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On Rational Wage Maximisers

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Abstract

Two issues raised by the behaviour of wage-maximising cooperative or labour-managed firms (LMFs) are addressed: the insensitivity of firms' equilibrium to the supply price of labour or to the centrally imposed calculated wage, which prevents the labour market to clear; the firms' sluggish if not negative output response to demand shifts, which provokes inflationary pressures but also harms LMFs' ability to compete against flexibly adapting profit-maximising firms. The paper proposes an automatic transfer mechanism which induces worker cooperatives to react to changes in their parameters with equal or greater intensity than the conventional profit maximisers.

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1. Introduction

The traditional Illyrian theory of labour-management (Ward, 1958; Domar, 1966; Vanek, 1970; Meade, 1972) identifies the labour-managed or cooperative firm with an enterprise run by its workers who equally share in firm's income and collectively set firm's policies so as to maximise the income per unit of employed labour, which may also be labelled full wage or dividend.

It is well understood that such a maximisation strategy will have negative implications for the functioning of a labour-managed economy, which appears to markedly differ from that of a system composed of entrepreneurial profit-maximising firms. Three problems, linked to a firm's short-run behaviour, are usually mentioned: the failure of the labour market to clear (Ward, 1958; Vanek, 1970); the suboptimal allocation of employed social labour (Domar, 1966; Bergson, 1967); the firms' sluggish or even negative output response to demand shifts (Ward, 1958; Domar, 1966; Steinherr and Thisse, 1979; Bonin and Fukuda, 1986), which is likely to generate strong inflationary pressures but also handicaps LMFs in the competition against conventional flexibly adapting profit-maximising firms (Montias, 1986).

The short-run behaviour of a cooperative firm provided therefore the focus for much of the analysis of labour-management and several recipes how to correct the detected anomalies emerged. Generally, the advanced proposals may be classified in two groups.

One group consists of solutions that combine some innovative institutional arrangements with the initially defined principles of worker-management (Meade, 1972; Bonin, 1981; Sertel, 1982; Miyazaki and Neary, 1983). Another class comprises corrective mechanisms that aim to remain within the original institutional design of the labour-managed enterprise (Ireland and Law, 1978; Thomson, 1982; Guesnerie and Laffont, 1984).

The present scheme falls in the second category but differs from the existing proposals in that it scales down the quest for allocative efficiency. In return, it puts a stronger emphasis on a firm's comparative statics, which is responsible for what may be argued to be

most serious problems of labour-management.

The outline of the paper is as follows. The presentation of the mechanism appears in part 2. Its impact on the LMFs' equilibrium is identified in part 3. In part 4 the functioning of the labour market is studied. In part 5 a firm's supply behaviour, induced by the mechanism, is analysed. Summary and conclusions are left for part 6.

In designing the scheme two modelling options are adopted: the principle of automatic control of a firm's behaviour, and the labour market with an auctioneer.

2. The Transfer Mechanism

The firm uses a fixed non-depreciating capital stock of value K and homogeneous labour L to produce output X via production function $X = X(L)$, characterised with U-shaped average variable costs schedule. It sells competitively at a price p and pays parametric rental rK , where r is the current rate of interest. The firm's income is $Y = (pX - rK)$, with $y = Y/L$ and $u = Y/K$ being, respectively, the income per worker or dividend, and the income per unit of invested capital, which will be called the rate of income.

It is the maximisation of the *per capita* y that is responsible for the listed deficiencies of worker-management.

Suppose now that, in responding to the problems observed, the cooperative authorities establish an incentive fund. The Fund defines the calculated wage or the tax exemption w , setting at the same time the minimum income per worker or the minimum wage $y = w_0$, at which the firm is either shut down or taken over by the Fund. The (calculated) profit emerging from this procedure amounts to $\Pi = (Y - wL)$ with $\pi = (y - w)$ being the profit per worker.

The Fund then levies an allocation tax on profitable firms, subsidising at the same time those that are making losses, where the transfer rate t depends on a firm's rate of income u . The complete schedule of transfer rates is defined by the following continuously twice differentiable function in u :

$$(1) \quad t = t(u) ; \quad t \in (0, 1)$$

$$(2) \quad \frac{u}{1-t} \frac{d(1-t)}{du} = e \\ \geq 0$$

where e represents a parameter of the t function, identified with the elasticity of a transfer complement with respect to a firm's rate of income, and hereafter referred to as the allocation parameter.

