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Stable Producer Co-operatives in Competitive Markets*

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Abstract*:* An argument often adopted to explain the relatively scarce presence of Producer Co-operatives (PCs) in Western capitalist economies is the instability that may affect this type of firm during the positive phases of the business cycle. In a nutshell the argument is that in profitable industries PCs can have an incentive to hire fixed-wage workers to replace the relatively more expensive firm's members. The paper shows that this phenomenon can fail to hold in very competitive and low barrier-to-entry markets in which, potentially, dismissed members have a chance to set up new firms. Furthermore, since some basic results on PC's stability are due to the assumption of an exogenous equilibrium wage as opposed to an endogenous PC's payoff, the paper attempts to remove this assumption. Two main insights are thus provided. Firstly, that workers possess an incentive to set up PCs only under specific circumstances. Secondly, that once PCs enter a market, conditions exist under which they are stable against the temptation to dismiss members to hire fixed-wage workers.

Keywords: Producer Co-operatives, Wages, Self-employment

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1. Introduction

Modern capitalist economies as well as economies in transition are often characterized by a puzzling mixture of large private and public corporations, small-size companies, producer co-operatives and self-employment type of ventures, sometimes coexisting in the same industries. There are, however, sectors in which certain types of firms seem to be particularly at ease. In particular, different forms of Producer Co-operatives (henceforth PCs) and partnerships can usually be found - although not exclusively - in construction, printing, glass-making, woodworking and service industries (for instance in Italy, France and Sweden), in clothing and footwear (in U.K.) and in plywood, reforestation and taxi cab industries (in U.S.). In other cases, these forms of organization appear concentrated in relatively restricted areas, with a diversified range of activities (as, for instance, in Mondragon, Spain).[1] However, in all these cases some common features of the industries in which PCs are clustered exist and seem to be, among the others, low barriers to entry, small size of firm, a rather specific and trained workforce and a relatively high degree of competition. Do these features have something to do with the arguments usually adopted to explain the PCs' (in)stability?

There is an extensive body of literature addressing the reason behind the birth of labour-managed types of organizations.[2] In particular, one element of this of literature concerns the feasibility and stability of democratic forms of enterprise in capitalist markets.[3] The bulk of the instability argument is that, in profitable industries, PCs' members can find convenient to dismiss part of the firm's membership to recruit less expensive fixed-wage workers. However, since the industries in which PCs usually operate appear to be (according to the above mentioned features) vulnerable to competition from new entrants into the market, it seems natural to look at what happens if, when dismissed, every PC's member has the possibility to set up a new firm. Furthermore, as said above, PCs generally occur in an environment in which companies' setup costs are low and employees often possess highly specific skills. These features allow the workers recruited both by PCs and capitalist firms (henceforth CF) alike to possess a concrete outside option during the wage bargaining process. Therefore, the effect of existing workers' outside options should be considered

[1]See Bonin, Jones and Putterman (1993) for a general overview on Producer Co-operatives.
[2]For updated surveys see, for instance, Bonin, Jones and Putterman (1993), Cuomo and Jossa (1996) and Dow and Putterman (1995).
[3]See, among the others, Webb and Webb (1920), Tugan-Baranovskii (1921), Jones (1975,1979), Ben-ner (1984,1988), Myizaki (1988).

in the determination of every industry equilibrium wage. In which case, dropping the usual exogenous wage assumption could help better explain
the mechanism of PC's instability. Since PC's members are usually assumed to compare their remuneration with a given equilibrium wage, ultimately the stability of a PC's membership should be tested against a wage endogenously determined.

The aim of this paper is to include some of the described features in a standard labour-managed firms setup. Two main insights are provided. Firstly, that in an environment in which dismissed members can set up new firms, the PC' s instability does not hold if not under specific conditions, mainly concerning the market demand elasticity. Secondly, that there are particular situations in which workers have an incentive to set up PCs while, under other circumstances, such incentives do not exist. Finally, if a co-operative is profitably formed in such environment, it can be shown to
be stable within a range of market parameters.

The paper uses a simple short-run perfectly competitive model with n firms to present its main results. Extensions to imperfectly competitive market and heterogenous workers setups are possible but, for ease of simplicity, are not presented here. The paper is organized as follows. Section 2 extends the traditional PC' s instability result and introduces the basic idea of the paper. Section 3 describes a simple model of endogenous wage determination from which the main results of the paper are obtained. Section 4 concludes.

