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The Degeneration of Workers' Cooperatives under Endogenous Membership in Mixed Oligopoly

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Abstract

We propose a new model of mixed oligopoly where a workers' cooperative firm competes with a number of profit maximizing companies. Building upon a large empirical evidence, we innovate as compared to the traditional literature on the objective function of the cooperative; moreover, its membership is treated as endogenous in the Cournot-Nash equilibrium. We show which factors may be responsible for the degeneration of the workers' cooperative firm, which occurs when the number of its members shrinks with respect to the overall employees.

JEL Classification: L21, L25, P13.
Keywords: cooperatives, mixed oligopoly, degeneration.

1 Introduction

According to a recent report of the International Cooperative Alliance (see Euricse, 2020), at least a billion people are members of cooperatives. In Europe - where Italy, France and Spain rank top - cooperatives account directly for almost 5 million employees.[1] Cooperatives are firms open to a large number of citizens for they usually require a modest entry fee to become member. They are run democratically by members (one head-one vote) who are the ultimate residual claimants of net revenue.

Among the various types of cooperatives (see Ammirato, 2018 and Zamagni, 2015 for useful taxonomies), we focus here on workers' cooperatives (henceforth, WCFs) often named *labour-managed firms* in the past. In such companies the ultimate control is held by workers because they own the firm. To prevent misunderstandings, a WCF does not necessarily meet Sertel (1982) definition of *workers' firm*, where "all workers are members and all member are workers". In fact, we are interested in analyzing the *membership ratio*, i.e., the ratio between the number of working members and the number of workers. Such a ratio is obviously equal to one in a workers' firm.

The founding members are labour suppliers who advance the necessary equity. This feature restricts the birth of WCFs to sectors with relatively low capital/labour ratios and low risk (as documented, for instance, by Podivinsky and Stewart, 2007 in the British manufacturing sectors). Then, unsurprisingly, WCFs are mainly operating in comparatively small manufacturing business, and they are frequently active in services as transportation, catering, facility management, tourism, entertainment, local welfare.

It is a matter of fact that WCFs are significantly less common than capital-managed firms and "no one argues that successful capitalist firms tend to degenerate into WCFs" (Dow, 2018, p.107).[2] Conversely, a group of scholars[3] have

[1] These figures make it somehow surprising the substantial disappearance of cooperatives from economics textbooks. See Hill (2000) and Kalmi (2007) for thoughtful accounts and explanations of such a tendency.

[2] As a model of enterprise alternative to the capitalist one, WCFs have received much attention in the literature since John Stuart Mill. He seemed exceedingly optimistic about the success of the cooperative form. In his *Principles of Political Economy*, published in 1848, four years after the birth of the first (users') cooperative (Rochdale, 1844), he claimed that worker-run organizations would eventually crowd capitalist enterprises out of the market because of their greater efficiency and other benefits for the working owners.

[3] See Dow, 2018, ch. 7, for an excellent discussion of the relevant literature.

claimed that WCFs seem to lean towards the capitalist ones (the so-called *degeneration*). In the next pages we will deal precisely with such an issue, although one may prefer to refer to it as "transformation" of WCFs. The choice would not be a merely stylistic one to avoid the intrinsically pejorative flavor of the term "degeneration", but it would also be driven by the multiplicity of experiences that can be collected when looking at the evolution of WCFs in the last decades. We will notice indeed that the actual cooperative magnitude would be significantly underestimated if summarized only through the number and performance of companies registered as cooperatives. The rich Italian experience, for instance, provides a more accurate evidence of the direct and indirect weight of cooperatives (including WCFs) within the economy in terms of employment as well as GDP.

In the second part of the paper we switch to theory. We propose a new model of mixed oligopoly where a workers' cooperative firm competes with a number of profit maximizing companies. Building upon a large empirical evidence, we innovate as compared to the traditional literature on the objective function of the cooperative; moreover, its membership is treated as endogenous in the Cournot-Nash equilibrium. We investigate the optimal choice of the membership within a new model of WCF's behaviour and we show which factors may explain its convergence towards a capitalist business organization. We interpret a reduction of the membership ratio as an instance of WCF degeneration, because as the proportion of members decreases the cooperative tends to look like the capitalist ones (Ben-Ner, 1984, p. 248). As such a ratio shrinks, in fact, a larger number of workers does not vote as member although the one head-one vote principle is preserved. To the best of our knowledge, we are first in treating the membership within a WCF as endogenous in a model of oligopoly.[4]

Among the main findings, we show that the membership ratio plays a crucial role. First, if not all workers are also members, then the two types of firms behave identically. If, instead, the membership ratio is unitary, the equilibrium is asymmetric and, in general, WCF's choices differ from their profit maximizing counterparts. The latter outcome is typical under the traditional objective function that has been used by most of the theoretical literature since Ward (1958). Second, we investigate which factors are responsible for the degeneration of WCFs. For

[4]Dow (2018, ch. 9) investigates the choice of membership under the assumptions of perfect competition in the product market and an objective function *à la* Ward (1958). Seminal papers tackling the same question in perfectly competitive markets are Ben-Ner (1984) and Miyazaki (1984).

instance, we show that an increase in market size, which is frequently correlated with the dimension of the companies, leads to a fall in the membership ratio.

