# What Determines Volunteer Work? On the Effects of Adverse Selection and Intrinsic Motivation

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**Abstract**

We analyze the screening problem of a firm hiring workers without knowing their ability while observing their intrinsic motivation. We show that volunteerism is the contractual outcome when workers are low-skilled, have high motivation, and are protected by limited liability.

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**Key-words**: volunteer work, adverse selection, intrinsic motivation, limited liability.

## 1 Introduction

Intrinsic motivation is the worker's enjoyment of her personal contribution to the employer's mission or goals. It is particularly relevant in sectors as the non-profit and the public sector where collective goods and services are produced. For example, health professionals are interested in the well-being of their patients, teachers care about the achievements of their students, and "public service motivation" is what pushes dedicated bureaucrats.

The existing literature on workers' intrinsic motivation has fostered the "donative-labour hypothesis", whereby motivated employees donate part of their labour to socially worthwhile organizations by accepting lower wages (Preston, 1989; Delfgaauw and Dur, 2007).[1] But what is the extent of labour donations?

In this paper, we embed labour donations stemming from intrinsic motivation in a model of adverse selection about workers' ability. We consider screening contracts that a firm offers to its potential applicants, who have heterogeneous and unobservable skills, but the same observable level of intrinsic motivation. Optimal contracts are fully separating and such that, when the level of motivation is sufficiently high, workers characterized by low skills earn negative wages. Therefore, it seems natural to

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[1] Accordingly, volunteerism is an important source of labour in these organizations.

provide highly motivated workers with some device that protects them against being 'exploited' by their employers.

A limited liability constraint is thus introduced. This is what happens in Makris (2009) and Makris and Siciliani (2013), where an administrative constraint ensures that the monetary costs of production faced by health providers be covered by the budget transferred by purchasers. Yet, our setup is different because our liability constraint is less restrictive, given that it only requires transfers to be non-negative, i.e. the firm cannot offer negative salaries. Our model is also reminiscent of Sappington (1983), which studies limited liability contracts that are agreed upon *ex-ante*, i.e. before the agent knows the actual realization of her type. We rather assume agents to observe their type before accepting the contract, whereby our participation constraint is more stringent.

When liability limitations are binding, our analysis provides an explanation of volunteerism as the contractual outcome for low-ability workers, whose motivation is sufficiently high. Optimal contracts are such that these workers are asked to provide the same level of effort independently of their skills, i.e. pooling emerges. Such uniform effort is the highest possible compatible with full participation, because it ensures a non-negative utility to all workers. Moreover, it is higher than in the absence of limited liability.

These results stand in contrast with Barigozzi and Burani (2016), showing that liability constraints are irrelevant when both ability and intrinsic motivation are workers' private information. "Paid volunteers" emerge, namely low-ability, high-motivation workers who are offered positive wages, but would be ready to work for free. This happens because highly motivated agents, being able to mimic less motivated types, enjoy information rents which drive their salaries up.

## 2 The model

Consider a principal-agent model with adverse selection. The principal (he) is a firm willing to hire a worker (she) to perform a given task. Both the firm and the agent are risk neutral.

The firm produces output according to a linear technology with labour as the only input. Its production function is $q(e) = e$, where $e$ is the observable and measurable effort that the worker is asked to exert. The firm's payoff is

$$\pi(e) = \alpha(q(e) - w) = \alpha(e - w), \tag{1}$$

where the (exogenous) price of output is set equal to 1, $w$ is the total salary paid to the worker, and $\alpha \in (0, 1]$. If $\alpha = 1$, the firm strictly maximizes profits. If instead $0 < \alpha < 1$, the firm might be: $(i)$ a non-profit organization committed to a non-distribution constraint, whereby the entrepreneur can only capture a fraction of profits in the form of perquisites (Glaeser and Schleifer, 2001); or $(ii)$ a for-profit socially responsible organization sacrificing some profits for the social interest (Bénabou and Tirole, 2010).

Workers differ in productive ability, which lowers the cost of effort provision $\theta$. High realizations of $\theta$ represent workers with high cost of effort provision and thus low ability, whereas low realizations of $\theta$ correspond to high-skilled workers.[2] For simplicity, we assume that $\theta \sim U\ [0,1]$. Ability cannot be observed by the firm, which only knows its distribution. Workers are also characterized by intrinsic motivation $\gamma \in [0,1]$. To a certain extent, workers derive utility from exerting effort. Since effort $e$ and output $q$ are equivalent, motivation also stems from the enjoyment of one's personal contribution to the firm's goals. Opposite to ability, motivation is perfectly observable to the employer.

