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Spatial Competition of Milk Processing Cooperatives in Northern Germany

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Spatial Competition of Milk Processing Cooperatives in Northern Germany[1]

Abstract:

In this paper we develop a theoretical model of competition among marketing cooperatives (co-ops) in a spatial market setting assuming uniform delivered pricing and Löschian conduct. The model is an extension to Alvarez et al.'s (2000) spatial competition model for investor-owned firms (IOF). Theoretical results include i) that the prices for raw milk are, ceteris paribus, higher in a pure market of coops than in a pure IOF market; ii) that even coops may imperfectly transmit price changes upstream; and iii) that the price farmers receive for their raw product is a function of economic space (distance times transportation costs) between coops. We test our theoretical findings for milk processing co-ops in Northern Germany using data of monthly average farm-gate prices for raw milk between 1999 and 2003 and estimating a reduced form regression model. Empirical results confirm our theoretical findings to a great extent.

Keywords: spatial competition, ologopsony, milk processing, cooperatives
JEL: L13, Q13

1 Introduction

Today, farmers face a high concentration in the food processing sector. For example according to Cotterill (1999), in 1997 the three-firm concentration ration (CR3) as an average of 20 different food products for 11 EU countries ranged from 89% in Ireland to 55% in Germany. This concentration might imply market power of processors torwards input suppliers and, consequently, lower prices and profits for farmers as well as deadweight losses for society. In addition, the selling of most agricultural raw products is limited to a relatively small geographic area due to its bulkiness and perishableness (and therefore relatively high transportation costs). Nevertheless, so far most research has focused on the market power of the food industry as a seller rather than as a buyer, and only a few papers are dealing with the spatial dimension of this problem (Sexton and Lavoie, 2001). An exception is Alvarez et al. (2000): They provide a theoretical model of spatial competition of IOFs under uniform delivered (UD) pricing and Löschian competition. An important result of their duopsony model is that processors may set prices above the monopsony level to decrease competition among themselves.

[1] The authors are in debt to the "Zentrale Markt- und Preisberichtstelle für Erzeugnisse der Land-, Forst- und Ernährungswirtschaft GmbH", and in particular Reinhard Schoch, for providing access to data and knowledge.

One strategy for farmers to evade market power from downstream processors is to forward integrate and form a co-op. COGECA (2000) reports a market share of 60% of co-ops for all agricultural products and more than 80% (90%) in milk processing in 9 (5) of the 15 EU member countries. Given the importance of co-ops in milk processing we adopt the theoretical duopsony model of Alavarez et al. (2000) for a situation of spatial competition among co-ops and, additionally, provide empirical evidence of spatial competition in Schleswig-Holstein.

The remainder of this paper is organized as follows: The next section develops a theoretical spatial monopsony and duopsony model of co-ops. The empirical model in section 3 uses panel data regression methods and a reduced form model to empirically test our theoretical results. We finnish by discussing our results in section 4.

2 Model

Alvarez et al. (2000) develop a theoretical model of investor owned firms (IOF) with buyer monopsony/oligopsony power in a spatial market setting under uniform delivered (UD) pricing. These IOFs are (milk) processors buying an input (raw milk) from a homogenous group of input producers (farmers). Under UD pricing processors pay an identical price to each producer and bear the costs for shipping the input from the producer to the processing plant. Under the assumption of Löschian competition each processor presumes that its rival will identically react to any proposed price change. For the model presented here this assumption is rationalized by the observation of overlapping markets in the procurement of milk in Germany, which is in line with the Lösch conjecture but not with the alternative Hotelling-Smities conjecture.

Alvarez et al.'s (2000) theoretical model for a monopsonistic IOF is illustrated in figure 1a (see appendix). Processor A is located on a linear, unbounded line with $\rho = p - c$ being the selling price p for the processed product net of constant per-unit processing cost c. A continuum of homogenous farmers is distributed along the line with a density of $D = 1$. The processor offers producers a farm-gate price u and bears shipping costs t, which are assumed to be linear in distance and quantity. Hence, tr are the costs of transporting one unit of the raw product r miles.

