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TRANSPARENCY, RECRUITMENT AND RETENTION IN THE PUBLIC SECTOR

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Transparency, Recruitment and Retention in the Public Sector[§]

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Abstract

This paper evaluates the impact of releasing performance measures on public sector recruitment and retention. We analyse the role played by the informativeness of disclosure by comparing a policy of transparency with confidentiality, and the role played by the timing of disclosure via a comparison with delayed (e.g. end of project) reporting. We show that relative wage compression in the public sector produces a recruitment-retention trade-off. Transparency minimises the cost of recruitment, delayed reporting minimises the cost of short-term retention, while confidentiality minimises the cost of long-term retention. The optimal disclosure policy varies with the type of public organisation - that is, with the relative value of public sector projects and the complexity of production - warning against the current 'one size fits all' policy.

Keywords: Recruitment and retention; wage compression; optimal disclosure policies.

J.E.L. classification numbers:*D82, D73, H1, J31, J44, J45*

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1 Introduction

How much information about a worker's performance should an employer disclose to outsiders? Should an employer disclose information to outsiders at an early rather than a late stage of the worker's career? More generally, how are workers' outside options in the labor market and future career choices affected by the *quantity* and *timing* of disclosure of performance measures by their current employer?

We address these questions by analyzing a stylized economy in which a public organization and a competitive labor market compete over time to hire a worker. The public employer has the ability of modifying the degree of transparency about a worker's performance, thus affecting the offers made by the (competitive) private sector.

The questions raised in this paper are inspired by the so called 'New Public Management' (NPM) schemes. These "government-wide institutional rules and organizational routines affect how government agencies are managed, operated and overseen: they structure that part of the governmental process usefully described as public management."[1] As Hood (1991) notes, one unifying feature of the NPM schemes was a belief that a reform of the public sector's organizational design demanded greater transparency. So much so that over the last decade we have seen a dramatic increase in the measurement and publication of public sector performance indicators. In the UK, for instance, teachers, doctors and police officers must now submit performance data such as exam results, waiting times or conviction rates for publication in league tables; academics are now regularly inspected and receive widely publicised grades for the quality of their teaching and research; while government departments are now bound by Public Service Agreements with very public penalties for failure.

Recent headlines, however, serve as a stark reminder that the recruitment and retention of good staff can prove equally vital to the success of a public organization. For instance, reporting on the perceived 'recruitment and retention crisis' in the UK public sector, the Audit Commission (2002) comments that current staff shortages are likely to stall the delivery of public service improvements.

The scale of this problem is reflected in Government targets. The Department of Health (DoH) has stated a need to recruit an additional 35,000 nurses and 15,000 consultants and GPs by 2008, the Department for Education and Skills (DfES) 10,000 teachers and 20,000 non-teaching staff by 2006 and the Home Office 9,000 more police officers by the end of 2003.[2] Likewise, the Government Economics Service must surely be hoping to improve on 2001 when it filled just 50%

[1] Barzelay (2001), Ch. 6.

[2] Figures are taken from the Audit Commission (2002) 'Recruitment and Retention: A Public Service Workforce for the 21st Century' available at http://www.audit-commission.gov.uk.

of its vacancies for civil service economists.[3] Low levels of retention are also a worry. In 1998 a survey of UK GPs revealed that 14% expected to quit the health profession within 5 years; a follow up survey in 2001 revealed that this figure had risen to 22%.[4]

If public services are ever to be provided efficiently, it seems important to understand how policies affect employee sorting over time (i.e. recruitment and retention) and vice versa. In this paper we take a first step towards this aim by exploring how greater transparency in public sector performance affects sorting behaviour. We investigate how the *publication* of performance information affects the public sector's ability to recruit and retain good staff.

We analyze the problem by considering a three-player model. A worker living for three periods decides at each point of her career to work either in the private or in the public sector. The task is the same in both sectors, although it may serve to produce two different goods. The task outcome can be either a success or a failure. The likelihood of a success depends upon the ability of the worker which is unknown to all players. The outcome of each task allows the worker to learn more about her ability. The two employers do not learn symmetrically about the worker's ability. Specifically, we assume that the outcome of a task *always* becomes public information if the worker is employed by the private sector. If, instead, the worker works in the public sector, the amount of information to outsiders depends upon the disclosure policy chosen by the public employer.

We consider three different disclosure policies: Interim Reporting, Confidentiality and End of Project Report. Interim Reporting implies that the public sector publishes the outcome of the worker's performance in every period. This policy provides the highest amount of transparency. Confidentiality can be thought of as the opposite case. No information is ever released. As long as the worker remains in the public sector, outsiders cannot observe her performance. Under End of Project Reporting, the public employer releases all information about the worker's performance only if she spends two consecutive periods in the public sector. Each disclosure policy carries a different *timing* and *quantity* of information disclosure. These two dimensions generate in turn a trade-off between hiring and retaining a worker in the public sector.

While the public sector can decide the degree of transparency about the worker's performance, its wage contracts are more rigid than those offered by the private sector. We assume an extreme form of asymmetry between public and private contracts. The public employer commits to a fixed wage schedule throughout the three periods. Thus wages never react to the worker's performance. The private sector, instead, offers spot contracts that fully react to the the worker's history. The latter including both past performance and sector choices.

The worker's decision to enter the public sector at any point of her career depends upon two key factors: the current pay incentive and the future pay incentive. Both of them may be phrased

[3]Source: 'So You Really Want to Make a Difference?', Financial Times 24/10/02.

[4]Figures taken from Sibbald, Bojke and Gravelle (2003).

in two simple questions: 'Does the public sector offer a higher wage *today*?'; and 'will going public maximize the chances of being offered a high wage *tomorrow*?' For any given level of the public wage, each disclosure policy generates different current and future pay incentives which, in turn, determine the cost for the public sector of recruiting and retaining a worker.

The analysis of our model proceeds as follows. We first determine how costly is for the public sector to hire any type of worker at any point in time for a given disclosure policy. Then we find the optimal disclosure policy as a function of the two main parameters of the model: the relative value of a successful project in the public sector with respect to the private sector; and the degree of complexity of the task which is captured by the difference between the probability that the task is successful given that the worker is born with high ability and the probability for a low ability worker. The closer these two probabilities the more complex the task since being endowed with high ability makes little difference in the likelihood of success.

The policy of Interim Reporting provides an instructive benchmark. The public sector embraces the highest degree of transparency. Thus the worker's performance becomes immediately visible to the private sector. The main consequence is that the future pay incentive does not play any role in the worker's decision whether or not to enter the public sector. Only the current pay incentive matters. In order to attract a given type of worker, the public sector has to fix a wage at least equal to the type's market value (Proposition 1). In other terms, past sector choices do not affect current wage offers by the private sector. This is no longer true under both Confidentiality and End of Project Reporting.

Under a policy of Confidentiality recruitment and short-term retention become more expensive than under Interim Reporting (Proposition 2). Recall that, under Confidentiality, the private sector cannot observe the worker's performance in the public sector. In order to understand how this policy modifies the current and the future pay incentives consider the scenario in which the worker has entered the public sector in the first period. Going private in the second period has now an *option value* since it allows the worker to reap the reward of future success. This option value is stronger for the worker who has successfully accomplished her task (the successful type) than the one who has failed (the failure type). The reason is that the successful type is more likely to get a second success than the failure type. Thus the worker's willingness to enter the private sector in the second period acts as a signal of success in the first period. Confidentiality then drives up the outside offers for both types of worker in the first period. This effect, coupled with the 'insurance' of re-entering the public sector in the third period if the worker gets a failure in the second, implies that the cost of retaining both performance types of worker in the public sector exceed their (full information) market values. Short-term retention is thus more expensive than under Interim Reporting.

The option value of 'going private' is at work in the first period as well. Indeed the worker anticipates that 'going public' in the first period reveals the nature of the performance only if the performance types make different sector choices in the second period, namely if the failure type remains in the public sector and the success type enters the private sector. Such a separation cannot happen if the public sector wage is just equal to the private sector's first period offer (which is merely the ex ante probability that the worker is of high ability). Then the public sector has to offer a wage in the first period strictly higher than the market wage. Recruitment is then more expensive than under Interim Reporting.

Proposition 3 establishes that under End of Project Reporting the public employer faces a trade-off between recruitment and retention. The public sector releases the whole performance history of an employee only if she spends two consecutive periods in the public sector. The first consequence is that whenever the worker enters the private sector in the first period, then the analysis of her sector choices coincides with the one under a policy of Confidentiality. Specifically, 'going private' in the first period has an option value that makes the hiring of each performance type by the public sector more costly than their market values.

Going public in the first period produces a *lock in* effect. Indeed, the success and the failure types have now opposite incentives to those under Confidentiality. It is by remaining in the public sector that the success type can fully reap the reward of a further success. Then going private in period 2 becomes a signal of failure. The public sector can now retain the successful type by offering *less* than its (full information) market value. However, the recruitment in the first period is only possible if the public wage is higher than the market wage. The explanation hinges again on the option value of going private in the first period. A success in the private sector in the first period generates an immediate reward, whereas the benefit of a success in the public sector accrues the worker only in the final period.

Propositions 4 and 5 characterize the Public Sector's optimal policy for releasing information about the worker's performance as a function of the nature of its organization. The latter is captured by two parameters: The relative value of a success in the Public sector with respect to that in the Private sector; and the degree of complexity of the organization, that is, how easier it is to successfully accomplish the task by being a high ability rather than a low ability worker. The degree of complexity is captured by the difference between the *ex ante* probability of being successful given that the worker is of high ability and the analogous probability given that the worker has low ability. A low difference means that the organization displays a low degree of complexity. Indeed being a low ability worker reduces only slightly the probability of being successful. Conversely, a high difference indicates that the organization has a high degree of complexity for being a 'high flyer' significantly increases the chances of obtaining a success.

In Proposition 4 we show that a policy of Interim reporting is optimal only if the two critical parameters are below two critical thresholds. That is, Interim reporting is optimal only if the Public sector is a quasi-private organization and displays a low degree of complexity. Finally, Proposition 5 shows that Interim reporting is *never* strictly optimal if failure becomes perfectly informative.

1.1 Related Literature

In labor markets, it is typical that information about an individual's productivity is revealed during her working lifetime. The works by Waldman (1984, 1990), Ricart-i-Costa (1988), and Milgrom and Oyster (1987) consider situations in which the worker's current employer gathers more information about the worker's productivity than other potential employers. Other firms may however observe some actions of the initial employer which can reduce the information asymmetry between the firms. In particular, Waldman (1984) and Ricart-i-Costa (1988) analyze how outsiders can partially infer a worker's productivity by considering her task assignment. In Waldman (1990), the same mechanism is at work when the current employer offers up-or-out contracts. Indeed, the decision of retaining a worker becomes a signal of the worker's (high) productivity, and thus reduces the asymmetry between firms. Moreover, up-or-out contracts provide the worker with the right incentives to invest in general human capital. The current paper differs from this branch of the literature in two respects. First, we consider a longer time horizon that allows us to treat both the issue of *recruitment* and *retention* of a worker. Second, by allowing the Public Sector to choose among different disclosure policies about the worker's performance, we are able to analyze how the *quality* and *timing* of information disclosure affects the worker's career path as she gathers more information about her innate ability.

The timing of our models bears some resemblance to Greenwald (1984)[5]. The author considers a dynamic adverse-selection model in which the worker's current employer is better informed about the worker's quality than outsiders. An employer's effort to retain high-quality workers becomes a barrier to mobility to other workers who cannot enter the 'secondhand market' since they would be pooled with low-quality applicants. Thus workers seeking to move from one firm to another will face low outside offers, and they might be stuck with their current employer. In our model, we allow one of the employers - the Public Sector - to be able to manipulate the nature of her current worker's outside offers through the quantity and the quality of information disclosure about performance to outsiders.

