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Do Cooperatives Offer High Quality Products?

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Do Cooperatives Offer High Quality Products?

Vertical Product Differentiation in a Mixed Oligopoly

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Abstract:

The present paper investigates the free-riding problem in determining product quality within cooperatives in a vertically related market. Whereas the individual member has to bear all costs associated with higher quality, the benefits of delivering higher quality have to be shared among all members. On the basis of a Mixed-Oligopoly model, we show that the free-rider problem in the supply of high-quality products, although important for the members of the cooperative, may not be strong enough to ensure that firms will always supply higher quality than cooperatives. Whether the cooperative can overcome the free-riding problem and supply a final product of high quality is shown to depend on the consumer's valuation of quality, the costs of producing high quality, the way in which the quality of the final product is determined from the quality levels of the inputs delivered as well as on the number of members of the cooperative.

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1. Introduction

Cooperatives and investor-owned firms are alternative forms of business organisation that coexist and compete in many markets. The theoretical literature has identified a number of comparative advantages and disadvantages of cooperatives (Fulton, 1995; Albaek and Schultz, 1998; Karantininis and Zago, 2001; Bogetoft, 2005). A classical problem of traditional cooperatives is the quantity control problem, which arises from the decentralised decision making of the members of a cooperative (Phillips, 1953). Each member (farmer) decides how much to deliver to the cooperative and the cooperative thus has no control over what is actually supplied to the market. Although an individual farmer realizes that an increase in production reduces the price in the final market, he does not internalize the profit loss stemming from the price decrease incurred by the other members of the cooperative (free-riding).[1]

Decentralized decision making within a cooperative also leads to quality control problems, which could be considered even more detrimental to the prosperity of cooperatives since, in contrast to quantities, the quality delivered by individual members very often is difficult to observe and might be non-contractible between independent actors. The problem of free-riding on product quality with decentralized decision making is a well-recognized problem in the literature on cooperatives (see, among others, Cook 1995, Fulton 1995 and Winfree and McCluskey, 2005) and is nicely illustrated in Babcock and Weninger's (2004) case study of

[1] Albaek and Schultz (1998) investigate the consequences of this behaviour in a market, where the cooperative competes with an investor owned firm (mixed duopoly). The authors find that due to the decentralisation of output decisions, cooperatives tend to overproduce. Interestingly, this negative externality turns out to be a comparative advantage of cooperatives in Cournot competition. Overproduction in the cooperative serves as a commitment device for credibly and profitably gaining market shares: '… the results of this paper suggest that in the long run all farmers would be members of the cooperative' (Albaek and Schlutz, p. 401).

the Alaskan Salmon Industry: "... suppose two fishermen deliver to a single processor. The fishermen know that part of the investment in quality that increases price will end up in the pocket of the other fisherman. The two fishermen get roughly a half-share of the benefit of quality-control efforts, yet both bear the full cost of those efforts" (p.14). Similar observations have been made for cooperatives in wine production in Germany (Frick, 2004; Dilger, 2005).

The present paper investigates this free-riding problem in determining quantity and quality within cooperatives in a vertically related market. Upstream firms (farmers) deliver inputs to the downstream market, where the cooperative and an investor owned firm (mixed duopoly) use the components delivered to produce a composite good which is then sold to consumers. Whether the cooperative can overcome the free-riding problem and supply a final product of high quality is shown to depend on the consumer's valuation of quality, the costs of producing high quality, the way in which the quality of the final product is determined from the quality levels of the inputs delivered as well as on the number of members of the cooperative.

In the next section (section 2) we set up the model. Section 3 investigates the quality decision of the profit maximizing firm and the cooperative, when the number of members of the cooperatives and the number of primary producers delivering to the firm is exogenous (closed-membership). In section 4 the primary producers are allowed to choose between being a member of the cooperative and delivering to the firm (open-membership). Section 5 concludes.