Given ρ, t and for the moment also u, the processor will collect milk up to the point where marginal cost $(tr + u)$ equal marginal revenues ρ, (all exclusive of processing cost). Hence, the profit maximizing radius R within which the processor collects milk is given by

$$R = \frac{\rho - u}{t} \tag{1}$$

Processor A's profits can be easily illustrated by means of figure 1a: The distance between the bottom line and the V-lines gives the costs of buying and transporting one unit of raw milk from different distances with firm A's profits being the triangle *abc*. Multiplying this triangle by the supply per farm q gives the monopsonist's profits:

$$\Pi_{IOF} = 2\left[\int_0^R (\rho - u - tr)\mathrm{d}r\right]q = 2R\left(\rho - u - \frac{1}{2}tR\right)q \tag{2}$$

Since $(tR)/2$ are average transportation cost per unit of raw milk, $(\rho - u - (tR)/2)$ represents the average profit margin. Multiplying this with $2R$ one derives the processor's profits from collecting one unit from each farmer, multiplying this by q gives total profits.

Alvarez et al. (2000) assume a simple unity supply function

$$q = u. \tag{3}$$

Although we follow this assumption here, Huck and Salhofer (2005) show that the qualitative results of Alvarez et al. (2000) also hold for a log-linear supply function $q = \alpha u^{\beta}$, as long as $\beta > 0$.

The IOF chooses the profit-maximizing farm-gate price:

$$u^*_{IOF} = \frac{\rho}{3} \tag{4}$$

Substituting equation (4) into (1) gives the optimal radius R^*_{IOF} subject to u^*_{IOF}:

$$R^*_{IOF} = \frac{2\rho}{3t} \tag{5}$$

In contrast to Alvarez et al. (2000) we assume here that firm A is an open membership co-op with the supplying farmers being the members and owners. The literature considers several objectives of a co-op (Cotterill, 1987). Most common, maximization of member welfare is assumed, which implies the joint maximization of member profits and earnings of the co-op, i.e. perfect forward integration of farmers. Let a single farmer's profit be defined by

$$\pi_f = uq - C(q) \tag{6}$$

with *C(q)* being total production cost. The first-order condition for profit maximization is given by

$$u = \frac{\partial C(q)}{\partial q} \tag{7}$$

Substituting equation (3) into (7) and taking integrals we derive a single farmers cost function (*C(q)*), which is (given the unity supply function) of a quadratic form:

$$C(q) = \frac{1}{2}q^2 + k \tag{8}$$

k is an integration constant or fixed cost, which we assume to be zero for simplicity. Farmers' profit margin for each quantity of raw milk supplied is

$$\frac{\pi_f}{q} = \frac{1}{2}u \tag{9}$$

Profits from milk supply of all farmers of a co-op are given by

$$\Pi_f = u^2 R \tag{10}$$

Since profits from milk processing in the co-op follow the same rules as for the IOF, the welfare (profit) of all co-op members $\Pi_{co\text{-}op}$ is given by

$$\Pi_{co-op} = \Pi_{IOF} + \Pi_f = 2R\left(\rho - \frac{1}{2}u - \frac{1}{2}tR\right)q \text{ with } R = \frac{\rho - \frac{1}{2}u}{t}. \tag{11}$$

Optimal farm-gate price of the co-op is double the price of the IOF

$$u^*_{co-op} = \frac{2}{3}\rho = 2u^*_{IOF} \tag{12}$$

However, the optimal radius, given u^*_{co-op}, is the same:

$$R^*_{co-op} = \frac{2\rho}{3t} = R^*_{IOF} \tag{13}$$

The differences between the IOF and the co-op are illustrated in figure 1a: Compared to the IOF the farm-gate price paid by the co-op is twice as high. The co-op collects milk as long as marginal revenues from both, milk production and processing, are equal to marginal cost: $\rho + u/2 = tr + u$. Hence, the co-op's profits from collecting and processing one unit of raw milk from each farmer are $def - ceg - bfh = 0$, with the sum of profits of all members from producing milk being *abhdgc*. Total profits are *abc* and therefore equal to the IOF. However, the quantity supplied by each farmer is twice as much compared to the IOF and therefore total profits as well.

