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Abstract

Traditionally, it has been argued that profit sharing can increase employment and welfare because it lowers marginal labour costs without reducing total cost or labour income. In this paper, we show that profit sharing can also represent a Pareto-improvement if labour supply is excessive due to relative consumption effects. Mandatory profit sharing reduces wages. If the rise in profit income keeps total income constant, profit sharing will have no income but only a substitution effect. Since labour supply is excessive, profit sharing constitutes a Pareto-improvement.

JEL-Code: D620, J220, J330.

Keywords: labour supply, profit sharing, relative consumption, status concerns.

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1. Introduction

Profit sharing is popular in many countries (OECD 1995, Pendleton et al. 2001) and has been credited with numerous benefits. It may raise labour productivity, avoid inefficient collective bargaining outcomes, reduce employment variability, and – perhaps most importantly – raise labour demand (Weitzman 1985, Pohjola 1987, OECD 1995, Jerger and Michaelis 1999, Lin et al. 2002). In order to demonstrate the advantages, most theoretical analyses assume non-competitive settings. Accordingly, one central argument in favour of profit sharing is that it moderates the unemployment consequences of market power. In this paper we show that profit sharing can have beneficial effects in a competitive labour market without unemployment as well. This will be the case if there are relative consumption effects or status considerations which give rise to negative externalities. These externalities, in turn, induce individuals to supply too much labour. Profit sharing reduces wages and raises the workers' profit income in such circumstances. In equilibrium, the net impact is zero for a given level of labour supply, such that the income effect has no consequences, while the substitution effect induces a reduction in hours of work. Since a fall in labour supply decreases aggregate profits, thus lowering profit income, the beneficial consequences of profit sharing may no longer arise if the share parameter is too high.

In Section 2, we describe the model and establish that relative consumption effects induce excessive labour supply also in the present set-up. In Section 3, we demonstrate that the introduction of profit sharing lowers hours of work and constitutes a Pareto-improvement.

2. Model

Set-up

There are many identical individuals who decide on the amount of work they supply. For simplicity, we normalise the number of individuals to unity. Utility, u, increases with the individual's own consumption level, c, of the sole commodity, and decreases with working time, h. Since the existence of preference interdependencies is well documented (cf. Clark et al. 2008 for a survey), and neglecting them has long been viewed as a major deficiency of traditional models of individual behaviour we, furthermore, assume that utility, u, declines with average consumption, $\bar{c}$. This implies that $u = u(c, \bar{c}, h)$ holds, where $u_1 > 0 > u_2, u_3$, and the subscripts i, i = 1, 2, 3, denote partial derivatives. The restriction $u_3 < 0$ captures disutility of work, while $u_2 < 0$ has been termed 'jealousy' or 'envy' (cf. Dupor and Liu 2003).

The utility function is strictly concave in each argument, so that $u_{ii} < 0$ holds. In addition, $u_1 + u_2 > 0$ (for $c = \bar{c}$) ensures that a general rise in consumption is beneficial.

Production of the single consumption good takes place with labour as the sole factor in n equal sites according to a strictly concave production function f, f = f(h/n), f ' > 0 > f ", where n is determined endogenously. Moreover, production entails set-up costs, K, per site.

Pareto-Efficiency

Assuming that all individuals are treated identically, Pareto-efficiency can be characterised by maximising utility, u, subject to the constraint that individual consumption and average consumption coincide, $c = \bar{c}$, and equal output, nf(h/n), less aggregate set-up costs, nK.

$$P(c, h, n, \lambda) = u(c, c, h) + \lambda(nf(h/n) - c - nK) \tag{1}$$

Maximisation of P yields $\partial P/\partial\lambda = 0$ and:

$$\frac{\partial P}{\partial c} = u_1 + u_2 - \lambda = 0 \tag{2a}$$

$$\frac{\partial P}{\partial h} = u_3 + \lambda f'(h/n) = 0 \tag{2b}$$

$$\frac{\partial P}{\partial n} = \lambda\left[f(h/n) - f'(h/n)\frac{h}{n} - K\right] = 0 \tag{2c}$$

The second-order conditions are assumed to hold. Combining equations (2a) and (2b) yields:

$$f'(h/n) = -\frac{u_3}{u_1 + u_2} \tag{3}$$

According to (3), marginal productivity equals the marginal rate of substitution between leisure ($-u_3$) and consumption ($u_1 + u_2$), where the latter incorporates the consumption externality. Let the working time characterised by equation (3) be denoted by h*.

