share of cattle marketed under vertical coordination mechanisms doubled between 1980 and 1998 from about 10% to more than 20%, and the pace of vertical coordination has accelerated rapidly since then. By 2009-10 negotiated cash procurement accounted for only 34.1% of cattle transactions (Ward 2010), and the percentage had fallen to under 20% during various weeks in the summer of 2012.

Vertical coordination in the pork industry has proceeded even more rapidly. As recently

[3] In the developing world contract farming, where a downstream processor/marketer provides inputs and technical advice to producers, has been a key approach to incorporating smallholders into high-quality export supply chains (e.g. Key and Runsten 1999; Takane 2004).

[4] Key and McBride (2003), for example, found dramatic efficiency gains to contract production, on the order of 20% output gains holding inputs constant–gains they attributed to knowledge transfer from integrators to growers.

[5] Arguably these contracts are labor-service contracts with the additional feature that a significant capital investment (in the form of growing houses) is required of the grower. *Ex ante* these growers have substantial alternatives for their labor input, but the capital investment creates an *ex post* lock-in, which exposes the grower to possible post-contractual opportunism.

as the early 1990s, nearly 90% of hogs were purchased in the spot market, but by 2010, the percentage of spot market hogs had fallen to the 5–7% range, with about one-fourth of hogs procured through packer vertical integration, and 68% acquired through production contracts, following the path of broilers (Lawrence 2010; O'Donoghue et al. 2011).

Does Agriculture Have a Market-Power Problem?

As the preceding discussion indicates, the processing and retailing sectors in many food industries fit a prototype differentiated-product oligopoly/oligopsony structure based upon the presence of a few large firms operating in the relevant geographic markets, perhaps a fringe of smaller competitors, and substantial barriers to entry in the form of sunk assets, including brand capital and specialized plant and equipment with little value in an outside use.

Moreover, the same leading firms interact repeatedly, both as buyers and sellers over time and across regions in these markets, creating opportunities to learn to cooperate, at least tacitly. Basic industrial organization analysis would suggest that these aforementioned conditions are rife for the exercise of market power.

Additional potentially worrisome considerations from a market-power perspective are that product differentiation and vertical control increasingly create lock-in situations between farmers and their buyers. Farmers make specialized investments in capital and crops to suit the needs of particular buyers, making it difficult to attract alternative buyers should the need arise. Reports by farmers of limited competition among buyers to secure their patronage are widespread.

These facts have provided the impetus for considerable policy concern at the state and national levels regarding competition in agricultural markets, especially for farm product procurement. Yet considerable research effort to investigate market power in specific industries, most notably the red-meat industries, has found at most only small departures from competitive pricing on either the selling or buying sides of the market.[6] For example, the U.S. GAO (2009), in responding to Congressional concerns about trends in concentration and prices in the food sector, concluded:

> The empirical economic literature has not established that concentration in the processing segment of the beef, pork, or dairy sectors or the retail sector overall has adversely affected commodity or food prices. Most of the studies that we reviewed either found no evidence of market power or found efficiency effects that were larger than the market power effects of concentration.

Yet, only modest departures from perfect competition should not provide solace to agricultural market researchers intent on applying the competitive model. In what follows, I summarize work conducted with several colleagues and former graduate students that shows even modest departures from competitive pricing of the type commonly found in empirical studies–relatively weak oligopoly or oligopsony power–are sufficient to lead analysis based upon the competitive model to severely biased conclusions in many cases. Thus, the empirical research on market power does not resurrect the competitive model. However, I then proceed to question whether the homogeneous-products market-power model that underpins these conclusions is itself too limited to capture the essential features of modern agricultural markets.

