Influence Costs in Heterogeneous Cooperatives: A Formal Model of Sales Distortion

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Abstract

Modern agricultural marketing cooperatives must implement farm-level differentiation to meet requirements from high-quality market segments, e.g. consumers focusing on animal welfare. This makes the cooperatives internally heterogeneous and increases the influence costs. In particular, the marketing of specialty, high-quality products is a controversial issue for cooperatives, because different producer groups have different interests. The standard producers, who normally hold the majority vote in the cooperatives, are reluctant to promote the sale of specialty products and hereby reduce the bargaining power of the specialty producers. We explore these arguments in a formal model.

Keywords: cooperatives, influence costs, market innovation

1 Introduction

Agricultural cooperatives play a major role in the processing and marketing of many agricultural products both in developing and developed economies. Therefore, the economics of cooperatives is very important for the development and marketing of new high-quality products.

Traditionally, agricultural marketing cooperatives had very homogeneous members producing the same standard product (e.g. milk or pork), cf. Hansmann (1996). The cooperatives then processed the standard product into different products, aimed at different market segments, e.g. butter and non-fat milk. Recent trends in consumer demand have changed this pattern. Many of the product qualities that are now in demand originate at farm-level (e.g. animal welfare) and must be documented throughout the production chain.
In order to satisfy such demands from different market segments, production must be diversified at farm-level. Thus, many marketing cooperatives now have more heterogeneous members, c.f. Giannakas and Fulton (2001) and Cook (1995).

Often, the transition of cooperatives has a number of common characteristics. Firstly, the differentiation often takes the form of vertical quality differentiation, where certain quality attributes are added to the product. This creates a marketing asymmetry because high-quality products can be sold at the specialty market as well as at the standard market. There are numerous examples of this: organic milk can be sold as conventional milk, non-GM crops can be sold on the market for GM crops, and pigs satisfying high animal welfare constraints can be sold as standard pigs.

Secondly, the specialty producers producing high-quality products are normally a minority in the cooperative. Hence, the standard producers can determine the conditions for the specialty producers. The standard producers must, however, respect that the specialty producers can leave the cooperative and use other marketing channels (e.g. start their own cooperative). This gives the specialty producers a certain bargaining power.

The allocation of economic returns between the standard and the specialty producers reflects the relative bargaining power of the producer groups. Therefore, not only is it important for the producer groups to make decisions that maximize the integrated profit (which can be allocated to the producers); it is also important to consider the effects on the bargaining power. In this paper, we demonstrate that cooperatives are reluctant to invest in sales and marketing activities for specialty products, because this reluctance reduces the bargaining power of the specialty producers.

Cooperatives are often criticized for investing too little in product and market innovation, c.f. Cook (1995), Fulton (1995), and Hendrikse and Bijman (2002). The contribution
of this paper is to analyze the criticism in a formal model and to provide specific insights into the reasons behind cooperatives’ reluctance in promoting high-quality products.

The remainder of this paper is organized as follows. In Section 2, we formalize the bonus system. In Section 3, we analyze the sale and marketing of specialty products. Section 4 analyzes the specialty production. In Section 5, we discuss the sources of influence costs, and finally we conclude the paper in Section 6.

2 Bonus System

The specialty producers require a bonus to undertake a more costly specialty production. Typically, the bonus depends on the supply and demand of the specialty production. This can come about either explicitly through a contract or implicitly through renegotiation of the bonus. We consider a model, which can be viewed both as an explicit contract and as a formal description of bargaining outcomes, where the bonus payment to the specialty producers is

\[ B(S, Q) = \max \left\{ \gamma, \frac{\alpha S/Q}{\gamma} \right\} = \begin{cases} \alpha S/Q & \text{if } Q < S \alpha / \gamma \\ \gamma & \text{if } Q \geq S \alpha / \gamma \end{cases} \]  

(1)

i.e. the specialty producers are guaranteed a minimum bonus of \( \gamma \), when the sale of specialty products \( S \) is low relative to the production of specialty products \( Q \). As the utilization \( S/Q \) increases, the bonus increases linearly to \( \alpha \).

We assume that the produce not sold on the specialty market are sold as standard products on a perfect competitive world market at the price \( P_w \) and that the specialty market is independent of the standard market. We also assume that there are no positive or negative

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1 In Danish Crown, the bonus system guarantees the special producers a minimum bonus of DKr 0.8 per kg. The bonus gradually increases to reach DKr 1.4 per kg, when all special pigs are sold as special pigs (Danish Crown, 2000).
synergies between specialty and standard products in the processing and sales, i.e. the quantity of one type of product does not affect the costs of processing another type of product. These assumptions enable us to trace the effects in a fairly simple model.

