1. Introduction.
This paper is concerned with self-regulation through producer organizations (PO) as an alternative to market or public intervention and its focus is on quality issues. A growing part of the literature now deals with quality. A market failure for quality provision is often the starting point for the analysis of some form of public regulation, even though it is often far from clear whether public intervention can in fact contribute to its solution. Previous analyses of the welfare effects of quality regulation enforced at the Marketing Order's level in the form of a minimum-quality standard show that it can not be welfare increasing (Bockstael, 1984; Chambers and Weiss, 1992).

The approach of the paper is the explicit consideration of the democratic process through which quality levels must be decided upon and enforced in the PO. It distinguishes between a constitutional and a working phase, which are analyzed taking into consideration the incentives of heterogeneous producers, i.e., the constraints represented by the voluntary participation and the asymmetric information about individual producers, in the spirit of the mechanism-design literature and in a situation in which only one group can be formed.

2. The model.
Consider an agricultural commodity as an experience good. Asymmetric information could be alleviated by a common label which would help to establish reputation for high quality. The problem for a group of farmers is to decide whether to form a Producer Organization (PO) with common rules about production and trade of products. If a PO is formed, a management committee will be formed to execute the agreement. The group is made of $n$ heterogeneous producers, and assume that producers can be of 2 types: $\mu^H$ denotes the high-quality type, which means a lower marginal cost of production for quality, and $\mu^L$ the low-quality. For convenience, we assume $n$ is an
odd number and $n_L + n_H = n$.

Technology can be represented using a technology set: $T_{\mu^i} = f(x; q)$: $x$ can produce $q$ given where $x > 0$ is a vector of inputs and $q > 0$ is the quality level. We normalize production level to unity to work only with quality levels. Producers' choices can be indirectly represented with their cost function: $c(q; \mu^i) = \min_x f_w x : (x; q) \in T_{\mu^i}$, where $w$ is the vector of input prices. We assume type $\mu^i$ member's cost of production, $c(q(\mu^i); \mu^i)$, to be twice differentiable, strictly increasing, strictly convex in $q$ and without fixed costs. In addition, we express the better skills of producers of type $\mu^H$ as: $c_q(q(\mu^H)) < c_q(q(\mu^L))$ for all $q$, that is the marginal cost of quality is everywhere higher for type $\mu^L$. We consider risk-neutral producers whose preferences are separable in income and effort and whose profits for the production of a unit of good of quality $q$ are: $\frac{1}{n} y(q) = \frac{1}{n} c(q(\mu^i); \mu^i)$, where $y(q)$ is the price each producer receives from the PO for a unit of product of quality $q$.

The paper considers hidden information. Each producer has private information about his own type and the PO can observe and verify the quality level provided by each producer ensuring that the payment to the producers is a function of the quality provided, $y(q)$. But the group cannot observe each producer type. The PO sells producers' commodity on the market and the price it receives is related to the quality that the buyers expect, i.e., consumers' willingness to pay is a function of the average quality of the good marketed by the PO. If $q(\mu^i)$ represents the quality of the good produced by the producer of type $\mu^i$, the average quality from the $n$ producers participating in the PO may be seen as $Q = \frac{1}{n} \sum_{i=1}^{n} q(\mu^i)$ and the consumers' willingness to pay equal to $p(Q)$, with $p'(Q) > 0$ and $p''(Q) < 0$.

The potential $n$ members meet together to decide whether to form the PO and how to run it. If the PO is formed, the producers would pool together their production under the collective brand and would receive a price in the market according to the level of quality they provide. One feature of the group is that it is a polity: any PO that is formed must be governed through a democratic process and we consider the case in which the decisions are made according to majority rule. We are interested in the rules about the payments to and the quality level provided by different producers.

Each individual behaves in his own interest and votes for the rules that best suit his own interests. It is reasonable to think that given the assumption about types two contracts emerge, one that is optimal for low-type and one for high-type producers. The PO adopts what is voted by the majority of the producers. Each producer can expect that what he can get from the
PO is "bounded". Indeed, he cannot receive less than what he would get from his outside opportunities, because otherwise he would be better off not participating; and he cannot receive more than what is allowed by the fact that the PO must break-even.

The idealized situation can be translated into a game. Nature at the beginning decides the distribution of the producers between the two types \( n_L \) and \( n_H \). Farmers have private information about their own type, but the distribution of types (Nature's choice) is not known. If \( n_L > n_H \), there is a low-quality majority, while if \( n_H > n_L \) the majority is of high-quality producers. The first phase is the constitutional choice: producers vote and agree on the set of rules for the producer organization. We assume that the set that gets the majority of the votes wins. The next is the working phase: producers can either reject or accept the contract.