The rest of the paper is organized as follows. Section 2 briefly reviews the related literature within a broader perspective about the academic research on WCFs since the late '50s of the last century. In section 3 we clarify how the transformation process of WCFs should be properly addressed on the basis of some available evidence. In section 4 we propose a model allowing us to investigate the choice of the membership ratio within an oligopolistic market structure. Section 5 provides a full characterization of the equilibrium of our mixed market. Section 6 concludes.

2 Related literature

The overall literature on WCFs is now vast: see, for instance, the classic survey by Bonin et al. (1993) and the more recent contributions by Dow (2018), Jones (2018), Mirabel (2021) and Mygind and Poulsen (2021). Two phases can be roughly identified. The first one, since the pioneering contribution by Ward (1958), was mainly concerned with the analysis of the so-called market socialism, a market-based economy different from the conventional capitalist ones because of the presence of companies own and/or run by workers.

Since Ward's article, most of the early theoretical literature modeled the WCF as maximizing the net income per worker (see Domar, 1966 and Vanek, 1970, among the most influential essays). More precisely, the short-run WCF's maximand is assumed to be revenue, net of fixed cost, per member. Under price-taking behaviour, if all identical workers (the only variable input) are members, this is equivalent to maximize the difference between revenue and all costs (named profit in a capitalist company) per member. Besides not finding significant empirical support, such approach entails a disturbing negative response of output (and then labour demand) to output price increases: since Ward (1958), this is known in the literature as the *perverse effect*. In most of the subsequent contributions, including ours, the perverse effect disappears.

For example, an interesting formulation avoiding backward-bending supply curve of the WCF is in Kahana and Nitzan (1989). Under price-taking behaviour and a unitary membership ratio, a WCF chooses the levels of inputs and output to

maximize the income per worker/member subject to an employment constraint or, alternatively, the level of employment subject to a profit per worker/member constraint. By duality arguments, one proves the equivalence between the two approaches which aim at capturing the concern for employment that should shape the decisions of firms owned and run by workers-members according to a democratic governance. This concern has been often detected in empirical research (further reviewed below).

The theoretical literature made little progress until the early '90s[5] when, retaining the same objective function as in Ward (1958), the behaviour of a WCF has been studied within models of *mixed oligopoly*, i.e., concentrated markets hosting firms pursuing different goals (De Fraja and Delbono, 1990). However, while these models remove the extreme assumption of price-taking behaviour in the product market, they retain Ward (1958)'s formulation about the WCF objective function (see, e.g., Delbono and Rossini, 1992 and Delbono et al., 2023, for the relevant references).

Likely also because of the stalemate in modeling WCF's behaviour, the last thirty years have witnessed a massive increase in empirical studies. Starting from a group of seminal papers investigating the plywood industry in the US Pacific Northwest, Craig and Pencavel (1992, 1993) and Craig et al. (1995) drew the conclusion that a WCF tends to adjust earnings more than employment when reacting to changes in market condition. The same conclusion is reached by Burdín and Dean (2009, 2012) regarding the Uruguayan economy. Both sets of papers share the finding that employment seems to occupy a more prominent role than earnings in the objective function of WCFs . This empirical evidence has been confirmed, inter alia, in a group of studies on Italian WCFs, e.g., Delbono and Reggiani (2013), Euricse (2013), Navarra (2016), and Caselli et al. (2022).

As for the so-called *degeneration problem*, several scholars have argued that - under imperfect (or no) membership markets - members of successful WCFs would find it preferable to hire employees and to pay them the market wage when departing members have to be replaced.[6] The evidence collected in several countries is far

[5] A notable exception is the model by Dow (1986) in which there is a market for membership and the incentive for WCFs to degenerate disappears. We owe this remark to an anonymous reviewer.

[6] Sertel (1991) shows that under imperfect competition in the product market, the equilibrium is not altered by replacing a profit maximizer by a Ward (1958)-like WCF if (i) there is a market for cooperative memberships and (ii) the membership ratio is unitary. Under conditions (i) and (ii), Mikami (2018) finds that a WCF is as efficient and viable as a capitalist firm.

from being conclusive and also shows that some institutional mechanisms may restrain the actual feasibility of the "degeneration". For instance, in France, also non-members are eligible for participating in the distribution of dividends.[7]

Moreover, it is worth noticing that sometimes the transformation goes the other way around, when unsuccessful capitalist companies sometimes convert themselves into WCFs. This is the case of workers buy-out by means of which employees in a capital-controlled firm take over the company to prevent its bankruptcy. For instance, between 2011 and 2021, the Italian cooperative fund CFI[8] has supported 88 such acquisitions of firms which account for a total turnover of 365 million euros and employ 2,286 persons. A similar conversion has been observed in France: between 1997 and 2001, about 7% of WCF's entry in French industries resulted from rescues of capital-controlled companies (Pérotin, 2006).

