2005

Price behavior in a dynamic oligopsony: Washington processing potatoes - A comment

N Lavoie

Comment and Reply

PRICE BEHAVIOR IN A DYNAMIC OLIGOPSONY: WASHINGTON PROCESSING POTATOES—A COMMENT

NATHALIE LAVOIE

In a recent article in this journal, Richards, Patterson, and Acharya (RPA) evaluate whether the Washington State frozen potato processors behave as an oligopsony and determine the welfare loss associated with this market structure. For this purpose, the authors use the Green and Porter trigger price model of collusion. However, this article contains errors in the derivation of the industry average conduct parameter and in the derivation and calculation of the loss in producer welfare. These errors make the article confusing and have important implications for the interpretation of the results and associated policy recommendations.

The first mistake occurs in the derivation of the values of the industry average conjectural variation (CV) elasticity under different forms of firm conduct. CV is defined as

$$(1) \qquad \theta_i = \frac{dX}{dx_i} = 1 + v_i$$

where X is the industry output, x_i is firm i's output, $v_i = \sum_{j \neq i}^{N} \frac{dx_j}{dx_i}$, and $x_j =$ firm j's output. CVs have been the subject of both criticism and confusion in their interpretation.[1] First, the nomenclature "conjectural variation" in itself is confusing because it has been used in the literature and textbooks to describe either θ_i, v_i (Waterson; Jacquemin), or even $\frac{dx_j}{dx_i}$ (Kamien and Schwartz; Brander and Zhang). Second, as emphasized by both Bresnahan, and Perloff,

the CV should not be interpreted in the same way in a theoretical versus empirical context. In theory, $\frac{dx_j}{dx_i}$ represents the "conjecture" of firm i regarding how firm j will react to an increase in quantity by firm i. Empirically, while early work gave a behavioral interpretation to the estimated value of θ_i or "conduct parameter," recent practice has been to interpret the conduct parameter as an index of market power that ignores the (unknown) game that firms play (Perloff).[2,3] Finally, Corts demonstrated that Bresnahan's middle ground interpretation of the conduct parameter—firms' behavior is as competitive as if they held the conjecture implied by the estimated value—is valid only under a restrictive condition.[4] Nevertheless, validations of the conduct parameter approach using direct measures of marginal cost to compute the "true" value of the conduct parameter have shown that the method performs reasonably well for low levels of market power (Genesove and Mullin; Clay and Troesken).

RPA model the profit-maximization problem of a typical potato processor in an industry characterized by oligopsony power. In this market structure, the notion of CV comes into play because firms are mutually interdependent in their actions. While the model is

Nathalie Lavoie is assistant professor in the Department of Resource Economics at the University of Massachusetts, Amherst.

[1] See Carlton and Perloff; Kamien and Schwartz; Bresnahan; Jacquemin; Perloff; and Corts for the discussion of this topic.

[2] The terminology "conduct parameter" has been used generically in the literature to describe the estimated value of either the CV (θ_i) or the CV elasticity ($\frac{\partial X}{\partial x_i} \frac{x_i}{X}$). I will use the term "conduct parameter" generically also.

[3] By expressing θ_i in elasticity form, its interpretation as a measure of departure from competition becomes clear. The Lerner index in this case corresponds to the CV elasticity divided by the elasticity of demand. Thus, the CV elasticity can be interpreted as an elasticity-adjusted Lerner index and provides a measure of market structure or departure from perfect competition (Perloff; Corts; Wolfram).

[4] Corts demonstrates that the estimated CV parameter measures the marginal, not average, collusiveness of conduct. Thus, market conduct inference is limited to cases where behavior in equilibrium is identical on the margin, not on average, to a CV game.

specified for a typical firm, only industry data are available—a common difficulty in this type of analysis. When only industry data are available, Bresnahan argues that the aggregate conduct parameter should be interpreted as the industry average conduct. It is in aggregating the firms' supply relation to obtain an industry average that an error occurs. This error leads to a misspecification of the benchmark values of the industry average CV elasticity against which the estimated parameters are compared to assess the degree of departure from competition and the associated welfare loss. Thus, the interpretation of the results is affected by this mistake.

