Oligopsony Power with Uniform Spatial Pricing:

Theory and Application to Milk Processing in Spain

1. Introduction

Society has become increasingly concerned with concentration and consolidation of power in the food processing or manufacturing sector. A recent survey by Sexton and Lavoie (1998) documents high and rising concentration and also increased vertical control in food processing for several North American and European countries. Economists have devoted increased attention to testing for imperfect competition in food markets and analyzing the efficiency and distributional consequences of market power when it exists.

This prior work has focussed mostly on processors' power as sellers of a finished product, with little attention paid to their role as buyers of agricultural products from farmers. However, processor oligopsony power in some raw product markets may be more important than oligopoly power in the corresponding downstream market. For example, although the relevant geographic market for the finished product may be national or international in scope, markets for the associated raw product are usually local or regional due to the high cost of transporting the raw product, which restricts farmers' access to only those buyers within a limited geographical area. Moreover, finished products that substitute for each other in consumers' budgets, such as various meats, do not substitute at all as raw product inputs, making the relevant market narrower for the raw product than for the finished product.

This study presents an economic analysis of buyer oligopsony power in a spatial markets setting. We focus on a well-defined geographic market--the purchase of raw milk in the Asturias region of Spain--and utilize a panel of firm-level data to study the determinants of firms' pricing practices.[1] Previous studies of market power in the dairy sector have utilized national data and focussed on processors' power, often facilitated through various government policies, as sellers of processed dairy products. Examples are Duff and Goddard (1997) for Canada, Suzuki *et al.* (1993) for Japan, and Masson and Eisenstat (1980), Suzuki *et al.* (1994), and Madhavan, Masson, and Lesser (1994) for the U.S. Prior studies of buyer market power in agriculture include several analyses of the U.S. meat packing industry: Schroeter (1988), Azzam and Pagoulatos (1990), Marion and Geithman (1995), and Muth and Wohlgenant (1997). These studies reach conflicting conclusions as to the existence and importance of oligopsony power among packers. Just and Chern (1980) found evidence of processor oligopsony power in the California processing tomato market, as did Huang and Sexton (1996) for Taiwanese processing tomatoes. Melnick and Shalit (1985) found strong evidence of buyer power in the market for fresh tomatoes in Israel. This study is a first attempt to analyze oligopsony power in milk procurement and to focus specifically on the spatial dimensions of oligopsony power.

2. The Asturias Region of Spain

Asturias is a mountainous region in Northern Spain with dimensions of roughly 300 km x 90 km. Dairy farming is the most important agricultural activity in the area, and the region is one of the most important suppliers to the national market for bottled milk. Most farms are family owned, with an average herd size of 12 cows. A system of production quotas was imposed on farmers in 1986 as a condition for Spain's entrance into the European Union, curtailing the expansion in production that had been observed prior to 1986. The distribution of milk production and processing facilities within the region is illustrated in Figure 1, where each number denotes the location of a processing firm, and counties with heavier concentrations of dairy production are noted by darker shading.

[1]Prior work conducted within both the structure-conduct performance (SCP) and the new empirical industrial organization (NEIO) frameworks has often involved unduly broad product categories that do not correspond to a relevant market as the term is used in antitrust matters.

Some international transshipment of raw milk occurs between farms and processors located near the border with France, but otherwise the milk is purchased by processors located within the Asturias region. Conversely, the market for bottled milk is national in scope, creating a scenario where structural conditions are more conducive to the exercise of processor oligopsony power than oligopoly power.

Processing firms are investor-owned enterprises with the exception of a cooperative (firm 1) located in the center of the region. The cooperative is the region's largest processor, with an average market share of 36.6% during the sample period. The largest of the for-profit processors held a 17.7% average share during the same period. Firms compete based on price to attract product, and the pricing schemes, including premiums and discounts for milk constituents and bacterial quality, are similar across firms. The spatial dimensions of the market are apparent from Figure 1. Processing firms pay transportation costs for shipping product from farms to the processing plants, what is known as a uniform pricing scheme. Costs of shipping are exacerbated by the mountainous character of the region. In the following section, we discuss the theory of price determination under uniform spatial prices. The empirical model is then presented, and the estimation results are discussed.

