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The accumulation of Capital in Labour-Managed Firms: Divisible Reserves and Bonds

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Abstract

The problem of the accumulation of capital in labor-managed firms and worker cooperatives has being attracting considerable attention among researchers. The Furubotn-Pejovich effect is considered to be the source of undercapitalization. The paper seeks to show that the presence of undercapitalization is due to a specific form of reinvestment, i.e. the reinvestment of self-financed capital funds in indivisible reserves. The introduction of divisible reserves appropriable by worker-members at some point in time would be a valid measure with which to counteract the horizon problem and undercapitalization. However, in the formulation given to it by this paper, it engenders less widely-explored problems connected with the way in which net surpluses are distributed and reinvested, and with the reimbursement of individual capital quotas. When divisible reserves are present, cooperative bonds can be introduced to deal with the shortcomings due to capital variability and allow a better match to be achieved between the members' and the firm's objectives. Members can cash in their individual capital stake by selling it, while the firm does not immediately have to reimburse members' quotas. However, the creation of a market for cooperative bonds is likely to generate risks of its own that again must be tackled appropriately. A minimum level of indivisible reserves will still be needed in order to stabilize the capital structure of the firm. The quota of the firm capital saleable in the form of cooperative bonds should be restricted. The sum of divisible reserves owned by incumbent members, and of indivisible reserves owned by the cooperative, should constitute a substantial part of its capital. Finally, a hierarchy of liabilities is required which prioritizes the reimbursement of debts owned by parties who undergo information disadvantages.

Key words: undercapitalization, net residual, divisible reserves, cooperative bonds, hierarchy of liabilities.

JEL classification: G31, J54, P51

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1. Introduction

The problem of the accumulation of capital in labor-managed firms[1] (LMFs hereafter) has been widely studied in the specialized literature. Worker-members in LMFs have a truncated temporal horizon of permanence in the firm. When self-financed funds invested in the firm cannot be recouped on quitting the organization, members will anticipate the unrecoverability in their choices by reducing self-financed investments to an inefficient level. Most scholars tend to recognize the existence of a tendency to underinvestment. However, not all authors agree on the matter, and some prefer to treat it as substantially irrelevant. At the empirical level it is difficult to isolate the effects of the institutional variables responsible for the existence of underinvestment, though some empirical tests partially support the hypothesis of undercapitalization. The main institutional variables are identified as being property rights, but also the governance of the organization. Other variables, such as the tax system, may have distorting effects on the basic institutional mechanisms.

This paper states the problem of underinvestment in LMFs as it was initially formulated by Furubotn and Pejovich and by Vanek in 1970. Starting from explanation of the reasons for the suspicion that capital funds are misallocated in LMFs, it surveys some noteworthy empirical tests and then focuses on institutional factors responsible for the problem of undercapitalization, and on possible solutions.

The focus is on the basic mechanisms regulating the introduction of divisible reserves. This institutional device is considered to be a solution to the problem of the truncated temporal horizon, since members would recoup individually invested quotas of capita at some point in time. The introduction of divisible reserves also has important positive potential because it engenders higher worker involvement at the financial level. In the version of divisible reserves advocated by the paper, labor remuneration would be increased by shares of the net residuals, and workers would receive a larger part of the value added of the firm. However, divisible reserves have critical aspects that need to be considered carefully. They concern the

[1] Meade (1972, p. 402) defines labor-managed firms as follows: "… a system in which workers get together and form collectives or partnerships to run firms; they hire capital and purchase other inputs and they sell the products of the firm at the best prices they can obtain in the market for inputs and outputs; they themselves bear the risk of any unexpected gain or loss and distribute the resulting surplus among themselves, all workers of any one given grade or skill receiving an equal share of the surplus; their basic objective is assumed to be to maximize the return per worker… the workers may be hiring their capital resources either in a competitive capital market fed by private earnings or else from a central governmental organization which lends out the State's capital resources at rentals which will clear the market".

mechanisms for distribution of the net residuals, the capitalization on individual shares of net residuals, and the mechanisms regulating the reimbursement of individual capital quotas. Various asymmetries between labor-managed firms and capitalistic firms will be highlighted in order to show the distinctive nature of the distribution of value added and the accumulation of capital in LMFs.

Cooperative bonds, in the version of them presented in this paper, constitute a further device with which to improve a firm's ability to manage the self-financed accumulation of capital and the reimbursement of individual capital quotas invested in the firm. If quitting members have the right to sell their quotas on regulated markets, the firm will no longer be forced to pay back short after the members' departure. A first risk connected with the introduction of saleable bonds is the transformation of a conspicuous part of the firm's capital into debt held by external financiers. A second risk is the strategic behavior of better-informed members, who may leave the organization when negative economic prospects are forthcoming. In order to curb the risks deriving from the separation between ownership and control, and from strategic quitting, various conditions for the firm's financial stability are likely to be needed.

The organization of the paper is as follows. Section 2 highlights the roots of the phenomenon of underinvestment and undercapitalization in worker cooperatives.[2] Section 3 introduces the question of how divisible reserves should be structured starting from their institutional underpinnings. Section 4 endeavors to furnish a more precise institutional proposal concerning the introduction of bonds in LMFs. Section 5 concludes.

2 Members' temporal horizon in labor-managed firms

Since the studies by Furubotn and Pejovich (1970) and Vanek (1970, 1975), the literature on LMFs has devoted considerable attention to the problem of capital accumulation. The focus has been on the existence of a truncated temporal horizon for worker-members in LMFs as a source of the inefficient allocation of self-financed investment funds.

[2] For the sake of simplicity, the terms (worker) cooperative and LMF (labor-managed firm) will be used interchangeably, although the former term is more commonly found in the empirical literature, whilst the latter is more widespread in the theoretical literature.