Koch and Peyrache (2003) and Calzolari and Pavan (2003) are closely related to our model. The first paper studies how *incentive schemes* designed for a worker are modified when an employer adopts an opaque organizational design rather than a transparent design. The flow of information

[5]See, in particular, Section 2.

to outsiders alters the worker's outside option and can be used by the current employer to sharpen incentives. The spirit of Koch and Peyrache (2003) is more in the tradition of Waldman (1984), thus there is no room for analyzing the worker's career choices over time. The second paper examines an environment in which two principals sequentially contract with a common agent and endogenizes the exchange of information between the two bilateral relationships. Our set-up imposes more constraints on set of contracts than the ones in Calzolari and Pavan (2003). However, a longer time horizon allows us to deal with the case of a worker interacting with the same principal at different points in time.

Finally, Lizzeri *et al.* (2002) study the problem of quality and timing of information disclosure in a two-period principal-agent model. The agent privately observes how hard she works, but cannot fully observe her performance. The question raised in the paper is whether the principal should conduct an interim performance evaluation and whether he should reveal it to the agent. The authors characterize the optimal incentive schemes under two scenarios: no-revelation and interim evaluation. By comparing the optimal incentives schemes, it results that the no revelation policy minimizes the expected cost of inducing any expected level of effort. Unlike Lizzeri *et al.* (2002), we consider a dynamic adverse selection model in which both the Public and the Private principals do not offer performance contingent contracts. While Lizzeri *et al.* (2002) look at how feedback on performance influences effort choices, we look at the *sorting* effects of public sector pay and disclosure policies.

The remainder of the paper is organized as follows. In section 2 we set up the model and discuss its main assumptions. Section 3 characterizes the worker's equilibrium sector choices as a function of the wage offered by the public sector and the degree of transparency adopted by the public organization. In section 4 we solve the public organization's problem of choosing the optimal disclosure policy about the worker's performance. We make some concluding remarks in section 5. All proofs that do not appear in the text are relegated into an appendix.

2 The Model

The model is the simplest needed to illustrate how the quality and timing of disclosure impact on recruitment and retention.

Primitives. A centralised public sector employer P_g (for government principal) and a competitive private sector labour market P_m (for market principal) compete to hire an agent to a project every period. The agent lives (or is productive) for 3 periods. Both projects take 2 periods to complete in the sense that the agent is needed to undertake two consecutive tasks that can either succeed or fail. The agent's period t performance (equivalently task outcome) is denoted by $y_t \in \{s, f\}$.

The probability that each task is a success depends solely on the agent's innate talent θ. For simplicity, we restrict attention to the possibility of 'high-flyers' (θ_h) and 'low-flyers' (θ_l), where $Pr(y_t = s \mid \theta_h) = \theta_h > Pr(y_t = s \mid \theta_l) = \theta_l$ for all t and $\theta_h + \theta_l > 1$ (i.e. success is more likely than failure).[6]

Information over θ is, *ex ante*, symmetrically incomplete: all players begin with the common prior $Pr(\theta = \theta_h) = Pr(\theta = \theta_l) = \frac{1}{2}$. The agent and her period t employer observe y_t perfectly at the end of period t. If the agent works in the private sector, then y_t is also observable to outsiders (for instance via profit signals because the agent produces a marketable good). However, if the agent works in the public sector, then the ability of outsiders to observe y_t depends on P_g's choice of disclosure policy, that is, on the degree of transparency about the agent's performance records.

Wage Setting. We place two restrictions on wage setting behaviour. First, neither employer can condition pay on current performance. Second, employers differ in their ability to condition pay on past performance. At the start of every period t, P_m makes the agent a wage offer w_{mt} equal to its (Bayesian) expectation of her future productivity conditional on the agent's observable history H_t. In contrast, any offer that P_g makes in period 1 must also be made in future periods.[7] Normalizing the market's valuation of success to 1 and failure to 0, we therefore have

$$w_{mt} = Pr(y_t = s \mid H_t) \tag{1}$$

$$w_{gt} = \overline{w} \geq 0 \, \forall t. \tag{2}$$

Since the agent has no history in period 1, the market's initial offer is always just the unconditional probability of success. To ease notation we will denote this initial offer by w_0 and subsequent offers by $w(H_t)$.

Sector Choices. The agent is risk neutral and motivated purely by pecuniary gain. In each period t she chooses a sector $c_t \in \{g, m\}$ to maximize her expected future (undiscounted) stream of future income. We will refer to the choice $c_t = g$ as 'going public' and to the choice $c_t = m$ as 'going private'.

The agent's period 1 strategy simply maps from P_g's choice of disclosure policy $d \in \mathcal{D}$ and her initial wage offers $\{\overline{w}, w_0\}$ into a probability of 'going public'. By period 2, however, she holds two pieces of information: her initial sector choice c_1 and her initial performance y_1. Similarly, by period 3, each of these endogenous types hold two further pieces of information: their period 2 sector choice c_2 and their period 2 performance y_2. Let A denote an agent in period 1, A_{τ_2} a 'sector and performance' type of agent in period 2, where $\tau_2 \in \mathcal{T}_2 = \{g, m\} \times \{s, f\}$ and A_{τ_3} a 'sector and

[6] Note that the two projects are therefore equally difficult but not necessarily identical.

[7] Our assumption that w_{gt} is constant is intended to reflect the relative compression of the wage distirbution in the public sector. For recent evidence in the US see Borjas (2002) and in the UK Disney and Gosling (2003).

performance' type of agent in period 3, where $\tau_3 \in \mathcal{T}_3 = \mathcal{T}_2 \times \{g, m\} \times \{s, f\}$. A (behavioural) strategy for A can then be defined as the triple $(\sigma, \sigma_{\tau_2}, \sigma_{\tau_3})$, where

$$\begin{aligned} \sigma &: \mathcal{D} \times \{\overline{w}, w_0\} \rightarrow [0,1] \\ \sigma_{\tau_2} &: \mathcal{D} \times \mathcal{T}_2 \times \{\overline{w}, w(H_2)\} \rightarrow [0,1] \\ \sigma_{\tau_3} &: \mathcal{D} \times \mathcal{T}_3 \times \{\overline{w}, w(H_3)\} \rightarrow [0,1]. \end{aligned} \tag{3}$$

More intuitively, σ is the probability that P_g is able to hire A given her choice of disclosure policy d and level of public sector pay $\overline{w}$, likewise σ_{τ_2} is P_g's chances of hiring A_{τ_2} and σ_{τ_3} P_g's chances of hiring A_{τ_3}.

Disclosure Policies. Our aim is to investigate how the quality and timing of information disclosure impact on P_g's ability to hire. To this end we focus on three different disclosure policies: (i) interim reporting (P_g publishes task outcomes at the end of the task); (ii) end of project reporting (P_g publishes task outcomes at the end of the project) and 'confidentiality' (P_g never publishes task outcomes to outsiders). Denoting this set of disclosure policies by $\mathcal{D} = \{I, ER, C\}$, P_g chooses $\overline{w}$ and $d \in \mathcal{D}$ to maximize

$$\begin{aligned} E[V(\overline{w}, d; \alpha)] = \; & \sigma^0(\overline{w}, d)(\Pr(s)\alpha - \overline{w}) + \\ & \sum_{y_1} \Pr(y_1)\sigma^0_{y_1}(\overline{w}, d)(\Pr(s \mid y_1)\alpha - \overline{w}) + \\ & \sum_{y_1}\sum_{y_2} Pr(y_1, y_2)\sigma^0_{y_1 y_2}(\overline{w}, d)(\Pr(s \mid y_1, y_2)\alpha - \overline{w}), \end{aligned} \tag{4}$$

where α parameterizes the value P_g attaches to a successful task relative toP_m and 0 denotes an equilibrium value.

Timing. The order of play is as follows.

Period 0 Nature chooses the agent's ability θ. P_g commits to a disclosure policy d and a level of public sector pay $\overline{w}$.

Period t = 1,2,3

- Stage 1 P_g and P_m respectively offer the agent w_{gt} and w_{mt}.
- Stage 2 The agent makes a sector choice $c_t \in \{g, m\}$. The task outcome $y_t \in \{s, f\}$ is realized and, if $c_t = g$, published according to d. The agent receives $w_{c_t t}$.

2.1 Discussion

The model hinges on several simplifying assumptions that are worth discussing. First, the nature of the 'public sector' is captured by its ability to commit to two dimensions: (i) the ability to hire any type of worker at a fixed wage regardless of the her past performance; (ii) the ability to commit to a well-defined disclosure policy about individual performance; and (iii) the higher value of the task than the one performed in the private sector ($\alpha \geq 1$).

Assumption (i), though admittedly extreme, reflects a higher wage compression in the public sector than in the private sector due to the adoption of low-powered incentive schemes.[8] Not only does the public sector commits to a fixed wage, it also provides an 'insurance' against bad performance in the private sector. A worker can enter the public sector at any point of her career. A more realistic model would allow some sensitivity of the public pay to the worker's past performance. In order to highlight the sorting effect of both the public sector pay and disclosure policies, we stretch the difference on the pay schedule between the public and the private sector so as to have the former *never* reacting and the latter *fully* reacting to individual performance. The qualitative features of our results in fact do not depend upon the assumption of a fixed wage in the public sector, rather on the higher sensitivity of the wage schedule in the private sector.

Assumption (ii) rules out the possibility that the public sector reconsiders its policy of releasing information about the worker's performance after observing the task outcome. It would be desirable to allow the public sector to modify the disclosure policy in any subgame, but this would certainly make the model less tractable.

Assumption (iii) captures the idea that the agent performs an identical task in both sectors, but produces two different goods. The value of the production in public sector embeds a social component which can be easily explained by the following example. A freshly graduated Ph.D. in Economics can either work as a economic consultant in a private firm or in one the Government's Antitrust Agencies. In the latter situation, the consultant may be in charge of a report on, say, the nature of competition in the telecommunication industry whose results ultimately benefit *all* agents active in that sector, that is, both firms and consumers.[9] The task of the same consultant in a private consultancy firm is unlikely to be as broad. A private firm is indeed unable to claim the benefits generated by a project similar to one realized by the public agency. Thus the main *raison d'être* of the public sector in our model is to undertake projects with a positive social value

[8] Hart *et al.* (1997) and Acemoglu *et al.* (2003) among others provide an explanation for the predominance of low-powered incentives in the public sector.

[9] Consider for instance the U.K.'s Office of Fair Trading and the Antitrust Division of the U.S.'s Department of Justice. The 'social' value of the projects of the Office of Fair Trading is clearly stated in its two purposes: (i) to protect consumers and explain their rights and (ii) to ensure that businesses compete and operate fairly (see http://www.oft.gov.uk). As to the second agency, we read that "[f]or over six decades, the mission of the Antitrust Division has been to promote and protect the competitive process and the American economy through the enforcement of the antitrust laws. ...The Division is also committed to ensuring that its essential efforts to preserve competition for the benefit of businesses and consumers do not impose unnecessary costs on American businesses and consumers." (more information can be gathered at http://www.usdoj.gov/atr/overview.html.)

that a private firm would not be able to realize.