Furthermore, "a related process may involve the formation of non-cooperative subsidiaries by worker cooperatives or outsourcing of some activities to conventional firms" (Dow, 2018, p.108). This aspect seems important in general and in Italy in particular; hence, we briefly turn our attention to this additional evidence.

3 The cooperative magnitude

To assess the overall cooperative magnitude, we need a set of data which transcend the number of cooperatives, their diffusion, sizes and direct impact on the economy (e.g., employment, GDP). A preliminary question, indeed, deals with the cooperative control over firms: a control which often extends outside the boundaries of cooperative firms. In other words, while stock companies can hardly take cooperatives over, given the dissemination of (normally untradable) property rights, cooperatives can acquire control over stock companies as this often occurs. For instance, Unipol-Sai, one of the leading companies in the Italian insurance market, is a firm listed on the national stock market, but it is controlled throughout an agreement among a group of cooperative companies.

To pursue the goal of summarizing the overall cooperative control over firms, we need to rely upon the category of *business group*, defined by Eurostat as: "an

[7] See Dean (2019) for an empirical study on the presence of degeneration in Uruguayan WCFs.
[8] For details, see: https://www.cfi.it/workers-buyout.php [Last accessed: February 19, 2025].

association of enterprises bound together by legal and/or financial links. (...) It constitutes an economic entity which is empowered to make choices, particularly concerning the unit it comprises" (European Regulation 696/93). Of course, we are interested in business groups controlled by WCFs.

To begin with, we focus on the Italian experience as it ranks top worldwide for the macroeconomic impact of cooperatives (7% of total employment and about 4% of the GDP of the private sector, according to Istat). In 2015 in Italy 29,414 cooperatives out of 59,027 active cooperatives were of the workers' type and were responsible of about 45% and 42% of overall cooperative added value and employment, respectively. Moreover, as carefully reported in Borzaga et al. (2019), 812 business groups were controlled by a cooperative firm and 1971 is the number of controlled non-cooperative enterprises. If we consider WCFs, they are 389 out of 812. In 2021 (see Euricse, 2023, p.13, Table 9) more than 10% of revenues from sales of Italian WCFs come from controlled stock companies.

We may conclude that, considering subsidiaries and cooperative groups, the overall macroeconomic impact of Italian cooperatives (the cooperative magnitude) goes up to 4.4% of GDP and 7.4 % of employment of the private sector. Most of this uplift can be attributed to the control of non-cooperative companies by WCFs, as they account for about a half of the business groups led in 2015 by cooperative companies.

A glance to the situation in the Italian region Emilia-Romagna strengthens the view that the cooperative magnitude is by far broader than the one emerging from a simple accounting of the sole cooperatives. As shown in a recent research of the Regional Union of the Chambers of Commerce on the cooperatives adhering to Legacoop - Caselli (2020) - the multiplying effect of leading business groups is quite impressive. In 2018, 172 cooperatives (not necessarily WCFs), with an overall turnover of about 19 billion euros and 86,719 employees, control 919 conventional companies accounting for almost 14 billion euros and more than 50 thousand employees. The actual regional cooperative magnitude of Legacoop - one of the two major Italian cooperative associations - is summarized by the aggregation of the figures above: a turnover of almost 33 billion euros and about 137 thousand employees.

4 A model of workers' cooperatives

We consider a mixed oligopoly in which a workers' cooperative (subscript W in the model) and $n \geq 1$ capitalist identical ones (subscript i) produce an homogeneous good, and compete in a game where the labour demand is the choice variable. Workers are uniform in skills and abilities; the nominal wage, $\omega > 0$, and the length of the workday are institutionally fixed. Labour supply is unconstrained at the market wage ω.[9] Both types of firms have a short run production function defined as: $q = f(L)$, where q represents the output and L is the amount of labour. Regarding $f(L)$, we assume:

$$\text{(i) } f(0) = 0, \text{ (ii) } f' > 0, \text{ (iii) } f'' < 0, \text{ (iv) } \lim_{L \to 0} f' = \infty, \text{ (v) } \lim_{L \to \infty} f' = 0.$$

Assumptions (iii)-(iv)-(v) are the well-known Inada conditions ensuring the existence of an interior solution in the labour demand. In our setting, these are sufficient to guarantee also uniqueness. Market price is strictly decreasing with respect to total quantity: $p = p(Q)$, $\frac{dp}{dQ} < 0$, $Q = q_W + \sum_i q_i$, where i is one of the n capitalist firms, i.e., $i = 1 \dots n$. There is a finite upper bound on demand when price approaches zero. Given the above monotonic production function, the market game we are going to analyze is equivalent to a quantity setting game.