Furubotn and Pejovich (1970)[3] consider a model of LMF that can be termed 'socialist' (Horvat, 1984) in that capital assets are assumed? to be publicly owned, i.e. worker members are not allowed privately to appropriate the net residuals reinvested in the firm, although the firm manages their utilization. Members can only benefit from distributed returns on investments taking the form of labor income. Hence, the system is defined as a kind of *usufruct* of socially owned capital assets, and is considered to accumulate self-financed capital by means of indivisible reserves. Firms are financed by two main means: bank loans, and self-finance through reinvested net residuals.

Worker-members of cooperatives receive an ordinary income (wage) from the firm's proceeds, and can use their savings to make two kinds of investment decision. The first is an investment in non-owned assets consisting of the cooperative's profits. The second is an investment in owned assets which workers can finance out of distributed labor income (wages) and save on individual bank accounts. The former type of investment is not redeemable and does not yield an individual return to members, while the second can be recouped and yields fixed returns. Hence, workers are induced to compare the returns on the two types of asset at the margin.

Assuming that all workers have the same preferences concerning investment projects and that they all expect to remain in the firm for the same amount of time, the following formula can be used to calculate the returns on each type of investment necessary to make workers indifferent between them:

$$PV_{LMF} = a_{LMF} \sum_{t=1}^{T} \frac{1}{(1+i)^t} = 1 \qquad (1)$$

[3] As is well known, the two authors referred to the former Yugoslav system. See also Pejovich (1990) and Furubotn (1976, 1978, 1980a, 1980b). Among other papers that address the problem of under-capitalization in LMFs from a theoretical point of view, those by by Zafiris (1982) and Bonin (1985) are worth mentioning. The book by Jossa and Cuomo (1997) and Jossa (1999) is a good survey of the literature and gives a comprehensive and detailed exposition of the theoretical aspects, as does Dow (2003), who advocates the introduction of a market for membership rights.

where PV_{LMF} is the present value of the self-financed investment owned by the cooperative, a_{LMF} is the return yield by the investment in one period of time: this represents the rate of indifference between investments in owned and non-owned assets a_{LMF} (the *hurdle rate*), since when it is too low and PV_{LMF} is lower than 1, workers will prefer investments in owned assets. T[4] is the members' temporal horizon, which is identified with the temporal horizon of the median members when preferences are heterogeneous, *i* is the rate of time preference which equals the interest rate paid by bank deposits at equilibrium. In the case of a 1 dollar investment, *a* is equal to the internal rate of return gross of depreciation. If the investment is to be undertaken, its present value needs to equal its initial value (1 in our example).

The same results are obtained by calculating the sum in (1):

$$a_{LMF} = \frac{i}{1-(1+i)^{-T}} \qquad (2)$$

Formula (2) shows that a_{LMF} is always greater than *i* and approaches *i* as the members' temporal horizon increases and tends to infinity (which obviously cannot be the case). LMFs instead tend to select only the projects with the highest returns down to the hurdle rate. Investments in productive assets are positive, but the system allocates investment funds inefficiently because Pareto-superior allocations are still available. In this respect LMFs are Pareto-dominated by capital-managed firms (CMFs below) because share ownership in CMFs guarantees the acquisition of returns arising out of self-financed investments virtually *ad infinitum,* i.e. without any temporal horizon throughout the duration of the firm itself. At equilibrium, CMFs select all the investment projects which yield a return superior or equal

[4] T is an intrinsically uncertain variable. It can be considered dependent on individual preferences and the external economic environment. For example, the alternative job opportunities available to worker-members tend to shorten T, and this is likely to increase time horizon problems for LMFs working in a dynamic economic environment. It may explain why LMFs are particularly rare in systems characterized by tough competition and strong labor marker flexibility, such as the United States and the United Kingdom. On the other hand, investments in human capital specific to a certain firm will tend to extend T since workers that have accumulated firm-specific human capital will have difficulties in finding comparable job opportunities in other firms and their competencies will gain in economic value for the firm itself.

(where equality is obtained for the marginal investment) to the market interest rate. CMFs extract all the possible rents accruing to the firm's operation and have an incentive to do so by using their own funds. Total returns on productive assets in LMFs will be lower than the socially optimal returns obtainable by CMFs.

The limited convenience to LMFs of reinvesting their profits may be balanced by access to external financial support in the form of bank loans. However, the comparative disadvantage with respect to CMFs can never be eliminated because limited self-financing implies a reduced capacity to build equity and collateral (Vanek, 1970). LMFs will suffer two disadvantages: the first due to their unwillingness to reinvest their net revenues in the firm; the second due to their limited ability to guarantee loans.

Although some authors (Horvat, 1986a, 1986b) have preferred not to recognize the significance of the horizon problem in LMFs, most of the literature insists on its importance, and other authors, for example Furubotn and Pejovih (1970) and Milanovich (1983), consider the horizon problem to be fatal. They seek to demonstrate that LMFs reach a Pareto optimal allocation only in exceptional cases, whilst inefficient allocation is the rule. The exceptionality of efficient solutions coupled with the uncertainty characteristic of investment decisions in market settings and the permanence of worker members in LMFs is one of the main reasons why worker cooperatives are rare in market economies.[5]

2.2. Empirical evidence

The empirical evidence is quite supportive of, but not fully consistent with, these theoretical conclusions. Horvat (1986a) and Milanovic (1983) found that Yugoslav firms had a pronounced propensity to increase their debt with respect to owned resources However, in the case of Yugoslavia, reinvestment of positive results was mandatory, and any reduction in the capital stock was forbidden. These factors may explain why loan financing was preferred in many circumstances. To our knowledge, the best empirical tests of the hypothesis of

