Multitasking in Motivational Jobs

Viki Nellas* Tommaso Reggiani†

Preliminary Draft: 20 Oct., 2015

Abstract

In most of the jobs in which intrinsic motivation matters, a relevant multitasking issue arises since the most valuable workers are the ones being intrinsically motivated towards the qualitative and unobservable task that characterize the job and, at the same time, they dislike the observable routinely task. Therefore, we extend the classical multitasking framework with the introduction of workers' intrinsic motivation towards the unobservable task. We show how the principal should define the multitasking incentive scheme considering the different motivational dimension of the tasks and not just their degree of measurability. Findings from our analysis can be directly applied to the nursing sector.

Keywords: Intrinsic motivation, multitasking, crowding out, incentives.
JEL Code: J32, J33, I10, L23

*University of Bologna (email: viki.nellas@unibo.it).

†LUMSA University & IZA (email: t.reggiani@lumsa.it). The financial support by the Deutsche Forschungsgemeinschaft is gratefully acknowledged – Research unit "Design & Behavior - Economic Engineering of Firms and Markets" (FOR 1371).

1 Introduction

The demographic change in western countries is generating a severe shortage of nursing staff. This is due to the relative lack of candidates with nursing qualifications but, above all, to the scarcity of intrinsically motivated nurses willing to work under current work arrangements.[1] The literature has documented a gap between what nurses believe their role should be and what it actually is. The resulting dissatisfaction derives from inadequate workforce planning and task allocation (Buchan and Aiken 2008). This discrepancy may lead a considerable share of nurses to reduce their effort (Pask 2005). It is therefore necessary to study the peculiarities of the nursing job to help health care organizations increasing nurses' supply and retention.

This sector represents a paramount example of job featured by an strong motivational component (Brekke and Nyborg 2010; Jacobsen et al. 2011) nested into a more general multitasking setting (Speedling 1990; Newton et al. 2009). Nurses, besides providing health care and human touch, are also expected to deal with administrative tasks. While the former activity embodies the profession's intrinsic motivation, that benefits workers, the latter does not have any intrinsic value.[2]

The interaction between intrinsic motivation and monetary incentives in unidimensional motivational tasks has been extensively analyzed (e.g. in the health care domain: Heyes 2005; Siciliani 2009; Barigozzi and Turati 2012). However, the interplay between intrinsic motivation and the optimal incentive scheme in a multitasking environment remains largely unexplored. To fill

[1] *The Economist* 2014.

[2] This multitasking issue arises in the nursing sector as well as in a vast range of other motivational jobs, e.g. teachers (classroom activities vs. organizational duties), detectives (investigations vs. formal reporting obligations).

this gap, we propose a more comprehensive multitasking model able to cope with agent's intrinsic motivation towards the qualitative and non-measurable task. In an *a la* Holmstrom and Milgrom's (1991) framework, we consider a motivated agent as having a motivational preference over the unmeasurable task qualifying the job, i.e.patients' care, while not having any particular intrinsic interest in the second measurable task, i.e. administrative activities. We identify the *indirect moral crowding out mechanism* that leads the optimal wage scheme to depend on the agent's intrinsic motivation for the unmeasurable task.

Canton's analysis (2005) is the closest to our own. Nonetheless, his basic assumptions are different. He assumes that motivated agents get intrinsic reward only when they provide an effort that enables the service's optimal provision to be offered. Instead, we argue that motivated agents obtain intrinsic utility by exerting effort in the motivational task with a magnitude that directly depends on their individual degree of intrinsic motivation.

2 Model

We introduce the notion of intrinsic motivation towards a given task into a standard multitasking framework *a la* Holmstrom and Milgrom (1991).

