LABOR MANAGEMENT IN A COMPETITIVE SOCIETY

by

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I. Introduction

Formal economic analysis of the labor-managed firm operating in a market economy began with Ward's (1958) path-breaking discussion. Since then, an extensive literature on the subject has developed. Much, if not most, of this literature takes the view that in the short run, labor-management is characterized by perverse comparative-static properties and an inefficient allocation of labor across firms. A number of economists have also questioned the efficiency of the investment decisions made by such organizations.

This paper contends that these criticisms are misguided, and stem from flawed assumptions about the design of a labor-managed firm. Existing models almost universally preclude trades in a set of valuable assets, namely memberships in the firm, and thereby prevent the establishment of labor market equilibrium.[1] This premise biases efficiency criteria against labor-management at the outset, despite the fact that there is no inconsistency between the presence of such a market and the goal of securing labor's control over the firm's actions. Moreover, the customary postulate that the labor-managed firm will maximize net income per hour of labor misrepresents the true interests of current firm members.

Sections 2 and 3 review some objections to labor management in a short run setting and in the realm of investment decisions, respectively. In each case, I show that a market in memberships,

or labor shares, induces the workers in a labor-managed firm to adopt policies which maximize the total market value of memberships. These policies are precisely those which an entrepreneurial firm would adopt, and accordingly, the efficiency losses described in the literature disappear.

Section 4 draws on the literature on stockholder unanimity to provide a general equilibrium framework for comparing labor management with alternative economic systems. In the 'share-goods economy', several classes of residual claim can exist for each firm, corresponding to the various input suppliers and output consumers who are assigned a role in the collective choice procedure governing the firm's production plans. When competition prevails in all markets, claimants of each type unanimously support value maximization as a decision criterion, and the resulting production choices parallel those in an entrepreneurial system. Any allocation sustainable as an equilibrium in a competitive entrepreneurial economy can also be sustained as an equilibrium in a labor-managed share-goods economy. This is true even if firms are prohibited from hiring certain inputs without also granting the factor owners involved a right to participate in management functions.

Section 5 comments on some implications of these findings. Interpreting labor management as an incentive-compatible form of market socialism, the share-goods model indicates that this system can perform as well as its capital-managed or entrepreneurial counterparts when the comparison is made in a competitive framework. This conclusion steers the debate over rival systems toward identification of the particular market

imperfections which are germane to relative efficiency assessments, and toward an analysis of the background institutions which shape the organizational form of an economy.

II. Labor Management in the Short Run

This section contrasts the short run behavior of one variant on labor management, the Ward-Domar-Vanek (WDV) firm, with another species of labor-managed firm. Before proceeding, however, it is necessary to clarify the nature of the 'entrepreneurial' firm, which provides the efficiency baseline used throughout the paper. An entrepreneurial firm hires all inputs and sells all outputs at explicit market prices, and chooses production vectors according to the criterion of profit maximization. This firm need not have the same properties as a labor-managed (or capital-managed) firm, since in the latter cases, the production plan is chosen by a particular set of factor owners, under institutional rules which are as yet unspecified. A central purpose of this paper is to state institutional rules which in fact guarantee that such firms imitate the entrepreneurial firm.

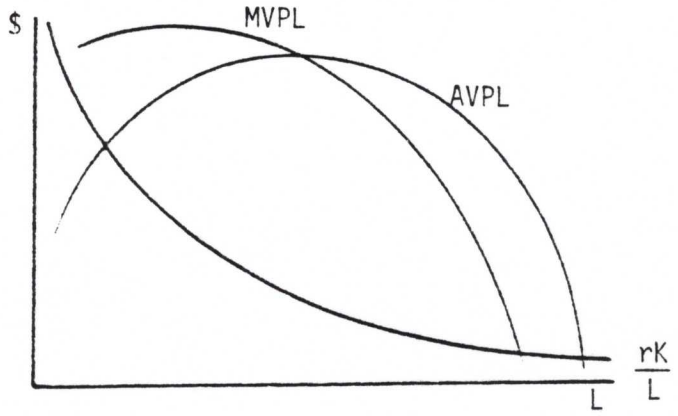
A WDV firm maximizes net income per worker or per hour worked, rather than entrepreneurial profit. This quantity will be termed the dividend rate, and denoted v(L). For a two-input, one-output production function F(K,L), where labor is variable in the short run and capital is fixed, the dividend rate is:

$$(1) \qquad v(L) = \frac{PF(K,L) - rK}{L} = AVPL - \frac{rK}{L}$$

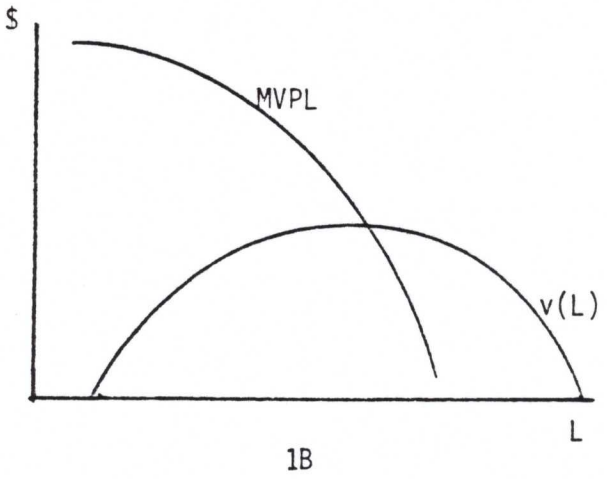
where P is the output price, rK is the fixed cost associated with previous capital commitments, and AVPL is the average value product of labor. Ordinarily it is assumed that the firm operates in an environment of excess labor supply, so that there is no labor market constraint on the choice of L. The maximum dividend rate corresponds to the point of maximum distance between AVPL and the fixed cost per worker, as in Figure 1. Notice that the marginal value product of labor (MVPL) intersects the maximum of both AVPL (Figure 1a) and the dividend rate v (Figure 1b), although at a higher level of labor input in the latter case. This implies that at the optimum L*, v* = MVPL, as shown in Figure 2.

