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Economic Modelling 19 (2002) 815–828

Economic Modelling

www.elsevier.com/locate/econbase

Profit sharing as a worker discipline device

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Accepted 15 May 2001

Abstract

A synthesis of profit-sharing and efficiency wage models is constructed to provide a preliminary account of how a firm determines its pay parameters, and why it chooses to be a profit-sharing or a fixed-wage firm. We find that the properties of the worker's effort function crucially influence the firm's choices between different compensation systems, and that the adoption of a profit-sharing scheme cannot guarantee the attainment of full employment. Other findings of the paper also seem to be very different from those of Weitzman's share model.

JEL classifications: J41; J023; J823

Keywords: Efficiency wages; Profit sharing; Involuntary unemployment

1. Introduction

One of the most provocative ideas of modern macroeconomics is Weitzman's share economy. In a number of influential papers and a popular book (Weitzman, 1983, 1984, 1985, 1986), Weitzman claims that the introduction of economy-wide profit sharing will shift the economy into a state of excess demand for labor. Profit sharing can, therefore, be viewed as a cure for the central economic dilemma of

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0264-9993/02/$ - see front matter
PII: S0264-9993(01)00081-5

our time — stagflation. He thus advocates that the government should encourage basic reforms in the compensation system from a traditional fixed-wage system to a profit-sharing one. His proposal has received wide attention in the popular press and from policymakers and economists. The general opinion, however, suggests that further work is required to test the theoretical validity and empirical significance of his assertions.[1]

An essential feature of the contrast between fixed-wage and profit-sharing systems is the motivation of workers. When a worker is hired at a given monthly or weekly wage in an entrepreneurial firm, any incremental profit due to her/his extra effort accrues to the entrepreneur. Workers thus have little or even no incentive to behave in a way that will promote the profitability of the enterprise, and tend to provide the minimum standard of effort so as to keep their job. By contrast, as is the assertion of Cable and Fitzroy (1980) and Bradley and Gelb (1983), the profit-linked property of a profit-sharing system may act to stimulate increased effort from the labor force.[2] Weitzman himself also proposes that this is one of the advantages of profit sharing, although Weitzman's share model does not contain such effects.[3] However, this productivity enhancing effect is not supported unequivocally by empirical studies. Based on 26 surveys, Kruse (1993a) finds that approximately 10% of surveys indicate that both the sharing ratio and the worker's effort display a significant negative relationship, while another 30% indicate that the worker's effort is positively, but insignificantly, related to the sharing coefficient.[4] Kruse (1993a, p. 152) also finds that productivity is not enhanced in over one-fourth of profit-sharing adopters. These mixed observations lead us to ask, under what circumstances can profit sharing be expected to play a role in improving worker performance, and whether the profit-sharing model incorporating the work effort may alter the economic implications of Weitzman's share model.

A major purpose of economic theories is to explain how a society determines its market prices and the corresponding resource allocation. In the context of the present paper, this would refer to the base wage and the profit-sharing ratio. However, Weitzman (1985, p. 946) does not propose a formal theory to explain why a society chooses a particular base wage and sharing-ratio configuration. Weitzman

[1] An excellent and brief review of Weitzman's essential arguments can be found in Nordhaus (1986). A comprehensive survey of relevant theoretical and empirical studies is furnished by Estrin and Wadhwani (1990).

[2] Weitzman (1984) offers three reasons why the widespread introduction of profit sharing may improve the functioning of the labor market. First, the remuneration may stimulate increased effort from the labor force, and thus increase the firm's demand for labor. Weitzman labels this argument 'soft-boiled'. Second, profit sharing may increase wage flexibility. This will reduce unemployment during a recession. Weitzman calls this argument 'medium-boiled'. Lastly and most importantly, a profit-sharing economy will always display an excess demand for labor. Weitzman names this 'hard-boiled'.

[3] These productivity effects may also have implications for labor demand. The same argument can be found in Meade (1972) in the discussions about labor-managed firms.

[4] For example, Jones and Pliskin (1991) and Kruse (1993b) find that employees in a profit-sharing firm may exhibit lower productivity.

recognizes this and presumably believes that his analysis would be needed anyway as a preliminary step towards any more ambitious formulations that directly attempt to tackle the pay parameters.[5] To state the question differently, what precisely are the economic forces that motivate a firm to choose to be a profit-sharing rather than a fixed-wage, or even a pure-sharing one? In fact, the co-existence of various payment systems without obvious government intervention in the real world indicates that there are some economic forces that drive firms to choose their compensation schemes.[6]

Another important development in modern macroeconomics is the efficiency wage theory.[7] The shirking model, the most popular version of the theory, emphasizes that the worker's effort is related to the payment system and working conditions including: the wage; unemployment rate; unemployment benefits; and the like. The theory also assumes that firms possess market power to set wages. Hence, if firms believe that a lower wage would significantly reduce work effort, it may be profitable for them not to lower their wages even in the presence of mass unemployment.