When firms are not identical (the more general case), aggregating involves weighting each firm's supply relation by its market share and summing across firms (Porter 1983a; Goldberg and Knetter; Wolfram).[5] When there are N identical firms, the market share of each firm is $1/N$ and aggregating is done by summing the supply relations over all firms and dividing by N (Perloff; Corts). RPA assume N identical firms with the same marginal cost (c_q), the same technology (λ, the conversion rate of raw potatoes to french fries), behaving according to the same CV (θ defined as in (1)), and facing the market supply curve $w(X, z)$, where z is a vector of exogenous supply-shift variables. RPA then aggregate the first-order condition over N firms to obtain the intermediate step:

$$N(\bar{p} - c_q)\lambda - Nw(X, z) - \eta\theta \sum_{i=1}^{N} x_i = 0$$

where $\eta = \frac{\partial w}{\partial X}$ and $\sum_{i=1}^{N} x_i = X$. Divide by N and rearrange to obtain a similar equation to equation (RPA5):

$$\bar{p}\lambda - w(X, z) = c_q\lambda + \eta\theta^a X.$$

This equation, however, differs from RPA in that $\theta^a = \frac{\theta}{N} = \frac{1}{N}(1 + \sum_{j \neq i}^{N} \frac{dx_j}{dx_i})$ whereas $\theta^{RPA} = 1 + \frac{1}{N} \sum_i \frac{dx_i}{dx_j}$, leading the authors to incorrectly specify the range of this conduct parameter. The above definition of θ^a, when firms are identical and $\theta_i = \theta$ for all i, is in agreement with the literature, e.g., Waterson; Perloff; Corts; and also Wolfram. The aggregation of the supply relationship from the firm level to an industry level changes only the inter-

---

[5] Note that Porter (1983a) uses θ_i to represent the firm's CV *elasticity* rather the CV defined in equation (1).

Table 1. Values of $\frac{dx_j}{dx_i}$, θ, and θ^a for Identical Firms under Different Forms of Firm Conduct

Firm Conduct	$\frac{dx_j}{dx_i}$	θ	θ^a
Perfect collusion	1	N	1
Cournot competition	0	1	$\frac{1}{N}$
Bertrand/perfect competition	$\frac{-1}{N-1}$	0	0

pretation of the conduct parameter to an "aggregate conduct parameter" (Corts, p. 231).

In fact, the aggregate conduct parameter (θ^a) can be interpreted as the industry average CV elasticity. The CV elasticity ($\frac{dX}{dx_i} \cdot \frac{x_i}{X}$) takes the form of θ/N when firms are identical (and $\theta_i = \theta$ for all i) because each firm has a market share equal to $1/N$. Table 1 summarizes the values taken by $\frac{dx_j}{dx_i}$, θ, and θ^a under different forms of firm conduct. In a Cournot setting with identical firms, θ^a takes the value of $1/N$ because each firm believes its rivals' quantity is fixed, i.e., $\frac{dx_j}{dx_i} = 0$ and $\theta = 1$. As shown in the table, θ^a ranges between 0 (perfect competition) and 1 (perfect collusion) and not between 0 and 2 as claimed by RPA.[6] The CV elasticity always ranges between 0 and 1.[7]

It is important to correctly specify the values taken by the CV elasticity under the forms of conduct listed in table 1 because those values can be used as benchmarks to determine the extent of market power in the industry. For example, when there are five identical firms buying an homogeneous product, an estimated value of θ^a greater than 0.2 but less than 1 would imply that the level of market power is greater than that implied by Cournot competition but less than under a joint monopsony

---

[6] RPA cite Brander and Zhang for the bounds of the industry average CV between 0 and 2. However, Brander and Zhang model an airline duopoly where they actually estimate each firm's conjecture (v_i). CV (θ as defined in (1)) does vary between 0 and 2 for a duopoly, but not the CV elasticity.