A capitalist firm maximizes its profits defined as:

$$\Pi_C(L_W, L_i) = p\left[f(L_W) + \sum_{i=1}^{n} f(L_i)\right] f(L_i) - \omega L_i - \Gamma, \quad i = 1 \dots n, \tag{1}$$

with respect to its labour demand, L_i and where Γ is the cost of non-labour input, which is fixed in the short run. The WCF maximizes the following objective function with respect to L_W and L_M:

$$V = \phi \Pi_W(L_W, L_i) + r\left[\tau L_M + (1 - \phi)\Pi_W(L_W, L_i)\right] - g(L_M), \tag{2}$$

[9] The value of market wage can be thought of as emerging from either national collective bargaining - this is the case in Italy, for instance - or competitive interaction in the labour market. As a consequence, there is no asymmetry between the two firms as for technology and costs. Indeed, the empirical research does not support either view about the presence of productivity gaps: "there are enough instances in which co-ops seem no less efficient than capitalist firms that a presumption of co-ops relative inefficiency is not warranted" (Pencavel, 2012, p. 26). In our model the only difference between the two types of firm lies in the objective function.

where $\Pi_W\left(L_W,\ L_i\right)$, the profit of the WCF, is given by:

$$\Pi_W\left(L_W,\ L_i\right) = p\left[f(L_W) + \sum_{i=1}^{n} f(L_i)\right] f\left(L_W\right) - \omega L_W - \Gamma, \tag{3}$$

and $L_M \leq L_W$ is the number of working members. In equation (2) workers of the WCF are divided into members, L_M, and non-members, L_{NM}, with $L_W = L_M + L_{NM}$. Hence, the membership ratio, m, is:

$$m = \frac{L_M}{L_W} > 0. \tag{4}$$

Only members share WCF's profits, if any, in the form of dividends (also called rebates). Clearly, $m \in (0, 1]$. If $m = 1$ all workers are members. If $m < 1$, the WCF distinguishes between labour supplied by members and by non-members.[10] The function $g(L_M)$ captures the monetary sacrifice of current members when membership is expanded. In fact, a greater number of members yields a lower distributed profit per member; moreover, there are organizational costs, which increase with L_M, especially within a governance entailing "one head one vote". The exact shape of $g(\cdot)$ is clearly an empirical issue and, for sake of tractability, we assume that $g(0) = 0$, $g' > 0$, and $g'' > 0$.

The main novelty of our model lies in the formulation of the WCF objective function. The first part of equation (2) consists in the share of profits distributed to members, $\phi\Pi_W\left(L_W,\ L_i\right)$, where $\phi \in [0, 1]$ is the weight assigned to distributed profits, provided that $\Pi_W > 0$. If $\Pi_W \leq 0$ then ϕ is zero. The right hand side of equation (2) also includes the returns (with r being the rate of interest) on the stock of total assets, which can be split into the value of membership (in which τ is the membership fee[11]) and undistributed profits, i.e., plough-back in the form of reserves. Note that the WCF can make negative profits ($\Pi_W < 0$) provided that the loss does not exceed the value of assets, net of the membership costs ($\tau L_M - g(L_M)$).

Notice that we ignore the capital remuneration in the objective function of the capitalist firm because it would be immaterial as for its optimization problem, which only considers the labour input and not the capital. On the contrary,

[10] Note that in practice non-members may receive less protection than members in case of negative shocks. See, e.g., Delbono et al. (2023).

[11] Note that τ is considered exogenous in the model and it represents the one-off payment to become member of the WCF. It is not refunded and it cannot be traded as we rule out the presence of a membership market.

we need to disentangle the overall revenue of the WCF, as the membership is endogenous and it affects the capital remuneration, which is part of its objective function.

Furthermore, it is apparent that, given the level of employment (L_W), an increase in the number of members yields two contrasting effects on the objective function V: while it reduces the distributed profit per member, as captured by $g(L_M)$, it raises the assets of the WCF.

Our model seemingly succeeds at stylizing the following empirical evidences.[12] First, it is well known that WCFs operate in mixed oligopolies, i.e., concentrated industries where they compete with capitalistic enterprises. In fact, we are not aware of sectors in which a WCF acts as a monopolist, or where all firms are WCFs. Second, in WCFs profits are mainly plough-back in the form of reserves: see Delbono and Reggiani (2013) for the Italian experience, and the references cited therein. Third, in WCFs workers receive a wage usually set through national collective bargaining and, if members, a share of profits in the form of rebates. Fourth, the ratio between working-members and workers seems to be varying over time and across countries and sectors. In samples of Italian WCFs, Pencavel et al. (2006) estimated a value of 85% in the mid '80s of the last century and Delbono and Reggiani (2013) obtained a figure of around 68% for the first decade of this century. Fifth, except in the US, there is no market for memberships. Since we rule out such a market, our model is more suited for the analysis of non-US experiences.

