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Abstract

Consider an agent who has an expertise in producing a non-marketable good. This good is valued by a single principal, and there is a verifiable measure of the agent's performance. Crucially, the agent is intrinsically motivated, due to 'warm glow altruism'. In addition, the agent's budget, which is controlled by the principal, must not be less than the monetary performance-cost faced by the agent. This gives rise to a limited-liability constraint. It also restricts the agent's ability to under-report costs. In such environment, we determine the link between the agent's budget and performance. Our results come in contrast to the received solution of the principal-agent problem, and to most in the literature on mission-motivated organisations and public services provision.

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1 Introduction

Reforming public services has been and remains very high on the policy agenda for many developed countries. Examples of the recent debates over organisational forms and incentive schemes in public service provision are the so-called “Reinventing Government”, “Modernising Government” and “New Public Management” approaches,¹ and the current policy discussions in UK, US and elsewhere.²

Some often posed questions are: is there scope for improvements in the performance of government organisations? If there is, should performance-pay be introduced, or how should public services/outputs and budget appropriations be linked, to enhance public service delivery? What are the efficiency properties of an optimally designed public organisation, or will production take place at minimum monetary costs and equate the sponsor’s marginal willingness to pay for with the marginal cost of public output? If not, how is the productivity of the agency related to the kind of the necessary inefficiencies? Should incentives be high-powered, or should the monetary rewards from exerting the appropriate level of effort and transmitting truthfully any required information be high?

The approaches mentioned above are based on the presumption that people care only about money and call for the introduction of private sector practices into the public sector. The theoretical apparatus most often used is the principal-agent paradigm, where, typically, one party - the principal - possesses all the bargaining power and the other party - the agent - has superior information about important determinants of production like the agent’s effort and/or productivity.³ The main message of this model is that, when the outside option of the agent is not very increasing with the agent’s productivity and the agent’s disutility from exerting effort is not very high, optimal organisation satisfies the following: if truthful transmission of information requires monetary incentives, then the low-productivity agent must be asked to produce below the full-information level. In addition, the high-productivity agent must be given information rents - in the form of a transfer/budget over and above the minimum

¹See Osborne and Gaebler (1993) and Barzelay (2001).

²For some discussions on the current debate, see Burgess and Ratto (2003), Propper and Wilson (2003) and Grout and Stevens (2003). For a recent policy document on reforming public services see HM Treasury (2003) “Public Services: Meeting the Productivity Challenge”.

³Hereafter, we will interchange the words (public) agency, agent(s) and agency’s head.

monetary cost of production - as long as the low-productivity agent is asked to provide a positive level of output. Moreover, the high-productivity agent will be asked to produce the full-information level. Furthermore, if shirking is a concern then the agent will need to be given the appropriate monetary incentives to exert the appropriate level of effort. Also, if effort is productivity-enhancing then the agent will be asked to provide, given productivity, the full-information level of services. In addition, incentives must be high-powered.⁴

Many applications of the principal-agent paradigm to public organisations emphasise also the possible multiplicity of an agency's principals, the multiplicity of tasks, measurement problems, the possible team-production elements and career concerns.⁵ In doing so, they investigate how the lessons of the standard principal-agent model have to be modified before being applied to the public sector. In most of this strand of research, however, profit-maximisation is still the maintained objective of the agency. In addition, agents are implicitly assumed to be able to use their own resources in order to manipulate the transmission of information to the principal(s).

Yet, production of non-marketable, or collective, goods and services, whether by public bureaucracies, Non-Governmental Organisations (NGOs) that are given the task of providing public services, or public-benefit nonprofit organisations, is often mission-driven. For such organisations, agents may be influenced by attitudes, ideology, professional modes, or simply they may care about the amount and quality produced and their input.⁶ For instance, doctors and nurses take satisfaction from curing and catering patients, academics take satisfaction in contributing to the advancement of knowledge, teachers take pleasure from producing good students, aid-workers care about the successful provision of aid.⁷

⁴See, for instance, Laffont and Martimort (2002) Chs. 2, 4, 7.2.

⁵See, for instance, Rose-Ackerman (1986), Tirole (1994), Dewatripont et.al. (1999), Burgess and Metcalfe (1999), Dixit (2002). For a related discussion see also Iossa and Bennett (2005).

⁶The non-pecuniary benefits that public agents derive from their output can also be thought of as a kind of intrinsic motivation. However, here these benefits do not depend explicitly on the extend of monetary incentives. For discussions of endogenous intrinsic motivation see Kreps (1997), Murdock (2002) and Benabou and Tirole (2003).

⁷See also Besley and Ghatak (2004). See Heckman et.al. (1997), Burgess and Ratto (2003), Glazer (2004), Francois (2000, 2003, 2004) for discussions and evidence of intrinsic motivation in various nonprofit organisations. For a discussion of mission-motivation in government bureaucracies see Wilson (1989), pp. 26. For an alternative model, of endogenously determined missions in bureaucracies, see Dewatripont et. al. (1999).

In addition, especially in public and nonprofit organisations responsible for the production of non-marketable goods and services, agents can only use the resources which are made available to them by the sponsor(s) for production. That is, agents cannot use their own wealth for the production of the organisation's output.⁸

Therefore, the above literature may not always be well-suited for the study of the design of public, and related, organisations. For this reason, this paper contributes to the current debate by studying the *optimal* design of an agency which *specialises* in the provision of *non-marketable, or collective, goods and services*.⁹ Notice that this paper's analysis is not positive in nature. Though our analysis could explain certain observations (see Section 5), we choose to contribute to the current debate by means of a normative analysis. In particular, we study the contract a principal should offer, in the presence of an *administrative constraint*, to a *motivated* agent,¹⁰ when the agent's motivation is common knowledge and the agent possesses superior information vis-a-vis the principal about his effort and/or productivity.¹¹ The agent is a not-for-profit entity in that, as long as she is responsible for production, a balanced-budget increase in production is welfare enhancing for her. In other words, the agent values the output that she produces beyond the associated wage she earns.¹² The administrative constraint requires that all monetary costs of production must be born solely by the principal. In other words, the agent cannot use her own wealth for the provision of the non-marketable services.

⁸See also Besley and Ghatak (2004) and Francois (2000,2003).

⁹In the terminology of Horn (1995) we focus on administrative bureaus. For discussions of administrative bureaus, see Horn (1995) pp. 33, 40-43, 79-82, 170-172 and 180, Niskanen (1971) pp. 24, Wilson (1989) pp. 33, and Dixit (2002).

¹⁰We use hereafter interchangeably the terms (intrinsically/mission/output) motivated agent and not-for-profit agent.

¹¹We abstract from issues of multiple tasks and/or career concerns and/or non-cooperation within the agency and/or within the decision-making body which is responsible for the agency's budget. We do not choose to do so because we believe that such issues are unimportant. Instead, we do so because we wish to focus on the implications for the design of mission-orientated organisations of the interaction of intrinsic motivation and administrative constraints, as a first step towards the study and understanding of more complicated environments. For a discussion of the above issues in a context where there is no administrative constraint and agents are profit-orientated see Dixit (2002).

¹²Thus, intrinsic motivation arises here due to warm-glow altruism. See, for instance, Andreoni (1988). An example of the relevance of such altruism is the Olympic Games volunteers. See for instance <http://www.athens2004.com/en/Volunteers/indexpage>.

In studying the optimal contract in question, we ask: are the efficiency properties of the workings of such an agency compromised by its possessing private information about important determinants of the provision of services? If so, how should performance measures and budget appropriations be linked to enhance public service delivery? How are the possible inefficiencies related to the intrinsic motivation of the agent? How does the power of incentives depend on the output-motivation of the agent, or is intrinsic motivation a substitute for monetary incentives? Does output, for given productivity, increase with the mission-orientation of the agent?

Our analysis has important implications for the optimal design of public agencies, NGOs and, in general, nonprofit organisations which are responsible for the production of collective goods.¹³ Specifically, by answering the above questions, it demonstrates how the naive application of the private sector model to the public sector may worsen public service delivery.

The principal-agent problem we focus on also has features that differ from existing studies of procurement and regulation - with very interesting and profound consequences for optimal contract design. What differentiates our study from the models in Baron and Myerson (1982), Laffont and Tirole (1993), Laffont and Martimort (2002) and elsewhere,¹⁴ is the *coexistence* of the not-for-profit motivation on the part of the agent *and* the administrative constraint.

We find that depending on the intensity of the non-pecuniary motive, the principal will either be able to implement the complete information contract, or find it optimal to distort the performance of *both* the inefficient *and* the efficient agent! Furthermore, in the latter case, the principal may be able to ensure that *no information rents* are given to the agent, i.e. that service provision takes place at minimum monetary costs, *regardless* of the agent's productivity and *even if* public services are always provided. In addition, we find that the power of incentives *is weakly decreasing* with mission-motivation. In particular, incentives can be 'flat' even if the agent produces regardless of her productivity, and even if the full-information outcome is not implementable. Finally, we find that higher output-motivation, while maintaining productivity,

¹³Notice here that Dixit (2002b) uses output-motivation in a multi-tasking model to discuss provision of social services. Dixit (1997) uses output-motivation in a multi-tasking and multi-principal model to discuss the power of incentives in public organisations. However, in both works, the agency relationship is not characterised by an administrative constraint.

¹⁴Note that the Baron and Myerson model, where the agent is money-motivated and there is no administrative constraint, is used also in Dixit (2002) for the discussion of adverse selection problems in public service delivery.

does not necessarily lead to an increase in public services. To the best of our knowledge, these are novel results. Using these results, we are then also able to discuss, in Section 5, various issues in reforming provision of collective goods, like increasing competition and/or user-involvement, the choice of an organisation's mission, bureaucratic conservatism and innovation.

To understand the intuition behind our results notice first that the administrative constraint gives rise to a limited-liability condition, which, in conjunction with the not-for-profit motivation of the agent, makes the agent's outside option inferior to *any feasible* employment offer by the principal. In other words, the fact that a balanced-budget increase in production has a positive welfare effect for a not-for-profit agent implies that the administrative constraint is more stringent than the participation constraint.¹⁵ Under full information, then, the appropriate level of effort is exerted, transfers match minimum production costs, and production is such that the principal's marginal benefit equals the marginal production cost. Thus, output is increasing with the agent's productivity. Here, also, incentives are 'flat': there are no monetary rewards for 'good performance', i.e. for exerting the appropriate level of effort and transmitting truthfully any required information. In addition, as the principal's marginal benefit and the marginal production costs are independent of the agent's motivation, full-information provision is independent of the output-motivation on the part of the agent.