[7] More generally, when firms are not identical and do not have the same conjectures, $\theta^a = \sum_{i=1}^{N} s_i^2 \theta_i$, where s_i is the market share of firm i, θ_i is as defined in (1), and $s_i\theta_i$ is the general form of the CV elasticity (Porter 1983a; Goldberg and Knetter; Wolfram). Thus, θ^a can be interpreted as the industry weighted average CV elasticity. It takes the values of 0, $\sum_{i=1}^{N} s_i^2$(Herfindahl index), and 1, under Bertrand/perfect competition, Cournot competition, and perfect collusion, respectively. It can be seen that $\theta^a = \theta/N$ is a special case of the general model and results from the assumptions of identical firms with identical conjectures. In this special case, the industry average CV elasticity (θ^a) is the same as each firm's CV elasticity. See also Muth and Wohlgenant for the derivation and interpretation of the aggregate conduct parameter under two special cases.

or perfect cartel. Porter (1983a); Brander and Zhang; Deodhar and Sheldon; Genesove and Mullin; Wolfram; Sexton; and Clay and Troesken are examples of articles comparing or testing estimated conduct parameters against theoretical benchmarks or giving them an "equivalent number of symmetric Cournot firms" interpretation (i.e., $N = 1/\theta^a$). Given that the trigger price model of Green and Porter and the one of RPA assume reversion to a single-shot Cournot–Nash equilibrium during punishment periods, it is imperative to compare the estimated level of market power under reversionary periods with this theoretical benchmark to evaluate the consistency of the results with the conceptual model.[8] From now on, I use the notation θ^a defined above.

RPA (personal communication) indicate that θ^a was not restricted in their estimation to lie within any conceptual bounds. Thus, while the empirical estimates of θ^a are not affected by this conceptual error, there are important implications for the interpretation of these estimates of market power.

The authors estimate the conduct parameters in the collusion regime to be 1.038 and 0.861 in the punishment regime. Note that under the authors' derivation of the industry average CV elasticity, $\theta^{RPA} = 1.038$ would be roughly equivalent to Cournot competition in the *collusive* regime. In contrast, their economic model, following Green and Porter, assumes that firms revert to Cournot competition in the *punishment* regime. Under the correct interpretation of the industry average CV elasticity, θ^a, the estimates of the conduct parameter under both the collusive and punishment regime mean a much higher degree of market power than implied by Cournot competition. Specifically, in collusive periods, $\theta^a = 1.038 \approx 1.0$ indicates that potato processors perfectly collude to maximize their joint profit. Even in the punishment regime ($\theta^a = 0.861$), the departure from competition is much larger

than predicted by the noncollusive Cournot scenario where $\theta^a = 0.2$ when $N = 5$, the number of major players in the industry according to RPA, and it in fact represents behavior close to a joint monopsony.[9] While $\theta^a > 1$, under the collusive regime, is not a problem in itself because the estimate is probably not statistically different from one, Porter (1983b) shows "in general the optimal quantity in cooperative periods will exceed that which would maximize expected joint net returns in any single period" (p. 314).[10] This logic would imply that the conduct parameter would normally be strictly less than 1, even in collusive regimes.

It is a source of concern that such high degrees of collusion are estimated under both regimes and, consequently, the results do not conform well to the trigger price strategy of collusion put forth by the authors. However, if one believes the estimated conduct parameters, then the estimated degree of departure from competition indicates the presence of a powerful cartel and would likely warrant an antitrust investigation.

The mistake in the definition of the benchmark values of the industry average CV elasticity also has important implications for the interpretation of the magnitude of welfare loss in RPA's table 2.[11] Given the extent of departure from competition implied by RPA's results, it is surprising that their estimate of producers' loss due to imperfect competition ($0.369 million/month) represents only 1.6% of the average shipment value during the sample period (when the supply flexibility (ρ) is 2.16). This percentage loss in producer surplus (PS) is small relative to the theoretical prediction that can be derived. In deriving the theoretical predictions, I have also found a mistake in equation (RPA18). In what follows, I rederive (RPA18) to develop theoretical predictions for the percentage loss in PS due to oligopsonistic power of potato processors.

---

[8] In collusive periods, the theory provides an expected range for the estimated value of the conduct parameter, i.e., greater than the value expected under the punishment period, but smaller than the value expected under static joint profit maximization (Porter 1983a, Porter 1983b). In punishment periods, the theory provides a specific expected value for the conduct parameter, i.e., the value of the CV elasticity under the Bertrand–Nash equilibrium when price is the strategic variable, or the value of the CV elasticity under the Cournot–Nash equilibrium when quantity is the strategic variable. Price is the strategic variable in Porter's (1983a) model, and he explicitly compares the estimated value of the conduct parameter under cooperation with both the Cournot benchmark and the expected range of this parameter to evaluate the consistency of the results with the conceptual model.

