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Increasing Concentration in the Agricultural Supply Chain: Implications for Market Power and Sector Performance

Richard J. Sexton[1] and Tian Xia[2]

[1]Department of Agricultural and Resource Economics, University of California, Davis, California 95616, USA; email: rich@primal.ucdavis.edu

[2]Department of Agricultural Economics, Kansas State University, Manhattan, Kansas 66506, USA

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Abstract

Increasing consolidation and vertical coordination in the food chain have made the prospect of market power abuses by powerful food manufacturers and retailers an issue and a policy concern worldwide, in terms of potential impacts on farmer and consumer welfare and sector efficiency. We address the extent to which traditional wisdom and standard conceptual and empirical models that have girded thought about market power in the food chain for decades apply in modern food-market contexts and examine recent work on competition in the food chain to gauge the most promising paths forward. A key conclusion is that considerations that go beyond the bounds of standard models likely cause market power to be less than would be predicted based on the highly concentrated structures of many modern agricultural and food markets. These considerations include downstream buyers who rationally internalize long-run implications of their pricing decisions to farmers, powerful food manufacturers and retailers who countervail each other's market power, and the complex pricing decisions of multistore and multiproduct food retailers.

1. INTRODUCTION

Market power in the food chain is an issue and a policy concern worldwide, in both developed and developing countries. Concern about the power of market intermediaries is long-standing (Myers et al. 2010), but fueled by increasing consolidation and vertical coordination and control in the food chain and by a burst of worldwide food price inflation beginning in 2007–2008 (McCorriston 2014), the topic has acquired a renewed focus and urgency in recent years. Among many examples are the unprecedented series of "listening sessions" held across the United States in the summer of 2010 by the US Departments of Agriculture (USDA) and Justice (DOJ) on competition and agriculture (US DOJ 2012), the OECD's policy roundtable in 2013 and substantive report on "competition issues in the food chain industry" (OECD 2014), and the series of reports issued by the European Commission on competition and business-to-business unfair trading practices (Agric. Mark. Task Force 2016; Eur. Comm. 2009, 2013, 2014, 2016).

The reasons for concern are not hard to understand. Food is an essential budgetary item that to this day comprises a large share for most of the world's poor (McCorriston 2014, USDA 2017). The extent to which the seller power of food manufacturers and retailers increases food costs and the budget shares required to achieve adequate nutrition is, accordingly, an important question and concern in most countries. Furthermore, in most countries, farmers are regarded as an economically disadvantaged and vulnerable group, making buyer power an important issue in terms of its possible impacts on farmer welfare and the economic vitality of rural areas. Small farmers are believed to be especially vulnerable to buyers' market power in both developed and developing countries (Agric. Mark. Task Force 2016, Sexton 2013, Vavra 2009).

Although policy makers and food-market participants probably do not believe they need the benefit of formal economic models to "connect the dots" between rising concentration and coordination in the food chain and market power, the support is nonetheless there. Sellers with market power recognize their influence on price and thus perceive a marginal revenue from product sales that is less than the sale price, causing the profit-maximizing firm to sell less and at a higher price than it would as a perfect competitor. This effect is present in all of the standard models of imperfect competition: linear-pricing monopoly, Cournot oligopoly, conjectural variations oligopoly (Cowling & Waterson 1976), and Bertrand oligopoly with differentiated products (Cotterill et al. 2000), including horizontal (Hotelling 1929, Nevo 2001) and vertical (Mussa & Rosen 1978) spatial differentiation. Thus, consolidation that creates monopolies or tighter oligopolies is routinely expected to yield these consequences.

Similarly, the monopsonist or oligopsonist recognizes its influence over the farm input's price, and, accordingly, perceives a marginal factor cost in excess of the farm price, buys less, and pays a lower price than it would as a perfect competitor. Most of the aforementioned models of seller power have their analogs in buyer power, where this fundamental effect is present and where buyer consolidation would reduce farm price and purchase volume.

Depending on the market power's severity or whether it is exercised at multiple stages in the supply chain, these restrictions of purchases or sales can have significant efficiency consequences in the form of deadweight losses. More important to policy makers and market participants, however, are much larger distributional impacts that shift economic surplus away from farmers and consumers into the hands of intermediaries exercising the market power (Alston et al. 1997, Sexton et al. 2007).

A further reflection of the importance of concentration, competition, and possible market power in the food supply chain is the considerable attention these topics have received in the academic literature. This activity has been chronicled in a number of recent surveys, including those by Kaiser & Suzuki (2006), McCorriston (2014), Perekhozhuk et al. (2017), Sheldon (2016),

Sheldon & Sperling (2003), and US GAO (2009). We perceive relatively little value added in augmenting and updating these studies. Rather, in this review, we address the extent to which the traditional wisdom and the standard conceptual and empirical models that have girded thought about market power in the food chain for decades apply in modern food-market contexts. We also examine recent work on competition in the food chain to gauge the most promising paths forward.[1]

Consider markets for procurement of farm products. Today, these markets often involve product differentiation in multiple and increasing dimensions, nonlinear prices, either formal or relational contracts, and close vertical coordination between farmers and downstream buyers (Otsuka et al. 2016; Sexton 2013; Swinnen & Vandeplas 2010, 2011; Wu 2014). These structural changes raise significant questions about analysis of market power in these settings:

- Do the market-power lessons from traditional models that presume arm's length, spot-market transactions and symmetry in effects between buyer power and seller power apply in modern agricultural markets?
- Can empirical models that are grounded in these traditional models provide accurate measurements of market power in key industries?
- If buyer and seller power are fundamentally different, as Adjemian et al. (2016), Crespi et al. (2012), Sexton (2013), and Swinnen & Vandeplas (2010, 2011, 2014) have argued, then can analyses of buyer power based on models that are, in essence, the flip side of seller power reach useful conclusions (Mérel & Sexton 2017)?

Or consider selling markets downstream from the farm. As described in the next section, the most profound structural change in the agri-food supply chain worldwide in recent decades has been the emergence of supermarket chains, often international in their geographic scope, as influential, if not dominant, participants in the supply chain. The emergence of powerful food retailers, along with continued increases in concentration among food manufacturers, raises issues of bilateral oligopoly and countervailing power in wholesale markets. Traditional market-power models assume price-taking behavior on one side of a transaction. While such behavior may well be attributed to farmers (except when they sell through coalitions such as state traders, cooperatives, or marketing boards) and final-product consumers, it hardly can be assumed in interactions involving modern food manufacturers and retailers, meaning that these models are of little value in studying interactions between modern food manufacturers and retailers. If food manufacturers and retailers use their market power, at least in part, to countervail the power of the other, it can imply a procompetitive effect for increasing concentration (Dobson & Waterson 1997, Iozzi & Valletti 2014, von Ungern-Sternberg 1996), quite the opposite of the standard prediction and belief.