2. The PC's instability argument

The traditional Ward's (1958) and Vanek's (1970) per capita value-added objective function assumed for the producer co-operatives is the feature usually thought to make these forms of enterprise unstable under positive profitability. Since a successful PC can profitably acquire new workers in the spot labour market at a given market wage to replace its members, this feature is supposed to yield an iterative process of substitution leading eventually a PC to be owned and managed by just one member and become a capitalist firm.[4]

[4]In some countries PCs are obliged by law to respect a given member-employee ratio according to the "open door" principle. However, this principle is usually not respected by employee-owned firms without a co-operative *status*. Moreover, in several countries legislative reforms have recently weakened the above mentioned constraint. For a survey of the main legislative changes occured in Europe and a theoretical analysis of their consequences, see, for instance, Marini and Zevi (1995, 1996) and Monzon C. & al. (1996).

Ben-ner (1984), for instance, establishes this result in a standard perfect competition and partial equilibrium framework either with fixed or with variable use of capital, also admitting the possibility of an individual members' productivity higher than that of workers hired in the spot labour market.[5]

In a model with uncertainty Miyazaki (1984) generalizes the PC' s instability result, showing that, whenever a CF' s expected profit is positive, the twin PC tends to degenerate into a CF. As a consequence, the only *raison d'etre* of a PC can be an environment in which CFs are expected to become insolvent.[6]

The PC's instability result can easily be described as follows. Suppose a perfectly competitive PC that has optimally recruited a certain number of members m and of fixed-wage workers ℓ to maximize its per member value added:

$$V\left(m^*, \ell^*\right) = \frac{p \cdot y_i\left(m^*, \ell^*\right) - w\ell^* - F}{m^*} \qquad (2.1)$$

where p indicates the market price for a certain commodity, y_i represents the commodity itself produced by every i-th firm $(i = 1,...,n)$ with the use of members and fixed-wage workers, w is a given market wage and F a fixed cost. Now, by dismissing one member and hiring one fixed-wage worker (assumed equally productive) to replace him, each remaining member achieves the following:

$$V\left(m^* - 1, \ell^* + 1\right) = \frac{p \cdot y_i\left(m^* - 1, \ell^* + 1\right) - w\left(\ell^* + 1\right) - F}{\left(m^* - 1\right)} \qquad (2.2)$$

By straightforward manipulations of (2.2) the following result ensues:

$$V\left(m^* - 1, \ell^* + 1\right) = V\left(m^*, \ell^*\right) + \frac{V\left(m^*, \ell^*\right) - w}{\left(m^* - 1\right)} \qquad (2.3)$$

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[5]In Ben-ner' s framework the only possible exception to this result occurs when there is a "network externality" among PC's members. This makes unprofitable to break the network of members to exchange inexpensive wage-labourers with expensive PC's members. Obviously, such an exception specifically depends upon the form assumed by the network externality.

[6]This is contained in Miyazaki (1984), proposition 1, p.917. The author also extends his analysis to include the possibility of both an incomplete insurance and an imperfect capital market.

It is obvious from expression (2.3) that the member-reducing strategy is convenient as long as $V\left(m^*,\ell^*\right)-w>0$, that is, the value added of each member is higher than the current market wage *w*. Furthermore, since $V\left(m^*,\ell^*\right)=w+\frac{\pi}{m^*}$, where π represents every CF' s profit, it turns out that as long as every CF is profitable, $V > w$ and every PC is unstable against the above mentioned process of members' substitution.

However, usually this argument does not take into account the behaviour of a member after his dismissal. In fact, in an environment in which the people associated with a PC have developed an entrepreneurial skill and barriers to entry are relatively low, a dismissed member may have the opportunity to set up a new firm either as entrepreneur, self-employed or member of a newly created PC, rather than be unemployed. In which case, every PC's payoff should include such a new entrant effect, even when just one member has been dismissed.

Two comparative statics exercises can be performed as a consequence of this observation. In the first it can be assumed that, although the dismissed member sets up a new firm in the same industry, the subsequent market price change does not affect the levels of m^* and ℓ^* optimally decided by the PC before the new firm's entry. Hence, the substitution of one member with one fixed-wage worker affects every remaining member' s payoff as follows:

$$V\left(m^*-1,\ell^*+1\right)=\frac{p\left(Y^*(n+1)\right)\cdot y_i\left(m^*-1,\ell^*+1\right)-w\left(\ell^*+1\right)-F}{\left(m^*-1\right)} \qquad (2.4)$$

where $p\left(Y^*(n+1)\right)$ is the market clearing price when a new firm has entered the market. Expression (2.4) can easily be rewritten as:

$$V\left(m^*-1,\ell^*+1\right)=V\left(m^*,\ell^*\right)+\frac{V\left(m^*,\ell^*\right)+\left(\Delta R(n)/\Delta n\right)-w}{\left(m^*-1\right)} \qquad (2.5)$$

where $\Delta R(n)/\Delta n$ represents the change in the firm's equilibrium revenue as due to the new firm's entry in the industry.[7]