---

[9] It should also be noted that those estimates of CV elasticity are also large in the context of previous empirical research. Sexton and Lavoie's survey of the literature indicates that the measured departures from competition in the food processing industry have mostly been small with CV elasticities often below 0.2. This result is true even in highly concentrated industries such as the meat processing industry where Azzam and Pagoulatos estimated the buyers' CV elasticity to be 0.223. See also table 1 of Sheldon and Sperling, which summarizes market power and Lerner index estimates in the food and related industries.

[10] Intuitively, colluding at a quantity higher than the monopsony quantity reduces the incentives to cheat on the agreement. The gains to cheating decrease as the colluding quantity increases for a given trigger price and length of punishment period.

[11] Note that with $\theta^a \in [0;1]$, the last three columns of RPA's table 2 are not relevant.

Table 2. Relative Measures of Producer Surplus (PS) Loss When $\rho = 2.16$

	Relative to Competitive PS: $(\frac{PS_{diff}}{PS_C}) \times 100$	Relative to Oligopsonistic PS: $(\frac{PS_{diff}}{PS_M}) \times 100$	Relative to Competitive Producer Revenue: $(\frac{PS_{diff}}{w_c \cdot X_c}) \times 100$	Relative to Oligopsonistic Producer Revenue: $(\frac{PS_{diff}}{w_m X_m}) \times 100$
Analytical expression	$[1 - (\frac{1}{\theta^a\rho+1})^{\frac{\rho+1}{\rho}}] \times 100$	$[(\theta^a\rho+1)^{\frac{\rho+1}{\rho}} - 1] \times 100$	$\frac{\rho}{\rho+1}[1 - (\frac{1}{\theta^a\rho+1})^{\frac{\rho+1}{\rho}}] \times 100$	$\frac{\rho}{\rho+1}[(\theta^a\rho+1)^{\frac{\rho+1}{\rho}} - 1] \times 100$
Value when $\theta^a = 0.861$	79%	365%	54%	250%
Value when $\theta^a = 1.038$	82%	459%	56%	314%

Note: The expression for PS_{diff} is given in equation (3) of this comment.

The expression for the marginal outlay (MO) curve is[12]

$$(2) \quad MO = (1 - \theta^a)\beta X^\rho + \theta^a(\rho + 1)\beta X^\rho.$$

Note that this specification also implies that θ^a ranges between 0 (perfect competition) and 1 (monopsony), because θ^a can be interpreted as a weight between the industry supply curve and marginal cost curve in determining the quantity purchased (Melnick and Shalit; Sexton and Lavoie). Moreover, two terms are missing in (RPA17), the equation that defines the difference in PS between competitive and oligopsonistic outcomes. It should read

$$(3) \quad PS_{diff} = \left(w_c\left(\frac{w_c}{\beta}\right)^{\frac{1}{\rho}} - \frac{w_c}{\rho + 1}\left(\frac{w_c}{\beta}\right)^{\frac{1}{\rho}} \right)$$
$$- \left(\frac{w_c}{\theta^a\rho + 1}\left(\frac{w_c}{\beta(\theta^a\rho+1)}\right)^{\frac{1}{\rho}} \right)$$
$$- \frac{w_c}{(\rho + 1)(\theta^a\rho + 1)}$$
$$\times \left(\frac{w_c}{\beta(\theta^a\rho+1)}\right)^{\frac{1}{\rho}} \Bigg).$$

Thus, the expected loss in PS when there are shifts in behavioral regime corresponds to

$$(4) \quad PS_{diff}^s = \frac{\rho}{\rho + 1}\left[w_c\left(\frac{w_c}{\beta}\right)^{\frac{1}{\rho}} - \tau\left(\left(\frac{1}{\beta}\right)^{\frac{1}{\rho}}\right.\right.$$
$$\times \left.\left(\frac{w_c}{\theta_1^a\rho + 1}\right)^{\frac{\rho+1}{\rho}}\right) - (1 - \tau)$$
$$\times \left.\left(\left(\frac{1}{\beta}\right)^{\frac{1}{\rho}}\left(\frac{w_c}{\theta_2^a\rho + 1}\right)^{\frac{\rho+1}{\rho}}\right)\right]$$

and differs from (RPA18) by the factor $\frac{\rho}{\rho+1}$.[13]

Four alternative analytical expressions for the relative loss of producer welfare due to imperfect competition can be derived by dividing the expression for absolute producer loss in equation (3) by the expressions for (a) the

---

[12] This expression simplifies to $MO = \beta X^\rho + \theta^a\rho\beta X^\rho$, where β is a constant in the equation for inverse supply, and ρ replaces η in RPA—a typo. To avoid confusion, readers should also note the typo in the definition of ρ on p. 266. As in Huang and Sexton, ρ represents a supply flexibility and should be defined as $\eta\frac{X}{w}$, not $\frac{\eta}{w}$.