[5] While some authors have tried to show that the problem is not as severe as it appears to be in the basic model (Stephen, 1980; Zafiris, 1982; Bonin, 1985; Horvat, 1986a, 1986b; Jossa and Cuomo, 1997, 2000; Jossa, 1999), others have attempted to devise alternative financial instruments (McCain, 1977; Vanek, 1977; Conte, Smith and Ye, 1992; Smith and Waldmann, 1999; Mazzoli and Negrini, 2000; Albanese, 2003) or institutional arrangements

undercapitalization have been performed in Western countries. Berman and Berman's (1989) study on plywood cooperatives in the US Pacific Northwest, characterized by the presence of a market for membership rights,[6] compared them to similar capitalist firms in the same sector and geographic region. The authors estimated a production function on the basis of balance sheet data and tested all the main implications of the standard version of the Ward model (1958). Cooperatives operated at constant returns to scale, since production took place at the point of minimum average costs. Hence they fully exploited their capital stock while capitalist firms may have been inefficiently overcapitalized. This tendency may have been due to a better ability to exploit lower capital intensity and to the use of labor intensive technologies. However, a higher marginal product of capital and a lower marginal product of labor, at least in the short run, was found. This evidence was coupled with a lower capital/labor ratio in cooperatives. These results support the idea that cooperatives tend to invest less than capitalist firms, though no capital starvation (fall of the capital stock to zero) was detected, and cooperatives were able to increase their size and capital stock over time. These findings are quite striking if the presence of transferable shares is taken into account, and they may indicate pronounced imperfections in the market for membership rights that prevent cooperatives from recouping their disadvantage with respect to capitalist firms at the financial level.

Bartlett et al. (1992) examined a matched sample of Italian industrial firms, coupling cooperatives with capitalist firms of similar characteristics. The Italian environment is characterized by the absence of a market for membership shares, which is forbidden by law. Until the time of the study, Italian cooperatives had accumulated capital almost exclusively by means of indivisible reserves, plus bank loans, even if members held individual capital quotas of limited amount and loans supplied by cooperative members were allowed. Bartlett et al. found a significantly lower ratio of fixed assets per head in cooperatives, indicating the use of more labor-intensive production processes. Lower capital intensity was off-set by significantly higher labor productivity favored by a lower incidence of managerial workers, strikes and worker turnover. In addition, the depreciation rate of fixed assets was lower in capitalist firms and may have signalled a shorter time horizon for the turnover of capital equipment in cooperatives, since depreciation costs were higher. Cooperatives showed a similar, though

(Vanek, 1975, 1996; Bernan and Bernan, 1978; Meade, 1980, 1995; Dow, 1986, 1993, 1996) which could be viable solutions for the horizon problem.

slightly lower, ratio of internal funds to total capital (about 50%) to capitalist firms. However, once internal member loans had been accounted for, the ratio of debt per head was significantly higher in cooperatives. Moreover, the Italian tax system for cooperatives, which strongly favored the accumulation of capital by means of indivisible reserves, may have played a role in sustaining the accumulation of internal funds. Once again, although strong evidence of undercapitalization was not found, and cooperatives had been able to grow despite the absence of tradable shares, differences with respect to capitalist firms were systematic.

The results of these studies may support the contention that worker cooperatives are able to compete with capitalist firms only in sectors characterized by relatively low capital intensity, where financial shortcomings can be compensated by cooperatives' advantages, for example higher labor productivity. However, such compensation is limited, and when the financial disadvantage is too pronounced cooperatives may be forced out of the market or transformed into capitalist firms. In Italy, for example, many cooperatives have been compelled in recent years to introduce financial instruments drawn from the capitalist environment in order to withstand competition by international companies, or to enter capital intensive sectors (Mazzoli, 2005).

Further empirical evidence shows that cooperatives usually self-select themselves in labor intensive sectors (Ben-Ner,1988). However, the same results have not be obtained for the Mondragon cooperatives (Thomas and Logan, 1982), which do not show signs of undercapitalization with respect to capitalist firms of similar size. This finding is crucial for the development of our argument, since the Mondragon cooperatives are characterized by the presence of (partly) divisible reserves of capital, which greatly increase their members' financial involvement, though no tradable shares for membership positions are allowed.

Finally, some factors that may limit the robustness of empirical tests should be highlighted. For example, the tax system may cause distortions. If current labor income is taxed, but reinvested profits are not, the optimal choice of investments will shift in favor of future consumption, and the Furubotn - Pejovich effect may be hidden even when it is present (Horvat, 1986a, pp. 25-26). If the central authorities control the credit market and administratively fix the interest rate on loans below the free market rate, firms will tend to

[6]Shares representing the value of the membership position in the firm can be sold on the market for membership rights by quitting members to incoming members. The market value of the shares is thought to mirror the present

overuse the credit market, all the more so in the presence of limited liability and soft budget constraints (Kornai, 1986, Buck and Wright, 1990). In these cases, LMFs may even turn out to be over-capitalized.

3. Divisible reserves in labor managed firms

Divisible reserves, i.e. a system of individual capital quotas appropriable by worker members at some future point in time, are a viable solution to the problem of unrecoverability of capital quotas, and they do not suffer from the Furubotn-Pejovich effect because invested funds are recouped by members. In order to achieve equivalence between the present and future ownership of invested funds, it is sufficient to remunerate them at the rate of time preference between present and future consumption. This seems to be one of the most effective mechanisms with which to counter the risk of undercapitalization.

The following exploration of the problems linked to the introduction of divisible reserves starts from the background institutions that support and influence the accumulation of capital in LMFs, primarily property rights. Some shortcomings of the proposal are examined, and possible solutions are suggested.