3 Sales
A cooperative has to take a number of sales and marketing decisions. Some products can be sold at different markets, and the marketing budget can be allocated to different markets. In our model, we reduce this complex problem to a problem of deciding whether to sell the specialty products at the specialty market or at the standard market. In our model, we do not distinguish between a poor sale due to low marketing investments and a poor sale caused by direct sales decisions.

The sales decisions depend crucially on the allocation of decision rights. We consider three different scenarios. The first scenario is the ideal case, where the members agree to maximize the sum of the profit to each member – the integrated profit. In practice, this scenario can only be viewed as a benchmark scenario, because the actual sales and marketing decisions will reflect the interests of the decision-makers rather than idealistic concerns. The second scenario is where members leave the sales and marketing decisions to a revenue maximizing management\(^2\). There seems to be a tradition in cooperatives to give the management large discretion over sales and marketing decisions, c.f. Hansmann (1996). In the third scenario, the standard producers hold the majority and make the sales decisions that maximize the profit to the standard producers.

The sales and production quantities that maximize the integrated profit \( (S^{FB}, Q^{FB}) \) are

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\(^2\) It is a widespread misunderstanding that the objective of a cooperative should be to maximize the return on what the members supply to the cooperative, see Bogetoft and Olesen (2000) for a discussion.
where \( R(S, Q) \) is the sales revenue (net of any processing costs) from the specialty production, when the quantity \( S \) is being sold as specialty products and the quantity \( Q-S \) is sold as standard products, i.e. \( R(Q, S) = P_s S + P_w (Q - S) \). The primary production costs\(^3\) from a specialty production of \( Q \) is \( C(Q) \).

It is not optimal to have specialty production exceeding the sale of specialty products, because the specialty production is more costly than the standard production. Therefore, the production should equal the sale \( S^{FB} = Q^{FB} \) and (2) can be rewritten as

\[
S^{FB} = \arg \max_S \left[ R(S, S) - C(S) \right]
\]

(3)

A revenue maximizing management will determine the sale of specialty products as

\[
\bar{S}(Q) = \arg \max_S \left[ R(S, Q) \right]
\]

(4)

When the standard producers determine how to sell the specialty production, they consider the effects on the total revenue and the effects on the allocation of the revenue. To understand this, note that if the cooperative increases the sale of specialty products, three effects come into play: (i) The sales revenue changes (increases if the marginal revenue on the specialty market exceeds the world market price). (ii) The bonus increases (at least weakly). (iii) The specialty production increases as a consequence of higher bonus.

The majority in the cooperative optimize the standard producers’ profit. In doing this, the standard producers consider the impact on revenue and bonus payment; i.e. they

\(^3\)More precisely \( C(Q) \) is the lowest possible cost of producing \( Q \), i.e. the production costs when the production \( Q \) is allocated efficiently among the special producers.
consider effect (i) and (ii) and equate marginal revenue to marginal bonus payment. Thus, the standard producers solve

\[
\max_S [R(S, Q) - B(S, Q)Q; \text{ st. } Q \geq S] \iff \max_S [SP_S(S) + (Q - S)P_w - B(S, Q)Q; \text{ st. } Q \geq S] \tag{5}
\]

where \(B\) is the bonus per unit of specialty product produced and \(S(Q)\) denotes the sales volume selected by the standard producers. The first order condition for this problem is

\[
P_S(S) + \frac{\partial P_S(S)}{\partial S} S - P_w - \frac{\partial B(S, Q)}{\partial S} Q = 0 \tag{6}
\]

Figure 1 illustrates the interaction between marginal revenues and bonuses in the bonus system. The upper left hand graph depicts the marginal revenue from the sale of specialty products, i.e. \(P_S(S)\). The graph shows how the sale of specialty products is determined as a function of the world market price \(P_w\). The upper right hand graph shows the sale of specialty products selected by the standard producers as a function of the specialty production \(S(Q)\). The lower figure shows the corresponding bonus per unit of specialty product produced as a function of the specialty production and the sale of the specialty products, i.e. \(B(S(Q), Q)\).

The four intervals in Figure 1 correspond to four possible solutions to the standard producers’ problem (5).

In interval I the production of specialty pigs is between 0 and \(S\). In this interval the price on the specialty market is so high that the standard producers choose to sell the entire specialty production as specialty products, because \(MR(S) - P_w - \alpha > 0\). Thus, the solution to the standard producers’ problem (5) is a corner solution \(S=Q\) and the bonus is \(\alpha\).
In interval II, where \( Q < \frac{\alpha S}{\gamma} \), the first order condition reduces to \( MR(S) - P_w - \alpha = 0 \) and an interior solution is found. We refer to this solution as \( S \). The standard producers do not want to increase the sale of specialty products beyond \( S \). The reason being that increasing the sale of specialty products by one unit will increase the bonus payment to the specialty producers by \( \alpha \). The additional revenue does not cover this cost to the standard producers, since \( MR(S) \) is a decreasing function. The bonus is between \( \gamma \) and \( \alpha \) in interval II.