The agent, a nurse in our example, performs two tasks. Task 1, the caring activity, is positively associated with the intrinsic motivation qualifying the profession. Task 2, the administrative activity, does not reflect the agent's intrinsic motivation. a_1 and a_2 represent the effort in the two tasks, with a one-to-one relationship between effort and outcome. The timing constraint implying that $a_1 + a_2 < 1$. The agent's information signals are

$$x_1 = a_1 + \varepsilon_1$$

$$x_2 = a_2 + \varepsilon_2$$

where $\varepsilon \sim N(0, \Sigma)$. The two signals are independent and represent the actual performances observed by the principal for the two tasks.

Other authors have underlined the relationship between the non-measurability a task's outcome and intrinsic motivation (Benabou and Tirole, 2013). We go one step further by assuming that the non-observability is not only associated with intrinsic motivation but caused by specific qualitative nature of the motivational task. We hypothesize that x_1 is not informative ($Var(\epsilon_1) = \infty$) due the non-measurability of the qualitative task[3]. The same is not true for x_2.

The agent has CARA utility function,

$$U(\omega, \gamma) = -e^{-\omega - C(a_i)}$$

where ω is the wage and $C(a_i)$ the cost of effort.

We qualify $C(a_i)$ to show how the intrinsic motivation modifies the standard multitasking framework. For an intrinsically motivated nurse, spending time in caring is rewarding per se, while administrative chores do not provide any intrinsic benefit. Therefore, since the execution of administrative duties subtracts time to patients' care, it decreases the worker' s overall reward. This stems from the reduction of the amount of motivational activity that potentially frustrates the intrinsic motivation and induces an increase of its marginal cost of effort.

[3]In vocational jobs the qualitative dimension of the task is extremely relevant. A nurse can take care of her patients simply administering medicines or taking care also of the relational aspects (Gui and Sugden 2010) of the patient. The way in which the task is carried out represents the qualitative and motivational-related dimensions of the service, not easily measurable.

***** EXAMPLE ******

tension between (i) the intrinsically motivated moral duty towards the engagement in the non-observable task and (ii) the opposite signal provided by the principal through the incentive scheme that emphasizes the observable task: Frustration

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Formally, a_1 and a_2 interact in $C(a_i)$ in a way that the marginal cost of effort in patients care is increased by the effort exerted in administrative duty. The agent has preference over the alternative tasks and so the two activities are substitutes in $C(a_i)$.

$C(a_1, a_2, \gamma)$ [4] is strictly increasing and convex in a_1 and a_2 and has a quadratic specification for better analytical tractability.

$$C(a_1, a_2, \gamma) = \frac{1}{1+\gamma} a_1^2 + a_2^2 + \gamma a_1 a_2 \tag{1}$$

The effort's cost depends non-linearly on a_1, a_2 and $\gamma \epsilon [0, 1]$, capturing the degree of intrinsic motivation for the vocational task characterizing the profession (as in Besley and Ghatak, 2005; Delfgaauw and Dur, 2008). If $\gamma = 1$ the direct cost of effort in caring is the lowest; if $\gamma = 0$ we are back to the standard case of a non-motivated agent. One unit of a_1 costs less than one unit of a_2 because of the intrinsic reward. γ measures also the magnitude of the interaction between a_1 and a_2 and represents the degree of cost substitutability. Two tasks are substitute in term of the cost of effort if the second cross partial derivative of the cost function is positive. In our case $C''_{a_1 a_2} = \gamma$

[4] The formal way in which we introduce intrinsic motivation in the model, described by Equation 1, is consistent with the literature related to our paper (for a review, see Francois and Vlassopoulos, 2008)

is positive since the agent is intrinsically motivated (i.e. $\gamma \neq 0$). So the intrinsic motivation is a well defined source of substitutability. To summarize, the intrinsic motivation leads both to a reduction of the direct effort's cost of caring and, simultaneously, to a variation of the cost associated to the interaction between the two tasks.

The marginal cost of caring, $C'_{a_1} = \frac{2}{1+\gamma}a_1 + \gamma a_2$, depends on γ and a_2. The higher γ is the stronger the interaction between tasks is and, consequently, the cost substitutability. Therefore, a rise in administrative duties increases C'_{a_1} (since $C''_{a_1,\gamma} > 0$) , since the agent perceives the reduction of time devoted to the motivational task as demotivating.