Under asymmetric information, however, the above allocation may not be feasible - that is, implementable - since the agent may have an incentive to shirk and/or manipulate the transmission of information to the principal. Crucially, though, the administrative constraint also limits the low-productivity/high-cost agent's opportunities to manipulate the transmission of information about productivity to the principal. This is due to the fact that the budget intended for a high-productivity/low-cost agent may not be sufficient to cover the monetary production costs that emerge when the agent over-reports his productivity. In addition, the intrinsic motivation on the part of the agent leads to a reduction of the information rents which are necessary to be given to the agent, in order to ensure the appropriate level of (productivity-enhancing) effort and/or the truthful transmission of information about the agent's productivity. In fact, an increase in the not-for-profit orientation of the agent reduces the incentive to under-report productivity (which aims at decreasing production and increasing appropriated profits) and to

¹⁵For an adverse selection problem with limited-liability constraints and the agent being only money-motivated, see Sappington (1983), and the treatment in Laffont and Martimort (2002) Ch. 3.5.

shirk. This is a direct consequence of the ‘donated labour’ or ‘mission-orientated’ or ‘devotion’ character of the agent’s preferences.¹⁶

It follows directly that if the agent’s intrinsic motivation is sufficiently high then asymmetric information does not have a bite and the principal can offer the full information contract. The agent cannot over-report productivity and does not want to under-report productivity. If, however, the mission-motivation is sufficiently low, the principal may need to offer information rents to the high-productivity agent to ensure ‘good performance’. That is, an optimally designed organisation may have to operate, when productivity is high, under excessive monetary costs. Nevertheless, due to the agent’s intrinsic motivation, these rents depend on the performance of the low-productivity agent *as well as on the performance of the high-productivity agent*. Therefore, reducing excessive monetary costs requires that performance differs from its full-information level *regardless* of the agency’s productivity. The fact that, under mission-motivation, the principal has *two* instruments to reduce information rents may also ensure that the agency can operate at minimum monetary costs regardless of the agency’s productivity, and even if production always takes place.

Moreover, due to the intrinsic motivation, the agent is more willing to perform well even in the absence of monetary rewards. This implies that mission-motivation reduces the power of incentives. This echoes the results in Besley and Ghatak (2004) and Francois (2000, 2003, 2004). Nevertheless, here, the fact that the agency can operate at minimum monetary costs regardless of the agency’s productivity implies that the power of incentives can be zero *even if* the full-information outcome is not implementable.

Finally, an increase in output-motivation increases the willingness of the agent to produce a high level of output instead of a low level of output. This in turn has two effects. On the one hand, it increases the ability of the principal to ensure good performance through requiring high level of production regardless of the agent’s productivity. On the other hand, it increases the ability of the principal to re-allocate production between productivity-types of the agent in order to improve upon the expected net surplus from the delivery of public services, while ensuring a good performance by the agent. These two effects may be of opposite direction. Thus, the effect of mission-orientation on the level of public services for given productivity will

¹⁶See, for instance, Francois (2003, 2004), Grout and Young (2003), Besley and Ghatak (2004) and Glazer (2004).

in general be *ambiguous* and depends on the balance between these two effects.

Our paper is related to the work by Francois (2000,2003,2004), in that agents have a non-pecuniary motivation. However, there this motivation arises out of pure altruism and not due to ‘warm glow’ altruism. In the spirit of private provision of public goods, pure altruism leads to a free-riding problem in donations of labour. Moreover, there, outcome-based wages are not used. In fact, either moral hazard is not a problem, due to the on-spot verifiability of effort, or wages are flat - with constant wages be “efficient”, i.e. above the market wage, whenever effort can be verified with a lag. Furthermore, information-eliciting monetary schemes are either not needed or not used. In Francois (2000, 2003) emphasis is also placed on the lack of commitment on the part of the employer to not turn the agent’s donated labour into profit when the employer is the residual claimant of any generated profits and can affect production after the donation of labour. This lack of commitment is not an issue here. Given these characteristics, these papers investigate when the power of incentives and/or ‘efficiency wages’ are lower in the nonprofit sector and/or when nonprofit organisations dominate for-profit firms in the provision of public goods.

Our work is also related to Glazer (2004) and Besley and Ghatak (2004). They too assume that motivation arises due to ‘warm glow’ altruism, and investigate the implications for collective production.

In Glazer (2004), the principal contributes also to the production. The focus there is on the possible lack of commitment on the part of the principal to not utilise the agent’s donated labour to merely increase profits by means of adjusting his input after the agent has exerted her effort. Here, instead, the principal does not supply any input, and so no commitment issues arise.

In Besley and Ghatak (2004), output levels - for given productivity - are fixed. Thus, that work may not be well-suited for the study of organisations whose output can vary for given productivity. That work focuses, instead, on the matching of principals and agents vis-a-vis mission-orientation, and the effects on productivity and the power of incentives. Here, we investigate the effect of mission-motivation *on production* and associated monetary costs, *for given productivity*. Furthermore our focus is on the *short-run*, i.e. on an environment where assortative matching between principals and agents has not yet taken place. Due to these differences in focus, one can view our work as complementary to theirs. In fact, some of our findings echo results in Besley and Ghatak (2004). Nevertheless, many of our results also do

not have counterparts there, like the results we emphasise above on the levels of production in an optimally, from the principal's point of view, designed mission-orientated agency.

Finally, our work is also related to Delfgaauw and Dur (2005a). There not all agents are mission-motivated, and intrinsic motivation and productivity are the agents' private information. Also, mission-motivated agents are by assumption high-productivity workers. Moreover, workers are not restricted by an administrative constraint. The question there is whether the principal finds it optimal to attract both motivated agents and profit-maximising-low-productivity agents. The answer is affirmative. Also, it is shown that when the principal does attract such a workforce, he implements distortions in the output of all workers. However, this result relies on the fact that, in that paper, the principal minimises the production costs of a *given* level of public services: decreasing the low-productivity agent's output to reduce rents requires an increase in the high-productivity agent's output to maintain total output. Our result, on the other hand, relies on the co-existence of mission-motivation and administrative constraints on the part of every worker responsible for the production of an *endogenous* output.

The organisation of the paper is as follows. Section 2 presents the model. Section 3 discusses some benchmark cases, while Section 4 solves for the optimal contract. Our results and their policy implications are discussed in Section 5. Section 6 concludes and points to directions for further research.

2 The Model

Our model consists of an agent and her principal. The agency is the sole producer of a good valued only by the principal. The agency can be thought of as a group of citizens who have an expertise in the production of a non-marketable good, i.e. in the attainment of the (public) agency's or the nonprofit organisation's mandated goal. The principal can be thought of as the decision-making body that has the authority of passing legislation for determining the interaction of the polity with the public bureau, or as the board of stakeholders of a nonprofit organisation who are responsible for determining the budget of the agency and how it is linked with the organisation's performance.

In general, the non-marketable nature of the service may also imply the non-verifiability and thereby the non-contractibility of the agency's attained goals. It is crucial therefore to emphasise here, in order to avoid any misunderstandings, that what we refer hereafter to as an

agency's output may differ from its mandated goal. In fact, as Baker (1992) and Heckman et. al. (1997), among others, emphasise, readily measured performance targets often substitute for the mandated goals of an agency, which are often non-verifiable. Such targets are what we refer, hereafter, to as the agency's (intermediate) output.¹⁷

Denote with q the verifiable measure of the agent's performance (towards the attainment of the agency's mandated goal). Assume that $q \geq 0$. For the purposes of our model, the monetary cost (in terms of the numeraire good) of production of q units of the agency's (intermediate) output is given by $C(q, \theta) = F + \theta q$, where $F \geq 0$ and $\theta > 0$ are scalars. The fixed cost of production F is common knowledge.¹⁸ The marginal cost of the agency's production (or the inverse of the agency's productivity) θ can take either of two values. In particular $\theta \in \{\theta_1, \theta_2\}$ with respective probabilities s and $1 - s$. These probabilities are common knowledge. Let $\Delta\theta \equiv \theta_2 - \theta_1 > 0$. Thus $\theta_2 - s\Delta\theta$ is the expected, from the principal's point of view, productivity of the agent.

In this paper we view the agent as a specialist in the production of the output. Specifically, we postulate that the likelihood of the marginal cost be low may depend on the 'effort' or 'managerial input' put by the agent, with more effort leading to lower *expected* marginal cost (or higher expected productivity). Thus, output may in general depend stochastically on effort, through the effect of the latter on the productivity of the agency. Also, the effort may not be contractible. In addition, the agent may have superior information about productivity,

¹⁷The distinction we make here between an agency's mandated goal and (intermediate) output, is essentially very similar to the distinction made in Wilson (1989) pp. 32-34 between a public bureau's 'goals' and '(critical) tasks'. See also HM Treasury (2003) "Public Services: Meeting the Productivity Challenge" pp.2. The agencies we have in mind can in general be divided into what Wilson (1989) refers to as production and procedural organisations. For the former, the goal and the critical task coincide and can be verified (see Wilson (1989) pp. 35, 160-162, 244). In the case of procedural agencies, the mandated goal is not verifiable, but the critical task is (see Wilson (1989) pp. 320-323, 163-164, 202). As an example, tax and pensions administration bureaus are production agencies. Universities and bureaus that administer military procurement and the army during peacetime are, instead, examples of procedural organisations.

¹⁸Our results are qualitatively robust to allowing for a general cost function $C(q, \theta)$ with $C_q > 0$, $C_{qq} \geq 0$, $C_{q\theta} > 0$ and $C(0, \theta) = F$, where $F \geq 0$ is a scalar. Note our assumption that the fixed cost F is common knowledge. This assumption avoids the emergence of multi-dimensional adverse selection, and allows us to isolate the consequences for the optimal contract of the presence of the administrative constraint when the agent is a not-for-profit entity.

*after effort has been exerted.*¹⁹

In fact, we focus here on an environment where θ is private information of the agency. We also assume in the main text that the relationship between the principal and the agency is not hindered by moral hazard, and, so, neither the realisation of the marginal cost of production nor the level of output, for given marginal cost, depend on some non-contractible activities of the agency. The reasons are the following. First, the interaction of moral hazard with output-motivation has been analysed by Francois (2000,2003,2004) and Besley and Ghatak (2004). Second, as we show in Appendix C our results would be qualitatively valid if the relationship was hindered only by non-contractability of productivity-enhancing effort. Third, there are public organisations where moral hazard is not a major problem.²⁰ Yet, even if moral hazard is not a concern, the agent may still have superior information over the true monetary costs of running the department.²¹ For such organisations, the model in Besley and Ghatak (2004) may not be well-suited. Instead, such organisations might be better studied by an adverse selection model like the one in the main text here. Fourth, in reality, it is often the case that an agency's superior is incumbered by both problems of asymmetric information with hidden action (or

¹⁹The monetary cost of production $C(q, \theta)$ can also be thought of as being a reduced form of a more complicated model where, along the lines of Francois (2000, 2003,2004), lower-tier workers are paid “efficiency” or flat wages which are determined by the agency's head, with the productivity of the agency being stochastically dependent on the head's managerial effort to monitor the agency's workers.

²⁰Wilson (1989) refers to these kinds of public organisation as agencies with standard operating procedures. The term standard operating procedures refers to the fact that bureaucratic slack for such agencies is not a major concern, due to inputs-monitoring. In such organisations, the actions of the employees are observable and there are processes that pertain to the observable actions. Political principal(s) of such an agency can determine how allocations are related to certain standard operating procedures, and possess a verifiable measure of the agency's performance. Examples of such public agencies are the army during peacetime, bureaus that administer (military) procurement and tax collection, transfer agencies where most of expenditure is simply passing through - like agencies that administer pensions. For discussions on process-monitoring in public organisations, see Wilson (1989), pp. 35, 133, 159-164, 202, 221, 244, 320-323, 375, Prendergast (2002) and Dixit (2002). For a model of endogenous process monitoring see Novaes and Zingales (2003) and Francois (2003).