Hansmann (1988, p. 269; 1996)[7] defines the ownership of a firm as the coupling of residual rights of control and the right to appropriate the net residual.[8] The former refers to the owners' authority in all events not explicitly covered by the contracts signed by the firm, especially labor contracts. In the presence of incomplete contracts, an uncertain economic environment and non-standardized tasks, residual rights of control will grant some degree of discretionary power in management of the firm. The latter is a consequence of the former (Putterman, 1988, Dow 2003)[9]: if the firm's owners are to control all non-contracted operations, they will also decide on the destination of the residual, which is non-contracted by

value of future returns on the membership position.

[7] I take Hansmann's definition to represent the property rights school, which, as is well-known, was initiated by other authors (Grossman and Hart, 1986; Hart and Moore, 1990, 1996)

[8] The residual is what if left at the end of the period, and corresponds to the profit in CMFs. Meade (1980, pp. 89-93) distinguishes between "residual" and "net residual". The *residual* is equal to *total net labor earnings,* the value added of the firm less the cost of capital. *Net residual* is the value added less the cost of capital less current labor income (a variable that roughly corresponds to wages in CMFs).

[9] For detailed and interesting discussion of the interplay and possible causal links between residual rights of control and residual rights of appropriation see Dow (2003).

definition. As a consequence, in the general case the two rights are bundled together.[10] If we compare Hansmann's definition of the ownership of the firm with the system of usufruct analyzed in section 2, we note that it does not entail the collective ownership of the means of production. It consequently does not exclude the individual appropriation of the end-of-period net residuals.

Application of Hansmann's definition to labor-managed firms yields important implications. In LMFs members enjoy residual rights of control. The residual has the economic nature of labor remuneration since labor as a production factor is entitled to decide about its destination. The members' right to appropriate the residual also implies that the remuneration of capital is contracted ex ante. The reason is that there cannot be two residuals in a single production organization, and if the unique residual is appropriated by labor, it cannot be appropriated by capital (Jossa and Cuomo, 1997). Capital remuneration may be above the market interest rate because of the higher financial risk undergone by individual capital quotas as compared to standard loans. Yet it is still contracted and, as a rule, fixed.

Appropriation by worker members of the net residual generates a search for workable reinvestment mechanisms compatible with LMF property rights. In the presence of divisible reserves, the net residual will have to be shared among members according to some kind of rule. Because the net residual has the nature of labor income, it must be distributed as an extension of the current labor income already paid during the accounting period. At the empirical level, the tradition of cooperative movements comprises a number of institutions that act in this manner. In Italy, for example, cooperatives can distribute part of the net residual to members in this way (under the heading *ristorni,* which have recently been reevaluated by legislation[11]). The same rule is followed by the Mondragon cooperatives.

The end-of-year extensions of current labor income constitute additional remuneration for workers which is not paid to employees in capitalistic firms. Workers' incomes will include a current part, similar to the wages paid by capitalist firms, and a residual part which is more

[10] In Hansmann's words (1988): "In theory, the right to control and to residual earnings could be held by different persons. In practice, however, they are generally joined, since those with control would otherwise have little incentive to use their control to maximize the residual earnings. To be sure, if all aspects of control could be contracted for ex-ante, then this problem would not arise. But control can usually be thought of as authority over precisely those aspects of firm policy that, because of high transaction costs or bounded rationality, cannot be specified ex-ante in a contract, but rather must be left to the discretion of those to whom the authority is granted".
[11] By law no. 42, 2001, and law no. 366, 2001.

similar to dividends paid out to shareholders in CMFs. End-of-year residuals serve various purposes: first, they are commonly used to self-finance risky investment projects; second, they constitute the collateral needed to obtain credit from financial institutions; third, they buffer workers against short-term fluctuations in the firm's revenues, thus limiting excessive fluctuations in current labor income; fourth, they are liable to absorb negative economic results such as losses; finally, they can be paid out in cash and represent additional current income. Hence, in many cases, workers do not appropriate the net residual in cash but must reinvest their share in order to finance investments, as happens in capitalist companies. When individual shares of net residuals are reinvested, divisible reserves of capital are created.[12]

Individual shares of net residuals, when used to self-finance a firm, can be equated to a form of equity capital since they perform the same functions as the latter. However, differences with respect to equity in capitalist firms should be borne in mind: first, they are remunerated by a fixed interest rate, while equity capital in CMFs receives the full residual (profit); second, they can be recoverable, and their circulation on the market in the form of equity shares may not be allowed because their accumulation is linked to the worker's personal position as a member of the cooperative.[13]

3.1. The compulsory capitalization of individual quotas and the danger of free riding

The use of shares of residual labor income as part of equity in LMFs may encounter an obstacle in the form of *free riding*. If the decision on what part of the individual quotas of the net residual is to be reinvested in the firm is left entirely to individual members, free riding is likely to ensue. The collective of members as a whole has an interest in investing the optimal amount of money because it will receive the maximum benefit from doing so, and it will be able to maximize the collective wealth. However, each individual member may prefer to withdraw his/her individual quota and put it to other uses. Withdrawing members will gain the

[12] Of course, ex ante decisions may influence the partition between current labor remuneration and the net-residual, thus conditioning investment decisions. If a lower level of investments is required, members may confidently pay out a higher level of current remuneration during the accounting period. However, the issue of the endogenous partition between current remuneration and and-of-the-year residuals will not be explicitly dealt with here, because the principal concern is to devise solutions suitable for the destination of the net residual, while the destination of current quotas of labor income is at the full disposal of members.