This one-shot game can be solved by backward induction. The optimal contract in the first phase can be found taking into account the incentives in the second phase. We use mechanism-design, where a mechanism is the combination of payments to and quality level provided by producers, i.e., \((y(\mu^i); q(\mu^i))\). The revelation principle (Myerson, 1979) allows to focus on direct revelation mechanisms, constructed so that it is in each producer's interest to tell the truth. One can design a contract in which producers tell the truth provided it is incentive-compatible. Hence, any payment schedule that the producers adopt has to satisfy:

\[
\begin{align*}
    y(\mu^L) &< c(q(\mu^H); \mu^L), \\
    y(\mu^H) &< c(q(\mu^L); \mu^H).
\end{align*}
\]

From eq. (1) follows the following lemma.

Lemma 1. Any mechanism \((y(\mu^i); q(\mu^i))\) that satisfies eq. (1) must also satisfy:

\[
\begin{align*}
    y(\mu^H) &< y(\mu^l), \\
    q(\mu^H) &< q(\mu^L).
\end{align*}
\]

Among the contracts that are implementable, producers have to guarantee those that satisfy eq. (1) and the participation constraint: \( y(\mu^i) \geq c(q(\mu^i); \mu^i) \), \( u(\mu^i) = 0 \), which says that each producer participates on a voluntary basis and so must receive at least its reservation utility. This latter is set equal to zero since the alternative for the single producer is to go to a competitive market with zero profits. In addition, the PO must break-even, that is: \( np(Q) = \sum_{i=L}^H n_i y(\mu^i) \), \( P \). Note that \( np(Q) \) is the revenue - net of processing costs - that the PO receives from selling the members' good in the market and is a function of the average quality \( Q \). The aggregate revenues
from the products sold in the market minus the payments to the producers must cover the fixed costs \( F \) for the PO.

The outcomes of the game played in the following sections may be compared with the equilibrium that would result with an Agency who sets up a collective brand, has perfect observability (and verifiability) of quality, no information on individual producers technology, and an utilitarian social welfare function with unitary weights. In such a case the rst-best equilibrium would be that each type produces the quality level up to the point in which the marginal price from selling the commodity is equal to the marginal cost of producing it, or the following rst-order conditions must be satisfied:

\[
p^0(Q) = c(q^0(\mu^H); \mu^H) \quad \text{and} \quad p^0(Q) = c_q(q^0(\mu^L); \mu^L).\]

We call this the rst-best (FB).

3. High-quality majority.

The rst case we consider is when Nature draws \( n_H > n_L \) and so the majority is of high-quality producers. At the constitutional stage, they have to pick the best of implementable and feasible contracts. The majority of the votes goes to the optimal contract selected by high-quality types, that is the program that has the objective the maximization of their profits \( \frac{1}{2}(\mu^H) \) and is implementable, that is subject to the constraints specified above:

\[
\begin{align*}
\text{(PO)} & \quad \max_{y(\mu^H); q(\mu^H)} \sum_{i=1}^{n} y(\mu^H) \cdot c(q(\mu^H); \mu^H) \\
\text{s.t.:} & \quad (IC_L) \quad y(\mu^H) \cdot c(q(\mu^H); \mu^H) \quad y(\mu^H) \cdot c(q(\mu^H); \mu^H); \\
& \quad (IC_H) \quad y(\mu^H) \cdot c(q(\mu^H); \mu^H) \quad y(\mu^H) \cdot c(q(\mu^H); \mu^H); \\
& \quad (PC_i) \quad y(\mu^H) \cdot c(q(\mu^H); \mu^H) \quad u(\mu^H) = 0; \\
& \quad (BC) \quad np(Q) \cdot \sum_{i=L}^{n_i} y(\mu^H) \quad F:
\end{align*}
\]

The choice variables \( y(\mu^H); q(\mu^H) \) must satisfy Lemma 1; \((IC_L)\) and \((IC_H)\) are the incentive compatible constraints; \((PC_i)\) are the participation or rationality constraints of the two types with the outside opportunities; \((BC)\) is the break-even constraint. Following Grossman and Hart (1983), the problem above can be decomposed in two steps:

\[
\max_{d(\mu^H)} \max_{y(\mu^H)} \sum_{i=1}^{n} y(\mu^H) \cdot d(C_L; C_H; PC_i; BC) \cdot c(q(\mu^H); \mu^H) :
\]
The high-type producer first chooses the payment scheme that maximizes the total payments to his type $\mu^H$ while satisfying all the constraints, and then finds the efficient level of quality to provide. Following the steps adopted in Weymark (1986) and Chambers (1997), it can be shown that the PO’s budget constraint (BC) is binding. The budget constraint, which negative slope is given by $\frac{dy(\mu^H)}{dy(\mu^L)} = \frac{n_L}{n_H}$, is illustrated in Fig. 1. If a solution to the first stage exists then it must be in this line. Equation (1) gives the incentive compatible constraints that must be satisfied, that is:

$$c(q(\mu^H);\mu^L), c(q(\mu^L);\mu^H), y(\mu^H), y(\mu^L), c(q(\mu^H);\mu^H), c(q(\mu^L);\mu^L)$$