After an inspection of these two strands of the literature, it is natural to ask how a profit-sharing remuneration scheme might affect the workers' effort, and in turn, how the responses of the work effort might alter the macroeconomic implications of profit-sharing and efficiency wage theories.[8] In the model presented in the paper, we examine what motivates a firm to be a profit sharing rather than a fixed-wage or a pure-sharing one. We also examine whether the introduction of profit sharing into an efficiency wage model can achieve full employment.

The remainder of this paper is organized as follows. Section 2 develops a synthesis of profit sharing and efficiency wage models and finds the equilibrium in the profit-sharing system. Section 3 discusses the robustness of Weitzman's propositions and Section 4 gives the concluding remarks.

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[5] Some economists have pointed out the need for a model where the pay parameters are endogenously determined. For example, Estrin and Wadhwani (1990, p. 236) claim that 'to be completely convincing, Weitzman's model must therefore be supplemented with a description of how wages are set'. Also, Estrin and Wadhwani (1990, pp. 255–256) indicate that 'the persistence of the fixed-wage system despite repeated efforts to reform it point to deep-rooted preferences of both workers and managers. The reasons for these preferences are not yet well understood.'

[6] Clearly, profit-sharing remuneration is a general payment formula of fixed-wage and pure-sharing compensations. We thus can expect that if a theory can succeed in endogenously determining the levels of its pay parameters, then the same model may also contribute a mircrofoundation for the reasons why an economy evolves into a profit-sharing one while others do not.

[7] The often-cited versions include: the shirking model of Shapiro and Stiglitz (1984); the turnover cost model of Salop (1979); the adverse selection model of Weiss (1980); and the gift exchange model of Akerlof (1982). Excellent surveys have been provided by Yellen (1984), Akerlof and Yellen (1986) and Katz (1986).

[8] Wadhwani (1987) sets up a synthesis model of efficiency wages and profit sharing, and he shows that if wages are determined according to the efficiency wage theories, then the wage and share economies can exhibit the same properties. A comment on the shortcomings of his model is provided by Cugno and Ferrero (1991).

2. The model

Consider an economy where each of many identical firms hires a number of identical workers to perform some task. Since workers prefer shirking to working, there must be some incentive devices to induce workers' exertion. The incentive devices with which this paper concerns itself are the profit-linked wage payment and the threat of dismissal for shirking.

2.1. The worker's optimization problem

The worker enjoys consumption goods by spending income (c), and dislikes putting forth effort (e). Effort e ($0 \leq e \leq 1$) is specified as the fraction of working hours (the number of working hours is normalized to 1) that the worker actually works. More specifically, the worker's utility function is U assumed to be:[9]

$$U(c,e) = c - e \tag{1}$$

Let ρ denote the probability of being fired when the worker gets caught shirking. When a worker is dismissed, she/he will try to find a new job. The probability of being hired by another firm is supposed to be the employment rate $(1 - u)$. The unemployment rate u is defined to be the ratio of the number of unemployed to the total number of workers in the economy.

In line with the static analytical framework of Pisauro (1991), there are three states of nature that an employed worker may face. First, she/he is not fired and receives a real income y_i with probability of $(1 - \rho)$. Second, she/he is dismissed, but finds another job at a real income y; the associated probability is $\rho(1 - u)$. When labor is hired, she/he puts forth effort e and the level of effort is symmetric across firms. Third, she/he is fired and cannot find another job; hence, she/he becomes unemployed (and enjoys all day leisure $e = 0$) and receives unemployment benefits b from the government. The probability in this case is ρu. Moreover, firms are assumed to be identical and pay the same real wage ($y_i = y$). The three states are thus reduced to two. The expected utility V of an employed worker is thus:

$$V = (1 - \rho u)(y - e) + \rho u b \tag{2}$$

We next take the profit-sharing scheme into account. Suppose that there is a large number of identical firms having the same production technology $f(\bar{e}n)$ with $f' > 0$ and $f'' < 0$. The term $\bar{e}$ is the (total) average effort of the firm's workers, n is the number of workers that the firm hires, and $\bar{e}n$ is thus the actual working hours or the effective labor force of the firm. The price of output is normalized to