This figure also shows the role of labor supply constraints.[2] When v* > w, the existing members find a queue of workers wanting to work at the dividend rate v*. This case is shown as $w = w_1$ in Figure 2. With labor in excess supply to the firm, maximization of the dividend rate implies a negatively-sloped short run output supply function. For this reason, a WDV regime may have unstable product markets. The firm also responds perversely to changes in fixed costs, hiring additional labor and expanding output as fixed costs rise (for proofs of these statements, see Ward, Domar, and Chap. 3 of Vanek).

Short run misallocations of labor are highly likely in this system. When the external wage is less than v*, MVPL > w, so that the existing members (and outside workers) would like the firm to be able to hire more labor at some wage between v* and w. However, this would require discrimination between existing and



1A



1B

FIGURE 1

THE DIVIDEND RATE FOR THE
WARD-DOMAR-VANEK FIRM

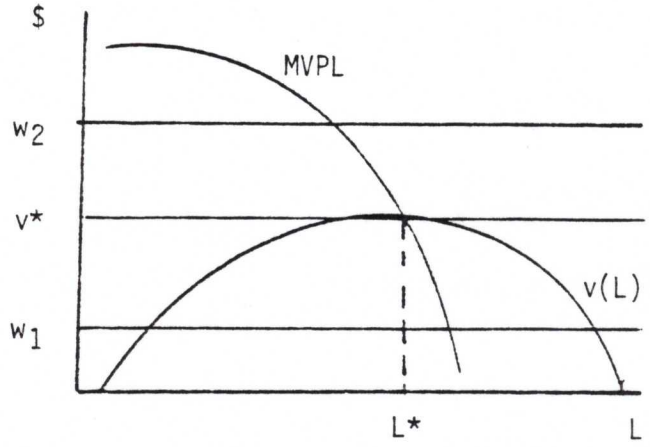


FIGURE 2

LABOR MARKET CONSTRAINTS ON THE WARD-DOMAR-VANEK FIRM

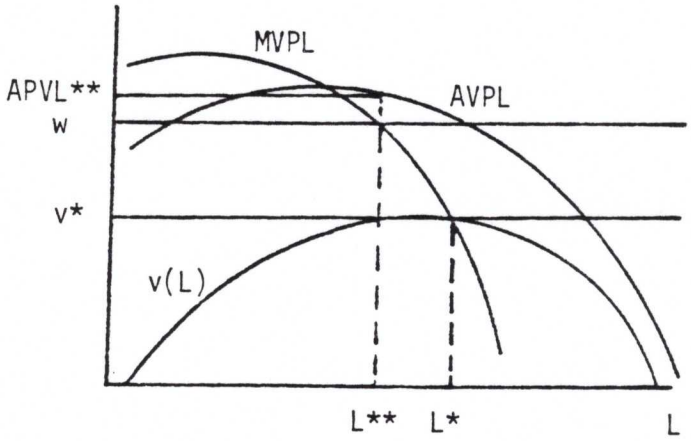


FIGURE 3

SHUTDOWN IN THE WARD-DOMAR-VANEK
AND ENTREPRENEURIAL FIRMS

new members, which is ordinarily ruled out by institutional assumptions.[3] Equalization of MVPL across firms occurs only by coincidence in the short run, because no market forces operate to bring v* into equality throughout the economy.

When $v^* < w$, individual members will want to leave the firm, since they can do better in the external labor market. This case is shown as $w = w_2$ in Figure 2. If departing workers carry no continued responsibility for the firm's fixed costs after leaving, the entire firm will disband. An entrepreneurial firm would not shut down so long as price exceeds average variable cost, or $AVPL^{**} > w$, where the double asterisk denotes the value assumed when L is chosen to satisfy MVPL = w. Inspecting Figure 3, we find that a wage rate somewhat above v* can be compatible with $AVPL^{**} > w$, and therefore with continued operation of the entrepreneurial firm. The WDV firm ignores the rise in the average value product of labor as the labor force shrinks from L^* to L^{**}.

These inefficiencies arise because the firm treats v, rather than w, as the cost of labor, and has no way of handling collective capital obligations. But the peculiarities of the WDV firm are deeper still. It is not quite clear whose interests are served by maximizing net income per worker. Consider a WDV firm which receives a lump-sum government subsidy, an example suggested by Domar. If the 'net income per worker' criterion is adopted, the optimal labor force is zero (or as close as the firm can get and still receive the subsidy!). If $v^* > w$ before the subsidy is offered, the workers who are dismissed from the firm in pursuit of this policy will surely raise objections.[4]

Now consider a regime in which memberships (labor shares) in the firm are transferable. Prior to production, there are L_o labor shares outstanding. The existing membership must collectively choose a labor input L, where the amount v(L) per labor share will be distributed to all production workers, old and new, after production occurs. If $L > L_o$, this requires that $L - L_o$ new labor shares be sold before production begins, and if $L < L_o$, shares must be repurchased by the firm from some existing members. The price of a membership (the right to contribute one hour of labor to production) will be the excess of the returns to membership over the external wage, or $v(L) - w$. Any revenue raised in this way is divided among the initial members in proportion to their membership holdings.[5]

A worker with initial holdings l_o will receive the net payoff

$$(2) \qquad l_o/L_o\ [v(L) - w](L - L_o) + l_o[v(L) - w] =$$
$$l_o/L_o\ [PF(K,L) - rK - wL] =$$
$$l_o/L_o\ [v(L) - w]L.$$

The first term in the first line is the worker's share of revenue from labor market transactions, and the second term is that worker's share of net income from production, adjusted for the opportunity cost of the worker's initial labor supply, wl_o. For any initial labor force L_o and any initial holding l_o, the worker will want L to be chosen to maximize the bracketed expression in the second line. This implies labor use and shutdown policies identical to those of a corresponding

entrepreneurial firm. In turn, this profit expression equals the ex post market value of all membership claims on the firm, as shown in the third line. Hence: A labor-managed firm which trades memberships has the same short-run comparative-static and efficiency properties as an entrepreneurial firm, and will maximize the market value of its memberships.