2. The Model

We follow Albaek and Schultz (1998) as well as Karantininis and Zago (2001) and consider a situation where there are two manufacturers and n farmers who sell through one or the other. We call one manufacturer the cooperative (C) and the other the investor owned firm, for short the firm (F). The cooperative and the firm compete in the market in a Cournot fashion. From the n farmers, n_C deliver to the cooperative and n_F to the firm ($n = n_F + n_C$). The

manufacturers use the components delivered from the farmers and produce a composite good which is then sold to consumers. Depending on the quality level of the components delivered, each manufacturer's product is associated with a number $s^g > 0$, $g \in \{H, L\}$ which represents its quality level (with $s^H > s^L$). To determine the quality of the final (manufacturer's) product, three different cases can be distinguished: (a) one could follow Economides (1999) and assume that the quality of the manufacturers' composite good is the minimum of the quality levels of its components (the inputs delivered by the individual farmers). (b) Alternatively, the quality of the final product could be determined as the (weighted) average of the quality of inputs delivered by farmers. This might be plausible in the case of wine production for example, where the quality of the wine crucially depends on the quality of the grapes delivered. And finally (c), one could take the other extreme and assume that the quality of the final product is determined by the highest quality of the inputs delivered. We consider the last assumption to be rather unrealistic and will not consider this case further here. In the following, we will first discuss the implications of assumption (a). The consequences when assuming (b) will be discussed later.

We assume that manufacturers have constant marginal costs which are normalized to zero. Farmers, on the other hand, have positive production costs. Producing high quality inputs is assumed more costly then producing low quality inputs: $c(q) = \frac{1}{2}cq^2 + f^g$ with $f^H > f^L$. To simplify notation, we normalize $f^L = 0$ and $f^H = f \geq 0$. For a given product quality, all farmers have the same production technology.[2]

Each farmer can choose between delivering to the cooperative or to the firm. If the farmer chooses to deliver to the cooperative, he has to decide whether to produce high or low quality

[2] Note that different assumptions concerning the cost of quality have been made in the literature on endogenous quality choice so far. Here, we do not consider the cost of quality as a variable cost component. A detailed discussion on this issue is available in Hoffmann (2005). An interesting extension would also be to consider heterogenous farmers to investigate, which type of farmer delivers to the cooperative and the firm respectively. Karantinides and Zago (2001) investigate this issue in more detail.

and what quantity (q) to produce and deliver. The cooperative uses the inputs received and produces the final good which is then sold to consumers. The cooperative thus operates with an 'individualistic' decision-making process, where each member decides how much and which quality to deliver, whereas the cooperative has no control over what is actually supplied to the market. The cooperative also retains no profit. The unit price paid to the farmer either is p^H, if the product is of higher quality than the competing firms' product, or p^L, in the case where the cooperative offers the product with the lower quality. Depending on the prices received, an individual members' profit is $p_C^g = p^g q_C - \frac{1}{2} c q_C^2 - f^g$.

The situation of farmers, who choose to deliver to the firm, is different. Following Albaek and Schultz (1998), we assume that the firm has a (perfect) contract with the farmers. Hence its behaviour can be described as if the firm maximises the vertically integrated profit of itself and its suppliers (farmers). In fact, the firm makes all the relevant decisions (how much to sell to the market and what level of quality to choose). As the distribution of profits is not essential here, we follow Albaek and Schultz (1998) in assuming that the vertically integrated profit is distributed among all farmers delivering to the firm.[3] Depending on whether the firm supplies high or low quality, its problem is to maximize $\Pi_F^g = p^g Q_F - n_F \frac{1}{2} c(\frac{Q_F}{n_F})^2 - n_F f^g$.

Each individual farmer receives $p_F^g = \frac{\Pi_F^g}{n_F}$.

