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# "WELFARE ENHANCING COORDINATION IN CONSUMER COOPERATIVES UNDER MIXED OLIGOPOLY"

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# Welfare Enhancing Coordination in Consumer Cooperatives under Mixed Oligopoly*

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**Abstract**

The aim of this paper is to study the welfare effects of consumer cooperatives in mixed oligopoly markets. We show that under decreasing returns to scale and sufficiently high market competition these firms can contribute more to social welfare when acting on behalf of *all* consumers rather than only *one* representative consumer. This is because, by coordinating the preferences of consumers, these firms reduce their excessive market output, helping the market to come closer to the first-best. In all other cases we show that such consumers' coordination is not required to improve welfare.

**Keywords:** Consumer-owned Firms, Mixed Oligopoly, Collusion, Welfare.

**JEL Classification Numbers**: C70, C71, D23,D43.

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# 1 Introduction

Cooperatives represent today a relatively widespread form of economic democracy, involving more than 700 million cooperators in 100 countries (ICA 2006). Among the various forms of cooperatives, consumer cooperatives, whose core stakeholders - at least in theory - are their consumers, are currently active in retail sectors of many developed economies. For instance in Europe the association of consumer cooperatives estimates approximately 3,200 consumer cooperatives (with a turnover of 70 billion euro), employing 300,000 workers and serving about 25 million consumer-members (Euro-Coop 2008).

With some exceptions so far the economic theory has mainly focused on the behaviour of these firms under monopoly, perfect or monopolistic competition.[1] In some of these models, the control of the firm by its own consumers yields surprising results. For instance, Farrell (1985) shows that, under monopoly, if consumers own the same fraction of a firm as their share of consumption, they decide unanimously for a marginal cost pricing. If, instead, the distribution of consumption is asymmetric, the firm deviates from efficiency, and the more so the skewer is the distribution of consumption across individuals. Under oligopoly, it can be shown that a direct involvement of consumers in companies decision-making may induce the firm to reduce prices and to expand sales, hence obtaining higher profits as compared to pure profit-maximizing rivals (Kelsey and Milne, 2008). A growing literature has recently focused on how the firm's concern towards its consumers may affect its performance in an imperfectly competitive market (e.g., Schaffer 1989, Starks 2009, Husted and Allen 2011 and Brand and Kopel 2013).

This paper contributes to study the welfare consequences of the consumers' ownership (and control) in firms competing in a mixed oligopoly market.[2] In particular, we show that the efficiency gains stemming from consumer ownership crucially depends on the behaviour of these firms as well as on the type of technology and on the strenght of existing market competition. In particular, we show that if marginal costs are increasing and sufficiently high, consumer cooperatives can contribute more to social welfare if they act on behalf of *all* market consumers rather than only *one* representative (atomistic) consumer. This is because, by coordinating the preferences of all consumers, these firms reduce their excessive market output and, as a result, the market comes closer to the first-best. When, instead, either production costs are low and competition intense (e.g., when products are highly homogeneous) or marginal costs are decreasing or constant, we show that by increasing market output consumers' coordination becomes counterproductive to

[1] See e.g. Bekenstein (1943), Enke (1945), Yamey (1950), Anderson, Porter and Maurice (1979) and (1980), Sandler and Tschirhart (1981), Ireland and Law (1983), Sexton (1983) and (1990), Sexton and Sexton (1987), Farrell (1985), Albaek and Schultz (1998), Hart and Moore (1996) and (1998) and Mikami (2003) and (2010). More recently, Kelsey and Milne (2008), Feng and Hendrickse (2011), Fulton and Giannakas (2001), Giannakas *et al.*. (2005), Marini and Zevi (2011) and Kopel and Marini (2012) have started to consider in more detail the case of consumer cooperatives under oligopolistic competition.

[2] The term mixed oligopoly refers to oligopoly competition among firms possessing different objective functions (e.g. De Fraja and Delbono, 1990).

allocative efficiency. To sum up, our paper highlights previously unnoticed implications of the firm control by its own consumers in a mixed oligopoly, which may prove useful to guide policy-makers' intervention in favour or against this type of firms. As is well known, many European countries are currently debating whether to maintain or not the privileged tax treatment received by consumer cooperatives.

