Accepted Manuscript

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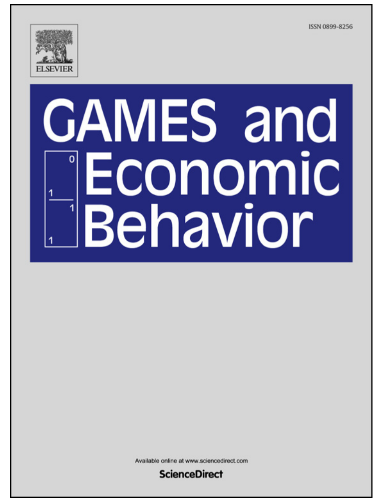

PII: S0899-8256(19)30068-5
DOI: https://doi.org/10.1016/j.geb.2019.04.012
Reference: YGAME 2994

To appear in: *Games and Economic Behavior*

Received date: 28 August 2017

Competition for Talent when Firms' Mission Matters

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Abstract

We study optimal non-linear contracts offered by a non-profit and a for-profit firm competing to attract workers, who are privately informed about their ability and motivation. Motivated workers are keen to be hired by the non-profit firm because they adhere to its mission. Workers with different ability self-select into firms depending on which organization holds a competitive advantage. This determines the sign and the composition of the wage differential between firms, which encompasses labor donations induced by motivation and the selection effect of ability. Our model thus rationalizes the mixed empirical evidence concerning for-profit *vs* non-profit wage differentials.

JEL classification: D82, D86, J24, J31, M55.

Key-words: multi-principals, bidimensional asymmetric information, skills, intrinsic motivation, for-profit vs non-profit organizations, wage differential.

1 Introduction

According to data from the yearly CEO Compensation Study, reported by Charity Navigator,[1] there are top executives of U.S. non-profit organizations whose annual compensation exceeds one million dollar.[2] Considering the media coverage of these studies, two different perspectives emerge. On the one hand,

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[1]See Charity Navigator "2016 Charity CEO Compensation Study" at www.charitynavigator.org

[2]Among them, the President of Chicago University, the President of the Icahn School of Medicine at Mount Sinai (N.Y.C.) or else the President of the Lincoln Center for Performing Arts.

it is highlighted that there is wide consensus by the public that seven-figure salaries are excessive for employees of non-profit organizations that receive private donations and, possibly, public funding. It is said that "if you are going to work at a non-profit, you should have as your primary motivation the public good (...) and you would accept less compensation...".[3] This is probably the reason why, in various federal states such as New Jersey, New York, Florida and Massachusetts, there have been recent proposals to introduce legislation that would cap top managers' compensations at non-profits. On the other hand, some contributors claim that "just because someone works for a non-profit, doesn't necessarily mean they're doing it for free".[4] Indeed, most non-profits tend to pay less than for-profit businesses for similar competencies. Moreover, those non-profit organizations that pay the highest compensations are multi-million dollar operations: leading one of them requires individuals that possess extensive management expertise together with a thorough understanding of the issues that are unique to the non-profit's mission. Therefore, "attracting and retaining that type of talent requires a competitive level of compensation as dictated by the marketplace".[5]

Our analysis contributes to this debate, fostering the idea that competition among heterogeneous firms in the labor market is a crucial determinant of the salary of non-profit employees (especially those at the top of the wage ladder). In particular, we show that competition between for-profit and non-profit organizations to attract the most talented workers tends to drive all salaries up. Adverse selection plays a key role: when a firm does not observe the workers' skills, it must provide its prospective managers with incentives in order to prevent them from misstating their ability type. This also contributes to push wages up. We finally analyze how these results interact with the managers' willingness to donate part of their labor to non-profit organizations whose mission they adhere to.

There exists a well-established empirical evidence on compensating wage differentials between different sectors or firms, according to which wage gaps are generated by differences in job attributes for which heterogeneous workers have different willingnesses to pay (see Rosen 1986). A possible source of compensating wage differentials is workers' motivation for being employed by non-profit or mission-oriented firms.[6] Those organizations pursue goals that are valuable for some workers, precisely those who believe

[3]See: "Is A One Million Dollar Nonprofit CEO Salary As Bad As It Sounds", Forbes, January 23, 2013.

[4]See The Street: "These 9 Nonprofit Executives Made Over 1-Million Dollar", September 15, 2014.

[5]See the "2014 CEO Compensation Study" by Charity Navigator.

[6]This idea has been first proposed by Handy and Katz (1998) for non-profit vs for-profit managers, by Heyes (2005)

in the same objectives and are moved by non-pecuniary motivations, together with the standard extrinsic incentives.[7] However, another strand of empirical work points out that wage differentials might arise because of a selection bias, given that wage gaps can also reflect *unobservable differences in workers' ability* across sectors or firms. Hence, a non-profit wage penalty would be due to the fact that, on average, workers with relatively lower skills self-select into the non-profit sector.[8]

Therefore, an open question still remains. Suppose that a wage penalty for workers employed at non-profit or mission-oriented firms is measured, although neither workers' motivation nor ability can be directly observed: then, non-profit wages can be lower either because of the lower reservation wages of motivated workers or because of the lower productivity of workers self-selecting into such firms (or due to a combination of these two effects). In other words, when workers' productivity and motivation are the workers' private information, is it possible to disentangle the pure compensating wage differential due to motivation from the selection effect of ability?

Finally, there's some other empirical evidence documenting a wage premium for non-profit workers.[9] Thus, another debated issue concerns the sign of the wage differential: under what conditions might the for-profit *vs* non-profit wage differential be negative despite the donative labor hypothesis?

In order to answer our research questions we consider two firms, a non-profit or mission-oriented firm and a standard for-profit firm,[10] competing for the exclusive services of a worker (manager). The two firms have different objective functions, because the for-profit firm strictly maximizes its profits whereas the non-profit firm is able to appropriate only a fraction of its revenues. In particular, the non-profit firm sacrifices some of its payoffs to engage in socially worthwhile projects and this allows it to

in the health sector, and by Delfgaauw and Dur (2007). In addition, Besley and Gathak (2005) consider mission-oriented firms that operate in specific sectors (education, health and defence) and produce collective goods. Bénabou and Tirole (2010) highlight the role of firms' corporate social responsibility.

[7]Empirically, the so-called *labor donative hypothesis* (see Preston 1989), as the determinant of compensating wage differentials, has been tested by Leete (2001) and Jones (2015), among others.

[8]See, for instance, Goddeeris (1988) for lawyers, Roomkin and Weisbrod (1999) for hospitals, and also Hwang *et al.* (1992) and Gibbons and Katz (1992).

[9]A wage penalty for non-profit workers has been documented by Roomkin and Weisbrod (1999), among others. For a non-profit wage premium see, for example, Preston (1988), Borjas *et al.* (1983) and Mocan and Tekin (2003).

[10]For expositional clarity, in the paper we address the dichotomy for-profit vs non-profit firms, but our model and its results could be applicable to standard for-profits vs profit-driven organizations that adhere to *corporate social responsibility,* which attracts motivated employees.

attract motivated applicants. Despite its revenue constraints, it is still possible for the non-profit firm to enjoy a competitive advantage with respect to the rival, because of other sources of firms' heterogeneity (technology, output prices, etc...).

Potential applicants are heterogeneous with respect to both their skills and their intrinsic motivation. All workers experience a cost from effort provision, which differs across workers' types, but which does not depend on the employer's organizational form. Differently, intrinsic motivation is only relevant when workers are hired by the non-profit employer (but is not affected by the workers' contribution to the output produced). Ability and motivation are the workers' private information and are independently distributed: workers can have either high or low ability, whereas motivation is a continuous variable.

In order to elicit the applicants' private information, the two firms simultaneously offer screening contracts consisting in a non-linear wage which depends on the observable effort (task) level. Because of the strategic interaction between the two firms, the workers' outside options are type-dependent and endogenous and thus the analysis of a multi-principal framework with bidimensional asymmetric information is called for. We characterize the optimal incentive schemes offered by each firm, the sorting pattern of workers into firms, and relate it not only to the sign, but also to the composition of the wage differential (disentangling the labor donative from the selection effect).

Optimal contracts are conditional on workers' ability, whereas motivation determines workers' self-selection between the two firms. Optimal incentive schemes differ according to the degree of heterogeneity between firms: when neither firm holds a sizeable competitive advantage with respect to the rival, equilibrium effort levels are set at the efficient level by both firms. Thus, competition between for-profit and non-profit firms is beneficial because it reduces allocative distortions. Otherwise, when the competitive advantage enjoyed by one firm is sufficiently high, effort distortions arise. In particular, the disadvantaged firm distorts high-ability workers' effort upwards, as a consequence of *countervailing incentives*,[11] and, eventually, the advantaged firm distorts low-ability workers' effort downwards. Workers' sorting is such that more motivated applicants always self-select into the non-profit organization and it is also related to which firm holds a competitive advantage relative to the other. There is negative (respectively positive) selection of ability into one firm when the share of high-ability workers is lower (respectively higher) than the share of low-ability workers that accept employment at that firm. We show that negative (resp.

[11] See Lewis and Sappington (1989).

positive) selection of ability into one firm is coupled with a competitive disadvantage (resp. advantage) of that firm with respect to the rival. In particular, suppose that the non-profit organization has a competitive disadvantage: then the non-profit organization can count on fewer high-ability workers than the for-profit, but its workers are highly motivated and provide high labor donations.

As for wages offered by the two firms, our results are sufficiently rich to account for both wage penalties and wage premia at the non-profit organization. Thus, our model accommodates for the mixed empirical evidence concerning for-profit *vs* non-profit wage differentials. When the non-profit firm has a competitive disadvantage, the total salary earned by non-profit workers is always lower than the salary that the same workers would gain if employed by the for-profit firm. Such a wage penalty for non-profit workers is associated with lower effort provision and it is in part due to a true compensating wage differential (the labor donative effect) and is in part driven by negative selection with respect to ability. The motivating example provided at the beginning of this Introduction fits into this case: top executives at non-profit organizations receive compensations that are high in absolute terms, because competition with the for-profit firm for the most talented managers drives all salaries up; nonetheless, non-profit salaries are still low in relative terms, because the non-profit organization appropriates labor donations from its employees. Suppose instead that the non-profit firm enjoys a competitive advantage. Our model then delivers some less intuitive and totally novel results. First, a non-profit wage penalty might emerge despite the non-profit competitive advantage: all non-profit employees exert higher effort than their for-profit colleagues, although the former are willing to accept lower wages because labor donations outweigh the positive selection effect into the non-profit firm. Secondly, a non-profit wage premium arises when the positive selection effect of ability is sufficiently strong as to offset the labor donative effect.

Finally, with respect to the debate about the desirability of a wage cap for CEOs of non-profit firms, our model predicts that such a cap would interfere with market forces and thus reduce efficiency. In addition, the equilibrium wage differential optimally encompasses labor donations from non-profit CEOs and differences in effort provision at for-profit *vs* non-profit firms, which in turn depend on the selection pattern of workers into firms.

The rest of the paper is organized as follows. In Subsection 1.1, we describe the related literature. In Section 2, we set up the model; in Section 3, as benchmark case, we present the equilibrium when firms are perfectly informed about workers' ability whereas they do not observe workers' motivation. Section

4 introduces asymmetric information about ability and describes the screening contracts offered by the two firms and the optimal sorting of workers. Section 5 focuses on wage differentials. Section 6 discusses our modelling strategies, relates them to the empirical evidence and explains to what extent they affect the results. Finally, Section 7 concludes.

1.1 Related literature

Our work contributes to two different strands of literature: it adds to the literature on the self-selection of motivated workers into different firms/sectors of the labor market, and it solves a multi-principal game in which two firms with different missions compete to attract workers characterized by two dimensions of private information.

As for the self-selection of motivated workers, the most closely related paper is Delfgaauw and Dur (2010). Under perfect competition and full information, it studies the sorting of managers, who are heterogeneous in both their productivity and public service motivation, into the public and the private sector. Given that the output price is assumed to be lower in the public than in the private sector, the key result is that the return to managerial ability is lower in the public than in the private sector, and this determines a public-private earnings penalty to occur. Our model extends the setup in Delfgaauw and Dur (2010) in two directions: first, we consider the more realistic case of bidimensional asymmetric information about workers' characteristics; second, we assume that firms interact strategically when competing to attract the most talented workers.[12]

Heyes (2005) and Delfgaauw and Dur (2007) study the selection of workers who are heterogeneous and privately informed with respect to their motivation. But workers' ability is not considered. The very few theoretical works about workers' sorting, that admit for workers' private information about both ability and motivation, provide ambiguous results on whether mission-oriented firms are able to hire workers with lower or higher productivity (see Handy and Katz 1998 and Delfgaauw and Dur 2008).[13]

[12]More recently, DeVaro *et al.* (2017) consider a non-profit firm offering flat wages and competing with two (perfectly competitive) for-profit rivals. It is shown that the most motivated workers are hired by the non-profit while for-profit firms set higher wages when they are more effective than non-profits in training workers.

[13]The design of optimal incentive schemes for intrinsically motivated workers, and its implications for workers' sorting, has also been considered by Murdock (2002), Besley and Gathak (2005), Francois (2000, 2003 and 2007), Prendergast (2007), Ghatak and Mueller (2011), and Auriol and Brilon (2014), whose attention has primarily been devoted to moral

The matching of workers to firms has also been analyzed by Kosfeld and von Siemens (2009, 2011) and Non (2012). In the former two papers, a competitive labor market with team production and adverse selection is analyzed, where selfish and conditionally cooperative workers coexist. In the latter, an employer can be egoistic or altruistic while some workers are willing to reciprocate the principal's altruism. The optimal contract might simultaneously signal the principal's altruism and screen reciprocal workers' types.