The principal is risk neutral and offers the linear contract [5]

$$\omega(x_1, x_2) = \alpha_1 x_1 + \alpha_2 x_2 + \beta.$$

α_1 and α_2 are the monetary rewards provided to incentivize effort provision for caring and administration; the fixed part β satisfies the individual rationality constraint. Coherently with Holmstrom and Milgrom (1991), we assume that $a_i > 0$, $\forall \alpha_i$.

The Certain Equivalent of the agent's wage is

$$CE = \alpha_1 x_1 + \alpha_2 x_2 + \beta - C(a_1, a_2) - \frac{r}{2}\alpha' \Sigma \alpha$$

where $\alpha' \Sigma \alpha$ is the variance of the agent's income under the linear compensation scheme and r the risk aversion.

[5] See Holmstrom and Milgrom (1987) for the conditions that guarantee the optimality of the linear contract.

The profit of the principal is $B(x_1, x_2) = x_1 + x_2 - \omega(x_1, x_2)$, increasing in both inputs. The expected profit is $E(\Pi) = (1-\alpha_1)a_1 + (1-\alpha_2)a_2 - \beta$ and the joint surplus is $a_1 + a_2 - C(a_1, a_2) - \frac{r}{2}\alpha'\Sigma\alpha$.

The optimal contract maximizes the expected total surplus under the agent's incentive compatibility constraint. Thus (a_i^*, α_i^*), i=1,2, must satisfy

$$max_{\alpha_1,\alpha_2} a_1 + a_2 - (\frac{1}{1+\gamma}a_1^2 + a_2^2 + \gamma a_1 a_2) - \frac{r}{2}\alpha'\Sigma\alpha \tag{2}$$

$$s.t.\ argmax_{a_1,a_2} \alpha_1 a_1 + \alpha_2 a_2 + \beta - (\frac{1}{1+\gamma}a_1^2 + a_2^2 + \gamma a_1 a_2) \tag{3}$$

From (3) we get $\alpha_i = C_i'(a_1, a_2)$. By totally differentiating and inverting $\alpha_i = C_i'(a_1, a_2)$ we get the elasticity of task a_i with respect to α_i, i.e. $\frac{\partial a_i}{\partial \alpha_i}$. The direct effect, $\frac{\partial a_i}{\partial \alpha_i}$, is positive while the indirect effect takes the form

$$\frac{\partial a_1}{\partial \alpha_2} = -\frac{\gamma(1+\gamma)}{4 - \gamma^2(1+\gamma)} < 0$$

Remark 1 *The higher the incentive for non-motivational task, (* the higher the cost for the motivational one : frustration *) the lower the amount of effort provided for the motivational one. We call this mechanism indirect moral crowding out.*

We talk, as Frey and Obberholzer-Gee (1997), about *moral crowding out effect* since the *crowding out* is due to the intrinsic motivation. However, here it is an indirect effect: the reduction of effort for caring is not caused by the monetary incentive for caring but by the extrinsic incentive for administration. So we call this mechanism *indirect moral crowding out* effect.

Remark 2 *The indirect moral crowding out effect represents the conjunction between Holmstrom and Milgrom's multitasking framework and Frey's*

behavioral studies.