Our set-up considers a very stylized private sector. A competitive market of homogeneous and symmetrically informed firms behave *à la* Bertrand by offering the worker a wage which is simply the posterior belief about her ability to successfully perform a task given all publicly available information. The major implication of this assumption is that, upon entering the private sector, the worker's performance becomes public information among all private firms regardless of the identity of her current employer. This simplification allows us to focus on the issue of the worker's career between a public and a private sector without worrying about which particular private firm the worker would join should she leave the public sector.

3 Analysis

P_m is interested in the agent's sector choices only insofar as they carry information on past task outcomes and hence, via Bayesian updating, future productivity. For this reason we introduce the notion of 'performance' types. Specifically, let A_{y_1} denote an agent whose initial task outcome was y_1 and $A_{y_1 y_2}$ an agent with outcomes y_1 and y_2.

Our aim is to establish how P_g's ability to hire A, A_{y_1} and $A_{y_1 y_2}$ varies with the disclosure policy. We proceed by solving (backwards) for $\sigma^0_{\tau_3}$ then $\sigma^0_{\tau_2}$ and σ^0 as a function of $\overline{w}$, taking P_g's disclosure policy d as given. Then, substituting for $\sigma^0(\overline{w}, d; \alpha)$, $\sigma^0_{y_1}(\overline{w}, d; \alpha)$ and $\sigma^0_{y_1 y_2}(\overline{w}, d; \alpha)$ in (4), for the optimal disclosure policy d^0 as a function of the relative valuation α.

3.1 Interim Reporting

We begin with the case of highest transparency in the public sector, namely interim reporting. Under this policy, the worker's performance history is publicly known *regardless* of her past sector choice. We proceed by characterizing the recruitment and retention costs in this benchmark case. Before doing so, it will prove useful to note that the worker must weigh up two pecuniary incentives when contemplating whether to work in the public sector. The first is what we term a *current pay incentive* (CPl): will 'going public' maximize my current income? The second is what we term a *future pay incentive* (FPl): will 'going public' maximize my future income?

This distinction immediately reveals that the period 3 problem is straightforward: period 3 types simply need to consider their CPl. Define $\Delta^I_{\tau_3}$ as the net benefit to A_{τ_3} from going public in period 3 under interim reporting. Since her performance is publicly observable at the end of every period, P_m offers every A_{τ_3} $w(y_1, y_2)$. Thus, given that P_g offers every type $\overline{w}$, we have

$$\Delta^I_{\tau_3} = \underbrace{\overline{w} - w(y_1, y_2)}_{\text{CPI}}, \tag{5}$$

and $\sigma_{\tau_3}^0 \geq 0$ iff $\overline{w} \geq w(y_1, y_2)$.

Similarly, define $\Delta_{\tau_2}^I$ as the *expected* net benefit to A_{τ_2} from going public in period 2 under interim reporting. Given $\sigma_{\tau_3}^0$ and the fact that P_m offers every A_{τ_2} $w(y_1)$, this can be written as

$$\begin{aligned}
\Delta_{\tau_2}^I &= \overline{w} - w(y_1) + \left[\begin{array}{c} \sum_{y_2} \Pr(y_2 \mid y_1) \max\{\overline{w}, w(y_1, y_2)\} - \\ \sum_{y_2} \Pr(y_2 \mid y_1) \max\{\overline{w}, w(y_1, y_2)\} \end{array} \right] \\
&= \underbrace{\overline{w} - w(y_1)}_{\text{CPI}}. \qquad (6)
\end{aligned}$$

Thus, under interim reporting, period 2 types also face a zero FPI and hence $\sigma_{\tau_2}^0 \geq 0$ iff $\overline{w} \geq w(y_1)$ with $\sigma_{gy_1}^0 = \sigma_{my_1}^0$ for any y_1 and $\overline{w}$.

Finally, define Δ^I as the *expected* net benefit to A from going public in period 1 under interim reporting. Recall that, under any disclosure policy, P_m's initial wage offer is w_0. Thus, given $\sigma_{\tau_3}^0$ and $\sigma_{\tau_2}^0$, this net payoff can be written as

$$\begin{aligned}
\Delta^I &= \overline{w} - w_0 + \sum_{y_1} \Pr(y_1)(\sigma_{gy_1}^0 - \sigma_{my_1})(\overline{w} - w(y_1)) \\
&= \overline{w} - w_0. \qquad (7)
\end{aligned}$$

Taken together (5), (6) and (7) yield our first, benchmark result

Proposition 1 *Under interim reporting P_g can hire any performance type of agent at her full information market value (FIMV).*

Proof. Immediate from (5)-(7). ■

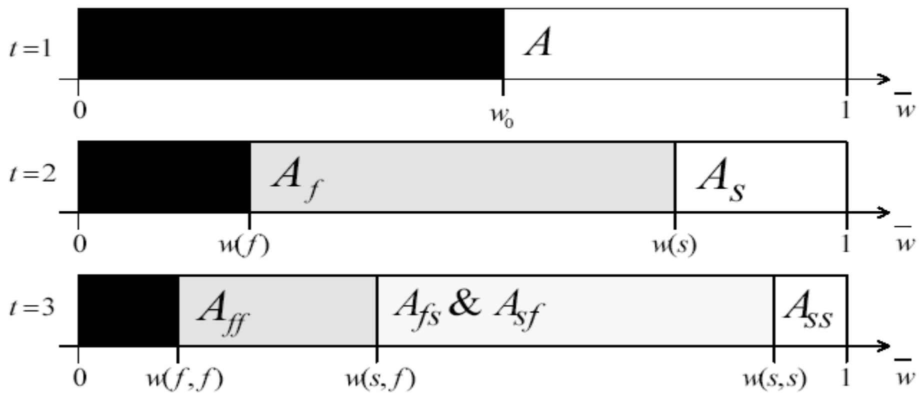

Fig.1: Sorting under Interim Reporting

The sorting effect of public sector pay under interim reporting are illustrated in Figure 1.[10] The intuition is simple. Under interim reporting both private and public sector wage offers are independent of the past sector choices. Since this ensures that the FPI is zero in *every* period, P_g can hire any performance type by giving her a weakly positive CPI, or in other words, by matching P_m's offer. For what follows we define such an offer as a performance type's full information market value (FIMV).

3.2 Confidentiality

Under confidentiality P_m cannot observe public sector performance. Since this implies that A_{y_1} and $A_{y_1 y_2}$ move with private information, we must now focus on Perfect Bayesian Equilibria (PBE's). Formally, we define a PBE of the sub-game in period $t = 2, 3$ as a couple $(\sigma^0_{\tau_t}, w(H_t))$ of probability of going public for type-τ_t of the worker and market wage offers given the worker's history at time t such that:

(i) along the equilibrium path market wage offers are derived via the Bayes' rule from A_{τ_t}'s past performances and strategies to date;

(ii) the probability that the agent goes public at each time t is optimal given the current market

[10]Note that straightforward application of Bayes' rule implies $w(f, f) < w(f) < w_0 < w(s) < w(s, s)$, while our assumption that success is more likely than failure guarantees that $w(s, f) = w(f, s) < w_0$.

wage offers.

In keeping with the notion that a competitive labour market, we assume that, if an information set is off the equilibrium path, P_m attributes the move to the type with the greater incentive to deviate, or in the absence of such a type, retains its current beliefs.[11] We will refer to any equilibrium satisfying these requirements simply as a sub-game equilibrium.

We begin by focusing on the sub-games following a decision to enter the private sector in period 1. Define $\Delta^C_{\tau_3}$ as the net benefit to A_{τ_3} from going public in period 3 under confidentiality. If the agent went private in period 2 confidentiality has no bite. That is,

$$\Delta^C_{my_1my_2} = \Delta^I_{\tau_3} = \overline{w} - w(y_1, y_2) \tag{8}$$

and $\sigma^0_{my_1my_2} \geq 0$ iff $\overline{w} \geq w(y_1, y_2)$. However, if the agent went public, P_m observes only y_1 and hence

$$\Delta^C_{my_1gy_2} = \overline{w} - w(y_1, g). \tag{9}$$

Let $\tilde{\sigma}_{my_1gy_2}$ denote the strategy that P_m thinks $A_{my_1gy_2}$ will play in period 3. Applying Bayes' rule, P_m's wage offer (to any agent willing to go private in period 3) is given by

$$w(y_1, g) = \sum_{y_2} \Pr(y_2 \mid m, y_1, g, m) w(y_1, y_2), \tag{10}$$

where

$$\Pr(y_2 \mid m, y_1, g, m) = \frac{\Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{my_1gy_2})}{\sum_{y_2} \Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{my_1gy_2})}. \tag{11}$$

Notice that A_{my_1gs} and A_{my_1gf} receive the same wage offer. In the absence of a FPI, both types must therefore make the same choice in any sub-game equilibrium. Since this ensures that P_m cannot draw any inference over y_2 from period 3 decision-making, we have $w(y_1, g) = w(y_1)$ and hence $\sigma^0_{my_1gy_2} \geq 0$ iff $\overline{w} \geq w(y_1)$.[12]

Turning to the period 2 problem, define $\Delta^C_{\tau_2}$ as the expected net benefit to A_{τ_2} from going public in period 2 under confidentiality. Given $\sigma^0_{my_1c_2y_2}$ and the fact that P_m offers every A_{my_1} $w(y_1)$ this can be written as

$$\Delta^C_{my_1} = \overline{w} - w(y_1) + \left[\max\{\overline{w}, w(y_1)\} - \sum_{y_2} \Pr(y_2 \mid y_1) \max\{\overline{w}, w(y_1, y_2)\} \right]. \tag{12}$$

Establishing the sign of (12) for any $\overline{w}$ and the substituting for the resulting period 3 types in (8) and (9) yields the following preliminary result.

[11] This is, loosely speaking, Cho-Kreps' *intuitive criterion*.

[12] For any $\tilde{\sigma}_{my_1gs} = \tilde{\sigma}_{my_1gf} < 1$ this follows directly from (10). In the remaining case $w(y_1, g)$ is off-the-equilibrium path. However, period 3 deviations are always equally likely to come from any type (i.e., there is never a FPI). Our standard refinement concept therefore ensures that $w(y_1, g) = w(y_1)$. We apply the same logic to period 3 wage offers throughout what follows.

Lemma 1 *Under confidentiality, if A goes private, there exist critical values* $\overline{w}_{y_1}^C \in (w(y_1), w(y_1, s))$, *such that* P_g *hire (at least with positive probability):*

(i) every A_{my_1} *iff* $\overline{w} \geq \overline{w}_{y_1}^C$;

(ii) every $A_{my_1 s}$ *iff* $\overline{w} \geq \overline{w}_{y_1}^C$ *and every* $A_{my_1 f}$ *at her FIMV.*

It is therefore harder to hire A_{ms} and A_{mf}, but easier to hire A_{mss} and A_{mfs}, than under interim reporting. A proof for this, together with subsequent results, can be found in the Appendix. The intuition behind part (i) is simple: while A_{my_1} faces the same CPI as under interim reporting, she now faces a (weakly) negative FPI.