From an analytical point of view, our paper draws from the literature on multi-principals that was initiated by the seminal contributions of Martimort (1992) and Stole (1992). Within this literature, the paper that is most closely related to ours is Rochet and Stole (2002) which extends the analysis carried out in Stole (1995) and studies duopolists competing in nonlinear prices in the presence of both vertical and horizontal preference uncertainty.[14] We depart from Rochet and Stole (2002) because they only consider symmetric firms and thus find that incentive compatibility constraints are always slack for all firms, so that efficient quality allocations with cost-plus-fixed-fee pricing emerge at equilibrium.[15] Barigozzi and Burani (2016b) extends the framework of Barigozzi and Burani (2016a) to allow for competition between a for-profit and a non-profit organization that screen workers for ability and motivation in a discrete 2×2 setting. There are some major differences between Barigozzi and Burani (2016b) and the present paper. The former considers output-oriented motivation, whereby a worker's intrinsic satisfaction depends on the effort she provides or on her personal contribution to the output produced. This assumption generates a bidimensional screening problem with optimal contracts being contingent on both worker's ability and motivation. In the present paper, workers' motivation does not depend on effort (or output) provision so that the single-crossing condition holds and firms only screen workers for their talent. As for the results, in Barigozzi and Burani (2016b) workers' sorting is independent of ability and wage differentials are only driven by labor donations. The two papers are complementary because they show how the nature of workers' motivation (output-oriented or not) affects both workers' self-selection and the composition of the wage differential.

hazard or free-riding, while we consider the screening problem.

[14] A similar setup is analyzed in Lehmann *et al.* (2014) that considers optimal nonlinear income taxes levied by two competing governments.

[15] Precisely the same result can be found in Armstrong and Vickers (2001) that model firms as directly supplying utility to consumers.

There are other two papers analyzing optimal contracts by multiple principals that are worth mentioning. Biglaiser and Mezzetti (2000) studies an incentive auction in which multiple principals bid for the exclusive services of an agent, who has private information about ability. It is shown that only downward effort distortions, if any, might occur, and that the presence of multiple principals reduces (with respect to the single-principal outcome) the distortions in the agent's effort level. As opposed to Biglaiser and Mezzetti (2000), we show that an upward distortion in effort provision for high-ability workers is always present at the optimal incentive contracts. Finally, Bénabou and Tirole (2016) embed multitasking and screening in a Hotelling framework where workers engage in two activities, one in which individual contributions are not measurable and are driven by motivation, and the other which is contractible and dependent upon a worker's talent. When motivation is known while talent is private information, equilibria range from the case of monopsonistic underincentivization of low-skilled work to the other extreme case of perfectly competitive overincentivization of high-skilled work. The main differences with respect to that paper are the following: (*i*) our firms have different missions and are inherently asymmetric;[16] (*ii*) in our setup, motivation is not observable, it influences the sorting of workers into firms and interacts with skills in determining incentive pay in equilibrium. We share with Bénabou and Tirole (2016) the result that competition for the most talented workers drives all salaries up, but we depart from their conclusion that competition leads to an escalation of performance pay that undermines motivation and calls for the introduction of wage caps. In our framework, motivation might rather dilute the effects of excessive performance pay.

2 The model

We consider a multi-principal setting with bidimensional asymmetric information. Since market power and strategic interaction among firms are key ingredients, we assume that two principals (firms) compete to hire agents (workers). Each agent (she) can work exclusively for one principal. Principals and agents are risk neutral.

Firms

[16] This is why we find that one firm distorts effort of high-ability workers upwards and the other distorts effort of low-skilled workers downwards, whereas in Bénabou and Tirole (2016), firms are homogeneous and they both distort effort and performance pay either upwards or downwards.

Firms differ in the mission they pursue: one firm is profit-oriented while the other is a non-profit institution. The only input the two firms need in order to produce output is the effort supplied by agents. We call x the *observable and measurable* effort (task) level that agents are asked to provide. Firms have similar technologies: both their production functions display constant returns to effort, so that the amount of output produced is $q_i(x) = c_i x$ for each firm $i = F, N$ (with F and N referring to the for-profit and to the non-profit firm, respectively), where the marginal product of labor c_i is (eventually) firm-specific.

Payoffs *per-worker*, conditional on the worker being hired, are given by

$$\pi_i(x) = \alpha_i p_i q_i(x) - w_i(x) = \alpha_i p_i c_i x - w_i(x), \tag{1}$$

where $w_i(x)$ is the *total* wage or salary paid by firm i to the worker exerting effort x and where the unit price of output p_i is assumed to be exogenous and, eventually, firm-specific. Parameter α_i captures the profit constraints possibly faced by the firms. We assume that $\alpha_F = 1$ whereas $0 < \alpha_N < 1$, implying that the non-profit firm is committed not to fully appropriate its revenues. [17] We defer the reader to Section 6 for more discussion. Workers' motivational premium is precisely generated by the non-profit commitment to this revenue constraint.

Let us focus on firm i's *marginal revenue* and denote it as $k_i \equiv \alpha_i p_i c_i$, so that $k_i > k_{-i}$ describes a situation in which firm i has a *competitive advantage* with respect to the rival firm, with $i = F, N$. The situation in which the for-profit firm has a competitive advantage relative to the non-profit firm (i.e. $k_N < k_F$) is easy to figure out.[18] Instead, a competitive advantage of the non-profit firm (i.e. $k_N \geq k_F$) can either stem from the higher output price that the non-profit firm can command, i.e. $p_N > p_F$,[19]

[17]For example, consider non-profit hospitals that provide compensated care (to insured patients) but are also committed to provide some charity care to poor (uninsured) patients. Specifically, let α_N be the fraction of insured (paying) patients and $1 - \alpha_N$ the fraction of uninsured patients. Let us interpret x_N as the total amount of surgeries a doctor is required to perform every month and $w_N(x_N)$ as her monthly salary. Finally, let p_N be the price charged by the hospital for each surgery. The per-doctor payoff earned by the hospital is thus $\alpha_N p_N x_N - w_N(x_N)$. Alternatively, consider non-profit universities that grant tuition wavers to outstanding incoming students, whose fraction is $1 - \alpha_N$. Only the fraction α_N of students paying their tuition fees in full counts for the university's revenues.

[18]Consider hospitals again. In Diagnosis Related Group (DRG) systems, all health providers are paid a fixed tariff for every patient admitted for treatment, so that both non-profit and for-profit hospitals face the same prices $p_F = p_N$. Hence, if non-profit and for-profit hospitals have similar technologies and $c_F \simeq c_N$, a non-profit hospital is likely to have a competitive disadvantage simply because of its commitment to provide uncompensated care, i.e. $\alpha_N < 1$.

[19]Indeed, the so-called "caring consumers" are ready to pay higher prices for commodities characterized by some public

or from the non-profit firm enjoying a superior technology, i.e. $c_N > c_F$,[20] or both. Moreover, these advantages must be sufficiently high to offset the disadvantage due to the non-profit revenue constraints.

Workers

Consider a population of workers (managers) with unit mass, who differ in two characteristics, ability and intrinsic motivation, that are independently distributed.[21] Ability is inversely related to the cost of providing effort and is denoted as $\theta \in \{\underline{\theta}, \overline{\theta}\}$, with $\overline{\theta} > \underline{\theta} \geq 1$ and $\Delta\theta \equiv \overline{\theta} - \underline{\theta}$. A fraction ν of workers has a low cost of effort (i.e. high ability) $\underline{\theta}$ and a fraction $1 - \nu$ has instead a high effort cost (i.e. low ability) $\overline{\theta}$. Intrinsic motivation γ is continuous and, for simplicity, uniformly distributed in the interval $[0, 1]$.

When a worker is not hired by any firm, her utility is zero. When a worker is hired by one firm, her *reservation utility* or *outside option* is endogenous and type-dependent because it is affected by the contract offered by the rival firm. If a worker is hired by the for-profit firm, her utility is given by the salary gained less the cost of effort provision, which depends on the agent's ability type θ, and

$$u_F(x_F, w_F) = w_F(x_F) - \frac{1}{2}\theta x_F^2.$$

Workers do not enjoy any benefit from motivation when hired by the for-profit firm. Thus, from the point of view of the for-profit firm, ability is the only relevant workers' characteristic. If, instead, a worker is hired by the non-profit firm, her utility takes the form

$$u_N(x_N, w_N) = w_N(x_N) - \frac{1}{2}\theta x_N^2 + \gamma,$$

where motivation γ also appears. According to Heyes (2005) and Delfgaauw and Dur (2010), we interpret intrinsic motivation as a non-monetary benefit that a worker enjoys only when employed by the non-profit firm. Indeed, non-profit workers obtain a premium because they are involved in the social cause pursued by their organization or because they care about the well-being of the recipients of the goods and services

good attribute (see Besley and Ghatak 2007), and recent surveys of ethical shopping show that ethical products, such as green electricity, do have higher prices.

[20]The 2012 report "For-Profit Higher Education: The Failure to Safeguard the Federal Investment and Ensure Student Success" by the U.S. Senate Committee on Health, Labor, Education and Pensions (available at http://www.gpo.gov/fdsys) suggests that non-profit colleges are more efficient than for-profit ones.

[21]We defer the reader to Section 6 for further discussion about this assumption.

provided by their employer. Observe that the motivational premium is not related to effort exertion and does not directly affect the non-profit firm's output. This assumption implies that a worker's indifference curves have positive slope in the (x, w) plane and that the single-crossing property holds, no matter the hiring firm (see also Section 6).

Firms' strategic interaction

Taking the workers' decision to accept the job offered by one firm as given, we suppose that firms offer incentive-compatible transfer schedules that are conditional on the effort target, namely we derive the non-linear wage schedules $w_i(x_i)$ offered by each firm $i = F, N$. To do so, given that a worker of type θ has preferences over effort-salary pairs which are independent of γ (conditional on being hired by one firm), we study the direct revelation mechanism such that: (i) each firm offers two incentive-compatible contracts, one for each ability type θ, consisting in an effort target and a wage rate, i.e. $\{x_i(\theta), w_i(\theta)\}_{i=F,N}$, and (ii) each agent selects the preferred pair. We can thus treat the firms' contract design problem as independent of the workers' choice about which firm to work for. The latter is considered as an indirect mechanism, because no report on γ is required. Given the contracts offered by the two firms, we find the indirect utilities of a worker who truthfully reports her ability type θ and we use them to tackle the worker's self-selection problem, which depends on motivation γ. This is why, in what follows, it will be more convenient to reason in terms of workers' indirect utility and to focus on contracts of the form $\{x_i(\theta), U_i(\theta)\}_{i=F,N}$.

Given the non-linear wage schedule $w_i(x_i)$ offered by firm $i = F, N$, a worker of type θ employed by firm i, solves

$$\max_{x_i} \quad u_i(x_i, w_i(x_i)).$$

Denoting by $x_i(\theta)$ the solution to the above program, one can write

$$U_i(\theta) = w_i(x_i(\theta)) - \frac{1}{2}\theta x_i^2(\theta), \tag{2}$$

with $U_i(\theta)$ being the *indirect utility* or information rent of an agent of type θ who is hired by firm $i = F, N$, *absent* the benefit accruing from intrinsic motivation. Once $U_i(\theta)$ is determined, it is possible to find the share of type θ workers employed by each firm, i.e. the probability that type θ workers prefer to be hired by firm i rather than by the rival firm $-i$. Indeed, a worker of type (θ, γ) gets indirect utility $U_F(\theta)$ if she is hired by the for-profit firm and *total* indirect utility $\mathcal{U}_N(\theta) = U_N(\theta) + \gamma$ if employed by the non-profit firm.

Definition 1 ***Indifferent worker.*** *The worker with ability* $\theta \in \{\underline{\theta}, \overline{\theta}\}$*, who is indifferent between working for the non-profit or the for-profit firm, is characterized by motivation*

$$\widehat{\gamma}(\theta) \equiv U_F(\theta) - U_N(\theta). \quad (3)$$

Thus, a type (θ, γ) worker strictly prefers to work for the for-profit firm if her motivation falls short of $\widehat{\gamma}(\theta)$, i.e. if $U_N(\theta) + \gamma < U_F(\theta)$; conversely, she strictly prefers to work for the non-profit firm if her motivation exceeds $\widehat{\gamma}(\theta)$ and $U_N(\theta) + \gamma > U_F(\theta)$. Given that γ is uniformly distributed on the $[0, 1]$ interval, the share of workers with ability θ who prefer being employed by the for-profit firm is

$$\varphi_F(\theta) \equiv \Pr(\gamma < \widehat{\gamma}(\theta)) = U_F(\theta) - U_N(\theta); \quad (4)$$

conversely, the share of employees choosing to be hired by the non-profit firm is

$$\varphi_N(\theta) \equiv \Pr(\gamma \geq \widehat{\gamma}(\theta)) = 1 - (U_F(\theta) - U_N(\theta)). \quad (5)$$

In order for both firms to have a positive labor supply of type θ workers, it must be that

$$0 < \widehat{\gamma}(\theta) < 1 \Longleftrightarrow \varphi_i(\theta) \in (0, 1) \text{ for each } i = F, N \text{ and each } \theta \in \{\underline{\theta}, \overline{\theta}\}. \quad (6)$$

For convenience, we will focus on the case in which condition (6) is satisfied.[22]

Finally, notice that inequality $\widehat{\gamma}(\theta) > 0$, or else $U_N(\theta) < U_F(\theta)$, for every θ, implies that a worker of type θ is ready to accept a lower wage at the non-profit than at the for-profit firm in exchange for the same level of effort. Thus, $\widehat{\gamma}(\theta)$ represents the labor donation, i.e. the amount of salary that type θ workers are willing to give up in order to be hired by the non-profit organization.

Before being able to set up each firm's maximization problem, let us go back to (2) and solve it for the wage rate as

$$w_i(\theta) = U_i(\theta) + \frac{1}{2}\theta x_i^2(\theta). \quad (7)$$

One can use expression (7) to eliminate the wage rate from the firms' payoffs (1). Then, per-worker profits, relative to each type θ worker, can be written as

$$\pi_i(\theta) = k_i x_i(\theta) - \frac{1}{2}\theta x_i^2(\theta) - U_i(\theta). \quad (8)$$

[22]Indeed, in order to study the selection effects of ability and the wage differentials, we need that each firm be able to attract both low- and high-ability workers.

