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A Double Adverse Selection Model With Socially Responsible Firms and Heterogeneous Workers

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Abstract

We model the coesistence in the labour market of a conventional sector and a socially responsible sector, the latter specialised in taking advantage of workers' intrinsic motivations. Some features of the model are drawn from the previous literature: the crowding out of intrinsic motivations by incentive schemes connecting pay to individual performance; and a second source of heterogeneity, beside the intensity of intrinsic motivation, ability. The novel elements are: workers' intrinsic motivations cannot be enjoyed for free by the firm, but need to be activated at a cost through socially responsible behavior; heterogeneous employers choose which organizational form to adopt, either conventional or socially responsible; the general equilibrium of the labour market of socially responsible firms is analysed, account being taken of the option, for both employers and employees, to move to the conventional sector.

We model the double adverse selection problem faced by socially responsible firms: relatively high wages may attract too large a share of workers with weak intrinsic motivations; but at the same time, relative wages may repel high ability workers, triggering a vicious circle of low pay and low productivity. In the last part of the paper we discuss the conditions under which the socially responsible sector can avoid both dangers.

1 Introduction

In recent years economics has witnessed an increase in the interest for intrinsic motivations with interesting attempts at incorporating them into rigorous economic models. Indeed the dialogue between economics and psychology has lead to economic theories of identity (Akerlof & Kranton, 2000; 2005), intrinsic motivation (Kreps, 1997; Frey, 1997; Frey and Götte, 1999; Frey and Jegen, 2001; Delgaauw and Dur, 2007), self-confidence (Benabou and Tirole, 2003; 2005) and self-esteem (Baguelin, 2005; Junichiro, 2006). This has enriched the economists' view of economic behavior, pushing it beyond the traditional "joint assumption of rationality and individual greed" (Sobel, 2005, p. 392).

Recognizing the fact that workers have complex and heterogeneous motivational structures has two immediate consequences for the theory of principal-agent and for organizational design. The first is referred to as the incentive problem; the second as to the selection problem. In this paper we simply sketch the former and delve instead on the latter.

2 Related Literature

The incentive problem has been variously analyzed both theoretically and empirically. Vocational and intrinsic motivations are "fragile" because using explicit incentives may be associated to a "hidden cost of reward" (Lepper e Greene, 1975; Frey e Götte, 1999; Frey e Jegen, 2001; Gneezy e Rustichini, 2000a e 2000b; Fehr e List, 2004). Explicit incentives may undermine motivation for several different reasons: because they crowd-out intrinsic motivations impairing self-esteem and responsibility (Frey, 1997; Frey and Oberholzer-Gee, 1997); or because they provide new information regarding the importance of the task for the principal in comparison with the wage, as suggested by Gneezy and Rustichini (2000a) and Benabou and Tirole (2003); or because they are insulting for the agent (Gneezy and Rustichini, 2000b); or else because they violate norms of fairness or trust (Fehr and Gachter, 2002; Fehr and List, 2004). Dirk Silkwa (2006) proposes a model where the different incentive-mix adopted by the principal is a signal of the imperfectly observable distribution of workers' preferences. Since these are subject to contagion, the incentive scheme offered or the autonomy granted can reveal a principal's beliefs about workers' conformity to a cooperation norm. Thus, Silkwa shows that: "High-powered incentives may crowd out motivation as pessimism about the norm is conveyed. But by choosing fixed wages or granting autonomy the principal may signal trust in a favorable social norm" (p. 1).

Experimental results show that principal's controlling behavior significantly reduces agents' willingness to act in the former's interest (Barkema, 1995). Falk and Kosfeld (2004) find a non-monotonic relation between agents' performance and the strength of material incentives: "if the principal has only weak incentives at his disposal it is better to trust since controlling reduces motivation of

the intrinsically motivated agents but only increases the performance of opportunistic agents marginally. As incentives get stronger, however, the disciplining effect eventually dominates the negative effect on motivation" (p.24). Fehr and Gächter (2002) and Irlenbusch and Sliwka (2003) have observed that the introduction of the option of using monetary incentives reduced efficiency, in comparison with a pure fixed wage setting. Field evidence from the Swiss Labour Force Survey analyzed by Frey and Götte (1999) shows a negative relationship between the time spent for volunteer work and the presence of monetary compensation.