In addition, the standard market-power models emphasize purchase and sales of single products. Can such models inform us about the behavior of modern grocers that stock tens of thousands of product codes, operate large numbers of stores, and sell to consumers who seek one-stop shopping to fulfill a market basket of purchases? In addition, can these models help us understand pricing strategies of retailers such as zone pricing (DellaVigna & Gentzkow 2017), where chain stores

[1]We restrict our focus to markets downstream from the farm. Market power is also a concern in certain farm input markets, in particular those for transgenic seeds, where patent protections afford sellers monopoly power, and also markets for some farm chemicals, where regional differences in environmental regulations afford buyers little opportunity to substitute among competing products. Market power in agricultural input markets presents unique issues, for example, in terms of the trade-off between incentivizing innovations at the expense of creating monopolies through patent protections. See Clancy & Moschini (2017), Moschini (2010), and Moss (2009) for perspectives on property rights, innovations, and market power in agricultural input markets.

set identical prices in stores within a potentially broad geographic area? Such a strategy ignores differences in market structure and consumer characteristics across local retail markets, but its implementation can have important implications for market power. Fortunately, a number of studies have emerged recently that have begun to address these fundamental aspects of retail food markets.

Before elaborating on these points and our knowledge as it pertains to market power in the modern agri-food supply chain, we first briefly review what is known regarding increasing concentration and coordination in the sector.

2. RISING CONCENTRATION AND COORDINATION IN THE AGRI-FOOD SUPPLY CHAIN

Formal measurement of market concentration is quite limited worldwide, and what is available is usually reported with a considerable time lag. Even among EU countries, food manufacturing concentration data have not been updated for nearly 20 years.[2] Almost no systematic market concentration data are available for developing countries. Further, when public data on market concentration are available, they are useful only in painting a broad picture because the data are organized according to political boundaries and product-category classifications, which likely bear little or no relationship to actual product or geographic markets for competition analysis.

The most recent concentration data for the United States based on the quinquennial Economic Census are summarized by Crespi et al. (2012) through 2007 and Saitone & Sexton (2017) through 2012. The most disaggregate industry classification statistics for which detailed US concentration data are available are six-digit North American Industry Classification System (NAICS) codes. Crespi et al. (2012) found increasing concentration in US food manufacturing for the decade from 1997 to 2007—an average increase of 13% in the four-firm concentration ratio (CR4) and 30% in the Hirshman-Herfindahl index (HHI).[3] This itself was a continuation of earlier trends (Rogers 2001). The same general pattern also held true for the subsequent five years (Saitone & Sexton 2017). On average, the HHI increased by 13.2% and CR4 by 2.8% from 2007 to 2012. In 2012, the simple average CR4 and HHI across 37 NAICS-6 agricultural manufacturing industries in the United States were 48.8% and 1,122.1, respectively. However, if we were to assume that the national NAICS-6 industries represented relevant geographic and product markets for analysis of market power, 29 of the 37 would still be considered unconcentrated based on US DOJ guidelines.[4]

The livestock industries are the US agricultural sector that has posed the greatest concerns about market power, in particular, processors' power over farmers (Muth et al. 2005, Saitone & Sexton 2012, US GAO 2009). Reasonably good national concentration statistics are available for livestock through the Packers and Stockyards Annual Report compiled by the USDA, and they illustrate how concentration tends to increase as we home in on relevant product markets. Statistics for 2015 indicate that steer and heifer slaughter had CR4 = 85%, hog slaughter had

[2] For example, McCorriston (2014), in his comprehensive "Background Note" to the recent OECD treatise on "Competition Issues in the Food Chain Industry," is forced to rely on concentration data in European food manufacturing from the mid-1990s.

[3] CR4 is the sum of market shares for the four largest sellers in a designated industry; HHI is the sum of the squared percentage shares for all sellers in the designated industry. $CR4 \in (0,\ 100\%]$; $HHI \in (0,\ 10,000]$.

[4] The US DOJ (2010) "Horizontal Merger Guidelines" classify industries according to HHI as follows: (*a*) unconcentrated: HHI of less than 1,500, (*b*) moderately concentrated: HHI between 1,500 and 2,500, and (*c*) highly concentrated: HHI above 2,500. The European Commission follows somewhat more stringent guidelines, considering a merger as likely to raise competition concerns if HHI in the relevant market exceeds 2,000, and a proposed merger would increase it by 150.

CR4 = 66%, and sheep and lamb slaughter had CR4 = 57%—all levels that that would ordinarily raise concerns about market power.[5] (HHI statistics are not included in the report.) The national Packers and Stockyards statistics likely understate concentration in local or regional procurement markets.

2.1. Food Retail Concentration

The greatest causes of heightened concern about market power in the agri-food supply chain are the worldwide supermarket revolution (McCorriston 2014) and the increasingly powerful position of a handful of international food-retailing chains. Food retailing transformed quickly from an unconcentrated sector featuring specialty retailers to one that is highly concentrated in most relevant markets and dominated by large international retail chains. This revolution took place in waves, first in the United States with major consolidation and structural change through mergers, acquisitions, and internal growth in the mid-to-late 1990s. This was followed by Western Europe and then spread quickly across the world, including Central and Eastern Europe (Dries et al. 2004), Latin America (Reardon & Berdegué 2002), Central America (Berdegué et al. 2005), Africa (Reardon et al. 2003a), and Asia (Hu et al. 2004, Reardon et al. 2003b).

Some of the fastest growth in this supermarket revolution has been achieved by discounters and supercenters or hypermarkets. Walmart is the world's largest food retailer despite having only entered food retailing in the mid-1980s. Its national market share in US food and beverage sales in 2016 was 17.3%, nearly double the 8.9% share of second place Kroger (Statistica 2017). Discounters Aldi and Lidl have acquired significant market shares in several European countries, including Germany, Austria, and Denmark (Bukeviciute et al. 2009).[6]

The presence and rapid growth of discount retailers are likely associated with increasing concentration but not necessarily higher prices because these sellers pursue strategies of share growth and physical, pecuniary, and information economies related to size instead of short-run profits (Basker 2007). They may also have a procompetitive effect on prices of conventional supermarkets (Cooper 2003, Basker & Noel 2009, Hausman & Leibtag 2007, Volpe & Lavoie 2008).

National statistics on food retailing say little about concentration in local markets, which is the relevant geographic dimension for consideration of food retailers' market power over consumers. Concentration measures for food retailing in localized markets are challenging to come by. Richards & Pofahl (2010) estimated the CR4 in five US cities: Atlanta 81.9%, Chicago 60%, Dallas 63.7%, Los Angeles 59.1%, and New York 63.8%. These results are consistent with the average CR4 of 63% for 2014 across 27 US Metropolitan Statistical Areas (MSAs) (Ma et al. 2017).