The objective of each firm $i = F, N$ is then to maximize its expected total payoff, that is

$$\max_{x_i(\cdot),U_i(\cdot)} E(\pi_i) = \nu \pi_i(\underline{\theta}) \varphi_i(\underline{\theta}) + (1-\nu)\pi_i(\overline{\theta})\varphi_i(\overline{\theta}) \tag{P_i}$$

Notice that motivation γ does not appear in the above expression, because it is replaced by the fraction $\varphi_i(\theta)$ of type θ workers being hired by firm $i = F, N$, which in turn depends on the difference between indirect utilities $U_F(\theta) - U_N(\theta)$ (see equations 4 and 5). Moreover, in firm i's expected payoff, the (reservation) utility offered by the other firm, i.e. $U_{-i}(\theta)$, is treated as given even though it is endogenous (and dependent on ability). Thus, firms compete against each other in the utility space: when a firm increases the utility offered to a given type of worker, it reduces its payoff when hiring the worker but it increases its probability of hiring the worker herself.

Finally, because ability is not observable by the firms, one has to consider the workers' incentive compatibility and participation constraints. Provided that both firms are able to hire workers with both ability levels, there are two incentive compatibility constraints for each firm: the *downward incentive constraint* (henceforth DIC) requiring that high-ability types be not attracted by the contract offered to low-ability types and the *upward incentive constraint* (henceforth UIC) requiring that low-ability types be not willing to mimic high-ability workers. For each firm $i = F, N$, such constraints (written in terms of effort levels and utilities) are given by

$$U_i(\underline{\theta}) \geq U_i(\overline{\theta}) + \frac{1}{2}(\overline{\theta} - \underline{\theta}) x_i(\overline{\theta})^2, \tag{DIC_i}$$

and

$$U_i(\overline{\theta}) \geq U_i(\underline{\theta}) - \frac{1}{2}(\overline{\theta} - \underline{\theta}) x_i(\underline{\theta})^2. \tag{UIC_i}$$

Again, observe that these constraints do not depend on motivation γ. Putting DIC_i and UIC_i together yields

$$\frac{1}{2}(\overline{\theta} - \underline{\theta}) x_i(\overline{\theta})^2 \leq U_i(\underline{\theta}) - U_i(\overline{\theta}) \leq \frac{1}{2}(\overline{\theta} - \underline{\theta}) x_i(\underline{\theta})^2,$$

which makes it clear that incentive compatible contracts must satisfy: (i) the *monotonicity condition* $x_i(\underline{\theta}) \geq x_i(\overline{\theta})$, requiring that high-ability workers exert more effort than low-ability types at each firm $i = F, N$; and (ii) condition $U_i(\underline{\theta}) \geq U_i(\overline{\theta})$, requiring that high-ability workers get an indirect utility not lower than low-ability types, for each employer $i = F, N$. As for the participation constraints, it must be that

$$U_F(\theta) \geq 0 \qquad \text{and} \qquad \mathcal{U}_N(\theta) = U_N(\theta) + \gamma \geq 0 \qquad \text{for all } \theta \in \{\underline{\theta}, \overline{\theta}\}. \tag{PC}$$

To sum up, firms simultaneously design menus of contracts of the form $\{x_i(\theta), U_i(\theta)\}_{i=F,N}$ by way of maximizing total expected payoffs with respect to the effort level and the indirect utility associated to each type θ worker (i.e. solving program P_i), taking as given the indirect utility $U_{-i}(\theta)$ that the rival firm leaves to the worker, and subject to the two incentive compatibility constraints DIC_i and UIC_i and to the participation constraints PC. Workers then observe the corresponding non-linear transfer schedule $w_i(x_i)$ for $i = F, N$, select the preferred one and thus choose which firm to work for.

Workers' self-selection

Given the indirect utilities $U_i(\theta)$ set by firms, prospective employees decide which firm to work for according to their motivation level. Three different sorting patterns of workers into firms are possible.

Definition 2 ***Workers' sorting.*** *The sorting of workers between the for-profit and the non-profit firm is such that:*

(i) *there is* ***ability neutrality*** *when*

$$\widehat{\gamma}(\underline{\theta}) = \widehat{\gamma}(\overline{\theta}) \Longleftrightarrow U_F(\underline{\theta}) - U_N(\underline{\theta}) = U_F(\overline{\theta}) - U_N(\overline{\theta});\tag{9}$$

(ii) *there is* ***negative selection of ability into the non-profit firm*** *when*

$$\widehat{\gamma}(\underline{\theta}) > \widehat{\gamma}(\overline{\theta}) \Longleftrightarrow U_F(\underline{\theta}) - U_N(\underline{\theta}) > U_F(\overline{\theta}) - U_N(\overline{\theta});\tag{10}$$

(iii) *there is* ***positive selection of ability into the non-profit firm*** *when*

$$\widehat{\gamma}(\underline{\theta}) < \widehat{\gamma}(\overline{\theta}) \Longleftrightarrow U_F(\underline{\theta}) - U_N(\underline{\theta}) < U_F(\overline{\theta}) - U_N(\overline{\theta}).\tag{11}$$

Ability neutrality captures the situation in which $\varphi_i(\theta)$, i.e. the fraction of workers who self-select into firm $i = F, N$, is constant and does not depend on workers' ability. Negative (respectively, positive) selection into the non-profit firm, instead, means that the fraction of workers attracted by firm N is bigger (resp. smaller) the lower workers' ability, whereas the fraction of workers attracted by firm F is bigger (resp. smaller) the higher workers' ability.

3 The benchmark contracts: full information about ability

Let us first consider the benchmark case in which workers' ability is fully observable, while motivation is the workers' private information. For each type $\theta \in \{\underline{\theta}, \overline{\theta}\}$, firm $i = F, N$ solves the program

$$\max_{x_i(\theta), U_i(\theta)} \left(k_i x_i(\theta) - \frac{1}{2}\theta x_i(\theta)^2 - U_i(\theta) \right) \varphi_i(\theta) \qquad (PB_i)$$

taking $U_{-i}(\theta)$, which enters the expression for $\varphi_i(\theta)$, as given. The first-order condition with respect to effort level $x_i(\theta)$ yields

$$x_i^B(\theta) = \frac{k_i}{\theta} = x_i^{FB}(\theta), \qquad (12)$$

where the superindexes B and FB stand for *benchmark* and *first-best*, respectively. Using (12), the first-order conditions with respect to utilities $U_i(\theta)$, which are not symmetric, solve for

$$U_F(\theta) = \frac{1}{2}\left(\frac{k_F^2}{2\theta} + U_N(\theta)\right) \quad \text{and} \quad U_N(\theta) = \frac{1}{2}\left(\frac{k_N^2}{2\theta} - (1 - U_F(\theta))\right). \qquad (13)$$

These are the reaction functions of the two firms, which characterize the optimal utility left by firm $i = F, N$ to a type θ worker given the utility $U_{-i}(\theta)$ that the same worker receives from the competing firm $-i$. Reaction functions have positive slopes in the utility space, so that utilities can be interpreted as *strategic complements* in this game. In a Nash equilibrium, the levels of utility given by both firms to type θ solve (13) simultaneously so that

$$U_N^B(\theta) = \tfrac{1}{3}\left(\tfrac{k_N^2}{\theta} + \tfrac{k_F^2}{2\theta} - 2\right) \quad \text{and} \quad U_F^B(\theta) = \tfrac{1}{3}\left(\tfrac{k_F^2}{\theta} + \tfrac{k_N^2}{2\theta} - 1\right). \qquad (14)$$

We can use expression (3) to obtain the equilibrium level of motivation for the worker of type θ, who is indifferent between firms, which is

$$\widehat{\gamma}^B(\theta) = U_F^B(\theta) - U_N^B(\theta) = \frac{1}{3}\left(1 + \frac{k_F^2 - k_N^2}{2\theta}\right),$$

so that the fraction of type θ workers hired by firm F is precisely $\varphi_F^B(\theta) = \widehat{\gamma}^B(\theta)$, whereas the fraction of type θ workers hired by firm N is $\varphi_N^B(\theta) = 1 - \widehat{\gamma}^B(\theta) = \frac{2}{3} - \frac{(k_F^2 - k_N^2)}{6\theta}$. Finally, using (7) one can compute the equilibrium salaries

$$w_N^B(\theta) = \tfrac{1}{3}\left(\tfrac{5k_N^2 + k_F^2}{2\theta} - 2\right) \quad \text{and} \quad w_F^B(\theta) = \tfrac{1}{3}\left(\tfrac{k_N^2 + 5k_F^2}{2\theta} - 1\right). \qquad (15)$$

The Proposition that follows summarizes the results obtained so far.

Proposition 1 ***Benchmark contracts.*** *When ability is observable (and motivation is the workers' private information), the benchmark contracts are the Nash equilibrium of the game in which firms compete in utility space. The benchmark contracts are such that each firm* $i = N, F$ *chooses the efficient allocation* $x_i^B(\theta) = x_i^{FB}(\theta)$ *and leaves to workers utilities given by (14).*

At equilibrium, how do workers characterized by different levels of ability sort between the two firms? It depends on which firm holds a competitive advantage with respect to the rival, as we describe below. In general, both firms are able to hire workers of each skill level, provided that the difference in marginal revenues be sufficiently small. Otherwise, the advantaged firm might be able to hire all high-ability workers. Figures 1(a)-1(c) depict all relevant instances.

(i) Let us first consider the case in which both firms have the same marginal revenues, so that $k_F = k_N = k$. Then $\widehat{\gamma}^B(\theta) = \frac{1}{3}$, which is independent of ability. All workers with motivation higher than $\frac{1}{3}$ prefer to work for the non-profit while all workers with motivation lower than $\frac{1}{3}$ prefer to accept employment at the for-profit firm. All workers prefer to work rather than being unemployed if $\overline{\theta} < 3k^2/2$.[23]

(ii) Consider now the case in which $k_F > k_N$, so that the for-profit firm has a competitive advantage with respect to the non-profit firm. The indifferent worker with high ability has higher motivation than the low-ability one, i.e. $\widehat{\gamma}^B(\underline{\theta}) > \widehat{\gamma}^B(\overline{\theta})$. This means that a negative selection of ability into the non-profit firm emerges. Notice that an interior solution, satisfying all workers' participation constraints and (6) exists if the following chain of inequalities

$$\frac{k_F^2 - k_N^2}{4} < \underline{\theta} < \overline{\theta} < \frac{2k_F^2 + k_N^2}{2} \tag{16}$$

holds.[24]

[23] This condition ensures that low-ability workers supply a positive amount of labour to both firms so that both $U_F\left(\overline{\theta}\right) > 0$ and $U_N\left(\overline{\theta}\right) > 0$ hold. This also implies that all other workers' participation constraints are satisfied.

[24] The righ-most inequality gurantees that low-ability (and thus all) workers' participation constraint be satisfied, no matter the hiring firm. The left-most inequality, instead, is equivalent to $U_N(\underline{\theta}) < \frac{k_N^2}{2\underline{\theta}}$ and to $\widehat{\gamma}^B(\underline{\theta}) < 1$, which ensure, respectively, that the non-profit firm leaves to its high-ability workers a utility smaller than the total surplus and that its share of high-ability hired workers be positive. Otherwise, the non-profit firm only hires a positive share of low-ability workers and is not able to attract any high-ability applicants, despite offering them the whole total surplus and making zero profits from that type of workers.

(iii) To conclude, consider the case in which the non-profit firm has a competitive advantage, despite its revenue constraints, and $k_F < k_N$. Now $\widehat{\gamma}^B\left(\underline{\theta}\right) < \widehat{\gamma}^B\left(\overline{\theta}\right)$ holds, and we observe a positive selection of ability into the non-profit firm. Again, an interior solution satisfying all PCs and (6) exists provided that

$$\frac{k_N^2 - k_F^2}{4} < \underline{\theta} < \overline{\theta} < \frac{2k_F^2 + k_N^2}{2} \tag{17}$$

holds.[25]

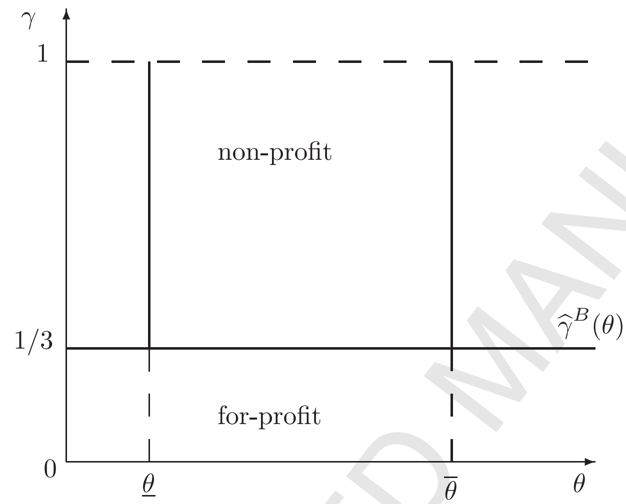

Figure 1(a). Ability-neutrality: $k_F = k_N$

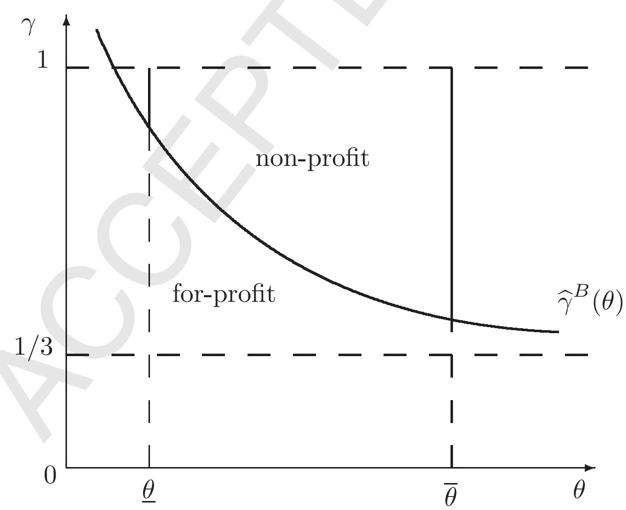

Figure 1(b). Negative selection of ability into the non-profit firm: $k_F > k_N$

[25]The righ-most inequality ensures that low-ability workers' participation constraint be satisfied, no matter the hiring firm. The left-most inequality is now equivalent to $U_F\left(\underline{\theta}\right) < \frac{k_F^2}{2\underline{\theta}}$ and to $\widehat{\gamma}^B\left(\underline{\theta}\right) > 0$, requiring the for-profit firm to be able to attract high-ability applicants and to make positive profits from them.