These results have important implications for the design of compensation schemes. Here, however, the selection problem also enters into the scene, as the compensation package influences the composition of the firm's workforce as to characteristics that are relevant to the employer. This problem has attracted much less attention and has not be satisfactorily integrated with the previous one.

Being intrinsically motivated brings about not only a lower reservation wage, but also a better morale. According to Bewley (2002), morale has three components: "One is identification with the firm and an internalization of its objectives. Another is trust in an implicit exchange with the firm and with other employees; employees know that aid given to the firm or to co-workers will eventually be reciprocated, even if it goes unnoticed. The third component is a mood that is conducive to good work. Good morale has to do with a willingness voluntarily to make sacrifices for the company and for co-workers" (p. 6). A good morale lead workers to cooperate with firms' objectives, to foster a climate of mutual trust and to increase productivity. Borzaga and Tortia (2006) empirically study the effect on morale and loyalty of workers' motivations. They find that workers' satisfaction and loyalty to the organization are influenced by workers' self-declared motivational structure as well as by the incentive-mix offered by different organizational forms. As for job satisfaction, intrinsic interest in the activity performed exerts great influence. As far as the selection problem is concerned, non-profit organizations appear to attract workers with substantially different characteristics from those employed by the for-profit sector (Young, 1983; Mirvis and Hackett, 1983). Other authors also find that, despite their wages are lower (on average and ceteris paribus), non-profit workers are more satisfied and more loyal toward their employers (Weisbrod, 1983; Preston, 1990; Frank, 1996). Such a result, at odds with efficiency wage theory, can been rationalized if one assumes that monetary compensation is only one among several components of reward. Minkler (2002) has classified, in order of relevance, these components: in the first place there are vocational and intrinsic rewards, then those connected with involvement and democratic governance, and only in the third place come monetary rewards.

In this vein Anthony Hayes (2005) develops a model where raising wages increases the probability of attracting the 'wrong sort' of people. Hayes models "vocation" as a "non-pecuniary benefit" that workers (nurses in his example) receive, along with their wage, from doing work that they "like" or "feel a need to do". Standard hedonic models posit that, all else equal, a worker will be

willing to take a lower wage for a job with characteristics she prefers. Indeed Hayes proves that someone with a "vocation", all else equal, will be willing to work for a lower wage than someone who does not feel such a vocation. If intrinsic motivations are though of simply as the willingness to be paid less in activities such as education, nursing care and civil rights, setting low wages is enough to select people with strong intrinsic motivation (see also Brennan, 1996, and Handy and Katz, 1998)

This "getting more by paying less" prescription has been opposed by, among the others, feminist economists Julie Nelson (1999; 2005) and Nancy Folbre (2006, with J. Nelson). According to their view, a low pay is not enough to select vocational workers, as these may simply not afford the luxury of accept too low a wage (while others can, for instance, since they are married women with financially successful spouses - remember that care workers are disproportionately female). Nelson concludes, contrary to Heyes, that higher wages "could increase the flow of 'real care' by making it possible for intrinsically motivated people to continue to care" (2005, p. 260). That higher wages may cause adverse selection is not the only paradox when workers have complex motivations. Delfgaauw and Dur (2007) show that when people are heterogeneous in their motivation to work (but not in their ability), the firm has all the bargaining power, and job candidates must bear an application cost, highly motivated workers are at risk of post-contractual exploitation. In fact, when each applicant's motivation is observable none of the workers applies for the vacancy, as she anticipates that the firm will extracts all her motivational rent, leaving her at a loss due to the (sunk) application cost. This result, known as the "Diamond paradox" (Diamond, 1971), holds even when the firm can not observe the motivation of the workers, as a process develops by which the withdrawal of non motivated workers from the market drives out motivated ones. To avoid this sort of labour market failure, the authors claim, the firm needs to commit to a minimum wage. The optimal level of the minimum wage depends on the degree of observability of applicants' motivations.