returns on investments made by their fellow workers in the form of labor income since, as a rule, labor remuneration in LMFs is distributed on the basis of collective decisions or rules valid for the entire membership. In big firms, the withdrawal of each individual quota may do little harm to the firm's patrimonial solidity since it may only reduce investments by a tiny fraction. However, the spread of this kind of behavior would cripple the firm's growth potential. If free-riding is the danger, it must be kept at bay, and the best way to do so is by imposing a collective obligation to abide by decisions on the reinvestment of residuals.[14]

This statement is supported by a wide array of experimental results in the field of public goods finance (Fehr and Fischbacher, 2002; Fehr and Gächter, 2000), but also by the neoclassical theory of public goods and club goods (Cornes and Sandler, 1986). If there is no constraint on individual behavior, the financing of public goods leads to severe free-riding phenomena which render the pursuit of production impossible. The imposition of mandatory contributions and of a system of punishments (fines) for deviant behavior produces completely different results. Since deviance is punished, everybody is able to trust the commitment to financing the endeavor, making accumulation possible. In our case, if reinvestment (partial or total) is mandatory for the entire membership, fines for deviant behavior are not necessary, because funds are directly reinvested by the firm,[15] different individual preferences notwithstanding.

At the empirical level, constitutional rules in Mondragon cooperatives impose compulsory capitalization of all positive residuals. Hence they do not leave the decision on the percentage of the net residual to be reinvested in each accounting period, or paid out in cash, to the discretion of their members. Indeed, the main founding values of the Mondragon group are growth and the creation of new employment, and these justify the prescription. In a general framework applying to an entire economy, it may be wiser to include both solutions in the firm's statutes.

3.2. The reimbursement of individual capital quotas

[13] Because it is a type of equity capital, the accumulation of net residuals may enable LMFs to avoid the problems linked to the dilemma of the collateral (Vanek, 1970), the law of increasing risk (McCain, 1977), and the lack of equity (Gui, 1985).
[14] Collective reinvestment of all net residuals is mandatory in the Mondragon cooperatives.
[15] For more comprehensive treatment see Tortia (2003).

A second fundamental asymmetry between capital quotas in capitalistic and labor managed firms arises because, in LMFs, worker-members must necessarily quit the firm at some point in time. Accumulation of equity capital is strictly linked to members' positions because it is the result of reinvestment of labor income residuals. When a member quits the organization, s/he is not entitled to any form of labor remuneration. Furthermore, quitting members lose their share of control over the firm. Control and risk-bearing are necessarily linked because lack of control implies that it is impossible to shield against the economic risk implied by the presence of equity capital. Consequently, quitting members are not in a position to accumulate new equity capital and to exert control over the use of the quotas accumulated in the past. These problems are absent in CMFs because, in their case, capital quotas are not linked to the positions of individual members, and they can be sold at a price mirroring the present value of future returns on the firm's investments.

The most common solution to the problem of a lack of control over equity capital by quitting members is the mandatory reimbursement of individual capital quotas, which engenders the well-known phenomenon of capital variability cooperative firms. This is the solution adopted, for example, by the Italian, French and Spanish legislations.[16] Equity capital variability may be a serious financial obstacle for cooperatives, which in this regard are usually considered to be at a disadvantage with respect to capitalistic firms (Dow, 2003). The compulsoriness of reimbursement may weaken the financial structure of the firm if numerous owners of important shares of capital quit the firm over a short period of time. Moreover, capital variability reduces the firm's ability to offer collateral to financial institutions, which will take a more conservative position when deciding whether to finance it.[17]

[16] For example, individual capital quotas are termed *capitale sociale* in the Italian cooperative tradition. They are reimbursed to quitting members within six months from approval of the budget following the member's departure. The Italian cooperative law defines cooperatives as "variable capital companies" as opposed to capitalistic firms *(società di capitali),* which are "fixed capital companies".

[17] The main alternative to the reimbursement of individual capital quotas is the creation of a market for membership rights (Dow, 2003) where quitting workers can sell their positions as members of the cooperative to incoming members. Dow (1986, 1993, 1996) shows that, at equilibrium, the market for membership rights would have the same efficiency features as markets for shares in capitalist economies. However, empirical evidence, for example concerning the plywood cooperatives in the USA Pacific North-West, shows various market imperfections which render its implementation problematic. The main shortcoming is the difficulty of finding suitable new members willing and able to buy the membership position. The new membermust be accepted by incumbent members and, at the same time, wealthy enough to afford the price of the position. Prices for membership positions may be extremely high in capital intensive sectors. Furthermore, asymmetric information is likely to play a crucial role in limiting the effectiveness of the market for membership rights. If the investment is partially sunk, a lock-in phenomenon can be envisaged whereby incoming members are subject to morally hazardous behavior by the rest of the membership. Finally, when the value of the membership position is difficult

When an important part of the firm's capital is accumulated in the form of divisible reserves to be reimbursed to members, financial instability may in the most extreme cases cause financial distress. Issues concerning asymmetric information and moral hazard must be taken into account as well. If members have access to privileged information on the economic and financial position of the firm, they may decide to quit strategically in order to have their quotas reimbursed before other liabilities come to the point of restitution [?], thus aggravating the crisis. The prediction of this kind of event induces many cooperatives not to accumulate divisible reserves and to resort to indivisible reserves, which cannot be appropriated by members at any point in time. This is the case, for example, of Italian cooperatives, where the shares of the net residual attributed to members is, in most cases, tiny or nil. Capital accumulation by means of indivisible reserves has the advantage of stabilizing the firm's equity capital. Because it is not appropriable, it is fixed and can both finance investment projects and serve as collateral. However, as stressed in Section 2, it impedes individual financial involvement and may trigger undercapitalization.[18]

Various solutions have been proposed for this problem.[19] Tortia (2002) and Zevi (2003, 2005) consider various possibilities. The first step is the transformation of individual capital quotas into debt to be repaid by the firm to quitting members. The problem of the lack of control by quitting members over risky quotas of capital is thus solved. Furthermore, the repayment of debt held by quitting members can be made conditional on? the repayment of standard loans held by third parties (Cuomo, 2003). This arrangement is necessary because it limits the danger of diluting the right of third parties to have their credits repaid before equity. As for the terms of reimbursement, the main solutions proposed are the following:

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to evaluate by newcomers, the actual price paid may be significantly less than its market value. Indeed, most plywood cooperatives in the USA have been sold to capitalist companies after being active companies for roughly half a century.