So far, we have discussed the situation for $d \geq 2R$, i.e. where the distance to the nearest competitor d is at least twice as large as the optimal radius and, hence, there is no market overlap. Alternatively, we can describe this situation by $s/\rho \geq 4/3$, where s/ρ measures the absolute importance of space relative to the net value of the product for $s = td$ (see Alvarez et al., 2000, p.351). Like Alvarez et al. (2000) for the case of competing IOFs we can identify two additional situations of competition: ii) competition en route with overlapping market areas between both firms: $d/2 < R < d$ or $4/7 < s/\rho < 4/3$ (figure 1b); and ii) competition in the backyard with overlapping market areas beyond the firms' location: $d \leq R$ or $0 < s/\rho < 4/7$ (figure 1c).

In the case of competition en route profits for the co-op (Π^{er}_{co-op}) are given by

$$\begin{aligned}\Pi^{er}_{co-op} &= \left[\int_0^R \left(\rho - \frac{1}{2}u - tr\right)\mathrm{d}r + \int_0^{d-R}\left(\rho - \frac{1}{2}u - tr\right)\mathrm{d}r + \frac{1}{2}\int_{d-R}^{R}\left(\rho - \frac{1}{2}u - tr\right)\mathrm{d}r\right]q \\ &= \left[\left(\rho - \frac{1}{2}u - \frac{1}{2}tR\right)R + \left(\rho - \frac{1}{2}u - \frac{1}{2}t(d-R)\right)(d-R)\right]q + \\ &\quad \left[+\frac{1}{2}\left(\rho - \frac{1}{2}u - \frac{1}{2}td\right)(2R-d)\right]q\end{aligned} \tag{14}$$

Equation (14) includes three segments: The first term gives the profits to the left (right) of firm A's (B's) location, the second term gives the profits to the right (left) of firm A (B) in the area without market overlap, and the last term gives the profits for the overlapping market area. Here, we assume that input supplying farmers are shared equally in the area of market overlap. Therefore, graphically profits of co-op A are the dark shaded area plus half of the light shaded area in figure 1b. In the case of competition in the backyard (figure 1c) profits (Π_{co-op}^{by}) are given by

$$\begin{aligned}\Pi_{co-op}^{by} &= \left[\int_{R-d}^{R}\left(\rho-\frac{1}{2}u-tr\right)\mathrm{d}r+\frac{1}{2}\int_{0}^{R-d}\left(\rho-\frac{1}{2}u-tr\right)\mathrm{d}r+\frac{1}{2}\int_{0}^{R}\left(\rho-\frac{1}{2}u-tr\right)\mathrm{d}r\right]q \\ &= \left[\left(\rho-\frac{1}{2}u-\frac{1}{2}t(2R-d)\right)d+\frac{1}{2}\left(\rho-\frac{1}{2}u-\frac{1}{2}t(R-d)\right)(R-d)\right]q+ \\ &\quad \left[+\frac{1}{2}\left(\rho-\frac{1}{2}u-\frac{1}{2}tR\right)R\right]q\end{aligned} \tag{15}$$

Graphically, profits of firm A are, again, the dark shaded area plus half of the light shaded area in figure 1c. Substituting equations (3) and (11) into equations (14) and (15) we can derive first-order conditions for profit maximization and optimal UD prices for competition en-route ($u_{co-op,er}^{*}$) and competition in the backyard ($u_{co-op,by}^{*}$):

$$u_{co-op,er}^{*}=\rho-\frac{s}{4} \tag{16}$$

$$u_{co-op,by}^{*}=\frac{4\rho-\sqrt{4\rho^{2}-6s^{2}}}{3} \tag{17}$$

Again, in both cases, the optimal farm-gate price of the co-op is double the price of the IOF with the optimal radius being the same for both models in each situation:

$$R_{co-op,er}^{*}=\frac{4\rho+s}{8t}=R_{IOF,er}^{*} \tag{18}$$

$$R_{co-op,by}^{*}=\frac{2\rho+\sqrt{4\rho^{2}-6s^{2}}}{6t}=R_{IOF,by}^{*} \tag{19}$$

Table 1 compares the comparative statics of the model of Alvarez et al. (2000) for IOFs and our model for a co-op: Price transmission is always higher in co-op markets. While price transmission is always imperfect for an IOF, it is perfect for the co-op in the case of competition en route. Interestingly, price transmission is lowest not in the monopsony case (2/3), but in the case of competition in the backyard (between 2/3 and 2/5).