Another contribution that leads to conclusions different from Heyes' *getting-more-by-paying-less* is Handy and Katz (1998). They consider, beside responsiveness to intrinsic motivation, another desirable and non-observable trait that makes the principal's problem more complex, but also more realistic: ability. They handle this additional element by introducing an ability test capable of screening applicants' ability, so the firm can avoid hiring low ability candidates. The need remains, however, to find some compensation in order to attract those with high ability. They suggest to do it by offering a larger provision of fringe benefits, which, if well chosen, can help select candidates along the other desirable characteristc: intrinsic motivations. A typical example in academia are research funds, as they are more appreciated by people with a genuine interest in research.[1] Notice, however, that assuming the existence of a cheap and accurate test of workers' ability is tantamount to remove asymmetric information in this

[1] Screening of candidates is also advocated by Auriol and Brilon (2007), who consider a model where workers' intrinsic motivation may not coincide with the goals of the firms.

regard. Furthermore, the suggestion to make recourse to fringe benefits that are more valued by motivated than by non motivated workers, is well targeted, but faces an obvious obstacle the two authors are aware of: the value recipients attach to in-kind remuneration is only a fraction of its cost. Furthermore, one could add, this fraction is likely to decline rapidly as the share of fringe benefits goes up.

We now turn to our model, that takes into account some of the elements of complexity that have been highlighted by the above mentioned literature. It is characterized by the following five features.

First, the positive effect of workers' intrinsic motivations cannot be enjoyed by the organization "for free", but need to be activated by a consistent mission-oriented or socially responsible behavior, which is costly for the employer (so vocational behavior is viewed as a reciprocal response to the employer's a commitment to social goals).

Second, in order to activate workers' intrinsic motivations the employer must avoid incentive schemes connecting pay to individual performance (otherwise motivation crowding out would occur).

Third, we also consider the entrepreneur's choice about which organizational form to adopt, either conventional or socially responsible. The conventional organizational form with material incentives is chosen by employers to whom the net cost of socially desirable behavior is relatively high, and vice-versa.

Fourth, workers differ, not only as to the level of intrinsic motivation, but also as to ability.

Fifth, we study the general equilibrium of the labour market of socially responsible firms, in which heterogeneous employers bid for heterogeneous employees.

Not surprisingly, socially responsible firms attract workers with relatively strong intrinsic motivation, and vice-versa. However, at the same time conventional companies reward ability more, so socially responsible firms are at risk of losing their best workers. Now paying low wages is no more necessarily beneficial as far as worker productivity is concerned. Indeed we find that a change in the relative wage paid by socially responsible firms can have quite different effects.

3 The model

We sketch a simple model of the labour market of the socially responsible (henceforth S) sector:

• there is a continuum of one worker firms of measure 1; firms are identical except for the cost of behaving in a socially responsible way $s \in [s_-, s_+]$;

• there is a continuum of workers of measure $n > 1$;

• each worker employed performs an activity whose probability of success is equal to her effort $0 \leq e \leq 1$; the activity's success has a value equal to π for the employer, while failure has zero value;

• both workers and firms are risk neutral; thus henceforth expressions such as "wage", "utility" and "profit" will refer to expected values with respect to the state of nature without further specification; expected values with respect to other variables will be mentioned explicitly;

• worker utility function is separable in its arguments: wage, (possible) intrinsic benefit from the success of the activity, and effort;

• workers are identical in all respects, apart from two characteristics, independently distributed:

a) ability $\alpha \in [0, \bar{\alpha}], \bar{\alpha} > 0$, a continuous variable which affects, inversely, the cost of effort: $c(e) = e^2/2\alpha$,

b) intensity of intrinsic motivation, μ; for simplicity we assume that μ only takes two values, one of which is zero, i.e. $\mu \in \{0, \bar{\mu}\}, \bar{\mu} > 0$; let σ denote the share of workers with motivation $\bar{\mu}$ (who henceforth are simply referred to as motivated workers);

• workers' intrinsic motivation is triggered by socially responsible behavior on the part of the firm,

• monetary incentives and intrinsic motivation are mutually excluding options, so only conventional (henceforth C) firms adopt monetary incentive schemes (for simplicity we assume these are linear),

• workers choose whether to apply for a job in the S or C sector, according to which ensures greater utility, before knowing whether in the latter they will be unemployed or employed in the current period (see below), or else which firm they will work for;

• workers' utility from unemployment is normalized to zero,

• firms do not observe worker type (i.e. ability and motivation), so they choose randomly among applicants; we assume that firms have correct expectations over the distribution of applicants;

• a firm chooses the S form as soon as the latter ensures non-negative profit (see below).