These are represented in Fig. 1 as the two lines above the bisector for a fixed $q$ and given strict inequalities in Lemma 1. The payments to producers that satisfy both the BC and the IC are then those in the BC line between the two ICs. The last constraint to consider in this first step is the low-quality type producers’ participation constraint which can be represented as a vertical line with the intercept $y(\mu^L) = c(q(\mu^L);\mu^L)$ which can intersect the BC in the three regions we consider in the next sub-sections.

Participation constraint non-binding. Here we analyze the case, as in Fig. 1, in which $PC_L$ cuts the BC to the left and above point B. Since the objective is to maximize type $\mu^H$’s welfare, the relevant point to consider is...
B. In the first step, the relevant constraints that are binding are the budget constraint and the low-quality producer’s incentive compatibility constraint (the PO has to avoid that the low-type “poses” as a high-type). From them we obtain

\[ y(\mu^H) = [c(q(\mu^H); \mu^L)] \frac{\mu^L}{n} + p(Q) \frac{\mu^L}{n} \text{ and } y(\mu^L) = y(\mu^H) + c(q(\mu^L); \mu^L) \cdot c(q(\mu^H); \mu^L). \]

As this latter equation shows, the payment for the low-quality type makes him just indifferent between his payment scheme and the one intended for the high-quality should he, the low-type, pose as high-type. In Guesnerie and Seade's (1982) terminology, this would represent an upward link in the payment-quality schedule.

In the second step, the problem is the choice of the efficient quality levels. From Lemma 1 we know that \( q(\mu^H) \geq q(\mu^L) \), and so we can define an auxiliary variable \( \hat{\mu} \geq 0 \) such that \( q(\mu^H) = q(\mu^L) + \hat{\mu} \) and which reduces the problem to a simple unconstrained nonlinear program. We maximize the following:

\[
\max_{q(\mu^H); \mu^L} \frac{1}{2} p(Q) \frac{\mu^L}{n} + \frac{1}{n} [c(q(\mu^H); \mu^L) \cdot c(q(\mu^H); \mu^L)] \frac{n}{n} \cdot c(q(\mu^H); \mu^H) ;
\]

obtaining the first order conditions which after some manipulations and assuming interior solutions for both variables lead to the following solutions:

\[
\frac{p^0(Q)}{c_q(q(\mu^H); \mu^H)} = \frac{n}{n} [c_q(q(\mu^H); \mu^H) \cdot c_q(q(\mu^H); \mu^L)];
\]

\[
\frac{p^0(Q)}{c_q(q(\mu^H); \mu^H)} = c_q(q(\mu^H); \mu^L):
\]

The optimal pricing mechanism requires low-quality types producing at the point at which their marginal cost equals the marginal price the PO receives from the sale of the commodity. At the same time, high-quality types produce up to a point above their marginal cost, since \( c_q(q(\mu^H); \mu^H) \cdot c_q(q(\mu^H); \mu^L) \cdot 0 \) implies \( p^0(Q) \cdot c_q(q(\mu^H); \mu^H) \). Note that the distortion for the high-quality types is higher the wider the cost differences with the low-type are and the more numerous the group of low-type producers is. When both types' costs are similar and low-quality types are few the distortion would be lower.

A policy that would implement such an optimal mechanism could be a minimum-quality standard tailored to keep the low-quality types above their reservation utility and a premium for high-quality products that would be lucrative only for high-quality producers. The rule just described could end up being a group that commercializes only products that are devoid of any blemishes. Any consumer used to buying fruits would recognize that among the commodities traded by those Orders with high-quality reputation it is
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almost impossible to find something different from a less than almost perfect product.