3. Uniform Pricing in Spatial Input Markets

The prototype form of spatial pricing is FOB or mill pricing, where, in the farm product marketing context, each seller is responsible for the costs of transporting her product to the processing facility and each receives the identical mill price at the plant gate. Any pricing arrangement that departs from the FOB standard is discriminatory in the sense that sellers do not bear the actual cost of shipping their product. In principle, discrimination can take two forms: freight absorption or phantom freight charges. Under freight absorption some portion of shipping costs are borne by the buyer with corresponding adjustment downward in the purchase price. Freight absorption discriminates against sellers located proximate to the processing facility. Phantom freight charges (charges in excess of actual shipping costs) can usually be undermined by seller arbitrage, making freight absorption the form of spatial price discrimination of most practical interest.

Under uniform pricing, the buyer pays the full costs of transportation from farm to the processing facility. It is, thus, an extreme form of freight absorption but is rather common in practice (Greenhut 1981, Durham, Sexton, and Song 1996). Whereas FOB pricing results in distinct, nonoverlapping market areas for each firm, uniform pricing can facilitate overlapping markets among competing firms. The popularity of uniform pricing is no doubt due in part to its simplicity to administer compared to other forms of price discrimination. Moreover, as Greenhut, Norman, and Hung (GNH 1987) and Anderson, De Palma, and Thisse (ADT 1989) have noted, uniform pricing, by discriminating in favor of distant customers, enables firms to compete effectively over a larger geographic area than would be possible under mill pricing. Thus, GNH anticipate that uniform pricing will emerge when extreme price competition exists, and ADT note that, even though shipping costs are higher under uniform pricing due to long hauls and overlapping markets, welfare may be higher under uniform relative to FOB pricing because uniform pricing promotes greater price competition.[2]

Most conceptual literature on spatial pricing has assumed the use of FOB prices, not because of its dominance in real-world applications but, rather, because the analytics of mill pricing are much simpler and more tractable than for the alternatives. Only very stylized models of uniform pricing in spatial markets have been developed to date, and most of this work applies to the polar case of a spatial monopolist. Schuler and Hobbs (1982) and Beckman and Thisse (1986) studied models of duopoly sellers and developed a key result concerning nonexistence of equilibrium under uniform pricing when sellers have Nash-Bertrand conjectures. Kats and Thisse (1993) derived a mixed

[2] Durham, Sexton, and Song (1996) studied the inefficiency in transporting processing tomatoes in California caused by uniform pricing and found actual haulage costs to be 9.3% higher than the estimated cost minimizing solution.

strategy equilibrium for this model. Lofgren (1986) presented the first theoretical analysis of buyer market power under mill and uniform pricing, but he considered only pure monopsony. The present analysis is the first to study the case of duopsony buyers.

Consider two processing firms, A and B, located exogenously distance d apart on a line populated uniformly with density D = 1 by farmers, who produce a homogenous farm product according to a linear supply function of the form $q = w(r)$, where $w(r)$ is the net price received by the farm at the farm gate and r is the distance the farmer is located from the processor.[3] Let $\rho = P - c$ denote processors' selling price for the finished product net of constant per-unit processing costs. The freight rate per unit of product is t per unit of distance traveled. The product $s = td$ measures the absolute importance of space in the market and the ratio s/ρ measures the importance of the spatial dimension relative to the net value of the product being produced. Schuler and Hobbs (1982) assumed that firms were located at the endpoints of a line, while Kats and Thisse (1993) studied firms located along the circumference of a circle. We also consider a linear market but assume somewhat more realistically that the market extends beyond the firms' locations in either direction.[4]

Let u denote the uniform price set by a processor. Hence, individual farm supply is $q = u$. The profit per unit from purchasing product from a farmer located distance r from the processing facility is then $\rho - u - tr$. Thus, a firm using a uniform delivered price will seek to serve a market radius of $R^* = (\rho - u)/t$.