III. Investment in the Labor-Managed Firm

In the long run, the Ward-Domar-Vanek firm can achieve an efficient allocation of labor and other resources even without a market for memberships. If firms enter industries having abnormally high dividend rates and exit where dividends are abnormally low, the set of equilibrium allocations coincides with the set of competitive equilibria for entrepreneurial firms (Dreze, 1976). However, Furubotn (1976) and Jensen and Meckling (1979) have offered a number of reasons why labor management might be inconsistent with proper investment incentives.

Jensen and Meckling (like Furubotn) define labor management as a system in which trading of memberships in firms is legally prohibited.[6] For this regime, they go on to raise the following issues involving investment decisions:

1. The Impossibility of Pure Rental. For reasons involving incentives for proper maintenance of capital goods, and the existence of intangible assets such as good will, it is inefficient or impossible to have a labor-managed firm rent all capital assets from external owners. Workers will therefore have to finance such assets through personal contributions or the

issue of pure financial claims. As investments, these expedients encounter the 'horizon' problem.

2. The Horizon Problem. Since there are no tradable claims on the firm, workers have no way to extract the principal of any previous investments in the firm at the time they leave employment. If the useful life of an asset exceeds the expected time of remaining employment, employees will use truncated income flows in evaluating the investment project, and will invest too little in long-term projects or maintenance.

3. The Common Property Problem. Due to institutional rules, new employees acquire the same claim on net income as old employees. When new investments are made which require additional labor, the old workers will be obliged to share the income streams resulting from past investments to which the newcomers did not contribute. Current employees will then be reluctant to make such new investments, even when they yield a positive present value to the firm as a whole.

It is surely true that rental is difficult or impossible for many capital assets. Moreover, many proponents of labor management are opposed to the separation of capital goods (the 'means of production') from labor as a matter of principle, and for them, a pure rental firm may not be sufficiently labor-managed to count. But these objections lose their force once the horizon and common property problems are resolved.

Setting aside legal prohibitions on transferable labor shares as irrelevant to the purposes of labor management,[7] the

horizon problem disappears, because the market value of labor shares adjusts in a way which fully capitalizes the future net income from current investments. Members can therefore schedule their participation in the firm as they please, without affecting the perceived desirability of investment proposals. The common property problem also disappears, because new labor suppliers have to purchase a membership right in the firm, and prices will reflect the present value of any past investments the current membership has made (as well as any debts they have incurred).

Define the following notation:

V_t = total market value of all labor shares at t

L_t = amount of labor input at time t, equalling the number of outstanding labor shares at t

l_t = labor input of a particular worker at t

$a_t = (L_t - l_t)/L_t$ = proportion of labor input (labor shares held) by other workers at t

w_t = opportunity wage at time t.

Production and investment technology are summarized by the function $I(K,\dot{K},L,t)$, which gives the income available for distribution to labor after expenditures for net investment $\dot{K}$ and payments to hired factors other than labor. I assume unrestricted borrowing and lending by the firm and individual workers at the common interest rate r, subject to known capacities to repay loans.

The planned input paths $\{L_s\}$ and $\{K_s\}$, $s \geq t$, are chosen collectively by the membership at time t. Collective plans are

treated as parametric by each member. Individual workers can freely vary their labor supply to the firm by buying or selling its labor shares. The value V_t equilibrates the market for labor shares, where L_t is the supply of labor shares (the firm's demand for labor) at time t.

At time t, the flow of net benefits to a participating worker who holds l_t shares is

$$(3) \qquad (1 - a_t)[I(K,\dot{K},L,t) + \dot{L}_t V_t/L_t] - \dot{l}_t V_t/L_t - w_t l_t$$

The four components of net benefits are:

(i) a proportional share of net income from production, after investment expense

(ii) a proportional share in the proceeds from current transactions by the firm in the market for labor shares, due to the sale of new shares or the repurchase of old ones, at the current price V_t/L_t

(iii) a deduction for any personal expenditures for new labor shares, or revenue from the sale of existing personal holdings, and

(iv) a deduction for the opportunity cost of current participation in the firm, $w_t l_t$.

From the definition of a_t, (3) can be rewritten as

$$(1 - a_t)I(K,\dot{K},L,t) + \dot{a}_t V_t - w_t l_t$$

A plan for future labor participation $\{l_s\}$, $s \geq t$, will bring the worker a stream of net benefits whose present value is:

$$\int_t^{\infty} e^{-rs}[(1 - a_s)I_s + \dot{a}_s V_s - w_s l_s]\, ds$$

Integrating by parts, using $\lim_{s \to \infty} e^{-rs}V_s = 0$, and cancelling terms gives:

$$(4) \quad \int_t^{\infty} e^{-rs}\,[(1 - a_s)(I_s + \dot{V}_s - rV_s) - w_s l_s]\, ds + (1 - a_t)e^{-rt}V_t$$

Given $\{L_s\}$, $\{K_s\}$, $\{V_s\}$, and $\{w_s\}$, every worker will attempt to devise a participation plan $\{l_s\}$ which maximizes this present value. But by the definition of a_s, (4) is linear in l_s, and so equilibrium in the market for memberships at time s requires

$$(5) \qquad I_s + \dot{V}_s - rV_s = w_s L_s.$$

If this equilibrium condition holds at all s, then the worker's net present value from any participation plan $\{l_s\}$ reduces to

$$(6) \qquad (1 - a_t)e^{-rt}V_t = (1 - a_t) \int_t^{\infty} e^{-rs}(I_s - w_s L_s)\, ds$$

which is a given fraction of the current market value of the firm's labor shares.

This shows that the current members unanimously support value maximization at each point in time.[8] Moreover, the total market value of all labor shares is simply the present value of an equivalent entrepreneurial firm, by the definition of I_s. The firm therefore behaves as if it were an entrepreneurial firm hiring labor on a spot market at the wage w_s, regardless of the time horizons of current members. Also, its policies are

intertemporally consistent, so it does not matter whether earlier members can make commitments which are binding on later members. To summarize: A labor-managed firm which recruits labor by selling marketable labor shares adopts the same investment policy as an entrepreneurial firm, and maximizes the market value of its labor shares.