[9] This simplest form of the utility function has been widely used in the efficiency wage literature, including Shapiro and Stiglitz (1984) and Levine (1989).

unity, so that the output $f(\bar{e}n)$ is also the revenue. Them y, the compensation of an employed worker, is thus:

$$y = w + s\left[\frac{f(\bar{e}n) - wn}{n}\right] \tag{3}$$

The terms w and s are the base wage and the profit-sharing ratio offered by the firm, respectively. In addition, the probability of being fired ρ is presumed to fall at a decreasing rate with the effort level, that is:

$$\rho = \rho(e),\ \rho' < 0,\ \rho'' > 0 \tag{4}$$

From Eqs. (1)–(4), the expected utility of the worker is:

$$V = [1 - \rho(e)u]\left[w + s\left(\frac{f(\bar{e}n) - wn}{n}\right) - e\right] + \rho(e)ub \tag{5}$$

Since unemployment benefits are not the focus of this paper, we set $b = 0$ in the following analysis. The worker's optimization problem is to choose the level of effort to maximize Eq. (5). The first-order condition is:

$$V_e = -\rho'(e)u\left[w + s\left(\frac{f(\bar{e}n) - wn}{n}\right) - e\right] + [1 - \rho(e)u][s\bar{e}_e f'(\bar{e}n) - 1] = 0 \tag{6}$$

where term $\bar{e}_e$ is the contribution of extra effort from a typical worker to the total average effort of the firm's workers. Eq. (6) indicates that the expected marginal gain from effort is equal to the expected marginal cost of effort. In addition, the second-order condition: $V_{ee} = -2\rho' u(sf' - 1) - \rho'' u[w + s\left(\frac{f - wn}{n}\right) - e] + [1 - \rho u]s(\bar{e}_e)^2 f'' < 0$ is satisfied.

From the vantage point of an individual worker, the total average effort $\bar{e}$ is defined as:

$$\bar{e} = \frac{1}{n}e + \frac{n-1}{n}\tilde{e} \tag{7}$$

where e is the worker's effort, and $\tilde{e}$ is the average effort of all firm's workers other than the worker we consider. It follows from Eq. (7) that the conjectural variation term $\bar{e}_e$ is:

$$\bar{e}_e = \frac{1}{n} + \frac{n-1}{n}\tilde{e}_e \tag{8}$$

Eq. (8) indicates that the contribution of an extra unit of effort from a typical worker to the total average effort $\bar{e}_e$ is the weighted average of his/her extra

unitary effort Eq. (1) and the incremental average effort of all other workers induced by his/her additional effort ($\tilde{e}_e$). The weights are $1/n$ and $(n-1)/n$, respectively. For ease of analysis and notation, suppose that his/her conjecture regarding other workers' effort response $\tilde{e}_e$ is a constant and in what follows is expressed as x.

Since workers are identical, it is natural to ascertain that $e = \bar{e} = \tilde{e}$. By imposing this condition on Eq. (6), the effort function can be solved as:

$$e = e(w,s,n,u,x) \tag{9}$$

where

$$e_w = \frac{\rho' u(1-s)}{(1-e_{\tilde{e}})V_{ee}} > 0^{10,11} \tag{9a}$$

$$e_s = \frac{1}{(1-e_{\tilde{e}})V_{ee}}\left[\rho' u\left(\frac{f-wn}{n}\right) - (1-\rho u)\bar{e}_e f'\right] \gtrless 0 \tag{9b}$$

$$e_n = \frac{-1}{(1-e_{\tilde{e}})V_{ee}}\left[\rho' u\frac{s}{n}\left(\frac{f}{n} - \bar{e}f'\right) + (1-\rho u)s(\bar{e}\bar{e}_e f'' + \bar{e}_{en} f')\right] \gtrless 0 \tag{9c}$$

$$e_u = \frac{1}{(1-e_{\tilde{e}})V_{ee}}\left\{\rho'\left[w + s\left(\frac{f-wn}{n}\right) - e - b\right] + \rho(s\bar{e}_e f' - 1)\right\} > 0^{12} \tag{9d}$$

$$e_x = \frac{-(1-\rho u)sf'}{(1-e_{\tilde{e}})V_{ee}} > 0 \tag{9e}$$

In Eq. (9c), $\bar{e}_{en} = \dfrac{1}{n^2}(x-1)$. Intuitively, the result $e_w > 0$ in Eq. (9a) states that the higher base wage will induce more effort. This result is the basic tenet of efficiency wage theories. Second, the result $e_u > 0$ in Eq. (9d) indicates that a higher unemployment rate increases the work effort. This result captures the basic idea of Shapiro and Stiglitz (1984) that unemployment is a worker discipline device. The result $e_x > 0$ in Eq. (9e) states that the higher confidence in his/her peers' effort response to his/her own extra endeavor x raises his/her pay expectation and motivates him/her to work harder to keep the job.