As described in Alvarez et al. (2000) the effect of a change in s (either due to a change in t or d) depends on the relative importance of space. If space is relatively important ($4/7 < s/\rho < 4/3$) and there is competition en route the farm gate price is decreasing in s. Higher transportation costs reduce the market area and competition. However, if space is relatively less important ($0 < s/\rho < 4/7$) and there is also competition in the backyard the UD price is increasing in s. This result is driven by the Löschian conjecture: The outcome of firms, which are close to each other and assume price matching behavior, is collusion. In the extreme case of two firms located on the same spot, their optimal policy would be to price like a monopsonist and share the rents. This is illustrated for $\rho = 1$ in figure 2.

Table 2 represents the comparative statics of R^* with respect to ρ, t, and d. Since the optimal radius is the same for a co-op and an IOF, comparative statics are the same for our model and for Alvarez et al. (2000)[2]: The radius is increasing in processor's selling price and decreasing in shipping costs. The optimal market radius is increasing in d in the case of competition en route but decreasing in d in the case of competition in the backyard.

3 Data and Empirical Model

In our empirical model we concentrate on the very northern part of Germany (Schleswig-Holstein) using panel data of 22 processors as complied by ZMP (2003) and consisting of data on average monthly prices paid to farmers and quantities collected from 1999 to 2003. In addition, it includes information on the type of business ownership (IOF, co-op) and location. In 2000, about 2.045

[2] However, Alvarez et al. (2000) do not provide these comparative statics.

million tons (t) of milk was shipped to processors in Schleswig-Holstein, whereas the 22 firms in the dataset account for 76%. Two firms processed more than 300,000 t a year on average from 1999 to 2003 with all other firms processing less than 125,000 t. Only two firms in the sample are IOFs, which process about 5% of the milk in the region. Unfortunately, we do not have price data for one of the biggest processors. However, knowing its quantity processed, we included it in calculating the distances between as well as the number of competitors. Including this processor we account for 96% of processed milk. Our panel is unbalanced and consists of 1.214 observations.

To empirically test for the influence of the distance between processors on the farm-gate price for raw milk, we follow Alvarez et al. (2000) and estimate the following reduced form model:

$$U_{i,j,k} = \alpha_i + \lambda_j + \gamma_k + \beta_1 S_{i,j,k} + \beta_2 S^2_{i,j,k} + \beta_3 P_{j,k} + \beta_4 P_{t-1} + \beta_4 N_{i,j,k} + e_{i,j,k} \qquad (20)$$

In explaining the price per liter paid to farmers $U_{i,j,k}$ by each firm i in each month j, in each year k we use three sets of dummies, where α_i accounts for firm level fixed effects, λ_j for monthly differences (j = 1,…,11) and γ_k for yearly differences (k = 1,…,4). $S_{i,j,k} = D_{i,j,k}F_{j,k}$ is the empirical counterpart of $s = td$ and is calculated in the following way: $D_{i,j,k}$ is constructed as the sum of distances from firm i to its nearest rivals such that the combined volume of the rivals equaled at least the volume of firm i. To approximate shipping costs t we multiplied the price per liter of diesel fuel by the average usage of diesel by dairy trucks ($F_{j,k}$). Since price changes with s as depicted in figure 2, β_1 is expected to be positive while β_2 is expected to be negative. $P_{j,k}$, is the empirical counterpart of p. As we lack data on wholesale prices received by processors, $P_{j,k}$, represents the national average price per litre for bottled milk. Additionally, $P_{j,k}$ was lagged one period (P_{t-1} for t = k_J). All prices are deflated by the consumer price index (2000 = 100). Similar to Alvarez et al. (2000) we include $N_{i,j,k}$, the number of rivals whose combined volume equals at least the volume of firm i. Table 3 gives a summary statistics of the variables.

In testing for heteroskedasticity and serial correlation we refer to Gujarati (2003) that under the coexistence of (cross-sectional) heteroskedasticity and (serial) autocorrelation the latter can only be detected after heteroskedasticity was controlled for. The Breusch-Pagan test based on the null

hypothesis of no heteroskedasticity is clearly rejected at the 1% level (Table 4). Using Weighted Least Squares, we estimate the first-order autoregressive coefficient. The Wald-test based on the null hypothesis of no autocorrelation is rejected at the 1% level. According to a Wald test the null hypothesis of no joint explanatory power is rejected at the 1% level.