IV. The Share-Goods Economy

The partial equilibrium models of the previous two sections can be generalized by adapting the approach used in the literature on stockholder unanimity and financial markets, particularly by DeAngelo (1981). I shall examine an economy in which there are two types of goods, 'ordinary' and 'share' goods. Ordinary goods are traded on conventional markets and are purchased or sold by firms at explicit prices, through contracts involving no transfer of management rights. Share goods represent a generalization of the usual stock market economy to multiple residual claims on each firm.

To heighten the contrast with an entrepreneurial economy, I shall suppose that in the share-goods economy, institutional rules prohibit firms from acquiring or selling certain goods without an associated transfer of management rights. Each firm issues as many types of residual claims as there are share goods, and these claims carry the right to participate in a specified collective choice procedure governing the firm's production plan. Possession of a given type of share in a firm obligates the claimant to supply (or consume) a quantity of the corresponding

good to be determined by the firm's production plan. In exchange, the claimant receives a dividend equal to a portion of the firm's net income from transactions involving ordinary goods.

For a competitive general equilibrium model with this structure, the following results hold:

(i) Whether management rights are assigned to some single class of shareholders (e.g. capital suppliers, labor suppliers, output consumers), or to some combination of factor suppliers and output consumers, there is an imputation scheme for valuing the contributions of each group which ensures unanimity concerning the firm's production plan. The plan chosen is independent of the group(s) holding management rights, and maximizes the total value of residual claims on the firm.

(ii) Regardless of the imputation scheme, if side payments among initial shareholders can be made costlessly, the production plan chosen in each firm will be identical to that chosen under the imputation scheme in (i), and unanimity will be preserved.

(iii) Any allocation which is an equilibrium of an entrepreneurial economy with given preferences, technology, and resource endowments can be sustained as an equilibrium in a parallel economy where one, several, or all goods are share goods to which management rights are attached.

These assertions will be made more precise as the model is

developed. First, it is necessary to describe the elements of a share-goods economy. These are:

I consumers, indexed by i.

J firms, indexed by j.

M goods traded on ordinary markets by consumers and firms, indexed by m.

N goods traded among consumers on ordinary markets, but traded by firms only through shares, indexed by n.

The following notation will be used:

$y_j = [y_{j1} \cdots y_{jM}, y_{j1} \cdots y_{jN}]$ = production vector for firm j.

$x_i = [x_{i1} \cdots x_{iM}, x_{i1} \cdots x_{iN}]$ = consumption vector for consumer i.

$b_i = [b_{i1} \cdots b_{iN}]$ = vector of net share good purchases from other consumers by consumer i.

$\bar{x}_{im}$ = consumer i's endowment of ordinary good m.

$\bar{x}_{in}$ = consumer i's endowment of share good n.

$p = [p_1 \cdots p_M]$ = price vector for ordinary goods.

$w = [w_1 \cdots w_N]$ = price vector for share goods.

$v_n = [v_{1n} \cdots v_{Jn}]$ = vector of share prices for n.

r_{jn} = imputed value of share good n for firm j.

π^i_{jn} = fraction of n-claims on j held by i.

$\bar{\pi}^i_{jn}$ = consumer i's endowment of n-claims on firm j.

β_{jn} = fraction of firm j's imputed value paid out in dividends to n-claimants.

Inputs appear in production vectors as non-positive entries. Each good is infinitely divisible, as are the claims on firms. The commodities may be goods delivered at various dates in the future, or in various states of nature, with the relevant price being that of the corresponding contingent claim in the present.

Let U^i be the ith consumer's utility function, and let Y^j be the jth firm's technology set. I assume that:

(A) U^i is defined over (some subset of) the non-negative orthant of Euclidean M+N space.

(B) U^i displays non-satiation.

(C) Each consumer's endowment of ordinary and share goods is a feasible consumption vector.

(D) The technology set Y^j is a subset of Euclidean M+N space containing the origin.

(E) The inner product $y_j z$ has a finite maximum over Y^j for any non-negative vector z.

(F) Unrestricted short or long positions in any firm's residual claims are admissible.

A share π^i_{jn} obligates consumer i to supply (or consume) the quantity $\pi^i_{jn} y_{jn}$ of share good n. Define firm j's imputed value as

$$(7) \qquad v^j = \sum_m p_m y_{jm} + \sum_n r_{jn} y_{jn}, \quad \text{all } j.$$

The share-claims of type n on firm j held by consumer i will pay out the dividend

$$(8) \qquad \pi^i_{jn}(\beta_{jn} v^j - r_{jn} y_{jn}).$$

The coefficients β_{jn} are fractions summing over n to unity, and depend upon the institutionally fixed bargaining strengths of the various claimant groups of firm j. The second term compensates the n-claimants for the imputed value of their contributions. By the sign convention, if n is an input, this term is a bonus to the n-claimants for the input supplied, while if n is an output, it is a deduction for the value of the good delivered to these claimants. The imputation system is needed to secure unanimity among initial shareholders when side payments within this group are not feasible. It can be verified that the sum of dividend payments over all i and n equals firm j's net income from ordinary goods transactions.

Fixing the production vectors y_j defines an exchange economy in which resource endowments and the net output of the J firms are to be allocated among the I consumers. Consumption of share goods equals endowments net of transactions with other consumers and firms:

$$x_{in} = \bar{x}_{in} + b_{in} + \sum_j \pi^i_{jn} y_{jn}, \quad \text{all } i, n. \tag{9}$$

The ith consumer's budget constraint is:

$$\sum_n \sum_j [\bar{\pi}^i_{jn} v_{jn} - \pi^i_{jn}(v_{jn} + r_{jn} y_{jn} - \beta_{jn} v^j)] - \sum_n b_{in} w_n + \sum_m (\bar{x}_{im} - x_{im}) p_m \geq 0 \tag{10}$$

The first term is the value of share endowments held by consumer i, while the second is the net cost of shares purchased. The

third term is the cost of share goods acquired from other consumers, or the value of goods sold to them if $b_{in} < 0$. Consumer i's choice variables are the x_{im}, the b_{in}, and the π^i_{jn}. The prices p_m, w_n and v_{jn} are determined in market equilibrium, and are parametric for each consumer. The endowments $\bar{\pi}^i_{jn}$, the bargaining strengths β_{jn}, and the imputations r_{jn} are given data.