Market Outcome

We assume that markets are competitive. Accordingly, each individual determines working time, h, optimally, taking as given average consumption, $\bar{c}$, and the wage, w. If the individual has an exogenous income, S, and the price of the output good is unity, consumption will be given by c = wh + S. Maximising $u(c, \bar{c}, h)$ with respect to working time, h, subject to this constraint, yields:

$$u_1(wh + S, \bar{c}, h)w + u_3(wh + S, \bar{c}, h) = 0 \quad (4)$$

The second-order condition is assumed to hold. For later use it is helpful to note that a general increase in exogenous income S which, hence, affects both individual consumption, c, and average consumption, $\bar{c}$, equally, will reduce labour supply if $\alpha := (u_{11} + u_{12})w + u_{13} + u_{23} < 0$ holds.

Each of the n identical firms employs a fraction 1/n of total labour supply, h, and incurs fixed set-up or market entry costs, K. Entry will, in the absence of profit sharing, take place until gross profits per firm, π, equal K.[1] The market equilibrium is determined by the firm's first order condition, $f'(h/n) = w$, for a profit maximum, equation (4) and $f(h/n) - wh/n - K = 0$. Therefore, $f(h/n) - f'(h/n)h/n = K$ holds and the number of firms will, ceteris paribus, that is assuming $h = h^*$, be Pareto-efficient. Substituting $f'(h/n) = w$ into (4) and rearranging yields:

$$f'(h/n) = -\frac{u_3}{u_1} \quad (5)$$

The working time resulting in a market economy without profit sharing is denoted by h^m. Since the right-hand side of equation (3) is greater than the right-hand side of equation (5), ceteris paribus, and the production function, f, is strictly concave, an individual's incentives to expand working time are still positive at the Pareto-efficient level, h*. Furthermore, total consumption increases with working time, taking into account adjustments in the number of firms, n, because $dc/dh = d(nf(h/n) - nK)/dh = [\partial n/\partial h][f(h/n) - K - f'(h/n)h/n] + f'(h/n) = f'(h/n) > 0$ holds. Additionally, in the absence of profit sharing the ratio h/n is determined by the profit constraint $f(h/n) - f'(h/n)h/n = K$ and, hence, constant in equilibrium. As long as the marginal rate of substitution between leisure and consumption, $-u_3/u_1$, rises with consumption, c, the right-hand side of equation (5) increases with working time. Therefore, working time resulting in a competitive market without profit sharing exceeds the Pareto-efficient amount ($h^m > h^*$) because individuals do not take into account the consumption externality (see, e. g., Persson 1995, Corneo 2002, Dupor and Liu 2003, Cahuc and Postel-Vinay 2005, and Alvarez-Cuadrado 2007 for an according prediction).[2]

[1] See Jackman (1988), Eckalbar (1988), and Georges (1998) for comparable settings.

[2] Note that consumption in the market equilibrium will be lower than the efficient amount at a given level of labour supply if there are profits which do not accrue to workers, for example, via profit sharing or direct firm ownership. The assumption $\partial(-u_3/u_1)/\partial c = -(u_{31}u_1 - u_3u_{11})/(u_1)^2 > 0$ ensures that the lower level of consumption in the competitive setting reduces the right-hand side of equation (5) further than presumed by the ceteris paribus assumption. In consequence, the left-hand side must also be smaller, which implies that the incentives to expand labour supply are even higher if differential consumption levels are taken into account.