Implications of Market Power for Agricultural Market Analysis

A basic approach from the work we have conducted regarding the implications of market power in agriculture has been to parameterize the extent of market power along the unit interval. A market power parameter equal to 0 denotes perfect competition, a market power parameter equal to 1.0 denotes pure monopoly or monopsony, and intermediate values indicate various degrees of oligopoly and oligopsony power.[7] This model is very

[6] Azzam and Anderson (1996) and Ward (2002) summarize much of this research for livestock and meat products, and Sheldon and Sperling (2003), Kaiser and Suzuki (2006), and U.S. GAO (2009) provide summaries for a broader cross-section of industries and product categories.

[7] The conceptual basis for this approach (or, as some would argue, lack of such a basis) is discussed in various papers cited in this section.

flexible in handling oligopoly and/or oligopsony power at various (and multiple) stages of a vertical market chain. A simple version is presented in Excel format in Saitone and Sexton (2009), where users can input key model parameters reflective of markets of importance to them, and view fundamental results.

However, this model's flexibility in handling market power at different stages of the market chain comes at the expense of simplifications achieved elsewhere, notably by retaining the perfect-competition assumptions that the products sold at the farm and to consumers are homogeneous, and that information is perfect. Thus, it will be worth questioning whether even this generalized model is appropriate for analysis in modern agricultural markets now characterized by extensive product differentiation and vertical control implemented to address asymmetric-information problems.

The following are key conclusions generated from work based upon this homogenous-products model of oligopoly/oligopsony power:

- Efficiency (deadweight) losses from modest departures from competition in the food-marketing sector are minor (Alston, Sexton, and Zhang 1997; Sexton 2000). This is the same fundamental point made by Harberger (1954). For a small departure from competition, the deadweight loss (Harberger) triangle is small, in the limit infinitesimally small. However, it increases at an increasing rate as a function of the degree(s) of market power exercised. So if market power is severe, or is exercised at multiple stages along the market chain (Sexton et al. 2007), deadweight losses become large and consequential, approaching upwards of 25% of the total market surplus that would be available under perfect competition.
- Oligopsony power matters for market efficiency only to the extent that the farm input matters as a factor in producing the final product. The farm share as a fraction of the food retail dollar is now less than 20% on average in the United States, making oligopsony power quite inconsequential as a source of overall economic inefficiency (Alston, Sexton, and Zhang 1997; Sexton 2000).
- The distributional consequences of market power exercised by market intermediaries are much greater than the pure efficiency consequences. This point is important because much of our market analysis is policy-oriented, with specific policies designed to help farmers and frequently also consumers. Graphically, the profits earned by the marketing sector represent a rectangle with height equal to the retail price minus farm price and marketing-sector costs, and width equal to the market output. Any market power that causes output in the market to decrease even slightly relative to the competitive level raises the price to consumers and reduces price to farmers, thereby expanding the height of the entire rectangle and generating concomitant reductions in consumer and producer surplus.
- Market intermediaries, with even rather modest amounts of market power, can capture large shares of the benefits from policies intended to benefit farmers. This point follows directly from the preceding one and has been made through analysis of several specific policies, including public sector investments in farm research (Alston, Sexton, and Zhang 1997), trade liberalization (Sexton et al. 2007),[8] and agricultural price supports (Russo, Goodhue, and Sexton 2011). Saitone, Sexton, and Sexton (2008) extended this framework to consider market power both upstream and downstream from the farm level in an evaluation of the U.S. subsidy provided for corn ethanol.
- The large distributional consequences due to market power of intermediaries distort farmers' incentives to invest. For example, intermediaries with market power can capture a large share of the benefits from the supply shift induced by farm sector research or adoption of new technology (Huang and Sexton 1996; Alston, Sexton, and Zhang 1997), or a large share of the benefits from a retail demand shift induced by commodity promotion (Zhang and Sexton 2002), thus attenuating farmers' incentives to invest in such programs.

[8] This analysis shows, for example, that even moderate levels of market power when exercised at multiple stages of the market chain allow market intermediaries to capture over half of the benefits from trade liberalization, leaving relatively little for developing-country farmers who are the intended beneficiaries of such a strategy.