Any conceptual model of imperfect competition must prescribe the manner in which rivals react to one another's behavior. In spatial models, two alternative conjectures are common. Under

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[3]This specification implies that the price elasticity of supply is unitary. It lacks generality but markedly simplifies exposition. As a basis for comparison, Hobbs and Schuler (1981) and Katz and Thisse (1993) assume perfectly inelastic demands in their duopoly models.

[4]None of these modelling approaches is inherently more general than the other. The approaches of Hobbs and Schuler and Kats and Thisse imply a symmetry of location among firms that is generally not present in the real world, causing us to prefer the approach wherein firms face a competitor on one side of the market, but not on the other side.

Loschian competition, each firm assumes that its market area is fixed. In a model of FOB pricing, fixed market areas imply that any price change by one firm is matched exactly by its rival(s). The common alternative conjecture is that a firm assumes its rivals will ignore its price change, what is known as Hotelling competition. Loschian competition is analogous to collusive behavior in nonspatial models, whereas Hotelling competition is analogous to Bertrand pricing.

In a duopoly model with Bertrand-Hotelling pricing, no equilibrium in pure strategies exists except when s/ρ is sufficiently great that each firm can act as a spatial monopolist. The logic of this result extends readily to a model of duopsony. Under Bertrand-Hotelling pricing, each buyer must select from one of two basic pricing strategies. Consider firm A. It can overbid B's price by setting $u_A = u_B + \varepsilon$, where ε is an arbitrarily small positive number, and thereby capture any market territory in dispute between itself and firm B. Under this strategy, A is willing to serve a market radius $R_A = (\rho - u_A)/t$. Alternatively, A can concede to B's higher price and offer a monopsony price u_A^m to any farmers not served by B. Because R is decreasing in u, the higher is the uniform price paid by B, the more attractive to A is the option of conceding the price competition and choosing to be a monopsonist over the territory that is unserved by B. Suppose A elects to pursue this strategy. Then B's best response is to cut its price to $u_B' = u_A^m + \varepsilon$. However, A's optimal response would then be to overbid u_B'.

In technical terms, the firms' payoff functions are not continuous and quasiconcave in their choice variables, u_A and u_B, conditions that Dasgupta and Maskin (1986) have shown lead generally to nonexistence of Nash equilibrium in pure strategies. However, an equilibrium in mixed strategies does exist under these conditions (Dasgupta and Maskin 1986). Kats and Thisse (1993) and Zhang (1997) discuss the properties of this equilibrium for the cases of duopoly and duopsony respectively.[5]

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[5]Other authors have turned to models of product differentiation as a means to obtain existence of Nash equilibrium in prices (De Palma, Labbe, and Thisse (1986) and ADT (1989)).

A key property of the mixed strategy equilibrium under Bertrand-Hotelling behavior is that firms' market areas will never overlap, i.e., one firm will always have overbid the other and captured all territory in dispute. Thus, the mere existence of overlapping market areas among the firms is compelling evidence that Bertrand-Hotelling behavior is not at work, and that some form of collusive or quasicollusive behavior, as epitomized by the Loschian conjecture, is being practiced.[6]

Under uniform pricing, a firm's desired market area varies continuously and inversely as a function of the price it pays. Thus, the fixed market area assumption of Loschian behavior does not apply *per se*. Rather, the Loschian analogue in a model of uniform pricing is the price-matching conjecture that the fixed market radius assumption implies in FOB pricing models. This price matching property implies that in equilibrium prices must be equal among firms engaged in direct competition: $u_A^* = u_B^* = u^*$, and firms have the same desired market radius: $R_A^* = R_B^* = R^* = (\rho - u^*)/t$. The degree to which markets overlap between duopsonists depends upon the value of s/ρ. For $s/\rho \geq 4/3$, the firms' markets are isolated and each can act as a spatial monopsonist, the case studied by Lofgren (1986). For $4/7 < s/\rho < 4/3$, overlap occurs only in the area between the two firms (see Figure 2), in which case a firm's profit, Π_1, consists of three components:

$$(1)\ \ \Pi_1 = u[\int_0^R (\rho - u - tr)\,dr + \int_0^{R-L} (\rho - u - tr)\,dr + \frac{1}{2}\int_{R-L}^{R} (\rho - u - tr)\,dr] = \frac{us}{t}[\rho].$$

where L = 2R - d denotes the length of the overlapping market area. The first integral measures profits from the side of the market with no competition, the second measures profits from the segment on d with no market overlap and, finally, the third measures profits in the area of market