Finally, it remains to describe consumer behaviour. Consumers' preferences are formalized in the spirit of Gabszewicz and Thisse (1979) and Tirole (1988). There is a continuum of

[3] An alternative would be to view the firm as acting in a Cournot duopsony. Given that farmers deliver to the firm are price takers, the firm will pay according to the farmers´ supply function (i.e. aggregate marginal costs). This assumes that the firm can write a perfect contract with its suppliers specifying quantity and quality of the product delivered. Although this version of the model would give very similar results we still prefer to consider the firm as a vertically integrated unit. The reason is that 'contracting leads to contract enforcement costs, which may be lower for cooperative firms than for investor owned firms (IOFs) because cooperative firms potentially have more ways to punish members who fail to live up to their contracts than do IOFs. Not only can a cooperative include the same noncompliance clauses in its contracts as does an IOF, but members who act opportunistically toward their cooperative may face social sanctions from their fellow farmers as well' (Staatz, 1987, p. 97).

consumers distributed uniformly over the interval $[q-1, q]$ with unit density, where $q > 1$. Each consumer either buys high quality, low quality or does not buy at all. The consumer indexed by the parameter $\tilde{q} \in [q-1, q]$ maximizes the following utility function:

$$(1)\quad u_{\tilde{q}} = \begin{cases} \tilde{q} v_i - p_i & \text{if he buys from firm } i \\ 0 & \text{otherwise} \end{cases}$$

All consumers prefer higher quality at a given price, but a consumer with higher $\tilde{q}$ is willing to pay more for higher quality. The parameter q measures the degree of consumer differentiation in evaluating product quality. The inverse demand functions for high and low quality are $p^H = qs^H - s^H Q^H - s^L Q^L$ and $p^L = s^L (q - Q^H - Q^L)$. To simplify notation, we normalize $s^L = 1$, $s^H = s \geq 1$. Note, that if all final products are of the same quality ($s = 1$), the inverse demand function is $p^H = p^L = p = q - Q$.[4] If products differ in quality ($s > 1$), consumers are willing to pay more for the higher quality ($p^H > p^L$).

3. Closed membership equilibrium

To describe the farmers', the cooperative's and the firm's behaviour, we first assume n_F and n_C to be exogenously given. Each farmer has already decided whether to deliver to the firm or to the cooperative (closed membership). Suppose that the final product of the cooperative is of higher quality then the competing firm's product. In this case, the cooperative receives the higher market price p^H and an individual members' profit is $p_C^H = [qs - s(q_C + Q_{C,-i}) - Q_F]q_C - \frac{1}{2}cq_C^2 - f$, where $Q_{C,-i}$ denotes the total output of all other members of the cooperative. If, however, the cooperative's product has lower quality, profits for each member would be $p_C^L = (q - q_C - Q_{C,-i} - Q_F)q_C - \frac{1}{2}cq_C^2$. Finally, in the case

[4] Note that this case exactly corresponds to Albaek and Schultz.

where there are no quality differences between the cooperative and the firm, profits are $p_C^{HH} = [q - (q_C + Q_{C,-i} + Q_F)]sq_C - \frac{1}{2}cq_C^2 - f$ or $p_C^{LL} = [q - (q_C + Q_{C,-i} + Q_F)]q_C - \frac{1}{2}cq_C^2$.[5]

Profit maximisation for the firm gives different results. If the firm supplies the higher quality, the equation to maximise is $\Pi_F^H = [qs - sQ_F - Q_C]Q_F - n_F \frac{1}{2}c(\frac{Q_F}{n_F})^2 - n_F f$. If the firm supplies lower quality instead, she maximizes: $\Pi_F^L = (q - Q_F - Q_C)Q_F - n_F \frac{1}{2}c(\frac{Q_F}{n_F})^2$.