However, even MSA concentration measures are still too broad to constitute a relevant geographic market for food retailing. Grocery markets are highly localized, with evidence suggesting that consumers typically travel at most a few miles or kilometers to shop for groceries (Ver Ploeg et al. 2015). Recent work has begun to incorporate the localized nature of competition in food retailing. Allain et al. (2017) defined store-level "catchment areas" to analyze a merger between

[5]The classic treatise on concentration and market power in food manufacturing by Connor et al. (1985, p. 73) suggested, for example, that CR4 > 40% enabled firms to "behave sufficiently interdependently to coordinate their output and pricing decisions."

[6]Bukeviciute et al. (2009) summarize national data on CR5 in food retailing for European countries for 2004 and 2007. For most countries, CR5 > 50%. Food retailing concentration is highest in Northern Europe, with Einarsson (2007) reporting CR3 from 80% to in excess of 90% for Denmark, Finland, Iceland, Norway, and Sweden. Australian grocery retailing is largely a duopoly involving Woolworths and Coles, with combined market share in 2002 of 76%, plus a competitive fringe (Jacenko & Gunasekera 2005). As a general rule, concentration in local markets will exceed the nationwide measures, perhaps substantially, because individual retailers are generally not present in all market areas.

supermarket chains in France. These areas were based on maximum consumer driving distances assumed by the French competition authority of up to 30 min to visit a hypermarket and 10–15 min to visit other grocers. Ma et al. (2017) defined market areas based on zip codes for the greater Los Angeles area and showed that geographic dimensions of zip codes coincided quite closely with what is known about consumer travel distances to shop for food. Average HHI in 313 zip codes in their study area was 3,600, well above the DOJ threshold to be considered highly concentrated.

The paucity of relevant data on market concentration is most severe for developing countries, where the predominant concern involves buyers' abilities to exploit farmers and reduce procurement prices below competitive levels. A considerable literature focuses on informational asymmetries and opportunistic behavior by traders who, depending upon the market setting, exploit farmers' lack of knowledge regarding market values, lack of ability to transport a crop to a more competitive selling environment such as a central city or port, and need to sell quickly due to liquidity constraints and to avoid quality deterioration, or because of a lack of appropriate storage facilities. The story is assembled not from public statistics, but rather, from detailed studies of trade for particular commodities in single countries (e.g., Courtois & Subervie 2014, Milford 2012, Osborne 2005, Piyapromdee et al. 2014).

Market concentration data at a national scale would be of no value in discerning this type of behavior because the key issue is not the total number of traders or other potential buyers of a commodity operating in a country. Instead, it is the number visiting villages at certain harvest periods, their interactions with each other,[7] their knowledge of market conditions relative to sellers, sellers' ability to avoid opportunistic behavior and distress selling, and presence or absence of institutions to enforce agreements and limit opportunistic behavior.

2.2. Vertical Coordination and Contracts

Increased vertical coordination in the supply chain and greater use of contract exchange has evolved simultaneously with greater supply-chain concentration and the market's demand for consistent product quality in a wide and increasing array of product characteristics (Saitone & Sexton 2017, Swinnen & Vandeplas 2014).[8] Modern supermarkets have adopted centralized procurement systems that have eroded the role of traditional wholesalers, replacing them with direct sales with suppliers; the sales involve close vertical coordination and often substantial vertical control exercised by the retail buyer. This coordination has included implementation of private standards to regulate product quality, food safety, and farm production practices (Dries et al. 2004, Reardon & Timmer 2007, Saitone et al. 2015). Among food manufacturers, vertical coordination is considered critical to securing access to a stable supply of farm products with desired quality characteristics needed to operate capital-intensive processing, packing, or retailing facilities at efficient capacity (Sexton 2013, US GAO 2009).

Although the efficiency rationale in modern supply chains for vertical coordination between farmers and their downstream buyers is clear (e.g., Otsuka et al. 2016), such developments have been controversial, and in the minds of some, they merge with evidence of increasing concentration

[7] Antitrust laws to prevent buyer or seller collusion are either nonexistent or poorly enforced in most developing countries, thus providing little in the way of legal barriers to collusive arrangements.

[8] The use of contracts in the United States has expanded rapidly over time. In 1969, only 5% of farms engaged in contracting, with those contracts covering roughly 11% of the value of production (McDonald & Korb 2011). By 2013, 35% of the production value of all commodities was transacted via contracts (McDonald 2015). Contracts are dominant for most livestock, fruit, nut, and produce industries. The aggregate percentage share for contracts is depressed due to the importance in the United States of major grains and oilseeds that are the remaining bastions for cash markets.

to create the significant concerns regarding agri-food supply chain market power. With vertical coordination and contract production, farmers may be "locked in" to a particular buyer and possibly vulnerable to opportunistic behavior, or "locked out" if they are unable to secure a contract, a key concern among small-farm advocates. Thus, according to this argument, competition among buyers is very likely even less than meets the eye because of de facto market allocation among buyers through contracts that may formally encompass only a single crop year or production cycle but implicitly are relational in nature (Crespi & Sexton 2004, Wu 2014) and long lived.

3. MODELING MARKET POWER IN THE AGRI-FOOD SUPPLY CHAIN

The standard quantity-setting models of imperfect competition in the agri-food supply chain assume transformation through a fixed-proportions technology of an agricultural product into a single finished consumer product.[9] The Leontief conversion coefficient can be set to 1.0 through choice of units of measurement for the farm and consumer products, meaning that each can be represented with a single variable, Q. Inverse consumer demand for the final product is $P = \mathrm{D}(Q|\mathbf{X})$, where $\mathbf{X}$ denotes demand shifters, and P is consumer price. Inverse supply of the farm product is $W = \mathrm{S}(Q|\mathbf{Z})$, where $\mathbf{Z}$ denotes supply shifters, and W is the farm price. The model is further simplified by assuming that N market intermediaries comprise an integrated marketing sector and have constant per-unit costs $c = \mathrm{C}(\mathbf{V})$, where $\mathbf{V}$ denotes cost shifters for the market intermediaries.[10]

The familiar equilibrium condition is

$$P\left(1-\frac{\xi}{\eta}\right)-c=W\left(1+\frac{\theta}{\varepsilon}\right), \qquad 1.$$

where $\eta(\varepsilon)$ is the absolute value of the elasticity of final product demand (farm product supply). Market power is introduced by defining two parameters, $\xi \in [0,1]$ and $\theta \in [0,1]$, indicating the extent of seller and buyer power in the market, respectively. Values of 0 for either parameter indicate a perfectly competitive market, values of 1 denote pure monopoly or monopsony, and intermediate values denote different levels of oligopoly or oligopsony. These parameters can be interpreted as conjectural elasticities, i.e., the percentage change in market output anticipated by a representative firm to result from a 1% increase in the firm's output (these conjectures would be assumed constant across firms), but this interpretation is objectionable to some and is unnecessary.[11] Instead, an interpretation is preferred wherein we acknowledge that in most any food-market setting, the participants are engaged in a long-lived, dynamic game with no known end date, so that the folk theorem applies. This opens the door to partially or fully cooperative outcomes emerging as subgame perfect equilibria. The analyst cannot observe the underlying game but can observe its outcome in terms of prices and quantities, which can be rationalized in terms of values for ξ and θ that in principle are estimable empirically (Karp & Perloff 1996).[12]

[9] Assumption of fixed proportions comes with some loss in generality that a number of authors have been unwilling to incur, e.g., Holloway (1991).