The implementation of the above mechanism makes the (after transfer) dividend the following continuously twice differentiable function in L :

$$(3) \quad z = w + \pi(1-t)$$

In what follows we shall call z simply the dividend, and will reserve the term "income per worker" to denote the before transfer magnitude y^1 .

Now, the first and second order conditions for the maximum of z reduce to:

$$(4) \quad pX' = \frac{y}{1+es} ; \quad s = \frac{\pi}{y}$$

$$(5) \quad z'' = \frac{(1-t)[pLX''(1+es) + e\pi(1-e^3+2es)]}{L^2(1+es)^2} < 0$$

where X' and X'' are the first and the second derivative of $X(L)$.

We shall refer to the labour-managed firm that follows the allocation rule of (4) as to the controlled LMF, or simply LMF, and will associate the term "Illyrian firm" with the uncontrolled behaviour of an untaxed or neutrally taxed cooperative.

3. Moving the Firm's Equilibrium

Throughout this section we assume that the LMF sells at a same price and faces same unit costs of capital and labour as the textbook profit

maximising firm (PMF).

We first have to ensure the positivity of the LMF's value marginal product of labour in (4), when profits are negative:

$$(6) \quad 1 + es > 0 \quad ; \quad s = \frac{\pi}{w + \pi}$$

This reduces to:

$$(7) \quad e < \frac{w}{-\pi} - 1$$

If (7) holds at the shut down level of π ($= w_0 - w$), it will hold *a fortiori* for any greater algebraic value of this function. Hence, a restriction on e is:

$$(7a) \quad e < \frac{1}{(w/w_0) - 1}$$

We can now proceed by examining the sensitivity of the LMF's equilibrium to changes in the e parameter. We differentiate (4) with respect to e to obtain, due to (6) and (5):

$$(8) \quad \frac{dL}{de} = \frac{-\pi(1 + es)}{pLX''(1 + es) + e\pi(1 - e^3 + 2es)} \gtrless 0 \quad \Leftarrow \quad \pi \gtrless 0$$

This may be summarised by the following proposition:

P1. A change in the e parameter to the LMF leads to a change in its employment (and output) in the same (opposite) direction when profits positive (negative)

The question raised by P1 is to what extent the LMF's equilibrium employment (and output) can be influenced by manipulating the e parameter. To examine this, we set the PMF's optimum employment as a standard of comparison, and write down its first order condition for the maximum profit:

$$(9) \quad pX' = w$$

We then ask whether the LMF can be induced to achieve greater (smaller) equilibrium employment and output than the PMF, when profits are positive (negative). Given the technological assumptions, a desired outcome will be ensured if between (4) and (9) the following relation holds:

$$(10) \quad \frac{y}{1+es} \leq w \Leftrightarrow \pi \geq 0$$

Taking account of the identity relations $y = w + \pi$ and $s = \pi/(w + \pi)$, equation (10) reduces to the requirement:

$$(11) \quad e > 1 + m ; \quad m = \frac{\pi}{w}$$

We now impose:

$$(12) \quad e = 1 + m^* > 1$$

where m^* is some m unlikely to be attained, in a specified time period, by uncontrolled LMFs. In what follows we assume that (7a) is not binding on (12)².

Equation (12) leads to the following proposition on the LMF's equilibrium employment and output:

P2. Faced with a same product price and with same labour and capital costs the LMF employs more (less) workers and produces more (less) output than the PMF, when profits are positive (negative)

4. The Effects of a Change in Calculated Wage

It is a well-known property of the Illyrian firm that it is insensitive to variations in the institutionally imposed labour cost or the calculated wage. This leaves the centre without an instrument that would be naturally suited to cope with the rigidities of the Illyrian labour market. It is therefore of interest to establish whether or how the controlled LMF reacts to changes in the w parameter.

4.1 *The Wage-Employment Response and the Collection of Demand for Labour Schedules*

To examine the LMF's employment reaction to a change in the calculated wage, we replace π with $(y - w)$ in (4), and differentiate the equation with respect to w to obtain:

$$(13) \quad \frac{dL}{dw} = \frac{eL(1 + es)}{pLX''(1 + es) + e\pi(1 - e^3 + 2es)}$$

which, in the limit, displays the Illyrian zero reaction ($e = 0$). Outside this limit, applying (6) and (5) to (13), it appears that the following proposition on the LMF's sensitivity to variations in the standard labour costs holds:

P3. A change in the calculated wage to the LMF leads to a change in its demand for labour in the opposite direction

Thus P3, which describes movements along a demand for labour curve generated by a given value of the e parameter, shows this curve to be negatively sloped in w .