An <u>exchange equilibrium</u> for the share-goods economy is:

a non-negative price vector $[p, w]$,

N vectors of share-claim values v_n which are unrestricted in sign, and

for each i, vectors $[x_{i1} \ldots x_{iM}]$,

$[b_{i1} \ldots b_{iN}]$, and

$[\pi^i_{11} \ldots \pi^i_{JN}]$

such that:

(a) U^i is maximized subject to (10) for all i, and

(b) the equilibrium conditions (11), (12), and (13) are satisfied:

$$\sum_i (x_{im} - \bar{x}_{im}) = \sum_j y_{jm}, \quad \text{all } m \tag{11}$$

$$\sum_i \pi^i_{jn} = 1, \quad \text{all } j, n \tag{12}$$

$$\sum_i b_{in} = 0, \quad \text{all } n. \tag{13}$$

Equation (13) follows from (9), (12), and the resource constraint on share goods.

The existence of an equilibrium is taken up below, in connection with the equivalence of entrepreneurial and share-

goods economies. For now, it is convenient to assume an equilibrium and examine its properties. These include

(14) $$v_{jn} = \beta_{jn}v^j + (w_n - r_{jn})y_{jn}, \quad \text{all } j, n.$$

This is shown as follows. Any consumer can acquire or sell unlimited quantities of share-good n at the explicit price w_n. If $y_{jn} \neq 0$, the implicit price of a unit of good n in firm j is $(v_{jn} - \beta_{jn}v^j + r_{jn}y_{jn})/y_{jn}$, the net cost of firm j's n-claims divided by its input or output of good n. If the explicit and implicit prices differ, the consumer can profit from arbitrage, since there are no restrictions on the signs or magnitudes of the b_{in} and π^i_{jn}. By non-satiation, this is incompatible with equilibrium, which therefore requires equality of the implicit and explicit prices, or (14). When $y_{jn} = 0$, π^i_{jn} does not directly affect i's consumption of any good. By (10) and non-satiation, $\beta_{jn}v^j > v_{jn}$ implies excess demand for the n-shares of firm j, and the reverse inequality implies excess supply. Equality must hold in equilibrium, implying (14) for the case when $y_{jn} = 0$ as well.[9]

Equation (14) states the equilibrium relationship among the prices of n-shares for firm j, the production vector of the firm, and its imputation scheme. If the jth imputation scheme does not assign good n its (explicit or implicit) market value, the difference is capitalized in the value of the firm-specific claim to that good. If $r_{jn} = w_n$ for all n, which I shall term the 'normal' imputation, then the v_{jn} sum over n to v^j.

No question of 'spanning' arises in the share-goods economy,[10] because there is a superfluity rather than a scarcity

of assets in relation to the number of goods. From the standpoint of an individual consumer, the NJ assets π^i_{jn} are redundant: in equilibrium, their availability does not enlarge the budget set, since each share good could equally well be acquired or sold at the explicit price w_n. The role of share-claims is not to allocate goods or risk among consumers, but to distinguish the parties responsible for managing firms, and through the equilibration of share prices, to bring about unanimity among these parties.

Assertions (i) and (ii) on unanimity in the share-goods economy can now be demonstrated. In exchange equilibrium, the prices of shares can be eliminated from the budget constraint (10) by using (14):

$$(15) \qquad \sum_j \mu_{ij} v^j + \sum_n \sum_j \bar{\pi}^i_{jn}(w_n - r_{jn})y_{jn} + \sum_m \bar{x}_{im}p_m \geq$$

$$\sum_n [b_{in} + \sum_j \pi^i_{jn} y_{jn}]w_n + \sum_m x_{im}p_m,$$

where

$$(16) \qquad \mu_{ij} = \sum_n \bar{\pi}^i_{jn}\beta_{jn}.$$

Now assume <u>competitivity</u>: each consumer believes all goods prices, the imputations and bargaining weights in all firms, and the production vectors of other firms are unaffected by firm j's choice of y_j.[11] Since the origin is in each technology set, the maximized sum of the first two terms on the left hand side of (15) is at least zero. Combining this with the assumption that

each consumer's endowment of goods is a feasible consumption vector, the inequality (15) always holds for some feasible choice of production and consumption vectors.

Due to non-satiation, consumer i always favors vectors y_j which maximize the sum of the first and second terms on the left hand side of (15). By competitivity, the maximization can be carried out independently for each j. For the normal imputation, the second term vanishes, and i favors maximization of

$$(17) \qquad v^j = \sum_m y_{jm} p_m + \sum_n y_{jn} w_n = \sum_n v_{jn}$$

for each j, provided that $\mu_{ij} > 0$. With non-negative prices, the maximum is well-defined by assumption.[12] This confirms assertion (i) of this section. If $\mu_{ij} = 0$, i is indifferent concerning y_j, and any i who is initially short in j favors value minimization.

If costless transfers among all consumers interested in the policies of firm j are possible, this group will unanimously favor maximization of

$$(18) \qquad \sum_i \mu_{ij} v^j + \sum_i \sum_n \bar{\pi}^i_{jn} (w_n - r_{jn}) y_{jn} = \sum_m y_{jm} p_m + \sum_n y_{jn} w_n$$

for each j.[13] This implies the same criterion as under the normal imputation, regardless of the imputation scheme formally in effect, which confirms assertion (ii). Notice that when imputations are assigned arbitrarily, $\mu_{ij} = 0$ is not a sufficient condition for indifference by i to y_j, so that in general, such consumers must be included in the group exchanging side payments,

along with those holding short endowments ($\mu_{ij} < 0$).