²¹See, for instance, Bendor et. al. (1985) and Horn (1995), pp. 87. As an example, civil servants in the Department of Defence often have superior knowledge on weapons systems and how they enhance military capability. Similarly, civil servants responsible for processing tax invoices and retirement benefits have better information on whether more, advanced or in number, computers will enable them to administer claims in a more efficient way.

moral hazard) and hidden information (or adverse selection). The classification then of agency relationships according to the type of asymmetric information problem they feature can be viewed as a highly stylised representation of real world situations, which nevertheless serves the purpose of highlighting the issues that may arise in each case separately and thereby easing our understanding of the hybrid (and definitely more complicated) environments where both problems are present. Finally, as we show in Appendix C our results would be qualitatively valid for a large range of parameters even in a ‘hybrid’ environment where the realisation of the marginal cost of production is the agent’s private information *and* depends in a stochastic manner on non-contractible activities of the agent.

The principal derives a utility $B(q)$ from the agent’s output, with $B(0) = 0$, $B' > 0$, $B'(0) > \theta_2$, $\lim_{q \rightarrow \infty} B'(q) = 0$, $B'' < 0$ and $B''' < 0$.²² Notice here that this representation of the principal’s preferences can also capture an environment where q is the intermediate output of the agency. To see this, suppose that $\tilde{B}(y)$ is the principal’s utility over the agency’s mandated goal y , and that this final output is given by $y = Y(q)$. Suppose now that $Y(\cdot)$ is known by both the principal and the agent, but non-verifiable by a third-party. Then, despite the fact that y is non-contractible, the principal and the agent can ‘calculate’ $B(q) \equiv \tilde{B}(Y(q))$.

We follow the accounting convention that the principal bears up-front the fixed cost of setting up the agency. The utility on the part of the principal after having born the fixed cost is then defined by

$$U_p(q, t) = B(q) - t,$$

where $t \geq 0$ is the budget allocated by the principal to the agency, i.e. the units of the composite good transferred to the agency.²³ We also assume, that the principal’s wealth net of fixed costs is sufficiently high, so that he will not face any binding wealth constraints.

Define with $t - \theta q$ the agency’s profits, appropriation or discretionary budget. This budget is a source of both pecuniary and non-pecuniary benefits for the agency: bureaucrats consume the discretionary budget in the form of both wages and perquisites. The agency also derives, due to ‘warm glow altruism’, direct utility from providing q units of the output. We

²²The latter assumption ensures a well-behaved optimisation problem on the part of the principal.

²³Qualitatively, our results are robust to allowing for a general welfare function on the part of the principal $U_p(q, t, \theta)$, with U_p being concave with respect to q , decreasing with t and $q_1^o > q_2^o$ where $q_i^o = \arg \max_q U_p(q, \theta_i q, \theta_i)$.

capture this non-pecuniary motive by assuming that the agent maximises

$$U(q, t; \theta, a) \equiv aB(q) + t - \theta q, \quad (1)$$

where $a > 0$.

Crucially, $aB(q)$ is non-monetary. That is, the only monetary returns of production for the agent are the budgetary appropriations t . The parameter a represents the extend of the agent's output-motivation, relative to the marginal utility of the discretionary budget. We refer hereafter to a as the not-for-profit/mission/output/intrinsic motive of the agent.²⁴ Clearly then the case of $a \rightarrow \infty$ reflects an output-maximising agency, and, at the other extreme, the case of $a \rightarrow 0$ represents at the limit a profit-maximising agent. In the standard study of procurement and regulation it is assumed that $a = 0$.²⁵ Assume that a is common knowledge.²⁶

Three important, and related, observations about the agent's preferences have to be made. First, the agent's welfare is not necessarily decreasing with output, as it is the case in the canonical principal-agent model. Second, balanced-budget increases in production are welfare-enhancing for the agent, with the gain being increasing with the mission motivation a . Third, the marginal rate of substitution between output q and budget appropriation t is $B'(q)$ for the principal and $\theta - aB'(q)$ for the agent. Thus, the higher the output motivation a , the lower the compensation the principal needs to give to the agent for increasing marginally production, while keeping the agent's utility constant.

Let t_i and q_i be the budget appropriation and the required output if the marginal pro-

²⁴Notice that, in principle, there is nothing in our model so far to preclude the case that $B(q)$ are the principal's profits. In fact, our model would also be compatible with an environment where $aB(q)$ are monetary returns on the part of the agents, that however are non-contractible. This could, for instance, be the case if a is observable but non-verifiable. I would like to thank Tim Besley for bringing this into my attention.

²⁵As we will see later on, the limiting solution of our model with $a \rightarrow 0$ does correspond to the solution of the standard problem where $a = 0$.

²⁶An implicit assumption in most of the literature is that preferences of civil servants are common knowledge. The same is true for the preferences of the mission-motivated agents in Besley and Ghatak (2004). In principle, a could also be private information on the part of the agency. However, in this paper the focus is on asymmetric information with respect to θ . The reason is again to isolate the consequences for the optimal contract of the agency being characterised by an administrative constraint and being a not-for-profit entity. For a discussion when productivity is common-knowledge but mission-motivation is the workers' private information see Delfgaaw and Dur (2005). For a discussion when both a and θ are the agent's private information see Iossa and Makris (2005).

duction cost is θ_i , $i = 1, 2$. Any feasible relationship between the principal and the agent must satisfy certain constraints. First, we assume that the agent cannot be coerced by the principal to participate in some mechanism for the determination of some allocation. Accordingly, feasible allocations must leave the agency at least as well off as the agency's outside option. In this model the principal is the only buyer of the agency's 'expertise' and hence the agent's utility from taking up the outside option is equal to zero.²⁷ So, to induce the agency to produce the output regardless of the underlying productivity, the following condition must be satisfied:²⁸

$$aB(q_i) + t_i \geq \theta_i q_i, \forall i \in \{1, 2\}. \quad (2)$$

Second, we assume the presence of an *administrative constraint*: the budget cannot fall short of the monetary costs of production the agent faces. One of the implications of the administrative constraint is that the following limited-liability constraint must hold:²⁹

$$t_i \geq \theta_i q_i, \forall i \in \{1, 2\}. \quad (3)$$

Note that, due to $a > 0$, the limited-liability constraint makes the participation constraint in (2) redundant. Hence we ignore in what follows the latter.

It is important for the understanding of our results to note that the administrative constraint is similar to, and yet not the same as, a limited-liability constraint. The reason is that the administrative constraint *also* affects the agent's ability to pretend she is of a different cost-type, while the standard limited-liability *does not* affect the agent's opportunities to conceal convincingly her productivity (see for instance Sappington, 1986, and Laffont and Martimort, 2002, Ch 2). In more detail, note, due to $t_2 \geq \theta_2 q_2$ and $\theta_2 > \theta_1$, that any allocation intended for the inefficient agent can also be administered by the low marginal cost agent (i.e. $t_2 > \theta_1 q_2$).

²⁷All that is needed for our results is that the reservation utility is sufficiently low. Again the reason for assuming zero reservation utilities is to isolate the consequences of administrative constraints in mission-orientated agencies.

²⁸As it will become obvious shortly, our results are robust to assuming, instead, that θ is on-task, rather than innate, productivity and hence that the ex ante participation constraint $s[aB(q_1) + t_1 - \theta_1 q_1] + (1 - s)[aB(q_2) + t_2 - \theta_2 q_2]$ must be satisfied.

²⁹The administrative constraint is similar to, and yet not the same as, a limited-liability constraint. The reason is that the administrative constraint also affects, as we will shortly see, the agent's ability to pretend she is of a different cost-type, while the standard limited-liability does not affect the agent's opportunities to conceal convincingly her productivity; see for instance Sappington (1986) and Laffont and Martimort (2002) Ch 2.

Crucially, however, the reverse may not be true: $t_1 < \theta_2 q_1$ can in principle be the case, which implies, given the administrative constraint $t_1 \geq \theta_1 q_1$, that a high-cost agency will not be able to execute the allocation $\{t_1, q_1\}$.

Assuming the existence of a perfect and benevolent device which ensures the enforcement of contracts, we have by the revelation principle³⁰ that the principal cannot do better than offering a direct revelation mechanism. Under such a mechanism, incentive-compatibility conditions must be satisfied.³¹ Yet, the administrative constraint *limits also* the opportunities for under-reporting costs, since, recall from above, it may be the case that $t_1 < \theta_2 q_1$. So, incentive-compatibility requires, here, that the agent of a certain cost-type has no incentive to choose a contract *that he can administer* and is intended for producers of a different type. That is,

$$aB(q_1) + t_1 - \theta_1 q_1 \geq aB(q_2) + t_2 - \theta_1 q_2 \text{ and} \quad (4)$$

$$aB(q_2) + t_2 - \theta_2 q_2 \geq aB(q_1) + t_1 - \theta_2 q_1 \text{ when } t_1 \geq \theta_2 q_1. \quad (5)$$

To re-emphasise the difference between a limited-liability and an administrative constraint, note that under the former and in the absence of the latter (5) would have been replaced by the *more stringent* condition $aB(q_2) + t_2 - \theta_2 q_2 \geq aB(q_1) + t_1 - \theta_2 q_1$.

Summarising, the principal's problem is to maximise $E_{\theta_i} U_p(q_i, t_i)$ subject to the constraints $q_i \geq 0$, $i = 1, 2$, and (3)-(5). We turn to the solution of this problem after we analyse some useful benchmark cases.

3 Benchmark Cases

Before we investigate the solution to the above problem we examine four benchmark cases. The first deals with the optimal contract under symmetric information. The second case deals with asymmetric information in the absence of both the administrative constraint and the mission-motivation, i.e. with the standard adverse selection problem. In the third case, the agent is output-motivated, but there is no administrative constraint. The fourth case deals with the environment where the agent is a profit-maximiser in the presence of the adminis-

³⁰See, for instance, Mas-Colell et. al. (1995) Ch. 23.

³¹Note that we restrict our analysis to the case of deterministic contracts. This can be motivated by postulating that stochastic allocation rules are hard to be enforced by a court of law.

trative constraint. The analysis of these cases will help the understanding of the forthcoming results and emphasise that they rely critically on the *co-existence* of mission-motivation and the administrative constraint.

We start by finding the optimal allocations when information is symmetric. These allocations are denoted with the superscript o . When information is symmetric, the agent cannot mis-report her type and hence the incentive-compatibility constraints (4) and (5) are irrelevant. Also, as the administrative constraint is more stringent than the participation constraint, the principal is only restricted by the latter, i.e. (3). As transfers are costly for the principal, it follows in a straightforward manner that the principal is better off by leaving no ‘excess budget’ to the agency (i.e. $t_i^o = \theta_i q_i^o$ for any $i \in (1, 2)$). So, the principal’s net surplus is $B(q) - \theta q$. Maximisation of the latter implies that the principal will ask the agent to provide the level of output q_i^o that satisfies:

$$B'(q_i^o) = \theta_i, \forall i \in \{1, 2\}. \quad (6)$$

Note that $q_1^o > q_2^o > 0$. We refer to these allocations as the full-information contract.

Thus under symmetric information the budget matches the minimum cost of production: the agency is productively efficient. We will refer hereafter to such a case as the principal leaving no (information) rents to the agent. Furthermore, output is a decreasing function of the marginal cost of production. In particular, output is such that the purchaser’s marginal benefit is equal to the marginal monetary cost of production. We will refer to the production level q^o as the efficient (from the principal’s point of view) level of production.