- Accepted "wisdom" regarding agricultural policies may not hold for imperfectly competitive markets. A key example is the widely acknowledged superior welfare consequences of decoupled agricultural income support programs relative to the traditional price floor or deficiency payment programs. Russo, Goodhue, and Sexton (2011) showed that either program, by fixing a minimum farm price outside of the market process, restricts downstream buyers' ability to exert oligopsony power. Thus, coupled support policies can be pro competitive and welfare-enhancing relative to the unregulated market.

Does a Prototype Market-Power Model Fit Modern Agricultural Markets?

How do we reconcile food industries that are structural oligopolies/oligopsonies with high barriers to entry, ample opportunities to obtain cooperative outcomes, and anecdotal evidence supporting little competition in farm-product procurement with an extensive empirical literature that finds little market power?

I think the answer lies in considering how the aforementioned structural changes in agricultural markets impact the prototypical market intermediary. At the risk of overgeneralizing, I set forth here several stylized facts regarding the operations of these firms, whether they are food manufacturers, produce grower-shippers, grocery retailers, or other agricultural-market intermediaries. I argue that, although these factors are pivotal in guiding the operational strategies of agricultural-market intermediaries, they are things we seldom consider explicitly in our analyses.

- The firm has a substantial investment in assets that are sunk in its present industry. Such assets might include physical plant and capital with little alternative use, investments in distinctive products and brands, or even a firm's reputation.
- The firm produces differentiated finished products and seeks differentiated farm products with characteristics that facilitate production of its differentiated products.
- The firm has a very inelastic demand for the agricultural product in any given procurement period due to, depending upon the particular product, firm, or industry: (i) processing capacity constraints; (ii) fixed shelf-space allocations in retail stores, and/or; (iii) fixed sales contracts for its finished product(s).
- The firm will seek to secure, *ex ante*, the requisite fixed supplies of the agricultural products with the required quality characteristics for its products. Reliance *ex post* upon the open market would leave the firm vulnerable to not finding products with the characteristics it seeks or in a situation where it is unable to secure sufficient raw product to meet its selling obligations and/or operate its facilities at efficient capacity. Such a failure would subject the firm to branding as an unreliable supplier.
- Transaction costs of executing contracts/agreements will be significant in this environment and increasing in the degree to which product quality, differentiation, and/or safety are issues.
- The value of a farmer's production in any market period will normally be greatest for the buyer who purchased it in the prior period because the farmer's production is tailored to that buyer's needs and is not readily altered.[9] The transaction costs of executing a new agreement with a different buyer will be greater than the costs of extending an existing agreement.

Some of these stylized facts are probably self-evident based upon the preceding discussion, but some elaboration on others is likely helpful. From basic production theory, we are normally motivated to posit smooth, downward-sloping input demands for buyers of agricultural products. Yet consider the following conclusions from recent comprehensive studies of the U.S. livestock industries:

> Large processing plants achieved cost economies by ensuring a smooth and undisrupted flow of hogs so they could operate their plants at near full capacity. Therefore, their desire to continue purchasing hogs to achieve these cost savings could overwhelm any incentives to exercise market power by restricting purchases (U.S. GAO 2009, p. 29).

> When both are operating close to capacity, smaller plants are at an absolute cost disadvantage compared

[9] These considerations may include spatial/location factors, as well as characteristics of the product itself.

> to larger plants. When larger plants operate with smaller volumes, they have higher costs than smaller plants operating close to capacity and, thus, have incentive to increase throughput. For all plants, large and small, average total cost increases sharply as volumes are reduced (Muth et al. 2005, p. ES-6).

The demand (or ability to pay) curve for live animals for these processors is essentially flat at the level of final product value less marginal processing costs until the plant capacity is reached, at which point it declines rapidly, in essence having a right-angle shape. The same characterization will apply to the farm product demand of intermediaries that lack such capacity constraints but have fixed sales contracts, fixed access to retail shelf space, etc.