[6]The notion that nonexistence of a Nash equilibrium under competitive Hotelling-Bertrand pricing in a spatial market with uniform pricing might cause firms to seek a more stable, collusive outcome is analogous to the well-known argument advanced by Telser (1978), Bittlingmayer (1982), and others in defense of collusive behavior in industries where plants have identical U-shaped (Viner) average costs. In general, no competitive equilibrium exists in these industries because, given marginal cost pricing, equal division of output among n incumbent firms will result in either of two outcomes, neither of which is sustainable: The n firms lose money because price is less than average cost, but n - 1 firms will earn supracompetitive profits, thus inviting entry by the n^{th} firm; or the n firms earn supracompetitive profits but entry by an additional firm will cause everyone to earn losses.

overlap. We assume customers are shared equally in areas of market overlap. Maximizing Π_1 with respect to u results in the following solution for the optimal uniform price:

$$(2) \quad u_1^*(\rho, s) = \frac{\rho}{2} - \frac{s}{8}.$$

When space is less important relative to the net value of the finished product, $0 < s/\rho < 4/7$), competition extends beyond the firms' locations as illustrated in Figure 3, in which case the relevant profit expression is

$$(3) \quad \Pi_2 = u[\int_{R-d}^{R} (\rho - u - tr)\,dr + \frac{1}{2}\int_{0}^{R-d} (\rho - u - tr)\,dr + \frac{1}{2}\int_{0}^{R} (\rho - u - tr)\,dr] = \frac{u}{2t}\left[(\rho - u)^2\right],$$

and the resulting solution for the optimal uniform price is:

$$(4) \quad u_2^*(\rho, s) = \frac{4\rho - \sqrt{4\rho^2 - 6s^2}}{6}.$$

The comparative statics concern the response of u* to changes in ρ and s and are as follows:

$$\partial u^*/\partial\rho = \frac{2}{3}\left(1 - \frac{\rho}{\sqrt{4\rho^2 - 6s^2}}\right) > 0, \text{ for } 0 < s/\rho < 4/7,$$

$\partial u^*/\partial\rho = 1/2 > 0$ for $4/7 < s/\rho < 4/3$, and

$$\partial u^*/\partial s = \frac{s}{\sqrt{4\rho^2 - 6s^2}} > 0, \text{ for } 0 < s/\rho < 4/7,$$

$\partial u^*/\partial s = -1/8 < 0$ for $4/7 < s/\rho < 4/3$.[7]

The Loschian uniform price is increasing in ρ, but retail price changes transmit only partially to the farm sector in contrast to the nonspatial competitive market case where $\partial u^*/\partial\rho = 1$, given constant per-unit processing costs. When space is important relative to the final product value (4/7 <

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[7] u* is discontinuous in s and not differentiable at the point $s = 4\rho/7$.

$s/\rho < 4/3$) so that active competition occurs only in the space between the two firms, exactly 1/2 of a retail price change is transmitted to the farm (a result identical to the nonspatial monopsony case). However, when space is relatively less important ($0 < s/\rho < 4/7$) and active competition extends beyond the two firms' locations, an even smaller fraction of a retail price change, ranging from $\partial u^*/\partial\rho \rightarrow 1/3$ as $s \rightarrow 0$ to $\partial u^*/\partial\rho \rightarrow 1/5$ as $s \rightarrow 4/7$, passes through to the farm level.