The outcomes of $e_s \gtrless 0$ and $e_n \gtrless 0$ in Eqs. (9b) and (9c) indicate that the effort effect of a rise in either the sharing ratio or the number of co-workers is

[10] Using the stability condition proposed by Romer (1996) (pp. 295–296), we restrict $(1-e_{\tilde{e}}) > 0$.
[11] In addition, $e_{ww} = \rho'\rho'' u^2(1-s)/(1-e_{\tilde{e}})(V_{ee})^2 < 0$ is relevant for the following discussion.
[12] Since the first term in Eq. (6) is positive, $(s\bar{e}_e f' - 1) < 0$.

ambiguous, and that these effects are dependent on the conjecture variables x, $\bar{e}_e$ and $\bar{e}_{en}$.

There are three ways to set the values of the conjectural variations in the relevant literature. One rules out the possibility that workers might jointly determine the coalition or collective effort (Miyazaki, 1984; Estrin and Wadhwani, 1990). This means that each worker has a Nash-like perception: each worker chooses his/her own effort level, taking as given the choices of his peers, so that the conjectural variation terms become $x = 0$, $\bar{e}_e = 1/n$, and $\bar{e}_{en} = -1/n^2 < 0$. Under this situation, Eq. (9b) and Eq. (9c) become:

$$e_s = \frac{1}{V_{ee}}\left[\rho' u\left(\frac{f}{n} - w\right) - (1 - \rho u)\frac{f'}{n}\right] > 0 \tag{9b'}$$

$$e_n = \frac{-1}{V_{ee}}\left[\rho' u\frac{s}{n}\left(\frac{f}{n} - ef'\right) + (1 - \rho u)s\left(\frac{ef''}{n} - \frac{f'}{n^2}\right)\right] < 0 \tag{9c'}$$

When the worker acts in a Nash-like way, the contribution of extra effort to the total average effort ($\bar{e}_e = 1/n$) is positive. Hence, a higher sharing ratio raises the payment and induces more effort as shown in Eq. (9b′). Eq. (9c′) states that the incentives for an additional amount of effort by an individual worker declines with the number of co-workers. Under a profit-sharing scheme, each worker must share the proceeds of his/her effort equally with co-workers. Even though more fellow employees imply a bigger pie to distribute, workers' rewards decrease as the number of co-workers increases due to the diminishing marginal return of labor (i.e. $f/n > ef'$ due to $f' > 0$ and $f'' < 0$).

Another specification allows workers to form groups or coalitions in relation to effort (Tyson, 1979). The rationale is that profit sharing is a particular sort of group incentive scheme, with rewards to performance assessed at the level of the enterprise and distributed to all employees. In such a group incentive scheme, an individual's pay depends on the effort of his peers as well as himself, and people will be motivated to monitor the effort supply of their fellow employees more keenly. As a result, profit sharing can provide incentives in support of a positive collusion to raise effort. Under such circumstances, the values of the conjectural variations become $x > 0$, $\bar{e}_e > 1/n$ and $\bar{e}_{en} = (x - 1)/n^2 \gtrless 0$. Accordingly, this will enhance the positive effort effect of an increase in either the sharing ratio or the number of co-workers, so that the sign of e_s will still be positive, while e_n may become ambiguous.

Not all economists, however, agree with the above arguments. They claim that when a profit-related wage payment fails to motivate workers to monitor one another more keenly, the incentive properties of a profit-sharing scheme weaken considerably by the free rider problem. Jensen and Meckling (1979) have argued that, if profit sharing is contrasted with individual incentive systems, it will be found to encourage shirking. Under such circumstances, the values of the conjectural variations become $x < 0$, $\bar{e}_e < 1/n$ and $\bar{e}_{en} = (x - 1)/n^2 < 0$. Consequently,

this weakens the positive effort effect of a rise in either the sharing ratio or the number of co-workers, so that the sign of e_n will still be negative, but the sign of e_s may become ambiguous.