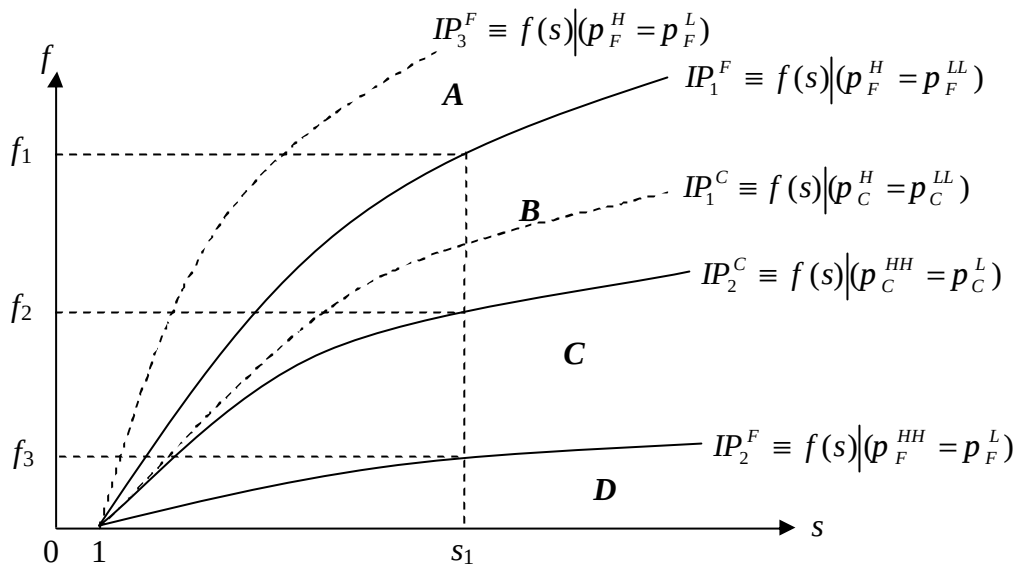
Assuming Cournot behaviour ($\frac{\partial Q_F}{\partial q_C} = \frac{\partial Q_{C,-i}}{\partial q_C} = 0$ and $\frac{\partial Q_C}{\partial Q_F} = 0$), we compute equilibrium profits for the individual members of the cooperative as well as for the farmers supplying the firm for all combinations of quality levels. The results are summarized in Table 1 in an appendix which is available in an extended version of this paper.

The choice of quality levels and the corresponding profits of the members of the cooperative and of the farmers delivering to the firm depend on parameters s and f as well as on the number of firms n_C and n_F. Figure 1 illustrates the farmers' choices for a given number of firms $n_F = n_C = 3$ and for $c = 1$ by means of five 'isoprofit' contours. The following paragraphs illustrate the logic of the individuals' decisions to provide low or high quality as well as the key results. A detailed (formal) analysis is provided in the appendix.

Since $f = 0$ and $s = 1$ implies that there in fact are no quality differences (neither in production costs nor in the consumers' willingness to pay), the isoprofit curves all originate in this point. As the costs of producing a high quality product relative to a low quality product (f) increases, the consumers' willingness to pay for higher quality (s) also has to increases in order to guarantee each farmer the same level of profits (the isoprofit curves slope upwards).

[5] The superscript always denotes whether the organization in question (the firm or the cooperative) produces high or low quality. Two superscripts denote that both the firm and the cooperative produce high (*HH*) or low (*LL*) quality, while one superscript indicates that the quality levels are different.

Figure 1. Isoprofit curves of the firm and the cooperative



Suppose the price increase, which can be realized due to higher quality (measured by s), is $s = s_1$. If the additional costs of producing high quality (f) are large ($f > f_1$), all members of the cooperative as well as the firm will choose to supply low quality (see proposition 1 in the appendix). Area A in Figure 1 represents all combinations of f and s where both, the firm and the cooperative deliver low quality. The profits for the individual farmers will be p_F^{LL} and p_C^{LL}. Note that $p_C^{LL} > p_F^{LL}$ as long as $n_F > 1$, which corresponds to Albaek and Schultz. If there are no quality differences between the firm and the cooperative, the cooperative will be more successful in terms of generating higher profits for its members (see proposition 2 in the appendix).

As f decreases below f_1 (for a given $s = s_1$) the firm and/or the cooperative will switch to higher quality. The following payoff matrix illustrates the decision making process within the cooperative given that the firm produces low quality.