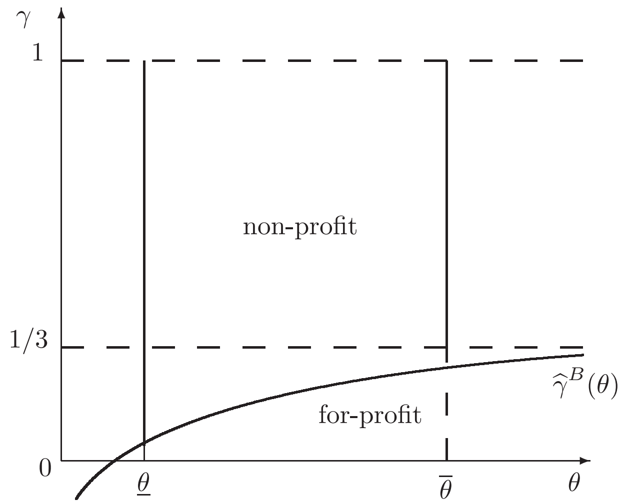

Figure 1(c). Positive selection of ability into the non-profit firm: $k_N > k_F$

The Proposition below focuses on how the difference in firms' marginal revenues affects workers' self-selection.

Proposition 2 ***Workers' sorting patterns at the benchmark contracts.*** *When ability is observable (and motivation is the workers' private information), benchmark contracts are such that the sorting of workers into firms only depends on the difference in firms' marginal revenues, i.e. on which firm holds a competitive advantage: (i) if $k_F = k_N$ there is ability-neutrality and $\widehat{\gamma}^B(\underline{\theta}) = \widehat{\gamma}^B(\overline{\theta})$; (ii) if $k_F > k_N$ there is a negative selection of ability into firm N and $\widehat{\gamma}^B(\underline{\theta}) > \widehat{\gamma}^B(\overline{\theta})$ holds; and (iii) if $k_F < k_N$ there is a positive selection of ability into firm N and $\widehat{\gamma}^B(\underline{\theta}) < \widehat{\gamma}^B(\overline{\theta})$ holds.*

The organization that is able to pay more its employees, because it enjoys a competitive advantage, is also able to attract a larger share of high-ability than of low-ability workers (see also Section 5). Independently of which firm holds the competitive advantage, the non-profit firm always hires the more motivated workers and benefits from their labor donations. In particular, under negative selection of ability into the non-profit firm, the latter receives relatively high labor donations from high-skilled workers, whose labor supply is relatively low, whereas it receives relatively low labor donations from low-skilled workers, whose labor supply is instead relatively high; the opposite holds under positive selection. Also notice that full market segmentation according to skills never occurs: it is never the case that all high-ability workers prefer to work for one firm while all low-ability workers prefer to be hired by the rival firm.[26]

[26] Our benchmark in which ability is observable to employers encompasses and extends the findings about negative selection

The situation in which ability is observable to employers is certainly relevant for higher education, at least in the case of senior positions, since publication records are common knowledge. Our model predicts that, in the competition between for-profit and non-profit universities on the job market, the organization enjoying an overall competitive advantage will be able to attract relatively more productive researchers, but the non-profit institution will always attract the most motivated academics, i.e. those who are more interested in the advancement of research and in spreading knowledge among their students.

4 Incentive contracts: screening for ability

Let us now solve the complete problem in which neither ability nor motivation are observable. This requires taking into account DIC and UIC constraints. Let us first state some preliminary results.

We first provide a sufficient condition under which the benchmark contracts analyzed in Section 3 represent full-fledged optimal contracts under asymmetric information about both workers' ability and motivation. Suppose each firm $i = F, N$ offers a menu of contracts such that agents of each type $\theta \in \{\underline{\theta}, \overline{\theta}\}$ are asked to exert the first-best effort level $x_i^{FB}(\theta)$ and are compensated according to $w_i^B(\theta)$ specified by (15). Then, under the following sufficient condition, both incentive constraints are slack.

Lemma 1 *At the benchmark contracts, all incentive constraints are slack for both firms if*

$$\frac{(k_F + k_N)\,|k_F - k_N|}{3\min\{k_F^2; k_N^2\}} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \tag{18}$$

holds.

Proof. See Appendix A.1. ■

This implies that each firm's problem can be treated as two independent problems, one for each ability level, since the presence of types $\underline{\theta}$ does not influence the optimal contract that firm i offers to types $\overline{\theta}$, and vice-versa. The Proposition below follows immediately from Lemma 1.

Proposition 3 ***Incentive compatible benchmark contracts.*** *Suppose that neither ability nor motivation is observable. If condition (18) is satisfied, optimal incentive contracts coincide with benchmark*

of ability into the public sector by Delfgaauw and Dur (2010, Section 4). Note that our concept of negative selection of ability into the non-profit firm is less stringent because it does imply that the average skills of employees be necessarily lower at the non-profit than at the for-profit firm.

contracts: for all $\theta \in \{\underline{\theta}, \overline{\theta}\}$, *both firms ask workers to exert first-best effort levels* $x_i^*(\theta) = x_i^B(\theta) = x_i^{FB}(\theta)$, *offer utilities* $U_i^*(\theta) = U_i^B(\theta)$, *and provide compensation schemes* $w_i^*(\theta) = w_i^B(\theta)$, *with* $i = F, N$.

Lemma 1 provides the condition under which competition between two firms with different missions leads to an efficient allocation.[27] This efficiency result is more likely to be attained when workers' heterogeneity, i.e. the difference in the costs of effort provision $\Delta\theta$, is sufficiently high relative to firms' heterogeneity, namely the difference in firms' marginal revenues $|k_F - k_N|$. Indeed, when types of workers are sufficiently distant from each other, mimicking becomes too costly to be attractive; moreover, when firms' heterogeneity is sufficiently low, competition between firms is fierce and both firms strive to attract the best workers by leaving them the highest possible utility. Notice that condition (18) is always satisfied when firms are symmetric, i.e. $k_F = k_N$, and ability neutrality holds.

When sufficient condition (18) is not fulfilled, it means that the benchmark contracts of at least one firm (the disadvantaged one) are no longer incentive compatible. Then, the following might happen.

Lemma 2 (*i*) *If condition (18) fails to hold but condition*

$$\frac{(k_F + k_N)|k_F - k_N|}{\min\{k_F^2; k_N^2\} + 2\max\{k_F^2; k_N^2\}} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{(k_F + k_N)|k_F - k_N|}{3\min\{k_F^2; k_N^2\}} \tag{19}$$

is satisfied, then the benchmark contracts of the advantaged firm are still incentive compatible, whereas upward incentive compatibility is violated by the benchmark contracts of the disadvantaged firm.
(*ii*) *If condition*

$$\frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{(k_F + k_N)|k_F - k_N|}{\min\{k_F^2; k_N^2\} + 2\max\{k_F^2; k_N^2\}} \tag{20}$$

holds, then neither firm's benchmark contracts are incentive compatible and upward incentive compatibility is violated by the benchmark contracts of the disadvantaged firm while downward incentive compatibility is violated by the benchmark contracts of the advantaged firm.

Proof. See Appendix A.1. ■

Figure 2 represents the relevant thresholds appearing in Lemmata 1 and 2, specifying which firm has a competitive advantage relative to the rival.

[27] The result contained in Proposition 3 is coherent with Rochet and Stole (2002), where firms are identical and no incentive constraint can ever be binding. Therefore, optimal contracts always consist in efficient allocations. The same result is obtained by Armstrong and Vickers (2001) as well.

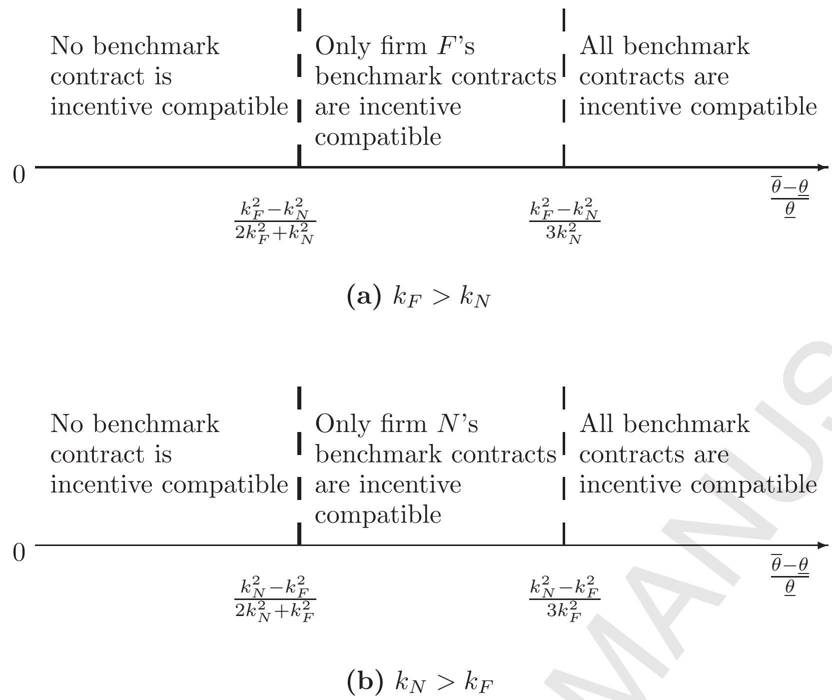

Figure 2. Incentive compatible benchmark contracts

In practice, Lemma 2 describes a situation in which firms' heterogeneity becomes more and more important relative to the heterogeneity in workers' ability. This might be relevant for higher education: universities hire professors who should all be well trained for doing research and whose records of publications is common knowledge, but whose administrative competencies as head of a department or dean might well be heterogeneous and very difficult to ascertain ex-ante. Managerial talent substantially matters for those organizations and they may want to design screening contracts to elicit such skills.

Lemma 2 offers some preliminary insights on which firm has to resort to incentive mechanisms and on which incentive constraints are relevant for which firm. Nonetheless, the scope of Lemma 2 is limited, because it focuses on the incentive properties of *benchmark contracts* and not of any screening contract. It is Lemma 3 that really specifies which are the incentive compatibility constraints that each firm can neglect, according to the sorting pattern of workers into firms.

Lemma 3 *(i) When there is ability-neutrality and* $\widehat{\gamma}(\underline{\theta}) = \widehat{\gamma}(\overline{\theta})$ *holds, then neither DIC nor UIC can*

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be binding for either firm. (*ii*) *When there is negative selection of ability into firm N and* $\widehat{\gamma}(\underline{\theta}) > \widehat{\gamma}(\overline{\theta})$ *holds, then neither* UIC_F *nor* DIC_N *can be binding.* (*iii*) *When there is positive selection of ability into firm N and* $\widehat{\gamma}(\underline{\theta}) < \widehat{\gamma}(\overline{\theta})$ *holds, then neither* DIC_F *nor* UIC_N *can be binding.*

Proof. See Appendix A.2. ■

Part (*i*) of Lemma 3 confirms the information already contained in Lemma 2, namely that benchmark contracts are incentive compatible when firms' marginal revenues are equal and ability neutrality holds. More interestingly, Lemma 2 and parts (*ii*) and (*iii*) of Lemma 3 together, help reduce the set of relevant incentive constraints to be considered in each firm's maximization program. In particular, two joint programs prove to be relevant: the one in which UIC is binding for the disadvantaged firm while the advantaged firm is not incentive constrained, and the one in which UIC is binding for the disadvantaged firm while DIC is binding for the advantaged firm.[28]

The intuition behind these findings is the following: the first organization to be incentive constrained is the disadvantaged one. Indeed, the advantaged firm, relying on more resources, can increase its transfers to potential mimickers and discourage them from selecting the contract targeted to workers with different skills. On the contrary, the disadvantaged firm needs to solve the usual rent-extraction/efficiency trade-off by resorting to effort distortions. Only when the difference in talents becomes sufficiently small, does the advantaged firm resort to effort distortions in order to prevent mimicking. Also notice that, the binding incentive constraint for the disadvantaged firm is the one which is relevant for low-ability workers, namely the workers employed in relatively larger amount at the disadvantaged firm. Conversely, the advantaged firm attracts a larger share of high-ability workers and its relevant constraint is precisely the one which ensures that high-skilled employees are not envious of their low-type colleagues.

In the subsections that follow, we further consider the implications of Lemma 2 and parts (*ii*) and (*iii*) of Lemma 3. Before doing so, recall that benchmark contracts ensure full employment and satisfy condition (6) provided that inequality (16) or (17) holds, respectively, under negative or positive selection

[28] These results stand in contrast to Biglaiser and Mezzetti (2000), where it is shown that UIC can never be binding for the principal. Our results also complement the findings by Bénabou and Tirole (2016), because, within their Hotelling framework, competing firms have either both their $UICs$ or both their $DICs$ binding. In our context, instead, the disadvantaged firm behaves as one of their perfectly competitive employers, having its UIC binding and asking for overexertion of effort, whereas the advantaged firm behaves as their monopsonistic employer, having its DIC binding and asking for underprovision of effort.

of ability for the non-profit firm, respectively. We assume that these inequalities be still satisfied when firms cannot observe workers' ability.[29] Moreover, let us introduce a restriction on skills' heterogeneity which is necessary for the disadvantaged firm to make positive payoffs from high-ability types when its UIC is binding (see Appendix A.3 for more details).

Assumption 1 *The difference in ability is sufficiently low so that* $2\underline{\theta} > \overline{\theta} > \underline{\theta} \geq 1$ *holds.*

Under Assumption 1, the disadvantaged firm is able to retain a positive share of the surplus from each high-ability worker. This in turn guarantees that this firm hires a positive mass of high-ability workers (and a fortiori of low-ability types), allowing us to focus on interior solutions satisfying condition (6).

4.1 Negative selection of ability into the non-profit firm

In this section, we analyze the situation described in part (*ii*) of Lemma 3, which is relevant when the non-profit firm has a competitive disadvantage, i.e. $k_N < k_F$. We consider two simultaneous programs in turn: first, the one in which UIC is binding for the non-profit firm while the for-profit firm is not incentive constrained, and the one in which UIC is binding for the non-profit firm while DIC is binding for the for-profit. We characterize optimal contracts $\{x_i^*(\theta), U_i^*(\theta)\}_{i=F,N}$ in both scenarios.