[10] The model is easily extended to incorporate market power of intermediaries across multiple stages of the supply chain (Sexton et al. 2007).

[11] The objections stem from "shoehorning" a dynamic interpretation—action and reaction—into a static framework and from the fact that, in most instances, the conjectures are inconsistent in that the conjectured behavior and optimal competitor response are not the same (Perloff et al. 2007).

[12] Increasing consolidation is likely to increase the unilateral market power (i.e., ability to influence price) of individual buyers or sellers, but it may also facilitate coordinated behavior, either overt collusion and cartel behavior (Connor 2008), or tacit collusion as manifest by "mutual forbearance." This can be reflected in a conjectural variations model by a degree of market

The left-hand side of Equation 1 can be interpreted as the marginal revenue product function for the farm-product input that firms in the industry perceive, while the right-hand side represents perceived marginal cost of acquiring the farm product. Given functional forms for D(Q) and S(Q), Equation 1 can be solved jointly with D(Q) and S(Q) to obtain equilibrium values for P, W, and Q, which we can express as $P^*(\eta, \varepsilon, \theta, \xi, c|\mathbf{X}, \mathbf{Z}, \mathbf{V})$, $W^*(\eta, \varepsilon, \theta, \xi, c|\mathbf{X}, \mathbf{Z}, \mathbf{V})$, $Q^*(\eta, \varepsilon, \theta, \xi, c|\mathbf{X}, \mathbf{Z}, \mathbf{V})$. Other market statistics of interest, such as consumer surplus (*CS*), producer surplus (*PS*), intermediary profits (π), and deadweight loss (*DWL*) can be computed in a straightforward manner. W^*, Q^*, PS^*, CS^* are all decreasing in θ and ξ, while P^*, π^*, DWL^* are all increasing in θ and ξ.

Despite the frequent use of this model as a theoretical construct or as underpinning for empirical analysis, key limitations present themselves. First is the question of which consumers and which farmers are depicted by D(Q) and S(Q), respectively. Relevant markets for procurement of a raw agricultural product will almost never have the same geographic dimensions as the market for the final product and may also differ in the product dimension.[13] This means the N processors cannot ordinarily comprise both a relevant end-product and farm-product market.[14] The problem is avoided if the analyst can safely assume perfect competition in either procurement or sales and focus on the relevant market where imperfect competition is a concern. This strategy runs the significant risk of conflating buyer or seller power if both are in fact an issue.

A second problem, especially in reference to the farm product market, is the spot-market nature of the solution, its inefficiency in terms of *DWL* created, and then its distribution of market surplus among farmers and processors, as determined by PS^* and π^*. Let q_o^* be the output of a representative farmer in this equilibrium and q_1^* represent the output for this farmer that equates her marginal cost of production with the highest net marginal revenue product of any potential buyer for that farmer's output. This is the efficient output for the producer, and in a traditional oligopsony model, $q_o^* < q_1^*$.

In settings where potential producers of the farm product can be identified ex ante, e.g., in advance of planting decisions for annual crops, there would seem to be few barriers to a buyer with optimal processing/packing/handling/selling capacity K^* identifying and offering production contracts (either formal or informal) to M farmers (assumed for simplicity to be identical) that call upon the farmer to produce and sell q_1^* units to the buyer, where $q_1^*.M = K^*$. This eliminates the *DWL* on these transactions and insures that the buyer operates at efficient capacity, which means if there is a functioning spot market with equilibrium based on Equation 1, there are gains to trade for processors and farmers to execute such contracts and disrupt the proposed equilibrium.

What would be the producer's payment in return for providing q_1^* units in this setting, and how would it compare to the predicted payment of $W^*q_o^*$ from the spot-market model? A first answer emerging from the principal-agent paradigm is that it must be sufficient to meet a farmer's short-run participation constraint, which at a minimum would require that the total variable costs of producing q_1^* at least be covered. However, it may be higher if there is a functioning cash market alternative (Xia & Sexton 2004), if the farmer has an outside option such as producing an

power that exceeds what firms could attain through noncooperative (e.g., Cournot-Nash) behavior. Nicholls (1941) was among the first to argue that food manufacturers adopted a cooperative stance toward rivals because they knew that aggressive competition would be met by retaliation. This is precisely the intuition that underlies so-called folk theorem results, which show that cooperative outcomes can be sustained as subgame perfect equilibria in long-lived strategic interactions among firms.

[13] For example, a processing plant for steers and heifers cannot handle hogs or sheep, so those farm products comprise separate product markets as inputs. But it is at least conceivable that an analyst or adjudication body would conclude that beef, pork, and lamb substituted closely enough on the demand side to comprise a single product market as outputs.

[14] If the N firms did constitute a relevant market for both the raw and finished products, then logically, $\theta = \xi$ (Schroeter 1988) in the presence of the fixed-proportions assumption.

alternative crop, if there is competition among buyers to sign farmers to contracts, or if buyers incorporate long-run considerations into payments to farmers.

Some key conclusions emerge from this brief discussion. First, a straightforward avenue exists to eliminate the deadweight loss associated with oligopsony power if farmers and downstream buyers can reach an enforceable agreement ex ante, and there is a clear economic incentive between buyers and sellers to execute such agreements. Analysts who propose spot-market equilibria in oligopsony/monopsony settings should justify reliance on such models, e.g., based on barriers to execution and enforcement of such agreements. Second, the payment to farmers is likely determined by considerations quite unrelated to the factors embedded in $W^*(\eta, \varepsilon, \theta, \xi, c|\mathbf{X}, \mathbf{Z}, \mathbf{V})$ that predict price in the spot-market oligopsony model, meaning that W^* could be a very poor predictor of the actual payment.

Especially important in this regard is that buyers of agricultural products from farmers face a short-run versus long-run trade-off that is not normally present in other types of transactions (Adjemian et al. 2016, Crespi et al. 2012, Mérel & Sexton 2017, Sexton 2013) and that the static models of competition cannot depict. Downstream buyers generally have invested substantial sunk and durable physical and human-capital assets into processing, packing, and selling particular agricultural products. The long-term success of these enterprises hinges on having a stable supply of the farm product with quality attributes amenable to producing the buyer's desired final-product supply and operating its facilities at efficient capacity, e.g., K^*.