To achieve a closed form solution, our analysis will proceed with the linear inverse demand function:

$$p = a - Q, \tag{5}$$

where $a > \omega > 0$, the following quadratic production function:

$$q_j = \sqrt{L_j}, \;\; j = W, i, \tag{6}$$

and:

$$g(L_M) = \frac{c}{2} L_M^2, \tag{7}$$

with $c > 0$. Equations (5), (6), and (7) are then plugged into equations (1), (2), and (3).

[12] It is worth stressing that members of WCFs could care about social aspects of production (see Albanese, 2020 and the literature cited therein), which are ignored in our formulation.

5 Analysis

We now solve the model looking for the Cournot-Nash equilibrium in labour demands (L_W and L_i). As already noticed, given our production function, this is clearly equivalent to compute the equilibrium in output levels. Simultaneously, the WCF also chooses the optimal number of members, L_M.[13]

Assuming symmetry among the other $n-1$ capitalist firms, indicated with the subscript $-i$, the first order conditions for L_W, L_M and L_i are, respectively:

$$\frac{\partial V}{\partial L_W} = \frac{(\phi - r(1-\phi))\left[a - \sqrt{L_i} - \sqrt{L_{-i}}(n-1) - 2\sqrt{L_W}(\omega+1)\right]}{2\sqrt{L_W}} = 0, \tag{8}$$

$$\frac{\partial V}{\partial L_M} = r\tau - cL_M = 0, \tag{9}$$

$$\frac{\partial \Pi_i}{\partial L_i} = \frac{a - 2(1+\omega)\sqrt{L_i} - (n-1)\sqrt{L_{-i}} - \sqrt{L_W}}{2\sqrt{L_i}} = 0. \tag{10}$$

Since the second order conditions are met and setting $L_C = L_i$ for all $i = 1 \dots n$ by symmetry, the equilibrium solutions are:

$$L_W^* = L_C^* = \frac{a^2}{(n+2\omega+2)^2}, \tag{11}$$

$$L_M^* = \frac{r\tau}{c}. \tag{12}$$

On the basis of (12) and (11), we compute the equilibrium value of the membership ratio, which is:

$$m^* = \frac{L_M^*}{L_W^*} = \frac{r\tau(n+2\omega+2)^2}{a^2 c}. \tag{13}$$

In the unique equilibrium:

$$\pi_W^* = \pi_C^* = \frac{a^2(1+\omega)}{(n+2\omega+2)^2} - \Gamma,$$
$$V^* = \frac{[r(1-\phi)+\phi]\left[a^2(1+\omega) - \Gamma(n+2\omega+2)^2\right]}{(n+2\omega+2)^2} + \frac{r^2\tau^2}{2c}.$$

Note that V^* is positive if profits are positive, and this requires Γ being not too

[13] Clearly this timing yields the same solution that would emerge if the WCF chooses L_M before competing in the product market.

large, i.e.:

$$\Gamma < \frac{a^2(\omega+1)}{(n+2\omega+2)^2}, \tag{14}$$

which we assume in what follows.

Moreover, in equilibrium we find $0 < L_M^* < L_W^*$ (i.e., $0 < m^* < 1$) provided that the interest rate r is not too large, i.e.:

$$r < \frac{a^2 c}{\tau(n+2\omega+2)^2} \equiv \overline{r}. \tag{15}$$

Hence, we can state the following result:

Proposition 1 (Equivalence)**.** *In the unique Cournot-Nash equilibrium, if $r < \overline{r}$, then $0 < m^* < 1$ and $L_W^* = L_C^*$.*

The equilibrium expressions for the labour demand in equation (11) prove Proposition 1. We further note, however, that the above equivalence result originates from the fact that, for a given labour demand of the remaining capitalist firms, the first order conditions (8) and (10) are exactly the same function, bar the inverted subscripts and up to a multiplicative constant. We note further that the content of Proposition 1 does not depend on the linear-quadratic formulations that we employed, but it holds under more general conditions.

The above result amounts to say that, when there are non-member workers (i.e., $m^* < 1$), then the two types of firms are actually maximizing profits, and the presence of L_M in the WCF objective function does not play any role in the WCF first order condition. As a consequence, the cooperative and the capitalist firms behave identically, employing exactly the same amount of workers to obtain the same amount of output.