In interval III the production is between \( \frac{\alpha S}{\gamma} \) and \( \frac{\alpha \bar{S}}{\gamma} \) (\( \bar{S} \) is defined below). Here the sale of specialty products is so low relative to the production that the bonus is at the minimum level \( \gamma \). However, the marginal revenue on the specialty market exceeds the world market price, so a higher sale of specialty products increases the sales revenue. As
the production increases in interval III, the sale of specialty products can increase without affecting the bonus (which remains at $\gamma$), if the sale of specialty products $S$ and the specialty production increase in the ratio $\alpha/\gamma$. Hence, $S = \frac{\gamma}{\alpha}Q$.

In interval IV where the $Q > \frac{\alpha}{\gamma}S$, the full potential of the specialty market has been exploited. Hence, increasing the sale of specialty pigs will in fact reduce the sales revenue, because the marginal revenue on the specialty market $MR(S)$ will be below the world market price $P_w$. The first order condition of the standard producers problem reduces to $MR(S) - P_w = 0$. This is the revenue-maximizing solution, which we refer to as $\bar{S}$.

We summarize the findings in the following proposition

**Proposition 1:** When standard producers hold the majority in the cooperative they choose the sale of specialty products as follows

$$
S(Q) = \begin{cases} 
Q & \text{if } Q < S \\
\frac{S}{\gamma} & \text{if } S \leq Q < \frac{\alpha}{\gamma}S \\
\frac{Q\gamma}{\alpha} & \text{if } \frac{\alpha}{\gamma}S \leq Q < \frac{\alpha}{\gamma}\bar{S} \\
\bar{S} & \text{if } Q \geq \frac{\alpha}{\gamma}\bar{S}
\end{cases}
$$

(7)

Inserting $S(Q)$ into $B(S,Q)$ gives us the following expression for the bonus per unit of specialty product produced

$$
B(S(Q),Q) = \begin{cases} 
\alpha & \text{if } Q < S \\
\frac{\alpha}{\gamma} & \text{if } S \leq Q < \frac{\alpha}{\gamma}S \\
\frac{\alpha}{\gamma}Q & \text{if } \frac{\alpha}{\gamma}S \leq Q < \frac{\alpha}{\gamma}\bar{S} \\
\frac{\alpha}{\gamma}\bar{S} & \text{if } Q \geq \frac{\alpha}{\gamma}\bar{S}
\end{cases}
$$

(8)

Notice that sale and production only increases in the ratio of 1:1 in interval I. In any other interval (when the utilization is below 100 percent), increasing production by one
unit will increase sales by less than one unit. Hence, the problem of excess production (specialty production sold as standard products) increases when production increases.

4 Production
Normally cooperatives only control the members’ production indirectly through price signals. Figure 2 illustrates how the specialty producers determine their production level. The figure illustrates four different marginal cost functions corresponding to the four different intervals in Figure 1.

![Figure 2 Determination of production level under different cost functions](image)

The standard producers have different ways of influencing the specialty production. Firstly, the bonus system may be renegotiated. The model we analyze, can be viewed as a formalization of the bargaining outcome. Secondly, in many cases the specialty production is based on production rights. This gives the cooperative an instrument to control the specialty production by reducing or increasing the number of production rights.

We now formalize the standard producers’ problem of determining the optimal production level. The standard producers must pay the specialty producers the bonus plus the base payment, which we approximate by $P_w$. Hence, the standard producers solve
\[
\max_q [P_q(S(Q)) \cdot S(Q) + P_w(Q - S(Q)) - B(S(Q), Q)Q - P_wQ]
\] (9)

The first order conditions in the four different intervals reveal whether or not the standard producers have an incentive to regulate the production level.

In interval I the first order condition of problem (9) is \( MR(S(Q)) - P_w - \alpha = 0 \). This first order condition does not hold in interval I, since \( MR(S) - P_w - \alpha > 0 \) in interval I. Hence, the standard producers want to motivate higher specialty production.

In interval II the production level influences neither the sale of specialty products nor the total bonus payment. Thus, the standard producers have no incentive to regulate the production in this interval.