3.1 Conventional firm

Let $w_C = a + be$ be the incentive pay scheme: a bonus equal to b is paid in case of success, so the expected bonus is be; we assume that a is set exogenously (one can think of a compulsory minimum wage).

3.1.1 Worker utility maximization (or incentive constraint):

$$max_e V_C(\alpha; b) = (a + be) - e^2/2\alpha$$

FOC:[2]	$b - e/\alpha = 0$
Optimum effort:	$e^*(\alpha; b) = \alpha b$
Maximum utility (given b):	$V_C^*(\alpha) = a + \frac{1}{2}\alpha b^2$

[2] The second order condition is clearly satisfied.

3.1.2 Choice by the firm of the incentive parameter b:

Let us initially assume that the firm faces a worker of known ability, α, whose participation constraint does not bind, so the firm can solve:

$$max_b \Pi_C = e^*(\alpha; b)\pi - [a + be^*(\alpha; b)] = \alpha b\pi - (a + \alpha b^2)$$

FOC:[3] $\alpha\pi - 2\alpha b = 0$
Incentive parameter: $b^* = \pi/2$
Wage: $w_C^* = a + \alpha\pi^2/4$
Maximum utility ($b = \pi/2$): $V_C^*(\alpha; \pi/2) = a + \frac{1}{2}\alpha\pi^2/4 = a + (1/8)\,\alpha\pi^2$

The fact that b^* does not depend on the worker's type implies that the firm it does not need to observe it in order to optimally determine the optimal incentive intensity.

We will see below that for the 'C' firm choosing a different value of b entails no benefit as far as worker selection is concerned.[4]

In the following we will assume that the a 'C' firm's maximum expected profit (across its pool of applicants - the set of those who choose the 'C' sector) is nonnegative.

3.2 Socially responsible firm

Here payment $w_S > 0$ is not contingent on the activity's success and is determined by demand and supply (so unemployment is nil in the 'S' sector) .

3.2.1 Worker utility maximization

The worker chooses effort and derives utility from the success of the activity he performs:

$$max_e V_S = w_S + \mu e - e^2/2\alpha$$

FOC:[5] $\mu - e/\alpha = 0$
Optimum effort: $e^*(\alpha, \mu) = \alpha\mu$
Worker's utility: $V_S^*(\alpha, \mu) = w_S + \frac{1}{2}\alpha\mu^2$

Then a S-firm's expected profit is a function of the expected value of the product $\alpha\mu$ over its workers.

Expected profit

$$E\left(\Pi_S(s)\right) = \pi E_S\left(\alpha\mu\right) - w_S - s$$

where $E_S\left(\alpha\mu\right)$ is the expected value of the product $\alpha\mu$ across workers who choose the 'S' sector.

[3] Here too the second order condition is clearly satisfied.
[4]
[5] Here too the second order condition is clearly satisfied.

3.3 Firms' choice between the two organizational forms

We assume that there is at least a subset of firm owners who have a preference for the socially responsible form 'S' over the conventional form 'C', so they choose the former as soon as it ensures non-negative profits.[6]

In formulae, the condition for choosing 'S' is then:

$$E\left(\Pi_S(s)\right) = \pi E_S(\alpha\mu) - w_S - s \geq 0$$

The above condition can be rewritten as: $s \leq s^\circ \equiv \pi E_S(\alpha\mu) - w_S$.

3.4 Workers' choice between the two organizational forms

On the basis of the analysis above a worker prefers to work in the 'S' sector iff:

$$V_S^*(\alpha, \mu) \geq \xi V_C^*(\alpha; \pi/2)$$

where $\xi < 1$ is the employment probability in the 'C' sector.

By definition it is:

$$\xi \equiv (1 - n_S)/(n - n_S) = 1 - (n-1)/(n - n_S)$$

where n_S denotes the employment in the 'S' sector. Since n_S is endogenous, ξ is too. However, given that its value is not very sensitive to small changes in n_S, we proceed by treating it as exogenous, as this has great benefits as far as both computation and interpretation are concerned (in particular, where ξ not treated as exogenous, we could not even define the labour demand and supply curves that are introduced below). In order to be sure that the results we obtain do not depend on this simplifying assumption, in the numerical example we present below we also compute the equilibrium with ξ endogenous, and check that the results are qualitatively the same.