4.1.1 UIC binds for the non-profit firm

Take $k_N < k_F$ and suppose that condition (19) is satisfied. This is the case in which UIC_N binds while all incentive compatibility constraints are slack for firm F. The Proposition that follows provides the most important qualitative results, focusing on allocative distortions and informational rents.[30] The information about optimal wages is given later on, in Section 5.

Proposition 4 ***Optimal incentive contracts when*** UIC_N ***binds.*** *When* $k_N < k_F$ *and condition (19) holds, optimal contracts are such that:* (*i*) *the for-profit firm sets first-best effort levels, i.e.* $x_F^*(\theta) =$

[29] Although the above-mentioned inequalities might not be sufficient to guarantee interior solutions at the screening contracts, they still are a useful guideline. In general, under screening, firms' marginal revenues should satisfy two requirements: (*i*) their difference should be sufficiently low in order to prevent the disadvantaged firm from making zero payoffs from the most talented workers; (*ii*) their sum must be sufficiently high in order to allow low-ability workers to receive a strictly positive utility from either firm.

[30] We refer the reader to Section 1 of the online Supplementary Material for a detailed analysis of this case.

$x_F^{FB}(\theta)$ *for each* $\theta \in \{\underline{\theta}, \overline{\theta}\}$*; the non-profit firm sets an efficient allocation for low-ability workers, i.e.* $x_N(\overline{\theta}) = x_N^{FB}(\overline{\theta})$, *whereas it distorts high-ability workers' effort upwards, i.e.* $x_N^*(\underline{\theta}) > x_N^{FB}(\underline{\theta})$, *with* $x_N^*(\theta) < x_F^*(\theta)$ *for each* $\theta \in \{\underline{\theta}, \overline{\theta}\}$; (ii) *utilities offered to high-ability workers are lower whereas utilities offered to low-ability workers are higher than at the benchmark, i.e.* $U_i^*(\underline{\theta}) < U_i^B(\underline{\theta})$ *while* $U_i^*(\overline{\theta}) > U_i^B(\overline{\theta})$ *for each* $i = F, N$.

Proof. See Section 1 of the online Supplementary Material. ■

As the heterogeneity in ability decreases with respect to condition (18), mimicking between types with different ability levels becomes more attractive. In particular, firm N is forced to distort the effort required from high-ability types upwards in order to make their contract less appealing to low-ability colleagues. Despite the upward distortion in effort, high-ability employees work less (and thus produce less) at the non-profit than at the for-profit firm. Moreover, the non-profit firm discourages mimicking by providing information rents to low-ability types, whose utility increases relative to the benchmark, whereby $U_N^*(\overline{\theta}) > U_N^B(\overline{\theta})$. This triggers a series of changes (which are partly driven by strategic complementarity) in all workers' utilities with respect to the benchmark contracts. As a consequence, the probability of low-ability workers self-selecting into firm N increases, whereas the probability of high-ability workers self-selecting into firm N decreases, i.e. both $\gamma^*(\overline{\theta}) < \widehat{\gamma}^B(\overline{\theta})$ and $\widehat{\gamma}^*(\underline{\theta}) > \widehat{\gamma}^B(\underline{\theta})$ hold. The effect of negative selection of ability into the non-profit firm is thus reinforced with respect to the benchmark (see Section 4.3).

4.1.2 UIC binds for the non-profit firm and DIC binds for the for-profit firm

Consider the case in which $k_F > k_N$ and condition (20) holds so that both firms are incentive constrained. Now, the objective of firm N is to solve programme (P_N) subject to UIC_N binding, as in the preceding case, whereas the program of firm F is (P_F) subject to DIC_F binding.[31]

Proposition 5 ***Optimal incentive contracts when*** UIC_N ***and*** DIC_F ***bind.*** *When* $k_N < k_F$ *and condition (20) holds, optimal contract are such that:* (i) *the for-profit firm sets an efficient allocation for high-ability workers, i.e.* $x_F^*(\underline{\theta}) = x_F^{FB}(\underline{\theta})$, *whereas it distorts downward the effort of low-ability workers, i.e.* $x_F^*(\overline{\theta}) < x_F^{FB}(\overline{\theta})$*; the non-profit firm sets an efficient allocation for low-ability workers, i.e.*

[31] We refer the reader to Section 2 of the online Supplementary Material for the detailed analysis of the system of first-order conditions characterizing the solution in this case.

$x_N^*(\overline{\theta}) = x_N^{FB}(\overline{\theta})$, whereas it distorts upwards the effort of high-ability workers, i.e. $x_N^*(\underline{\theta}) > x_N^{FB}(\underline{\theta})$; effort levels are such that $x_N^*(\overline{\theta}) < x_N^*(\underline{\theta}) < x_F^*(\overline{\theta}) < x_F^*(\underline{\theta})$; (ii) utilities $U_N^*(\overline{\theta})$ and $U_F^*(\underline{\theta})$ are higher whereas utilities $U_N^*(\underline{\theta})$ and $U_F^*(\overline{\theta})$ are lower than at the benchmark contracts.

Proof. See Section 2 of the online Supplementary Material. ■

What is new to this case is that firm F prevents high-ability workers from mimicking low-ability types by distorting the effort level required from low-skilled workers downwards, and giving information rents to high-skilled applicants, whose utility necessarily increases with respect to the benchmark contracts, i.e. $U_F^*(\underline{\theta}) > U_F^B(\underline{\theta})$. Moreover, strategic complementarity is no longer relevant, and thus the utilities, that the two firms offer to the same type of worker, now move in opposite directions. A fortiori, both $\widehat{\gamma}^*(\underline{\theta}) > \widehat{\gamma}^B(\underline{\theta})$ and $\widehat{\gamma}^*(\overline{\theta}) < \widehat{\gamma}^B(\overline{\theta})$ hold in this case. As the heterogeneity in workers' talent $\Delta\theta$ shrinks with respect to the difference in firms' marginal products, the negative selection effect of ability into the non-profit firm is further exacerbated.

As an example, consider a non-profit hospital that has a competitive disadvantage with respect to its for-profit competitor, because, say, it is bound to offer some charity care and enjoys neither a higher price for its treatments nor a more efficient technology. When each hospital provides health professionals with incentives in order to overcome their informational advantages about their skills, our model predicts that the non-profit hospital requires high-skilled managers and chief of departments to perform more engaging tasks than when ability is observable, but still it asks them to work relatively less (and in exchange for lower rents, i.e. utilities) than its rival for-profit hospital. This result may help to explain the following quote from Roomkin and Weisbrod (1999, page 750): "In the U.S. hospital industry, (...) non-profit managers may lack incentives for efficiency, and so may pursue other goals such as a quiet life".

In the next subsection, we consider the symmetric case of positive selection into the non-profit firm, which is purposely very short and streamlined. The uninterested reader might skip this part and move directly to Section 4.3.

4.2 Positive selection of ability into the non-profit firm

Consider now the situation described in part (iii) of Lemma 3, which is relevant when $k_N > k_F$. We first solve the program in which UIC_F is binding while the non-profit firm is not incentive constrained; we then consider the program in which both UIC_F and DIC_N are binding.[32]

4.2.1 UIC binds for the for-profit firm

When condition (19) is satisfied, then UIC_F is binding while all incentives constraints are slack for firm N. The optimal contracts are characterized in the Proposition that follows.

Proposition 6 ***Optimal incentive contracts when*** UIC_F ***binds.*** *When* $k_N > k_F$ *and condition (19) holds, optimal contracts are such that: (i) the non-profit firm sets first-best effort levels, i.e.* $x_N^*(\theta) = x_N^{FB}(\theta)$ *for each* $\theta \in \{\underline{\theta}, \overline{\theta}\}$*; the for-profit firm sets an efficient allocation for low-ability workers, i.e.* $x_F(\overline{\theta}) = x_F^{FB}(\overline{\theta})$, *whereas it distorts high-ability workers' effort upwards, i.e.* $x_F^*(\underline{\theta}) > x_F^{FB}(\underline{\theta})$, *with* $x_F^*(\theta) > x_N^*(\theta)$ *for each* $\theta \in \{\underline{\theta}, \overline{\theta}\}$; *(ii) utilities offered to low-ability workers are higher whereas utilities offered to high-ability workers are lower than at the benchmark, i.e.* $U_i^*(\overline{\theta}) > U_i^B(\overline{\theta})$ *while* $U_i^*(\underline{\theta}) < U_i^B(\underline{\theta})$ *for each* $i = F, N$.

Proof. See Section 3 of the online Supplementary Material. ■

4.2.2 UIC binds for the for-profit firm and DIC binds for the non-profit firm

Finally, consider the case in which condition (20) holds. Now, the objective of firm F is to solve programme (P_F) subject to UIC_F binding, whereas the program of firm N is (P_N) subject to DIC_N binding.

Proposition 7 ***Optimal incentive contracts when*** UIC_F ***and*** DIC_N ***bind.*** *When* $k_N > k_F$ *and condition (20) holds, optimal contracts are such that: (i) the non-profit firm sets an efficient allocation for high-ability workers, i.e.* $x_N^*(\underline{\theta}) = x_N^{FB}(\underline{\theta})$, *whereas it distorts downward the effort of low-ability workers, i.e.* $x_N^*(\overline{\theta}) < x_N^{FB}(\overline{\theta})$*; the for-profit firm sets an efficient allocation for low-ability workers, i.e.* $x_F^*(\overline{\theta}) = x_F^{FB}(\overline{\theta})$, *whereas it distorts upward the effort of high-ability workers, i.e.* $x_F^*(\underline{\theta}) > x_F^{FB}(\underline{\theta})$*; effort levels are such that* $x_F^*(\overline{\theta}) < x_F^*(\underline{\theta}) < x_N^*(\overline{\theta}) < x_N^*(\underline{\theta})$; *(ii) utilities* $U_F^*(\overline{\theta})$ *and* $U_N^*(\underline{\theta})$ *are higher whereas utilities* $U_F^*(\underline{\theta})$ *and* $U_N^*(\overline{\theta})$ *are lower than at the benchmark contracts.*

Proof. See Section 4 of the online Supplementary Material. ■

[32] The formal analysis of these programs is relegated to Sections 3 and 4, respectively, of the online Supplementary Material.

As an example, consider the University of Chicago, which is a non-profit and one of the world's premier academic and research institutions; its President is among the top earners mentioned in the Introduction. It is not difficult to imagine that the University of Chicago has some form of competitive advantage with respect to any other for-profit university in its neighborhood and that it is able to attract the largest share of the most talented researchers and prospective administrators. Since applicants' administrative skills remain mostly unknown to the employers, our model predicts that the University of Chicago will require all its faculty members to exert more effort than its for-profit competitors, although its less skilled employees will be asked to perform less engaging tasks than under full information.

Before moving to the next section and analyze optimal wages, let us consider some general features of the sorting pattern of workers into firms.

4.3 Workers' sorting patterns under screening

When the non-profit firm has a competitive disadvantage with respect to the for-profit firm , i.e. $k_N < k_F$, and incentive contracts are in place, the negative selection effect of ability into firm N is amplified with respect to the benchmark contracts, i.e. $\widehat{\gamma}^* (\underline{\theta}) > \widehat{\gamma}^B (\underline{\theta})$ and $\widehat{\gamma}^* \left(\overline{\theta}\right) < \widehat{\gamma}^B \left(\overline{\theta}\right)$. This implies that the labor supply of high-ability workers faced by the non-profit firm (respectively by the for-profit firm) decreases (resp. increases) relative to the benchmark, whereas the labor supply of low-ability workers faced by the non-profit firm (respectively by the for-profit firm) increases (resp. decreases) relative to the benchmark. The opposite is true when $k_N > k_F$.

It is then possible to bunch both cases of negative and positive selection and derive a general statement about how workers' self-selection into the two firms changes when benchmark contracts are no longer incentive compatible.

Proposition 8 ***Workers' sorting patterns at the incentive contracts.*** *When condition (18) is not satisfied and incentive contracts are in place, the selection effects of ability are more pronounced (i.e. the function $\widehat{\gamma}(\theta)$ is steeper) than at the benchmark contracts.*

The Proposition above suggests that each firm designs its incentive contracts in such a way as to make the sorting pattern of workers as favorable to itself as possible. Indeed, when a firm is upward incentive constrained, its per-worker payoffs π_i are decreasing in ability (i.e. increasing in the cost of effort θ).[33] Therefore, the disadvantaged firm, whose UIC is binding, is better-off the higher the fraction of low-ability workers and the lower the fraction of high-ability workers that it is able to hire. The opposite happens when the firm with a competitive advantage is downward incentive constrained. That is why the selection effects of ability are reinforced at the incentive contracts.

Finally, Proposition 8 hints at the possibility that incentive contracts, in the limit, might have an exclusionary effect. Indeed, moving from the benchmark to the screening contracts, i.e. letting $\Delta\theta$ decrease with respect to $|k_F - k_N|$, the supply of high-skilled labor facing the disadvantaged firm decreases until it might approach zero.

5 Wage differentials

In this section, we analyze the for-profit *vs* non-profit wage differential, i.e. $w_F(\theta) - w_N(\theta)$, that characterizes the contracts offered in equilibrium by the two firms. In particular, we study whether a worker with given ability θ is paid more by the for-profit or by the non-profit firm. Interestingly, our results concern not only the sign of the wage differential but also its composition: we are able to disentangle the effect of labor donations to the non-profit firm (stemming from workers' motivation) from the effect of a negative or positive selection of ability into the non-profit firm (which depends upon which firm holds a competitive advantage). Using expression (7), for each $\theta \in \{\underline{\theta}, \overline{\theta}\}$, the wage differential can be rewritten as

$$w_F(\theta) - w_N(\theta) = \underbrace{U_F(\theta) - U_N(\theta)}_{\substack{\equiv \widehat{\gamma}(\theta) \text{ labor donative effect} \\ (+)}} + \underbrace{\frac{1}{2}\theta\left(x_F^2(\theta) - x_N^2(\theta)\right)}_{\substack{\text{selection effect of ability:} \\ (+) \text{ for negative selection into } N\ /(-) \text{ for positive selection into } N}} . \tag{21}$$

Expression (21) above contains two terms. The first one measures the labor donative effect and it coincides with the motivation of the indifferent worker of type θ, i.e. $\widehat{\gamma}(\theta)$, which is strictly positive by condition (6). Thus, the first term represents the amount of salary that sufficiently motivated workers (with motivation above $\widehat{\gamma}$) are giving up in order to be hired by the non-profit firm. The second term accounts for the selection effect of ability, which in turn depends on which firm has a competitive advantage with respect to the other; it is proportional to the difference between the squared levels of effort set by the two firms,

[33] See the preliminary Result 1 contained in the proof of Lemma 3 in Appendix A.2.

where $x_F(\theta) > x_N(\theta)$ if there is negative selection into firm N, or $x_F(\theta) < x_N(\theta)$ holds when there is positive selection into firm N.