Table 2: Payoff matrix for members of the cooperative if the firm produces low quality

		Member i	
		H	L
All other members	H	$p_C^H \quad p_C^H$	$p_C^{LL-} \quad p_C^{LL}$
	L	$p_C^{LL} \quad p_C^{LL-}$	$p_C^{LL} \quad p_C^{LL}$

Note that the cooperative still produces low quality even if farmer i delivers high quality but all other members of the cooperative produce low quality. Since farmer i has higher production costs, his profits will be smaller $p_C^{LL-} < p_C^{LL}$. Whether the cooperative ends up producing high or low quality depends on the comparison between p_C^H and p_C^{LL}. If $p_C^H < p_C^{LL}$, the dominant strategy for all members is to deliver low quality. If on the other hand $p_C^H > p_C^{LL}$, Table 2 suggests the existence of two Nash equilibria in the decision making within the cooperative. To evaluate whether the firm or the cooperative will first switch to higher quality as f decreases (for a given s), we compare two isoprofit curves. The isoprofit curve $IP_1^F \equiv f(s)\big|(p_F^H = p_F^{LL})$ represents all combinations of f and s for which the firm is indifferent between producing high and low quality ($p_F^H = p_F^{LL}$) given that the cooperative produces low quality. The curve $IP_1^C \equiv f(s)\big|(p_C^H = p_C^{LL})$ is the corresponding isoprofit curve for the cooperative, given that the firm has low quality. The fact that $IP_1^F > IP_1^C$ suggests, that the firm will first switch to high quality as f decreases (see proposition 3 in the appendix). All combinations of f and s, where the firm will supply high and the cooperative will deliver low quality are represented by area B in Figure 1.

As f further decreases (below f_2), the incentives from supplying high quality for each member of the cooperative becomes stronger. Note that the payoff matrix for the individual member of

the cooperative has changed since (for $f < f_1$) the firm now produces high quality. The new payoffs are shown in Table 3.

Table 3: Payoff matrix for members of the cooperative if the firm produces high quality

		Member i	
		H	L
All other members	H	p_C^{HH} p_C^{HH}	p_C^{L-} p_C^{L}
	L	p_C^{L} p_C^{L-}	p_C^{L} p_C^{L}

Note, that there are incentives for free riding within the cooperative. Given that the firm produces high quality (since $f < f_1$), <u>all</u> members of the cooperative would also have to deliver high quality to guarantee a high quality final product for the cooperative. As soon as one member delivers low quality, the final product of the cooperative will be of lower quality than the rival (firm's) product. p_C^{L-} denotes a members' profit if she produces high quality whereas the other members of the cooperative free ride and deliver low quality only. Free riding would save production costs and thus $p_C^{L-} < p_C^{L}$.

Whether the cooperative will produce high quality depends on the comparison between p_C^{L} and p_C^{HH}. If $p_C^{L} > p_C^{HH}$, delivering low quality is the dominant strategy for both members. If however $p_C^{L} < p_C^{HH}$, the payoff matrix again suggests two Nash-equilibria (see proposition 4 in the appendix). In one case, all members of the cooperative deliver low quality. Note that the decision of the cooperative to produce low quality reinforces the decision of the firm to produce high quality (since $f < f_1$). The equilibrium would be characterised by the firm producing high and the cooperative low quality.

In the second case, all members of the cooperative decide to produce high quality. How would the firm respond to the decision of the cooperative to supply high quality? To answer this question, it is helpful to compute an isoprofit contour for the firm under the assumption that

the cooperative supplies high quality. The firm is indifferent between high and low quality if (for any given s) $f = f(s)\big|(p_F^L = p_F^{HH}) \equiv IP_2^F$. For a given $s = s_1$, the firm will always want to produce high quality (even if the cooperative should decide to produce high quality too) if $f < f_3$. Area D in Figure 1 is characterised by combinations of s and f such that the firm always produces high quality whereas the cooperative will produce high or low quality (proposition 5 in the appendix).