Buyer oligopsony power that reduces the farm price below the competitive level necessarily reduces the rate of return on farm investment below the level needed to sustain investment in the industry. This causes exit or reduced rate of entry in the long run, outcomes that are detrimental to the buyers' long-run profit. Thus, it would seem that buyers (*a*) who sufficiently value the future in the sense of not discounting future profits too much and (*b*) who are able to internalize the benefit from paying farmers returns sufficient to ensure a stable supply of the farm product have incentive to offer such payments.

Thus, the prediction is that in market environments where conditions *a* and *b* hold, farmers would over time receive payments and earn profits at least equivalent to those received in a competitive equilibrium, even if the procurement market is highly concentrated. The market process generating this rate of return is, however, completely different from the familiar tatonnement process of long-run competitive equilibrium. The prediction of the short-run oligopsony model would be inaccurate, perhaps wildly so, in these settings.

In fact, classifying procurement markets based on the extent to which conditions *a* and *b* hold can be an effective way to assess settings where we should be concerned with buyer market power. Condition *a* may not hold, for example, in declining industries or in industries where downstream buyers have few assets sunk into procuring and handling the farm product, and hence, do not have a long-term horizon. Condition *b* will likely not hold in "loose" oligopsonies where a handful of firms have buyer power, but none can internalize the benefit of paying a return sufficient to sustain investment in producing the farm product. It will also not hold in the presence of farmer moral hazard (Swinnen & Vandeplas 2010, 2011) for the same reason. Developing-country settings are especially problematic in regard to meeting conditions *a* and *b* because traders may lack substantial sunk investment in procuring particular commodities,[15] and institutions are lacking to prevent moral hazard behavior among farmers, such as "side sales" of production promised to particular buyers or farm inputs provided by the buyer.

[15] For example, the principal capital of a trader in these settings is likely to be transportation equipment, which is not sunk to the purchase and sale of any particular commodity.

3.1. Estimation of Market-Power Parameters

Econometric estimation of market-power parameters such as θ and ξ for food industries became common beginning in the late 1980s with Schroeter's (1988) work on the US beef-packing industry.[16] This work, based on structural econometric models of firms and industries such as those summarized in Equation 1, was emblematic of what became known as the new empirical industrial organization (Kaiser & Suzuki 2006). This focus continued in subsequent years, with primary emphasis on the US meatpacking industries (Azzam & Pagoulatos 1990, Crespi & Sexton 2005, Morrison Paul 2001, Schroeter & Azzam 1990, Schroeter et al. 2000, Zheng & Vukina 2009). Studies on food manufacturers' selling power in other agricultural industries included cigarettes/tobacco (Appelbaum 1982, Bhuyan & Lopez 1997, Raper et al. 2007), coffee (Draganska et al. 2010), pear processing (Wann & Sexton 1992), dairy products (Bonnet & Bouamra-Mechemache 2016, Liu et al. 1995, Mérel 2009), potato processing (Katchova et al. 2005), and ready-to-eat breakfast cereal (Nevo 2001, Reimer 2004).[17]

Across industries, these studies tended to find only mild departures from perfect competition, with estimates of θ or ξ generally being less than 0.2, the equivalent of a five-firm symmetric Cournot oligopsony or oligopoly. In their survey of 38 studies of food or fiber industries, Perekhozhuk et al. (2017) reported an arithmetic mean of parameter estimates of either buyer or seller market power of 0.075 for studies that followed Bresnahan's (1982) general identification method and 0.188 for those following the production theoretic approach of Appelbaum (1982).

The work that focused on directly estimating market-power parameters has, however, been subjected to substantial criticism that has limited its influence. Corts (1999) showed that estimates of the conduct parameter in many empirical studies can result in seriously inaccurate estimates of market power. He argued that the conjectural variations parameter in conceptual analysis; for example, Equation 1 represents the average relationship of the price-cost margin to quantity, while the conduct parameter estimate in typical studies measures the marginal relationship of price-cost margin to quantity changes caused by demand shifters; i.e., the empirical model will rely on the marginal responses of quantity to demand shocks to identify the value of the conduct parameter. The conduct parameter estimated in this manner will accurately measure market power only in exceptional circumstances.

A second serious criticism is with the fragility of the estimates, something that tended not to be revealed in much of the published work. This point was first emphasized by Hyde & Perloff (1995) and reinforced strongly by Perekhozhuk et al. (2017), who attribute the fragility of estimates to

[16] We focus on studies that attempt to measure the extent of market power. A smaller group of studies (e.g., Holloway 1991) conducted tests for the departure of markets from perfect competition, i.e., whether or not a null hypothesis of perfect competition is rejected. The usefulness of such tests is limited because (*a*) failure to reject the null hypothesis of perfect competition is not the same as offering evidence that a market is indeed perfectly competitive, and (*b*) the more important question is how much and how important the departure from competitive behavior are in terms of gauging the market's performance and assessing the need for policy interventions, given that most markets likely depart to some extent from perfect competition.

[17] Most formal studies of food manufacturer market power have focused on the United States or Europe, no doubt owing to both the availability of data and the well-developed and apparently powerful food manufacturers in these locations. However, China's rapid economic growth has stimulated several recent studies examining food manufacturer market power. Studies suggest that Chinese dairy manufacturers have exercised both oligopoly power (Dai & Wang 2014, Guo et al. 2016) and oligopsony power (Dai & Wang 2014), with market-power estimates showing significant regional differences due to geographical concentration of firms (Zheng & Wang 2017) and policy intervention by local governments (Guo et al. 2016). Other industries that have been examined for market-power issues include tobacco processing and cigarettes (Hao & Wang 2003), wine (Zheng & Wang 2017), liquor (Zhou & Wang 2012), and sugar (Si 2005). Issues and challenges related to market power in agricultural and food industries in China and other developing countries will likely increase with their economic development, especially for product categories such as fluid milk not amenable to international trade, because manufacturing industries in their nascent stages are very likely to be highly concentrated.

(*a*) identification method, (*b*) estimation technique, and (*c*) choice of functional forms. To this list we could add choice of explanatory variables to include in-demand, supply, and cost/production-function specifications.

The third shortcoming, and one that is likely to be chronic, is a limitation of data. Researchers will most often have to rely on public data, which will be aggregate and collected according to geographic boundaries and product categories that likely do not correspond to relevant geographic or product markets. Retail scanner data represent something of an exception, enabling prices and sales for participating retailers to be discerned and researchers to define market boundaries based on inclusion or exclusion of specific stores. Other data on food retailers, such as store locations and gross revenues, are also available through vendors such as Nielsen TDlinx. The key limitation in terms of understanding retailer pricing and market power is the unavailability of data on retailers' wholesale costs.