The effect of a change in s (caused either by a change in t or a change in d) also depends on s/ρ. When space is relatively important so that active competition occurs only in the area between the firms' locations, the equilibrium uniform price is decreasing in s. However, when space is relatively less important and competition extends beyond the firms' locations, the optimal uniform price is increasing in s (see Figure 4). This result is perhaps counterintuitive, and is due to some fundamental, but heretofore unexplained economics of competition under uniform pricing. Increasing the farm price above the monopsony level has two effects. A direct effect is that the profit from purchasing product from a given set of farmers decreases because $u^m = 1/3$ is the price that maximizes profits, *ceteris paribus*.

The market area, R, a firm is willing to serve is also decreasing in u. Hence, by raising its price, firm A reduces its market area, foregoing service to customers located at its existing market boundary. These suppliers at the margin add nothing to profit. However, under the Loschian conjecture, firm A expects firm B to match a price increase and, accordingly, contract its market area. Firm A will capture the entire supply of farmers in the area abandoned by B on its left side (see Figure 3). These farmers are valuable to A under uniform pricing because they are located relatively close to A's plant and uniform pricing by construction discriminates against nearby suppliers. This consideration gives firms incentive under Loschian competition to pay a price above the monopsony level. Essentially, the firms pay more than they otherwise would in order to commit credibly to reducing their market area relative to the monopsony solution, thereby reducing the range of space in which they compete actively for suppliers.

Paradoxically, this effect is strongest, not when firms are located near to each other but, rather, when they are located an intermediate distance apart ($s/\rho = 4/7$ in our model). When firms are located in close proximity, their markets are nearly fully overlapped, and the customers gained by reducing market overlap through offering higher prices are not very valuable under uniform pricing. As the economic distance separating firms increases, the market boundary of the rival firm moves closer to the location of a given firm's plant, giving that firm greater incentive under Loschian competition to increase price above the monopsony level so as to reduce the area of market overlap and active competition.

4. The Empirical Model

Data for the study consist of monthly observations of price paid to farmers and shipments received by 13 Asturias dairy processors for the eleven years from 1985-1995. However, we lack complete data for some of the firms, so the panel is unbalanced--a common occurrence with panel data sets. The processors' locations are indicated in Figure 1. We lack data on firms' processing costs that might have enabled us to estimate a structural NEIO model. We instead estimate a reduced form SCP model with the price per liter offered to farmers by each firm i in each monthly period τ, $u_{i,\tau}$, as the dependent variable and focus on tests of the theory of uniform pricing under collusive (Loschian) behavior.

The key explanatory variables emerging from the theory of uniform spatial pricing are (i) the importance of space in the market, as measured by the product of the distance between firms and per-unit shipping costs, and (ii) the retail value of the processed product net of per-unit processing costs.

As an empirical counterpart to the conceptual variable $s = td$, we first constructed $D_{i,\tau}$ as the sum of the distances from firm i to its nearest rivals such that the combined volume of the rivals at least equaled the volume of firm i. Of course, in some cases $D_{i,\tau}$ will involve only the distance to a single firm. We utilized the price, F_τ, of diesel fuel to approximate shipping costs t. Thus, the empirical counterpart of s is $S_{i,\tau} = D_{i,\tau}F_{\tau}$. Although the spatial theory of uniform pricing was developed only for duopsony, in reality firms may compete with more than one direct rival. Therefore, we also included $N_{i,\tau}$, the number of rival firms j that were utilized to compute $D_{i,\tau}$, as an additional explanatory variable to test whether number of direct rivals has an effect on price paid independent of its indirect effect through $S_{i,\tau}$. Because the theory predicts a nonmonotonic relationship between $S_{i,\tau}$ and $u_{i,\tau}$ (see Figure 4), we also included, $S^2_{i,\tau}$, the square of $S_{i,\tau}$, as an explanatory variable.