In this case, even under positive profitability of a twin CF, the usual PC' s instability does not necessarily arise. In general, in a market with *n* identical (PC) firms, a change in the firm's equilibrium revenue as due to the entry of new firms can be expressed as:

$$\frac{dR(n)}{dn} = \frac{dP\left(Y^*(n)\right)}{dY} \cdot \frac{dY}{dn} \cdot y_i^* + P\left(Y^*(n)\right) \cdot \frac{dy_i^*}{dn} = \frac{dY}{dn} \cdot \frac{P\left(Y^*(n)\right)}{n} \cdot \left(1 - \frac{1}{\eta}\right) \qquad (2.6)$$

where η indicates the industry demand elasticity. Expression (2.6) shows that if the industry demand elasticity is (in absolute value) less than 1, new firms' entry, by decreasing the price, reduce as well the revenue of every PC in the market. Furthermore, the lower the number of firms in the market, the stronger will be the negative entry effect of a dismissed member on every PC's revenue and consequently more unlikely will be the phenomenon of PC members' substitution. More precisely, for a member's dismissal to be surely profitable, it must be that, for $\eta < 1$:

$$V\left(m^*, \ell^*\right) + \left(\Delta R(n)/\Delta n\right) - w > 0 \qquad (2.7)$$

It is easy to see that, for $\left(\Delta R(n)/\Delta n\right) < 0$ the condition above may fail to hold also for $V > w$.

A second comparative statics exercise can be performed by taking into account the whole change caused by the replacement of one member with one fixed worker. After this happens, every PC's payoff can be expressed as:

$$V\left(m^*(n+1), \ell^*(n+1)\right) = \frac{p\left(Y^*(n+1)\right) \cdot y_i\left(m^*(n+1), \ell^*(n+1)\right) - w\ell^*(n+1) - F}{\left(m^*(n+1)\right)} \qquad (2.8)$$

[7] A market price reduction has traditionally the effect on existing PCs to decrease ℓ^* and increase m^*. However, expression (2.5) implies an out-of equilibrium reduction of 1unit for m^* and a rise of 1 unit for ℓ^*,with obviuosly no effect on $y_i\left(m^*, \ell^*\right)$.

where respectively $m^*(n+1)$ and $\ell^*(n+1)$ represent the new equilibrium number of members and workers after the firm's entry. The following example shows that expression (2.8) can be lower than the original payoff $V(m^*, \ell^*)$ even for $\eta \geq 1$.

Example 1. *Let the inverse market demand function be isoelastic and equal to* $P(Y) = A \cdot Y^{-\eta}$, *where* $Y = \sum_{i=1}^{n} y_i$, *and* y_i *is the quantity of each identical PC in the market. For each PC let the production function be a modified Leontief equal to* $y_i = \min\left\{\sqrt{\frac{m}{\alpha}}, \sqrt{\frac{\ell}{\beta}}\right\}$, *where* α *and* β *are parameters belonging to the interval* $(0,1)$. *In this example, by assuming* $\eta = 1$, *it can be obtained:*

$$V\left(m^*(n), \ell^*(n)\right) = \frac{A^3 - A^2 Fn}{\alpha n^5 F^2} \tag{2.9}$$

and

$$V\left(m^*(n+1), \ell^*(n+1)\right) = \frac{A^3 - A^2 F(n+1)}{\alpha (n+1)^5 F^2} \tag{2.10}$$

A comparison of expressions (2.9) and (2.10) shows that for existing PCs it is never convenient to exchange members with fixed-wage workers. This depends on the behaviour of a dismissed member that, by setting up a new firm, reduces the market price, rises every PC's equilibrium quantity (with an unmodified revenue, since $\eta = 1$*) hence changing m and* ℓ *in a given proportion (due to the Leontief's type of production function) with a final negative effect on every PC's payoff.*

The next proposition generalizes the instability result under the entry threat of a dismissed member.