The previous discussions conform to empirical observations. Weitzman and Kruse (1990, p. 100) propose that 'to get the productivity-enhancing effects, something more may be needed — something akin to developing a corporate culture that emphasizes company spirit, promotes group cooperation, encourages social enforcement mechanisms, and so forth.' In his empirical studies, Kruse (1993a) confirms this viewpoint, namely, that the characteristics of corporate culture, the history of employee relations and peer pressure indeed play a crucial role in stimulating work effort.

Before ending this section, there is a point worthwhile to highlight. In a fixed-wage economy ($s = 0$), Eq. (6) becomes $V_e = -1 < 0$ if $u = 0$. When there is no unemployment, the worker will shirk all of the paid for hours ($e = 0$). That is, full employment is inconsistent with any positive effort level. This outcome is similar to the no-shirking condition in Shapiro and Stiglitz (1984). The labor market equilibrium therefore must be characterized by unemployment in a fixed-wage economy. By contrast, in a share economy, Eq. (6) becomes $V_e = s\bar{e}_e f'(\bar{e}n) - 1 = 0$ as $u = 0$. In other words, in the presence of the sharing scheme, workers may furnish a positive effort for extraneous sharing even without unemployment being used as a discipline device. The labor market equilibrium in a share economy, therefore, may be characterized by full employment.

2.2. The firm's optimization problem

A firm's profit π is:

$$\pi = (1 - s)[f(e(w,s,n,u,x)n) - wn] \tag{10}$$

As with the usual setting of efficiency wage models, a higher w has a benefit as well as a cost, as does s (a higher revenue if $e_s > 0$) in this synthetic model. On the contrary, in Weitzman's and most other share models where $e = 1$ (there is no shirking problem), Eq. (10) becomes $\pi = (1 - s)[f(n) - wn]$. In this case, an increase in either w or s will only raise the firm's labor cost, while leaving revenue unchanged. Weitzman emphasizes that the sharing ratio in his model plays the same role as a pure profit tax, which does not have any impact on employment and output. By contrast, in our model a higher sharing ratio may raise the work effort. This, in turn, will raise the output level and motivate the firm to hire more workers. Consequently, the sharing ratio no longer plays the same role as a pure profit tax.

In the profit-sharing literature, the profit-sharing ratio is always assumed to be set by the government, and the wage is determined by a Walrasian auctioneer. Although this assumption can simplify the analysis, it is undoubtedly more realistic to invest the firm with the market power to set the wage as well as the sharing ratio. Thus, the firm's optimization problem is to choose the levels of n, w and s so as to maximize its profit in Eq. (10). Since the firm is small, it makes its

employment decisions under the belief that it cannot influence the unemployment rate. The first-order conditions with respect to n, w and s are:

$$\pi_n = (1 - s)[(e + e_n n)f'(en) - w] = 0 \tag{11}$$

$$\pi_w = (1 - s)[e_w nf'(en) - n] = 0 \tag{12}$$

$$\pi_s = (1 - s)e_s nf'(en) - [f(en) - wn] \leq 0 \tag{13}$$

These are the usual MR = MC conditions.

Since this paper focuses on whether the firm will adopt a profit-sharing scheme ($s > 0$) or a fixed wage one ($s = 0$), the first two first-order conditions are thus supposed to hold.[13] However, owing to the ambiguous sign of e_s, the first-order condition with respect to the sharing ratio s may not hold. A firm will adopt a profit-sharing scheme ($s > 0$) if $\pi_s = 0$, or a fixed wage one ($s = 0$) if $\pi_s < 0$.[14] As discussed above, one obvious reason for the case of $\pi_s < 0$ may arise from the possibility that an increase in the sharing ratio has a negative impact on work effort ($e_s \leq 0$) due to the free-rider problem. When the profit-related wage payment fails to motivate workers to monitor one another more keenly and is accompanied by the free-rider problem, the incentive properties of a profit-sharing scheme are weakened considerably. The firm should then give up the profit-sharing program and adopt the fixed-wage system.

If $\pi_s = 0$, then the three endogenous variables n, w and s can be solved as the functions of u and x from Eqs. (11)–(13) as follows:

$$n = n(u,x) \tag{14}$$

$$w = w(u,x) \tag{15}$$

$$s = s(u,x) \tag{16}$$

2.3. The labor market equilibrium

Letting the number of identical firms be m, the aggregate labor demand function is $N^d = mn(u,x)$. Since the firms possess market power in determining their employment and pay parameters, the labor market equilibrium is prominently determined by the demand side in this shirking model. Let N be the total number

[13] The main purpose of this paper is to demonstrate the determinations of the payment parameters, rather than investigate the effects of unemployment benefits and the like. We therefore will not explicitly report and discuss the comparative static results in the analysis that follows.