It is well understood among agricultural marketing professionals that a supplier's reliability is of paramount importance. Unreliable suppliers will not have selling opportunities in the future. Thus, a supplier who fails to satisfy its customers' demands in one period not only foregoes profits in that period but also likely in future periods as well.

A dynamically optimal procurement strategy for such intermediaries is to secure *ex ante*, through contracts or vertical integration, the requisite supplies of the farm product needed to meet its sales commitments, but such firms have little or no incentive to procure product beyond those needs. These firms, too, have right-angle input demands that become very inelastic at the quantity of farm product associated with their fixed sales commitments.

In an environment where transaction costs are important, buyers will seek to limit these costs by executing relatively few contracts, meaning they will seek to engage buyers who can reliably supply large quantities of the needed product, or they will seek to provide these supplies internally through vertical integration. Further, transaction costs of engaging with repeat suppliers will likely be considerably less than transaction costs of locating and contracting with new suppliers. Accordingly, an optimal procurement strategy for buyers will be to attempt to secure the long-term patronage of a relatively small, stable group of high-volume suppliers.[10]

This characterization of the farm-product procurement process is fully consistent with farmer complaints regarding an absence of competition among processors to procure their products, but is it consistent with buyers exercising traditional market power over farmers?

Modeling Modern Agricultural Markets

A linear-pricing oligopolist or oligopsonist exercises market power by restricting sales or purchases so as to raise prices to consumers and/or depress price to producers. Such behavior creates deadweight losses. We know from basic theory that these deadweight losses can be reduced or eliminated if firms have the flexibility to employ nonlinear prices. Contracts provide transacting parties with exactly such flexibility. Thus, concerns about efficiency losses from market power are dissipated in an environment of contract agriculture. Efficiency losses from adverse selection and moral hazard problems are also addressed through contracts, creating the clear efficiency motivation for contracts that many authors have discussed.

How do contracts between farmers and market intermediaries affect the distribution of market surplus between them, and thus determine farm income? This is the key concern of many, and the reason that efforts to proscribe contracting practices have come to the forefront in policy discussions.

I address this question within a simple framework consistent with the aforementioned stylized facts. A buyer, i, has fixed demand to purchase $\bar{Q}_i$ quantity of an agricultural product.[11] The variable V_{ij} denotes the maximum value of grower j's production, Q_j, to buyer i (net of i's costs). This value emerges if i and j are able to execute a contract for the production of Q_j. Contract provisions are assumed to be flexible enough that Q_j is chosen to maximize the total surplus available in the transaction. Let $C_j^S(Q_j)$ denote grower j's variable costs of fulfilling the contract, and $C_j^L(Q_j)$ denote the total costs. Finally, T_{ij} denotes the transaction costs of i and j reaching an agreement,

[10] An alternative procurement model involving seeking raw product on the "open market" at the best price would certainly be dominated on a transactions-cost basis by a strategy of procuring on an ongoing basis from a stable group of suppliers.

[11] This demand would be limited by a reservation price, above which it would not be optimal for the buyer to operate. I ignore this consideration.

which depend upon whether a prior contract relationship exists between i and j.

The economic surplus to the transaction is $S_{ij} = V_{ij} - C_j^S(Q_j) - T_{ij}$. If

$$(1) \qquad S_{ij} > S_{kj} \quad \forall k \neq i$$

and the additional condition is met that j is an optimal supplier to i in the sense that a sufficient number of alternative suppliers do not exist, m, such that

$$(2) \qquad S_{mj} > S_{ij} \text{ and } \sum_m Q_{mi} \geq \bar{Q}_i$$

then it is efficient for i and j to execute a contract.

What will the terms of this contract be? The common approach to studying this contract would be to invoke a principal-agent framework with the buyer as principal and farmer as agent, effectively giving the power to dictate terms of trade to the buyer, subject to meeting participation and incentive compatibility constraints for the farmer-seller. I focus on the participation constraint that is crucial to answering the question of distribution of economic surplus between the buyer and seller.