The paper is organized as follows. Section 2 introduces a general setup to illustrate the behaviour of consumer cooperatives competing oligopolistically with profit-maximizing rivals. It is then shown that, welfare enhancing coordination may only occur under decreasing returns of scale. Section 3 applies the analysis to a simple linear-demand and quadratic-cost mixed duopoly with differentiated goods and shows how the interplay between technology and competition is crucial for the final effect on welfare. Section 4 concludes.

# 2 The Model

We assume a *continuum* of identical consumers $i \in I$, with $I = [0, 1]$, possessing quasi-linear preferences defined over a bundle of $n$ symmetrically differentiated goods $x_k$, $(k = 1, ..., n)$ and one *numeraire* $y$. For each consumer preferences are expressed by a utility function $U^i : \mathbb{R}^{n+1}_+ \to \mathbb{R}_+$

$$U^i\left(x_1^i, ..., x_k^i, ..., x_n^i, y^i\right) = u_i\left(x_1^i, ..., x_k^i, ..., x_n^i\right) + y^i \tag{1}$$

where $x^i_{k,}$and $y^i$ denote the individual consumption of the goods. Let $u_i(.)$ be smooth, increasing and strictly concave in all $x_k^i$ for $k = 1, 2, ..., n$.

If the available income of a $i$-th consumer (denoted by $\overline{y}^i$) is sufficiently high (and we assume so) individual inverse demands are obtained from the first-order conditions of the maximization problem (1) subject to the budget constraint

$$\sum_{k=1}^{n} p_k\left(x_1, ..., x_n\right) x_k^i + y^i \leq \overline{y}^i, \tag{2}$$

as

$$p_k = \frac{\partial u_i\left(x_1^i, x_2^i, ..., x_n^i\right)}{\partial x_k^i}, \text{ for } x_k^i > 0 \text{ and } k = 1, 2, ...n. \tag{3}$$

Note that since the market is assumed oligopolistic, in (2) the price of each $k$-th good depends on the profile of quantities $(x_1, ., x_n)$ and not on individual purchases. Suppose now the industry consists of $n$ firms supplying $n$ goods (or bundles of goods), whose $m$ are supplied by consumer cooperatives and $(n - m)$ by traditional profit-maximizing firms. Let $M \subset N$ denote the subset of firms controlled by consumers. Moreover, let profit-maximizing firms maximize their profit, as

$$\pi_k\left(x_1, ...x_n\right) = p_k\left(x_1, x_2, ...x_n\right) x_k - c_k(x_k), \tag{4}$$

where $c_k(x_k)$ is the cost for every firm to produce the good.

For a consumer cooperative, let us consider here two distinct behaviours: (i) a consumer cooperative acts on behalf of a representative consumer (*atomistic case*); (ii) the consumer cooperative acts on behalf of all market consumers, who decide jointly the strategy of the firm (*coordinated case*). It is shown below that these two cases may yield qualitatively different outcomes, in particular when consumer cooperatives compete oligopolistically with profit-maximizing firms.

## 2.1 The Atomistic Case

First consider the case of a consumer cooperative producing a good (denoted $h$) on behalf of a representative consumer, assumed to receive a share of the firm's net profit proportional to his share of consumption of the good, $x_h^i/x_h$.[3] In this case, the objective-function of every $h$-th consumer cooperative would be:

$$\begin{array}{c} \max\limits_{x_h^i} u^i\left(x_1^i, x_2^i, ..., x_n^i\right) + y^i \quad \text{s.t.} \\ \sum\limits_{k=1}^{n} p_k\left(x_1, ..., x_n\right) x_k^i + y^i \leq \overline{y}^i + \sum\limits_{h \in M} \dfrac{x_h^i}{x_h}\left[p_h\left(x_1, ..., x_n\right) x_h - c_h\left(x_h\right)\right], \end{array} \tag{5}$$

with FOC for an interior maximum given by:

$$\frac{\partial u_i\left(x_1^i, ..., x_n^i\right)}{\partial x_h^i} = \frac{c_h(x_j)}{x_h} \text{ for } x_h > 0, \tag{6}$$

provided that the price charged by a $h$-th consumer cooperative is sufficiently high to generate a nonnegative profit, namely, $p_h\left(x_1, .., x_n\right) \geq c_h(x_j)/x_h$.[4] Note that a consumer cooperative sets its output to equate the representative consumer's willingness to pay for good $h$ (coinciding with its price) to the average cost.