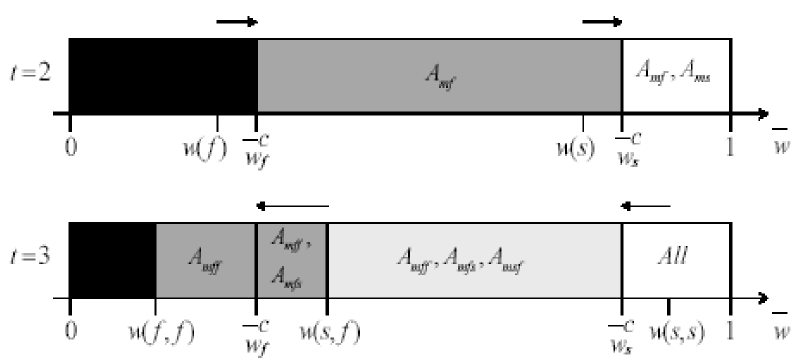

Fig. 2: A_{my1}'s sector choices under Confidentiality

In more detail, A_{my_1} now face a zero FPI only if public sector pay is sufficiently low ($\overline{w} \leq w(y_1, f)$) or sufficiently high ($\overline{w} \geq w(y_1, s)$). In the former case, this is because she will certainly go private tomorrow. Thus, given that going private (resp. public) today reveals (resp. hides) a failed task as well as a successful one, both sector choices yield the same expected future wage, i.e., $w(s)$.[13] In the latter case this is because she will certainly go public tomorrow, which again ensures that both sector choices yield the same expected future wage, i.e., $\overline{w}$. For any other level of public sector pay, however, going private today has an option value: in the event of a further success she can go private tomorrow and earn the higher wage $w(y_1, s)$; in the event of a failure she can go public

[13]Formally, $w(y_1) = \sum_{y_2} \Pr(y_2 \mid y_1) w(y_2, y_1)$.

tomorrow and earn $\overline{w} \geq w(y_1, f)$. We term this weakening of the FPI the *option value effect* of confidentiality.

Turning to part (ii), we know that any A_{my_1} will have gone private if P_g offers a wage less than her FIMV $w(y_1)$. This ensures that P_m offers $w(y_1, y_2)$. Thus given period 3 types always resolve their sector choices on the basis of current offers and failure results in a lower wage (i.e., $w(y_1, f) < w(y_1)$), P_g must therefore be able to hire every A_{my_1f} at her FIMV. Moreover, we also know that, while A_my_1s only goes public at more than her FIMV, she does so at a wage that is less than $w(y_1, s)$. Thus given that P_g cannot back out y_2 from c_3, confidentiality enables P_g to hire A_{my_1s} at *less* than her FIMV.

In short, when A goes private the downside of confidentiality is that it creates an option value to going private that makes it harder to hire in period 2: A_{my_1} trades off a less generous offer from the market today against the option of a reward for any given success. The upside is that, if P_g does decide to hire A_{my_1}, she can retain more valuable agents (that is, agents who are successful in period 2) at the same wage in period 3.

We now turn to the sub-games following a decision to enter the public sector in period 1. Since P_m now observes the agent's performance only if she goes private in period 2, the benefit to going public in period 3 given, respectively private and public in period 2, is

$$\Delta^C_{gy_1my_2} = \overline{w} - w(g, y_2) \tag{13}$$

$$\Delta^C_{gy_1gy_2} = \overline{w} - w(g, g). \tag{14}$$

Let $\tilde{\sigma}_{gy_1}$ denote the strategy that P_m believes was played in period 2. Applying Bayes' rule, P_m therefore offers the following wages (to any agent willing to go private in period 3)

$$w(g, y_2) = \sum_{y_1} \Pr(y_1 \mid g, m, y_2, m) w(y_1, y_2) \tag{15}$$

$$w(g, g) = \sum_{y_1} \sum_{y_2} \Pr(y_1, y_2 \mid g, g, m) w(y_1, y_2) \tag{16}$$

where

$$\Pr(y_1 \mid g, y_2, m) = \frac{\Pr(y_1)(1 - \tilde{\sigma}_{gy_1}) \Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{gy_1my_2})}{\sum_{y_1} \Pr(y_1)(1 - \tilde{\sigma}_{gy_1}) \Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{gy_1my_2})} \tag{17}$$

$$\Pr(y_1, y_2 \mid g, g, m) = \frac{\Pr(y_1)\tilde{\sigma}_{gy_1} \Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{gy_1gy_2})}{\sum_{y_1} \sum_{y_2} \Pr(y_1)\tilde{\sigma}_{gy_1} \Pr(y_2 \mid y_1)(1 - \tilde{\sigma}_{gy_1gy_2})}. \tag{18}$$

Note that P_m's period 3 wage offers now depend on the choices made by A_{gs} and A_{gf} in period 2. To establish these wage offers, and hence the equilibrium strategies $\sigma^0_{gy_1my_2}$ and $\sigma^0_{gy_1gy_2}$ for any given $\overline{w}$, we therefore need to turn to the period 2 problem.

The expected net benefit to going public in period 2 is

$$\Delta^C_{gy_1} = \overline{w} - w(g) + \left[\max\{\overline{w}, w(g,g)\} - \sum_{y_2} \Pr(y_2\ y_1) \max\{\overline{w}, w(g, y_2)\}\right]. \tag{19}$$

Again, applying Bayes' rule, P_m offers the following wage (to any agent willing to go private in period 2)

$$w(g) = \sum_{y_1} \Pr(y_1 \mid g, m) w(y_1), \tag{20}$$

where

$$\Pr(y_1 \mid g, m) = \frac{\Pr(y_1)\Pr(1 - \tilde{\sigma}_{gy_1})}{\sum_{y_1} \Pr(y_1)\Pr(1 - \tilde{\sigma}_{gy_1})}. \tag{21}$$

Establishing the signs of (13), (14) and (19) for any set of beliefs ($\tilde{\sigma}_{gy_1}, \tilde{\sigma}_{gy_1my_2}$ and $\tilde{\sigma}_{gy_1gy_2}$) and $\overline{w}$ and substituting for the resulting period 3 types in (13) and (14) yields our second preliminary result.

Lemma 2 *Under confidentiality, if A goes public, there exists a further critical value* $\overline{w}^C_{gf} \in (w_0, w(s))$ *such that* P_g *hires (at least with positive probability):*

(i) A_{gs} *iff* $\overline{w} \geq \overline{w}^C_s$ *and* A_{gf} *iff* $\overline{w} \geq \overline{w}^C_{gf}$*;*

(ii) A_{gss} *iff* $\overline{w} \geq \overline{w}^C_s$*,* A_{gy_1f} *iff* $\overline{w} \geq w(f)$ *and* A_{gfs} *iff* $\overline{w} \geq \overline{w}^C_{gf}$

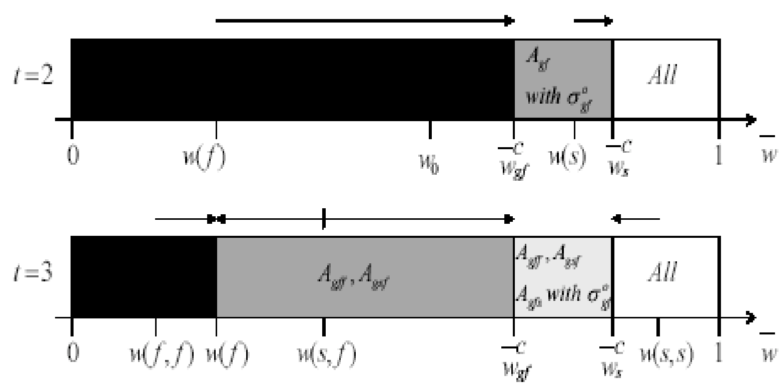

Fig. 3: A_{gy1}'s sector choices under Confidentiality

It is therefore harder to retain A_{gs}, A_{gf}, A_{gfs} and A_{gff} but easier to hire A_{gsf} and A_{gss} than under interim reporting. This is because P_m must now attempt to infer y_1 from the agent's period 2 decision-making *and* is aware that A_{gs} has more of a reason (in the shape of an option value) to go private than A_{gf}.

To see part (i) note that, when A goes public, P_g offers the same wage, conditional on period 2 sector choice and performance, to any agent in period 2. Bayesian updating of the probability of future success therefore ensures that going private has greater option value for A_{gs} than A_{gf}.[14] Thus, given that both types face the same CPI, A_{gs} must have a strictly greater incentive to go private for any $\overline{w} < w(g,s)$. This, in turn, guarantees that, for some $\overline{w}$, A_{gs} and A_{gf} will make different sector choices and hence enables P_m to draw inference over y_1 from period 2 decision-making. For instance, suppose P_m believes A_{gf} goes public. Willingness to go private now acts as a signal of period 1 success and so P_m offers $w(g) = w(s)$ and $w(g,s) = w(s,s)$. Consequently, in any equilibrium in which P_g successfully hires both types, A_{gs} actually faces the same FPI and CPI as A_{ms}.

It should now also be clear why it is harder to hire A_{gf} than A_{mf}. By suppressing her poor performance in period 1, confidentiality gives A_{gf} a weaker FPI and a weaker CPI (i.e. in any equilibrium in which P_g hires A_{gf} with positive probability P_m offers $w(g) > w_0 > w(f)$).

More generally, confidentiality created an option value effect that is strongest for successful agents. Since willingness to work in the private sector serves as a signal of past success, this raises P_m's outside offer to all but the highest period 2 type (i.e. no distortion at the top), making it unambiguously harder to hire A_gf than A_mf.

Turning to part (ii), we again know that A_{gf} will have gone private if P_g offers a wage less than her FIMV $w(f)$. Given that A_{gs} will also have gone private, confidentiality now 'hides' the agent's initial performance. P_m therefore offers $w(y_2)$ rather than $w(y_1, y_2)$ making it harder to hire both A_{gff} and A_{gfs} but easier to hire A_{gsf}. Again, we also know that A_{gs} goes public at a wage less than $w(y_1, s)$, enabling P_g to hire A_{gy_1s} at *less* than her FIMV. We term this the *outside offer effect* of confidentiality.

In sum, when A goes public the additional downside of confidentiality is that outside offers become inflated by P_m's inference that it is successful agents who are likely to leave. This feeds through into period 3 since A_{gf}'s willingness to pool with A_{gs} at higher levels of public sector pay hides y_1 and hence inflates the outside offers made to unsuccessful agents in period 3.

We now turn to the period 1 problem. Define Δ^C as the expected net benefit to A from going

[14]It can never be an equilibrium for A_{gs} to go public and A_{gf} private. Suppose not. Then P_m would offer $w(g,g) = w(s)$ and $w(f, y_2)$ giving A_{gf} an incentive to deviate. Given that P_m can never back out y_2 from c_3 we therefore have $w(g,f) \leq w(g,g) \leq w(g,s)$ which creates an option value to going private for any $\overline{w} < w(g,s)$.

public in period 1 under confidentiality. From above this can be written as

$$\begin{aligned}\Delta^C &= \overline{w} - w_0 + \\ &\sum_{y_1} \Pr(y_1)[(\sigma^0_{gy_1}\overline{w} + (1-\sigma^0_{gy_1})w(g)) - (\sigma^0_{my_1}\overline{w} + (1-\sigma^0_{my_1})w(y_1))] + \\ &\sum_{y_1}\sum_{y_2} \Pr(y_1, y_2)\left[\begin{array}{c}(\sigma^0_{gy_1}\max\{\overline{w}, w(g,g)\} + (1-\sigma^0_{gy_1})\max\{\overline{w}, w(g,y_2)\}) - \\ (\sigma^0_{my_1}\max\{\overline{w}, w(y_1)\} + (1-\sigma^0_{my_1})\max\{\overline{w}, w(y_1,y_2)\})\end{array}\right]. \quad (22)\end{aligned}$$

Establishing the sign of (22) for any $\overline{w}$, given $\sigma^0_{\tau_2}$ (as stated in Lemmas 1 and 2) and the wage offers induced by P_m's beliefs, yields our final preliminary result.