- *Since* $C''_{a_1a_2} > 0$ *the two tasks are substitutes in* $C(a_1, a_2, \gamma)$ *so the Holmostrom and Milgrom' s crowding out effect occurs. Therefore* $\frac{\partial a_1}{\partial \alpha_2} < 0$.
- *Frey points out the link between extrinsic and intrinsic rewards and proposes the moral crowding out effect, such that* $\frac{\partial a_1}{\partial \alpha_1} < 0$.
- *In our multitasking framework with intrinsic motivation* $C''_{a_1a_2} = \gamma > 0$, *implying that* $\frac{\partial a_1}{\partial \alpha_2} < 0$. *Therefore the crowding out is indirect since the monetary incentive for administrative chores crowds out the effort for caring by increasing the marginal cost of the motivational task (*$C''_{a_1,\gamma} = \frac{-2a_1}{(1+\gamma)^2} + a_2$*)*

The solution of the principal's problem is

$$\alpha_1^* = 0 \tag{4}$$

$$\alpha_2^* = \frac{1 - \frac{\gamma(1+\gamma)}{2}}{1 + r\sigma_2^2(2 - \frac{\gamma^2(1+\gamma)}{2})} \tag{5}$$

Proposition 1 *The signal* x_1 *is totally uninformative, therefore there is no direct incentive for task* 1 *and* α_2^* *is function of the degree of intrinsic motivation.*
The optimal provision of incentives for task 1 *passes through the value of* α_2^*, *since* $\frac{\partial a_i}{\partial \alpha_j} < 0$.

α_1^* and α_2^* embody the *indirect moral crowding out effect*: the bigger the γ, the lower the optimal value of α_2^* since by increasing α_2^* the principal raises the opportunity cost of a_1 and decreases the effort for caring. Therefore,

when the motivational incentives are very strong, the principal should induce the agent to spend few time in bureaucratic activity. In the limit case of $\gamma = 1$ the agent's effort should be rewarded only through the fixed part of the wage, β.

Proposition 2 *In a one-principal one-agent framework where both tasks are necessary to produce the outcome, the optimal wage scheme depends on the degree of intrinsic motivation for task* 1.

- *when* $\gamma = 1$, $\alpha_1^* = \alpha_2^* = 0$ *and so* $\omega = \beta$.
- *when* $0 < \gamma < 1$, $\alpha_1^* = 0$ *and* $\alpha_2^* > 0$ *and so* $\omega = \alpha_2^* x_2 + \beta$.

Noteworthy, not only α_2 but also the fixed part of the wage is a function of γ (since β is such that the individual rationality constraint $U(\omega, \gamma) = \omega(\gamma) - C(a_1, a_2, \gamma) = \bar{U}$ is satisfied - $\bar{U}$ is the worker's outside option -).

Finally, we derive the optimal levels of effort, a_1^*, a_2^*, that reflect the incentive mechanism summarized in Proposition 1

$$a_1^* = -\frac{\gamma(1+\gamma)[2-\gamma(1+\gamma)]}{2(2-\frac{\gamma^2(1+\gamma)}{2})[1+r\sigma_2^2(2-\frac{\gamma^2(1+\gamma)}{2})]} \tag{6}$$

$$a_2^* = \frac{2-\gamma(1+\gamma)}{(2-\frac{\gamma^2(1+\gamma)}{2})[1+r\sigma_2^2(2-\frac{\gamma^2(1+\gamma)}{2})]} \tag{7}$$

3 Discussion

We have presented a model of multitasking with intrinsic motivation. Our main finding is that the wage scheme should be defined taking into account

the worker's intrinsic motivation and different tasks' motivational components. The result is driven by the *indirect moral crowding out*, according to which the provision of extrinsic incentives for non-motivational activities crowds out the effort exerted in the motivational task. This theoretical result has significant implications for the optimal job design's definition (Schoettner 2008). It suggests that the allocation of tasks and the way in which they are incentivized play a central role in order to crowd-in/crowd-out the worker's effort in motivational jobs. This is consistent with the idea that a good match between job organization and employee preferences represents a crucial issue (Ben-Ner 2013), particularly in the nursing sector. Previous studies showed (Clark et al. 2002; Burke 2003) a negative relation between job organizations that induce nurses to spend less time in direct patient care and levels of satisfaction and effort exerted by nursing staff. Consistently with the model, these results suggest that nursing sector's job design plays a key role in sustaining the intrinsic motivation of nurses.

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