A necessary condition to satisfy the grower's participation constraint is that the contract payment, P_{ij}, at least covers the variable costs, $C_j^S(Q_j)$ of producing Q_j. We can thus express the contract payment to j by i as follows:

$$(3) \qquad P_{ij} = C_j^S(Q_j) + \alpha S_{ij}$$

that is, j receives payment for his variable costs, plus a share $0 \leq \alpha \leq 1$ of the surplus generated from their transaction. Setting $\alpha = 0$ is not sufficient to meet j's participation constraint if j is able to obtain a competing offer that earns a surplus above his variable costs. Indeed, $\alpha = 1$ in the equilibrium in a competitive market due to competition among buyers to procure the product.

The model sketched here lacks sufficient structure to predict formally whether such an offer is forthcoming in equilibrium. However, if we attribute positive transaction costs to the act of seeking buyers and offering contracts, and if conditions (1) and (2) hold, it would not be rational for any other buyers operating in the market to offer a contract to j because (i) it would be costly to do so, and (ii) the equilibrium outcome is for buyer i to bid sufficiently to secure this contract. Other bidders would expend transaction costs with no rational hope of securing the contract.[12] This result is not due to any collusion among buyers, but, rather, purely to their ability to foresee the equilibrium to the contracting game among buyers and sellers. Any tacit collusion or "mutual forbearance" among buyers only reinforces this outcome.[13]

Although setting $\alpha = 0$ meets a short-run participation constraint, it is insufficient to retain the farmer's patronage in the market in the long run. Yet it is likely optimal in a dynamic framework for the buyer to incentivize the seller to remain in the market in the long run. Exit of its incumbent sellers would require the buyer to seek other sellers, either those serving other buyers or new entrants. Soliciting incumbent suppliers to other firms would raise transaction costs relative to contracting with a stable group of suppliers, and engender head-to-head competition with other buyers and possible retaliation. Attracting de novo entrants by incentivizing them to sink entry costs would require offering long-term contracts with payments sufficient to recover the entrants' capital costs.

Thus, it will be optimal for buyers to offer sellers contracts that meet a long-run participation constraint, namely by offering $\alpha > 0$ sufficient to insure that

$$(4) \qquad P_{ij} \geq C_j^l(Q_j).$$

A contract that satisfies (4) gives the farmer at least a long-run normal rate of return on investment, that is, the long-run equilibrium return for a competitive firm. The difference is that receipt of this rate of return in this context is not due to long-run adjustments in a competitive market but, rather, to an optimal dynamic procurement strategy for a buyer who may hold considerable oligopsony power, but also has a substantial investment of sunk costs and a long-term commitment to the industry.[14]

However, not all farmers need receive contract offers in this model. A seller who does not

[12] The model's prediction that sellers do not switch to different buyers is easily reversed by introducing the possibility of market- and seller-specific shocks to the model that are sufficient to disrupt the matching between buyers and sellers.

[13] Fear of retaliation for "poaching" another firm's suppliers provides a rational basis for mutual forbearance.

[14] These capital investments represent a credible commitment or "hostage" in exchanges between farmers and buyers such that each party to the transaction has a significant sunk asset involved–the marketable farm product in the farmer's case and, for example, the processing facility in the case of a food processor. The mutuality of this arrangement protects both sides in the transaction from opportunistic behavior (Williamson 1983).

satisfy condition (2) for at least some buyer will be excluded. To the extent that $C_j^L(Q_j)$ embodies economies of size, and T_{ij} is relatively independent of size such that the average transaction cost is declining in output, producers excluded from this market will be those constrained for whatever reason to produce at a smaller scale.