Despite the shortcomings of much of the prior empirical work, obtaining good estimates of the exercise of market power remains an important priority, given the high interest of policy makers and market participants in the topic. Researchers have developed various methods to solve or avoid the problems noted by Corts (1999) that represent paths forward. They include structural econometric modeling (Reiss & Wolak 2007); development of conceptual and econometric models that avoid estimating cost parameters (Nevo 2001); use of firm-level data on marginal costs that are presumed accurate to avoid estimation (Genesove & Mullin 1998), a stochastic frontier estimator of markups that avoids estimation of the conduct parameter (Kumbhakar et al. 2012, Lopez et al. 2017); a continuous and time-varying measure of collusion to improve estimation of market power (Shcherbakov & Wakamori 2017); and modeling static pricing and imperfect collusion as special cases (Puller 2009). Because Corts' problem arises from joint estimation of cost and conduct parameters, the most fruitful and generally applicable approaches moving forward will be those that avoid the need to estimate directly either cost parameters (Genesove & Mullin 1998, Nevo 2001) or conduct parameters (Kumbhakar et al. 2012, Lopez et al. 2017).

A first essential step to addressing fragility of estimates is to perform the robustness checks that fortunately have become regarded as standard practice in applied econometrics today. Conducting and reporting such checks will help consumers of such research in interpreting results, but the broader problem, namely the difficulty in obtaining good estimates of market power, is likely to remain in the absence of access to firm-level information on costs, prices, and outputs. Reliance on time series of industry-level data is generally ill advised for many reasons, among them absence of stationary data series and spurious correlations, failure to identify relevant markets in public data, difficulties in accounting properly for structural changes, and measurement errors in the data.

4. FOOD MANUFACTURER–FOOD RETAILER INTERACTIONS

Historically, concern about market power in the food chain has focused on both buyer and seller power of food manufacturers. In the United States, concerns about market power of the "big five" meat packers led to passage in 1921 of the Packers and Stockyards Act (Myers et al. 2010), which introduced regulatory oversight to these specific industries by the USDA. Much of the food-industry analysis that developed mid-century under the aegis of the structure-conduct-performance paradigm (Bain 1956) focused on these industries. This body of work reached its pinnacle with the publication of the influential book by Connor et al. (1985), which concluded that US consumers paid from 6% to 10% more for food due to oligopoly power of food manufacturers. Soon thereafter, studies under the aegis of the new empirical industrial organization took up the investigation of market power in these industries, with much of it subject to the limitations already noted.

A further issue with both conceptual and empirical work on food manufacturer market power is that it has mostly ignored the possible strategic interactions between food manufacturers and retailers, either by assuming nonstrategic behavior by retailers or by assuming an integrated processing/retailing sector. However, such approaches are today generally unacceptable in light of the supermarket revolution discussed previously, and a growing literature has emerged to take on the challenge of understanding strategic interactions among manufacturers and retailers using Nash bargaining models, bilateral oligopoly models, and other conceptual frameworks. Studies using Nash bargaining (Dobson & Waterson 1997; Inderst & Shaffer 2004; Inderst & Wey 2003, 2007, 2011; Iozzi & Valletti 2014; von Ungern-Sternberg 1996) show that concentrated retailers may use buyer power to countervail the seller power of upstream firms, whereas the impacts on prices and welfare depend on the specific contract pricing terms (e.g., linear or nonlinear pricing) and the nature of competition among upstream sellers and downstream buyers.

Greater retailer power may not reduce retail prices even though retailers may countervail food manufacturer seller power to reduce the wholesale price, because retailers can also use their power to increase retail markups (Chen 2007, Dobson & Waterson 1997, von Ungern-Sternberg 1996). For example, retailer countervailing power through offering a private label can lead to either higher or lower retail prices depending on various factors, including the response of national brand manufacturers and whether consumers are loyal to the national brand or will switch to a private label (Gabrielsen & Sørgard 2007).

Although this body of work considerably advances our knowledge about interactions between powerful food manufacturers and retailers, its weakest aspect in general is predictions about retailers' exercise of their pricing power, which is done in accordance with the standard profit-maximizing models. Although this may be an adequate approach in some industries, it likely is inadequate to study food retailing for several reasons discussed in the next section.

Applications of the Nash bargaining framework to the food supply chain include those of Draganska et al. (2010) on German coffee markets and Bonnet & Bouamra-Mechemache (2016) on French fluid milk markets. These studies use the characteristics of food manufacturers and retailers and a structural econometric model of supply and demand to empirically estimate the relative bargaining power and margins of manufacturers and retailers. Draganska et al. (2010) show that relative bargaining power and profit shares are determined by firm size, store-brand positioning, and service-level differentiation. Bonnet & Bouamra-Mechemache (2016) find that manufacturers enjoy more bargaining power for organic milk products, while retailers have greater bargaining power for conventional milk. Such results are possible only when strategic interactions between manufacturers and retailers are specifically modeled, demonstrating the limitations of traditional models of one-sided market power.

A second group of studies has developed specific conceptual models to examine retailers' use of vertical restraints as tools in their strategic interactions with manufacturers. Slotting allowances assessed on manufacturers by retailers are a key example, and they have been analyzed extensively to understand their effects on market competition and welfare (Bonnano & Vickers 1988; Desiraju 2001; DeVuyst 2005; Innes & Hamilton 2006, 2009, 2013; Richards & Patterson 2004; Shaffer 2005). Slotting allowances can be used as a mechanism to help retailers or manufacturers exercise market power and vertical control (Innes & Hamilton 2006, 2009; Shaffer 2005). In addition, slotting allowances help allocate shelf space (Sullivan 1997), signal the success rates of products (Bloom et al. 2000), and allow retailers and manufacturers to share the risk of product failure (Richards & Patterson 2004).

Private labels are another tool to allow retailers to gain more leverage with manufacturers of national brands, especially when the location of a private label product in attribute space is close to that of national brands (Richards et al. 2010). Introducing a private label can help limit

manufacturer power, alleviate the double marginalization problem, and lower the wholesale price (Bergès-Sennou et al. 2004). Manufacturers of national brands are more likely accommodate the entry of a private label if the private-label product is of low quality and cost (Bontems et al. 1999).

The effects of private labels on retail prices depend on the quality and cost difference between national brands and the private label, in addition to other factors such as the nature of competition among retailers and manufacturers (Bergès-Sennou et al. 2004, Bontems et al. 1999, Bontemps et al. 2008, Gabrielsen & Sørgard 2007). Although using a private label can strengthen retailer countervailing power, it may either reduce or increase the retail prices of national brands, depending on the vertical market structure and competition and on consumer characteristics (Gabrielsen & Sørgard 2007).