3. Mandatory Profit Sharing

Suppose now that the government imposes a profit sharing scheme in all n firms which entitles employees to a share s, $0 \leq s < 1$, of gross profits. Since the number of workers has been normalised to unity, the (single) worker is employed in n firms and the non-wage related component of income equals $S = sn\pi$. Furthermore, handing over a share s of profits to employees lowers the amount available for covering market entry costs K from π to $(1 - s)\pi$. Thus, gross profits per firm, π, have to rise. In consequence, profit sharing reduces wages.

In equilibrium, any change in wages and profits will affect consumption, c, of the individual under consideration and average consumption, $\bar{c}$, equally. Furthermore, gross profits per firm, π, are independent of the number of firms, n, and aggregate labour supply, h, because firms choose h/n optimally, and decline with wages, w, $\partial\pi/\partial w = - h/n$. Therefore, the equilibrium is determined by $A := u_1(c, \bar{c}, h)w + u_3(c, \bar{c}, h) = 0$ (cf. equation (4)), for $c = \bar{c} = wh + sn\pi(w)$, the restriction on profits, labelled B, and $C := f'(h/n) - w = 0$:

$$B := (1-s)\pi - K = (1-s)\left[f\left(\frac{h}{n}\right) - w\frac{h}{n}\right] - K = 0 \tag{6}$$

Total differentiation yields:

$$\begin{bmatrix} A_h & A_w & A_n \\ 0 & B_w & 0 \\ C_h & C_w & C_n \end{bmatrix}\begin{bmatrix} dh \\ dw \\ dn \end{bmatrix} = \begin{bmatrix} -A_s \\ -B_s \\ 0 \end{bmatrix}[ds] \tag{7}$$

Derivatives are given by $A_h = w[(u_{11} + u_{12})w + 2u_{13} + u_{23}] + u_{33}$, $A_w = u_1 + h(1 - s)\alpha$, $A_n = \alpha s\pi(w)$, $B_w = -(1 - s)h/n < 0$, $C_h = f''(h/n)/n < 0$, $C_w = -1$, $C_n = -f''(h/n)(h/n^2) > 0$, $A_s = \alpha n\pi(w)$, $B_s = -\pi(w) < 0$, while α has been defined above as $\alpha = (u_{11} + u_{12})w + u_{13} + u_{23}$. We subsequently assume the equilibrium to be unique, which implies that $[A_h h/n + A_n] < 0$ holds and, hence, $\Delta := -B_w C_h[A_h h/n + A_n] > 0$.

The change in working time, h, resulting from a rise in the share parameter, s, is given by:

$$\frac{dh}{ds} = \frac{C_n[A_w B_s - A_s B_w] - A_n B_s C_w}{\Delta} = \frac{-\pi[C_n u_1 + A_n]}{\Delta} \tag{8}$$

Since $C_n > 0$, while $A_n = \alpha s\pi(w)$ cannot be signed without additional restrictions, we can summarise the result as

Proposition 1:

Assuming a unique equilibrium, the introduction of profit sharing diminishes working time, h, below the level, h^m, arising in a competitive economy in the absence of profit sharing.

Proof:

The introduction of profit sharing is equivalent to evaluating equation (8) at s = 0 which implies $A_n = 0$ and, thus, $dh/ds = -\pi u_1 C_n/\Delta < 0$.[3]

The intuition for the negative impact of profit sharing on hours of work is as follows. A rise in the profit share parameter, s, requires a decline in the wage, w, in order to raise gross profits, π, $dw/ds = -\pi n/((1 - s)h) < 0$ (cf. equations (6) or (7)). A lower wage will only be compatible with the first-order condition, $C = f'(h/n) - w = 0$, if the ratio h/n rises, given a strictly concave production function f. A reduction in labour supply, h, hence implies that the number of firms n declines as well, $dn/ds < 0$. Furthermore, the above calculations (cf. equation (8)) show that total income of workers, $wh + sn\pi(w)$, remains constant when the share parameter, s, is increased, as long as the number of firms, n, remains the same. This is the case because a constant total income per worker guarantees that profits available for covering market entry costs, K, remain at the original level. Accordingly, the income effect, $d(wh + sn\pi(w))/ds$, of a rise in the share parameter, s, is zero, for a given number of firms. Consequently, the labour supply effect is solely determined by the substitution effect of lower wages, which is unambiguously negative. However, the decline in the number of firms, n, reduces the worker's profit income. If a general rise in income lowers labour supply, that is if $\alpha < 0$ and $A_n = \alpha s\pi(w) < 0$ hold, the fall in the number of firms, n, will mitigate or even over-compensate the negative labour supply impact of profit sharing. Solely if the level impact of a change in the number of firms is absent, that is, if profit sharing is introduced, this possibly countervailing impact will be absent.