Given the existence of heteroskedasticity and autocorrelation we adopt a cross-sectionally heteroskedastic and timewise autoregressive model (Kmenta (1986)), characterized by $E\left(e_{i,t}^2\right)=\sigma_i^2$, $E\left(e_{i,t}e_{l,t}\right)=0$ for $i \neq l$ and $t=k_J$ with $k=1,...,K$ and $j=1,...,J$; for $u_{i,t} \sim N\left(0, \sigma_{u_i}^2\right)$;

$e_{i,t} \sim N\left(0, \dfrac{\sigma_{u_i}^2}{1-\rho_i^2}\right)$, and $E\left(e_{i,t-1}u_{l,t}\right)=0$ for all i, l.

The final model controls for cross-sectional heteroskedasticity using cross-section GLS weights and accounts for autocorrelation using an AR(1) term in the equation.

The results are given in table 5. All coefficients are significant at the 1% level and the coefficients of *S*, S^2, *P* and *P(-1)* have the expected signs, which supports the theoretically predicted U-shaped influence of the absolute importance of space *S* on the farm-gate price *U*. The influence of the retailing price *P* is much lower than expected. A combined value of 0.30 (current observations and observation lagged one period) implies a quite imperfect price transmission between the price of the processed good and the price for raw milk. However, this low value seems to be additional evidence for competition in the backyard. The negative influence of the number of competitors *N* is contrary to Alvarez et al. (2000) but obviously in line with Lösch competition.

4 Conclusions

We develop a model of co-ops competing in economic space for farmers as members and input providers in a market under UD pricing and Löschian conjecture. Farm-gate prices and profits from farming are ceteris paribus higher in markets of co-ops. However, this is at the expense of profits from processing and dynamically implies the problem of accumulating shareholders' capital in co-ops. For example, Gabler (2003) in an analysis of Bavarian co-ops concludes that the preference of

farmers as co-op members for high prices is still the biggest problem in accumulating own capital, resulting in a lack of capital for investments in product innovation or marketing. This might explain why in reality we observe a higher average raw milk price in the IOF dominated former Eastern Germany (29.6 Cent on average between 1999 and 2003) or in an area of a mixed market like Bavaria (30.7 Cent) compared to the co-op dominated Schleswig-Holstein (29.1 Cent) (ZMP, 2004).

Like Alvarez et al. (2000) we derive three different situations with respect to the distance between firms: i.) spatial monopsony, ii) competition en route: overlapping of market areas between the two firms, iii) competition in backyard: overlapping beyond the firms' location. In line with Alvarez et al. (2000), the farm-gate price increases with increasing economic space (distance times transportation cost) between competitors in a situation of competition in the backyard. Two close rivals will decrease the price to shrink their market areas and by that decrease competition. More loosely formulated, as firms get close to each other they become more collusive. Obviously, this result is driven by our assumption of Löschian competition, which is supported by two facts: i) the observation of overlapping markets and ii) the common procedure of processors in Germany to derive the raw milk price as an average of the prices of selected surrounding competitors.

Our theoretical findings with respect to the influence of economic space between processors are empirically supported for Schleswig-Holstein in northern Germany, where 95% of the milk is collected by co-ops. Our estimates support the theoretically predicted parabolic influence of economic space between processors on the farm-gate price. Interestingly, all of our 22 firms are estimated to be in the situation of competition in the backyard and, therefore, a further concentration would increase the farm-gate price. For this reason and also because of expected economies of scale, a further and faster concentration of the dairy industry in Germany can be recommended.

As derived from our theoretical model price transmission is always higher in a market of co-ops. However, only competition en route will lead to perfect price transmission, while the lowest pass-through is observed under competition in the backyard. Empirically, we estimate a price transmission of 30%. This is much lower than the 60% derived by Alvarez et al. (2000) for Asturias

and also lower than the minimum of 40% predicted by our theoretically model. Although the absolute value is somehow puzzling, the fact that it is low additionally supports the finding of competition in the backyard.

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ZMP - Zentrale Markt- und Preisberichtsstelle, 2004. Marktbilanz Milch 2004, Bonn.