For a given marginal cost of production θ , the principal will indeed offer the contract in question to the agency and output will be produced, if the net value of public service delivery $B(q_i^o) - (\theta_i q_i^o + F)$ is non-negative. Note, due to $\Delta\theta > 0$, the definition of q_1^o and the properties of $B(q)$, that $B(q_1^o) - \theta_1 q_1^o > B(q_2^o) - \theta_1 q_2^o > B(q_2^o) - \theta_2 q_2^o > 0$. Thus, a sufficient condition for production to always take place under complete information is that the services of the high-cost agency are socially valuable, that is

$$B(q_2^o) - (\theta_2 q_2^o + F) \geq 0. \quad (7)$$

We maintain this assumption throughout. Accordingly, under complete information the agency is set up and the principal’s welfare is

$$s[B(q_1^o) - \theta_1 q_1^o] + (1 - s)[B(q_2^o) - \theta_2 q_2^o] - F > 0. \quad (8)$$

If the agent is a profit-maximising entity, i.e. $a = 0$, that can pretend to be of any cost-type regardless of the associated allocation, the incentive-compatibility constraints (4) and (5) reduce to $t_j - \theta_j q_j \geq t_k - \theta_j q_k$ $j, k = 1, 2, j \neq k$. Let $\pi_i \equiv t_i - \theta_i q_i$, $i = 1, 2$, be the type- θ_i agent's information rents. The principal's problem is then $\max_{\{\pi_i q_i\}_{i=1,2}} \{s[B(q_1) - \theta q_1 - \pi_1] + (1-s)[B(q_2) - \theta q_2 - \pi_2]\}$ s.t. $\pi_j \geq \pi_k + (\theta_k - \theta_j)q_k$ and $\pi_i \geq 0, q_i \geq 0, i, j, k = 1, 2, j \neq k$. As it is well-known, in this case we have that the inefficient agency attains utility equal to that under its outside option, i.e. $\pi_2 = 0$, while the efficient agency is given just enough utility to prevent it from claiming that it is inefficient, i.e. $\pi_1 = \Delta\theta q_2$. In addition, the efficient agent would (be asked to) produce her full-information level of output, q_1^o , while the inefficient agent would produce $\max\{0, B'^{-1}(\theta_2 + \frac{s}{1-s}\Delta\theta)\}$ which is lower than her full-information level of output q_2^o . The high-cost agent's output strikes a balance between distorting downwards its production and reducing the low-cost agent's information rents.³² Notice also that here the power of incentives, i.e. the reward from reporting truthfully that productivity is high, is $\pi_1 - \pi_2 = \Delta\theta q_2$. This solution to the principal's problem pre-supposes that the agency is not shut down. We assume, hereafter, that a profit-maximising entity is never shut-down.³³

If there was no administrative constraint and $a > 0$ the problem would be equivalent to the textbook model of adverse selection, after treating $(1+a)B(q) \equiv S(q)$ as the principal's gross surplus and defining with $U_i \equiv \pi_i + aB(q_i)$ the agent's utility. To see this, observe that in the absence of an administrative constraint the incentive-compatibility constraints would be, $U_j \geq U_k + (\theta_k - \theta_j)q_k$, $k, j, 1, 2, k \neq j$, and the participation constraints $U_i \geq 0$, would, instead of the limited-liability constraints, be relevant. Note also that under feasible self-financing, the full-information production levels are given by $S'^{-1}(\theta_i; a) \equiv B'^{-1}(\theta_i/(1+a))$, $i = 1, 2$. Solving for the optimal contract under asymmetric information we would thus have that the inefficient agency attains utility equal to that under its outside option, i.e. $U_2 = 0$, while the efficient agency is given just enough utility to prevent it from claiming that it is inefficient, i.e. $U_1 = \Delta\theta q_2$. In addition, the more productive agent would produce her full-information level of output, $S'^{-1}(\theta_1; a)$, while the less productive agent would produce $\max\{0, S'^{-1}(\theta_2 + \frac{s}{1-s}\Delta\theta; a)\}$ which is lower than her full-information level of output. Furthermore, output would

³²See, for instance, Laffont and Martimort (2002) Ch. 2 for more details.

³³In general, if s is high enough shut-down may be optimal. If a shut-down policy was optimal then the principal would offer the contract $t_2 = q_2 = 0$ and $t_1 = \theta_1 q_1$ and $q_1 = q_1^o$. Thus, only the high-productive agent would operate, and incentives would be 'flat', i.e. $\pi_1 - \pi_2 = 0$.

be increasing with the not-for-profit motive, regardless of productivity. Again, the output of the less productive agent strikes a balance between distorting downwards the high-cost agency's output and reducing the more productive agent's *utility* rents $\Delta\theta q_2$.

Finally, if the administrative constraint was present, but the agent was maximising profits ($a = 0$) then the model would effectively be identical to the canonical paradigm. The reason is very simple: with no output-motivation, i.e. $a = 0$, feasibility of mis-reporting only relaxes the inefficient producer's incentive-compatibility constraint (vis-a-vis the canonical model) which is anyway redundant in designing the optimal contract. To see this note that if $a = 0$ and we ignore the low-productivity incentive-compatibility constraint, then the resulting contract is the one under the canonical model. So, $q_2 = \max\{0, B'^{-1}(\theta_2 + \frac{s}{1-s}\Delta\theta)\} < q_1^o = q_1$. But, then, mis-reporting by the high-cost agent is neither beneficial nor feasible for the high-cost agent. The former follows from $\pi_1 - \pi_2 = \Delta\theta q_2 < \Delta\theta q_1$, while the latter follows from $\pi_1 = \Delta\theta q_2 < \Delta\theta q_1$. So, the administrative constraint has no bite when the agent is not output-motivated.

Accordingly, if an agent is *not both* output-motivated agent *and* faced with an administrative constraint, the optimal contract, when an agency is set up regardless of its productivity, is such that the less productive agency under-produces while the more productive agent produces its full-information output. Also, the less productive agent is indifferent between accepting the contract and taking up her outside option, while the more productive agent's welfare gain from accepting the contract instead of taking up her outside option is equal to $\Delta\theta q_2$. In addition, if the agent is mission-motivated and there is no administrative constraint then output increases with output-motivation, regardless of productivity.

We turn to the derivation of the optimal contract when the agent is both output-motivated and wealth-constrained.

4 The Optimal Agency

Using the definition of information rents π_i , $i = 1, 2$, to eliminate t_i from the principal's problem, we have that the optimal contract in terms of output and agent's rents $\{\pi_i, q_i\}_{i \in \{1, 2\}}$ satisfies $q_i \geq 0$, $i = 1, 2$, the incentive-compatibility constraints

$$\pi_1 \geq \pi_2 + \Delta\theta q_2 - a[B(q_1) - B(q_2)], \quad (9)$$

$$\pi_2 \geq \pi_1 - \Delta\theta q_1 + a[B(q_1) - B(q_2)] \text{ when } \pi_1 \geq \Delta\theta q_1, \quad (10)$$

the limited-liability constraints

$$\pi_1 \geq 0, \quad (11)$$

$$\pi_2 \geq 0, \quad (12)$$

and maximises

$$s[B(q_1) - (\pi_1 + \theta_1 q_1)] + (1 - s)[B(q_2) - (\pi_2 + \theta_2 q_2)]. \quad (13)$$

In what follows, let us denote with $(\pi_i^*(a), q_i^*(a))$, $i = 1, 2$, the optimal contract offered to the agency, given the utility parameter a .³⁴

Compared to the problem when the agent is a profit-maximising entity and there is no administrative constraint, we have that the minimum information rents that ensure participation are still equal to zero (see (2) with $a = 0$). Nevertheless, our problem here is not a standard adverse selection problem. The reason is twofold. First, due to the administrative constraint, the producer is, in effect, wealth-constrained, and thereby the high-cost incentive-compatibility constraint is less stringent, all other things equal, in the sense that if $\pi_1 < \Delta\theta q_1$ then the high-cost agent cannot under-report her costs.³⁵ Second, conditional on mis-reporting costs being feasible, i.e. $\pi_1 \geq \Delta\theta q_1$, and $q_1 > q_2$, mission-motivation, i.e. $a > 0$, makes under-reporting costs more attractive and, crucially for our purposes, over-reporting costs less attractive. That is, the low-cost (resp. high-cost) incentive-compatibility constraint is relaxed (resp. becomes more stringent). In fact, these effects are stronger the higher is the mission-motivation. This is a direct consequence of the fact that for any given information rents the agent values output directly by $aB(q)$.

Consider now the full-information contract. Under this contract $\pi_1^o = 0 < \Delta\theta q_1^o$ and thereby the less productive agent cannot claim that she is more productive. Also, $\pi_2^o = 0$ and $q_1^o > q_2^o$. Thus, the low-cost agency has no incentive to over-report costs if $a \geq \frac{\Delta\theta q_2^o}{B(q_1^o) - B(q_2^o)} \equiv a^o > 0$, and the full-information contract can be implemented.

We thus have:

Proposition 1 (The Efficient Regime) *If $a \geq a^o$ we have that $q_i^*(a) = q_i^o$ and $t_i^*(a) = \theta_i q_i^*(a)$, for any $i = 1, 2$.*

So, if the not-for-profit motive of the agent is high enough, the exchange relationship between the principal and the output-provider will be efficient, even if the productivity of the

³⁴We suppress the obvious dependence of the optimal contract on s .

³⁵See also, for instance, Che and Gale (2000).

agency is its private information. That is, the efficiency properties of the workings of the agency are not compromised.

Turn now to the case of $a < a^\circ$. In this case, the output-motivation of the agent is sufficiently low so that the incentive to over-report costs, in order to achieve an increase in profits by $\Delta\theta q_2^o$, dominates the incentive to produce a high level of output due to mission motivation. Clearly, then the optimal contract $\{\pi_i^*(a), q_i^*(a)\}_{i \in \{1,2\}}$ will differ from the full-information contract.

Recall our assumption from Section 3 that a profit-maximising agency would never be shut-down. This implies that the agency is set up regardless of its mission-motivation and regardless of its cost-type.³⁶ In presenting the corresponding optimum mechanism it will prove useful to employ the following definitions:

$$\begin{aligned} \hat{q}_i(a), \text{ for any } i &= 1, 2, \text{ are defined by} \\ B'(\hat{q}_1(a)) &= \theta_1/(1+a) \text{ and} \\ \hat{q}_2(a) &= \arg \max_{q \geq 0} \{[1 - s(1+a)]B(q) - \theta_2 q[1 - s + s \frac{\Delta\theta}{\theta_2}]\}, \end{aligned} \tag{14}$$

$$\begin{aligned} \bar{q}_i(a) &> 0, \text{ for any } i = 1, 2, \text{ are defined by the solution of the system} \\ \frac{aB'(\bar{q}_1(a))}{aB'(\bar{q}_2(a)) + \Delta\theta} &= -\frac{s[B'(\bar{q}_1(a)) - \theta_1]}{(1-s)[B'(\bar{q}_2(a)) - \theta_2]} \text{ and} \\ aB(\bar{q}_2(a)) + \Delta\theta\bar{q}_2(a) &= aB(\bar{q}_1(a)) \end{aligned} \tag{15}$$

It turns out that when we examine the optimal mechanism we can ignore the incentive-compatibility constraint for the high-cost agency (10). As in the typical model, this constraint is satisfied ex post. We can also ignore the constraint $q_1(a) \geq 0$. In addition, we have that the low-cost agency's incentive compatibility constraint is binding. Also binding is the high-cost agent's limited-liability constraint.³⁷ Thus the optimal contract is given by $\{\pi_i^N(a), q_i^N(a)\}_{i \in \{1,2\}}$ with $\pi_2^N(a) = 0$, $\pi_1^N(a) = \pi_2^N(a) - a[B(q_1^N) - B(q_2^N)] + \Delta\theta q_2^N(a)$, and $q_i^N(a)$, for any $i = 1, 2$, maximising

³⁶A straightforward application of the envelope theorem, implies that, as it was expected, under no shut-down higher motivation is always beneficial for the principal if $a < a^\circ$. Also, if the high-cost agency is shut down the low-cost agent is efficient and hence the principal's payoff is, crucially, independent of the agent's motivation. Moreover, as we will see shortly, as $a \rightarrow 0$ the optimal no shut-down contract approximates the corresponding contract under $a = 0$. These observations imply, directly, that if a profit-maximising agency operates regardless of its productivity, so is an intrinsically motivated agent.