[18] This is not the case of divisible reserves. If we return to formula (2) in section two and use the same symbols, we can see that divisible reserves evade the problem of the temporal horizon. Since they need to be reimbursed at some point in time, they can be likened to loans. If we consider the present value of 1 Euro invested in a bank deposit:

$$PV_{BA} = i\sum_{t=1}^{T}(1+i)^{-t} + (1+i)^{-T} = 1 \qquad (3)$$

we find that the sum is equal to 1 whatever the values of T and *i*. In fact (3) is an identity, not a equilibrium condition. The present value of one Euro deposited in a bank account, yielding an interest of *i* for T periods of time and withdrawn at time T is 1.

[19] No solution is to be found in the financial structure of CMFs, since, as already stated, in their case the problem of the temporal horizon does not exist.

- Extended terms for reimbursement. Suitable longer terms for reimbursement may be devised to reduce financial pressures on firms and lessen the risks of members' moral hazard: if there is a long time span between quittance and reimbursement the possibility of strategic behavior can be limited.

- Sale of the credit to financial institutions. Quitting members could sell their credit to financial institutions. This would be a step toward reconciling the firm's and members' interests. Members could increase their liquidity and firms would have longer terms for repayment.

- Transformation of credits into bonds saleable on regulated financial markets. Credits held by quitting members could be allowed to circulate on financial markets in the form of bonds. The market would fix the price of the title and, again, members would be able to increase their liquidity. Banks and other ad hoc financial institutions could be given the task of buying individual shares and circulating them on the market.

These solutions need to be discussed further.[20] The next section outlines a more specific institutional proposal concerning the introduction of LMF bonds.

4. The structuring of new institutional solutions: LMF bonds

The previous section concentrated on the possible problems arising from the introduction of divisible reserves in LMFs. This section will focus on institutional mechanisms with which to address the problems concerning capital variability and the reimbursement of individual capital quotas.

The role of indivisible reserves must be examined before the structure of divisible reserves and the introduction of cooperative bonds are discussed. Indivisible reserves are a crucial component of LMFs' capital structure, and they will continue to be so in the future, even if their role will become less all-embracing, and more room for individual quotas will be required. Indivisible reserves are the collective element in the financial structure of a firm, and

[20] Experimental economics could play an important role in offering general suggestions, for example about the parameters adopted to regulate the firm's financial stability in the presence of divisible reserves, before in-field experimentation starts.

they are not subject to the frictions due to the heterogeneity of individual preferences and strategic behavior linked to capital variability. They may cushion individual members against individual losses and represent the financial resource of last resort needed in periods of economic crisis so that the firm can survive when individual members are unable to support it. All the other components of a LMF's capital structure can undergo changes more or less dangerous to its financial stability. A minimum level of indivisible reserves is therefore necessary. In order to dampen the Furubotn-Pejovich effect, and so as not to reduce the members' financial involvement excessively, their amount is likely to need an upper bound? as well.

When part of the net residual is distributed individually and reinvested in the firm, divisible reserves of capital are created. In this case, given the above considerations, all the members contribute their individual shares, which are additional parts of labor remuneration.

4.1. Reimbursement of individual quotas and LMF bonds

As a rule, individual quotas accumulated cannot be reimbursed while the worker is a member of the enterprise. This is a norm necessary in order not to reduce members' financial involvement and not to reduce the firm's capital. When the member quits the organization, the controlling body may decide to reimburse his/her quota immediately (for example when the value of the quota is negligible) but it may also decide to retain the quota within the firm. If the member is not allowed to sell his/her quota, a reimbursement schedule must be established. It is possible to imagine the creation of independent bodies assessing (on request by the interested parties) the suitable duration of the reimbursement period given the share of the overall capital of the firm held by the member, and the firm's general financial conditions. The law may impose an upper and a lower time bound? on reimbursement schedules.

If individual quotas can be sold on a market for LMF bonds, the reimbursement period can become much longer and favor the undertaking of long-run investment projects. It is possible to imagine the pay-back process lasting from 10 to 30 years or more, but it is also possible to envisage irredeemable bonds. Members will then be able to choose between the sale and the retention of their quota. In the latter case, when their quotas are redeemable, they will have to wait for the fixed schedule term before they are reimbursed. When quotas are

irredeemable, members may either retain them and sell them at a future moment in time, or wait for the firm's liquidation.

The introduction of saleable bonds has the potential to spur individual effort, because members who quit firms in better economic and financial circumstances will be able to sell their quotas at higher prices (Zevi, 2003, 2005). Individual quotas will be likely to be sold at a discount whose amount will mirror the firm's financial conditions and default probabilities. The presence of saleable bonds will also reduce the risk of members quitting the organization for strategic reasons. Quitting members know that weakening the firm's financial structure will increase the risks of default, hence reducing the market value of their quotas. An endogenous incentive will be created whereby members will tend to leave the organization only upon retirement or because of other unavoidable necessities.