The wage differential turns out to be negative, so that $w_F(\theta) < w_N(\theta)$ and non-profit employees experience a wage premium, only if there is positive selection of ability into the non-profit firm *and* if this selection effect is strong enough to offset the labor donative effect. This requires the competitive advantage of the non-profit firm to be relevant.

Wage differentials not only arise at the optimal incentive contracts, they are already in place at the benchmark contracts. So, in what follows, we distinguish between the two situations.

5.1 Benchmark contracts

Let us consider the benchmark contracts first. Suppose that motivation is the worker's private information and that either ability is observable or ability is not observable but the sufficient condition (18) is satisfied.

Proposition 9 ***Wage differentials at the benchmark contracts.*** *At the benchmark contracts, a wage penalty for non-profit employees exists, i.e.* $w_F^B(\theta) > w_N^B(\theta)$ *holds for all* $\theta \in \{\underline{\theta}, \overline{\theta}\}$, *unless there is positive selection of ability into firm* N *and the competitive advantage of firm* N *is sufficiently high that* $k_N^2 - k_F^2 \geq \frac{\overline{\theta}}{2}$.

More specifically, consider the expressions for wages given by equation (15). The following situations might then be observed. (i) If no firm has a competitive advantage and $k_N = k_F$ holds, a wage differential favoring for-profit workers is always in place, i.e. $w_F^B(\theta) > w_N^B(\theta)$ is true for every θ. The for-profit firm asks its employees to provide the same first-best effort as the non-profit firm, but in exchange for a higher salary. The wage differential is purely compensating because it originates solely from labor donations, whereas the selection effect is zero. (ii) If the for-profit firm holds a competitive advantage, i.e. if $k_F > k_N$, workers are asked to exert higher effort at the for-profit than at the non-profit firm and the sign of the selection effect is positive. A wage premium in favour of for-profit workers exists, because the labor donative and the selection effect reinforce each other. (iii) Finally, if the non-profit firm has a competitive advantage and $k_N > k_F$, the sign of the selection effect is negative but the wage differential may be either positive or negative according to the magnitude of the difference in firms' marginal revenues. In particular, if $k_N^2 - k_F^2 < \underline{\theta}/2$, a for-profit wage premium still exists for all workers: equally skilled workers exert more effort but are paid less at the non-profit than at the for-profit, because the labor donative effect outweighs the selection effect. Alternatively, if $\underline{\theta}/2 \leq k_N^2 - k_F^2 < \overline{\theta}/2$, the wage differential changes its sign according to workers' ability: high-ability workers earn more when employed by the non-profit firm (but they also exert more effort), whereas low-ability workers earn more (despite exerting less effort) when employed by the for-profit firm. Finally, if $k_N^2 - k_F^2 \geq \overline{\theta}/2$, all workers get a wage premium at the non-profit firm. When the advantage of the non-profit firm is sufficiently important, then non-profit workers' higher effort is rewarded with a higher salary, because the selection effect (which has a negative sign) outweighs the labor donative effect.

5.2 Incentive contracts

Firms' provision of incentives affects both the labor donative and the selection effects, i.e. it changes both terms in equation (21). In what follows, we consider in detail the case in which the for-profit firm has a competitive advantage and $k_F > k_N$ holds. Symmetric conclusions can be drawn for the case in which $k_N > k_F$ and there is positive selection of ability into firm N.

From Proposition 8, we already know that labor donations increase (decrease) for high- (low-)ability workers relative to the benchmark, i.e. both $\widehat{\gamma}^* (\underline{\theta}) > \widehat{\gamma}^B (\underline{\theta})$ and $\widehat{\gamma}^* \left(\overline{\theta}\right) < \widehat{\gamma}^B \left(\overline{\theta}\right)$ hold. This means that the labor donative effect in (21) is higher for talented workers while it is lower for regular workers. Let us distinguish between the two different incentive constrained programs and let us first suppose that only UIC_N is binding and Proposition 4 holds. For low-ability workers, the selection effect does not change because there are no allocative distortions; a non-profit wage penalty exists, which is nonetheless reduced with respect to the benchmark because wages gained by low-ability workers increase and $w_i^* \left(\overline{\theta}\right) > w_i^B \left(\overline{\theta}\right)$ for each $i = F, N$. As for high-ability workers, they also experience a wage penalty, but it is ambiguous whether it is lower than at the benchmark. Let us then consider the instance in which both UIC_N and DIC_F are binding and Proposition 5 holds. Now $x_F^* \left(\overline{\theta}\right)$ is distorted downward. Then, considering low-ability workers, the selection effect is positive in sign but its magnitude decreases with respect to the benchmark. Given that the labor donative effect is smaller than at the benchmark (and also relative to the case in which only UIC_N binds), the wage penalty is reduced for low-ability workers. As for high-ability workers, it is ambiguous whether the wage penalty is higher or lower.

The Proposition that follows provides a synthesis of our results.

Proposition 10 ***Wage differentials at the incentive contracts.*** *(a) If $k_F > k_N$, a non-profit wage penalty exists, which is smaller than at the benchmark contracts for low-ability workers. (b) If $k_N > k_F$, both wage penalties and wage premia for non-profit workers might be observed. For low-ability workers, if a non-profit wage premium exists, it is lower than at the benchmark contracts, whereas, if a non-profit wage penalty exists, it is higher than at the benchmark contracts.*

To sum up, we can conclude that the interplay between firm N's profit constraints, i.e. $\alpha_N < 1$, and labor donations, captured by $\widehat{\gamma}^*(\theta)$, pushes towards a wage penalty for non-profit workers. This result is consistent with the empirical evidence by Roomkin and Weisbrod (1999) and Jones (2015), among others. Nonetheless, our model also predicts that wage premia for non-profit employees are possible, but only when the non-profit organization enjoys a competitive advantage and this advantage is sufficiently high. In such a case, the non-profit firm benefits most from hiring high-ability workers and, despite labor donations received from all its employees, it pays both high- and low-ability applicants a compensation that is larger than the one offered by the for-profit firm. As mentioned in the Introduction, this result is also empirically relevant and documented in Preston (1988) and Mocan and Tekin (2003) for the child care industry and in Borjas et al. (1983) for the health care market. What are the determinants of the non-profit competitive advantage that generate non-profit wage premia in these sectors? Primarily non-profits can command higher output prices ($p_N > p_F$) because they have a reputation for providing services of higher quality.[34] Other sources of competitive advantage for non-profit firms are higher productivity ($c_N > c_F$)[35] and tax exemptions (on this last point see Lakdawalla and Philipson 2006).

Finally, the allocative distortions introduced by the screening mechanism are such that, for low-ability workers, the difference in effort levels shrinks with respect to the benchmark. Then the magnitude of the selection effects (see the second term of equation 21) is reduced and the wage differential for low-ability

[34] The role of high prices signalling high quality is particularly relevant in sectors such as health and child care, in which quality is hardly measurable and contractible. In the theoretical literature, mechanism that explain the emergence of higher quality and higher prices in the non-profit sector are analyzed in Glaeser and Shleifer (2001) and Francois (2003). As for the empirical literature, studying the nursing home market in the U.S., Hillmer *et al.* (2005), Grabowski and Hirth (2003) show that quality is higher in the non-profit sector. In education, Morris and Helburn (2000), Cleveland and Krashinsky (2001) and Sosinsky *et al.* (2007) document higher child care quality in non-profit organizations in Canada and in the U.S..

[35] The empirical evidence on productivity of for-profit and non-profit hospitals presents mixed results (see Barros and Siciliani 2012 for a review). Evidence of higher productivity in the non-profit sector is provided by Rosko (2001) who analyzes a sample of 1,631 U.S. hospitals during the period 1990-1996 and finds that non-profit hospitals are more efficient.

workers is smaller than at the benchmark. This is not necessarily true for high-ability employees, because the difference in effort levels required by the two firms can either increase or decrease relative to the benchmark according to which firm holds the competitive advantage. This result is consistent with the empirical literature showing that wage differentials between non-profit and for-profit firms are almost absent at the lowest job levels but increase at higher levels in the hierarchy (see, among others, DeVaro *et al.* 2017).

6 Discussion

In this section we discuss our modeling strategies, relate them to the empirical evidence and explain to what extent they affect our results.

The nature of intrinsic motivation

Two main interpretations of workers' intrinsic motivation appear in the literature: *output-independent* and *output-oriented* motivation. We have chosen the first interpretation and assumed that intrinsic motivation is independent of the workers' contribution to the output. With asymmetric information on the workers' characteristics, our assumption implies that the competing firms solve a problem of *unidimensional screening* for ability, and that motivation does not enter the optimal contracts but rather determines the sorting of workers between the two employers. When, instead, motivation is output-oriented the utility premium enjoyed by the worker depends on her effort provision and on her contribution to the output.[36] Under asymmetric information, this interpretation requires the firms to solve a much harder problem of *bidimensional screening* in which optimal contracts depend on both workers' ability and motivation (on this point, see also Section 1.1 where we refer to Barigozzi and Burani 2016b).

Results on workers' sorting and on wage differentials are sensitive to which interpretation is considered. With output-independent motivation, sorting is driven by both ability and motivation, as we proved in this paper. Only in this case, it is possible to decompose the wage differential in labor donation and selection effect of ability. Conversely, with output-oriented motivation, sorting is ability-neutral and it only depends on motivation. Then wage differentials are only driven by the labor donative effect, because

[36] The same assumption is made in the theoretical works by Delfgaauw and Dur (2007, 2008), and Barigozzi and Burani (2016a, 2016b). Also see the utility function with work meaning in Cassar and Meier (2018).

the selection effect of ability vanishes.[37]

Experimental economics recently tried to address the question: 'Is workers' intrinsic motivation output-independent or output-oriented?'. Specifically, experiments have been designed to test whether prosocial initiatives increase workers' effort (see Cassar 2019, Cassar and Meier 2018, for a survey, and DellaVigna and Pope 2018, for a meta-analysis). The evidence in this respect is mixed. Two papers that support our hypothesis and point to output-independent motivation are Tonin and Vlassopoulos (2010) and Fehrler and Kosfeld (2014). In the former, a real effort field experiment is designed with students-workers employed in a simple data entry task. By providing more effort, subjects can increase their personal compensation and can also generate a donation to a charity of their choice. It is found that men are not responsive to donations, and that only women slightly increase their effort.[38] Similarly, in a laboratory experiment, Fehrler and Kosfeld (2014) test whether subjects provide higher effort if they can generate a donation to an NGO of their choice in addition to their own payoffs. The result is that effort provision is not affected by charitable giving.

The statistical distribution of ability and motivation

The assumption of independence between the two workers' characteristics is functional to the purpose of our paper, which aims at analyzing and decomposing the wage differential between for-profit and non-profit firms. Introducing correlation between the workers' characteristics would somehow interfere with the selection effect of ability and would thus prevent us from disentangling the two components of the wage differential.[39]

Besides that, our assumption is in line with the evidence provided by the laboratory experiment by

[37] With both interpretations of intrinsic motivation, it is true that pro-social workers are ready to accept lower wages because their reservation wage decrease. This fact is well known and has been documented in surveys (see, among others, Frank 1996) and, more recently, by some experimental (see Burbano 2016 and Banuri and Keefer 2016) and empirical (see Nyborg and Zhang 2013) evidence.

[38] See also Jones *et al.* (2018) for the impact of pay-for-performance on workers' effort in mission-oriented vs non-mission-oriented treatments.

[39] To the best of our knowledge, the unique theoretical model that relaxes the assumption of independent distribution of ability and motivation is Barigozzi *et al.* (2018). They study the crowding effects arising from ability and motivation being correlated and analyze the impact of monetary incentives on the sorting patterns of workers in mission-oriented sectors. Nevertheless, for the sake of tractability, the setting considered in that paper is necessarily stylized, the role of firms is streamlined and strategic interaction is absent.

Banuri and Keefer (2016). They study the interaction between motivation and wages in pro-social organizations and show that, within the whole pool of experimental subjects (Indonesian university students), the correlation between ability and motivation is weakly positive but not significant. Some papers provide, instead, evidence consistent with the existence of a positive correlation between workers' ability and motivation. In a field experiment on a large-scale recruitment drive by the Mexican government, Dal Bó *et al.* (2013) examine applicants to the position of 'community development agents' and show that higher salaries attract workers who are more skilled and have a higher public service motivation. In the field experiment with workers hired in online labor marketplaces, Burbano (2016) shows that higher-performing workers have stronger preferences for social responsibility in the workplace. In both papers, however, the evidence of positive correlation should be interpreted carefully. Indeed, Dal Bó et al. (2013) point out that the positive correlation between ability and motivation identified within the candidates' sample might not be extended to the entire population of potential applicants because it might be driven by workers' self-selection (see page 1199).

Using the insights derived from our setting, we are nevertheless able to provide some predictions for some specific cases of correlation between motivation and ability. The simplest situations to study are: (i) positive correlation combined with a competitive advantage for the non-profit firm (meaning that on average, high-ability workers are highly motivated and that $k_N > k_F$); and (ii) negative correlation combined with a competitive advantage for the for-profit (high-ability workers have on average low motivation and $k_F > k_N$). In those two instances, all results from the paper might be confirmed and even reinforced, because the most efficient firm is always able to attract high-ability workers. In the remaining situations, instead, the workers' sorting pattern depends on the interplay among different forces: the relative size of the heterogeneity in ability, $\Delta\theta$, and in motivation, $\Delta\gamma$, and the difference between the firms' marginal revenues.