[Figure 1 about here]

At the same time P2 and P1, combined with P3, imply that in the relevant interval of the e parameter, defined by (12) and (7a), there exists an infinite number of negatively sloped demand for labour curves. Some of these curves are depicted in figure 1, where $VMP_L (= pX')$ and y denote the value-marginal-product-of-labour and the income-per-worker schedule, respectively.

4.2 *Clearing the Labour Market under Worker-Management*

It now appears that the defined mechanism makes calculated wage the instrument for clearing the labour market in a cooperative economy, provided the same occurs in the twin entrepreneurial system.

Thus, in the case of a fixed aggregate labour supply, the centre will gradually increase e until it generates the aggregate demand for

labour curve which intersects the aggregate labour supply schedule at least at the point of the minimum calculated wage w_0 , defined in part 2. Of course, if the corresponding value of the e parameter still falls short of the magnitude required by P2 and defined in (12), the centre will continue to increase e until it reaches this magnitude.

It emerges however that the centre will also be able to clear the labour market in an economy with elastic labour supply. In order for the proper employment equilibrium to be ensured in this case, the labour supply should not be decreasing in calculated wage. Suppose now that the information on the current value of the dividend is public³, which implies that the aggregate labour supply is increasing in z of (3). But the differentiation of (3) with respect to w gives:

$$(14) \quad \frac{dz}{dw} = t > 0$$

We therefore conclude that the following proposition on the sensitivity of labour supply holds:

P4. A change in the calculated wage in an economy populated with LMFs leads to a change in the aggregate labour supply in the same direction

At the same time, changes in the allocation parameter will have no impact on the labour supply schedule as a function of w , since the differentiation of (3) with respect to e exactly yields:

$$(15) \quad \frac{dz}{de} = 0$$

It follows that, similar to the case of a fixed labour supply, the centre can start the adjustment process by gradually increasing the allocation parameter. This will lead to anti-clockwise "rotation" of the aggregate demand curve for labour until it intersects the aggregate labour supply schedule at the point equal to or greater than the minimum calculated wage.

Thus, by selecting the appropriate value of the e parameter and acting as an auctioneer in the labour market the centre will, both in the case of fixed and elastic labour supply, eventually find the

(unique) market clearing calculated wage which, at the same time, will not fall short of its critical magnitude, determined by the minimum tax exemption.

V. The Effects of a Change in Product Price

Proposition 2 implies that, at least in some price interval, the LMF will have the normal (positive) employment and output response to a change in the product price. However, a more definite conclusion on the LMF's supply behaviour can be reached. In order to do this, we differentiate (4) with respect to p , to obtain:

$$(16) \quad \frac{dL}{dp} = \frac{(1 + es) [rK + e(rK + wL - 2rKs)]}{p[plX''(1 + es) + e\pi(1 - e^3 + 2es)]}$$

Due to (6) and (5) it is seen that the positive employment (and output) response is consistent with the negativity of the square bracketed term of the numerator, i. e., with the following condition:

$$(17) \quad e > \alpha$$

where:

$$(18) \quad \alpha = \frac{1}{1 + (wL/rK) - 2s}$$

Since e is already established to be greater than unity, in the region of negative profits (17) holds, which ensures the positive employment reaction by the LMF.

To establish the algebraic sign of (16) in the region of nonnegative profits, we differentiate α , defined in (18), with respect to p :

$$(19) \quad \frac{d\alpha}{dp} = -wrK \left(1 + \frac{2rKes}{Y(1 + es)} \right) \frac{dL}{dp}$$

Let p_0 be the price at which $s = 0$. Note also that at p_0 (17) holds, so that in the vicinity of this point dL/dp is positive. Furthermore,

since α is continuously differentiable in p there always must exist some interval $[p_0, p_1]$ where (17) holds and where, due to the consequential positiveness of dL/dp , α is monotonically decreasing in p . Suppose now that α reaches the minimum at p_1 , i.e., that $d\alpha/dp$ is equal to zero. But it is seen from (19) that, with s and Y being positive, this can only happen if dL/dp is equal to zero. However, at p_1 (17) holds, and dL/dp is strictly positive. Hence α does not have a minimum at p_1 . The infinite repetition of the argument reveals that α does not have a minimum in the entire region of nonnegative profits, i. e., that it is monotonically decreasing in p in this interval.