Proposition 1. *Under a given market wage for workers, sufficient conditions for every PC to conveniently dismiss a member and hire a fixed wage-earner are, for* $\eta \leq 1$, *that:*

$$\left[R^*(n+1) - w\ell^*(n+1) - F\right] \cdot m^*(n) > \left[R^*(n) - w\ell^*(n) - F\right] \cdot m^*(n+1)$$

and, for $\eta > 1$, *that:*

$$R^*(n+1)\cdot m^*(n) > R^*(n)\cdot m^*(n+1).$$

Proof. This simply follows by straightforward manipulations of expressions (2.1) and (2.8). □

The proposition shows that, under the threat of a new firm's entry, the instability of a PC is not granted anymore. The argument does not apply to the case of members' retirement, in which usually there is not formation of new firms. Similarly, high barriers to entry in the market and high individual members' risk aversion, by reducing the chance of the creation of new companies, also weaken the relevance of the argument. Perhaps thus, it is not so casual that usually PCs populate industries characterized by significantly high skilled workforce (with an easily transferable human capital) and low entry barriers.

3. Endogenous wage and firm stability

It has been stressed that "the different choices of labour, and therefore output in the short run (between a PC and a CF), are attributable to the different decision-making problems used to represent the two organizational forms, i.e., the wage is exogenous to the CF but endogenous and higher in the PC." (Bonin, Jones and Putterman 1993, pp.1298). The analysis presented in this section seeks to remove the above asymmetric treatment adopted for CF workers and PC members' compensation, so as to make both endogenous. If a PC has to be judged for its stability, why should not the same criteria apply to a CF? In a highly competitive industry there might be reasons why very low wages are not sustainable by the existing CFs. Were the current wage lower than every worker's outside option, employees would start leaving their workplace and set up new firms either as entrepreneurs, self-employed or members of new PCs. By taking this point of view, an endogenous equilibrium wage for a given industry (a wage for which a CF is stable) can be described. As a result, it is under this equilibrium wage that PC' s birth and stability has to be tested against alternative forms of organization.

This section models a standard market with *n*-profit maximizing capitalistic firms in which every identical firm produces a homogeneous good *y* with the use of labour and a given setup cost.[8] The

[8]It may well be possible to start with a mixed market in which a certain number of CFs and PCs coexist togheter. However, a logical objection would be: why have PCs been created if they are not stable? Since the main paper concern

basic feature of the model that drives its particular results is given by the nature of workers' entrepreneurial skill and by the firm-worker relationship. What is basically assumed is that, once recruited as employees by a firm, workers acquire a specific skill (for instance a certain knowledge on how to organize the production) that *potentially* enables them to set up new production units through the same or another organizational form. The common knowledge of this possibility gives rise to a *concrete* outside option for every firm's employee. This outside option is taken into account by every firm's owner when fixing the wage. The employees' exit and the consequent creation of new firms can in fact lower existing firms' profitability. Under these circumstances, a PC can be set up by a group of workers only when the newly created PC's expected value added is at least equal to the equilibrium workers' remuneration, endogenously determined within the industry. Moreover, for a new PC to be a stable form of organization, its payoff has to be stable against a process of further members' dismissal and creation of new firms in the market.

3.1 The equilibrium wage in a capitalistic industry

Let us assume *n* profitable capitalist firms exist in a given product market. After bearing a given fixed cost let every firm need a certain quantity of labour to produce just one commodity. A first observation concerns the decision of every CF to pay its workers a certain equilibrium wage. A first assumption simplifies every CF' s decision on this matter. The assumption states that, under positive profitability, an existing CF will always find convenient to pay the resulting endogenous equilibrium wage rather than let each employee leave and set up a new firm.

Assumption 1. *Under every firm's profitability, i.e.,* $\pi_i^* \geq v$*, where v is a given minimum reservation wage for every agent in the economy, the following expression holds true:*[9]

$$\pi_i^*\left(w^*(n), n\right) \geq \pi_i^*\left(w^*(n+1), n+1\right) \tag{3.1}$$

where respectively $\pi_i^*\left(w^*(n), n\right)$ *indicates every CF' s profit at the given equilibrium wage when n firms are competing in the market and* $\pi_i^*\left(w^*(n+1), n+1\right)$ *is that profit after one more firm has entered the market (also affecting the equilibrium wage).*

The Appendix shows the precise conditions ensuring assumption 1 to hold. However, assumption 1 seems a natural condition for a market in which some CFs operate. Did the assumption not hold,

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is precisely the PCs' stability, it seems more reasonable to start with a given number of CFs in the market in order to check if room potentially exists for the subsequent formation and survival of PCs.

existing firms would find profitable to let their hired workers leave the firm and set up new companies, in order to reduce the equilibrium wage, until condition (3.1) would again hold true.