If worker-members are entitled to have their individual quotas reimbursed, or to sell them when they quit the organization, a rule determining the minimum amount of equity held by incumbent members is required. The reason for this is that if the bulk of the firm's capital is held by quitted workers (ex-members) or sold on the market, a dangerous separation between ownership (of the firm capital) and control (of the organization) will arise. The protection of the firm's creditors (e.g. banks) and its members' financial involvement would be too weak. Members may choose excessively risky investments if their financial stake is too small. The cost of the debt offered by financial institutions would increase, and rationing might arise because the firm would no longer be able to offer adequate collateral. Risks of default would increase and the price of saleable quotas would fall. The law of increasing risk (MacCain, 1977) would once again operate.

Since this kind of perverse dynamic may be triggered members quitting strategically and selling their quotas on the market before their price falls, it may be necessary to impose a restrictive rule: individual quotas may not be sold if the percentage of capital held by incumbents falls below a minimum threshold. Buyers of LMF bonds and other creditors would be protected against members' morally hazardous behavior if the quotas held by quitted members are reimbursed after liabilities toward third parties have been fulfilled?.

Loss sharing is a further problem to be solved if the firm is to retain its financial equilibrium. Losses can be covered by indivisible reserves, but only under certain conditions:

the level of indivisible reserves must be high enough to comply with legal requirements. Cumulated indivisible reserves will no longer absorb losses when their level falls below some minimum threshold. If indivisible reserves are above the minimal threshold fixed by law, then members may have the right to impute losses to the common part of capital. When losses are not absorbed by indivisible reserves, the individual quotas held by incumbent members must be reduced.

When individual quotas are reduced, it is possible also to consider the possibility of reducing the value of titles held by terminated members and by bond owners. For example, with a 3-Euros reduction in quotas held by incumbent members, the value of titles held by quitting members may be reduced by 2 Euros, and the value of bonds held by third parties by one Euro. This mechanism would entail:

- The redistribution of losses among all capital owners, without giving incumbent members an incentive to undertake excessively risky investment projects (they would still bear the worst consequences of negative economic results);
- The increased riskiness of cooperative bonds. The higher risk is likely to reduce the market value of the titles. However, the risks incurred by members during their work experience would be reduced;
- The incentive to quit the firm in the presence of difficult economic conditions would be reduced, because members would know that they are not the only party suffering financial losses in the case of negative performance, and that they would incur losses even if they quit the firm.

The mechanisms described in the preceding paragraphs would generate two new categories of stakeholders: terminated members (classified between retired and non-retired) and LMF bond owners. Given that they may undergo financial losses in the event of negative economic results, their stake in the firm is risky, and suitable participatory arrangements should be made for their inclusion in management of the firm's finances. Control over the firm is still exercised by incumbent members because they are responsible for its activity and its consequences on their welfare in terms of income and working conditions, and they also bearing the bulk of the financial risks. Participation by other financial stakeholders may be structured on the basis of information and consultation rights. If the firm takes decisions risky

for stakeholders other than incumbent members, the provision of suitable information may assist them in deciding on the sale or the retention of their titles.

4.2. Hierarchy of liabilities

An important requirement that ensues from the institutional mechanisms regulating divisible reserves is that liabilities must be ordered according to their specific rights to reimbursement in the event of default or upon liquidation, for two reasons:

1) In the absence of a precise order in rights to reimbursement upon default, better informed subjects (the incumbents) may exploit their information advantage.

2) More closely-involved subjects (again, the incumbents) bear the responsibility for strategic choices. They will have to bear the costs of wrong decisions before all the other financial stakeholders.

Hence, a suitable order of financial instruments must be devised in order to reduce the risks for less well-informed financial stakeholders.

Indivisible reserves must be treated separately from the other financial instruments because they are funds owned by the firm itself, and are not at the disposal of the financial stakeholders of the firm. Upon liquidation, a minimum required level of indivisible reserves should be protected against appropriation by other stakeholders, while surplus? quotas may be used to compensate liabilities. In the absence of this limitation, past reserves accumulated by previous generations of workers would be at risk of improper appropriation by newcomers, for example in the form of higher salaries or fringe benefits that may increase losses. The residual value of indivisible reserves may be transferred to other cooperatives or to common funds used to finance new cooperative enterprises? (inter-cooperative mutuality), as happens, for example, in Italy.

Among the financial instruments owned by the stakeholders in the firm, traditional loans must enjoy maximum protection and must be the first to be reimbursed. The creditors are usually financial institutions able to verify the firm's ability to repay loans. However, because

they are purely contracted liabilities, without direct links with the firm's managerial choices, they should bear the minimum amount of risk.

LMF bonds sold on the market come second in the hierarchy of liabilities. They can be bought by subjects uninvolved in the firm's management. However, they are directly linked with the firm's management because they derive from the sale of titles held by members. Moreover, they have always been viewed as risky financial activities which may be only partly reimbursed if the firm is unable to cover its losses with other means. Higher returns will compensate for higher risks.

Third, retired members who decide not to sell their quotas should enjoy privileged reimbursement with respect to incumbent members. This mechanism would create an incentive to stay with the firm and be loyal, because retired members enjoy more secure financial positions. Furthermore, retired members no longer take strategic decisions within the firm and should not bear the consequences of wrong decisions.

Individual quotas held by quitted members and quotas held by incumbent members should be the riskiest financial activities, and hence the last to be reimbursed, since they derive directly from strategic choices taken within the firms by subjects in possession of the best information concerning the firm's economic results and prospects.