The payoff function of the non-profit firm

Our specification of the payoff of the non-profit firm (see equation 1 and Program P_N), entailing the penalization $\alpha_N < 1$, is also well-suited to describe the behavior of any for-profit but mission-oriented firm. For instance, it allows us to extend the model and its results to profit-driven organizations that adhere to *corporate social responsibility* and attract motivated employees (see Burbano 2016, page 1010). Indeed, corporate socially responsible firms do sacrifice profits or revenues in order to pursue a social cause:

consider, for instance, environmental friendly organizations adopting less efficient but green technologies (see Bénabou and Tirole 2010 and Kitzmueller and Shimshack 2012), or else ethical banks investing in social projects with low returns.[40] We decided to set our model in terms of a non-profit firm competing with a for-profit firm because there is a broad and well established empirical evidence about the relative performance of for-profits vs non-profits and, in particular, about wage differentials.

The additional advantage of our specification is that it keeps the problem tractable: the objective functions of the two firms remain sufficiently similar in nature and the heterogeneity between the firms is simply captured by the difference in their marginal revenues k_N and k_F. As a referee and the Advisory Editor suggested, a possible alternative would be to consider a non-profit firm willing to maximize its total output under a non-negative profits constraint. However, this specification would make our model fully asymmetric: the benchmark would become very complicated with an unclear sorting pattern of workers to firms and, more importantly, screening contracts would be hardly possible to characterize.[41]

7 Concluding remarks

How does asymmetric information in the labor market affect the competition between for-profit and non-profit organizations for the most talented and motivated workers? In our model, workers are ready to donate a part of their labor to the non-profit firm because the latter is committed to a mission and sacrifices some revenues in the social interest. Under full information about talent, workers with high motivation are always hired by the non-profit firm, but the most advantaged organization (i.e. the firm that has the highest marginal revenues) is able to attract a fraction of high-ability workers which is larger than the fraction of low-ability workers. This selection pattern is confirmed and intensified under asymmetric information when screening contracts are implemented.

Suppose that committing to the non-profit status makes the non-profit firm the weaker competitor (i.e. when $k_N < k_F$) and also assume that the degree of heterogeneity between firms is high. Then,

[40] This idea of a 'voluntary loss' is also reminiscent of the objective function of non-profit firms proposed by Glaeser and Shleifer (2001). Their interpretation refers to the non-distribution constraint of the non-profit firm which limits the entrepreneur's ability to appropriate the firm's profits. In our model, the constraint is imposed on revenues rather than profits because a constraint on profits would not have any impact on the equilibrium.

[41] The analysis for this alternative specification is available from the authors upon request.

not only do screening contracts generate sizeable allocative distortions, but they also drive the supply of high-skilled labor close to zero for the non-profit organization, which might find it very difficult to hire talented top managers and executives. This result has an interesting policy implication. The government can affect the degree of heterogeneity between the two firms by directly setting α_N (take, for example, hospitals, and interpret $1 - \alpha_N$ as a mandatory charity care required to obtain the non-profit status). A decrease in α_N increases the degree of heterogeneity between the two firms and worsens the competitive disadvantage of the non-profit firm. This would lead to a more extensive use of screening contracts (because Condition 18 would fail more often) together with a departure from allocative efficiency.

As for wage differentials, our model allows us to decompose the gap in the wages offered by the two firms in two components: the first one quantifies labor donations and pushes towards a wage penalty for non-profit employees whereas the second describes the selection effects of ability. Both terms are affected by possible distortions due to asymmetric information. Our model is sufficiently rich to account for both non-profit wage penalties and wage premia, thus providing a rationale for the mixed empirical evidence. The motivating example mentioned at the beginning of the Introduction might well reflect the instance in which the non-profit firm has a competitive disadvantage with respect to the for-profit rival and a non-profit wage penalty emerges. Then, the non-profit firm offers to its top managers a compensation which is high in absolute terms (because competition with for-profit employers drives all salaries up), but which is lower than the salary they would have gained if employed by the for-profit organization. The wage penalty is due to two facts: (*i*) non-profit CEOs are endowed with a high intrinsic motivation and donate a large part of their labor to their organizations; (*ii*) non-profit CEOs exert less effort than their for-profit colleagues, and thus contribute less to their organization's output.

Acknowledgements We are grateful to Ennio Bilancini, Giacomo Calzolari, Vincenzo Denicolò, Robert Dur, Josse Delfgaauw, Luca Lambertini, Ester Manna, Andrea Mattozzi and Bauke Visser for useful conversations, and to seminar participants at the Universities of Bologna, Barcelona and Modena. The paper was also presented at the 14th Journées Louis-André Gérard-Varet and at the Asset 2016 Meeting.

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A Appendix

A.1 Proof of Lemmata 1 and 2

Let us define the function $\phi_i^B\left(\underline{\theta},\overline{\theta}\right)$ as the difference between the utility that type $\underline{\theta}$ receives from firm i when revealing her true type and the utility that she would receive from the same firm i when claiming that her type is $\overline{\theta}$, if exerting the first-best level of effort and receiving a compensation as in the benchmark contract. Thus, function $\phi_i^B\left(\underline{\theta},\overline{\theta}\right)$ corresponds to the downward incentive constraint DIC_i whereby type $\underline{\theta}$ is not attracted by the benchmark contract that firm i offers to type $\overline{\theta}$. In particular, $\phi_i^B\left(\underline{\theta},\overline{\theta}\right) > 0$

means that DIC_i is always slack at the benchmark contract, or else that the benchmark contract is downward incentive compatible for firm $i = F, N$. Then

$$\phi_i^B\left(\underline{\theta}, \overline{\theta}\right) = w_i^B\left(\underline{\theta}\right) - \frac{1}{2}\underline{\theta} x_i^B\left(\underline{\theta}\right)^2 - \left(w_i^B\left(\overline{\theta}\right) - \frac{1}{2}\underline{\theta} x_i^B\left(\overline{\theta}\right)^2\right),$$

where the consequence of type $\underline{\theta}$ mimicking type $\overline{\theta}$ is visible directly in the cost of effort. All other effects are mediated by type $\underline{\theta}$ choosing effort $x_i^B\left(\overline{\theta}\right)$ instead of effort $x_i^B\left(\underline{\theta}\right)$. Likewise, one can obtain functions $\phi_i^B\left(\overline{\theta}, \underline{\theta}\right)$ for each firm $i = F, N$, reverting the roles of the ability types. When $\phi_i^B\left(\overline{\theta}, \underline{\theta}\right) > 0$, UIC_i is always slack at the benchmark contract. Let us rewrite functions ϕ_i^B extensively and rearrange terms. For firm N, one has

$$\phi_N^B\left(\underline{\theta}, \overline{\theta}\right) = \frac{\left(2k_N^2\overline{\theta} - 3k_N^2\underline{\theta} + k_F^2\overline{\theta}\right)\left(\overline{\theta} - \underline{\theta}\right)}{6\overline{\theta}\underline{\theta}},$$

where $\phi_N^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ holds for $k_F \geq k_N$, whereas, for $k_F < k_N$, $\phi_N^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ is satisfied if and only if

$$\frac{k_N^2 - k_F^2}{2k_N^2 + k_F^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}}. \tag{22}$$

Moreover,

$$\phi_N^B\left(\overline{\theta}, \underline{\theta}\right) = \frac{\left(3k_N^2\overline{\theta} - 2k_N^2\underline{\theta} - k_F^2\underline{\theta}\right)\left(\overline{\theta} - \underline{\theta}\right)}{6\overline{\theta}\underline{\theta}},$$

where $\phi_N^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ holds for $k_F \leq k_N$, whereas, for $k_F > k_N$, $\phi_N^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ is satisfied if and only if

$$\frac{k_F^2 - k_N^2}{3k_N^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}}, \tag{23}$$

which corresponds to condition (18) in the main text. Considering firm F, one has

$$\phi_F^B\left(\underline{\theta}, \overline{\theta}\right) = \frac{\left(2k_F^2\overline{\theta} - 3k_F^2\underline{\theta} + k_N^2\overline{\theta}\right)\left(\overline{\theta} - \underline{\theta}\right)}{6\overline{\theta}\underline{\theta}},$$

with $\phi_F^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ holding when $k_F \leq k_N$, whereas, for $k_F > k_N$, $\phi_F^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ is satisfied if and only if

$$\frac{k_F^2 - k_N^2}{2k_F^2 + k_N^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}}. \tag{24}$$

Finally,

$$\phi_F^B\left(\overline{\theta}, \underline{\theta}\right) = \frac{\left(3k_F^2\overline{\theta} - k_N^2\underline{\theta} - 2k_F^2\underline{\theta}\right)\left(\overline{\theta} - \underline{\theta}\right)}{6\overline{\theta}\underline{\theta}},$$

where $\phi_F^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ is always true when $k_F \geq k_N$, whereas, for $k_F < k_N$, $\phi_F^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ is satisfied if and only if

$$\frac{k_N^2 - k_F^2}{3k_F^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}}, \tag{25}$$

which, again, corresponds to condition (18) in the main text.

Summing up, suppose that $k_F = k_N$. Then all ϕ_i^B are strictly positive and we can conclude that the benchmark contracts are incentive compatible. Alternatively, suppose that $k_F > k_N$. Then $\phi_N^B\left(\underline{\theta}, \overline{\theta}\right)$ and $\phi_F^B\left(\overline{\theta}, \underline{\theta}\right)$ are strictly positive, so that the benchmark contracts are downward incentive compatible for firm N and upward incentive compatible for firm F, respectively. Moreover, $\phi_N^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ holds when condition (23) is satisfied and $\phi_F^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ holds when condition (24) is satisfied, with

$$\frac{k_F^2 - k_N^2}{2k_F^2 + k_N^2} < \frac{k_F^2 - k_N^2}{3k_N^2}.$$

Then, all ϕ_i^B are strictly positive and both firms' benchmark contracts are incentive compatible when condition (23) holds, whereas only ϕ_F^B are strictly positive, implying that only firm F's benchmark contracts are incentive compatible, when

$$\frac{k_F^2 - k_N^2}{2k_F^2 + k_N^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{k_F^2 - k_N^2}{3k_N^2},$$

which corresponds to condition (19) in the main text. Finally, when

$$\frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{k_F^2 - k_N^2}{2k_F^2 + k_N^2},$$

neither firm's benchmark contracts are incentive compatible. To conclude, suppose that $k_F < k_N$. Then $\phi_N^B\left(\overline{\theta}, \underline{\theta}\right)$ and $\phi_F^B\left(\underline{\theta}, \overline{\theta}\right)$ are strictly positive, implying that the benchmark contracts are always upward incentive compatible for firm N and downward incentive compatible for firm F, respectively. Moreover, $\phi_N^B\left(\underline{\theta}, \overline{\theta}\right) > 0$ holds when condition (22) is satisfied and $\phi_F^B\left(\overline{\theta}, \underline{\theta}\right) > 0$ holds when condition (25) is satisfied, with

$$\frac{k_N^2 - k_F^2}{2k_N^2 + k_F^2} < \frac{k_N^2 - k_F^2}{3k_F^2}.$$

Then, all ϕ_i^B are strictly positive and both firms' benchmark contracts are incentive compatible when condition (22) holds, whereas only ϕ_N^B are strictly positive meaning that only firm N's benchmark contracts are incentive compatible when

$$\frac{k_N^2 - k_F^2}{2k_N^2 + k_F^2} < \frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{k_N^2 - k_F^2}{3k_F^2},$$

which, again, corresponds to condition (19) in the main text. Finally, when

$$\frac{\overline{\theta} - \underline{\theta}}{\underline{\theta}} \leq \frac{k_N^2 - k_F^2}{2k_N^2 + k_F^2},$$

neither firm's benchmark contracts are incentive compatible.

A.2 Proof of Lemma 3

In order to prove Lemma 3, let us first consider a preliminary step. Let us express incentive constraints in terms of firm's payoffs relative to each ability type (see expression 8), whereby DIC_i becomes

$$\pi_i\left(\underline{\theta}\right)-\pi_i\left(\overline{\theta}\right)\leq S_i\left(\underline{\theta}\right)-S_i\left(\overline{\theta}\right)-\frac{1}{2}\left(\overline{\theta}-\underline{\theta}\right)x_i^2\left(\overline{\theta}\right)$$

and UIC_i takes the form

$$\pi_i\left(\underline{\theta}\right)-\pi_i\left(\overline{\theta}\right)\geq S_i\left(\underline{\theta}\right)-S_i\left(\overline{\theta}\right)-\frac{1}{2}\left(\overline{\theta}-\underline{\theta}\right)x_i^2\left(\underline{\theta}\right),$$

where

$$S_i\left(\theta\right)\equiv k_i x_i\left(\theta\right)-\frac{1}{2}\theta x_i^2\left(\theta\right)$$

is the surplus realized by a worker of type θ providing effort $x_i\left(\theta\right)$ for firm i (again, absent the benefit accruing from intrinsic motivation, when $i=N$).