The equivalence result in Proposition 1 clearly depends on our formulation of the WCF objective function. It is worth stressing that the objective function (2) seems consistent with the empirical evidence and delivers results that are rather different from the received theoretical literature since Ward (1958), in which m is assumed to be unitary. Indeed, the following result can be stated:

Proposition 2 (Asymmetric behaviour)**.** *If $r > \overline{r}$, then in equilibrium $m^* = 1$ and L_W^* differs from L_C^*.*

Proof: We start by stating the first order conditions for each type of firm, under the assumption that $r > \overline{r}$. These are, respectively:

$$\frac{\partial V}{\partial L_W} = \frac{(r+\phi-r\phi)\left[a-\sqrt{L_i}+(n-1)\sqrt{L_{-i}}\right]}{2\sqrt{L_W}} + \\ + r\tau + (\omega+1)[r(\phi-1)-\phi] - cL_W = 0 \tag{16}$$

$$\frac{\partial \Pi_i}{\partial L_i} = \frac{a-2(1+\omega)\sqrt{L_i}-(n-1)\sqrt{L_{-i}}-\sqrt{L_W}}{2\sqrt{L_i}} = 0. \tag{17}$$

We then proceed by contradiction and assume $L_C^* = L_W^* = L^*$. The first order condition for the capitalist firm suggests that:

$$L^* = \frac{a^2}{(n+2\omega+2)^2}.$$

We then evaluate the first order condition for the WCF at L^*, and obtain:

$$r\tau - \frac{a^2 c}{(n+2\omega+2)^2},$$

which vanishes for $r = \frac{a^2 c}{\tau(n+2\omega+2)^2} = \overline{r}$. For any $r > \overline{r}$, the first order condition is not satisfied, hence $L_C^* \neq L_W^*$, a contradiction.

In line with the literature pioneered by Ward (1958), Proposition 2 states that when the number of members of the WCF coincides with the number of its employees, the equilibrium behaviour of a firm depends on its nature, i.e., WCF or capitalistic.

Given the complexity of the first order conditions in this case, we fall short of providing an indication of which type of firm, WCF or capitalist, employs more workers in equilibrium. However, we further illustrate the previous finding through a numerical example, in which the WCF produces *more* than the capitalist competitor.

Example 1. *Consider the following parametrization of our model:* $a = 5$, $\phi = 0.5$, $\Gamma = 0.1$, $\omega = 1$, $\tau = 1$, $r = 0.6$, $c = 0.5$ *and* $n = 1$. *Note that with this parameter constellation indeed* $r = 0.6 > \overline{r} = 0.5$ *and* $\Gamma = 0.1 < \overline{\Gamma} = 2$. *Solving the system of the first order conditions leads to:*

$$L_W^* = 1.08289, \quad L_C^* = 0.97979.$$

More generally, we note the following. Equations (10) and (17) are identical, as the problem of the capitalist firms is independent of L_M, the number of member workers. From Proposition 1 we know that those first-order conditions are satisfied and take value zero at the equilibrium labour demand, (11). Evaluating (16) at the equilibrium (11), one can show that for $r > \overline{r}$ the first-order condition of the WCF is positive. This suggests that (16) locally dominates (17) and, as the first-order conditions are decreasing in the labour demand, it is likely that $L_W^* > L_C^*$. This is consistent with numerical simulations for a range of admissible parameters in our model.[14]

Comparative statics. We now perform a comparative statics analysis on the equilibrium value of the membership ratio for the case of $r < \overline{r}$, i.e., $m^* < 1$. To do so, we differentiate m^* with respect to the parameters of our model (treating n as a continuous variable). By simple inspection of the equilibrium membership ratio (13), the derivative with respect to r and τ is clearly positive. In both cases, profits are unaffected, but the increase in the value of assets dominates the additional cost of extra members. On the contrary, an increase in c only worsens the overall payoff and, as a reaction, membership is reduced.

If the maximum size of the market, a, increases, instead, the model predicts a degeneration of the WCF as the membership ratio decreases. Formally, this happens because L_M does not vary, whereas L_W increases: hence, m^* shrinks. Intuitively, current members face a trade-off. Indeed, the profits to be distributed are higher if the demand increases. However, on the one hand, the current members would not like to share them with more members, as captured by the function $g(L_M)$; on the other hand, more members would strengthen the financial position of the firm. The first effect dominates the second.

If the market size is correlated with firm size, our result rationalizes some evidence about the membership ratio. Indeed, this seems decreasing in the employment size of the WCF. For a sample of WCFs adhering to Legacoop, such a ratio is currently around 60% for small and medium firms, but it falls to about 36% in large WCFs.[15]

[14] Details of this simulations in Mathematica are available upon request.

[15] These percentages are reported in a private communication (e-mail, November 14th, 2023) by Francesco Linguiti, of the Research Area of Legacoop (Rome, Italy). His estimates come from the analysis of a sample of 146 Italian WCFs in 2022, accounting for 12,722 workers and 6,223 working members, where the average membership ratio is around 49%.

The effects of changes in the marginal cost of labour, ω, and in the number of capitalist firms, n, have the same intuitive explanation. In either case, as a response to the fall in profits, the WCF increases its membership to expand the value of its assets.