³⁷See Appendix A for more details.

$$s[(1+a)B(q_1) - (aB(q_2) + \Delta\theta q_2 + \theta_1 q_1)] + (1-s)[B(q_2) - \theta_2 q_2] \quad (16)$$

subject to

$$\begin{aligned} q_2 &\geq 0 \text{ and} \\ aB(q_2) + \Delta\theta q_2 &\geq aB(q_1). \end{aligned}$$

Note that the latter constraint is nothing else but the limited-liability constraint for the low-cost agency, when (a) this agency is indifferent between the contract designed for it and the contract designed for the high-cost agent, and (b) the high-cost agency's limited-liability constraint is binding. It follows that production under this scheme is given by³⁸

$$q_i^N(a) = \hat{q}_i(a) > 0, \text{ for any } i = 1, 2, \text{ if } aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) \geq aB(\hat{q}_1(a)) \quad (17)$$

or

$$q_i^N(a) = \bar{q}_i(a), \text{ for any } i = 1, 2, \text{ if } aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) < aB(\hat{q}_1(a)). \quad (18)$$

Accordingly, at this scheme, production is strictly positive regardless of the agent's cost-type, and output is increasing with the agent's productivity, i.e. $q_1^N(a) > q_2^N(a)$.³⁹ More interestingly, output distortions occur regardless of the agent's type. In particular, we have in a straightforward manner from $a < a^o$, conditions (17) and (18) and the definitions of $\hat{q}_i(a)$ and $\bar{q}_i(a)$ $i = 1, 2$, that $0 < q_2^N(a) < q_2^o < q_1^o < q_1^N(a)$. That is, the high-cost agency under-supplies *and the low-cost agency oversupplies* the valued services. In addition, as expected, problems of excess production cost may arise. The reason is that now the low-cost agency's limited-liability constraint may be slack, i.e. the low-cost agency may enjoy information rents. This will be the case if and only if $aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) > aB(\hat{q}_1(a))$, or, after re-arranging, $a \in (0, \frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))})$. Yet, in contrast to the case when the agent is not output-motivated, the low-cost agency may also produce at minimum cost, despite the high-cost agency's output being positive. This occurs when $a \geq \frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))}$.

³⁸See Appendix B for the derivation.

³⁹Note that under this solution we have that $\pi_1^N(a) - \Delta\theta q_1^N(a) = a[B(q_2^N(a)) - B(q_1^N(a))] + \Delta\theta(q_2^N(a) - q_1^N(a)) < 0$ and $\pi_2^N(a) - \pi_1^N(a) + \Delta\theta q_1^N(a) - a[B(q_1^N(a)) - B(q_2^N(a))] = \Delta\theta(q_1^N(a) - q_2^N(a)) > 0$, and thus the high-cost agency does not find it either feasible or optimal to mis-report its cost-type.

To understand the above contract,⁴⁰ recall that if $a < a^o$ the low-cost agency, when offered the full-information contract, does have an incentive to over-report costs. As in the canonical model, then, we have that the less-productive agency is given no information rents, $\pi_2 = 0$. Also, the low-cost agent's incentive-compatibility constraint is binding and the principal distorts downwards the production of the high-cost agent to decrease the information rents of the more productive agent. But, here, due to the agent being output-motivated, information rents can *also* be reduced by distorting upwards the production of the low-cost agent. To see this, note that a binding low-cost incentive-compatibility constraint implies that $\pi_1 = \Delta\theta q_2 - a[B(q_1) - B(q_2)] \equiv \pi(q_1, q_2, a, \Delta\theta)$. So, (non-negative) information rents $\pi(q_1, q_2, a, \Delta\theta)$ are decreasing with q_1 , as well as increasing with q_2 . Thus, the principal has an incentive to decrease the output of the high-cost agent, *and* increase the output of the low-cost agent. The optimal production levels strike a balance between distortions and excessive production costs by the low-cost agency, as it is the case in the canonical model. In fact, note that problem (16), which gives the solution $q_i^N(a)$ $i = 1, 2$, can be written as $\max_{q_i \geq 0} \{s[B(q_1) - \theta_1 q_1 - \pi(q_1, q_2, a, \Delta\theta)] + (1-s)[B(q_2) - \theta_2 q_2] \text{ s.t. } \pi(q_1, q_2, a, \Delta\theta) \geq 0\}$. Finally, the fact that the principal has two (distorting) instruments may enable him to expropriate all rents, even if the high-cost agent's output is positive.

We refer to the above mechanism (irrespective of the existence of rents) as the No-Shut-Down Regime/Contract. It follows then directly that:

Proposition 2 (The Second-Best Regime) *If $a < a^o$, the second-best contract is the No-Shut-Down contract.*

To summarise our discussion so far, let us identify the following cases, depending on the strength of the intrinsic motive. First we have the efficient regime. This occurs if and only if $a \geq a^o$. In this case, the agency produces the full-information level of output at minimum cost, regardless of its productivity.

Then, we have the second-best regime. This regime occurs if and only if the not-for-profit motive is sufficiently low, $a < a^o$. Now, the low-productivity agency under-produces,

⁴⁰Taking the limit of the solution of our model as $a \rightarrow 0$ we find that our solution approximates the solution of the standard adverse selection problem. To see this define $q_i^N(0) \equiv \lim_{a \rightarrow 0} q_i^N(a)$ for any $i = 1, 2$, and observe that as $a \rightarrow 0$ we have that $a[B(\hat{q}_2(a)) - B(\hat{q}_1(a))] + \Delta\theta\hat{q}_2(a) \geq 0$. Hence note from (17) and (18) that $q_1^N(0) = q_1^o > q_2^o > q_2^N(0) = \min\{0, B'^{-1}(\theta_2 + \frac{s}{1-s}\Delta\theta)\}$. Finally, we have that the high-cost agent operates at minimum cost and the low-cost agency enjoys information rents equal to $\Delta\theta q_2^N(0)$.

while the high-productivity agency over-produces. Also, the low-productivity agency is always productively efficient, i.e. never enjoys information rents, while the high-productivity provider may or may not be productively efficient. Specifically, the production plan $\{q_1^*(a), q_2^*(a)\}$ will be such that $0 < q_2^*(a) = q_2^N(a) < q_2^o < q_1^o < q_1^*(a) = q_1^N(a)$. Also, the low-cost agent will enjoy rents if and only if the not-for-profit motive is very low (i.e. $a \in [0, \frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))})$).

Our results are in striking contrast to those of the canonical model: First, if $a \geq a^o$ then the agency operates under the full-information contract *regardless of its cost-type*. Second, if $a < a^o$, then the low-cost agency *over-produces* and it can be productively efficient *even if* the high-cost agent produces a positive level. Clearly, then, using the lessons from the canonical principal-agent model in the design of collective-goods provision may be a mis-guided reform agenda.

5 Discussion of Results

Recall that when output-motivation is sufficiently high, i.e. $a \geq a^o$, then provision of collective goods is efficient from the principal's point of view. This implies that output is independent of the intrinsic motivation. The reason is that the principal's net surplus from the provision of collective goods is independent of the agent's intrinsic motivation.

Furthermore, it is interesting to note that the above implies that if we had assumed that the polity is faced with a pool of 'experts' for the provision of public services then the (political) principal would have appointed an agency which is characterised by sufficiently high motivation, i.e. $a \geq a^o$, to ensure efficient provision of public services. Therefore, introducing competition at the supply-side of the provision of collective goods can improve the efficiency properties of the workings of an agency. This will be the case if increased competition ensures the emergence of agents with high intrinsic motivation.⁴¹

Let us turn to the case of distorted production, i.e. $a < a^o$. To get a closer look at how levels of provision depend on the not-for-profit motive, consider, first, the case of the low-cost agency enjoying information rents. Recall that in this case $q_i^N(a) = \hat{q}_i(a) > 0$, $i = 1, 2$. Clearly then a marginal increase in the not-for-profit motive will increase the low-cost agency's output,

⁴¹For related discussions on how do politicians decide which agencies to create see, for instance, McCubbins (1985), Calvert et. al. (1989) and Banks and Weingast (1992). See also Besley and Ghatak (2004) for a related discussion on the effects of competition in the provision of public services.

while it will *decrease* the *less productive* agency's production. The former results from the associated increase in 'donated labour' by the low-cost agency. The latter arises from the associated increase in the rents of the low-cost agent, which make it more beneficial for the principal to distort further downwards the less productive agent's output. That is, an increase in output-motivation increases the ability of the principal to re-allocate production towards the high-productivity agent in order to improve upon the expected net surplus from the delivery of public services, while ensuring incentive compatibility.

Let us turn our attention now to the case of the agency being productively efficient, regardless of its cost-type. In this case, the effect of higher not-for-profit motive on the output of the high-productivity agency is ambiguous. To see this in a simple manner recall first that in this case $q_i^N(a) = \bar{q}_i(a) > 0$, $i = 1, 2$, and the low-cost agent is indifferent between truth-telling and over-reporting costs. Notice then, from its definition, that the output-bundle $\{\bar{q}_i(a)\}_{i=1,2}$ can be viewed as arising from the equalisation of the marginal rate of substitution (MRS hereafter), $-\frac{s[B'(q_1)-\theta_1]}{(1-s)[B'(q_2)-\theta_2]}$, and the marginal rate of transformation (MRT hereafter), $\frac{aB'(q_1)}{aB'(q_2)+\Delta\theta}$, so that $q_1 > q_1^O$, $q_2 < q_2^O$ and $a[B(q_2) - B(q_1)] + \Delta\theta q_2 = 0$.

The MRS represents the willingness of the principal, at the margin, to re-allocate production between cost-types, given that the net surplus from the services provided by an agency of cost-type θ is $B(q) - \theta q$ and the weight on the net surplus from the low-cost (resp. high-cost) agent is s (resp. $1 - s$). Notice that the MRS is positive. Note also that a higher MRS implies that an increase in the low-cost agent's output requires an even higher increase in the high-cost agent's output to leave the principal indifferent.

The MRT represents the ability, at the margin, of the principal to re-allocate production between types, given that production takes place at minimum cost and the low-cost agent's incentive-compatibility constraint is binding. Notice that a higher MRT means that an increase in the low-cost agent's output requires an even higher increase in the high-cost agent's output to ensure zero rents and incentive compatibility for the high-productivity agent. Note also that zero output levels are always feasible for the principal.

We then have, in a straightforward manner, that a marginal increase in the intrinsic motive leaves the MRS unaffected, while it leads to an increase in the MRT. This has a positive effect on the production level of the low-productivity agent and an ambiguous effect on the production of the high-productivity agency.