When condition (3.1) holds, every CF will always try to retain its employees through the payment of the equilibrium wage. The conditions needed to obtain the equilibrium wage (a wage that enables every CF to keep its employees within the firm) can be represented as follows:

$$w(n) \geq P\left(Y^*(n+1)\right)y^*_{CF}(n+1) - w(n+1)\ell^*_{CF}(n+1) - F \tag{3.2}$$

$$w(n) \geq v + \frac{P\left(Y^*(n+1)\right)y^*_{PC}(n+1) - F}{\ell^*_{PC}(n+1)} \tag{3.3}$$

$$w(n) \geq P\left(Y^*(n+1)\right)y^*_{SE}(n+1) - F \tag{3.4}$$

where respectively $y^*_{CF}(n+1)$ and $\ell^*_{CF}(n+1)$ indicate the quantity of good and the number of workers optimally selected by a newly set up capitalist firm, $y^*_{PC}(n+1)$ and $\ell^*_{PC}(n+1)$ the quantity and the workers chosen by a new entrant producer co-operative and $y^*_{SE}(n+1)$ is the output decided by a new entrant self-employed. As long as the wage respects the above conditions, none of the hired workers will find convenient to set up new firms as entrepreneurs (3.2), PC's members (3.3) or self-employed (3.4).

Notice that in each condition above, every CF, whose employees have the option to leave, is assumed to recruit one or a group of unemployed to replace them. This implies that a pool of unemployed workers exists in equilibrium, even if, when not hired by a firm, their outside option is just equal to v.[10] Denoting the wage obtained by solving expressions (3.2), (3.3) and (3.4) respectively as w_I, w_{II} and w_{III} the next definition simply illustrates the fact that, in the above framework, the equilibrium wage needs to respect four basic conditions.

Definition 1. *For each number n of CFs initially existing in the market, the equilibrium wage paid by every firm must respect the following conditions:*

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[9]This reservation wage can be nornalized to zero. We assume here, for the sake of the following examples, that $v > 0$.

[10]The existence of a group of unemployed workers can be made endogenous whenever $w^*(n) > v$, where v is a given reservation wage of the economy. Furthermore, every entrepreneur is assumed to behave *à la* Nash, in the sense that

$$\frac{p\left(Y^*(n)\right)y^*_{CF}(n)-F}{\left(1+\ell^*_{CF}(n)\right)} \geq w^*(n) \geq \max\left\{w_I, w_{II}, w_{III}\right\} \geq v \qquad (3.5)$$

Explanation. From assumption 1 it follows that, as long as $\pi_i^* \geq v$, each firm will find convenient to pay the current equilibrium wage. This wage must respect the first RHS of expression (3.5), otherwise every employee, given the other employees' behaviour, will start leaving the firm. The LHS of (3.5) simply ensures that every CF's entrepreneur never prefers to become employee. Finally, for the workers to participate in production, the equilibrium wage must never be lower than the reservation wage *v* payable in the economy.

3.2 Birth and stability of a PC

A direct consequence of the simple definition introduced above is that, as long as the equilibrium industry wage respects all the stability conditions, PCs can be formed only under particular circumstances. These are expressed in the next proposition.

Proposition 2. *Under the industry equilibrium wage* $w^*(n)$*, all existing active workers are indifferent between being members of a new PC and being employees of an existing CF only if the following condition holds:*

$$w^*(n) = w_{II} \geq \max\left\{w_I, w_{II}\right\} \qquad (3.6)$$

When, conversely, $w^*(n) = w_I > w_{II}$ *or* $w^*(n) = w_{III} > w_{II}$*, every worker will prefer to be employee, entrepreneur of a CF or self-employed rather than form a new PC.*

Proof. (Self evident) In all subcases included in expression (3.6) workers are indifferent between being employed in a CF or being members of a newly created PC. Thus, their choice will mainly depend upon their personal preferences. When, conversely, $w^*(n) = w_I > w_{II}$,, workers will be indifferent between being entrepreneurs in a new CF (using unemployed workers paid their current equilibrium wage $w^*(n+1)$), and being employees for an existing CF. However, since $w^*(n) > w_{II}$, no worker or group of workers will have incentives to set up a PC. The same situation arises (with the self-employment option) when $w^*(n) = w_{III} > w_{II}$.. Finally, since unemployed workers do not

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any other' s strategy (for instance which of the other recruited workers) is taken as given during the negotiation with

possess the specific knowledge required to set up a firm, their only possibility is to be inactive, obtaining the reservation wage *v* (represented, for instance, by a public subsidy). □

The above proposition describes a market in which employees' threat to leave their firm and become direct competitors affects their final equilibrium wage. This framework can suitably describe only those industries in which existing firms require both highly trained workers and relatively low setup costs to produce a commodity. The next example constitutes a specific application of the results of proposition 2.