Quitted members may decide whether to retain their quotas or to sell it. If they decide not to sell their quotas, the problem of the reimbursement of their quotas relative to incumbent members arises. They have a strong relation with the firm's activity (their past work experience) but have more limited information than incumbents and do not bear responsibilities for recent strategic decisions. Their responsibilities for negative economic results are more limited than those of incumbents. Hence, preference could be given to their positions so that they enjoy privileged reimbursement with respect to incumbent members. However, other considerations suggest a different solution. First, loyalty to the firm should be rewarded, while premature exits should not be incentivised. Second, if quitted members enjoy privileged reimbursement, a strong incentive would be created for them to leave the firm when its economic prospects are negative, further weakening the firm's competitive potential and financial strength. If the riskiness of their financial stakes is unchanged when they leave the firm, this incentive would by eliminated. Of course they could quit anyway and sell their

quotas, cashing them in at the market value and evading future economic risks. However, in this case, the market for LMF bonds would play a crucial role in curbing morally hazardous behavior. If anomalous exits take place, market exchanges will tend to punish this behavior by increasing the discount rate applied to the sale of members' quotas. The discount rate may become so large that it discourages sale altogether. On the other hand, quitting the job may be a bad solution if firm-specific, at least partly sunk, investments in human capital have been made.

A final issue concerning the hierarchy of liabilities has to do with the restitution of individual capital quotas. The firm cannot be forced to repay capital quotas to individual workers while they are members of the firm. However, the majority of members may decide collectively to reimburse part of their capital stakes, for example when over-capitalization is present or down-sizing is needed. They may be allowed to do so, but only under stringent conditions. First, restitution cannot in any circumstance lead to a reduction of indivisible reserves. When part of individual capital quotas are paid back the ratio of indivisible reserves to total capital increases. If only a minimum level is required for the part of capital to be held collectively, then indivisible reserves can be "eaten" by means of this mechanism. This way, funds accumulated by previous generations of workers would risk to be dissipated. Second, restitution can take place only when the ratio between the total amount of quotas held by incumbent members and the total capital of the firm (indivisible reserves plus quotas held by members - incumbent, quitted and retired - plus bonds) is higher than the minimum required. Third, the ratio of capital to external debt must also be higher than the minimum. When all the conditions for financial viability are met, members may be allowed to vote for restitution of the surplus. In this case, incumbent members[21] may be favored by being allowed to enjoy restitution before all other classes of financial stakeholder, for example before quitted members. The reason for this is that incumbent members bear all the relevant economic risks, and are the least protected in the event of financial difficulties. Moreover, this mechanism would be a further incentive to loyalty because only incumbent members could vote for restitution, while quitted and retired members would lose this right. An incumbent member would weigh the possibility of leaving the firm and selling his/her quota at a discount against the possibility of staying with the firm and voting for partial restitution at face value.

[21] Also the position of retired members who did not sell their individual quotas may be favored and equated to the position of incumbent members.

Restitution of capital quotas is allowed in capitalistic firms, while cooperative legislation often precludes this possibility. For example, the Italian legislation on cooperatives forbade it until a few years ago. Under new legislation (corporate law, no. 366, 2001) individual members may not ask for partial restitution (in order to counter predictable risk of free-riding on individual contributions), but it is not forbidden to reduce the total amount of capital held individually by the workforce as a whole.

At any rate, partial restitution of individual quotas is likely to be a rare occurrence, given the requirement to respect stringent constraints on financial stability. Heterogeneous preferences among members would often preclude this possibility, since young incumbents would prefer to retain capital within the firm, even when members about to quit would prefer restitution. Furthermore, firm directors would often prefer a higher equity to debt ratio so that the firm's financial strength can be preserved.

5. Concluding remarks

The Furubotn-Pejovich effects has been acknowledge by various authors as the main obstacle against the efficient allocation and accumulation of self-financed capital funds in labor-managed firms, when collective ownership of the means of production and indivisible reserves of capital are accepted as the institutional standard. The literature on Yugoslav-type economic systems is thus able to explain the causes of undercapitalization and self-selection in labor-intensive sectors. However, the type of cooperative firm described by the most studies in the literature is very specific and based on the usufruct of collectively-owned capital funds. Hence, it should not be taken as a general pattern, and improvements are possible if new institutional devices prove effective.

Among the proposals on how to correct the distortions caused by the Furubotn-Pejovich effect, the introduction of divisible reserves of capital seems particularly promising. Its main positive features are greater worker involvement at the financial level with the corresponding addition of shares of value added in labor remuneration, and the elimination of the horizon problem. This paper has concentrated on the potential problems arising from the introduction of divisible reserves. Different property rights between capitalist and labor-managed firms give rise to fundamental asymmetries which are particularly marked as far as the mechanisms of

distribution of the net residuals, the reinvestment and the reimbursement of individual capital quotas are concerned. Analysis of the problem shows that it is on these asymmetries that future research will have to focus if viable solutions to increase the growth potential of worker cooperatives are to be found.

The structuring of new institutional mechanisms is crucial if sustainable processes of capital accumulation are to be devised. The final section of the paper has examined the critical aspects of the conversion of individual capital quotas into titles saleable on the market for cooperative bonds; an arrangement which has the potential to solve the problem of capital variability in the presence of divisible reserves. The most evident doubt concerns the sustainability of this kind of market. Although a certain degree of imperfection is intrinsic to any kind of market, excessively severe imperfections may prevent any market from operating. If LMF bonds prove too risky a financial tool, buyers will demand high discount rates. In this case, quitted members will have little or no incentive to sell their quotas, and they would have to accept the prospect of very long pay-back periods, often amounting to relinquishment of? their ownership rights. The feasibility of the market for LMF bonds and the regulation of its working mechanisms are the substantial difficulty but also the potential innovativeness of this approach.

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