The preference condition of a worker of type (α, μ) can be written as:

$$w_S + \frac{1}{2}\alpha\mu^2 \geq \xi(a + \frac{1}{2}\alpha\pi^2/4)$$

or:

$$\frac{1}{2}\alpha(\xi\pi^2/4 - \mu^2) \leq w_S - \xi a.$$

[7]

[6] A more sophisticated choice criterion could require a comparison between the levels of profit associeted with the two forms, account being taken of a possible utility premium a firm owner may attach to the form S. However, both sides of the resulting inequality would be endogenous, which would complicate the model without adding crucial insights. Observe that the criterion we adopt does not exclude that some or most entrepreneurs may have a strong reluctance to adopt the S form, as such reluctance can be incorporated into the cost of behaving in a socially responsible way, s, as a psychic cost.

[7] Conversely, the preference condition can be expressed as : $\mu^2 \geq \xi\pi^2/4 - 2(w_S - \xi a)/\alpha]$.

We assume that the parameters are such that $\xi\pi^2/4-\bar{\mu} > 0$, i.e. the intrinsic motivation is not quite as strong as the monetary incentive, and furthermore that $w_S - \xi a > 0$, i.e. that working in the 'S' sector ensures an expected level of payment not smaller than working in the 'C' sector, in case one earns no bonuses. These two assumption ensure, on the one hand, that a worker whose ability is nil (i.e. the cost of effort is infinitely high) certainly prefers the 'S' sector, and, secondly, that the greater a worker's ability, the more she is (relatively) attracted by the 'C' sector.

So the preference condition above can be rewritten as

$$\alpha \leq 2(w_S - \xi a)/(\xi\pi^2/4 - \mu^2)$$

The right hand side of this expression is the threshold value of α below which a worker with intrinsic motivation μ prefers to work in the S sector (and vice-versa above it).

Let the threshold for non-motivated workers be denoted as:

$$\alpha^\circ \equiv 2(w_S - \xi a)/(\xi\pi^2/4) = \frac{8}{\xi\pi^2}(w_S - \xi a)$$

Observe that it is $\frac{\partial \alpha^\circ}{\partial w_S} = \frac{2}{\xi\pi^2/4-\mu^2}$ and $\frac{\partial \alpha^\circ}{\partial a} = -\frac{2\xi}{\xi\pi^2/4-\mu^2}$.

If we denote, instead, $\alpha^{\circ\circ}$ the threshold for motivated workers, the following holds

$$\frac{\alpha^{\circ\circ}}{\alpha^\circ} = \frac{\partial\alpha^{\circ\circ}/\partial w_S}{\partial\alpha^\circ/\partial w_S} = \frac{\partial\alpha^{\circ\circ}/\partial a}{\partial\alpha^\circ/\partial a} = \frac{\xi\pi^2/4}{\xi\pi^2/4-\bar{\mu}} \equiv \rho > 1$$

In other words, the ratios between the two thresholds and those between their derivatives both with respect to w_S and with respect to a, all coincide and, furthermore, do not depend on w_S.

3.5 Labour supply in the S sector

Given stochastic independence of ability and motivation, we can denote $F(\alpha)$ the distribution function of ability among workers of each level of motivation (and $f(\alpha)$ the corresponding density function). In the S sector the wage level is determined competitively, so we consider labour supply and demand. The labour supply is simply

$$L^s = n\left[(1-\sigma)F(\alpha^\circ) + \sigma F(\rho\alpha^\circ)\right]$$

Then

$$\frac{\partial L^s}{\partial w_S} = n\left[(1-\sigma)f(\alpha^\circ) + \sigma f(\rho\alpha^\circ)\rho\right]\frac{\partial\alpha^\circ}{\partial w_S}$$

It is clearly $\frac{\partial L^s}{\partial w_S} > 0$, since all addends and factors are positive.

3.6 Labour demand in the 'S' sector

Labour demand in the 'S' sector equals the measure of firms for which profit as a S firm is non-negative. Let $G(s)$ denote the distribution of the cost of behaving in a socially responsible way s over the population of firms (and $g(\alpha)$ the corresponding density function).