## 2.2 The Coordinated Case

Let now assume that the consumer cooperative acts on behalf of all consumers and, therefore, maximizes the sum of their utilities (here assumed transferrable). In this case every $h$-th consumer cooperative would face the following maximization program:

$$\begin{array}{c} \max\limits_{x_h} \int\limits_{i \in I} U_i\left(x_1^i, ..., x_n^i, y^i\right) di \qquad \text{s.t.} \\ \sum\limits_{k=1}^{n} p_k\left(\mathbf{x}\right) \int\limits_{i \in I} x_k^i di + \int\limits_{i \in I} y^i di \leq \int\limits_{i \in I} \overline{y}^i di + \sum\limits_{h \in M} \dfrac{\int_{i \in I} x_h^i di}{x_h}\left[p_h\left(\mathbf{x}\right) x_h - c_h\left(x_h\right)\right], \end{array} \tag{7}$$

[3] This is a standard assumption (e.g. Anderson et al. 1979 and 1980) since usually consumer cooperatives pay their members a rebate proportional to the monetary value of their purchases.

[4] Throughout the paper we assume that firms always prefer to avoid losses.

where $\mathbf{x} = (x_1, x_2, .., x_n)$. Using (2), problem (7) can be rewritten as

$$\max_{\{x_h\}_{h\in M}} \left\{ u(\mathbf{x}) + \overline{y} - \sum_{k\in N\setminus M} p_k(\mathbf{x})\, x_k - \sum_{h\in M} c_h(x_h) \right\}, \tag{8}$$

and the FOC of every $h \in M$ is

$$\frac{\partial u(\mathbf{x})}{\partial x_h} = \underbrace{\frac{\partial c_h(x_h)}{\partial x_h}}_{MC_h} + \underbrace{\sum_{k\in N\setminus M} \frac{\partial p_k(\mathbf{x})}{\partial x_h} x_k}_{\sum_{k\in N\setminus M} \frac{\partial R_k}{\partial x_h}}, \tag{9}$$

again under a nonnegative profit constraint. The meaning of (9) is the following: when consumer cooperatives act to maximize the utilities of *all consumers*, they select a marginal cost pricing strategy with, in addition, a *distortion* adopted to internalize the effect of its output choice on the revenues of the rival profit-maximizing firms that, in turn, affect the budget constraints of the cooperative's consumer-members. In this way the consumers attempt to manipulate the market condition of the goods produced by the rival profit-maximizing firms to their own advantage. The direction of this effect on output can, in general, be positive or negative if goods are, in turn, complements or substitutes. Moreover, we can show that the final effect of consumers' coordination on market output as well as on welfare can be either positive or negative, depending on the interplay between the existing technology and the intensity of competition. As a first step, the next proposition makes clear that when a firm's technology is characterized by either constant or increasing returns to scale (corresponding to constant and decreasing marginal costs) consumers' coordination can never increase social welfare, and that, therefore, this can only occur when the technology exhibits decreasing returns of scale.

**Proposition 1** *If firms' technology exhibits constant or increasing returns to scale and profits are nonnegative, the coordination of consumer preferences by consumer-cooperatives in a mixed oligopoly can never be welfare-enhancing. This phenomenon can only occur under decreasing returns to scale.*

**Proof.** By definition a marginal cost pricing strategy maximizes the social welfare and, hence, under *constant* returns to scale a consumer cooperative acting on behalf of all consumers always weakly distorts its choice with respect to an atomistic consumer cooperative that sets its price equal to the average (and, then, marginal) cost. Using (9) and the nonnegative profit constraint, we know that under increasing returns of scale a cooperative coordinating all consumers' preferences either selects a price equal to the average cost (as in the atomistic case) to avoid losses, or higher than it, thus reducing even more the social welfare. As a result, a necessary (but not sufficient) condition for the welfare-enhancing effect of consumers' coordination taking place in cooperatives is the presence of a decreasing returns to scale technology. ■