Lemma 3 *Under confidentiality there exists a critical value $\overline{w}^C \in (\overline{w}^C_{gf}, \overline{w}^C_{gf*})$ such that P_g hires A iff $\overline{w} \geq \overline{w}^C$.*

In period 1 A has future, but no past, performances to take into account. Confidentiality therefore creates an option value effect but cannot exert an outside offer effect. Specifically, A faces a negative period 2 FPI for any $\overline{w} \in ((\overline{w}^C_{gf}, \overline{w}^C_{gf*})$ and a (weakly) negative period 3 FPI for any $\overline{w} \in (w(f,f), \overline{w}^C_{gf*})$.[15] This ensures that it is unambiguously harder for P_g to hire A than under interim reporting.

Such reasoning tells us that P_g must offer more than her FIMV w_0 but not how much more. An easy way to work this out is to compare the incentive facing A with those facing A_{gf}. Suppose that $\overline{w}$ is sufficiently low such that A_{gf} is willing to go private with certainty. Recall from Lemmas 1 and 2 that A_{mf} will go public and A_{ms} private and that $w(g) = w_0$ and $w(g, y_2) = w(y_2)$. Thus A_{gf} and A face the *same* CPI (i.e. P_m offers them both w_0). Moreover, turning to their FPI, while going private has an option value for A_{gf} - i.e. she receives $w(s)$ rather than $\overline{w}$ in the event of a future success - this option value effect is clearly greater for A. For instance, her period 2 FPI is smaller because: (i) untarnished by failure, she attaches a higher probability to future success; (ii) in the event of success she receives $w(s)$ rather than $w_0 < \overline{w}$; and (iii) in the event of a failure she receives $\overline{w}$ rather than w_0. Thus, given that A also has an additional negative period 3 FPI, A must go private whenever $A_g f$ goes private.

Now suppose that $\overline{w}$ is sufficiently high such that A_{gf} is willing to go public with certainty. Recall from Lemmas 1 and 2 that A_{mf} will go public, while A_{gs} and A_{ms} will choose the same sectors and that $w(g) = w(s)$ and $w(g, y_2) = w(s, y_2)$. Since P_m now backs out y_1 from c_2, A no longer faces an option value effect (i.e., irrespective of her sector choice she receives $w(s)$ and $w(s, s)$ in the event of a success and $\overline{w}$ in the event of a failure). Thus, given that A now has a

[15]the agent's period 3 FPI is zero for any $\overline{w} \in (\overline{w}^C_f, w(s,f))$ since $\Pr(s,s)w(s) + \Pr(f,s)w(s) = \Pr(s,s)w(s,s) + \Pr(s,f)w(s,f)$ but is otherwise strictly negative.

positive CPI and zero period 2 and 3 FPIs, A must go public whenever A_{gf} goes public which, of course, implies that $\overline{w}^C \in (\overline{w}^C_{gf}, \overline{w}^C_{gf^*})$.

Taken together, Lemmas 1-3 allow us to state our second result.

Proposition 2 *A policy of confidentiality makes it harder to recruit A and A_f, harder to retain A_s but easier to retain A_{ss} and A_{fs}.*

Proof. Immediate from Lemmas 1-3. ■

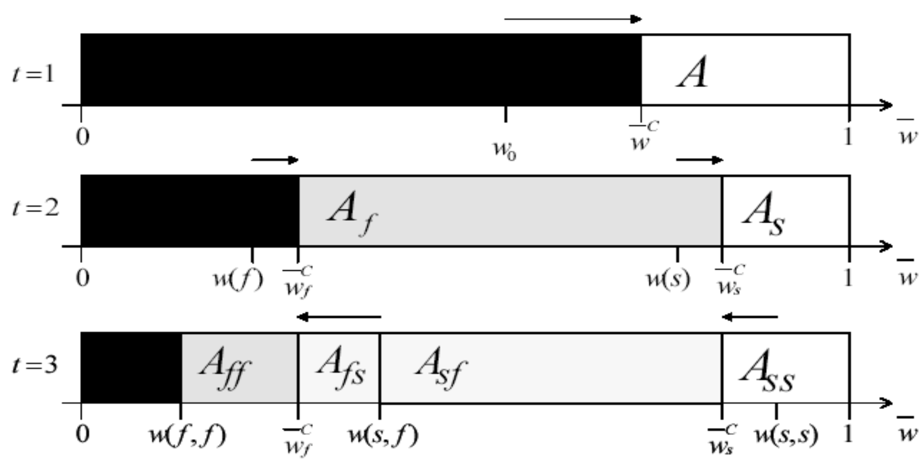

Fig. 4: Sorting under Confidentiality

The sorting effect of public sector pay under confidentiality are illustrated in Figure 4. It is worth re-iterating the intuition. Confidentiality created an option value effect that makes it harder to recruit in period 1. Suppose that P_g decides *not* to recruit in period 1 - i.e., by setting $\overline{w} < \overline{w}^C$. This ensure that P_m observes y_1. Obviously A_s will continue to go private since she receives a better offer from P_m. However, the presence of the option value effect also makes it harder to recruit A_f. If P_g decides *not* to recruit A_f - i.e., by setting $\overline{w} < \overline{w}^C_f$ - confidentiality has no impact on P_m's final offer, leaving P_g able to hire A_{ff} at her FIMV in period 3. However, if P_g *does* decide to recruit A_f - i.e. by setting $\overline{w} \in (\overline{w}^C_f, \overline{w}^C)$ - P_m cannot observe (or back out) y_2 leaving P_g able to hire A_{fs} at less than her FIMV and, since she spent both periods in the private sector, A_{sf} at her FIMV.

Alternatively, suppose that P_g does decide to recruit in period 1 - i.e. by setting $\overline{w} \geq \overline{w}^C$. This ensures that P_m cannot directly observe y_1. However, given that P_m knows that it is successful agents who have more of a reason to leave the public sector, a policy of confidentiality does not actually prevent A_s from receiving an attractive outside offer. This, in combination with the option value effect, makes it harder to retain A_s.[16] However, if P_g does decide to retain A_s - i.e. by setting $\overline{w} > \overline{w}_s^C$ - P_m can now not observe (or back out) y_1 or y_2, leaving P_g able to hire A_{ss} at less than her FIMV.

3.3 End of Project Reporting

Under end of project reporting P_m observes the agent's performance in both tasks only if she completes the project. Again we focus on perfect Bayesian equilibria. Given that the agent can only complete a project before the final period if she goes public in period 1, the sub-game following a decision to go private coincides with the case of confidentiality (i.e., $\sigma^0_{y_1}(\overline{w}, ER) = \sigma^0_{y_1}(\overline{w}, C)$ for all y_1 and $\sigma^0_{y_1 y_2}(\overline{w}, ER) = \sigma^0_{y_1 y_2}(\overline{w}, ER)$ for all y_1, y_2).

Define $\Delta^{ER}_{\tau_3}$ as the net benefit to A_{τ_3} from going public in period 3 under end of project reporting. If A went public in both period 1 and 2 we have

$$\Delta^{ER}_{gy_1gy_2} = \Delta^I_{\tau_3} = \overline{w} - w(y_1, y_2) \tag{23}$$

and $\sigma^0_{gy_1gy_2} \geq 0$ iff $\overline{w} \geq w(y_1, y_2)$. While if she went public in period 1 but private in period 2 we have

$$\Delta^{ER}_{gy_1my_2} = \Delta^C_{gy_1my_2} = \overline{w} - w(g, y_2). \tag{24}$$

Recall from (15) that $w(g, y_2)$ depends upon the strategies that P_m thinks A_{gs} and A_{gf} are playing. To establish this wage offer, and hence $\sigma^0_{gy_1my_2}$ for any given $\overline{w}$, we again need to turn to the period 2 problem.

Defining $\Delta^{ER}_{\tau_2}$ as the expected net benefit to A_{τ_2} from going public in period 2 under end of project reporting, we have

$$\Delta^{ER}_{gy_1} = \overline{w} - w(g) + \left[\begin{array}{c} \sum_{y_2} \Pr(y_2 \mid y_1) \max\{\overline{w}, w(y_1, y_2)\} - \\ \sum_{y_2} \Pr(y_2 \mid y_1) \max\{\overline{w}, w(g, y_2)\} \end{array} \right], \tag{25}$$

where $w(g)$ is given in (20).

Establishing the signs of (23), (24) and (25) for any set of beliefs ($\tilde{\sigma}_{gy_1}$ and $\tilde{\sigma}_{gy_1my_2}$) and $\overline{w}$ yields our final preliminary result.

Lemma 4 *Under end of project reporting, if A goes public, there exists a critical value $\overline{w}_s^{ER} \in (w(s, f), w_0)$ such that P_g hires (at least with positive probability):*

[16] In fact, as Figure 4 shows, it is also harder to retain A_f (she now goes public with probability σ^0_{gf}). As will become clear below, this does not affect the optimality of confidentiality.

(i) A_{gy_1} *if* $\overline{w} > \overline{w}_s^{ER}$;[17]

(ii) A_{gy_1f} *iff* $\overline{w} \geq w(f)$, A_{gfs} *iff* $\overline{w} > \overline{w}_s^{ER}$ *and* A_{gss} *at her FIMV.*

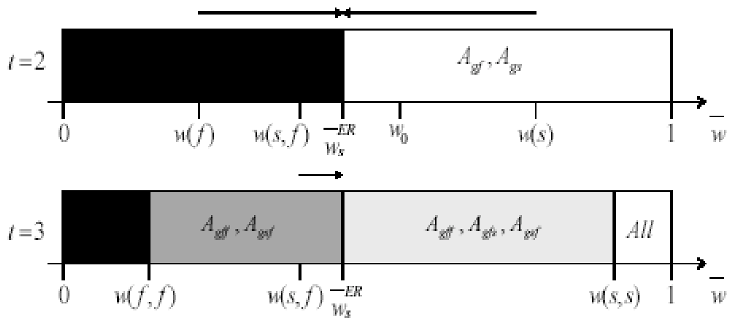

Fig. 5: A_{gy1}'s sector choices under End of Project Reporting

It is therefore easier to hire A_{gs} and A_{gfs} but harder to hire A_{gf} than under interim reporting. The intuition stems from the fact that P_m still has to make inference over y_1 from the agent's period 2 decision-making but now A_{gs} more than a reason to go public (to reveal her past success) than A_{gf}.

To see this more clearly, note that P_m now makes different period 3 wage offers to A_{gs} and A_{gf} if they go public in period 2, that is, $w(g, g) = w(y_1, y_2)$. This, in turn, ensures that it cannot be an equilibrium for A_{gs} to go private and A_{gf} to go public and hence that $w(f, g) \leq w(g, y_2) < w(s, y_2)$. P_g's commitment to reveal y_1 at the end of the project therefore gives A_{gf} a (weakly) negative FPI but A_{gs} a (strictly) positive FPI for any $\overline{w} < w(s, s)$. We term this strengthening of A_{gs}'s FPI the *lock-in effect* of the end of project reporting.

It is now straightforward to see why it is easier to hire A_{gs} than under interim reporting. Since P_m now has reason to consider willingness to private as a signal of period 1 failure, P_m offers $w(g) \leq w_0$. This ensures that A_{gs} has both a stronger CPI and FPI than under interim reporting.

[17] In fact, for any $\overline{w} < \overline{w}_s^{ER}$ there are multiple equilibria. To simplify the statement of Lemma 3 we assume that, if a pooling on private sub-game equilibrium exists, then it prevails. This is entirely without loss of generality, Proposition 3 would remain unchanged if any of the other equilibria prevailed.