Loosely speaking, the ambiguous effect on the production of the low-cost agent of a

change in the MRT is reminiscent of the conflict between the income and substitutions effects, after a change in the relative price - the consumer's MRT - in the standard leisure-consumption problem in consumer theory. In fact, if, for instance, the, appropriately defined here, substitution effect dominates the income effect we have that a marginal increase in the MRT leads to higher output-level for the high-productivity agent as well. So, in this case, a marginal increase in output-motivation leads to an increase in both production levels. If, on the other hand, the appropriately defined substitution effect is dominated by the income effect we have that a marginal increase in the MRT leads to lower output-level for the low-cost agent. So, in this case, a marginal increase in output-motivation leads to a *decrease* in the *low-cost* agency's production.

Therefore, in contrast to common belief, developing a user-orientated culture in the provision of collective goods will not necessarily increase the level of provision. Interestingly, note that this is true regardless of production costs. Our discussion here emphasises also that the qualitative effect of higher not-for-profit motivation on the production levels crucially depends on the level of a . In fact, our result that the effect of mission-motivation on output is ambiguous for sufficiently low levels of output-motivation echoes that of Glazer (2004) in a different context. Here, the principal does not contribute any real input into the production, while in Glazer (2004) the principal's and agent's inputs are substitutes and the principal can commit on the level of his input prior to the agent contributing hers.

Next, we discuss the power of incentives. The power of incentives is defined here as the difference $[t_1^*(a) - \theta_1 q_1^*(a)] - [t_2^*(a) - \theta_2 q_2^*(a)] \equiv P(a)$. Thus, the power of incentives in a mission-orientated organisation with administrative constraint is equal to $\pi_1^*(a) - \pi_2^*(a)$. So, if $a \geq a^o$ we have that $P(a) = 0$, while if $a < a^o$ then the power of incentives is $P(a) = \Delta\theta q_2^N(a) - a[B(q_1^N(a)) - B(q_2^N(a))]$. Recall that $q_1^N(a) > q_1^o > q_2^o > q_2^N(a)$ and $a[B(q_1^N(a)) - B(q_2^N(a))] \leq \Delta\theta q_2^N(a)$. Clearly, then, the power of incentives under the full-information contract is (weakly) lower than that under the No-Shut-Down contract. In fact, notice that if $a < a^o$ then $P(a) = \pi(q_1^N(a), q_2^N(a), a, \Delta\theta)$. That is, the power of incentives coincides with the size of rents given to the high-productivity agent. Thus, if $a \in (0, \frac{\Delta\theta \hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))})$, incentives are not 'flat'. Yet, within this range, the power of incentives and mission-motivation are substitutes, i.e. $P' < 0$. To see this, recall that if $a \in (0, \frac{\Delta\theta \hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))})$ then $q_i = \hat{q}_i(a)$, $i = 1, 2$, $\pi(q_1, q_2, a, \Delta\theta) = \Delta\theta q_2 - a[B(q_1) - B(q_2)]$ and $\hat{q}_1'(a) > 0$, $\hat{q}_2'(a) < 0$. It follows that the power of incentives here is lower than that in a profit-maximising agency, i.e. than

$P(0)$. This is consistent with Besley and Ghatak (2004) and Francois (2000,2003,2004). Recall, however, that if $a \in [\frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a))-B(\hat{q}_2(a))}, a^o)$ then rents are zero. So, here, for intermediate levels of output-motivation, incentives are ‘flat’, despite the fact that the full-information outcome is not implementable.

These results complement the existing explanations, outlined in the Introduction, of why incentives in the public sector may be of low power. The policy implications of these observations are clear. Namely, introducing high-powered incentives in the provision of public services and other collective goods, simply because such incentives seem to work well in the profit-maximising sector, may not be the best of practices.

Another way to put this is to note that $\max_{\{q_i \geq 0\}_{i=1,2}} \{s[B(q_1) - \theta_1 q_1 - \pi(q_1, q_2, a, \Delta\theta)] + (1-s)[B(q_2) - \theta_2 q_2] \text{ s.t. } \pi(q_1, q_2, a, \Delta\theta) \geq 0\}$, i.e. the expected *net surplus* (on the part of the principal) from the provision of public services, is either negatively correlated or independent of the power of incentives for sufficiently low motivation, i.e. $a < a^o$. To see this note first that a straightforward application of the envelope theorem tells us that the expected net surplus is increasing if $a < a^o$. Second, recall from the above discussion that the power of incentives is decreasing with output-motivation if $a \in (0, \frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a))-B(\hat{q}_2(a))})$, while incentives are flat if $a \in [\frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a))-B(\hat{q}_2(a))}, a^o)$. This result is similar to the relationship between incentives and the agent’s expected *productivity* emphasised in Besley and Ghatak (2004).

We leave this Section by commenting upon the choice of missions in the provision of collective goods. Recall that the principal’s net surplus depends on the agent’s motivation, as the latter reduces the information rents on the part of the agent that are necessary for the agent to perform well, i.e. $P'(a) \leq 0$. This implies that the choice, for instance, of a school’s curriculum will affect the *net expected returns from education*. In fact, in terms of our model, the net surplus is increasing in the agent’s output-motivation if $a < a^o$. This implies that, during a reform in the provision of collective goods, care must be taken so that agents do not become demotivated in the event of a change in the organisation’s mission - that is, so that, in terms of our model, a does not decrease. This is particularly important for nonprofit organisations that often accept donations which are conditional on the organisation’s mission. It is also relevant for government-funded organisations, as, in this case, the government may attempt to influence the organisation’s mission to bring it closer to the preferences of the electorate. These observations echo similar observations vis-a-vis an agency’s expected productivity in Besley and Ghatak (2004).

Note now that an agent's net surplus from the provision of collective goods will also depend on the organisations mission. In terms of our model, if $a < a^o$, then, at optimum, the high-productivity agent's net surplus is $aB(q_1^*(a)) + P(a)$, while the low-productivity agent's net surplus is $aB(q_2^*(a))$. Thus an agent's surplus depends on her not-for-profit motive both directly and indirectly, through production and information rents. Recall from our discussion above that if $a \in (0, \frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))})$ then $P(a) > 0$ with $P'(a) < 0$ and $q_2^{*'}(a) < 0$. Also, if $a \in [\frac{\Delta\theta\hat{q}_2(a)}{B(\hat{q}_1(a)) - B(\hat{q}_2(a))}, a^o]$ then $P(a) = 0$ and $q_1^{*'}(a)$ is ambiguous. So, the agent's net surplus can be decreasing with output-motivation, regardless of her productivity. In fact, this will be the case if (a) output is decreasing with intrinsic motivation and/or incentives are not flat, and (b) the corresponding negative welfare effects dominate the direct positive welfare effect of mission-motivation.⁴² This potential conflict of interest over the organisation's mission (like a school's curriculum) between the principal (like a school's board of governors) and the agent (like a school's teachers) raises additional problems in the choice of the mission. Namely, changing an organisation's mission may meet the opposition of the agency; that is, output-motivation on the part of agents may lead to conservatism. This is of particular importance for public bureaucracies, where the political principal - who may have her/his own views about the agency's goal or mission - is chosen by an electoral process. It may also explain why public bureaucracies are often accused of resisting innovation. Finally, this potential conflict of interest implies that empowering parents to intervene in schools' teaching methods and curriculums and enabling patients to intervene in the provision of health services may meet the opposition of education and health providers.⁴³

6 Conclusions

We have investigated a non-standard principal-agent model, which we believe can be used to study government and other mission-orientated organisations. We have postulated that the relationship is hindered by an administrative constraint which requires budget appropriations to cover monetary production costs, and that the agent is intrinsically motivated in that the

⁴²Note that if $a \geq a^o$ then the principal's surplus is independent of a , while the agent's welfare $aB(q^o)$ is increasing with her intrinsic motivation. So, in this range, increasing intrinsic motivation does not create a conflict of interest.

⁴³See Besley and Ghatak (2004) for a related discussion.

agent values balanced-budget increases in output. The agency under investigation is thought of as the side with the monopoly of information about aspects of production.

In this paper we have assumed that the agent does not have an outside option. Nevertheless, our results are valid if the derived utility from this option is not too high. An interesting exercise would be to investigate the robustness of our results to the introduction of a highly valuable outside option for the agency.

Moreover, we have assumed that the only source of asymmetric information is the agent's productivity. In reality, however, the fixed cost could also be private information of the bureau. In such an environment the principal will be faced with bidimensional asymmetric information. This would also be the case if the extent of the non-profit motivation was as well private knowledge of the agency. The investigation of the optimal design of the agency in the presence of multidimensional asymmetric information is a very interesting and challenging topic and is left for future research.⁴⁴

In our model, the administrative constraint is present and the agent values output over and above any monetary income she receives in the process. As we have seen the emerged results differ significantly from the ones of the problems where the agent is either intrinsically-motivated or wealth-constrained but not both. This leads us to conjecture that investigating further the case where the agent is both wealth-constrained and mission-motivated is worthwhile both from a theoretical point of view and for the deeper understanding of the operation of government and other nonprofit organisations. So, for instance, one could investigate the case of a continuum of types, the case of informed principal, the case of repeated interactions, the presence of career concerns, the case of team-production, the case of common agency and the case of moral hazard for given productivity. These tasks are left for future research.

⁴⁴For some related issues involved in multidimensional mechanism design see, for instance, Armstrong (1996) and Rochet and Chone (1998).

7 Appendices

7.1 Appendix A

Ignoring $q_1 \geq 0$, (10) the first order conditions (for the derivation of the optimal revelation mechanism) with respect to π_2 , π_1 , q_1 and q_2 are, respectively,

$$\mu_2 = \lambda_1 + 1 - s \quad (19)$$

$$\lambda_1 = s - \mu_1 \quad (20)$$

$$s[B'(q_1) - \theta_1] = -\lambda_1 a B'(q_1) \quad (21)$$

$$(1 - s)[B'(q_2) - \theta_2] + v = \lambda_1[\Delta\theta + aB'(q_2)], \quad (22)$$

where μ_1 is the Kuhn-Tucker multiplier of the low-cost agency's limited-liability constraint, μ_2 is the Kuhn-Tucker multiplier of the high-cost agency's limited-liability constraint, λ_1 is the the Kuhn-Tucker multiplier of the low-cost agency's incentive-compatibility constraint, and v is the Kuhn-Tucker multiplier of the high-cost agency's output non-negativity constraint. Moreover, we have the following complementary-slackness conditions

$$\mu_1 \geq 0, \pi_1 \geq 0, \mu_1 \pi_1 = 0, \quad (23)$$

$$\mu_2 \geq 0, \pi_2 \geq 0, \mu_2 \pi_2 = 0, \quad (24)$$

$$\lambda_1 \geq 0, \pi_1 - \pi_2 + a[B(q_1) - B(q_2)] - \Delta\theta q_2 \geq 0, \quad (25)$$

$$\lambda_1[\pi_1 - \pi_2 + a[B(q_1) - B(q_2)] - \Delta\theta q_2] = 0 \quad (26)$$

$$v \geq 0, q_2 \geq 0, v q_2 = 0. \quad (27)$$

First, note that $\mu_2 > 0$ and thus $\pi_2 = 0$. Second note that if $\lambda_1 = 0$ then the above conditions imply that $\mu_1 = s > 0$, $\pi_1 = 0$ and $q_i = q_i^o$ for any $i = 1, 2$, which violate $\pi_1 - \pi_2 + a[B(q_1) - B(q_2)] - \Delta\theta q_2 \geq 0$ given that $a < a^o$.