Management rights have no value when normal imputations are used. The same production vector will be chosen whether or not a given consumer participates in the decision, and that consumer's opportunity set is unaffected by participation rights. With arbitrary imputations but unrestricted side payments, the distribution of management rights is irrelevant in choosing the firm's production vector, but the particular collective choice procedure used will generally affect the distribution of wealth among individual claimants, by determining the direction in which side payments flow.[14]

With complete contingent claims, management decisions are made once, by the initial shareholders. An institutional requirement that share-goods not be traded by firms without an associated transfer of management rights has no bite, because there are no decisions to be made by _ex post_ claimants. A more interesting case arises when there are sequential spot markets in each commodity, with each period's production decision made by the contemporaneous share-good claimants of the firm. In this economy, _ex post_ shareholders in period t become _ex ante_ in period t+1, and no period's shareholders can commit the membership of the firm to specific actions at later dates.

For this system, it is interesting to ask whether the initial shareholders will still support value maximization, since implementing the corresponding production plan may involve diluting the control of the initial members, and the _ex post_ claimants may not want to carry out the intended plan. If the

value maximization rule is intertemporally consistent, the members at later dates always find it in their interest to carry out the remainder of the plan originally adopted by their predecessors, and knowing this, the initial claimants continue to support value maximization at the earlier date. Make the dating of commodities explicit by setting m = (q,t) and n = (r,t), where the q and r are commodity indexes for ordinary and share goods. Let $p^t_{q,s}$ be the present value at date t of the spot price at date s of ordinary commodity q, with a similar notation for share-good prices. Then intertemporal consistency holds if:

$$p^t_{q,s} = \rho_t p^{t+1}_{q,s}, \quad \text{all } q \text{ and all } s > t, \text{ and}$$

$$w^t_{r,s} = \rho_t w^{t+1}_{r,s}, \quad \text{all } r \text{ and all } s > t,$$

for some discount factor $\rho_t > 0$. The value of firm j, using a normal imputation, then obeys

$$v^{j,t} = \sum_q p^t_{q,t} y^t_{jq} + \sum_r w^t_{r,t} y^t_{jr} + \rho_t v^{j,t+1}$$

where the inputs and outputs in the firm's production vector are appropriately dated. The required modifications in the model closely parallel the analysis in section 3, and need not be developed in detail here.

Returning to the complete markets context, the last task of this section is to demonstrate assertion (iii) by comparing the equilibria of an entrepreneurial economy with those of a share-goods economy when preferences, technology, and goods endowments are identical. A by-product of the analysis will be an existence proof for equilibrium in a share-goods economy. To begin, it is

necessary to define a production equilibrium for a share goods economy, where I assume a normal imputation and non-negative initial claims. This is done by appending to the definition of exchange equilibrium the further requirement:

(c) For each j, no initial shareholder of firm j prefers that the production vector y_j be replaced by some alternative vector in Y^j.

In order to define an entrepreneurial equilibrium, consider the budget constraint

$$(19) \qquad \sum_j \mu_{ij} v^j \geq \sum_m p_m(x_{im} - \bar{x}_{im}) + \sum_n w_n(x_{in} - \bar{x}_{in})$$

where μ_{ij} is i's share in the jth firm, and

$$(20) \qquad v^j = \sum_m p_m y_{jm} + \sum_n w_n y_{jn}, \text{ the value of firm n.}$$

Since only normal imputations will be used henceforth, the role of v^j as firm j's value in both the entrepreneurial and share-goods economies should cause no confusion. An entrepreneurial equilibrium is:

a non-negative price vector [p, w],

a set of I consumption vectors x_i, and

a set of J production vectors y_j, such that:

(a) U^i is maximized over the opportunity set defined by (19), for all i,

(b) v^j is maximized over Y^j for all j, and

(c) the equilibrium conditions

$$\sum_i (x_{im} - \bar{x}_{im}) = \sum_j y_{jm} \qquad \text{and}$$

$$\sum_i (x_{in} - \bar{x}_{in}) = \sum_j y_{jn}$$

hold for all m and n.

Assumptions (A) through (E) stated earlier in this section apply to the entrepreneurial economy as well. Therefore, the maximized value of each firm is non-negative, and each consumer's endowment of goods is a feasible consumption vector. Using any additional set of restrictions on the U^i and Y^j sufficient to guarantee the existence of an entrepreneurial equilibrium,[15] select a specific equilibrium relative to the given preferences, technology, and endowments. Denote all equilibrium production, consumption, and price vectors by a prime. An equivalent production equilibrium can be constructed for the share-goods economy as follows.

Consider requirement (c), unanimity on production vectors. Retain the equilibrium prices p' for the ordinary goods, and take w' to be the vector of prices at which consumers trade share goods among themselves. The valuation of firms by (20) and the goal of value maximization carry over to the share-goods economy when normal imputations are used. Since equilibrium production vectors in the entrepreneurial economy are value-maximizing, condition (c) holds for these production vectors.

Next, consider condition (a), consumer optimality. Set $\beta_{jn} = 1/N$ for all j and n, and assign $\bar{\pi}^i_{jn} = \mu_{ij}$ for all i, j, and n, so that (16) is satisfied. Value the share claims at $v_{jn} = \beta_{jn} v^j$

$= v^j/N$. With a normal imputation and identical endowments of goods, this leaves the value of each consumer's endowment unchanged by the move to a share-goods setting. Any consumption vector available to consumer i in the entrepreneurial equilibrium can be obtained in the share-goods economy by leaving the x_{im} entries unchanged and choosing $b_{in} = x_{in} - \bar{x}_{in}$ and $\pi^i_{jn} = 0$ for all j and n. However, no new consumption vector is available in the share-goods economy, because with this assignment of v_{jn} and a normal imputation, (10) reduces to (19). Since preferences and consumption opportunities are unchanged, the allocation of commodities among consumers in the entrepreneurial equilibrium also satisfies condition (a) for share-goods equilibrium.

Finally, consider requirement (b) for equilibrium in all markets. Because the consumption and production vectors are unchanged, equilibrium continues to hold in the markets for the the M ordinary goods, satisfying (11). The b_{in} and π^i_{jn} will now be assigned so that each i consumes the optimal quantity x'_{in} of each share good, and the equilibrium conditions (12) and (13) hold. All share goods must be in one of the following classes:

(i) $y'_{jn} = 0$ for all j. In this case, set

$$b_{in} = x'_{in} - \bar{x}_{in}, \quad \text{all i, and}$$

$$\pi^i_{jn} = 1/I, \quad \text{all i, j.}$$

Using (9), this gives $x_{in} = x'_{in}$ for all i. This assignment clearly satisfies (12) for all j. Condition (13) also holds, using the fact that the x'_{in} satisfy a resource constraint on good n in the entrepreneurial economy.