Note that the reason it is harder to hire A_{gf} stems from our assumption that pooling private equilibria prevail in the event of multiplicity (i.e., $w(g) = w_0 > w(f)$). In any other equilibrium $w(g) = w(f)$ giving A_{gf} the same CPI and FPI as under interim reporting.

The intuition behind part (ii) is very similar to Lemma 2. We know that A_{gf} and A_{gs} will have gone private if P_g offers a wage less that $w(f)$. Since neither agent completes their project, P_m again fails to observe (or back out) y_1 and hence offers $w(y_2)$ rather than $w(y_1, y_2)$. Thus, just as confidentiality, it is harder to hire both A_{gff} and A_{gfs} but easier to hire A_{gsf}. The difference is that when A_{gs} goes public P_m offers $w(y_1, y_2)$ rather than w_0 and hence it is possible to hire A_{ss} at her FIMV.

In sum, when A goes public, end of project reporting acts as a bait that gives successful agents a reason to remain in the public sector. The obvious downside - at least in comparison with confidentiality - is that in doing so P_g raises the outside offers P_m makes to the most valuable agents in period 3.

We now turn to the period 1 problem. Define Δ^{ER} as the expected net benefit to A from going public in period 1 under end of project reporting. From above this can be written as

$$\begin{aligned}
\Delta^C = {} & \overline{w} - w_0 + \\
& \sum_{y_1} \Pr(y_1)[(\sigma^0_{gy_1}\overline{w} + (1-\sigma^0_{gy_1})w(g)) - (\sigma^0_{my_1}\overline{w} + (1-\sigma^0_{my_1})w(y_1))] + \\
& \sum_{y_1}\sum_{y_2} \Pr(y_1, y_2) \left[\begin{array}{c} (\sigma^0_{gy_1} \max\{\overline{w}, w(y_1, y_2)\} + (1-\sigma^0_{gy_1}) \max\{\overline{w}, w(g, y_2)\}) - \\ (\sigma^0_{my_1} \max\{\overline{w}, w(y_1)\} + (1-\sigma^0_{my_1}) \max\{\overline{w}, w(y_1, y_2)\}) \end{array} \right]. \quad (26)
\end{aligned}$$

Establishing the sign of (26) for any given $\overline{w}$, given $\sigma^0_{\tau_2}$ (as stated in Lemmas 1 and 3) and the wage offers induced by P_m's beliefs yields the following preliminary result.

Lemma 5 *Under end of project reporting there exists a critical value $\overline{w}^{ER} \in (w_0, \overline{w}^C)$ such that P_g hires A iff $\overline{w} \geq \overline{w}^{ER}$.*

The intuition why P_g must offer A more than her FIMV runs as follows. First, recall that end of project reporting created a positive FPI for A_{gs} since going public was a way to receive $w(s, s)$ in the event of further success. Thus, from a perspective of period 1, the period 3 FPI in never positive. Second, note that for any $\overline{w} < w(s)$, end of project reporting actually creates an option value to going private in period 2 since this yields $w(s)$ in the event of a success and $\max\{w(f), \overline{w}\}$ in the event of a failure (rather than w_0 or $\overline{w}$ for sure). Since we know A always faces the same CPI it mist therefore be harder to recruit than under interim reporting.

Taken together, Lemmas 1,4 and 5 allow us to state our third result.

Proposition 3 *A policy of end of project reporting makes it harder to recruit A and A_f, but easier to retain A_s and A_{fs}.*

Proof. Immediate from Lemma 1,4, and 5. ■

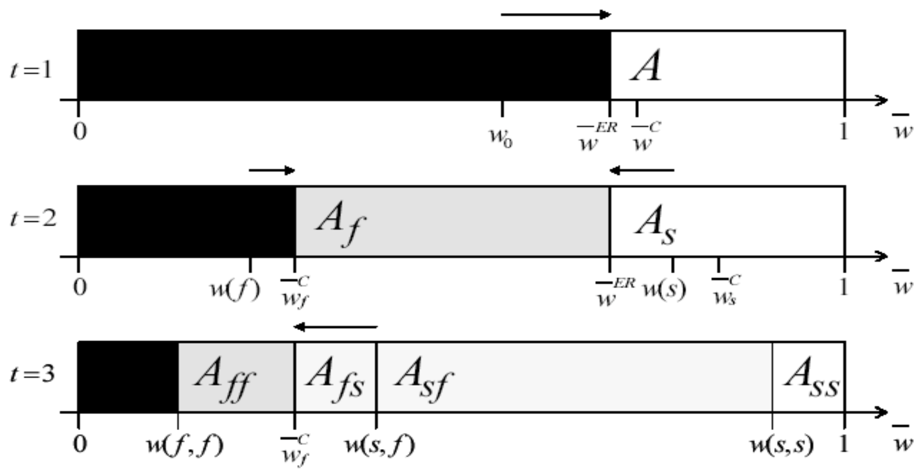

Fig. 6: Sorting under End of Project reporting

The sorting effects of the public sector pay under end of project reporting are illustrated in Figure 5. From the perspective of period 1, end of project reporting creates an option value effect that makes it harder to recruit in period 1. If P_g decides not to recruit in period 1 - i.e., by setting $\overline{w} < \overline{w}^{ER}$ - her ability to recruit and retain is identical to confidentiality. Things change, however, if P_g does decide to recruit in period 1. Again, P_m is unable to observe y_1 directly. However, P_m now knows that it is unsuccessful agents who have more of a reason to leave the public sector, which, in turn, mutes P_m's outside offer. This, in combination with the lock-in effect, ensures that P_g is able to retain A_s at no extra cost but must resign herself to only being able to hire A_{ss} at her FIMV.

4 Choosing Between Disclosure Policies

Propositions 1-3 highlight that both the quality *and* the timing of information disclosure matter, in that they affect the cost of hiring and retaining each performance type. More precisely, the cost of hiring A_{ff} and A_{sf} is identical under all disclosure rules, while interim reporting minimizes the cost of recruiting A and A_f. Both end of project reporting and confidentiality minimize the cost of retaining A_{fs}. Moreover, the former minimizes the cost of retaining A_s (i.e., short-term retention), while the latter minimizes the cost of retaining A_{ss} (i.e., long-term retention). In short, the optimal disclosure policy depends upon *whom* exactly the public sector employer wants to hire.

Propositions 4 and 5 characterize the Public Sector's optimal policy for releasing information about the worker's performance as a function of the nature of its organization. The latter is captured by two parameters: The relative value of a success in the Public sector with respect to that in the Private sector ($\alpha \geq 1$); and the degree of complexity of the organization, that is, how easier it is for a high ability than for a low ability worker to successfully accomplish the task. The degree of complexity is thus captured by the difference $\Delta\theta \equiv \theta_h - \theta_l$. A low $\Delta\theta$ captures the feature of a public organization with a low degree of complexity. Indeed being a low ability worker reduces only slightly the probability of being successful. Conversely, an organization with a high degree of complexity arises when $\Delta\theta$ is large, since being a 'high flyer' significantly increases the chances of successfully performing the task.

The optimal disclosure rule depends upon three parameters: θ_l, θ_h and α. In order to make the problem tractable we adopt two simplifications. In Proposition 4, we normalize θ_l to 1/2 and let θ_h vary within the interval $(1/2, 1]$. We find that a policy of Interim reporting is optimal only if α and θ_h are low enough. That is, Interim reporting is optimal only if the Public sector is a quasi-private organization and displays a low degree of complexity. In Proposition 5, we assume that an unsuccessful task is perfectly informative, that is, $\theta_h = 1$. We then show that there exists no region of the relevant parameters where interim reporting is strictly optimal.

Let's consider the first case. Assume θ_l to be 1/2 and let $\theta_h \in (1/2, 1]$. Substituting for $\sigma^0(\overline{w}, d; \alpha)$, $\sigma^0_{y_1}(\overline{w}, d; \alpha)$ and $\sigma^0_{y_1 y_2}(\overline{w}, d; \alpha)$ from Propositions 1-3 in (4) and solving for the optimal $d \in \{I, ER, C\}$ and $\overline{w} \geq 0$ for any given α, we establish the following result.

Proposition 4 *The optimal disclosure policy varies with the nature of the Public Sector organization. Interim reporting is only strictly optimal if the organization is quasi-private ($\alpha < \overline{\alpha}$) and displays a low degree of complexity ($\theta_h < \overline{\theta}_h$).*

An illustration of Proposition 4 is given in Figures 7 and 8. Proposition 4 suggests that each disclosure policy is strictly optimal for a given region of the parameter space. The intuition behind this result runs as follows. If the public sector aims at hiring the worker in the first period, Propositions 1-3 show that the recruitment cost is minimized by adopting the policy of interim reporting. If the value of α is high enough to make the recruitment of A possible, the benefit of retaining all *lower* performance types more than compensates the overall wage bill. What Proposition 4 says is that recruiting the worker in the first period is the public sector's optimal policy only if $\alpha < \overline{\alpha}$ and $\theta_h < \overline{\theta}_h$ as illustrated in Figure 8[18].

[18] In the Mathematica file containing the proof of Proposition 4, we find that $\overline{\alpha} \approx 1.008$ and $\overline{\theta}_h \approx .62$.

Figure 7 shows that in the region where $\alpha > \overline{\alpha}$ and $\theta_h > \overline{\theta}_h$ Interim Reporting is never *the* optimal policy. In order to grasp the intuition conveyed by figure 7, it is useful to perform the following exercise. Fix a value of $\theta_h > \overline{\theta}_h$ (that is, keep fixed both the benefit and the cost of hiring each performance type) and consider a very high value of α (say $\alpha > 1.3$). In this case the value of a successful task to the public sector is high enough to pay the wage bill of the most valuable performance type, that is, A_{ss}. Propositions 1-3 tell us that confidentiality minimizes the cost of retaining A_{ss}. By setting the wage in the first period so as to retain A_{ss} (that is, $\overline{w}_s^C < w(s,s)$), the public sector can hire the worker in the first period and retain her forever. This explains why confidentiality is the optimal disclosure rule. As α falls, the public sector will not have enough resources to target A_{ss}, but it can aim at hiring the second most valuable performance type, that is, A_s. From Propositions 1-3 we know that end of term reporting minimizes the cost of retaining A_s. Thus by adopting the latter disclosure policy and by setting a wage in the first period so as to retain A_s, the public sector is able to hire A and to retain all performance types but A_{ss}. This explains the optimality of end of term reporting. Figure 7 illustrates that if we keep lowering α, the value of a successful task in the public sector makes it affordable to hire A_{fs} whose wage bill is minimized by adopting either Confidentiality or End of Term Reporting.

Consider now how the optimal disclosure rule changes as θ_h increases while α remains constant (say $\alpha = 1.2$). In this case, both the benefit and the hiring cost of each performance type vary with θ_h. Thus which policy is adopted depends ultimately on how *fast* the benefit changes with θ_h relatively to the cost. When θ_h is close to 0.5, the wage bill to hire A_{ss} is low enough so that a small value of α provides the public sector with the necessary resources to target the most valuable performance type. Thus Confidentiality is the optimal disclosure policy. As θ_h increases, the cost of retaining A_{ss} grows faster than its benefit. There exists then a threshold value for θ_h such that A_{ss} cannot be hired, thus the public sector can target at most A_s whose wage bill is minimized by adopting a policy of end of project reporting[19]. Figure 7 illustrates that End of Project reporting remains the optimal disclosure policy *regardless* of the value of θ_h for an interval of values of α. If, instead, α is below a certain threshold (which is approximately 1.12), then A_s becomes too expensive for high values of θ_h. Thus the public sector can only target A_{fs} which requires the adoption of either Confidentiality or End of Term Reporting.