As long as $\Gamma < \overline{\Gamma}$, the WCF is active and its value does not impact the equilibrium membership. Similarly, also the value of the weight of profits ϕ does not affect the equilibrium membership ratio.

The next proposition summarizes the previous results about degeneration:

Proposition 3 (Degeneration)**.** *The membership ratio m^* is decreasing in a and c.*

Proposition 3 can be meaningfully connected to existing empirical evidence. For example, the Italian industry of welfare services, in which part of the supply is provided by *social cooperatives*, which represent a type of WCF. This is a growing sector, in which the demand is by far dominated by the public sector (low a). Moreover, in such companies c is low because of their small size and small distributed profits (Euricse, 2023, p.19, Table 17). Hence, the marginal cost of increasing membership is likely modest. Indeed, the large majority of workers (72%) are also members in social cooperatives.[16]

Finally, an arguably anecdotal evidence shows that successful WCFs (in terms of our model, $V^* > \omega$) tend to grow and a high value of c apparently induces them to expand the share of non-member workers. This is the case in the Italian facility management sector, as well as in the declining construction one, aligning with the predictions emerging in Ben-Ner (1984) and in Miyazaki (1984), although in fairly different models. However, it is worth noting that in the legislation of some countries (e.g., Italy and Uruguay), fiscal benefits stop holding for WCFs whose membership ratio falls below specific thresholds. Clearly, this penalty may counterbalance the incentive to "degenerate".

6 Concluding remarks

In this paper, we have proposed a new model to describe the behaviour of a workers' cooperative. The main novelties lie in a evidence-backed formulation

[16]These percentages are reported in a private communication (e-mail, October 1st, 2024) by Francesco Linguiti. His estimates come from the analysis of a large sample of Italian WCFs in 2022 (see footnote 15).

of the cooperative objective function and in the endogeneity of membership. We embed its strategic choices within an oligopolistic industry populated also by a number of profit seeking companies.

The analysis of the Cournot-Nash equilibrium of our model reveals that membership matters in driving the properties of the equilibrium itself. Moreover, a careful scrutiny of the membership ratio allows one to envisage which factors may be responsible for a fall in the proportion of non-member workers. We interpret a reduction of the membership ratio as a neat example of "degeneration".

Beyond these new theoretical findings, we also recommend caution when interpreting data on cooperative firms and workers' cooperatives in particular. We indeed provided evidence that the actual weight of the cooperative presence (understood as the ultimate decision maker) in an economic system is greater than the one obtained by simply counting the official direct weight. This is because the transformation of workers' cooperatives into stock companies controlled by cooperatives should be considered as well to obtain a more accurate picture of the overall cooperative magnitude. The degeneration issue, if any, could then be quantified within such a more complete frame.

Our approach can be extended in many direction; we sketch three of them. First, the static nature of the model could be relaxed in order to study the dynamics of the membership and the role of undistributed profits on its evolution. Second, the weight of distributed profits in the objective function of the workers' cooperative firm could also be considered as endogenous. Lastly, our analysis is inherently short-run in nature and it could be of some interest to make also non-labour inputs strategically chosen by the companies. These potentially fruitful extensions are left for future research.

References

Albanese, M. (2020). Social and relational variables in worker cooperatives: Implications for the objective function. *Journal of Entrepreneurial and Organizational Diversity*, 9:26–44.

Ammirato, P. (2018). *The growth of Italian cooperatives: innovation, resilience and social responsibility*. Routledge, New York-London.

Ben-Ner, A. (1984). On the stability of the cooperative type of organization. *Journal of Comparative Economics*, 8(3):247–260.

Bonin, J. P., Jones, D. C., and Putterman, L. (1993). Theoretical and empirical studies of producer cooperatives: will ever the twain meet? *Journal of Economic Literature*, 31(3):1290–1320.

Borzaga, C., Calzaroni, M., Carini, C., and Lori, M. (2019). Structure and performance of italian cooperatives: a quantitative analysis based on combined use of official data. *Journal of Entrepreneurial and Organizational Diversity*, 8(1):65–83.

Burdín, G. and Dean, A. (2009). New evidence on wages and employment in worker cooperatives compared with capitalist firms. *Journal of Comparative Economics*, 37(4):517–533.

Burdín, G. and Dean, A. (2012). Revisiting the objectives of worker-managed firms: An empirical assessment. *Economic Systems*, 36(1):158–171.

Caselli, G. (2020). La Magnitudo Legacoop e i gruppi di impresa. *Unioncamere Emilia-Romagna*, Bologna.

Caselli, G., Costa, M., and Delbono, F. (2022). What do cooperative firms maximize, if at all? Evidence from Emilia-Romagna in the pre-Covid decade. *Annals of Public and Cooperative Economics*, 93:821–847.