Example 2. *Suppose, as before, an inverse market demand function isoelastic and equal to* $P(Y) = A \cdot Y^{-\eta}$, *with* $\eta = 1$. *Furthermore, let each CF's production function be* $y_i = \sqrt{\ell}$, *and let F be a fixed cost required to start the production. By condition (3.6) included in definition 1, the equilibrium wage must respect the following condition:*

$$w_{IV} \geq w^*(n) \geq \max\{w_I, w_{II}, w_{III}\} \geq v$$

where $w_{IV} = \dfrac{p\left(Y^*(n)\right) y^*_{CF}(n) - F}{\left(1 + \ell^*_{CF}(n)\right)}$. *By straightforward calculations, the following expressions ensue:*

$$w_I = \frac{A}{2(n+1)} - F \tag{3.7}$$

$$w_{II} = \frac{v}{2AFn - \dfrac{1}{n} - 1} \tag{3.8}$$

$$w_{III} = \sqrt{\frac{A - F(n+1) + \sqrt{A^2 - 2AF(n+1) + F^2}}{(2+n)}} \tag{3.9}$$

$$w_{IV} = \frac{A}{2n} - F \tag{3.10}$$

In figure below, these values are plotted against different number of CFs assumed to exist in the market. It can be noticed that, for n = 16, $w_{IV} > w_{II} \geq w_{III} > w_I$. *Hence, given this initial number of*

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every employee. For a complete description of the game, see Marini (1997).

firms, it ensues by definition 1 that $w^*(n) = w_{II} \geq w_{III}$, *and, by proposition 2, that existing employees have incentives to form PCs whenever, for this level of earnings, they prefer to be PC's members than employees for a CF.*

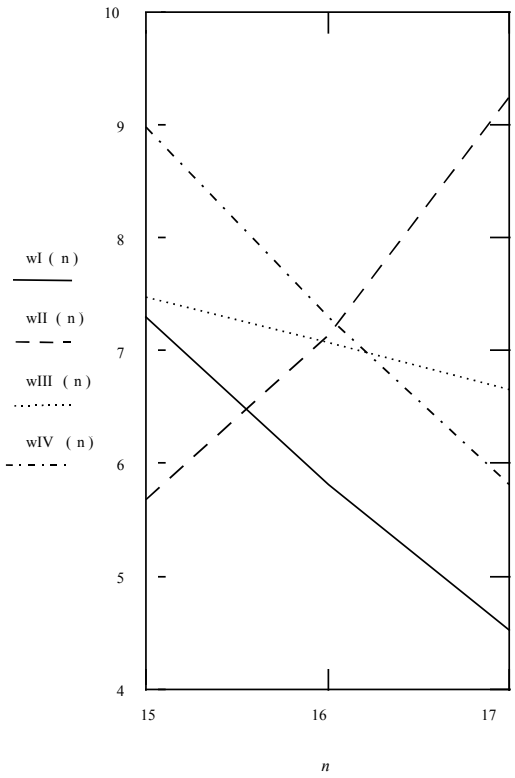

Fig. 3.1 - Levels of the different workers' outside options for n = 15,..17 (A = 800, v = 1, F = 17.5)

Figure 3.1 shows that w_{II} (the PC's type of outside option) is the only outside option increasing with the number of CFs supposed to exist in the market. The reason is that PCs react to a price reduction (due to the higher number of firms) with an increase in the number of members and, hence, with a rise in the output. In the above example, with unitary elasticity, this effect always rises every PC's payoff.

We can now turn to the stability of every newly formed PC. In a framework like the one described above, when a PC is set up it can also be proved to be stable against the subsequent process of substitution of members with spot labour market workers in the
sense of Ben-ner (1988) and Myizaki (1988). In fact, although at a first glance it may look profitable to exchange existing members with unemployed workers, once trained, the newly recruited workers have to be paid the current equilibrium wage. That a newly formed PC can be stable, however, needs to be proved. This is done in the next proposition.