(ii) $y'_{jn} \neq 0$ for some j. Choose a firm k for which this is true. To consumers i = 1 . . . I - 1, assign

$$b_{in} = 0, \quad \text{and}$$

$$\pi^i_{jn} = (x'_{in} - \bar{x}_{in})/y'_{kn}, \quad j = k$$

$$= 0, \quad \text{otherwise.}$$

This is always possible because there are no restrictions on short or long positions in shares. Using (9), $x_{in} = x'_{in}$ for i = 1 . . . I - 1. For consumer I, assign

$$b_{In} = 0, \quad \text{and}$$

$$\pi^I_{jn} = 1 - [\sum_q y'_{qn} + \bar{x}_{In} - x'_{In}]/y'_{kn}, \quad j = k$$

$$= 1, \quad \text{otherwise.}$$

Substituting in (9), consumer I obtains $x_{In} = x'_{In}$. Condition (12) is satisfied for all j, and (13) also holds.

Applying this procedure to every share good n, a full assignment of the b_{in} and π^i_{jn} can be generated which is consistent with optimal consumption for each i and satisfies the equilibrium conditions (12) and (13).

This completes the demonstration that for any entrepreneurial equilibrium, the same production and consumption vectors can be sustained as a share-goods equilibrium. Assumptions sufficient to show that any Pareto optimum can be sustained as an entrepreneurial equilibrium also suffice to show that any Pareto optimum can be sustained as an equilibrium with arbitrarily designated share goods, provided that (A) through (F)

hold. Existence of production equilibrium for a share-goods economy with given bargaining weights and share endowments can be shown by converting these parameters into a set of conventional shares μ_{ij}, setting $v_{jn} = \beta_{jn} v^j$, and working with the corresponding entrepreneurial economy.

V. Labor Management Reconsidered

The share-goods model shows that under competitive conditions, management rights can be assigned to any combination of factor suppliers or output consumers without endangering unanimity or allocative efficiency. This result merely echoes Samuelson's famous observation that in a perfectly competitive market, it doesn't matter who hires whom.[16] If one takes socialism to mean not centralized administration of the economy, but rather a political guarantee that workers will collectively control the production processes of their firms, then a Pareto-efficient, incentive-compatible market socialism is possible under competitive conditions.[17]

This conclusion seemingly contradicts the many adverse judgments which have been rendered on the efficiency of labor management. These judgments have necessarily assumed the presence of market imperfections, either overtly or otherwise. This is most evident for the Ward-Domar-Vanek model, where the labor-managed economy is assumed to operate without an effective labor market, at least in the short run. The objections reviewed in section 3 also presuppose departures from competitivity. For this reason, it is necessary to stress that a priori, labor

management does not imply such imperfections. The assignment of management rights is one thing, and the competitivity of the economy something else again.

The share-goods analysis orients the comparison of alternative economic systems toward explicit theoretical analysis of the behavior of firms when market imperfections exist, and toward an empirical assessment of the specific departures from competition which matter. Proponents of labor management are not content merely to argue that this system is no worse than ordinary capitalism, which is the strongest conclusion available in the competitive analysis. Likewise, the critics believe not only that labor management fails to improve on capital management or entrepreneurship, but that it is predictably worse.

Concerns about fairness and wealth distribution probably play a larger role in motivating these disputes than do efficiency considerations. Common sense suggests that the transfer of management rights from capital to labor amounts to a redistribution of wealth, and this is confirmed by the share-goods model of section 4: with unrestricted side payments among initial shareholders, the assignment of management rights does not affect production plans, but can affect the direction in which bribes must flow. Management rights are fundamentally property rights, and often have a non-zero price. And beyond the economic issue of pie-slicing, various social philosophers have argued that workers should exercise greater control over their own activities.

While the ultimate court of judgment may be political and

philosophical, efficiency considerations also play a part in the debate. I have argued that marketable labor shares can remove many of the alleged inefficiencies of labor management, but these markets will not automatically remove problems of moral hazard, adverse selection, nonconvexities, indivisibilities, irreversibilities, idiosyncratic inputs to production, costs of bargaining, and so forth. It is conceivable that labor management might be especially vulnerable to one or more of these nuisances.[18] However, capital-managed and entrepreneurial firms also face these problems, and it is not obvious why such firms should be inherently better equipped to surmount them.

Incomplete markets may lead an entrepreneurial economy to an inefficient assortment of job characteristics across firms, just as competitive markets may not provide optimal product differentiation.[19] Working conditions are often local public goods, and workers often possess important information about their preferences and abilities, or about the production process, which is unavailable to other factor suppliers.[20] Potential opportunism in the capital-labor relationship argues for some form of ownership integration for these factors,[21] but prohibitions on slavery require such integration to be incomplete at best in a capital-managed regime. These points suggest possible efficiency gains from an explicit collective choice mechanism through which workers influence or control management decisions.

Skeptics often resort to the argument that labor management must be inefficient because it is seldom observed in the modern economy.[22] This position is virtually atheoretical unless one

describes in some detail what one means by labor management, and explains why the alleged inefficiencies are empirically important. Without such a theoretical underpinning, the argument amounts to a Panglossian faith that whatever exists is better than anything which doesn't.

This view also ignores the background role of institutions such as the state in determining which organizational forms are viable and, in a world where transactions costs are positive, which markets exist. The institutional context of market trade is not so thoroughly neutral as to make an entrepreneurial model, in which anyone can hire anyone else with equal ease, a plausible description of any real industrial economy. For example, the limited liability corporation was engendered by a combination of legislation and court interpretation. The state continues to support and regulate stock markets in various ways, including insider-trading rules, rules concerning proxy solicitation and takeover attempts, and so forth. No comparable effort has been made to facilitate the formation of labor-managed firms, or the creation of associated markets in labor shares, insurance services, etc. Much more work is needed on the role of background institutions in shaping the organizational forms found in the modern economy.