# 3 Mixed Duopoly

To illustrate in detail the welfare-enhancing effect of coordination described in Proposition 1, it is sufficient to consider the case with only two firms. Let the choice variables for both firms $k = 1, 2$ be quantities and let also the two firms possess identical strategy sets $X_k = [0, \infty)$ and a decreasing returns to scale technology expressed by a quadratic cost function, $c_k(x_k) = \frac{c}{2}x_k^2$. Consumers' preferences are expressed by the following quadratic utility function $U^i : \mathbb{R}^3_+ \to \mathbb{R}_+$

$$U^i\left(x_1^i, x_2^i, y^i\right) = a(x_1^i + x_2^i) - \frac{1}{2}((x_1^i)^2 + (x_2^i)^2) - \beta x_1^i x_2^i + y^i, \tag{10}$$

where $a \geq \frac{c}{2} + 1$, and $\beta \in (0, 1]$ denotes the degree of product differentiation (e.g., Singh and Vives, 1984).[5] Carrying out the derivation in the usual way yields the following inverse demand functions for the two goods

$$\begin{aligned} p_1(x_1, x_2) &= a - x_1 - \beta x_2, \\ p_2(x_1, x_2) &= a - x_2 - \beta x_1. \end{aligned} \tag{11}$$

The profit-maximizing firm (firm 1) is assumed to maximize its profit, yielding the following best-reply,

$$x_1(x_2) = \frac{1}{2 + c}(a - \beta x_2).$$

In the pure profit-maximizing duopoly, equilibrium outputs are:

$$x_1^{PMF} = x_2^{PMF} = \frac{a}{(2 + c + \beta)}. \tag{12}$$

Under a mixed duopoly, by solving condition (6) the following best-reply is obtained for the atomistic consumer cooperative (firm 2) in competition with the profit-maximizing firm,

$$x_2(x_1) = \frac{1}{1 + \frac{c}{2}}(a - \beta x_1),$$

and this yields the following equilibrium quantities (denoted MC):

$$x_1^{MC} = \frac{a}{c + 2\beta + 2}, \; x_2^{MC} = \frac{2a}{c + 2\beta + 2}. \tag{13}$$

When, instead, the consumers can coordinate their preferences, by (9) we obtain an inelastic best-reply

$$x_2(x_1) = \frac{a}{1 + c},$$

[5] These two constraints on parameters guarantee nonnegative equilibrium profit for all firms and, in particular, for coordinated and atomisitc cooperatives.

and equilibrium outputs (denoted MCC) given by

$$x_1^{MCC} = \frac{a\,(1+c-\beta)}{(1+c)\,(2+c)},\ x_2^{MCC} = \frac{a}{1+c}. \tag{14}$$

Social welfare can be computed as

$$W = a(x_1+x_2) - \frac{1}{2}(x_1^2+x_2^2) - \beta x_1 x_2 - \frac{c}{2}x_1^2 - \frac{c}{2}x_2^2, \tag{15}$$

which, using expressions (12)-(14) yields respectively

$$W^{PMF} = \frac{a^2\,(c+\beta+3)}{(2+c+\beta)^2}, \tag{16}$$

$$W^{MC} = \frac{1}{2}\frac{a^2\,(c+8\beta+7)}{(2+c+2\beta)^2}, \tag{17}$$

and

$$W^{MCC} = \frac{1}{2}\frac{a^2\left(15c-6\beta-8c\beta+10c^2+2c^3+3\beta^2+c\beta^2-2c^2\beta+7\right)}{(c+1)^2\,(c+2)^2}. \tag{18}$$

Note that all noncooperative choices differ from the first-best (Pareto-optimal) outputs $x_1^{PO} = x_2^{PO} = a/\,(1+c+\beta)$, that yield a social welfare equal to $W^{PO} = a^2/\,(c+\beta+1)$. The next Proposition presents a full comparison of welfare in various mixed duopoly cases.

**Proposition 2** *In a mixed duopoly with linear demand and quadratic costs, for $c > 2\beta$, for $\beta \in (0,1]$,*

$$W^{PO} > W^{MCC} > W^{MC}.$$

*When, alternatively, $c \leq 2\beta$,*

$$W^{PO} > W^{MC} > W^{MCC}.$$

**Proof.** By straightforward manipulations of expressions (16)-(18). ■

The intuition behind the above result can be easily illustrated with the two figures below. When the cost of production is sufficiently high (in the numerical example for $c > 1+\beta = 1.5$), the mixed duopoly with an "atomistic" cooperative overproduces with respect to the first-best (i.e., $X^{MC} > X^{PO}$, for $X = x_1 + x_2$). The opposite occurs under a low cost level ($c < 1.5$ in the example). Therefore, when the cost is sufficiently high and market competition not too intense ($c > 2\beta$) a coordinated behaviour of the cooperative reduces its output without increasing too much the rival's and improves social welfare (see Figure 1 and 2). On the other hand, when the production cost is low ($c \leq 2\beta$) or market competition very intense, a coordinated behavior of the consumer cooperative reduces the welfare as compared to the atomistic case.