The equilibrium in this market with contract procurement is not easy to reconcile with the spot-market equilibrium of a market-power model such as discussed earlier in this paper. In general, buyers have no incentive to distort sellers' outputs in this model, and sellers' earn at least a normal or competitive return on their investment, although they may capture relatively little of the economic surplus generated by their production. Sellers also seldom, if ever, receive a competing offer for their production, an outcome fully consistent with the frequent producer complaint of lack of competition among buyers to procure his production. Is there buyer market power in this type of procurement setting? If there is, it cannot be quantified using the traditional approaches such as the flexible oligopoly/oligopsony model discussed earlier in the paper.

What Happens When the Model Doesn't Apply?

This model does not predict that an oligopsony/monopsony market will pay farmers as much as or more than a competitive market in all settings. The equilibrium emerges because buying firms produce differentiated products, require vertical coordination through contracts with significant transactions costs, and are committed to a future in the industry due to their own sunk investments. In settings where the future matters less and vertical coordination is not an issue, all of the well-known concerns about exercise of buyer power would apply. Thus, for example, an itinerant trader purchasing a staple commodity from smallholder farmers in a developing country will likely exercise any short run buyer power he has, whereas a beef packer, wine maker, and fruit processor in the United States likely will not.

The exercise of buyer market power can drive returns to farmers' investments below the competitive rate and cause farming resources to exit the industry to the long-run detriment of buyers of farm products. However, in a spot-market environment where there is no matching of buyers and sellers, the availability of productive capacity on the farm to supply buyers is a public good from the collective perspective of the buyers, and the preservation of this capacity is subject to free riding. Buyers will exercise whatever short-run market power they have in this environment because they internalize at most only the portion of the long-run negative consequence of a drain of capital from the industry equivalent to their share of the market, or they internalize none if they discount the future enough. In contrast, firms in the stylized contract market fully internalize the benefit of maintaining the production of their suppliers in the long run.

The irony then is that most critics of modern agricultural markets may have it just wrong; they criticize and try to restrain contract exchange and exalt spot markets. Examples include attempts in prior farm bills and current legislation to mandate that a minimum fraction (generally 25%) of a buyer's livestock purchases must be made in the spot market, the recent regulatory restrictions on livestock contracting proposed by the U.S. Department of Agriculture, Grain Inspection, Packers & Stockyards Administration (GIPSA), proposed legislation to ban packer ownership of live animals, and proposed legislation to severely limit contract provisions. The GIPSA regulations would have required standardization and uniformity of animal procurement practices, prohibited "paying of a premium or applying a discount... without the reason(s) and substantiating the revenue and cost justification associated with the premium or discount," and required that processors "maintain written records that provide justification for differential pricing or any deviation from standard price or contract terms offered to poultry growers, swine production contract growers, or livestock producers," (75 Fed. Reg. 119 2010, p. 35351). The Livestock Marketing Fairness Act before Congress now contains many of the same provisions.

Conclusions

Agricultural markets throughout the world have undergone a rather dramatic transformation. It is marked by consolidation and market domination by large processing, trading, and retailing firms, disappearance of traditional auction or spot markets for exchange of farm products, and their replacement by various forms of contracts and vertical control, and a growing emphasis on product differentiation and increasingly broad dimensions of product

quality. This paper has summarized some of these changes and discussed their implications for public policy and how we study agricultural markets.

The aforementioned trends seem inexorable. Some farmers and marketers no doubt get left behind in the midst of such changes, and in the case of farming the implications of loss of farms for the vitality of rural America can be profound. Policies such as those proposed for livestock and poultry can possibly stem this tide to some extent, but at the consequence of having an agricultural system that is less efficient, less competitive in the face of increasingly open agricultural markets, and less capable of meeting the demands consumers are placing on the food system.

References

Alston J.M., R.J. Sexton, and M. Zhang. 1997. The Effects of Imperfect Competition on the Size and Distribution of Research Benefits. *American Journal of Agricultural Economics* 79:1252–1265.