In cases where $f_2 < f < f_3$, the firm would supply high quality only if the cooperative should decide to produce low quality. If the Nash-equilibrium in the decision making process within the cooperative has all members delivering high quality products, the firm would prefer to switch to a low quality product instead. To understand this (surprising) result, suppose the firm also decides to produce high quality. If all members of the cooperative produce high quality, the equilibrium will be characterised by a situation where each member of the cooperative earns profits of p_C^{HH} whereas farmers delivering to the firm receive p_F^{HH}. Note that if there are no quality differences between the firm and the cooperative, $p_C^{HH} > p_F^{HH}$ as long as $n_F > 1$ (which corresponds to Albaek and Schultz). Thus, given that the cooperative prefers to produce high quality (for $s = s_1$ and $f_3 < f < f_2$), the firm is better off by saving production costs and producing lower quality. The equilibrium in area C will always be characterized with products of different quality, but the model does not provide a clear prediction of whether the cooperative or the firm will supply the superior or the inferior quality (proposition 4 in the appendix shows that $IP_2^C > IP_2^F$).

Finally, for the reason given above we again have two Nash-equilibria in the area D in figure 1 (for $f < f(s)\big|(p_F^{HH} = p_F^L) \equiv IP_2^F$. Here, the dominant strategy for the firm is to produce high quality whereas the decision making process within the cooperative (see Table 3) has all members either producing high or low quality (proposition 5 in the appendix).

In the specific situation analysed so far, where $n_F = n_C = 3$ and the quality of the manufacturers' composite good is determined by the minimum of the quality levels of its components (the inputs delivered by the individual farmers), we find that no general predictions as to the whether the firm or the cooperative provides higher quality can be derived. The free-rider problem in the supply of high-quality products, although important for the members of the cooperative, is not strong enough to ensure that firms will always supply higher quality than cooperatives.

The extent of the free riding problem however crucially depends on the way in which the quality of the final (manufacturers') product is determined from the inputs of the farmers. In the case considered so far, the free-rider problem is mitigated since a reduction of the quality of inputs delivered by one member immediately leads to a reduction in the quality of the final product. Any costs savings associated with lower quality have to be weighted against the losses from a price reduction. In the alternative scenario, where the quality of the final product is the (weighted) average of the quality of inputs delivered by farmers, the free-riding problem is much larger. In this case, which is described in more detail in the extended version of this paper, we find that the quality of the firms' product will never be below the quality of the cooperatives' product (if $n_F = n_C = 3$).

4. Open-membership equilibrium

The previous section considered the choice of product quality given the number of farms n_F and n_C ($n_F = n_C = 3$). In an open-membership equilibrium, the total number of farmers n is exogenously given but the share of farmers delivering to the cooperative and to the firm is endogenous. As long as both manufacturers choose to deliver the same level of product quality, analyzing an open-membership equilibrium does not provide new insights. In this case, farmers delivering to the cooperative will receive larger profits as long as $n_F > 1$. In the long run, all farmers will become members of the cooperative, which corresponds to Albaek

and Schultz (1998). The open-membership equilibrium however will be different when the firm and the cooperative offer products of different quality, which is shown in Figure 2.