One important issue, which is almost completely ignored in the literature on food manufacturer–food retailer interactions, is how the multiproduct nature of food retailing affects the strategic interactions between food manufacturers and retailers and the corresponding effects on prices and welfare. A retailer's selling strategies for the large number of related goods it carries will certainly influence its selling strategy for the product under study, which in turn affects its bargaining strategies and power in negotiations with the manufacturer.[18]

Increasing horizontal concentration at both food manufacturing and retailing stages of the supply chain as well as the vertical coordination/restraints between food manufacturers and retailers indicate that traditional modeling of market power on only one side of food manufacturer–retailer interactions and presuming simple linear transfer prices will likely yield erroneous results and conclusions about market power in the food chain. Strategic behavior from both food manufacturers and retailers is likely to alleviate inefficiencies such as double marginalization, reduce at least some wholesale prices, and result in a more competitive food system than if power were concentrated in the hands of only manufacturers or retailers. The weakest element in this important body of work is its modeling of retail price setting, the topic to which we now turn.

5. FOOD RETAILER SELLING BEHAVIOR

The equilibrium market structure of food retailing is a natural oligopoly of major firms with a competitive fringe due to the strong spatial dimension of food retailing and retailers' endogenous fixed costs of investment to provide desired varieties of products in stores (Ellickson 2007). Moreover, as noted, food retailers are generally perceived to have gained significant power due to the consolidation of food retailing that has occurred in recent decades and that has increased concentration in local food-retailing markets. Accordingly, considerable recent research has focused on food retailing and food retailers' pricing strategies and market power. We turn now to examining this work, focusing on studies that have begun to address the complexities of food retailers' pricing decisions and the implications for pricing and sector performance.

5.1. The Multiproduct Nature of Food Retailing

Studies of food retailer pricing and seller power have often focused on single products or product categories, with dairy representing the most frequently studied category, including fluid milk

[18]One implication would be that manufacturers of powerful brands have greater bargaining power due to the multiproduct nature of food retailing and the fact that shoppers typically purchase a market basket. A retailer cannot reach a bargaining impasse with these sellers because failure to carry their brands would mean the retailer loses not just the margin on sales of those products but also the margin on the entire baskets of customers who are loyal to those brands and who would shop elsewhere if they were unavailable.

(Chidmi et al. 2005, Cohen & Cotterill 2011, Hovhannisyan & Gould 2012, Richards et al. 2012), yogurt (Villas-Boas 2007), and cheese (Sckokai et al. 2013). Other categories studied include breakfast cereals (Nevo 2001), beef (Anders 2008, Claycombe & Mahan 1993), pork (Anders 2008, Jumah 2004), eggs (Allender & Richards 2010), and coffee (Villas-Boas 2009).

These studies do not account for cross-category interdependence in food retailing. Modern supermarkets provide 70,000 or more unique product codes, and a central research issue is how to measure retailers' market power in these settings and how the multiproduct, multistore nature of modern retailing impacts food prices and market power. Is it adequate or reasonable for most research questions to study just a single product or a few products in stores?[19]

Some studies have attempted to model food retailers as multiproduct sellers to analyze their pricing decisions and market power for multiple goods (Bliss 1988, Giulietti & Waterson 1997, Glauben et al. 2011), or they explicitly include complementarity among goods within a category (Richards 2006), cross-category externalities (Thomassen et al. 2017), and cross-elasticities between stores of the same retail chain (Smith 2004) to analyze their effect on retailers' seller power and pricing strategies. Given the evident significant effects of these interdependencies on food retailers' pricing strategies and market power (Thomassen et al. 2017), it is vital for research on food retailer market power to address these considerations. Thomassen et al. show in particular that incorporating complementary relationships across product categories significantly curtails retailers' exercise of market power in terms of high price-cost margins for specific products.

5.2. Presence of Discounters

A central part of the supermarket revolution has been the emergence of discount retailers such as Walmart and Aldi and their growth to account for a significant portion of sales in food retailing (Martinez 2007). Their presence has changed the nature of market competition in food retailing and influenced the selling strategies of traditional food retailers (Sheldon 2016). In addition to charging low prices in pursuit of share growth and associated economies, discounters can promote competition and lower retail prices among their competitors (Hausman & Leibtag 2007) or cause traditional supermarkets to focus on higher-quality products to avoid intense price competition (Sheldon 2016).

Because some discounters such as Walmart and Costco carry a large amount of nonfood general merchandise in addition to food items. The interdependence between the pricing strategies for general merchandise and for food items is likely to have non-negligible effects on the prices of discounters and traditional food retailers with which they compete. This interdependence, though seldom studied, is likely among the reasons that discounters charge lower prices for food items compared to traditional supermarkets.

5.3. Spatial Dimensions

The spatial dimensions of food retailing are critically important, though seldom studied until recently. Most consumers travel only a few miles or kilometers to shop (Ver Ploeg et al. 2015), meaning that relevant markets for food retailing are highly localized, and national or even city-level measures of concentration are of limited relevance in gauging the potential for food retailer market

[19] For example, studies of farm-retail price transmission or farmer share of the food dollar for specific farm commodities would be instances in which focusing on a few key items at retail is appropriate. Drawing broad conclusions about retailer pricing behavior from such studies, however, is likely not appropriate.

power. The second consideration, and one that offsets to an unknown degree the importance of local markets, is that many retail chains set identical or near identical prices across broad geographic zones (Adams & Williams 2017, Gopinath et al. 2011), despite significant differences in conditions of local markets where individual stores operate and suffer an apparent loss in profits from pursuing this strategy (DellaVigna & Gentzkow 2017).

However, evidence in support of zone pricing is not universal. Atkin & Donaldson (2015) found that retail prices in Ethiopia and Nigeria depended on the remoteness of location. Jaravel (2016) found that food prices were related to income levels of local markets, and Beraja et al. (2016) found evidence that retail prices respond to local demand shocks. Ma et al. (2017) found strong support for uniform pricing by supermarkets in the greater Los Angeles area, but that small retailers exploited local market power in areas without a supermarket competitor. Differences in results can probably be explained in part by differences in market location—sub-Saharan Africa for Atkin and Donaldson's study versus the United States for DellaVigna and Gentzkow's work. Another factor is the number of stores and products covered; for example, a relative handful were included in the studies finding local response versus a comprehensive study of products for 64 US chains by DellaVigna and Gentzkow. Finally, the research methods utilized also affected the results.