[14] Let us suppose that the relevant second-order conditions are all satisfied in the discussion that follows.

of people in the labor force and N^s be the number of such people who can get a job. The relationship between N^s, u and N is $N^s = (1 - u)N$.[15]

If $N^d = N^s$ holds at a positive unemployment rate, then the labor market equilibrium is characterized by unemployment in the share economy. On the contrary, if $N^d > N^s$ holds at any positive rate of unemployment, then full employment equilibrium is achieved. We first consider the former case.

When $N^d = N^s$ holds at $0 < u < 1$, the labor market equilibrium condition is:

$$mn(u,x) = (1 - u)N \tag{17}$$

Therefore, the equilibrium unemployment rate u^* can be solved as:

$$u^* = u^*(x) \tag{18}$$

Substituting Eq. (18) into Eq. (15) and Eq. (16), the market equilibrium level of the base wage w^* and the sharing ratio s^* can be solved as:

$$w^* = w^*(x) = w[u^*(x),x] \tag{19}$$

$$s^* = s^*(x) = s[u^*(x),x] \tag{20}$$

To summarize, there are N workers who are willing to work at the prevailing market levels of the base wage w^* and the sharing ratio s^*, and provide the effort level according to the effort function. However, the total available vacancies that all firms in the economy are willing to afford is only $(1 - u^*)N$, and thus there are u^*N workers who cannot get a job. Obviously, the unemployment of these workers is involuntary.

Weitzman claims that the introduction of economy wide profit sharing will shift the economy into a state of excess demand for labor in the short run and full employment in the long run. However, as mentioned previously, pure sharing may be a proxy for unemployment to act as a worker discipline device, but it does not mean that profit sharing will lead the economy to full employment. Eq. (18) clearly demonstrates that the labor market may be characterized by involuntary unemployment. This result is dramatically different from Weitzman's proposition. However, this result is supported by empirical work. Based on UK evidence, Wadhwani and Wall (1990) conclude that 'it is, though, hard to believe that the PS (profit sharing) firms are, in fact, in an excess demand for labour regime for much of our sample period, which was, in fact, characterized by high unemployment.' Using French micro data, Cahuc and Dormont (1997) find that the profit-sharing scheme does not lead to a significant expansion in labor demand. Developing a turnover cost model, Koford and Miller (1991) also obtain a similar result.

[15] Under the assumption that all workers are homogeneous, we must assume that the expected utility of a worker who participates in the labor market is greater than the utility of an individual who does not. This implies that every worker is willing to undertake a job. However, not all workers can find a job, unless there is zero unemployment. In fact, given the total labor force, the higher the unemployment rate is, the fewer the workers there are who can get a job.

If the notional labor demand is larger than the labor supply ($N^d > N^s$) for any positive rate of unemployment, then the labor market is always in a state of excess demand for labor, and thus the full employment equilibrium will be fulfilled. In such a situation, since all firms are identical the relatively few workers will be equally distributed among the competing firms in equilibrium. An interesting question is what the level of pay parameters is under full employment. When the unemployment rate is zero ($u = 0$), the first-order condition in Eq. (6) becomes $V_e = s\bar{e}_e f'(\bar{e}n) - 1 = 0$ and the effort function in Eq. (9) is rewritten as:

$$e = e(s,n,x),\ e_s > 0, e_n < 0, e_x > 0$$

Note that $e_w = 0$ under full employment. This implies that when there is no unemployment the worker will receive a base wage with certainty and, therefore, a higher base wage will not stimulate any effort. The irrelevance between the work effort and the base wage means that a higher base wage just raises the firm's production costs, but leaves revenue unchanged. The firm will thus set the base wage as low as possible. The minimum wage may be the lower wage bound.