[13] The omission of the factor $\frac{\rho}{\rho+1}$ in (RPA18) cannot by itself explain low measures of welfare loss. If RPA omitted the factor $\frac{\rho}{\rho+1}$ in their calculation of producers' welfare loss, the correct numbers in table 2 of RPA would be lower, thus only reinforcing my observation that the welfare losses are small compared to the theoretical predictions.

competitive PS, (b) the oligopsonistic PS, (c) the competitive producer revenue, and (d) the oligopsonistic producer revenue. These analytical expressions appear in the first row of table 2. All expressions are a function of ρ and θ^a. Thus, they can be evaluated at the estimated value of ρ (2.16) and under a collusive ($\theta^a = 1.038$) and a punishment ($\theta^a = 0.861$) regime. Regardless of the measure used, the relative loss in PS is much larger than 1.6%, as calculated by RPA. I presume that the reference revenue used by RPA ("the average monthly value of producer shipments") represents the oligopsonistic producer revenue. However, the theoretical prediction suggests that the percentage loss in PS should be between 250% and 314% relative to the oligopsonistic producer revenue, or at least $58.66 million per month. The predictions presented in table 2 are also consistent with those of Sexton who shows, using simulations based on linear demand and supply equations, that the loss in PS represents an important percentage of the competitive PS even at modest departures from competition.

Note that the theoretical predictions depend on the estimated values of ρ and θ^a, and the functional form assumption for the supply of processing potatoes. However, the relative welfare loss calculations also depend on the value of β, the value of the proxy for the competitive price of processing potatoes (w_c), and the reference measure of producers' revenue. The value of the proxy is especially important for the calculation of welfare losses. Specifically, lower values of w_c than that implied by the model would generate lower absolute and relative welfare loss than that predicted by theory.[14]

---

[14] I find that the value of w_c implied by the model is much higher than the value of the proxy used by RPA. RPA proxy the competitive price of processing potatoes (w_c) by scaling downward the fresh market potato price series by 23% to take into account a conversion ratio of raw to processed potato of 0.5. The average monthly price of fresh potatoes is $4.75/cwt (according to the data provided by RPA), thus the average monthly value of w_c is $3.66/cwt. According to the data provided by RPA, the average monthly shipments of processed potatoes is 4.738 million cwt. Presumably, those shipments represent oligopsony quantities (X_m). Knowing that the quantity determined by oligopsonists is found by equating the perceived marginal outlay expression (2) with marginal value product (w_c in RPA's setup), we can get an idea of the magnitude of w_c implied by the model using the estimated values for β (0.539), ρ (2.16), and θ^a under punishment (0.861) and collusion (1.038). Those calculations reveal that the magnitude of w_c implied by the model is between $44.37 and $50.31 per cwt, which is more than ten times higher than the values used by RPA ($3.66/cwt on average). Thus, a possible explanation for the low magnitude of welfare loss compared to the theoretical prediction is the difference between the average value of the proxy for w_c used by RPA and the value implied by the model at the estimated parameter values.

In summary, RPA estimated conduct parameters within a Green and Porter trigger price framework of collusion to determine the level of market power in the Washington State potato processing industry. Errors in the benchmark values of the industry average conduct parameter affect the interpretation of their results. Specifically, I show that the estimated values of the conduct parameter imply a much larger degree of market power in the potato processing industry than indicated by RPA. In fact, the results indicate that under collusive periods, potato processors maximize their joint profit as if they were acting as a monopsony. Even under the punishment regime, the conduct is close to perfect collusion with $\theta^a = 0.861$. Such a high level of departure from competition should imply large welfare losses for potato producers relative to what would be attained under perfect competition. I also show that the relative measure of welfare loss calculated by RPA is significantly lower than the theoretical predictions for this level of departure from competition.