Appendix: Figures and Tables

Figure 1a: Monopsony model of an IOF and a co-op

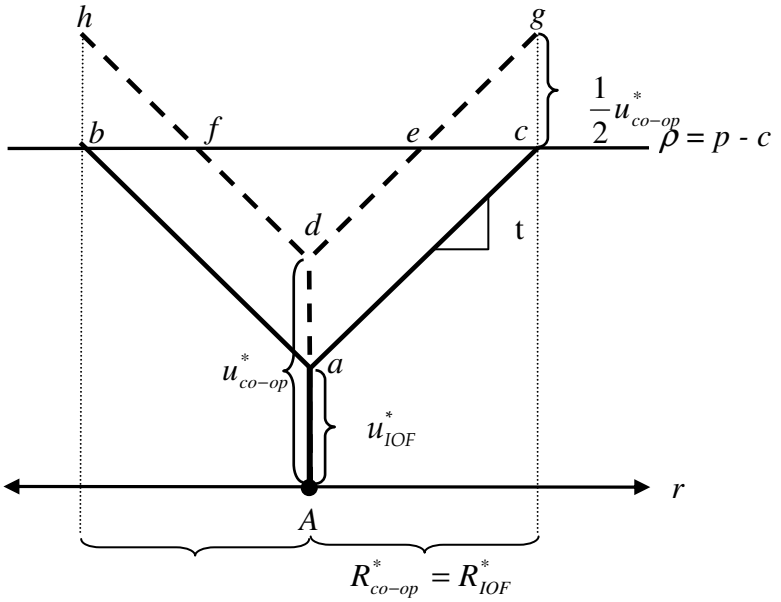

Figure 1b: Competition en route

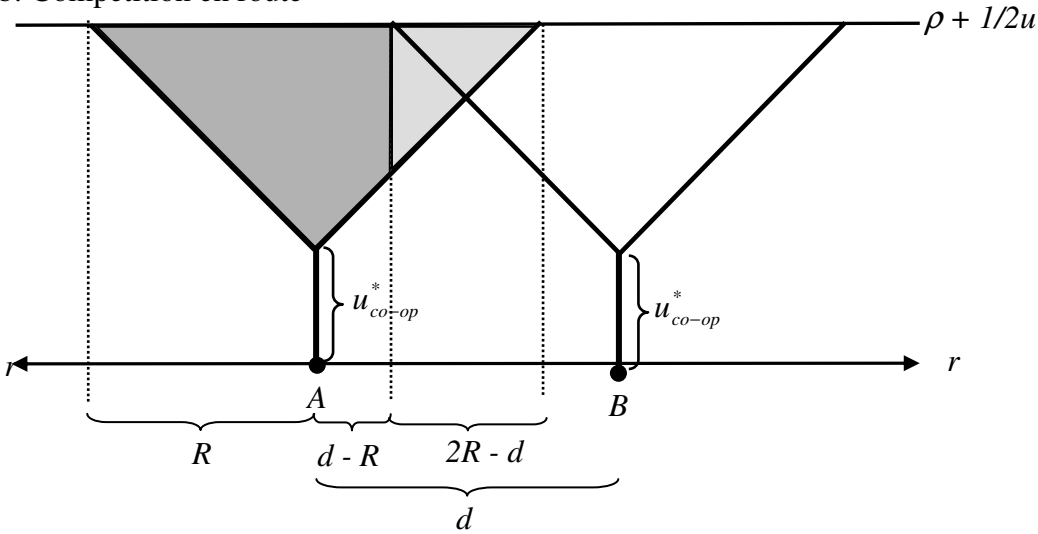

Figure 1c: Competition in the backyard