3. Discussions

We have attempted so far to explain how the pay parameters (i.e. w and s) in a share economy are determined. In Weitzman's share model where there is no shirking problem ($e = 1$), if the firm still possesses market power to determine not only its employment but also pay parameters, Eqs. (11)–(13) become:

$$\pi_n = (1 - s)[f'(n) - w] = 0 \tag{11'}$$

$$\pi_w = -(1 - s)n < 0 \tag{12'}$$

$$\pi_s = -[f(n) - wn] \leq 0 \tag{13'}$$

The negative sign of Eq. (12′) reveals that the firm will set its base wage as low as possible, where either the minimum wage or the worker's reservation wage may be the lower wage bound. As proposed by Weitzman, Eq. (11′) indicates that the role of the profit-sharing ratio is similar to that of the profit tax rate for firms. The profit-sharing coefficient is independent of a firm's employment decision. In other words, the other two variables (n and s) cannot be solved from the remaining equations, Eq. (11′) and Eq. (13′). It is therefore inadequate to allow the firm with market power to determine its pay parameters when there is no shirking problem. The reason for this is that when the work effort is not related to the base wage and profit-share payment, a higher wage payment will only raise labor costs, but leave revenue unchanged.

In contrast to our framework, at least three labor market structures have been proposed to solve the predicament in the literature. The first one is the Walrasian

type of competitive market where the base wage is endogenously determined by the market-clearing condition, while the profit-sharing ratio is set by the government by fiat, or is somewhat exogenously fixed (Weitzman, 1987; Wadhwani, 1987). The shortcoming of a competitive market is that one market clearing condition cannot determine two remaining pay parameters simultaneously. This may answer the question of why Weitzman's share model cannot provide an explanation as to how a society determines both parameters simultaneously. The second labor market structure is the monopoly union model where the union fixes the base wage and firms set employment unilaterally (Tracy, 1986; Jackman, 1988). However, if the effort level is independent of payments, the share parameter plays the role of a pure profit tax rate. Neither the union nor the firm should be invested with the power to set the share parameter, so that a full explanation cannot be developed from the monopoly union model. The third and final labor market structure that can provide an explanation is the efficient bargaining model where pay parameters and employment can be assumed to be negotiated by the trade union and the firm. The problem here is that the evidence clearly suggests that workers often have no choice in the decision as to whether profit sharing is to be introduced or not, nor do they have any say in the size of the employees' share. The profit-sharing program seems to be totally a matter for managerial prerogative rather than for firm–union bargaining (Pemberton, 1991). This fact is not only observed in American firms (Klein and Rosen, 1986), but also in British companies (Poole, 1988). In this sense, our efficiency wage model seems to be more realistic and plausible.

4. Concluding remarks

The co-existence of fixed-wage and profit-sharing firms without obvious government intervention indicates that there are economic forces that drive firms to choose their compensation schemes. Instead of comparing the macroeconomic implications of a shift from a fixed-wage scheme to a profit-sharing one, this paper tries to investigate those economic forces that affect the choices of compensation systems, and compare the economic implications of the economy wide profit-sharing and fixed-wage remuneration systems. Our conclusions are unfavorable to the Weitzman thesis. In effect, our findings confirm the Estrin and Wadhwani (1990, p. 255) criticism that 'the models which take the wage parameters as fixed exogenously suffer from the serious flaw that they do not provide a story to link the short run to the long run. When a theory of wages is appended, it can cast serious doubts on Weitzman's conclusions.'

Perhaps the fairest way to evaluate Weitzman's conclusions is to see whether a share economy performs better than a wage economy. However, when the compensation system is endogenously determined, the comparison must be undertaken more carefully. Thus, to compare the macroeconomic implications of a shift from a fixed-wage scheme to a profit-sharing one under the same total payment may be inadequate. A better approach might be to compare the economic performance of

different endogenously determined schemes, when they are faced with exogenous shocks.

Acknowledgements

We are grateful to an anonymous referee who provided us with useful suggestions on a previous version of this article. However, any errors or shortcomings are our responsibility.