We therefore conclude that the following proposition on the LMF's response to price variations will generally hold:

P5. A change in the product price to the LMF leads to a change in its employment and output in the same direction⁴

At the same time P5, combined with P2, indicates that, at least in the large and most relevant segment of the price region, which encompasses the zero-profits price point, the controlled LMF will adapt to demand shifts more flexibly than the entrepreneurial PMF, in the sense that its product supply curve will be less steep than the corresponding PMF's schedule.

[Figure 2 about here]

Finally, P2 and P1, combined with P5, imply that in the interval of the e parameter defined by (12) and (7a) there exists an infinite number of positively sloped product supply curves. Some of these curves are depicted in figure 2, where MC and ATC respectively denote the marginal and the average total costs schedule.

VI. Summary and Conclusions

In this paper we have defined an automatic transfer mechanism, coupled with the auctioneer organisation of the labour market, that improves the short-run performance of competitive labour-managed firms and

economies without modifying their institutional arrangements.

The basic effects created by its operation may be summarised as follows.

First, it makes both the users and the suppliers of labour to react to variations in the centrally imposed calculated wage in the qualitatively same way as they would respond to changes in the market wage in an entrepreneurial system. The calculated wage thus becomes an instrument which secures, through the auctioneer procedure, the clearance of the labour market under worker-management.

Second, the mechanism generates an infinite number of positively sloped product supply curves available to the LMF which are, at least in the most relevant segment of the price region, less steep than the marginal costs schedule. This will reduce the inflationary pressures in a cooperative economy, which are likely to be lower than in conventional entrepreneurial systems. At the same time the LMFs' chances in the competition against PMFs will also be improved, due to their more flexible adaptation to demand shifts.

Further research is required to analyse the working of the scheme in the presence of adjustment costs, labour heterogeneity, or various monopolistic distortions. The impact of the mechanism on the risk shifting by a cooperative and on the allocative efficiency is also to be studied.

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NOTES

1. If the earning differentials, caused by the mechanism, become a matter of concern, the Fund could introduce a progressive tax on the dividend in excess of the calculated wage. The tax may also help to cover possible deficits in the Fund's budget, as the scheme does not have built in safeguards for keeping it balanced.
2. If this, however, occurs, one would have to dispense with the unique value of the e parameter for the regions of negative and nonnegative profits.
3. In the presence of asymmetric information on the profit component of the dividend the argument presented below will hold *a fortiori*.
4. If the worker would not be better off after a relocation required by P3, the question of his voluntary withdrawal will arise. A solution to the problem could be found in a one-time compensation negotiable by all interested parties. Another possible arrangement is to make a distinction between the junior workers, both with the right and the duty to leave the cooperative first, and the senior ones, with the privilege of no involuntary withdrawal but also with an obligation to stay with the ailing firm until it is declared bankrupt. While the "must leave" rule is essentially a technical one and is intended to enable the necessary short-run adjustments, the "must stay" arrangement provides a basis for granting labour the control rights and may be taken to represent a major precondition for the feasible worker-management.

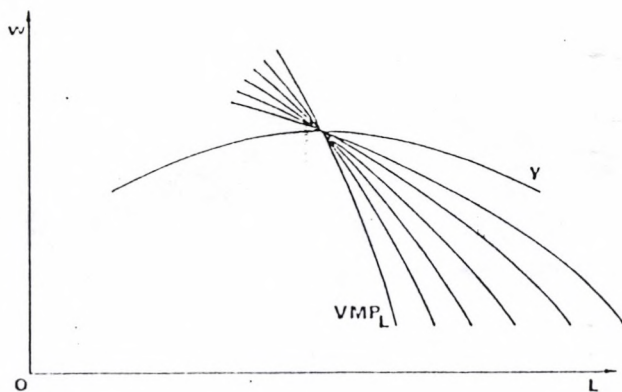


Fig. 1: The Collection of Demand for Labour Curves
Available to the LMF

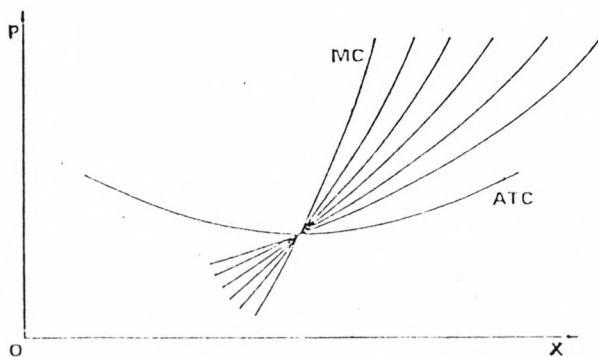


Fig. 2: The Collection of Product Supply Curves Available to the LMF

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