For each type $\theta$, the worker's utility is quasi-linear in income and takes the form

$$u(\theta, e, w) = w - \frac{1}{2}(\theta + 1)\, e^2 + \gamma e. \tag{2}$$

Figure 1 represents utility (2) in the $(e, w)$ space. It shows that, when effort is sufficiently low (or when motivation is high and ability is low), i.e. $e < \frac{2\gamma}{\theta+1}$, workers obtain positive utility from effort exertion and might be willing to receive a non-positive reward.[3] Utility (2) satisfies the single-crossing condition $\frac{\partial^2 u(\theta,e,w)}{\partial e \partial \theta} = -e < 0$.

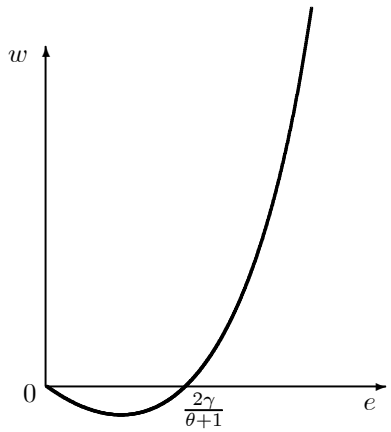


**Figure 1.** Level curve $u(e, \theta, w) = 0$ on the $(e, w)$ plane ($\theta = 1/3$, $\gamma = 2/3$)

Workers' outside option is type-independent and normalized to zero.

The firm aims at maximizing expected profits. By the Revelation Principle, it chooses effort levels $e(\theta)$ and wages $w(\theta)$ based on the worker's truthful report of her type $\theta$. Let

$$U(\theta) = w(\theta) - \frac{1}{2}(\theta + 1)\, e(\theta)^2 + \gamma e(\theta) \tag{3}$$

denote the information rent (or surplus) of a type $\theta$ worker accepting contract $[e(\theta), w(\theta)]$. Solving (3)

[2] We refer to 'workers' or 'a worker's types' interchangeably.

[3] When effort is even lower, i.e. $e < \frac{\gamma}{\theta+1}$, it becomes a 'good' because increasing effort provision raises workers' satisfaction.

for $w(\theta)$ and substituting it into profits (1), one can write the firm's problem as

$$\max_{e} \pi = \max_{e} \int_0^1 \alpha \left[ (1+\gamma)\, e(\theta) - U(\theta) - \frac{1}{2}(\theta+1)\, e(\theta)^2 \right] d\theta \qquad (P)$$

subject to

$$\frac{\partial e(\theta)}{\partial \theta} \leq 0, \qquad (C.1)$$

$$\frac{\partial U(\theta)}{\partial \theta} = -\frac{1}{2} e(\theta)^2, \qquad (C.2)$$

$$U(\theta) \geq 0 \text{ for all } \theta \in [0,1]. \qquad (C.3)$$

Condition $(C.3)$ represents the participation constraint, whereas monotonicity condition $(C.1)$ and envelope condition $(C.2)$ characterize incentive compatibility (Laffont and Martimort, 2002).

In what follows, we first solve program $P$ without considering liability issues; we then add the requirement that the firm cannot make negative transfers. Both problems are analyzed using the Hamiltonian technique (see Appendix).

## 2.1 The second-best contract

When liability limitations are not at stake, optimal incentive schemes solving program $P$, i.e. second-best contracts, are characterized in what follows.[4]

**Proposition 1** *The second-best contract is such that the firm asks workers to provide effort*

$$e_{SB}(\theta) = \frac{1+\gamma}{2\theta+1}$$

*and offers the wage schedule*

$$w_{SB}(\theta) = \frac{(1+\gamma)\left[(2\theta+1)(1-2\gamma) + (1-\theta)(1+\theta)(1+\gamma)\right]}{3(2\theta+1)^2}.$$

Second-best contracts are well-behaved because three standard properties hold: $(i)$ full participation and full separation, whereby all worker's types are employed, and effort levels and wages are never the same for distinct types of worker; $(ii)$ no-distortion-at-the-top, whereby effort levels are downward distorted with respect to the efficient ones for all workers but the most productive one; and $(iii)$ zero-rents-at-the-bottom, whereby all workers receive information rents (which decrease in $\theta$), except for the least productive applicant who is left with her zero outside option.

Nonetheless, $w_{SB}(\theta)$ is not standard because it is strictly positive for $\gamma \leq 1/2$, whereas it turns negative for $\gamma > 1/2$ and sufficiently low levels of ability (high $\theta$). Workers might then pay (instead of being paid) to be hired by the firm, even when they provide strictly positive effort.