Proposition 3. *When new PCs are set up by trained workers leaving an existing CF, they are always stable against the temptation to reduce their membership through the recruitment of available unemployed workers as long as the market elasticity,* $\eta \leq 1$. *When, conversely,* $\eta > 1$, *PC's stability is guaranteed only under specific conditions.*

Proof. Proposition 2 showed that new PCs can only be formed under condition (3.6). Thus, if an unemployed worker is hired by a newly created PC to substitute a member, this worker will become trained and will threaten to leave unless paid the new equilibrium wage. By the results of the model, this wage will be greater or equal to $w_{II}(n+1)$. Thus, to decide whether or not a PC is stable against the process of members' dismissal, it has to be checked that:

$$\frac{P\left(Y^*(n+2)\right)y^*{}_{PC}(n+2) - w_{II}(n+1) - F}{m^*(n+2)} \leq \frac{P\left(Y^*(n+1)\right)y^*{}_{PC}(n+1) - F}{m^*(n+1)} \tag{3.11}$$

When $\eta \leq 1$, it follows that, in terms of revenue, $R^*_{PC}(n+2) \leq R^*_{PC}(n+1)$. Moreover, in general, $m^*(n+2) > m^*(n+1)$. Hence, for $\eta \leq 1$, expression (3.11) holds with strict inequality even for $w_{II}(n+1) = 0$, so that PC's stability is always ensured as a result. When $\eta > 1$, in order to undermine every PC's stability, the rise in revenue due to every member's substitution must prevail over a sum of negative effects. Specifically, straightforward manipulations show that PC's stability is preserved as long as:

$$\left[R^*_{PC}(n+2) - w_{II}(n+1) - F\right] \cdot m^*(n+1) \leq \left[R^*_{PC}(n+1) - F\right] \cdot m^*(n+2) \tag{3.12}$$

Thus, under the existing equilibrium wage, if new recruited workers are not more productive than existing members, it turns out that only under specific conditions (that represented in expression (3.12)) PCs do not find profitable to substitute members with fixed-wage workers. □

In example 2, since $\eta = 1$, it can be checked that, $R^*_{PC}(n+2) = R^*_{PC}(n+1)$, and, since in general $P\left(Y^*(n+2)\right) < P\left(Y^*(n+1)\right)$, it ensues that:

$$m^*(n+2) = \left(y^*_{PC}(n+2)\right)^2 = \left(\frac{2F}{p\left(Y^*(n+2)\right)}\right)^2 > m^*(n+1) = \left(y^*_{PC}(n+1)\right)^2 = \left(\frac{2F}{p\left(Y^*(n+1)\right)}\right)^2$$

Hence, condition (3.11) is always respected with strict inequality sign.

In general, proposition 3 helps to see that, in a given industry, the presence of an endogenous equilibrium wage makes PCs more robust against the instability process than in presence of a given wage.

3.3 Other forms of instability: an example

The model presented above has described a situation in which, once workers become trained and ready to set up new companies, a certain equilibrium wage can endogenously be obtained. However, when a change takes place in the existing market conditions, it may well be possible that other forms of PCs' instability enter the scene. The next example describes a situation in which an exogenous shock in the market demand gives rise to a switch in the equilibrium wage from w_{II} to w_{III}. When this happens, the newly created PC' s members can suddenly find convenient either to become employees for existing CFs (with the further advantage for CFs to get rid of some of the existing PCs and hence reduce the market competition), or, alternatively, to become self-employed. This is just one example of instability usually not considered in the traditional models of labour-managed firms.

Example 3. *Adopting the same model specification introduced above, let A, the market demand size parameter, be subjected to an exogenous shock. The figure below depicts the effects of an increase in A, from A = 860 to A' = 920, for a given number of existing firms (n = 15) and for certain values of parameters (F = 17.5, v = 2.5). The figure shows that, as long as* $860 \leq A \leq 865$*, the equilibrium wage* $w^*(n)$ *is equal to* w_{II} *and the entry of new PCs in the market is viable. However, a small change in A (such to make A > 865) makes incumbent PCs potentially unstable. Under the new value of A, the equilibrium wage becomes equal either to* w_{III} *or* w_I *and hence now PCs' members find attractive either to be hired as employee by existing CFs or to set up new units of production respectively as self-employees or entrepreneurs.*

That represented is just one of the possible forms of instability that a PC can suffer during its life-cycle. Similar examples can certainly be found, showing that, even in a very simple setup, the economics of companies institutional changes is indeed a very complex matter.