Figure 2. Open-membership equilibrium for different quality levels

Figure 2a

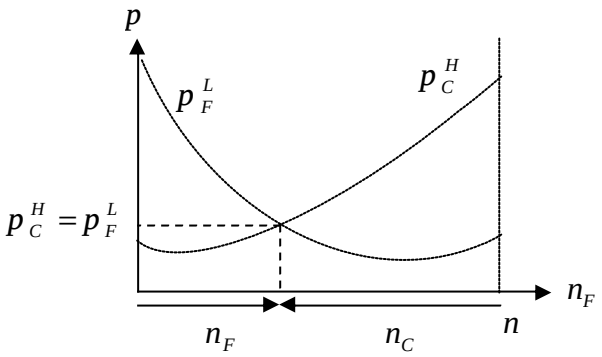


Figure 2b

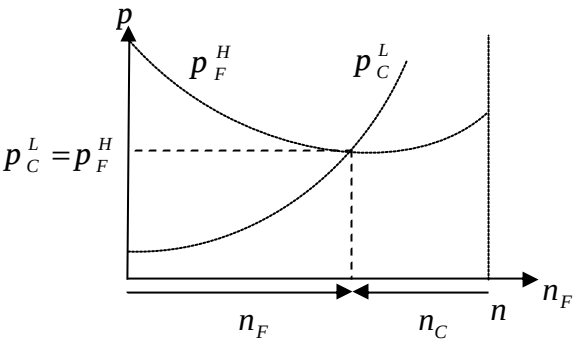
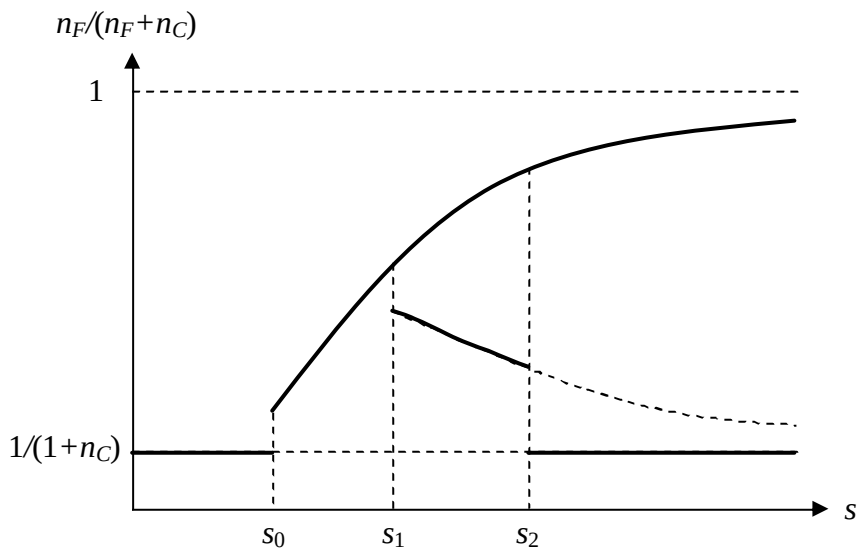


Figure 2 illustrates the level of profits per farmer delivering to the firm (p_F) and the cooperative (p_C) in the case where the cooperative produces higher quality (Figure 2a) as well as where the firm's products are of superior quality (Figure 2b). The profit of each farmer depends on the market share of the cooperative and the firm (defined as the share of farmers delivering to the cooperative and to the firm). As long as $p_C > p_F$, farmers would join the cooperative. An additional farmer delivering to the cooperative increases the output of the cooperative and thus reduces the price of its product. Whether this increases or decreases aggregate profits in the cooperative is unclear (and depends on the parameters of the model). As the aggregate profit of the cooperative now has to be shared among more members, the profits per farmer (p_C) decline. On the other hand, profits per farmer delivering to the firm will increase since n_F declines. This process stops as soon as there are no incentives to join the cooperative, that is when $p_C = p_F$.

The number of farmers delivering to the firm and the cooperative in an open-membership equilibrium are determined by the parameters *c*, *s*, *f* and *n*. The effects of a change of these parameters on the profits and on the market shares of the firm and the cooperative are summarized in the appendix.

The following Figure 3 illustrates some comparative static results. If, for a given $f = f_0$, the consumers willingness to pay for higher quality (s) is small ($s < s_0$), the cooperative and the firm will choose to supply low quality. In this case, the profits of cooperative members will exceed those of farmers delivering to the firm as long as $n_F > 1$ and the market share of firms ($n_F/(n_F + n_C)$) will thus be small. As high quality becomes more important for consumers and s increases above s_0, the firm will start producing high quality whereas the cooperative prefers to produce low quality (see Figure 1). As the relative profitability of farmers delivering to the high quality producer (the firm) increases with s (see Table 5 in the appendix), more and more farmers will leave the cooperative. The market share of the firm increases.

Figure 3. Market shares of the firm and the cooperative



As s increases above s_1, there are two Nash-equilibria (see again Figure 1). If the firm is the high-quality producer and the cooperative supplies low quality, then the share of farmers delivering to the firm further increases with s. However, if the product of the cooperative turns out to be of higher quality, then the market share of the firm decreases with s (see Table 5 in the appendix).