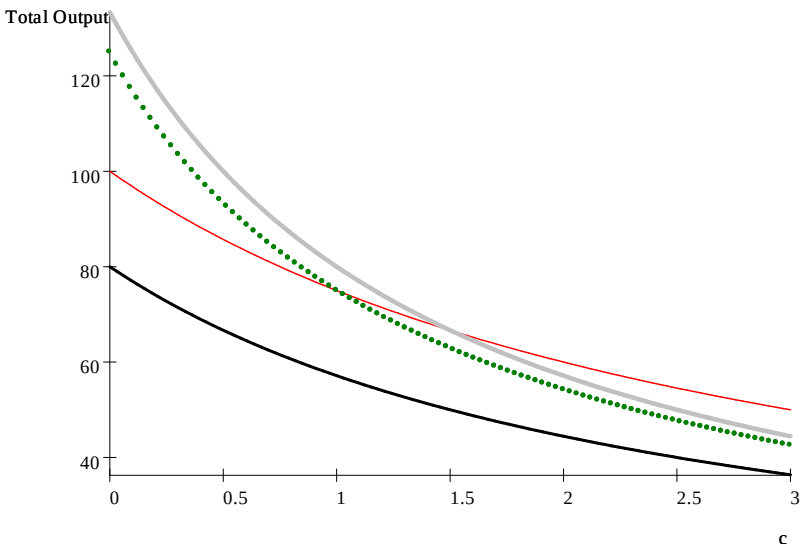


Fig. 1 - Equilibrium market outputs: $X^{MC}$(red continuous line), $X^{MCC}$ (green dotted line) , $X^{PMF}$ (black continuous line), $X^{PO}$ (thich grey line), $\beta = 0.5$ and $c \in (0, 3)$ .

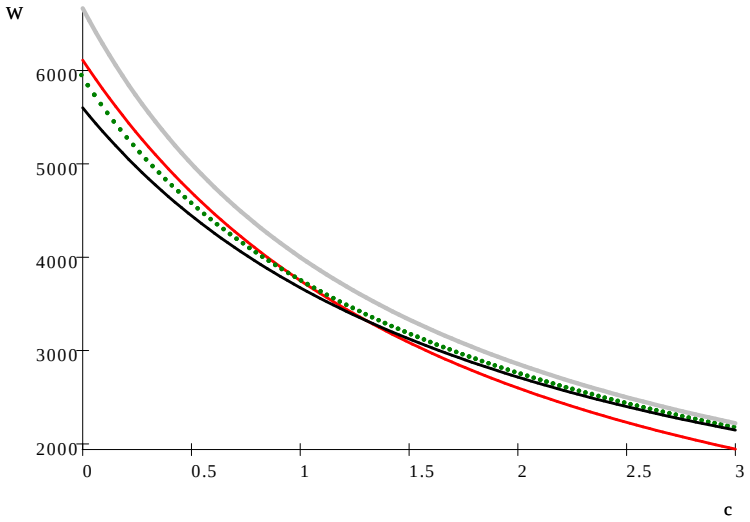


Fig. 2 - Market welfare: $W^{MC}$(red continuous line), $W^{MCC}$ (green dotted line), $W^{PMF}$ (black continuous line), $W^{PO}$ (thich grey line), $\beta = 0.5$ and $c \in (0, 3)$ .

# 4 Concluding Remarks

We have shown that in a mixed oligopoly with consumer cooperatives and profit-maximizing firms the interplay between objective-functions, existing technology and intensity of market competition matters for the level of welfare reached in equilibrium. In particular we show that a *coordinated* governance on behalf of all consumers can determine an increase in the welfare only if the firm technology exhibits decreasing returns of scale, production costs are sufficiently high and the intensity of competition low.

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