Then demand is:

$$L^d = G(s^\circ) = G(\pi E_S(\alpha\mu) - w_S)$$

It is

$$E_S(\alpha\mu) = \frac{\sigma F(\rho\alpha^\circ)}{(1-\sigma)F(\alpha^\circ) + \sigma F(\rho\alpha^\circ)} \bar{\mu} E_S(\alpha; \bar{\mu})$$

where $E_S(\alpha\mu; \bar{\mu})$ is the expected value of $\alpha\mu$ across highly motivated workers who have chosen in the 'S' sector. Since these all have the same motivation parameter, it is $E_S(\alpha\mu; \bar{\mu}) =$, where the latter expression is average ability of motivated workers in the 'S' sector.[8]

Then it is

$$\frac{\partial L^d}{\partial w_S} = g \cdot (\pi \frac{\partial E_S(\alpha\mu)}{\partial w_S} - 1).$$

In words, in case average ability of applicants were not affected by the wage, the derivative of labour demand would equal $-g$, just because the wage is a negative component of profit. To the extent that a change in w_S has an impact on expected labour productivity, then $\frac{\partial L^d}{\partial w_S}$ takes on a value different from $-g$. In particular, if this impact is positive and large enough, labour demand in the 'S' sector can have a reverse (i.e. increasing) slope.

3.7 Equilibrium

Given exogenous parameters, the equilibrium wage level in the S sector is determined by the market clearing condition:

$$L^d - L^s = G(\pi E_S(\alpha\mu) - w_S) - n\left[(1-\sigma)F(\alpha^\circ) + \sigma F(\rho\alpha^\circ)\right] = 0.$$

As a consequence, also the employment level in the 'S' sector is determined, as the common value of $L^d(w_S^*)$ and $L^s(w_S^*)$. We will assume that the equilibrium is unique and internal (i.e. that $0 \leq \alpha^\circ \leq \rho\alpha^\circ \leq \bar{\alpha}$).

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[8] If we define $H(\alpha^\circ) \equiv \int_{\alpha_-}^{\rho\alpha^\circ} \alpha f(\alpha) d\alpha$, it is by definition $E_S(\alpha; \bar{\mu}) = \frac{H(\rho\alpha^\circ)}{F(\rho\alpha^\circ)}$, so $E_S(\alpha\mu)$ can be more coveniently computed as

$$E_S(\alpha\mu) = \frac{\bar{\mu}\sigma H(\rho\alpha^\circ)}{(1-\sigma)F(\alpha^\circ) + \sigma F(\rho\alpha^\circ)}$$

3.8 Comparative statics with respect to the C firm's fixed wage a

In the model an increase in the parameter a can represent various exogenous factors that enhance the relative attractiveness of the C sector to workers: not only an increase in the fixed component of the wage paid by C firms, or an increase in non-wage (e.g. health care) benefits granted to their employees, but also the reduction in a possible lump-sum subsidy to S-sector workers (e.g. a favorable treatment as far as social security contributions are concerned).

Observe that

$$\frac{dw_S}{da} = \xi(1 - \frac{g}{\frac{\partial L^s}{\partial w_S} - \frac{\partial L^d}{\partial w_S}}).^{9}$$

Furthermore, focusing on the labour supply curve, we obtain:

$$\frac{dn_S}{da} = -\xi g \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} - \frac{\partial L^d}{\partial w_S}}.^{10}$$

For a given w_S, greater values of a make the C sector more attractive. This exerts a negative impact on labour supply to the S sector. However, not only the size of S-sector labour force is affected, but its composition too, as to both ability and motivation. As a consequence, the expected ability of motivated workers and their share in the labour force - the two determinants of expected worker productivity - both vary. This generates a rich set of possible outcomes, that we order according to the value taken by $\frac{\partial E_S(\alpha\mu)}{\partial w_S}$, the derivative of average productivity with respect to S-sector's wage (remember that $\frac{\partial E_S(\alpha\mu)}{\partial a}$ is proportional to $\frac{\partial E_S(\alpha\mu)}{\partial w_S}$ by a factor $-\xi$).