References

Akerlof, G.A., Yellen, J.L., 1986. Efficiency Wage Models of the Labor Market. Cambridge University Press, Cambridge.
Akerlof, G.A., 1982. Labor contracts as partial gift exchange. Q. J. Econ. 97, 543–569.
Bradley, K., Gelb, A., 1983. Worker Capitalism: The New Industrial Relations. Heinemann, London.
Cable, J.R., Fitzroy, F.R., 1980. Cooperation and productivity: Some evidence from West Germany's experience. Econ. Anal. Workers Manage. 14, 163–190.
Cahuc, P., Dormont, B., 1997. Profit-sharing: Does it increase productivity and employment? A theoretical model and empirical evidence on French micro data. Labour Econ. 4, 293–319.
Cugno, F., Ferrero, M., 1991. Share Systems and Unemployment: A Theoretical Analysis. St. Martin's Press, New York.
Estrin, S., Wadhwani, S., 1990. Profit-sharing. In: Sapsford, D., Zafiris, T. (Eds.), Current Issues in Labor Economics. Macmillan, London, pp. 159–171.
Jackman, R., 1988. Profit-sharing in a unionized economy with imperfect competition. Int. J. Ind. Organ. 6, 47–57.
Jensen, M.C., Meckling, W.H., 1979. Rights and production functions: An application to labor-managed firms and codetermination. J. Bus. 52, 469–506.
Jones, D.C., Pliskin, J., 1991. The productivity effects of profit sharing and worker representation on the board. Working Paper No. 91/6. Department of Economics, Hamilton College.
Katz, L.F., 1986. Efficiency wage theories: A partial evaluation. In: Fischer, S. (Ed.), NBER Macroeconomics Annual. MIT Press, Cambridge, pp. 235–276.
Klein, K.J., Rosen, C., 1986. Employee stock ownership in the United States. In: Stern, R.N., McCarthy, S. (Eds.), The Organizational Practice of Democracy. John Wiley, Chichester, pp. 83–102.
Koford, K.J., Miller, J.B., 1991. The natural rate and adjustment to shocks in an efficiency-wage share economy. J. Macroecon. 13, 299–316.
Kruse, D., 1993a. Profit Sharing: Does It Make a Difference? The Productivity and Stability Effects of Profit-Sharing Plans. W.E. Upjohn Institute for Employment Research, MI.
Kruse, D., 1993b. Does profit sharing affect productivity? NBER Working Paper No 4542.
Levine, D., 1989. Just-cause employment policies when unemployment is a worker discipline device. Am. Econ. Rev. 79, 902–905.
Meade, J., 1972. The theory of labour-managed firms and of profit sharing. Econ. J. 82, 402–428.
Miyazaki, H., 1984. Work norms and involuntary unemployment. Q. J. Econ. 99, 197–211.
Nordhaus, W., 1986. Introduction to the share economy. J. Comp. Econ. 10, 416–420.
Pemberton, J., 1991. Profit sharing, unions and investment: An extension. Scand. J. Econ. 93, 577–584.
Pisauro, G., 1991. The effect of taxes on labour in efficiency wage models. J. Public Econ. 46, 329–345.
Poole, M., 1988. Factors affecting the development of employee financial participation in contemporary Britain: Evidence from a national survey. Br. J. Ind. Relations 26, 21–36.
Romer, D., 1996. Advanced Macroeconomics. McGraw–Hill, New York.
Salop, S., 1979. A model of the natural rate of unemployment. Am. Econ. Rev. 69, 117–125.

Shapiro, C., Stiglitz, J.E., 1984. Equilibrium unemployment as a worker discipline device. Am. Econ. Rev. 74, 433–444.
Tracy, J.R.G., 1986. Unions and the share economy. J. Comp. Econ. 10, 433–437.
Tyson, L., 1979. Incentives, income sharing and institutional innovation in the Yugoslav self-managed firm. J. Comp. Econ. 3, 285–301.
Wadhwani, S.B., 1987. Profit-sharing and Meade's discriminating labor-capital partnership: A review article. Oxf. Econ. Pap. 39, 421–442.
Wadhwani, S.B., Wall, M., 1990. The effects of profit-sharing on employment, wages, stock returns and productivity: Evidence from UK micro-data. Econ. J. 100, 1–17.
Weiss, A., 1980. Job queues and layoffs in labor markets with flexible wages. J. Polit. Econ. 88, 526–538.
Weitzman, M.L., 1983. Some macroeconomic implications of alternative compensation systems. Econ. J. 93, 763–783.
Weitzman, M.L., 1984. The Share Economy. Harvard University Press, MA.
Weitzman, M.L., 1985. The simple macroeconomics of profit sharing. Am. Econ. Rev. 75, 937–953.
Weitzman, M.L., 1986. Macroeconomic implications of profit sharing. In: Fischer, S. (Ed.), NBER Macroeconomics Annual. MIT Press, Cambridge, pp. 235–276.
Weitzman, M.L., 1987. Steady state unemployment under profit-sharing. Econ. J. 97, 86–105.
Weitzman, M.L., Kruse, D., 1990. Profit sharing and productivity. In: Blinder, A.S. (Ed.), Paying for Productivity. Brookings Institution, Washington, D.C., pp. 95–140.
Yellen, J.L., 1984. Efficiency wage models of unemployment. Am. Econ. Rev. Proc. 74, 200–205.