[19]It must be the case that this threshold value for θ_h is an increasing function of α. This explains the shape of the frontier between the regions where Confidentiality and End of Term reporting are optimal.

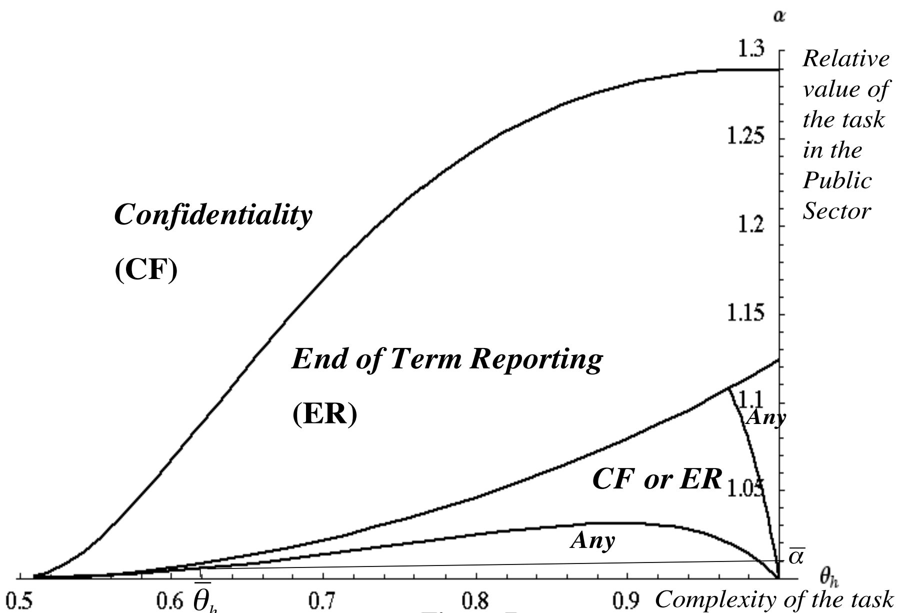

Figure 7

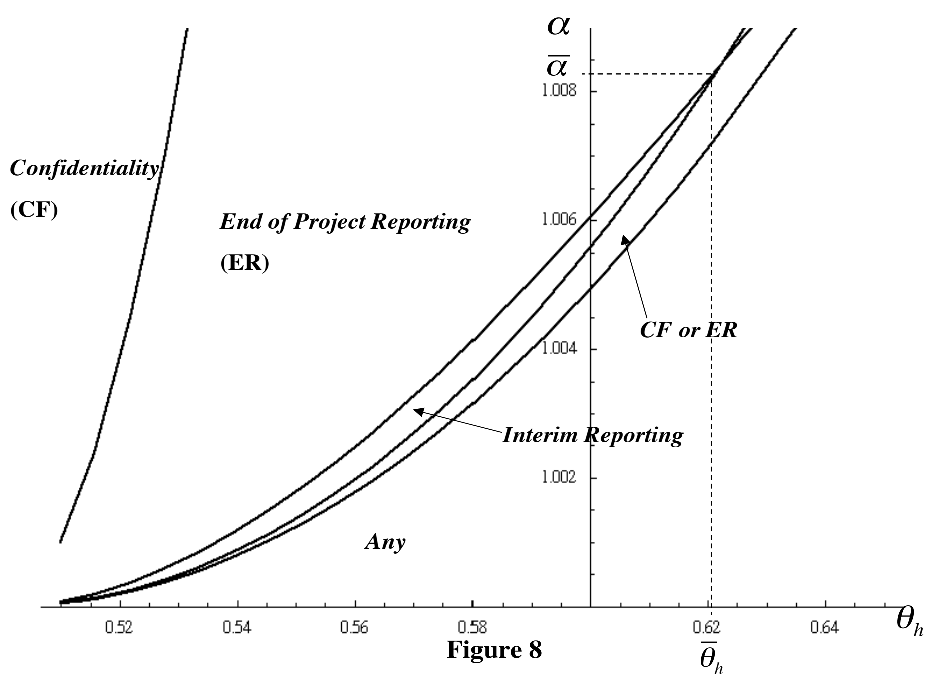

Figure 8

Our final result establishes a simple sufficient condition under which interim reporting is *never* strictly optimal.

Proposition 5 *In the absence of incentive considerations and public sector discounting, it is never strictly optimal to use a policy of interim reporting if failure is perfectly informative (i.e., $\theta_h = 1$).*

The intuition behind this result runs as follows. When failure is perfectly informative going private no longer has an option value for A_{mf} - irrespective of whether she succeeds or fails today P_m will offer her $w(f)$ tomorrow. This ensures that P_g can hire every unsuccessful agent (i.e., A_{ff}, A_{fs}, A_{sf} and A_f) at her FIMV $w(f) = \theta_l$ under *any* disclosure policy.

Thus, in contrast to above, P_g now faces a choice between five 'hiring alternatives'. She can choose: (i) not to recruit in any period; (ii) to recruit A_f & A_{sf} and hence (automatically) retain A_{ff} & A_{fs}; (iii) to recruit A and hence (automatically) recruit A_{sf} and retain A_f, A_{ff} & A_{fs}; (iv) to recruit A and retain A_s and hence (automatically) retain A_f, A_{ff}, A_{fs} & A_{sf}; (v) to recruit A and retain A_s and hence (automatically) retain A_s, A_f, A_{ff}, A_{fs} & A_{sf}. Any disclosure policy is equally effective at achieving alternatives (i) and (ii), interim reporting minimizes the cost of (iii), end of project reporting minimizes the cost of alternative (iv) and, finally, confidentiality minimizes the cost of alternative (v). P_g's preferred hiring alternative, and hence disclosure policy, depends on her relative valuation of task success α. It therefore remains to show that there does not exist an α such that P_g has a strict incentive to choose alternative (iv).

First, note that, given a rigid public sector wage, the probability of success in the public sector cannot exceed P_g's prior belief $\Pr(s) = w_0$ in any period. However, P_g can only achieve alternatives (iii)-(iv) if she offers *more* than w_0 and alternative (ii) if she offers $\Pr(s \mid f) = w(f)$. Accordingly, if P_g attaches a *lower* value to project success than P_m (i.e., $\alpha < 1$), she cuts her losses by choosing not to recruit in any period.

Alternatively, suppose that P_g attaches a *higher* value to project success ($\alpha \geq 1$). Clearly, the higher α, the more important it is to P_g to recruit and retain good staff. For small differences in relative value ($1 \leq \alpha < \alpha^{ER}$) this consideration is insufficient to outweigh the higher expected wage bill and P_g chooses alternative (ii) leaving her indifferent between disclosure policies. In contrast, for large differences ($\alpha > \alpha^C$) the project is sufficiently important to ensure that P_g chooses alternative (v) and hence a policy of confidentiality. For intermediate values, however, P_g always chooses alternative (iv). The reason is simple: if α is sufficiently high to ensure that P_g wants to recruit A then it is also sufficiently high to ensure that she wants to retain A_s. More precisely, the extra expected benefit from retaining A_s, $\Pr(s)w(s)\alpha$, exceeds the extra expected wage bill, $\Pr(s)\overline{w}^{ER} + \Pr(f) + (1 - \Pr(s, s))(\overline{w}^{ER} - w_0)$.

5 Conclusion

The implementation of the main guidelines inspired by the 'New Public Management' has led to an increasing measurement and the publication of performance records concerning public sector's employees. This paper has maintained that a public organization, unable to respond to individual performance as fully as a competitive labor market, does not always find optimal to *continuously* and *fully* release information about a worker's performance to outsiders. We have shown that, by varying the quantity and the timing of release of information about an employee's performance, the Public Sector creates a trade-off between the cost of hiring and retaining a worker. We have emphasized that the tension between these two dimensions is strengthened by the Public Sector's inability to fully adjust its wage offer to the quality of the worker's performance.

Moving towards a policy of full transparency at each point in time (Interim Reporting) lowers the bill of hiring young workers but makes costly the retention of good workers. If the wage compression in the Public Sector is high enough, good workers will be offered higher wage offers by a competitive private sector. Hiding information about performance generates higher recruitment cost, lowers short-term retention in the case of End of Project reporting and lowers long-term retention in the case of Confidentiality. The value to the Public Sector of the three different disclosure policy depends upon both the nature of the production in the Public Sector and the degree of complexity of the task. The two dimensions determine the amount of the public sector's resources and the wage bill required by each (performance) type of worker. Interim Reporting may become the optimal policy only when the project realized by the public sector does not embed a sizable social value (low α) and when the task undertaken by the worker is sufficiently simple (low $\theta_h - \theta_l$). The results hinges on the assumption that the public sector only cares about the benefit and the cost of hiring any type of worker, but does not care about *when* a type of worker is hired. If the public sector valued more present than future payoffs,[20] then interim reporting would become more attractive since it allows the public employer to minimize the wage bill to hire the worker in the first period.

There are other important dimensions of the competition for workers between a public and a private sector which are missing in our model. First, by assuming a pure dynamic adverse selection framework, we ignore the possibility that a worker might invest resources to increase her likelihood of being successful. This aspect may be embodied in the model through either a general or employer-specific human capital investment. Obviously, the worker's choice of the human capital investment will depend upon what outsiders are able to observe or to infer from the worker's actions. Second, by focussing on a case with only one worker we have not touched on the issue of team production

[20]A four- or five-year electoral mandate might convince a government to put more emphasis on hiring young workers (that is, hire A) in order to minimize the delay for realizing the public project.

in either sector. It would be certainly instructive to analyze a framework in which ‘young’ workers interact with ‘old’ workers. The problems related to hiring and retention of workers would then arise at every point in time within the Public Sector. These issues deserve much attention and will be the object of future research.

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Appendix

Proof of Lemma 1.

Part (i). First note that $w(y_1) \equiv \sum_{y_2} \Pr(y_2 \mid y_1) w(y_1, y_2)$. Thus, from (12), A_{my_1} has a negative FPI (weakly so for any $\overline{w} < w(y_1, f)$ and $\overline{w} > w(y_1, s)$) and a negative CPI for any $\overline{w} < w(y_1)$. This immediately implies that P_g hires A_{my_1} with probability zero (resp. one) for any $\overline{w} < w(y_1)$ (resp. $\overline{w} > w(y_1, s)$). For any $\overline{w} \in [w(y_1), w(y_1, s)]$ (12) simplifies to $\Delta^C_{my_1} = \overline{w} - w(y_1) + \Pr(s \mid y_1)(\overline{w} - w(y_1, s))$. Accordingly, P_g can hire A_{my_1} (with positive probability) iff

$$\overline{w} \geq \overline{w}^C_{y_1} \equiv \frac{1}{1 + \Pr(s \mid y_1)} w(y_1) + \frac{\Pr(s \mid y_1)}{1 + \Pr(s \mid y_1)} w(y_1, s). \tag{27}$$

Part (ii). From part (i) A_{my_1} goes private for any $\overline{w} < \overline{w}^C_{y_1}$. P_m then offers $w(y_1, y_2)$ and thus, from (8), P_g can hire $A_{my_1 f}$ at her FIMV. Similarly, from part (i) A_{my_1} goes public for any $\overline{w} \geq \overline{w}^C_{y_1}$. P_m then offers $w(y_1, g) = w(y_1)$. From (27) $\overline{w}^C_{y_1} > w(y_1)$. Thus, from (9), P_g can hire $A_{my_1 s}$ at less than her FIMV. ■

Proof of Lemma 2.