Participation constraint binding. When the low-quality type’s participation constraint cuts the budget constraint to the right and below point B, in the first step the relevant constraints to consider are the budget constraint and the low-quality producer’s rationality constraint from which we obtain

\[ y(\mu^H) = \frac{n}{n_H} p(Q) + \frac{F}{n_H} i + \frac{n_L}{n_H} c(q(\mu^L); \mu^L) \]

and

\[ y(\mu^L) = c(q(\mu^L); \mu^L) \]

As this latter equation shows, the payment for the low-quality type leaves him with no rents. In the second step, the problem is the choice of the efficient quality level. We maximize the following:

\[ \max_{q(\mu^L)} \frac{1}{n_H} p(Q) i + \frac{F}{n_H} i + \frac{n_L}{n_H} c(q(\mu^L); \mu^L) \]

After some manipulations the first order conditions give the following

\[ p_0(Q) = c(q(\mu^H); \mu^H) \]

and

\[ p_0(Q) = c(q(\mu^L); \mu^L) \]

When the high-quality types are in the majority and decide the optimal mechanism, given that the rationality constraint for the low-quality types in the minority is binding, they offer a payment that is equal to the minority type’s cost of production and such that the choice for the quality level is not distorted with respect to the first-best.

No feasible solutions. Here we consider when it is not feasible to form a group, i.e., the minority type’s participation constraint is to the right of point A in fig. 1. At this point, the payment schedule makes the high-quality type indifferent, i.e.,

\[ y(\mu^H) i + c(q^H(\mu^H); \mu^H) = y(\mu^L) i + c(q^L(\mu^L); \mu^H) \]

Rearranging the budget constraint together with the previous equation we obtain

\[ y_A(\mu^L) = p(Q) i + \frac{F}{n} + \frac{n_H}{n} [c(q^H(\mu^H); \mu^H) i + c(q^L(\mu^L); \mu^H)] \]

Now consider the payment for the low-quality type corresponding to the same quality level but when the rationality constraint is binding. The minority type’s producers get

\[ y(\mu^L) = c(q^L(\mu^L); \mu^L) \]

and we can form the following inequality:

\[ y_A(\mu^L) = p(Q) i + \frac{F}{n} + \frac{n_H}{n} [c(q^L(\mu^L); \mu^H)] \geq c(q^L(\mu^L); \mu^L) \]

When this inequality is satisfied the group may form, otherwise it can not.

Now notice when the minority type’s is binding. At point B in fig. 1 the payment for the low-quality type is such that

\[ y(\mu^L) i + c(q^H(\mu^L); \mu^L) = y(\mu^H) i + c(q^L(\mu^H); \mu^H) \]

i.e., the low-quality type is indifferent between the payment/quality combination intended for him and that intended for the other type. Note that the quality level chosen is that corresponding to the
rst-best. Rearrange together the budget constraint with the previous equa-
tion to obtain $y_\mu L = p(Q^n) i + \frac{F}{n} + \frac{n_H}{n} [c(q^{\mu^L}; \mu^L) i \ c(q^{\mu^H}; \mu^L)]$, with 
\rnest best quality level. Now consider the payment for the low-quality type 
corresponding to the same quality level but when the rationality constraint 
is binding and the minority type producers get $y_\mu L = c(q^{\mu^L}; \mu^L)$, to form 
the following inequality:

$$y_B(\mu^L) = p(Q^n) i + \frac{F}{n} + \frac{n_H}{n} [c(q^{\mu^H}; \mu^L) i \ c(q^{\mu^H}; \mu^L)] \ c(q^{\mu^H}; \mu^L):$$

When this inequality is satis\rned it is indeed feasible for the group to leave 
some rents above their reservation utility to the minority type's producers. 
The term on the left of the inequality can be interpreted as the size of the 
opportunity to be taken, which is a function of the demand parameters, minus 
the costs of doing it. These latter depend on the \rxed cost component, spread 
among all the producers, and on the differences between the two types. The 
term on the right of the inequality is the payment for the minority's type 
when his rationality constraint is binding. This inequality says that when 
the "size of the cake" is big enough, then it is optimal for the majority to 
leave some rents to the minority's producers. Vice-versa, when there are not 
big opportunities to be taken, or the group is relatively heterogenous, it is 
optimal for the majority to leave the minority's producers at their reservation 
utility.

4. Low-quality majority.

In this case Nature draws $n_L > n_H$ and low-type producers have the 
majority. The Board of Directors enforces a pricing mechanism that can be 
represented as the result of the following program:

$$(PO) \max_{y(\mu^L) ; c(\mu^L)} \sum_{i=1}^{n} y(\mu^L) i \ c(q(\mu^L); \mu^L)$$

subject to the same constraints de\rned in eq. (2). The maximand represents 
the \rrofits of the low-quality type. Like in the previous case, the problem 
can be decomposed in two steps, the choice of the payment scheme and the \re\cient level of quality. Using the same arguments, it can be shown that 
the PO's budget constraint is binding. Eq.(3) gives the incentive compatible 
constraints that must be satis\rned and that are represented in ..g. 1. The par-
ticipation constraint to consider now is the high-quality type's, represented 
by a horizontal line with the intercept $y(q^{\mu^H}) = c(q^{\mu^H}; \mu^H)$. With this 
majority, only two regions are relevant. The ..rst is when the participation
constraint is not binding, i.e., it is below point A. The second is when the participation constraint cuts the BC above point B (no feasible solutions).