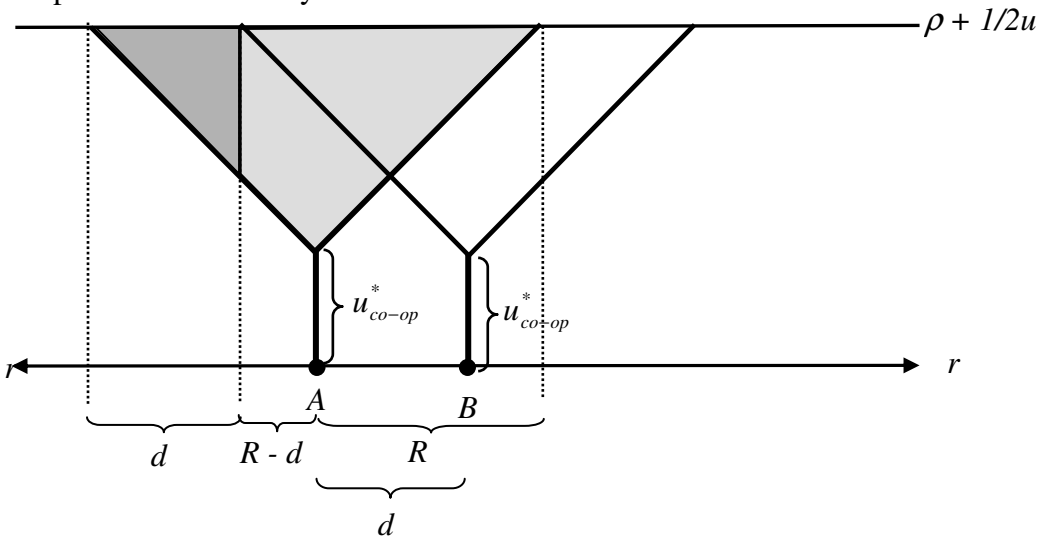

Figure 2: Optimal uniform price for co-ops and IOFs under Löschian competition

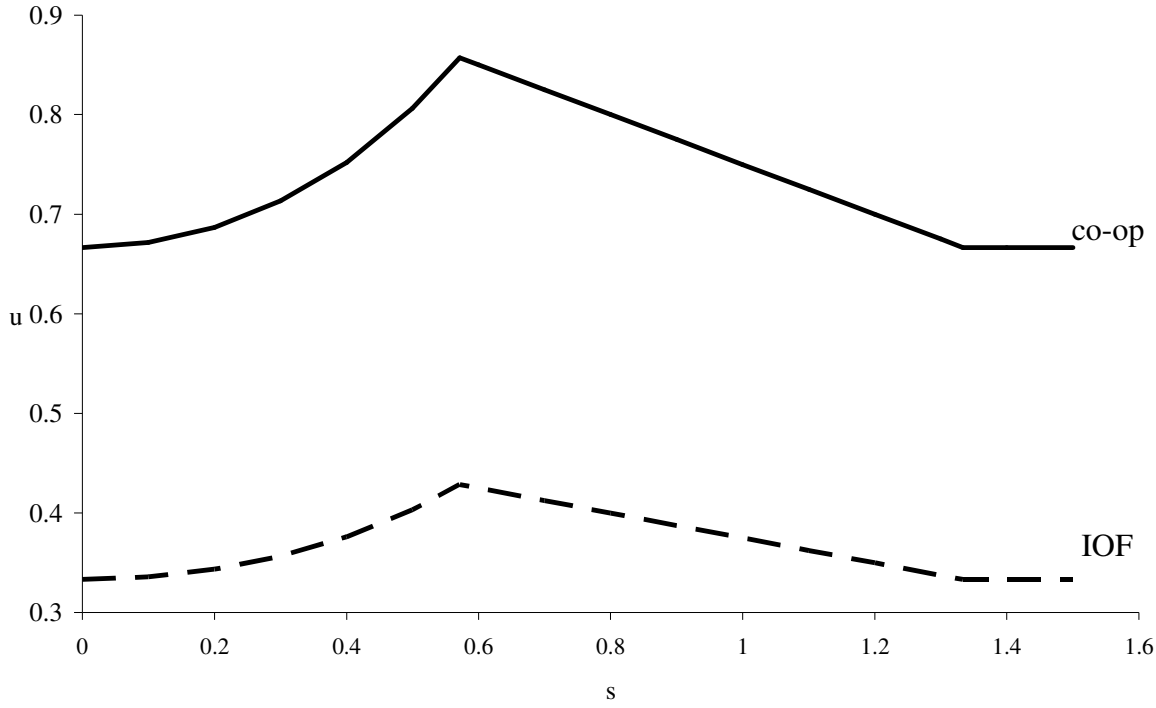

Table 1: Comperative statics concerning the response of u^* to changes in ρ and s.