[4] See Figure 2.

This might be the case of volunteer tourists, who travel to developing countries and work on international development programmes addressing basic needs such as education, health and sanitation. These workers not only offer their services for free, but also often contribute to their own travel and accommodation expenses.

## 2.2 The limited liability contract

Let us now examine how the screening problem of the firm changes when negative wages are ruled out. At most, workers endowed with a strong motivation can become volunteers, getting $w(\theta) = 0$ in exchange for some positive level of effort $e(\theta) > 0$. From now on, we consider $\gamma > \frac{1}{2}$, so that limited liability has a bite.

Consider program $P$ again, with the additional requirement

$$w(\theta) = \max\left\{0, U(\theta) + \frac{1}{2}(\theta+1)\, e(\theta)^2 - \gamma e(\theta)\right\}. \tag{4}$$

Because $U(\theta) \geq 0$ by individual rationality, $w(\theta)$ is always positive when $e(\theta) \geq \frac{2\gamma}{\theta+1}$. Conversely, when both $e(\theta) < \frac{2\gamma}{\theta+1}$ and $U(\theta) < \gamma e(\theta) - \frac{1}{2}(\theta+1)\, e(\theta)^2$ hold, the liability constraint is binding and $w(\theta) = 0$. In this case, the firm's objective reduces to maximizing expected revenues, i.e. $\max_e \int \alpha e(\theta)\, d\theta$, subject to $(C.1) - (C.3)$.[5]

In a nutshell, the optimal contract with liability limitations is such that the firm pools the less efficient workers and offers them the same contract, entailing a null salary. Less able workers become volunteers and are asked to provide the same level of effort, irrespective of their ability. Such effort level is the highest possible compatible with zero surplus for the least efficient worker $\theta = 1$. The firm then partly compensates the higher costs coming from the need to increase salaries, in order to satisfy limited liability, with the higher revenues stemming from higher effort and production.

**Proposition 2** *Suppose that $\gamma > \frac{1}{2}$. The limited liability contract is such that the firm asks workers to provide effort*

$$e_L(\theta) = \begin{cases} \frac{1+\gamma}{2\theta+1} & \text{for } 0 \leq \theta \leq \overline{\theta} = \frac{1}{2\gamma} \\ \gamma & \text{for } \overline{\theta} = \frac{1}{2\gamma} \leq \theta \leq 1 \end{cases}$$

*and offers the wage schedule*

$$w_L(\theta) = \begin{cases} \frac{(1+\gamma)(4\theta(1-\gamma)+3-\gamma)}{4(2\theta+1)^2} - \frac{1}{4}\gamma(2-\gamma) & \text{for } 0 \leq \theta \leq \frac{1}{2\gamma} \\ 0 & \text{for } \frac{1}{2\gamma} \leq \theta \leq 1 \end{cases}.$$

[5] The bounds of integration are now endogenous and part of the solution.