Thus, if the reader accepts the estimated values of the conduct parameters, the results of RPA suggest significant producer welfare loss due to the presence of a monopsony-like cartel in the potato processing industry. Given such anticompetitive behavior and associated loss in producer welfare, an antitrust investigation would seem to be warranted. However, some readers may not readily accept this conclusion without a clearer explanation of the apparent inconsistencies noted here between the empirical results and the underlying theory. In this case, further research should reinvestigate the degree of imperfect competition in the Washington processing potato industry.

References

Azzam, A., and E. Pagoulatos. "Testing Oligopolistic and Oligopsonistic Behavior: An Application to the U.S. Meat Packing Industry." *Journal of Agricultural Economics* 41(1990):362–70.

Brander, J.A., and A. Zhang. "Market Conduct in the Airline Industry: An Empirical Investigation." *Rand Journal of Economics* 21(1990):567–83.

Bresnahan, T. "Empirical Studies of Industries with Market Power." In R. Schmalensee and

R.D. Willig, eds. *Handbook of Industrial Organization*. Amsterdam: North Holland, 1989, pp. 1011–57.

Carlton, D.W., and J.M. Perloff. *Modern Industrial Organization*, 2nd ed. New York: HarperCollins College Publishers, 1994.

Clay, K., and W. Troesken. "Further Tests of Static Oligopoly Models: Whiskey, 1882–1898." *Journal of Industrial Economics* 51(2003):151–66.

Corts, K.S. "Conduct Parameters and the Measurement of Market Power." *Journal of Econometrics* 88(1999):227–50.

Deodhar, S.Y., and I.M. Sheldon. "Is Foreign Trade (Im)perfectly Competitive?: An Analysis of the German Market for Banana Imports." *Journal of Agricultural Economics* 46(1995):336–48.

Genesove, D., and W.P. Mullin. "Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890–1914." *Rand Journal of Economics* 29(1998):355–77.

Green, E.J., and R.H. Porter. "Noncooperative Collusion under Imperfect Price Information." *Econometrica* 52(1984):87–100.

Goldberg, P.K., and M.M. Knetter. "Measuring the Intensity of Competition in Export Markets." *Journal of International Economics* 47(1999):27–60.

Huang, S.-Y., and R.J. Sexton. "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(1996):558–71.

Jacquemin, A. *The New Industrial Organization: Market Forces and Strategic Behavior*. Cambridge, MA: MIT Press, 1987.

Kamien, M.I., and N.L. Schwartz. "Conjectural Variations." *Canadian Journal of Economics* 16(1983):191–211.

Melnick, R., and H. Shalit. "Estimating the Market for Tomatoes." *American Journal of Agricultural Economics* 67(1985):573–82.

Muth, M.K., and M.K. Wohlgenant. "Measuring the Degree of Oligopsony Power in the Beef Packing Industry in the Absence of Marketing Input Quantity Data." *Journal of Agricultural and Resource Economics* 24(1999):299–312.

Perloff, J. "Chapter 3: Econometric Analysis of Imperfect Competition and Implications for Trade Research." In I. Sheldon and D. Henderson, eds. *Industrial Organization and International Trade: Methodological Foundations for International Food and Agricultural Market Research*. NC-194 Research Monograph No. 1, 1992, pp. 59–105.

Porter, R.H. "A Study of Cartel Stability: The Joint Executive Committee, 1880–1886." *Bell Journal of Economics* 14(1983a):301–14.

———. "Optimal Cartel Trigger Price Strategies." *Journal of Economic Theory* 29(1983b):313–38.

Richards, T.J., P.M. Patterson, and R.N. Acharya. "Price Behavior in a Dynamic Oligopsony: Washington Processing Potatoes." *American Journal of Agricultural Economics* 83(2001):259–71.

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

Sexton, R.J., and N. Lavoie. "Food Processing and Distribution: An Industrial Organization Approach." In B. Gardner and G.C. Rausser, eds. *Handbook of Agricultural Economics*. Amsterdam: North-Holland, 2001, pp. 863–932.

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

Waterson, M. *Economic Theory of the Industry*. Cambridge: Cambridge University Press, 1984.

Wolfram, C.D. "Measuring Duopoly Power in the British Electricity Spot Market." *American Economic Review* 89(1999):805–26.