Azzam, A.M., and D.G. Anderson. 1996. *Assessing Competition in Meatpacking: Economic History, Theory, and Evidence*. Washington, DC: U.S. Department of Agriculture, Grain Inspection, Packers and Stockyards Administration, GIPSA-RR 96-6.

Barkema, A., and M. Drabenstott. 1995. The Many Paths of Vertical Coordination: Structural Impacts for the Food System. *Agribusiness* 11:483–492.

Breimyer, H.F. 1965. *Individual Freedom and the Economic Organization of Agriculture.* Urbana, IL: University of Illinois Press.

Connor, J.M., R.T. Rogers, B.W. Marion, and W.F. Mueller. 1985. *The Food Manufacturing Industries: Structure, Strategies, Performance, and Policies.* Lexington, KY: Lexington Books.

Goodhue, R.E. 2011. Food Quality: The Design of Incentive Contracts. *Annual Review of Resource Economics* 3:119–140.

Goodwin, H.L. 2005. Location of Production and Consolidation in the Processing Industry: The Case of Poultry. *Journal of Agricultural and Applied Economics* 37:339–346.

Harberger, A. 1954. Monopoly and Resource Allocation. *American Economic Review* 44:77–87.

Huang, S.-Y. and R.J. Sexton. 1996. Measuring Returns to an Innovation in an Imperfectly Competitive Market: Application to Mechanical Harvesting of Processing Tomatoes in Taiwan. *American Journal of Agricultural Economics* 78:558–571.

Johnson, R., and G.S. Becker. 2009, January 30. *Livestock Marketing and Competition Issues*. Washington, DC: U.S. Congressional Research Service Report RL33325.

Kaiser, H.M., and N. Suzuki. 2006. *New Empirical Industrial Organization and the Food System.* New York, NY: Peter Lang Publishing.

Kaufman, P. 2000. *Consolidation in Food Retailing: Prospects for Consumers & Grocery Suppliers*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, *Agricultural Outlook*, August.

Kaufman, P. 2006. *Consolidation in Food Retailing: Prospects for Consumers & Grocery Suppliers*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, *Agricultural Outlook,* August.

Key, N., and W. McBride. 2003. Production Contracts and Productivity in the U.S. Hog Sector. *American Journal of Agricultural Economics* 85:121–133.

Key, N., and D. Runsten. 1999. Contract Farming, Smallholders, and Rural Development in Latin America: The Organization of Agroprocessing Firms and the Scale of Outgrower Production. *World Development* 27:381–401.

Lavoie, N. 2005. Price Discrimination in the Context of Vertical Differentiation: An Application to Canadian Wheat Exports. *American Journal of Agricultural Economics* 87:835–854.

Lawrence, J.D. 2010. Hog Marketing Practices and Competition Questions. *Choices* 25 (issue number). Available at: http://www.choicesmagazine.org/magazine/article.php?article=122.

MacDonald, J.M. 1999. *Cargill's Acquisition of Continental Grain: Anatomy of a Merger*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, *Agricultural Outlook,* September: 21–24.

MacDonald, J.M., and P. Korb. 2011. Agricultural Contracting Update: Contracts in 2008. Washington, DC: U.S. Department of Agriculture, Economic Information Bulletin No. EIB 72, February.

Marion, B.W., ed. 1986. *The Organization and Performance of the U.S. Food System.* Lexington, MA: D.C. Heath.

McCorriston, S. 2002. Why Should Imperfect Competition Matter to Agricultural Economists? *European Review of Agricultural Economics* 29:349–372.

McEowen, R.A., P.C. Carstensen, and N.E. Harl. 2002. The 2002 Senate Farm Bill: The Ban on Packer Ownership of Livestock. *Drake Journal of Agricultural Law* 7:267–304.