The retail value of the processed product was represented by the national price per liter for bottled milk, P_{τ}.[8] We also needed to account for exchange rate fluctuations between the Spanish Peseta and the French Franc, given the Asturias region's proximity to the French border and, thus, the possibility for Spanish processors to purchase milk from France. The Variable RER_{τ} is the ratio of the Peseta to the Franc, adjusted for relative inflation factors in the two countries based on International Monetary Fund statistics. An increase in RER makes French milk more expensive in Spain, which should increase demand and price for milk produced in Spain.The variables u, S, and P were all deflated by the Spanish CPI (1985:1 = 100). Table 1 provides summary statistics for the explanatory variables.

A modified version of the well-known Demsetz critique of SCP studies of profitability has been levelled against studies which seek to explain pricing behavior.[9] The argument is that the most successful firms provide the best quality products and related services, thereby receiving a price premium for products sold or paying discounted prices for inputs purchased and attaining a large market share. In the context of the present study, proponents of the modified Demsetz critique

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[8]We were unable to obtain a satisfactory measure for processing costs, c. Spain does not maintain a suitable price index for use in this regard. A wage rate proxy was considered but data were not available for the entire sample period.

[9]The original Demsetz critique (Demsetz 1973) argued that the statistical correlation between profit and concentration could be due to the most efficient firms increasing their market shares and earning high profits due to their lower costs rather than to supracompetitive prices as implied by the SCP analyses.

might argue that the most successful and, hence, largest processors offer farmers a bundle of characteristics such as technical assistance and timely and reliable payment that enable them to pay a lower price than rivals. Although we lack variables to account directly for these effects, we may test for their existence given the pooled data set. We posit a set of individual firm fixed effects, where Z_i = 1 for firm i and Z_i = 0 otherwise. The Z_i account directly for the existence of firm-level characteristics other than price and location.

We account similarly for seasonality in milk prices through a set of monthly indicator variables M_j, j = 1,...,11, where month 1 is January, and so on. Finally, we also included a set of indicator variables to account for fixed year-to-year fluctuations in price: Y_k, k = 1,...,10, where Y_1 denotes 1985 and so on. In particular, prices paid to farmers increased sharply in 1988 and 1989 due to an apparent price war.[10]

The empirical model is thus one involving a full set of firm and time dummy variables to account for both firm-level and temporal fixed effects. As Greene (1997) notes, this formulation facilitates the proper computation of the variance-covariance matrix in unbalanced panel models. The full model can be written as follows:

$$(5) \qquad u_{i,j,k} = \alpha_i + \lambda_j + \gamma_k + \beta_1 S_{i,j,k} + \beta_2 S^2_{i,j,k} + \beta_3 P_{j,k} + \beta_4 N_{i,j,k} + \beta_5 ER_{j,k} + \varepsilon_{i,j,k},$$

where i = 1,...,13 denotes firms, j = 1,...,11 denotes months, and k = 1,...,10 denotes years 1985-1994. (Variables for the month of December and the year 1995 are excluded to avoid perfect collinearity.)

5. Results

Equation (5) was estimated using White's (1980) estimator of the variance-covariance matrix to correct for heteroskedasticity. The model was estimated for both the full panel and a balanced

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[10]Such a price war might, for example, emerge from a breakdown in a collusive (Loschian) pricing regime. Green and Porter (1984) developed a theory of "trigger" pricing to show how periodic price wars might emerge in equilibrium. Porter (1983) applied this model to pricing by railroads, and it has been applied to study pricing for U.S. beef by Koontz, Garcia, and regime (Green and Porter, 1984).

panel of seven firms (firms 1-5, 7, and 11) for which full data were available. Estimation results are contained in Table 2.[11] Results indicate that firm-specific effects are important. F = 29.84 for the test $\alpha_1 = \alpha_2 = \ldots = \alpha_{13}$ performed on the full panel. Seasonality in the farm price is also important, with prices being highest in the winter months of October through December and lowest during the spring months of April - June. Year fixed effects vary in importance, with positive and significant effects recorded in 1988 and 1989 and negative and significant effects indicated for 1991-93.