Therefore, $\lambda_1 > 0$ and $\pi_1 - \pi_2 + a[B(q_1) - B(q_2)] = \Delta\theta q_2$. This condition and $\pi_2 = 0$ imply that $\pi_1 \geq 0$ can be re-written as $aB(q_2) + \Delta\theta q_2 \geq aB(q_1)$. Note also that after eliminating μ_2 and λ_1 from the first order conditions with respect to q_1 and q_2 we have that the latter become, respectively,

$$s[(1 + a)B'(q_1) - \theta_1] = \mu_1 a B'(q_1) \quad (28)$$

$$(1 - s)[B'(q_2) - \theta_2] + v = [s - \mu_1][\Delta\theta + aB'(q_2)], \quad (29)$$

Clearly, these are the necessary conditions of problem (16) in the main text.

7.2 Appendix B

Consider the problem (16) in the main text:

$$\max_{q_1, q_2} s[(1+a)B(q_1) - (aB(q_2) + \Delta\theta q_2 + \theta_1 q_1)] + (1-s)[B(q_2) - \theta_2 q_2] \quad (30)$$

subject to

$$q_2 \geq 0 \text{ and} \quad (31)$$

$$aB(q_2) + \Delta\theta q_2 \geq aB(q_1). \quad (32)$$

Denote the solution with $q_i^N(a)$, $i = 1, 2$. If $aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) \geq aB(\hat{q}_1(a))$ then the unconstrained solution $\hat{q}_i(a)$, $i = 1, 2$, satisfies all the constraints, that can therefore be ignored. The unconstrained maximum has strictly positive output levels. That is, $q_i^N(a) = \hat{q}_i(a) > 0$, with the inequality following from $\hat{q}_1(a) > q_1^o(a) > 0$ and $aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) \geq aB(\hat{q}_1(a)) > 0$. Note also that $\hat{q}_1(a) > q_1^o(a) > q_2^o(a) > \hat{q}_2(a)$. The latter follows from $1-s+s\frac{\Delta\theta}{\theta_2} > 1-s-sa$.

Suppose now that the unconstrained maximum is not feasible. It follows then that the second constraint is binding. To see this note first that the first order conditions with respect to q_1 and q_2 are

$$s[(1+a)B'(q_1) - \theta_1] = \mu_1 aB'(q_1) \quad (33)$$

$$(1-s)[B'(q_2) - \theta_2 - \frac{s[aB'(q_2) + \Delta\theta]}{1-s}] + \mu_1[aB'(q_2) + \Delta\theta] + v = 0, \quad (34)$$

where v and μ_1 are the Kuhn-Tucker multipliers of the above constraints, respectively. If $\mu_1 = 0$ the above conditions imply that $q_i = \hat{q}_i(a)$ for any $i = 1, 2$. Given $aB(\hat{q}_2(a)) + \Delta\theta\hat{q}_2(a) < aB(\hat{q}_1(a))$ the second constraint is violated. Hence, $\mu_1 > 0$. Eliminating μ_1 from the above conditions we then have after some trivial re-arrangement of terms that $\frac{aB'(q_1)}{aB'(q_2) + \Delta\theta} = -\frac{s[B'(q_1) - \theta_1]}{(1-s)[B'(q_2) - \theta_2] + v}$ and $\mu_1 = \frac{s[(1+a)B'(q_1) - \theta_1]}{aB'(q_1)} > 0$. The latter implies that $q_1^N(a) < \hat{q}_1(a)$. Moreover, the former condition implies, in conjunction with $B'(0) > \theta_2$, that if $q_2 = 0$ then $q_1 > q_1^o$. But $0 < aB(q_1^o)$ and so the condition $aB(q_2) + \Delta\theta q_2 \geq aB(q_1)$ is violated when $q_2 = 0$. Thus $q_2 > 0$ and $v = 0$. The fact that $\mu_1 > 0$, and hence $aB(q_2) + \Delta\theta q_2 = aB(q_1)$, in conjunction with $q_2 > 0$, implies that $q_1 > 0$. So, $q_i^N(a) = \bar{q}_i(a)$. Notice now that due to $a < a^o$, $q_1^o > q_2^o > 0$ and the properties of B , we have that $\bar{q}_1(a) > q_1^o(a) > q_2^o(a) > \bar{q}_2(a) > 0$.

7.3 Appendix C

This appendix is available upon request. Here, it is enclosed for the use of the editor and the referees.

In this Appendix we show that our results are qualitatively robust for a large range of parameters of a moral hazard and a ‘hybrid’ environment where both adverse selection and moral hazard are present.

Specifically, assume that the actual marginal cost of production depends in a stochastic manner on the effort exerted by the agent after she accepts the contract and prior to production taking place. In more detail, the model here is as in the main text with the only difference that probability s becomes endogenous to the agent’s effort e : $s(e) = \Pr(\theta = \theta_1 \mid e)$.

Assume also that effort can take two values, $e \in \{0, 1\}$, with $s \equiv s(1) > s_o \equiv s(0)$: high effort makes it more likely that the agent will be more productive. Let $\Delta s \equiv s - s_o$. Assume also that effort is costly: exerting effort, i.e. $e = 1$, costs ψ in terms of utility. Let ψ be common knowledge.

Note also that here it is the ex ante participation constraint, $s(e)[aB(q_1) - t_1 - \theta_1 q_1] + (1 - s(e))[aB(q_2) - t_2 - \theta_2 q_2] \geq \psi(e)$, which is relevant, where $\psi(e)$ is the cost of effort with $\psi(0) = 0$ and $\psi(1) = \psi$.

Let us assume hereafter that $a[sB(q_1^o) + (1 - s)B(q_2^o)] \geq \psi$. That is, the cost from effort is sufficiently small (or intrinsic motivation is sufficiently high) to ensure that the expected non-pecuniary benefits outweigh the utility cost from exerting effort for an output-motivated agent under an employment contract that implied efficient provision of collective goods at minimum costs.

Define with $W_i^o \equiv B(q_i^o) - \theta_i q_i^o$, $i = 1, 2$, and with $\Delta W^o \equiv W_1^o - W_2^o$. $\Delta s \Delta W^o$ is the net expected gain on the part of the principal, under efficient provision of collective services at minimum costs, from the agent exerting effort *and* the principal being able to verify the marginal cost of production. Assume hereafter that $\Delta s \Delta W^o \geq \psi - \Delta s a[B(q_1^o) - B(q_2^o)]$: the net expected gain on the part of the principal is not lower than the corresponding *net of donated labour* cost on the part of the agent.

Let us also assume that $\frac{\psi}{\Delta s} \leq \Delta \theta q_1^o$: the agent’s disutility from exerting effort is not very high. This assumption ensures that, under both moral hazard and adverse selection, a profit-orientated agent who does not face any constraints in mis-reporting her productivity will, at optimum, face “regular” incentives. Specifically, this assumption ensures that the high-productivity agent will not be asked to produce above the full-information level, and the

low-productivity agent will not be given information rents.⁴⁵ Recall also, from our discussion in the Introduction, that our aim in this paper is to compare the “regular” incentives predicted by the standard model, and advocated by many to be used in the public sector, with the incentives under mission-motivation and administrative constraint.

Under these conditions we have that the results of our basic model extend to an environment where moral hazard is (also) a problem.

7.3.1 The Moral Hazard Model

Assume here that the marginal cost of production can be independently verified by the principal. The principal is then faced with the problem of inducing effort. Here, payments and production can be state-contingent without the need for truth-telling by the agent. Also, the administrative constraint reduces to the limited-liability constraint, used also, for instance, in Besley and Ghatak (2004). So, the net transfer/wage, $t_i - \theta_i q_i$, to the agent is non-negative.

This version of our model is, in effect, a generalisation of the simple moral hazard problem presented in Laffont and Martimort (2002) for the presence of an administrative constraint and the agent being output-motivated.⁴⁶ To proceed, define $U_i \equiv aB(q_i) + t_i - \theta_i q_i$, and use this to eliminate t_i from the principal’s problem. We have that the optimal contract in terms of output and agent’s utility $\{U_i, q_i\}_{i \in \{1,2\}}$ satisfy $q_i \geq 0$, $i = 1, 2$, $e \in \{0, 1\}$, the limited-liability constraints

$$U_1 \geq aB(q_1), \quad (35)$$

$$U_2 \geq aB(q_2), \quad (36)$$

the effort incentive-compatibility constraint

$$U_1 \geq U_2 + \frac{\psi}{\Delta s} \text{ if } e = 1, \quad (37)$$

$$U_1 \leq U_2 + \frac{\psi}{\Delta s} \text{ if } e = 0, \quad (38)$$

the participation constraint

$$s(e)U_1 + (1 - s(e))U_2 \geq \psi(e) \quad (39)$$

⁴⁵See Laffont and Martimort (2002) Ch. 7.2.

⁴⁶To see this let the stochastic outcome of the agent’s effort be the marginal cost θ , the state-dependent benefit on the part of the principal be $B(q_i^o) - \theta_i q_i^o$, $i = 1, 2$, and recall that $B(q_i^o) - \theta_i q_i^o$ is increasing in i .

and maximise

$$s(e)[(1+a)B(q_1) - (U_1 + \theta_1 q_1)] + (1-s(e))[(1+a)B(q_2) - (U_2 + \theta_2 q_2)]. \quad (40)$$

In what follows, let us denote with $(U_i^M(a), q_i^M(a))$, $i = 1, 2$, the optimal contract offered to the agency, given the utility parameter a .

Consider first the full information contract. If the principal is not incumbered by asymmetric information, he tries to minimise monetary production costs for given effort and resulting productivity on the part of the agent. Note that minimum production costs, for given productivity, i.e. $t_i = \theta_i q_i$ for any i , imply, given the presence of intrinsic motivation, that the participation constraint is satisfied regardless of the effort exerted. This follows directly from $\psi(0) = 0$, $U_i \geq aB(q_i) \geq 0$ for any i , and our assumption that $a[sB(q_1^o) + (1-s)B(q_2^o)] \geq \psi$. It follows that monetary production costs are minimised, given the presence of the limited-liability constraints, when $t_i = \theta_i q_i$ for any i . The principal then will demand from the agent to exert the level of effort and produce ex post the levels of output that maximise $s(e)[B(q_1) - \theta_1 q_1] + (1-s(e))[B(q_2) - \theta_2 q_2]$. Given our assumption that $\Delta s \Delta W^o \geq \psi - \Delta s a[B(q_1^o) - B(q_2^o)]$, we thus have that $e^o = 1$ and $q_i = q_i^o$.

Suppose now that effort is the agent's private information. Assume for expositional simplicity that the principal wants to implement full effort. This implies that the principal has to ensure (37). Notice now that the agent's participation constraint here is $sU_1 + (1-s)U_2 \geq \psi$. Observe then that due to the limited-liability constraint $U_2 \geq aB(q_2)$, the effort-incentive-compatibility constraint (37) and $\frac{s}{\Delta s} > 1$, we have that the participation constraint is always satisfied.