Muth, M.K., G. Brester, J. Del Roccili, S. Koontz, B. Martin, N. Piggott, J. Taylor, T. Vukina, and M. Wohlgenant. 2005. *Spot and Alternative Marketing Arrangements in the Livestock and Meat Industries: Interim Report* Washington, DC: U.S. Department of Agriculture, Grain Inspection, Packers and Stockyards Administration

O'Donoghue, E., J. MacDonald, U. Vasavada, and P. Sullivan. 2011. *Changing Farming Practices Accompany Major Shifts in Farm Structure*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, *Amber Waves,* December.

Pindyck, R.S. and D.L. Rubinfeld. 2009. *Microeconomics.* Boston, MA: Pearson Publishing.

Reardon, T., P. Timmer, C.B. Barrett, and J. Berdgué. 2003. The Rise of Supermarkets in Africa, Asia, and Latin America. *American Journal of Agricultural Economics* 85:1140–1146.

Roe, B., and I. Sheldon. 2007. Credence Good Labeling: The Efficiency and Distributional Implications of Several Policy Approaches. *American Journal of Agricultural Economics* 89(4):1020–1033.

Rogers, R .T. 2001. Structural Change in U.S. Food Manufacturing, 1958–1997. *Agribusiness* 17(1):3–32.

Russo, C., R.E. Goodhue, and R.J. Sexton. 2011. Agricultural Support Policies in Imperfectly Competitive Markets: Why Market Power Matters in Policy Design. *American Journal of Agricultural Economics* 93:1328–1340.

Saitone, T.L., and R.J. Sexton. 2009. A Flexible Oligopoly-Oligopsony Model for Classroom Simulations and Policy Analyses. *Journal of Industrial Organization Education* 1: Art. 1.

Saitone, T.L., and R.J. Sexton. 2010. Product Differentiation and Quality in Food Markets: Industrial Organization Implications. *Annual Review of Resource Economics* 2:341–368.

Saitone, T.L., R.J. Sexton, and S.E. Sexton. 2008. Market Power in the Corn Sector: How Does It Affect the Impacts of the Ethanol Subsidy? *Journal of Agricultural and Resource Economics* 33:169–194.

Sexton, R.J. 2000. Industrialization and Consolidation in the U.S. Food Sector: Implications for Competition and Welfare. *American Journal of Agricultural Economics* 82:1087–1104.

Sexton R.J., I.M. Sheldon, S. McCorriston, and H. Wang. 2007. Agricultural Trade Liberalization and Economic Development: the Role of Downstream Market Power. *Agricultural Economics* 36:253–270.

Sheldon, I., and R. Sperling. 2003. Estimating the Extent of Imperfect Competition in the Food Industry: What Have We Learned? *Journal of Agricultural Economics* 54:89–109.

Takane, T. 2004. Smallholders and Nontraditional Exports Under Economic Liberalization: The Case of Pineapples in Ghana. *African Study Monographs* 25: 29–43.

U.S. Government Accountability Office. 2009. *Concentration in Agriculture,* GAO-09-746R, June 30. Available at: http://www.gao.gov/new.items/d09746r.pdf.

U.S. Department of Justice. 1999. *Justice Department Requires Divestures in Cargill's Acquisition of Continental Grain*. Available at: http://www.justice.gov/atr/public/press_releases/1999/2554.htm.

Ward, C.E. 2002. A Review of the Causes for and Consequences of Economic Concentration in the Meatpacking Industry. *Current Agriculture, Food, and Resource Issues* 3:1–28.

Ward, C.E. 2010. Assessing Competition in the U.S. Beef Packing Industry. *Choices* 25. Available at: http://www.choicesmagazine.org/magazine/article.php?article=121.

Williamson, O.E. 1983. Credible Commitments: Using Hostages to Support Exchange. *American Economic Review* 73:519–540.

Wilson, W.W. 1989. Differentiation and Implicit Prices in Export Wheat Prices. *Western Journal of Agricultural Economics* 14:67–77.

Zhang M. and R.J. Sexton. 2002. Optimal Commodity Promotion when Downstream Markets Are Imperfectly Competitive. *American Journal of Agricultural Economics* 84:352–365.