Turning to the variables of most economic interest, we find that the estimates for the spatial variables S and S^2 conform closely to the spatial theory summarized in Figure 4. The F statistic for the joint test $\beta_1 = \beta_2 = 0$ is 19.86, and the hypothesis is rejected at all conventional significance levels. The predicted "parabolic" form of the relationship is, in fact, obtained with the maximum value of u occurring at S* = 6,067 for the full panel and S* = 4,096 for the balanced panel. Denoting S_i as the mean value of $S_{i,\tau}$, we have $S_i > S^*$ for firms 1, 3, and 9, with firm 5 also included if the balanced panel results are used. For the remaining firms, the spatial dimension of the market is less important, and the competitive consequences of overlapped markets support higher farm prices, *ceteris paribus.* The number N of direct spatial competitors is also a positive and significant determinant of the farm price paid. Each additional direct competitor causes a firm to pay about an additional 0.6 pesetas (2.2%) per liter of milk.

As expected, the retail price is a strong determinant of the farm price. However, only about 60 percent of a retail price change is transmitted back to the farm. This percentage is rather close to, although somewhat higher than, the values predicted by the spatial duopsony model but differs markedly from the 100 percent pass through predicted by the nonspatial competitive markets model.

Hudson (1993) and Weliwita and Azzam (1996).

[11]Equation (5) was also estimated using the nominal values of all variables, and an inflation-adjusted model was also estimated using a real exchange rate computed from International Monetary Fund statistics. Results from these models were very similar to the results reported in Table 2, although models estimated with the nominal data not surprisingly have somewhat higher explanatory power.

The deviation of the estimated percentage transmission from that predicted by the theory is perhaps due to actual competition for some of the firms being more intense than indicated by the duopsony theory.

Finally the real exchange rate with France has a significant effect on the farm price for milk in the Asturias region. The estimated

	Full Panel		Balanced Panel	
Variable	Coefficient	Abs. t-ratio	Coefficient	Abs. t-ratio
S	0.000178	1.57	0.0000892	0.75
S^2	-0.0000000146	2.74	-0.0000000107	1.91
N	0.590	7.34	0.624	7.65
P	0.592	16.38	0.609	13.77
RER	0.170	3.07	0.190	2.87
Firm effects				
Z_1	-9.688	4.43	-10.840	4.06
Z_2	-7.598	3.54	-8.854	3.36
Z_3	-7.657	3.48	-8.604	3.20
Z_4	-7.548	3.52	-8.804	3.34
Z_5	-6.881	3.18	-8.001	3.01
Z_6	-6.274	2.92		
Z_7	-7.002	3.26	-8.282	3.14
Z_8	-8.476	3.97		
Z_9	-6.235	2.86		
Z_{10}	-7.218	3.36		
Z_{11}	-8.680	4.03	-10.077	3.81
Z_{12}	-6.693	3.11		
Z_{13}	-8.195	3.82		
Month Effects				
M_1	-0.628	3.40	-0.704	3.32
M_2	-0.771	4.28	-0.799	3.85
M_3	-1.387	8.52	-1.425	7.64
M_4	-2.036	14.41	-2.004	12.33
M_5	-2.216	13.92	-2.225	11.82
M_6	-2.181	13.36	-2.165	11.23
M_7	-1.832	11.91	-1.786	10.22
M_8	-1.649	11.38	-1.631	9.81
M_9	-0.734	4.92	-0.637	3.80
M_{10}	-0.147	1.03	-0.147	0.92
M_{11}	0.068	0.45	-0.052	0.31
Year effects				
Y_{85}	-2.260	3.07	-2.362	2.64
Y_{86}	-0.584	1.02	-0.554	0.78
Y_{87}	-0.555	1.21	-0.553	1.00
Y_{88}	2.258	4.16	2.202	3.37
Y_{89}	2.117	3.24	1.973	2.54
Y_{90}	-0.555	1.02	-0.431	0.66
Y_{91}	-1.169	2.20	-1.022	1.60
Y_{92}	-1.741	3.74	-1.548	2.81
Y_{93}	-1.020	3.96	-0.768	2.45
Y_{94}	0.154	1.14	0.357	2.58

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