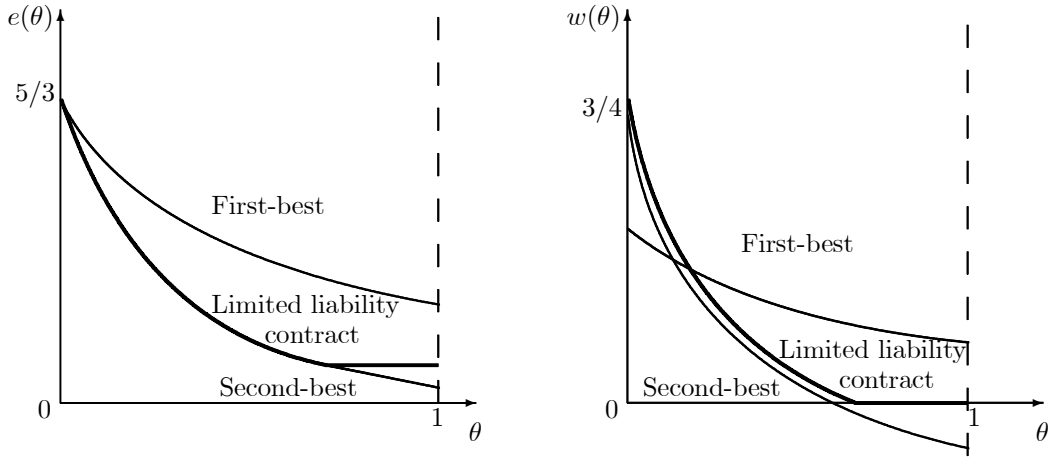


**Figure 2.** Efforts and wages ($\gamma = 2/3$). Solid lines indicate LL contracts.

Figure 2 depicts the schedules of effort and wage for the limited liability contract, comparing them with the first- and second-best. All schedules are continuous and at least weakly decreasing in $\theta$. Optimal allocations $e_L(\theta)$ coincide with the second-best ones $e_S(\theta)$, but only for the most efficient types of workers, with low $\theta$. There exists an optimal threshold $\overline{\theta} = \frac{1}{2\gamma}$ above which the firm offers pooling contracts: all workers with effort cost $\theta \in \left[\overline{\theta}, 1\right]$ provide the same effort and receive the same null salary. Notably, less efficient workers provide more effort under limited liability than at the second-best, i.e. $e_L(\theta) > e_{SB}(\theta)$ for $\theta \in \left[\overline{\theta}, 1\right]$. Nonetheless, $e_L(\theta)$ is never upward distorted relative to the first-best. Wages $w_L(\theta)$ are strictly positive below the threshold $\overline{\theta}$ and identically equal to zero above it, with $w_L(\theta) > w_{SB}(\theta)$ for all $\theta \in [0, 1]$. Moreover, information rents $U_L(\theta)$ are such that $U_L(\theta) > U_{SB}(\theta)$ for all $\theta \in [0, 1)$, whereas the most inefficient type gets zero surplus and $U_L(1) = U_{SB}(1) = 0$.

The intuition for these results is the following. First of all, because of labour donations, it is never in the firm's interest to exclude any worker's type. So optimal contracts always ensure full participation, i.e. full employment. Second, liability limitations do not substantially alter rent extraction relative to the second-best. The worker always has incentive to understate her ability, and the firm mitigates the worker's informational advantage by distorting effort provision below its efficient level. This implies that only the participation constraint of the least efficient worker is binding. Thus, optimal contracts still satisfy the no-distortion-at-the-top and zero-rents-at-the-bottom properties. Third, limited liability does conflict with incentive compatibility for low-ability workers, giving rise to allocative distortions which are different from the second-best. The firm tends to increase low-ability workers' effort, because this relaxes the liability constraint. But raising effort makes incentive compatibility harder to fulfil. Indeed, monotonicity condition $(C.1)$ fails to hold strictly for low-ability workers, and pooling arises. More specifically, effort in the pooling region is set so as to leave zero information rents to the least able type $\theta = 1$, conditional on her getting a null wage. The threshold of the pooling interval $\overline{\theta}$ is then determined

by continuity of the effort schedule.

Our results stand in contrast to Makris (2009) and Makris and Siciliani (2013) where the trade-off between limited liability and rent extraction is solved in a different way. Their type-dependent administrative constraint, coupled with altruism, makes overreporting efficiency more attractive and underreporting efficiency less attractive for workers. Thus, full separation remains feasible but countervailing incentives arise and the firm might distort effort provision upwards.

# 3 Conclusion

We analyze the screening problem of a firm hiring motivated workers who have private information about their ability. We show that, when motivation is sufficiently high, optimal wages become negative, calling for the introduction of additional liability constraints. Then, low-ability workers become volunteers and exert the same level of effort, irrespective of their ability, which is higher than in the absence of liability limitations.

# References


[1] Barigozzi F. and N. Burani (2016), "Screening Workers for Ability and Motivation", *Oxford Economic Papers*, 68(2), 627-650.

[2] Bénabou R. and J. Tirole (2010), "Individual and Corporate Social Responsibility", *Economica* 77, 1-19.

[3] Delfgaauw J. and R. Dur (2007), "Signaling and Screening of Workers' Motivation", *Journal of Economic Behavior and Organization* 62, 605-624.

[4] Glaeser E. L. and A. Shleifer (2001), "Not-for-profit entrepreneurs", *Journal of Public Economics* 81, 99-115.

[5] Laffont J.-J. and D. Martimort (2002), *The Theory of Incentives: The Principal-Agent Model*, Princeton University Press, Princeton N.J.

[6] Makris M. (2009), "Incentives for Motivated Agents Under an Administrative Constraint", *Journal of Economic Behavior and Organization* 71, 428-440.

[7] Makris M. and L. Siciliani (2013), "Optimal Incentive Schemes for Altruistic Providers", *Journal of Public Economic Theory* 15(5), 675-699.

[8] Preston, A. (1989), "The Nonprofit Worker in a For-Profit World", *Journal of Labor Economics* 7, 438-463.

[9] Sappington D. (1983), "Limited Liability Contracts between Principal and Agent", *Journal of Economic Theory* 29, 1-21.