Notes

1. Although Meade (1972, pp. 423-425) suggested compensation payments within and across labor-managed firms as a way of removing inefficient allocations of labor, Sertel was apparently the first to recognize the importance of membership markets in overcoming the flaws of the Ward-Domar-Vanek firm. This paper's analysis of the short run case is anticipated by Sertel (1982, ch. 2).
2. It is common in the literature to impose an upward-sloping labor supply constraint on the firm which, when binding, removes some of the perverse comparative static results mentioned in the text. Examples include Domar (1966) and Vanek (1970, Ch. 4). However, this only replaces a non-equilibrating labor market with a non-competitive one.
3. Domar considers possible discrimination within the firm when there is a rising labor supply curve to the firm by its members. Meade permits discrimination both among the current members and between members and outsiders in his discussion of the 'Inegalitarian Cooperative.'
4. Berman (1977) remarks that an analogous situation would arise in the capitalist economy if some shareholders could expel other shareholders of the same firm without compensation, merely because this increased the value of the shares held by those who remained. Some recent writers (Steinherr and Thisse, 1979, and Brewer and Browning, 1982) have tried to rectify the perversities of the WDV firm by randomizing the expulsion of individual workers and assuming

risk aversion. However, this is a second-best strategy in combating a problem which has a first-best solution.

5. This system satisfies Meade's (1972, p. 421) rules for a labor cooperative:

   (i) A new partner enters the firm only if

      (a) the new partner wishes to come in, and

      (b) this is acceptable to the existing partners.

   (ii) An existing partner departs only if

      (a) this partner wishes to leave, and

      (b) the partner's exit is acceptable to the remaining partners.

6. Jensen and Meckling (1979) begin by remarking:

> Labor-managed cannot mean that labor owns the firm in the traditional sense, that is, it cannot mean that tradable residual claims on the firm are held by employees. If that is all it means we are back to the traditional profit maximizing firm. What the term 'labor-managed' really means is that the models being used presume there are <u>legal prohibitions</u> against the existence of tradable residual claims on the entire sequence of future cash flows generated by the firm (what we usually think of as common equity). (p. 475, emphasis in original)

Elsewhere, they assert:

> All claims on the firms themselves are held by employees, but there is no market for these claims . . . eligibility for claims is conditional on employment, and the right to become an employee is not legally for sale. (p. 477)

7. The <u>sine qua non</u> of labor management is not a lack of transferable membership claims, but the control of management functions by the current workforce, through some suitable collective choice procedure. Firms in which these decisions are made by labor do not presuppose any legal

prohibitions on trading memberships, any more than capital-managed firms require prohibitions on trading in common stock. Management rights may reside with labor suppliers for various reasons, including the voluntary consent of other factor owners or requirements imposed by the state. The fact that properly designed systems of labor management have the same efficiency features as entrepreneurial systems should be interpreted as an interesting attribute of labor management, not as a reason to redefine the concept.

8. Furubotn (1976) reaches different conclusions because in his model there are no marketable labor shares, and collectives are forbidden to borrow against future income or liquidate the existing capital stock. Workers cannot recover the principal of any retained earnings invested in the firm, and due to the horizon problem, cannot be expected to support any investment proposal unanimously. Also, initial members have a motive to prolong their control of management, in order to ensure the dominance of their own preferences.

9. By the same reasoning, the implicit prices of share goods would equalize across firms even if share goods could not be traded directly among consumers, and the unanimity results would still hold. However, the lack of a consumer exchange market would prevent the proof of assertion (iii) in section 4, because in an entrepreneurial equilibrium, it is possible that no firm uses or produces some share good. A shift to a share-goods regime would then shrink the opportunity set of each consumer.

10. Baron (1979) reviews the vast literature on spanning and

unanimity theorems for stock market economies. DeAngelo's (1981) interpretation of this literature using the concept of global dominance for consumers' opportunity sets is closely related to the present discussion.

11. As used here, competitivity means the perceived independence of prices and individual production choices, not actual price independence. See DeAngelo (1981) for a discussion of the alternative competitivity assumptions used in proving unanimity theorems.

12. As Makowski (1983) points out, competitivity can be consistent with equilibrium rents, so the firm's maximized value may be strictly positive. Assumption (E) excludes the combination of constant returns to scale and positive market value.

13. A similar maximand is proposed by Grossman and Hart (1979) to deal with incomplete markets. They envisage takeovers in the stock market, rather than direct bargaining among ex ante shareholders, as the mechanism enforcing use of their maximand.

14. This is essentially an application of the 'Coase theorem' on externalities to the public goods problem of choosing the firm's production vector--see Coase (1960).

15. For example, see Debreu (1982). Assumptions sufficient to prove existence will generally entail assumptions (A) through (E) in the text, so that the unanimity results follow automatically for such an economy.

16. Samuelson (1957), p. 894.

17. The Lange-Lerner version of market socialism was not incentive-compatible, because it required managers of enterprises to follow behavioral rules assigned to them by the state, without explaining their motivation to do so. In the share-goods economy, the state's role is limited to enforcing property rights, including the rights of claimants to participate in appropriate collective choice processes.

18. Meade (1972) holds that the inability of workers to diversify their job holdings in a manner parallel to stockholder diversification can explain why risk-bearing capital usually hires labor, rather than the reverse. However, it is unclear why similar insurance services cannot be provided directly to undiversified workers. Moral hazard and adverse selection problems will certainly exist, but they should be no worse than those faced by capitalists in hiring (and insuring) workers. In either case, some monitoring of workers by insurers will be needed, but this need not compromise the principle that workers are the ones who take the initiative in management functions.

19. See Dreze (1976).

20. Unions already provide one means, albeit an incomplete one, for coping with these public goods and informational problems--see Freeman and Medoff (1979).

21. Relevant discussions include Williamson (1975), Klein, Crawford, and Alchian (1978), and Dow (1983).

22. Examples include Nozick (1974, Ch. 8) and Jensen and Meckling (1979).

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