Either a local pricing strategy or more centralized strategies such as zone or uniform pricing can be optimal choices for a retail chain based on market conditions (Dobson & Waterson 2005), so it may not be surprising to see different strategies in operation. However, DellaVigna & Gentzkow's (2017) results, given their comprehensive coverage of the United States, are powerful, and similar tests need to be conducted for other countries to determine the ubiquity of the results. Unquestionably, the degree of centralization of pricing strategies affects food retailers' exercise of local market power (Allain et al. 2017) and should impact how antitrust authorities treat prospective mergers. For example, the common policy of requiring selective divestiture of stores where local competition is perceived to be impeded by a merger makes little sense under zone pricing.

5.4. Market Basket Shopping

A typical consumer will purchase a market basket containing multiple goods in a food shopping trip, whether the trip is one-stop shopping (Beggs 1992, Smith & Hay 2005) or multistop shopping (Chen & Rey 2012, Klemperer 1992). Market basket shopping is a crucial factor in understanding food retailer behavior because it emphasizes the importance of cross-category and/or cross-product price effects (e.g., Thomassen et al. 2017) and also the fact that retailers compete not just for sales of particular products but to attract customers to their stores in the first place (Saitone et al. 2015). This fact would appear to immediately place a brake on retailers' exercise of market power, especially for staple product categories that are likely integral to consumers' purchasing decisions. For example, a profit-maximizing decision on a price to set for fluid milk made in a single-product context would involve balancing the benefits of a higher margin from raising price with the costs of reduced fluid milk sales. However, incorporating the market basket dimension of consumer shopping means that the retailer should incorporate the impacts of higher milk prices on the number of shoppers who visit the store at all and the loss in profits from the entire market basket of those who elect to shop elsewhere due to higher milk prices.

The shopping basket phenomenon has been addressed in several studies such as those by Mehta (2007), Russell & Petersen (2000), Singh et al. (2005), and Song & Chintagunta (2006). However, the norm in empirical work is to model consumers as making purchasing decisions for a single product or category, which is chosen to meet a certain research objective (e.g., Anders 2008, Nevo 2001, Sckokai et al. 2013), rather than as buyers who make joint purchasing decisions for all goods in their

shopping baskets. While such studies can provide valuable information for the product categories studied, they should not be used to draw general inferences about food retailer market power.

5.5. Food Retailing Summary

Food retailers have become dominant players in the food chain globally through the developments in the past decades. The supermarket revolution has unquestionably spurred efficiencies in the entire supply chain, countervailed the power of food manufacturers, which is long believed to be a key source of market power in the food chain (Connor et al. 1985), and dramatically expanded consumer choice. However, it has also raised concerns about powerful retailers' exercise of market power to the detriment of consumers (e.g., McCorriston 2014).

Modern grocery retailing is inherently oligopolistic in structure, given the size of modern supermarkets and localized food retailing markets. Whereas economic thought grounded in traditional structure-performance linkages would regard such a structure with concern in terms of market power implications, much of the recent literature on food retailing suggests that food retailers' exercise of market power is limited and that consumers are likely the primary beneficiaries of the supermarket revolution. These considerations include the presence of discount retailers in many markets globally and the competitive yardstick effect they may exert on rivals, retailers' preference for ignoring local market conditions in favor of uniform pricing in broad geographic zones, and the multiproduct considerations inherent in retailers' pricing strategies. This latter dimension introduces cross-category interactions into pricing decisions, as well as strategies to appeal to market basket or one-stop shoppers.

6. CONCLUDING COMMENTS

Studies of market power in the food supply chain have a long history in agricultural economics, given the importance of food as a budgetary item in most countries and for the poor in any country, and because farmers often have low incomes and are viewed as a vulnerable segment of the population. Concerns about the market power of food manufacturers and retail grocery chains have assumed increasing importance in light of rapid structural changes and rising concentration across the supply chain. Much of this work has been ably chronicled in recent survey papers cited herein, and our goal was not to replicate or even to update this work, but rather to ask some fundamental questions about our standard approaches to studying food sector market power, both conceptually and empirically, in light of the structural changes that have occurred in the sector.

Analysis of market power in the food sector faces serious challenges. They begin with a paucity of appropriate data caused by public agencies either failing to collect it at all or collecting it in accord with political jurisdictions and product categories that do not correspond to appropriate geographic or product markets for analysis of market power. These issues are most severe for food manufacturers and their behavior as buyers from farmers or as downstream sellers to retailers. The widespread availability of scanner data for some locations enhances opportunities to understand food retailer behavior, but retailers' interactions with their supplies remain shrouded in almost all cases.

We have also found the traditional industrial organization models that have been widely applied to study food sector market power to be increasingly inadequate to study the modern food supply chain. Models of single-product competition are generally appropriate to study relationships between farmers and downstream buyers, but the implicit spot-market character of the standard models limits their applicability in a world increasingly characterized by either formal or relational contracts between farmers and their buyers and where the potential to forge symbiotic long-term

relationships often exists. Indeed, the presence or absence of conditions conducive to formation of such relationships represents a useful guide to understanding when buyer power is or is not likely to be a significant concern.

The worldwide supermarket revolution and the emergence of supermarkets in their various formats as powerful players in the food sector means that interactions between food manufacturers and retailers must generally be studied with models that recognize explicitly the bilateral power that exists in such relationships. Fortunately, researchers have responded to this challenge, and our understanding of food manufacturer–retailer bargaining relationships and the roles of specific strategic interventions such as slotting allowances and use of private labels has accordingly been greatly enhanced. Similarly, the profession has made considerable strides, both conceptually and empirically, to understanding the complexities of pricing strategies by modern food retailers that both operate multiple stores and sell tens of thousands of products within a given store.

The structural changes that have occurred in food retailing have been driven by a quest for efficiency and to eliminate costs from the system, and there can be little question that this has been accomplished to the betterment of consumers in terms of expanded choices and low prices. A recurrent theme in this review has been that considerations that go beyond the bounds of the standard industrial organization models tend to cause market power to be less than would be predicted based on the predominant oligopolistic and oligopsonistic structures of many modern agricultural and food markets. Such factors include downstream buyers who rationally internalize long-run implications of their pricing decisions to farmers, powerful food manufacturers and retailers who countervail each other's market power, and considerations inherent to the decisions of multistore and multiproduct food retailers.

However, this optimistic assessment is not meant to imply that market power is not a problem in the food chain in some instances. Buyer power will be a concern whenever farmers' selling options are few, long-run considerations are unimportant to buyers, and benefits to preserving farm investment cannot be internalized by buyers. In the same way, to understand when seller power is likely to be important, we must look for oligopoly or monopoly wholesale or retail market structures where countervailing power is not strong, and in terms of food retailing, where discounters and chain supermarkets are not present so that the sellers who are operating have market power and no incentive to curtail its use. Perhaps the greatest accomplishment of recent research on the industrial organization of the food sector is that it has provided a clear lens enabling us to identify such settings and prescribe appropriate remedies.

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