1) Expected worker productivity in the S sector reacts positively and moderately to a change in S-sector wage. In formulae:

$$0 \leq \frac{\partial E_S(\alpha\mu)}{\partial w_S} < \frac{1}{g\pi}\frac{\partial L^s}{\partial w_S}$$

In other words, an increase in the wage is effective at attracting more desirable workers, but the resulting increase in labour demand is smaller than the increase in labour supply. As a consequence it is

$$0 < \frac{dw_S}{da} < \xi \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g} < \xi,$$

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[9] Since it is $\frac{\partial(\alpha^\circ)}{\partial a} = -\xi\frac{\partial(\alpha^\circ)}{\partial w_S}$ and $\frac{\partial L^d}{\partial a} = -\xi\left(\frac{\partial L^d}{\partial w_S} + g\right)$ it is $\frac{dw_S}{da} = -\frac{\frac{\partial L^d}{\partial a} - \frac{\partial L^s}{\partial a}}{\frac{\partial L^d}{\partial w_S} - \frac{\partial L^s}{\partial w_S}} = -\frac{-\xi\left(\frac{\partial L^d}{\partial w_S}+g\right)+\xi\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^d}{\partial w_S} - \frac{\partial L^s}{\partial w_S}} = \xi\frac{\left(\frac{\partial L^d}{\partial w_S}+g\right) - \frac{\partial L^s}{\partial w_S}}{\frac{\partial L^d}{\partial w_S} - \frac{\partial L^s}{\partial w_S}} = \xi(1 + \frac{g}{\frac{\partial L^d}{\partial w_S} - \frac{\partial L^s}{\partial w_S}})$ provided $0 \neq \frac{\partial L^s}{\partial w_S} - \frac{\partial L^d}{\partial w_S}$.

[10] In fact it is $\frac{dn_S}{da} = \frac{\partial L^s}{\partial a} + \frac{\partial L^s}{\partial w_S}\frac{dw_S}{da} = -\xi\frac{\partial L^s}{\partial w_S} + \frac{\partial L^s}{\partial w_S}\frac{dw_S}{da} = \frac{\partial L^s}{\partial w_S}\left(-\xi + \frac{dw_S}{da}\right)$.
Then it is enough to substitute the expression of $\frac{dw_S}{da}$ given above.

that is, following a change in a the wage moves in the same direction, but by less than it would occur were $E_S(\alpha\mu)$ unaffected, which in its turn is less that it would be needed in order to fully offset the attraction effect exerted on workers by the initial change in a itself. As to employment it is

$$\frac{dn_S}{da} < -g\xi \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g} < 0,^{11}$$

that is, the change is negative and greater, in absolute value, than the change associated with a constant worker productivity.

Our model, together with some numerical examples, suggests that this is to be seen as the normal outcome: a drop in the relative wage attractiveness of the S sector does not in general entail an increase in worker average productivity, nor an increase in the share of motivated workers in the S sector labour force.[12]

2) Expected worker productivity reacts adversely to a change in the wage, i.e.

$$\frac{\partial E_S(\alpha\mu)}{\partial w_S} < 0.$$

Since an increase in w_S certainly boosts $E_S(\alpha; \bar{\mu})$, the average ability of motivated workers, the adverse effect can only be due to a large enough fall in their share in the pool of S-sector workers (adverse selection as to motivation). It is

$$\xi \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g} < \frac{dw_S}{da} < \xi \text{ and } -g\xi \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g} < \frac{dn_S}{da} < 0,^{13}$$

that is the increase in the wage is close to the level that would fully offset the attraction exerted on workers by the initial increase in a (as a goes up, the upward push on w_S due to a reduced labour supply is reinforced by an improvement in average productivity, that strengthens labour demand). Not surprisingly, the greater the adverse effect on average labour productivity, the greater the value of $\frac{dw_S}{da}$ and the smaller, in absolute value, the fall in employment (*ceteris paribus*). This case can rightly be called *getting more by paying (relatively) less*: introducing a subsidy to C-sector workers ensures the S sector a more productive work force.

3) The reaction of S-sector expected worker productivity to a change in the wage is positive and strong (but not extreme):

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[11] In fact $\frac{dn_S}{da} = -\xi g \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} - g\pi \frac{\partial E_S(\alpha\mu)}{\partial w_S} + g} < -\xi g \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g}$,
since $0 < \frac{\partial L^s}{\partial w_S} - g\pi \frac{\partial E_S(\alpha\mu)}{\partial w_S} + g < \frac{\partial L^s}{\partial w_S} + g$

[12] Indeed it is:

[13] It is: $\frac{dn_S}{da} = -\xi g \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} - g\pi \frac{\partial E_S(\alpha\mu)}{\partial w_S} + g} > -\xi g \frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g}$
since $0 < \frac{\partial L^s}{\partial w_S} + g < \frac{\partial L^s}{\partial w_S} - g\pi \frac{\partial E_S(\alpha\mu)}{\partial w_S} + g$

$$\frac{1}{g\pi}\frac{\partial L^s}{\partial w_S} \leq \frac{\partial E_S(\alpha\mu)}{\partial w_S} < \frac{1}{g\pi}\frac{\partial L^s}{\partial w_S} + \frac{1}{\pi}.$$[14]

The (reverse) change in average worker productivity in the S sector following a change in a (adverse selection as to ability) is strong enough as to fully offset the effect exerted on the wage by the change in labour supply. Now not only the employment, but also the wage, moves in the opposite direction with respect to a (or, in the limit, stays put)

$$\frac{dw_S}{da} \leq 0 \wedge \frac{dn_S}{da} < 0.$$

Now the reaction of employment to a change in a is large (in absolute value), relatively to the slope of labour supply; in fact it is

$$\frac{dn_S}{da} \leq -\xi\frac{\partial L^s}{\partial w_S} < -g\xi\frac{\frac{\partial L^s}{\partial w_S}}{\frac{\partial L^s}{\partial w_S} + g} < 0,$$

To get an intuition, recall that the two ability thresholds are both proportional to $(w_S - \xi a)$: as it is $\frac{dw_S}{da} \leq 0$, now the effects on the thresholds of the changes in a and w_S do not offset, but rather reinforce, each other.

4) The reaction of S-sector expected worker productivity to a change in the wage is positive and extreme, i.e.

$$\frac{\partial E_S(\alpha\mu)}{\partial w_S} > \frac{1}{g\pi}\frac{\partial L^s}{\partial w_S} + \frac{1}{\pi}.$$

Now both equilibrium employment and wage in the 'S' sector move in the same direction as a (the wage overreacts).

$$\frac{dn_S}{da} > 0 \Longleftrightarrow \frac{dw_S}{da} > \xi.$$

This case is but an extreme version of the former, and the equilibrium in unstable. We are not particularly interested in this borderline case, as to which, by the way, the usefulness of an equilibrium analysis, as opposed to disequilibrium dynamics, is scant.

3.9 Numerical examples

We have computed a few numerical examples. They show that case 2) and 3) obtain, for a given set of all the other parameters, in different ranges for the parameter a. Of course, the outcomes depend crucially on the population

[14] Equivalently: $0 < \frac{\partial L^s}{\partial w_S} - \frac{\partial L^d}{\partial w_S} \leq g$

distribution function $F(\alpha)$. However, for two symmetric distributions having the highest density at the mean (one with a density function constant on three intervals, and one with a triangular density function) we find that adverse selection as to motivation (case 2) can occur at relatively low levels of a (and, consequently, relatively high levels of n_S), while adverse selection as to quality (case 3) can occur at relatively high levels of a (and, consequently, relatively low levels of n_S). We intend to consider further examples and, furthermore, to simulate the equilibria by treating the variable ξ as endogenous.

3.10 Fringe benefits

The model lends itself easily to an analysis of the effects of fringe benefits. However, these are not at all straightforward, as both labour demand and supply are affected. The crucial variable is the value for motivated workers of a benefit that costs 1 to the firm, k (for simplicity we can assume that the corresponding value for non-motivated workers is zero). It is possible to show that when k is close to 1 the full wage and of motivated workers increases, while that of non-motivated ones decreases. The share of motivated workers in the S sector labour force also increases, while the change in employment is ambiguous.

4 Conclusions

The model of the labour market we have presented in this paper takes into account workers with intrinsic motivations and "socially responsible" firms specialized in activating them. Our results suggest that the normal effect of a reduction in the relative wage attractiveness of the socially responsible sector is a reduction in average worker productivity, possibly accompanied by a reduction in the share of workers with high intrinsic motivations. The famous "getting more by paying less" result, due to a drastic increase in the share of workers with weak intrinsic motivations, is but a possibility, that is more likely to occur when the wage attractiveness of the socially responsible sector is relatively high. However, socially responsible firms also face an opposite risk: that unfavourable relative wages may repel high ability workers, triggering a vicious circle of low pay and low productivity.

Integrating into the analysis worker-worker interactions and the impact of (relative) pay on worker morale - two aspects that do not appear in the model presented above - represents the next step in our investigation.

5 References

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