Participation constraint non-binding. Using the same procedure, we find that assuming interior solutions we obtain the following:

\[
\begin{align*}
\rho_0(Q) & = c_q(q(\mu^L); \mu^L) = \frac{n_H}{n}[c_q(q(\mu^H); \mu^H) - c_q(q(\mu^L); \mu^H)]; \\
\rho_0(Q) & = c_q(q(\mu^H); \mu^H);
\end{align*}
\]

When low-quality producers have the majority, their choice of the pricing mechanism induces high-quality producers to produce at their marginal cost, and offer them a payment that leave them just indifferent between it and the payment intended for low-quality types. Low-quality producers produce less than the rst-best. The Producers Organization produces at a lower quality level, since the majority of producers - the low-quality type - is relatively inefficient at providing quality. In this way they maximize their profits and have the high-quality members making some positive profits. A policy that could implement this optimal mechanism would pay a relatively high price to low-quality products and would have a relatively low premium for high-quality ones.

No feasible solutions. In the case of low-quality majority, the minority type’s participation constraint can never be binding: if the high-quality type is left with no rents, i.e., \(y(\mu^H) - c(q(\mu^H); \mu^H) = 0\), he may pose as a low-type and get \(y(\mu^L) - c(q(\mu^L); \mu^H) > 0\). The fact is that the high-quality type can always pretend to be a low-quality type and get higher profits than this latter since he is more productive. So we would have \(y(\mu^L) - c(q(\mu^L); \mu^H) > y(\mu^H) - c(q(\mu^H); \mu^H) \geq 0\). But this would contradict the incentive compatibility constraint for the high-quality type, i.e., \(y(\mu^H) - c(q(\mu^H); \mu^H) \geq y(\mu^L) - c(q(\mu^L); \mu^H)\). The only way to leave the high-quality type at no rents would be to offer a payment/quality combination that would make the low-quality to earn negative profits. But this of course in not reasonable. With a low-quality majority, the high-quality minority’s producers will be always left with some rents above their reservation utility.

The other problem is for what parameter values it is feasible to form a group, i.e., the participation constraint of the minority’s type below point B. At this latter point, the payment schedule leaves the low-quality type indifferent, with the rst-best quality. Using the same line of arguments of
the previous section, we can form the following inequality:

\[ y_B(\mu^H) = p(Q^n) \cdot \frac{F}{n} + \frac{n_L}{n} \left[ c(q^n(\mu^L); \mu^L) \cdot \left[ c(q^n(\mu^H); \mu^H) - c(q^n(\mu^L); \mu^L) \right] \right] : \]

When this inequality is satisfied the group may form, otherwise it can not.

5. Concluding remarks.

This paper studies the interaction of asymmetric information and the democratic process in the quality choices of a group of heterogenous producers. It presents the pricing rules and the quality provision in a group of producers (PO) facing an opportunity to gain from their collective capacity to establish a reputation for their quality products. This paper makes the choice of the PO's pricing mechanism endogenous, compares different equilibria and for each of them it determines the profit levels for producers. When conditions are not very favorable to the group, the majority's better choice is to drive the minority producers to their reservation utility. When the conditions are more favorable, the majority's better choice is to leave some positive profits to the minority's types in order to provide an incentive-compatible payment scheme.

We find an asymmetry between the low-quality and the high-quality majority with respect to whether the rationality constraint is binding. When low-quality producers are in the majority, they find convenient to have the high-quality producers in the group to increase the average quality and the price that the group can receive. Since high-quality types are more efficient, they always have to be "bribed" to stay in the group. In other terms, they can not be driven to their reservation utility because they could just mimic the low-quality producers and earn more profits.

In the case of high-quality majority, only when the opportunities to be seized by the collective action are relatively big the low-quality types must be left with some rents. Indeed, if the two types are relatively similar offering to the low-quality type a payment that drives him to his reservation utility would not be incentive-compatible. High-quality producers would prefer in most cases to have the low-quality producers in the group, even if this implies a lowering of the average quality, because they can extract some of the profits of the minority and keep it for themselves.

References.