Craig, B. and Pencavel, J. (1992). The behavior of worker cooperatives: The plywood companies of the Pacific Northwest. *American Economic Review*, 82:1083–1105.

Craig, B. and Pencavel, J. (1993). The objectives of worker cooperatives. *Journal of Comparative Economics*, 17(2):288–308.

Craig, B., Pencavel, J., Farber, H., and Krueger, A. (1995). Participation and productivity: a comparison of worker cooperatives and conventional firms in the plywood industry. *Brookings Papers on Economic Activity. Microeconomics*, 26:121–174.

De Fraja, G. and Delbono, F. (1990). Game theoretic models of mixed oligopoly. *Journal of Economic Surveys*, 4(1):1–17.

Dean, A. (2019). Do successful worker-managed firms degenerate? *Journal of Comparative Economics*, 47(2):317–329.

Delbono, F., Lanzi, D., and Reggiani, C. (2023). Workers' firm in mixed duopoly. *Economic Modelling*, 122:106247.

Delbono, F. and Reggiani, C. (2013). Cooperative firms and the crisis: evidence from some italian mixed oligopolies. *Annals of Public and Cooperative Economics*, 84(4):383–397.

Delbono, F. and Rossini, G. (1992). Competition policy vs horizontal merger with public, entrepreneurial, and labor-managed firms. *Journal of Comparative Economics*, 16(2):226–240.

Domar, E. D. (1966). The soviet collective farm as a producer cooperative. *American Economic Review*, 56(4):734–757.

Dow, G. K. (1986). Control rights, competitive markets, and the labor management debate. *Journal of Comparative Economics*, 10(1):48–61.

Dow, G. K. (2018). *The labor-managed firm: Theoretical foundations*. Cambridge University Press.

Euricse (2013). World cooperative monitor: Exploring the co-operative economy. https://www.euricse.eu/publications/world-cooperative-monitor-report-2013/. [Last accessed: February 19, 2025].

Euricse (2020). World cooperative monitor: Exploring the co-operative economy. https://www.euricse.eu/publications/world-cooperative-monitor-2020/. [Last accessed: February 19, 2025].

Euricse (2023). La cooperazione in italia, research report n. 031/23. [Last accessed: February 19, 2025].

Hill, R. (2000). The case of the missing organizations: co-operatives and the textbooks. *Journal of Economic Education*, 31(3):281–295.

Jones, D. C. (2018). The economics of participation and employee ownership (peo): an assessment. *Journal of Participation and Employee Ownership*, 1:4–37.

Kahana, N. and Nitzan, S. (1989). More on alternative objectives of labor-managed firms. *Journal of Comparative Economics*, 13(4):527–538.

Kalmi, P. (2007). The disappearance of cooperatives from economics textbooks. *Cambridge Journal of Economics*, 31(4):625–647.

Mikami, K. (2018). Are cooperative firms a less competitive form of business? production efficiency and financial viability of cooperative firms with tradable membership shares. *Economic Systems*, 42(3):487–502.

Mirabel, T. (2021). Past, present and future of empirical research on employee-owned firms: a structured literature review over 1970–2019. *Journal of Participation and Employee Ownership*, 4:1–25.

Miyazaki, H. (1984). On success and dissolution of the labor-managed firm in the capitalist economy. *Journal of Political Economy*, 92(5):909–931.

Mygind, N. and Poulsen, T. (2021). Employee ownership–pros and cons–a review. *Journal of Participation and Employee Ownership*, 4(2):136–173.

Navarra, C. (2016). Employment stabilization inside firms: An empirical investigation of worker cooperatives. *Annals of Public and Cooperative Economics*, 87(4):563–585.

Pencavel, J. (2012). Worker cooperatives and democratic governance. *IZA Discussion Paper 6932*.

Pencavel, J., Pistaferri, L., and Schivardi, F. (2006). Wages, employment, and capital in capitalist and worker-owned firms. *ILR Review*, 60(1):23–44.

Pérotin, V. (2006). Entry, exit, and the business cycle: Are cooperatives different? *Journal of Comparative Economics*, 34(2):295–316.

Podivinsky, J. M. and Stewart, G. (2007). Why is labour-managed firm entry so rare?: An analysis of UK manufacturing data. *Journal of Economic Behavior & Organization*, 63(1):177–192.

Sertel, M. (1982). *Workers and Incentives*. Elsevier North-Holland, Amsterdam.

Sertel, M. R. (1991). Workers' enterprises in imperfect competition. *Journal of Comparative Economics*, 15(4):698–710.

Vanek, J. (1970). *The general theory of labor-managed market economies*. Cornell University Press, Ithaca, NY.

Ward, B. (1958). The firm in Illyria: market syndicalism. *American Economic Review*, 48:566–89.

Zamagni, V. N. (2015). The cooperative movement. In Jones, E. and Pasquino, G., editors, *The Oxford Handbook of Italian Politics*. Oxford University Press.

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