Although the introduction of profit sharing decreases excessive hours of work, this will only be desirable if welfare rises. Since firms enter the market until gross profits less profit-share payments, $\pi(1 - s)$, equal market entry costs, K, the firms' aggregate payoff, $n(\pi(1 - s) - K)$, is zero. In consequence, we need to consider only utility, $u = u(c, \bar{c}, h)$, which changes with the

[3] If employees obtain a share, s, of gross revenues, f(h/n), instead of gross profits, π, consumption will equal $wh + snf(h/n)$, where $nf(h/n)$ is exogenous from an individual's point of view and (6) will read $(1 - s)f(h/n) - wh/n - K = 0$. It can then be shown that $dh/ds > 0$ also requires $A_n = 0$ as sufficient condition. In this analytical framework, therefore, profit and revenue sharing are also equivalent (cf. Michaelis (1997) for an equivalence result in a unionised setting).

share parameter, s, because hours of work, h, the wage, w, and the number of firms, n, vary with s. Since average consumption equals individual consumption in equilibrium, $\partial c/\partial x = \partial \bar{c}/\partial x$ holds, for x = h, w, n, s. Hence, the variation in utility, u, can, using equation (4), $\partial\pi/\partial w = -h/n$, and the wage change, which has been computed above ($dw/ds = -\pi n/((1-s)h)$), be calculated as:

$$\frac{du}{ds} = \frac{\partial u}{\partial h}\frac{\partial h}{\partial s} + \frac{\partial u}{\partial w}\frac{\partial w}{\partial s} + \frac{\partial u}{\partial n}\frac{\partial n}{\partial s} + \frac{\partial u}{\partial s}$$

$$= (\underbrace{u_1 w + u_3}_{=0} + u_2 w)\frac{\partial h}{\partial s} + (\underbrace{u_1 + u_2}_{+})\left[h(1-s)\frac{\partial w}{\partial s} + s\pi(w)\frac{\partial n}{\partial s} + \pi(w)n\right]$$

$$= u_2 w \frac{\partial h}{\partial s} + (u_1 + u_2)s\pi(w)\frac{\partial n}{\partial s} \qquad (9)$$

Assuming s = 0, we have $\partial h/\partial s < 0$ (cf. equation (8)), while the second term in equation (9) drops out, so that du/ds > 0 results. This yields

Proposition 2:

The introduction of profit sharing constitutes a Pareto-improvement.

Since own hours of work, h, are chosen optimally, the variation in h has no first-order impact. In addition, the fall in average consumption, $\bar{c}$, due to the decline in working hours, h, makes each individual better off. In consequence, the internalisation impact of profit sharing, the first term in equation (9), is unambiguously positive. Furthermore, profit sharing changes wages and profit income, with the net effect on consumption being zero for a given number of firms, as explained above. Therefore, the first and third terms in square brackets in (9) sum to zero. Finally, the decline in the number of firms reduces profit income, as indicated by the terms including $\partial n/\partial s$ in (9). This effect will only arise if workers obtain profit income, i. e., if the share parameter, s, is positive. Therefore, at least the introduction of profit sharing constitutes a Pareto-improvement.

However, profit sharing cannot ensure the first-best allocation, as can be noted from comparison of equations (4) and (5). The reason for this is that marginal costs of labour for a firm and the marginal gain in consumption for an individual are the same and equal to the wage. A Pareto-efficient allocation can be reached only if the firm's labour costs exceed an individual's income gain at the margin, for example, because labour income is taxed (e.g., Persson 1995, Corneo 2002, Dupor and Liu 2003).

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