In the interval $s > s_2$, the firm will always produce high quality whereas the cooperative will supply high or low quality. In this interval, the market share of the firm will further increase

(with an increase in s) if the firm is the only producer of high quality products. If, however both manufacturers (the firm and the cooperative) deliver high quality products, the market share of the firm drops dramatically (to $1/(1 + n_C)$) since the product quality of the two manufacturers is identical again.

This theoretical analysis of an open-membership mixed-duopoly offers some implications that could in principal be tested empirically. (a) The incentives for an investor-owned firm to supply higher-quality products are larger compared to the incentives for cooperative members. Members of a cooperative face a free-rider problem with respect to the supply of quality. (b) The free-rider problem in the supply of high-quality products however may not be strong enough to ensure that firms will always supply higher quality than cooperatives. (c) The market share of the cooperative will not necessarily be as high as suggested in Albaek and Schultz (1998). (d) The market share of the cooperative will be high in markets, where quality differences between products are not considered important by consumers (no vertical product differentiation). (e) The market share of firms on the other hand can be particularly high in market where consumers consider quality to be important. (f) The model predicts the existence of multiple-equilibria in markets where quality matters. This suggests that for the same product, differences in market shares of cooperatives might well exist between countries (or different time periods).[6]

[6] We do not attempt to provide a detailed empirical analysis here but rather refer to some evidence collected in different studies. Hendrikse (1998) provides some data on market shares of cooperatives for different products in Europe (see Table 6 in Appendix C). While cooperatives have large market shares in some countries and some markets (e.g. milk production in Ireland) they are virtually non-existent in other markets (e.g. beef production in Belgium or Greece). Within a particular country (e.g. Denmark), the market shares of cooperatives vary between 0 % (poultry and sugar beet) and 97 % (pork), and within a specific market (e.g. vegetables), market shares differ between 8 % (Ireland) and 90 % (Denmark). For the U.S.A., Cook (1995) observes that the market share of cooperatives in the market for milk production in the US increased steadily from 46 % in 1951 to 85 % in 1993 (see Table 7 in Appendix C). The market shares in other markets remained fairly stable (e.g. fruits and vegetables) or even declined slightly (e.g. livestock).

4. Conclusions and Extensions

The speed of structural change has not been the same in different parts of the agrifood sector. Whereas processing and distribution of agricultural products now is highly concentrated in most developed countries, farming still is characterized by a large number of small family owned businesses. 'This combination of dispersed family ownership and highly concentrated processing and distribution sectors poses unique challenges, particularly with respect to vertical coordination and quality control over the supply chain' (Menard and Klein, 2004, p. 751).

The present paper investigates the issue of product quality in a vertically related industry. Quality choices of an investor owned firm and a producer cooperative are analyzed within a mixed duopoly framework. Assuming that the members of the cooperative are paid according to the quantity they deliver and that the quality of the inputs is non-contractible between independent actors, there is a strong incentive to free-ride and deliver low quality. This free rider problem among members of cooperatives is a well-recognized problem in the literature (see, among others, Cook 1995 and Fulton 1995). The investor owned firm on the other hand is assumed to be vertically integrated and thus is not plagued by a quality coordination problem.

The free rider problem within the cooperative with respect to product quality suggests that the investor owned firm will sell products of higher quality. In contrast to Albaek and Schultz (1998) the investor owned firm will be able to gain a large market share. However, we find that free-riding among members of the cooperative may not be strong enough to ensure that firms will <u>always</u> supply higher quality than cooperatives. In markets, where delivering high quality is highly rewarded by consumers (s is large) and/or the costs of producing high quality are low (f is small) the cooperative will produce the higher quality product. Despite the fact that the investor owned firm is vertically integrated (and thus does not face a coordination problem with respect to product quality) the quality of its product can be lower.

To what extent the degree of competition influences the quality decisions in a mixed duopoly has not yet been investigated in detail. The previous discussion assumed Cournot-behaviour between the cooperative and the investor-owned firm. If competition is more aggressive however, the comparative advantage of the cooperative in a homogenous product market disappears. The question whether this influences the incentives of the firm and/or the cooperative to supply high quality products is left for future research.

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