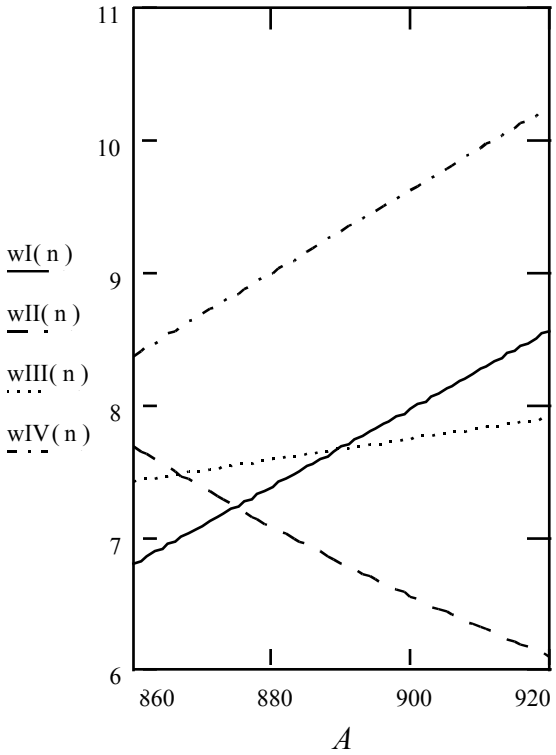

Fig. 3.2 - Levels of workers' outside options
for A = 860, ..., 920 (n =15, v = 2.5, F = 18.5)

4. Concluding Remarks

The paper has shown that the usual argument for Producer Co-operatives' instability may not hold if an active (rather than passive) behaviour is assumed on the part of every member after their dismissal. Whether this is a reasonable description of a member' s behaviour is probably dependant on the specific context in which a firm is assumed to sell its product. In markets characterized by low entry barriers and a highly skilled workforce, dismissed members are probably able to set up new production units rather than be inactive. If this is the case, the traditional conclusions on Producer Co-operatives's instability have to be corrected and further analysis is needed to draw conclusive results on the general robustness of this form of enterprise. Moreover, since labour-managed forms of organization are often observed in markets characterized by a highly skilled workforce, low entry barriers and high potential competition (e.g., in fisheries, potteries or services

industries), assuming an endogenously determined workers' compensation does not seem too unrealistic for these markets. The paper has shown that, under such circumstances, Producer Co-operatives' instability is even less likely to arise. However, other sources of instability then become possible. Particular instances of instability can occur as a consequence of exogenous shocks that, by changing the current equilibrium wage, may undermine the internal stability of newly formed Producer Co-operatives.

5. Appendix

This appendix describes the general conditions under which Assumption 1 holds true.

A.1. *Under every firm's profitability, i.e.,* $\pi_i^* \geq v$*, where v is a given minimum reservation wage for every agent in the economy, the following expression holds true:*

$$\pi_i^*\left(w^*(n), n\right) \geq \pi_i^*\left(w^*(n+1), n+1\right) \qquad (A.1).$$

Three cases can be considered, in correspondence of the three possible equiliblibrium wages, w_I, w_{II} and w_{III}. When the best current workers' outside option is w_I (to be entrepreneurs), assumption A.1 can be rewritten as:

$$R^*(n) - 2\left[R^*(n+1) - R^*(n+2) + R^*(n+3) - R^*(n+4) + \ldots + R^*(n+k-2) - R^*(n+k-1)\right] - F \geq 0$$

where k represents, given F, the number of firms that makes $\pi^*(n+k) = v$ for each identical i-th firm. Hence, if $\eta \leq 0$, the succession within brackets above is less or equal to zero and A.1 is always respected. Conversely, when $\eta > 0$, in order A.1 to hold, the following expression must be respected:

$$R^*(n) - F \geq 2 \cdot \sum_{j=1}^{k-1} (-1)^{j+1} \cdot R(n+j)$$

that is likely to be respected just for markets near the minimum profitability v.

When, conversely, the best current workers' outside option is w_{II} (to be member of a new PC), straightforward manipulations show that the relevant condition for A.1 to be respected becomes:

$$R^*(n) - R^*(n+1) \geq V^*(n+1) - V^*(n+2)$$

that usually should hold true.

Finally, when w_{III} is the equilibrium wage, A.1 is ensured when:

$$R^*(n) - R^*(n+1) \geq {R_{SE}}^*(n+1) - {R_{SE}}^*(n+2)$$

where ${R_{SE}}^*(\cdot)$ indicates the revenue of a self-employed. Also this condition should hold whenever the entry of a new firm affects the revenue of a CF more than that of a (usually smaller) self-

employed venture. Moreover, as noted above, when A.1 does not hold, this type of instability will be adjusted through the entry of new ventures in the market.

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