In interval III the first order condition for (9) is \( \frac{\gamma}{\alpha} [MR\left(\frac{\gamma}{\alpha} Q\right) - P_w - \alpha] = 0 \). This condition is not met in interval III, because \( MR\left(\frac{\gamma}{\alpha} Q\right) - P_w - \alpha < 0 \). Thus, the standard producers have incentive to reduce the excessive specialty production by reducing the number of production rights.

In interval IV the total bonus is \( \gamma Q \) and changing the production does not influence the sale. Hence, the first order condition for (9) is \( -\gamma = 0 \), which does not hold if the specialty producers are guaranteed a positive minimum bonus. In such cases, the standard producers will want to reduce the specialty production.

We can summarize the analysis in the following proposition.

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4 In interval II we have \( MR(S) - P_w - \alpha = 0 \). Since \( \frac{\gamma}{\alpha} Q > S \) in interval III we must have \( MR\left(\frac{\gamma}{\alpha} Q\right) - P_w - \alpha < 0 \) because \( MR(\bullet) \) is a decreasing function.
**Proposition 2:** Interval II ($S \leq Q < S_a/?)$ is the only stable interval, where the standard producers have no incentive to change the bonus system or the number of production rights.

In the following we, therefore, restrict our analysis to interval II. Note that a stable solution in interval II involves excess productions, such that high-quality specialty products are sold as standard products.

5 **Influence costs**

Influence costs play an important role in the design of payment schemes in cooperatives, c.f. Cook (1995), Hansmann (1996) and Bogetoft and Olesen (2000). In cooperatives, influence costs can arise whenever organizational decisions affect the allocation of wealth, and are created by selfish activities, aiming at increasing the benefits for one particular producer group. Influence activities are costly, because they can lead to costly decisions and because the activities divert resources from productive tasks (Milgrom and Roberts, 1990).

Section 3 and 4 lay the ground for determining the influence costs caused by costly decisions. The costs of suboptimal decision-making can be measured as loss of integrated profit. In Figure 3, the net effect on the integrated profit from choosing the revenue-maximizing sale, rather than the sale preferred by the standard producers, is $\Delta R - \Delta C$. When the demand on the specialty market is elastic relative to the production costs (right hand graph), the integrated profit is highest when the standard producers determine the sales quantity, i.e. $S = \bar{S}$ and $\Delta R - \Delta C < 0$. On the other hand, if the demand on the specialty market is un-elastic relative to the production costs (left hand graph), the integrated profit is highest with revenue maximization sale of specialty products, i.e. $S = \bar{S}$ and
\[ \Delta R - \Delta C > 0. \] Hence, in this case the members are better off leaving all sales decisions to a revenue maximizing management (e.g. compensated on provision). This means that the discussion about corporate governance in cooperatives ought to reflect the underlying demand and cost structures, because these determine whether it is better to have the standard producers (the majority) or a profit maximizing management, controlling the sales and marketing decisions. Thus, maximizing the sales revenue is not always an appropriate goal for the management in cooperatives.

Figure 3 Losses and gains from revenue maximization

A specific analysis based on sales and production data for the Danish cooperative slaughterhouse Danish Crown showed that revenue maximizing sales decisions would increase the additional revenues created on the specialty market by approximately 10 percent, relative to the sales decisions made by the standard producers (the majority), c.f. Olesen (2001).

The decision making process is also costly in itself, because the participants spend time and energy on a nonproductive task. In interval II, the standard producers have no incentive to regulate the specialty production. Thus, the member groups will not spend

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5 The latter can actually be efficient even if the management will consume a fraction of the revenues for perks.

6 See Bogetoft and Olesen (2000) for a thorough discussion of this result.
time arguing about the level of specialty production. On the other hand, the producer groups have conflicting interests regarding the sale of specialty products. This debate is very intense in many cooperatives, c.f. Olesen (2001).

6 Conclusion
Agricultural marketing cooperatives are undergoing interesting transitions due to changes in consumer demands. Many cooperatives have introduced differentiation at farm-level, in order to satisfy high-quality demands from certain market segments. This development increases the internal conflicts within cooperatives, because the members become more heterogeneous. In this paper, we analyze a formal model of the influence costs that arises due to distortions in sales decisions in cooperatives with heterogeneous members. We also discuss the influence costs incurred due to costly decision-making.

Normally, the producers of standard products hold the majority in the cooperative enabling the standard producers in controlling the decisions regarding high-quality products. In particular, the standard producers can control the sales and marketing decisions in the cooperative. When the standard producers determine the sales and marketing of specialty products, they take into account the fact that increased sale of specialty products will strengthen the bargaining position of the specialty producers. This makes the standard producers reluctant to promote the sale of specialty products. This critique has been raised without formal proof in the literature.
7 References