Result 1 *(i) If DIC_i is binding for firm $i=F,N$, then per-worker payoffs are strictly decreasing in θ and $\pi_i\left(\underline{\theta}\right)>\pi_i\left(\overline{\theta}\right)$. (ii) If UIC_i is binding for firm $i=F,N$, then per-worker payoffs are strictly increasing in θ and $\pi_i\left(\overline{\theta}\right)>\pi_i\left(\underline{\theta}\right)$. (iii) If neither DIC_i nor UIC_i is binding for either firm, then per-worker payoffs can be either decreasing or increasing in θ.*

Proof. The proof of this result follows an argument similar to the one developed by Rochet and Stole (2002). When DIC_i is binding for firm $i=F,N$, effort levels are such that $x_i\left(\overline{\theta}\right)\leq x_i^{FB}\left(\overline{\theta}\right)$ and $x_i\left(\underline{\theta}\right)=x_i^{FB}\left(\underline{\theta}\right)$; namely, the high-ability type gets the first-best allocation while the effort of the low-ability type is downward distorted. Moreover, when DIC_i is binding, one has

$$\pi_i\left(\underline{\theta}\right)-\pi_i\left(\overline{\theta}\right)=S_i\left(\underline{\theta}\right)-S_i\left(\overline{\theta}\right)-\frac{1}{2}\left(\overline{\theta}-\underline{\theta}\right)x_i^2\left(\overline{\theta}\right).$$

The right-hand-side of the above equality is minimized when $x_i\left(\overline{\theta}\right)$ is the highest possible, that is when it equals the first-best effort level. Substituting for such effort level yields

$$\pi_i\left(\underline{\theta}\right)-\pi_i\left(\overline{\theta}\right)=S_i\left(\underline{\theta}\right)-S_i\left(\overline{\theta}\right)-\tfrac{1}{2}\left(\overline{\theta}-\underline{\theta}\right)x_i^2\left(\overline{\theta}\right)\geq\frac{k_i^2\left(\overline{\theta}-\underline{\theta}\right)}{2\underline{\theta}\overline{\theta}}-\frac{\left(\overline{\theta}-\underline{\theta}\right)k_i^2}{2\overline{\theta}^2}=\frac{k_i^2\left(\overline{\theta}-\underline{\theta}\right)^2}{2\underline{\theta}\overline{\theta}^2}>0\ .$$

Similarly, when UIC_i is binding for firm $i=F,N$, effort levels are such that $x_i\left(\overline{\theta}\right)=x_i^{FB}\left(\overline{\theta}\right)$ and $x_i\left(\underline{\theta}\right)\geq x_i^{FB}\left(\underline{\theta}\right)$; namely, the low-ability type gets the first-best while the effort of the high-ability type is distorted upwards. Moreover, when UIC_i is binding, one has

$$\pi_i(\underline{\theta}) - \pi_i(\overline{\theta}) = S_i(\underline{\theta}) - S_i(\overline{\theta}) - \frac{1}{2}(\overline{\theta} - \underline{\theta})\, x_i^2(\underline{\theta}).$$

The right-hand-side of the above equality is maximized when $x_i(\underline{\theta})$ is the lowest possible, that is when it equals the first-best effort level. Substituting for such effort level yields

$$\pi_i(\underline{\theta}) - \pi_i(\overline{\theta}) = S_i(\underline{\theta}) - S_i(\overline{\theta}) - \tfrac{1}{2}(\overline{\theta} - \underline{\theta})\, x_i^2(\underline{\theta}) \quad \leq -\frac{k_i^2(\overline{\theta}-\underline{\theta})^2}{2\underline{\theta}^2\overline{\theta}} < 0 \ .$$

When neither DIC_i nor UIC_i is binding, then each firm sets all effort levels at the first-best and the difference in per-worker payoffs $\pi_i(\underline{\theta}) - \pi_i(\overline{\theta})$ can be either positive or negative. ■

Let us then move to the actual proof of Lemma 3. Suppose that there is negative selection of ability for firm N and thus that $\widehat{\gamma}(\underline{\theta}) > \widehat{\gamma}(\overline{\theta})$ holds, whereby

$$U_F(\underline{\theta}) - U_N(\underline{\theta}) > U_F(\overline{\theta}) - U_N(\overline{\theta}) \Longleftrightarrow 1 - \left(U_F(\overline{\theta}) - U_N(\overline{\theta})\right) > 1 - \left(U_F(\underline{\theta}) - U_N(\underline{\theta})\right).$$

Take the programme (P_N) of the non-profit firm (see page 13) subject to DIC_N and UIC_N. Build the Lagrangian associated with this problem, where λ_N^D and λ_N^U are the multipliers associated with DIC_N and UIC_N, respectively

$$\begin{aligned}\mathcal{L}_N = \quad & \nu\left(k_N x_N(\underline{\theta}) - \tfrac{1}{2}\underline{\theta} x_N^2(\underline{\theta}) - U_N(\underline{\theta})\right)\left(1 - \left(U_F(\underline{\theta}) - U_N(\underline{\theta})\right)\right) \\ & + (1-\nu)\left(k_N x_N(\overline{\theta}) - U_N(\overline{\theta}) - \tfrac{1}{2}\overline{\theta} x_N^2(\overline{\theta})\right)\left(1 - \left(U_F(\overline{\theta}) - U_N(\overline{\theta})\right)\right) \\ & + \lambda_N^D\left(U_N(\underline{\theta}) - U_N(\overline{\theta}) - \tfrac{1}{2}(\overline{\theta} - \underline{\theta})\, x_N^2(\overline{\theta})\right) + \lambda_N^U\left(U_N(\overline{\theta}) - U_N(\underline{\theta}) + \tfrac{1}{2}(\overline{\theta} - \underline{\theta})\, x_N^2(\underline{\theta})\right).\end{aligned} \tag{26}$$

The first-order conditions relative to utilities are

$$\begin{aligned}\tfrac{\partial \mathcal{L}_N}{\partial U_N(\underline{\theta})} = \quad & -\nu\left(1 - \left(U_F(\underline{\theta}) - U_N(\underline{\theta})\right)\right) \\ & + \nu\left(k_N x_N(\underline{\theta}) - \tfrac{1}{2}\underline{\theta} x_N^2(\underline{\theta}) - U_N(\underline{\theta})\right) + \lambda_N^D - \lambda_N^U = 0\end{aligned} \tag{N1}$$

$$\begin{aligned}\tfrac{\partial \mathcal{L}_N}{\partial U_N(\overline{\theta})} = \quad & -(1-\nu)\left(1 - \left(U_F(\overline{\theta}) - U_N(\overline{\theta})\right)\right) \\ & + (1-\nu)\left(k_N x_N(\overline{\theta}) - \tfrac{1}{2}\overline{\theta} x_N^2(\overline{\theta}) - U_N(\overline{\theta})\right) - \lambda_N^D + \lambda_N^U = 0.\end{aligned} \tag{N2}$$

Consider the following two cases.

(a) Suppose that $\lambda_N^U > 0$ while $\lambda_N^D = 0$. Then DIC_N is slack while UIC_N is binding. Then equations

$(N1)$ and $(N2)$ become

$$\begin{aligned} \frac{\partial \mathcal{L}_N}{\partial U_N(\underline{\theta})} = & -\nu\left(1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)\right) \\ & +\nu\left(k_N x_N\left(\underline{\theta}\right)-\frac{1}{2}\underline{\theta} x_N^2\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)-\lambda_N^U=0 \end{aligned} \quad (N1a)$$

$$\begin{aligned} \frac{\partial \mathcal{L}_N}{\partial U_N(\overline{\theta})} = & -(1-\nu)\left(1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)\right) \\ & +(1-\nu)\left(k_N x_N\left(\overline{\theta}\right)-\frac{1}{2}\overline{\theta} x_N^2\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)+\lambda_N^U=0 \end{aligned}. \quad (N2a)$$

Solving both $(N1a)$ and $(N2a)$ for λ_N^U yields

$$\pi_N\left(\underline{\theta}\right) \equiv k_N x_N\left(\underline{\theta}\right)-\frac{1}{2}\underline{\theta} x_N^2\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)>1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)$$

and

$$1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)>k_N x_N\left(\overline{\theta}\right)-\frac{1}{2}\overline{\theta} x_N^2\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right) \equiv \pi_N\left(\overline{\theta}\right)$$

Given that, by Result 1, per-worker payoffs of firm N are increasing in θ when UIC_N is binding, one has that

$$1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)>\pi_N\left(\overline{\theta}\right)>\pi_N\left(\underline{\theta}\right)>1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)$$

which requires negative selection of ability for firm N. In other words, our initial assumption about negative selection is compatible with UIC binding for firm N.

(b) Conversely, assume that UIC_N is slack while DIC_N is binding whereby $\lambda_N^U=0$ while $\lambda_N^D>0$. Now, first-order conditions $(N1)$ and $(N2)$ specify as

$$\begin{aligned} \frac{\partial \mathcal{L}_N}{\partial U_N(\underline{\theta})} = & -\nu\left(1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)\right) \\ & +\nu\left(k_N x_N\left(\underline{\theta}\right)-\frac{1}{2}\underline{\theta} x_N^2\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)+\lambda_N^D=0 \end{aligned} \quad (N1b)$$

$$\begin{aligned} \frac{\partial \mathcal{L}_N}{\partial U_N(\overline{\theta})} = & -(1-\nu)\left(1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)\right) \\ & +(1-\nu)\left(k_N x_N\left(\overline{\theta}\right)-\frac{1}{2}\overline{\theta} x_N^2\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)-\lambda_N^D=0. \end{aligned} \quad (N2b)$$

Solving both $(N1b)$ and $(N2b)$ for λ_N^D yields

$$1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)>k_N x_N\left(\underline{\theta}\right)-\frac{1}{2}\underline{\theta} x_N^2\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right) \equiv \pi_N\left(\underline{\theta}\right)$$

and

$$\pi_N\left(\overline{\theta}\right) \equiv k_N x_N\left(\overline{\theta}\right)-\frac{1}{2}\overline{\theta} x_N^2\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)>1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right).$$

For firm N, per-worker payoffs are decreasing in θ when DIC_N is binding and thus

$$1-\left(U_F\left(\underline{\theta}\right)-U_N\left(\underline{\theta}\right)\right)>\pi_N\left(\underline{\theta}\right)>\pi_N\left(\overline{\theta}\right)>1-\left(U_F\left(\overline{\theta}\right)-U_N\left(\overline{\theta}\right)\right)$$

contradicting the fact that there's negative selection of ability for firm N.

Considering now the problem (P_F) of the for-profit firm, the following result holds: the assumption of negative selection of ability for firm N is compatible with the situation in which DIC_F is binding and UIC_F is slack (because per-worker payoffs are decreasing in θ for firm F when DIC_F is binding); such assumption is instead not compatible with the case in which DIC_F is slack and UIC_F is binding (given that per-worker payoffs are increasing in θ for firm F when UIC_F is binding).

Finally, when one assumes either a positive selection of ability for firm N or ability-neutrality, the argument follows the same lines and is thus left to the reader.

A.3 Necessity of Assumption 1

Assumption 1 in the main text is necessary at the screening contracts because, unless the difference in ability is sufficiently low that $2\underline{\theta} > \overline{\theta}$ holds, per-worker payoffs for firm F from type $\underline{\theta}$ are certainly negative under positive selection for the non-profit firm and, similarly, per-worker payoffs for firm N from type $\underline{\theta}$ might be negative under negative selection for the non-profit firm. Indeed, consider positive selection first and firm F's per-worker payoffs

$$\pi_F\left(\underline{\theta}\right) = \left(k_F x_F\left(\underline{\theta}\right) - \frac{1}{2}\underline{\theta} x_F^2\left(\underline{\theta}\right) - U_F\left(\underline{\theta}\right)\right).$$

Substitute for

$$U_F\left(\underline{\theta}\right) = U_F\left(\overline{\theta}\right) + \frac{1}{2}\left(\overline{\theta} - \underline{\theta}\right) x_F^2\left(\underline{\theta}\right),$$

from the binding UIC_F, yielding

$$\pi_F\left(\underline{\theta}\right) = \left(k_F x_F\left(\underline{\theta}\right) - \frac{1}{2}\overline{\theta} x_F^2\left(\underline{\theta}\right) - U_F\left(\overline{\theta}\right)\right).$$

Since, at the optimal contract, $x_F^*\left(\underline{\theta}\right) > x_F^{FB}\left(\underline{\theta}\right)$ so that surplus $S_F^*\left(\underline{\theta}\right)$ is decreasing in $x_F\left(\underline{\theta}\right)$, it is true that

$$\pi_F^*\left(\underline{\theta}\right) < \left(k_F x_F^{FB}\left(\underline{\theta}\right) - \frac{1}{2}\overline{\theta} x_F^{FB}\left(\underline{\theta}\right)^2 - U_F^*\left(\overline{\theta}\right)\right) = -\frac{\left(\overline{\theta} - 2\underline{\theta}\right) k_F^2}{2\underline{\theta}} - U_F^*\left(\overline{\theta}\right)$$

Then , given that $U_F^*\left(\overline{\theta}\right) \geq 0$ by the participation constraint of type $\overline{\theta}$ hired by firm F, it follows that $\pi_F^*\left(\underline{\theta}\right) < 0$ whenever $\left(\overline{\theta} - 2\underline{\theta}\right) \geq 0$. Hence, a necessary condition preventing firm F from making negative payoffs from type $\underline{\theta}$ workers under positive selection of ability for firm N is that $\overline{\theta} < 2\underline{\theta}$.

Similarly, consider negative selection of ability and firm N's profit margins from type $\underline{\theta}$

$$\pi_N\left(\underline{\theta}\right) = \left(k_N x_N\left(\underline{\theta}\right) - \frac{1}{2}\underline{\theta} x_N^2\left(\underline{\theta}\right) - U_N\left(\underline{\theta}\right)\right).$$

Substituting $U_N\left(\underline{\theta}\right)$ from the binding UIC_N yields

$$\pi_N\left(\underline{\theta}\right) = \left(k_N x_N\left(\underline{\theta}\right) - \frac{1}{2}\overline{\theta} x_N^2\left(\underline{\theta}\right) - U_N\left(\overline{\theta}\right)\right).$$

Since, again, at the optimal contract, $x_N^*\left(\underline{\theta}\right) > x_N^{FB}\left(\underline{\theta}\right)$ so that surplus $S_N^*\left(\underline{\theta}\right)$ is decreasing in $x_N\left(\underline{\theta}\right)$, one can write

$$\pi_N^*\left(\underline{\theta}\right) < \left(k_N x_N^{FB}\left(\underline{\theta}\right) - \frac{1}{2}\overline{\theta} x_N^{FB}\left(\underline{\theta}\right)^2 - U_N^*\left(\overline{\theta}\right)\right) = -\frac{\left(\overline{\theta} - 2\underline{\theta}\right) k_N^2}{2\underline{\theta}} - U_N^*\left(\overline{\theta}\right)$$

Although $U_N^*\left(\overline{\theta}\right)$ can be negative, because what matters is the participation constraint $U_N\left(\overline{\theta}\right) + \widehat{\gamma}\left(\overline{\theta}\right) \geq 0$, the right-most term is possibly negative when $\overline{\theta} \geq 2\underline{\theta}$ and hence a condition preventing firm N to make non-negative payoffs from the $\underline{\theta}$ type under negative selection of ability is that $\overline{\theta} < 2\underline{\theta}$.