The optimal contract when adverse selection is not a concern, $\{U_i^M(a), q_i^M(a)\}_{i=1,2}$, is then given by maximising

$$s[(1+a)B(q_1) - \theta_1 q_1 - U_1] + (1-s)[(1+a)B(q_2) - \theta_2 q_2 - U_2] \quad (41)$$

subject to $q_2 \geq 0$, (35), (36) and (37), with the optimal solution turning out to be such that $q_1^M(a) > 0$.

Obviously, since transfers to the agent are costly for the principal, we have that the high-cost limited-liability constraint, (36), is binding. That is, $U_2^M(a) = aB(q_2^M(a))$: the high-cost agency is given zero rents. Consider now the case of $a \geq a^M \equiv \frac{\psi}{[B(q_1^o) - B(q_2^o)]}$ (i.e. $w^M = 0$). In this case, the full-information outcome $\{t_i = \theta_i q_i^o, q_i = q_i^o, e = 1\}_{i=1,2}$ can be implemented. This echoes the result of the baseline model, where moral hazard is not a concern, when $a \geq a^o$.

If, however, $a < a^M$, this outcome violates the effort-incentive-compatibility constraint. It follows, in a straightforward manner, then that (37) is also binding, i.e. $U_1^M(a) = aB(q_2^M(a)) + \frac{\psi}{\Delta s}$. Furthermore, the optimal production-bundle is given by the solution of the problem

$$\begin{aligned} \max_{q_1, q_2} \{ & s[(1+a)B(q_1) - \theta_1 q_1 - aB(q_2) - \frac{\psi}{\Delta s}] + (1-s)[B(q_2) - \theta_2 q_2] \} \\ \text{s.t. } & q_2 \geq 0 \text{ and } aB(q_2) + \frac{\psi}{\Delta s} \geq aB(q_1). \end{aligned} \quad (42)$$

Clearly, due to $0 < a < a^M$, $B'^{-1}(\frac{\theta_1}{1+a}) > q_1^o > q_2^o > 0$ and $\arg \max_{q \geq 0} \{(1-s(1+a))B(q) - (1-s)\theta_2\} < q_2^o$, we have, in a similar manner to the one in Appendix 2, that $0 \leq q_2^M(a) < q_2^o < q_1^o < q_1^M(a)$. That is, both production levels are distorted with the high-productivity (resp. low-productivity) agent over-producing (resp. under-producing). Also, it can be the case that the low-cost agency operates under minimum monetary costs of production, even if the high-cost does produce. This will be the case if $q_2^M(a) > 0$ and $aB(q_2^M(a)) + \frac{\psi}{\Delta s} = aB(q_1^M(a))$.⁴⁷ These echo the results of the baseline model, where moral hazard is not a concern, when $a < a^o$.

In passing, notice that the power of incentives here is zero if $a \geq a^M$ while it is equal to $\frac{\psi}{\Delta s} - a[B(q_1^M(a)) - B(q_2^M(a))]$ if $a < a^M$. Thus, as in Besley and Ghatak (2004), the power of incentives is lower in nonprofit organisations (where $a > 0$). We now turn to the case where both moral hazard and adverse selection hinder the relationship.

7.3.2 The Hybrid Model

Assume here that the marginal cost of production can only be verified by the agent, and that effort is the agent's private information. The principal is then faced with the problem of inducing effort and eliciting the correct information by the agent. Assume also, again, that the principal wants to implement full effort. Assume also, to simplify exposition, that a shut-down policy is not optimal. This version of our model is, in effect, a generalisation of the hybrid model in Laffont and Martimort (2002) for the presence of an administrative constraint **and** the agent being output-motivated.

We have that the optimal contract in terms of output and agent's utility $\{U_i, q_i\}_{i \in \{1,2\}}$

⁴⁷Here, we also derive the additional result that the low-cost agency may be given rents even if the high-cost agency does not produce! This will be the case if $q_1^M(a) = B'^{-1}(\frac{\theta_1}{1+a}) < \frac{\psi}{\Delta s}$, and $\arg \max_{q \geq 0} \{(1-s(1+a))B(q) - (1-s)\theta_2\} = 0$. Notice also that if $a = 0$ then $q_i^M(0) = q_i^o$: a profit-maximising agent would produce the full-information output levels.

satisfy $q_i \geq 0$, $i = 1, 2$, $e \in \{0, 1\}$, the truth-telling incentive-compatibility constraints

$$U_1 \geq U_2 + \Delta\theta q_2, \quad (43)$$

$$U_2 \geq U_1 - \Delta\theta q_1 \text{ when } U_1 \geq aB(q_1) + \Delta\theta q_1, \quad (44)$$

the limited-liability constraints (35), (36), the effort incentive-compatibility constraint (37), the participation constraint (39), and maximise (40). Call this problem A. In what follows, let us denote with $(U_i^*(a), q_i^*(a))$, $i = 1, 2$, the optimal contract offered to the agency, given the utility parameter a .

Consider first the full-information contract. This is the same with the one found above. So, if the principal was not incumbered by asymmetric information vis-a-vis effort and agent's after-effort productivity, he would offer the contract $t_i = \theta_i q_i$, $q_i = q_i^o$, for any i , and $e = 1$.

Turn now to the case of asymmetric information. We have the following cases:

7.3.3 The Full-Information Case

This case is relevant if $a \geq a^o$ and $a \geq a^M$. Here, the full-information outcome $\{t_i = \theta_i q_i^o, q_i = q_i^o, e = 1\}_{i=1,2}$ can again be implemented, even under both moral hazard and adverse selection hindering the principal-agent relationship. The reason is that the full-information outcome satisfies the incentive-compatibility constraints (43), (44) and (37), and hence they can be ignored when solving problem A. This result is in contrast to Laffont and Martimort (2002) Ch.7.2, where $a = 0$ and the full-information outcome is not implementable.

7.3.4 The Adverse Selection Case

This case is relevant if $a < a^o$ and the 'pure adverse selection' contract $\{U_i^N(a), q_i^N(a)\}_{i=1,2}$ is consistent with effort being exerted, i.e. $\frac{\psi}{\Delta s \Delta \theta} \leq q_2^N(a)$. When the latter condition holds, the effort-incentive-compatibility constraint (??) and the high-cost agent's truth-telling incentive-compatibility constraint (44) can be ignored when solving problem A. Thus, the 'pure adverse selection' contract $\{U_i^N(a), q_i^N(a)\}_{i=1,2}$ is optimal. Again, the characteristics of this contracts are in contrast to those in Laffont and Martimort (2002) Ch. 7.2.

7.3.5 The Moral Hazard Case

This case is relevant if $a < a^M$ and $\frac{\psi}{\Delta s \Delta \theta} \geq q_2^M(a)$. When these conditions hold, the truth-telling incentive-compatibility constraints (43) and (44) can be ignored when solving problem

A. Thus, the ‘pure moral hazard’ contract $\{U_i^M(a), q_i^M(a)\}_{i=1,2}$ is optimal. Notice that here the high-cost agency cannot mis-report her cost-type. To see this recall out assumption that $\frac{\psi}{\Delta s \Delta \theta} \leq q_1^o$. Then, due also to $q_2^M(a) < q_1^M(a)$ and $q_1^M(a) > q_1^o$, we have that $aB(q_2^M(a)) + \frac{\psi}{\Delta s} < aB(q_1^M(a)) + \Delta \theta q_1^M(a)$.

Notice that, in contrast to Laffont and Martimort (2002) Ch. 7.2, here output distortions take place regardless of productivity, with the high-productivity (resp. low-productivity) agent over-producing (resp. under-producing).

7.3.6 The Mixed Case

This case is relevant if either $\{a < a^o, \frac{\psi}{\Delta s \Delta \theta} > q_2^N(a), a \geq a^M\}$ or $\{a < a^M, \frac{\psi}{\Delta s \Delta \theta} < q_2^M(a), a \geq a^o\}$ or $\{a < a^o, \frac{\psi}{\Delta s \Delta \theta} > q_2^N(a), a < a^M, \frac{\psi}{\Delta s \Delta \theta} < q_2^M(a)\}$. When these conditions hold, the high-cost agent’s truth-telling incentive-compatibility constraint (44) can be ignored when solving problem A.

It follows, in a straightforward manner, that the high-cost agent is given no information rents: $U_2 = aB(q_2)$. In addition, both the low-cost agent’s truth-telling incentive-compatibility constraint (43) and the effort-incentive-compatibility constraint (??) are binding. Thus, $U_1 = aB(q_2) + \frac{\psi}{\Delta s}$ and $q_2 = \frac{\psi}{\Delta s \Delta \theta}$. Furthermore, the optimal production for the low-cost agent is given by the solution of the problem

$$\begin{aligned} \max_{q_1} \{ & s[(1+a)B(q_1) - \theta_1 q_1 - aB(\frac{\psi}{\Delta s \Delta \theta}) - \frac{\psi}{\Delta s}] + (1-s)[B(\frac{\psi}{\Delta s \Delta \theta}) - \theta_2 \frac{\psi}{\Delta s \Delta \theta}] \} \\ \text{s.t. } & aB(\frac{\psi}{\Delta s \Delta \theta}) + \frac{\psi}{\Delta s} \geq aB(q_1). \end{aligned} \quad (45)$$

The inequality constraint is simply the limited-liability constraint for the high-productivity agent when the effort-incentive-compatibility constraint and her incentive-compatibility constraints are binding.

Note that if $a < a^M$ and $\frac{\psi}{\Delta s \Delta \theta} < q_2^M(a)$ then $q_2 = \frac{\psi}{\Delta s \Delta \theta} < q_2^o$ (recall that $q_2^M(a) < q_2^o$). Also, if $a^M \leq a < a^o$ (and $\frac{\psi}{\Delta s \Delta \theta} > q_2^N(a)$) we have directly that $\frac{\psi}{\Delta s \Delta \theta} < q_2^o$. So, in any case, $q_2 < q_2^o$.

In addition note that at an interior solution $q_1 = B'^{-1}(\frac{\theta_1}{1+a}) > q_1^o$. So, both production levels are distorted with the direction of the distortions following the familiar, by now, pattern.

If, however, the constraint is binding then the direction of the distortion of the low-cost agency’s output is ambiguous as there is no unambiguous relationship between $aB(\frac{\psi}{\Delta s \Delta \theta}) + \frac{\psi}{\Delta s}$

and $aB(q_1^o)$. Nevertheless, even in this case, the low-cost agency's output will in general *as well* be distorted,⁴⁸ in contrast to the received literature.

Notice now that at an interior solution $q_1 = B'^{-1}(\frac{\theta_1}{1+a}) > q_1^o > q_2^o > \frac{\psi}{\Delta s \Delta \theta} = q_2$. Also, at a solution where the constraint is binding we have, due to $\frac{\psi}{\Delta s} > 0$, that $q_1 > \frac{\psi}{\Delta s \Delta \theta} = q_2$ again. Thus, in any case, $q_1 > q_2$ and, again, the high-cost agent cannot mis-report her type.

Also, it can again be the case that the low-cost agency operates under minimum monetary costs of production, even if the high-cost does produce. This will be the case if the above problem does not have an interior solution, i.e. if $aB(\frac{\psi}{\Delta s \Delta \theta}) + \frac{\psi}{\Delta s} = aB(q_1)$.

Once again, in contrast to Laffont and Martimort (2002) Ch. 7.2 where $a = 0$, output distortions take place regardless of productivity.

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⁴⁸This will not be the case only in the knife-edge case where $aB(\frac{\psi}{\Delta s \Delta \theta}) + \frac{\psi}{\Delta s} = aB(q_1^o)$.

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