co-op	IOF (Alvarez et al. 2000)
Monopsony: for $\frac{s}{\rho} \geq \frac{4}{3}$	
$\frac{\partial u^*}{\partial \rho} = \frac{2}{3} > 0$	$\frac{\partial u^*}{\partial \rho} = \frac{1}{3} > 0$
Competition en route: for $\frac{4}{7} < \frac{s}{\rho} < \frac{4}{3}$	
$\frac{\partial u^*}{\partial \rho} = 1 > 0$	$\frac{\partial u^*}{\partial \rho} = \frac{1}{2} > 0$
$\frac{\partial u^*}{\partial s} = -\frac{1}{4} < 0$	$\frac{\partial u^*}{\partial s} = -\frac{1}{8} < 0$
Competition in the backyard: for $0 < \frac{s}{\rho} \leq \frac{4}{7}$	
$\frac{\partial u^*}{\partial \rho} = \frac{4}{3}\left[1 - \frac{\rho}{\sqrt{4\rho^2 - 6s^2}}\right]$	$\frac{\partial u^*}{\partial \rho} = \frac{2}{3}\left[1 - \frac{\rho}{\sqrt{4\rho^2 - 6s^2}}\right] > 0$
$\frac{\partial u^*}{\partial s} = \frac{2s}{\sqrt{4\rho^2 - 6s^2}} > 0$	$\frac{\partial u^*}{\partial s} = \frac{s}{\sqrt{4\rho^2 - 6s^2}} > 0$

Table 2: Comparative statics concerning the response of R^* to changes in ρ, t, and d.

	$\frac{\partial R^*}{\partial \rho}$	$\frac{\partial R^*}{\partial t}$	$\frac{\partial R^*}{\partial d}$
Monopsony	$\frac{2}{3t} > 0$	$-\frac{2\rho}{3t^2} < 0$	
Competition en route	$\frac{1}{2t} > 0$	$-\frac{\rho}{2t^2} < 0$	$\frac{1}{8} > 0$
Competition in the backyard	$\frac{1}{3t}\left[1+\frac{2\rho}{\sqrt{4\rho^2-6t^2d^2}}\right] > 0$	$-\frac{\rho}{3t^2}\left[1+\frac{2\rho}{\sqrt{4\rho^2-6t^2d^2}}\right] < 0$	$-\frac{td}{\sqrt{4\rho^2-6t^2d^2}} < 0$

Table 3: Descriptive statistics

Variable	Mean	SD	Maximum	Minimum
Farm gate price U in cent/kg	30.15	3.32	39.08	21.77
Price for processed milk P in cent/kg	46.47	2.61	51.98	43.10
Number of competitors N	1.86	1.51	10.00	1.00
Distance D in km	51.67	86.69	619.00	5.00
Shipping costs F in €/100km	23.41	2.44	27.88	16.90

Table 4: Tests on heteroscedasticity, autocorrelation, and significance of fixed effects

Test	H0	F-stat	P-Value
Breusch-Pagan test	no heteroscedasticity	F(20, 1193) = 2.95	0.00
Wald test	no autocorrelation	F(1, 1191) = 634.12	0.00
Wald test	$\alpha_1 = \alpha_2 = ... = \alpha_{22}$	F(21, 1149) = 2.93	0.00
Wald test	$\lambda_1 = \lambda_2 = ... = \lambda_{11} = 0$	F(11, 1149) = 281.53	0.00
Wald test	$\gamma_1 = \gamma_2 = ... = \gamma_4 = 0$	F(4, 1149) = 49.48	0.00

Table 5: Regression results

variable	coefficient	t-statistic
C	15,371	8,827
S	0,248	3,942
S^2	-0,001	-3,651
P	0,193	6,816
P(-1)	0,102	3,697
N	-2,099	-4,490
λ_1	-1,357	-8,584
λ_2	-1,817	-10,898
λ_3	-2,491	-15,214
λ_4	-2,796	-17,443
λ_5	-2,750	-17,449
λ_6	-2,083	-13,636
λ_7	-1,013	-6,893
λ_8	0,688	5,015
λ_9	2,039	16,299
λ_{10}	3,304	30,772
λ_{11}	3,455	43,440
γ_{99}	5,156	8,820
γ_{00}	4,979	11,628
γ_{01}	3,203	10,178
γ_{02}	1,033	4,708
AR(1)	0,874	53,021
Adj. R^2	0.984 (weighted)	