Part (i). From (15) we have $w(g, s) > w(g, f)$, while from Bayes' rule we have $\Pr(s \mid s) > \Pr(f \mid s)$. Thus, from (19), $\Delta^C_{gs} \leq \Delta^C_{gf}$ for any $\overline{w}$ (with the inequality strict for any $\overline{w} < w(g, s)$). This leaves three possible equilibria in which at least one type goes public: (1) semi-separation ($\sigma_{gs} = 0, \sigma_{gf} \in (0, 1)$); (2) full-separation ($\sigma_{gs} = 0, \sigma_{gf} = 1$); and (3) pooling on public ($\sigma_{gs} = \sigma_{gf} = 1$). We proceed by establishing necessary and sufficient conditions on $\overline{w}$ for the existence of each equilibrium in turn.

Semi-separation. P_m's offers under semi-separating beliefs are as follows. From (20)

$$w(g) = \frac{\Pr(s)}{\Pr(s) + \Pr(f)(1 - \tilde{\sigma}_{gf})} w(s) + \frac{\Pr(f)(1 - \tilde{\sigma}_{gf})}{\Pr(s) + \Pr(f)(1 - \tilde{\sigma}_{gf})} w(f). \tag{28}$$

Recall that pooling equilibria are the only possibility in period 3 and, moreover, that P_m offers the same wage in either equilibrium. Thus, from (15) and (16) $w(g, f) = w(g, g) = w(f, f)$ and

$$w(g) = \frac{\Pr(s, s)}{\Pr(s, s) + \Pr(f, s)(1 - \tilde{\sigma}_{gf})} w(s, s) + \frac{\Pr(f, s)(1 - \tilde{\sigma}_{gf})}{\Pr(s, s) + \Pr(f, s)(1 - \tilde{\sigma}_{gf})} w(f, s). \tag{29}$$

Notice that $w(g)$ and $w(g, s)$ are increasing functions of $\tilde{\sigma}_{gf}$ on $[w_0, w(s)]$ and $[w(s), w(s, s)]$ respectively. Substituting for these wage offers in (19), it follows that P_g hires A_{gy_1} with probability zero (resp. one) for any $\overline{w} < w_0$ (resp. $\overline{w} > w(s, s)$). For any $\overline{w} \in [w_0, w(s, s)]$ (19) simplifies to $\Delta^C_{gy_1} = \overline{w} - w(g) + \Pr(s \mid y_1)(\overline{w} - w(g, s))$. For any given $\tilde{\sigma}^*_{gf} \in [0, 1]$, we can therefore find a level of public sector pay,

$$\overline{w}^C_{mix}(\tilde{\sigma}^*_{gf}) = \frac{1}{1 + \Pr(s \mid f)} w(g; \tilde{\sigma}^*_{gf}) + \frac{\Pr(s \mid f)}{1 + \Pr(s \mid f)} w(g, s; \tilde{\sigma}^*_{gf}) \tag{30}$$

such that $\Delta^C_{gf} = 0$ (and hence $\sigma^0_{gs} = 0$ and $\sigma^0_{gf} = \tilde{\sigma}^*_{gf}$ iff $\overline{w} = \overline{w}^C_{mix}(\tilde{\sigma}^*_{gf})$. Defining $\overline{w}^C_{gf} \equiv \overline{w}^C_{mix}(0)$, P_g therefore hires A_{gf} with positive probability iff $\overline{w} > \overline{w}^C_{gf}$.

Full-separation. P_m now offers $w(g) = w(s), w(g,g) = w(f), w(g,f) = w(s,f)$ and $w(g,s) = w(s,s)$. Substituting for these wage offers in (19), P_g therefore hires A_{gy_1} with probability zero (resp. one) for any $\overline{w} < w(s)$ (resp. $\overline{w} > w(s,s)$). For any $\overline{w} \in [w(s), w(s,s)]$ (19) simplifies to $\Delta^C_{gy_1} = \overline{w} - w(s) + \Pr(s \mid y_1)(\overline{w} - w(s,s))$. Defining $\overline{w}^C_{gf*} \equiv \overline{w}^C_{mix}(1)$, we therefore have $\Delta^C_{gs} < 0$ and $\Delta^C_{gf} > 0$ (and hence $\sigma^0_{gs} = 0$ and $\sigma^0_{gf} = 1$) iff $\overline{w} \in (\overline{w}^C_{gf*}, \overline{w}^C_s)$, where $\overline{w}^C_s$ is given in (27).

Pooling on public. Given that A_{gs} has the greater incentive to deviate to going private, P_m offers $w(g) = w(s)$, $w(g,g) = w_0$ and $w(g,y_2) = w(s,y_2)$. Again, P_g hires A_{gy_1} with probability zero (resp. one) for any $\overline{w} < w(s)$ (resp. $\overline{w} > w(s,s)$) and, for any $\overline{w} \in [w(s), w(s,s)]$ (19) simplifies to $\Delta^C_{gy_1} = \overline{w} - w(s) + \Pr(s \mid y_1)(\overline{w} - w(s,s))$. P_g therefore hires A_{gs} with positive probability, that is, $\Delta^C_{gy_1} \geq 0$ for all y_1 implying $\sigma^0_{gs} = \sigma^0_{gf} = 1$, iff $\overline{w} \geq \overline{w}^C_s$.

Part (ii). From part (i) we know that A_{gf} and A_{gs} pool on private for any $\overline{w} < \overline{w}^C_{gf}$. From (15) P_m then offers $w(g,y_2) = w(y_2)$. Thus, from (13), P_g can only hire A_{gff} and A_{fs} at more than their FIMVs (i.e., $w(f) > w(f,f)$ and $w(s) > w(f,s)$) but can hire A_{gsf} at less than her FIMV (i.e., $w(f) < w(s,f)$). Similarly, from part (i), we know that A_{gs} goes public for any $\overline{w} > \overline{w}^C_s$. From (16) P_m then offers $w(g,g) = w_0$. Moreover, from (27) $\overline{w}^C_s < w(s,s)$. Thus, from (14), P_g can hire A_{gss} at less than her FIMV.■

Proof of Lemma 3.

Define $\overline{w}^C$ such that $\Delta^C(\overline{w}^C) = 0$. Our aim is to show that $\overline{w}^C \in (\overline{w}^C_{gf}, \overline{w}^C_{gf*})$. Suppose that $\overline{w} \in [\overline{w}^C_{gf}, \overline{w}^C_{gf*}]$. From Lemmas 1 and 2 we know that $\sigma^0_{ms} = \sigma^0_{gs} = 0$, $\sigma^0_{gf} \in [0,1]$ and $\sigma^0_{mf} = 1$. Substituting for these strategies, and the resulting wage offers, in (22) we have

$$\begin{aligned}\Delta^C &= \overline{w} - w_0 + \\ &\quad \begin{bmatrix} \Pr(s)(w(g) + \Pr(s \mid s)w(g,s) + \Pr(f \mid s)\overline{w}) + \\ \Pr(f)\left((1-\sigma^0_{gf})(w(g) + \Pr(s \mid f)w(g,s) + \Pr(f \mid f)\overline{w}) + \sigma^0_{gf}\overline{w}\right) - \end{bmatrix} - \\ &\quad [\Pr(s)(w(s) + \Pr(s \mid s)w(s,s) + \Pr(f \mid s)\overline{w}) + \Pr(f)\overline{w}]. \end{aligned} \tag{31}$$

Recall from the proof of Lemma 2 that, if A_{gf} is willing to mix, then $\overline{w} + \Pr(s \mid f)\overline{w} = w(g) + \Pr(s \mid f)w(g,s)$. This allows us to re-write (31) as

$$\Delta^C = \overline{w} - w_0 + \Pr(s)(w(g) - w(s)) + \Pr(s,s)(w(g,s) - w(s,s)). \tag{32}$$

From the definition of $\overline{w}^C_{gf}$,

$$\begin{aligned}\Delta^C_{gf}(\overline{w}^C_{gf}) &= \overline{w}^C_{gf} - w_0 + \Pr(s \mid f)(\overline{w}^C_{gf} - w(s)) = 0 \\ \Delta^C(\overline{w}^C_{gf}) &= \overline{w}^C_{gf} - w_0 + \Pr(s)(w_0 - w(s)) + \Pr(s,s)(w(s) - w(s,s)).\end{aligned}$$

Given that $\Pr(s) > \Pr(s \mid f)$ and $\overline{w}^C_{gf} > w_0$, it follows that $\Delta^C(\overline{w}^C_{gf}) < 0$. Similarly, from the definition of $\overline{w}^C_{gf^*}$, $\Delta^C(\overline{w}^C_{gf^*}) = \overline{w}^C_{gf^*} - w_0 > 0$. Since it is immediately obvious that $\Delta^C > 0$ for any $\overline{w} > \overline{w}^C_{gf^*}$, and straightforward to verify that $\Delta^C < 0$ for any $\overline{w} < \overline{w}^C_{gf}$, we must have $\overline{w}^C \in (\overline{w}^C_{gf}, \overline{w}^C_{gf^*})$. Specifically, $\overline{w}^C$ solves

$$\overline{w}^C - w_0 + \Pr(s)(w(g;\sigma^0_{gf}(\overline{w}^C)) - w(s)) + \Pr(s,s)(g,s;\sigma^0_{gf}(\overline{w}^C)) - w(s,s)) = 0. \tag{33}$$

■

Proof of Lemma 4.

Part (i). We first show that a pooling on private equilibrium ($\sigma_{gs} = \sigma_{gf} = 0$) exists iff $\overline{w} \leq \overline{w}^{ER}$. Under these beliefs P_m offers $w(g, y_2) = w(y_2)$ and $w(g) = w_0$. Thus, from (25), A_{gf} has a *negative* FPI for any $\overline{w}$ (weakly so for $\overline{w} \leq w(s)$), while A_{gs} has a *positive* FPI for any $\overline{w}$ (weakly so for any $\overline{w} leq w(s,s)$) and hence deviates $\overline{w} \geq w_0$. If $\overline{w} < w_0$ we have $\Delta^{ER}_{gs} = \overline{w} - w_0 + \Pr(s \mid s)(w(s,s) - w(s))$. Consequently, such an equilibrium exists iff

$$\overline{w} \leq \overline{w}^{ER}_s \equiv w_0 - \Pr(s \mid s)(w(s,s) - w(s)). \tag{34}$$

Note that Bayes' rule implies $w_0 - w(f) > w(s,s) - w(s)$. Thus $\overline{w}^{ER} \in (w(f), w_0)$. It therefore remains to show that a pooling on public equilibrium ($\sigma^0_{gs} = \sigma^0_{gf} = 0$) exists if $\overline{w} > \overline{w}^{ER}_s$. Recall that, under end of the project reporting, A_{gf} always has more incentive to deviate to private than A_{gs} implying that P_m offers $w(g, y_2) = w(f, y_2)$ and $w(g) = w(f)$. From (25), for any $\overline{w} > \overline{w}^{ER}_s$, we have $\Delta^{ER}_{gs} = \overline{w} - w(f) + \Pr(s \mid s)(w(s,s) - \overline{w}) > 0$ and $\Delta^{ER}_{gf} = \overline{w} - w(f) > 0$ and hence such an equilibrium exists.

Part (ii). From part (i) A_{gf} and A_{gs} go private for any $\overline{w} < \overline{w}^{ER}_s$. From (15) P_m then offers $w(g, y_2) = w(y_2)$. Moreover, from part (i) $\overline{w}^{ER}_s > w(f, s)$. Thus, from (24), P_g can only hire A_{gff} and A_{fs} at more than their FIMVs (i.e., $w(f) > w(f,f)$ and $w(s) > w(f,s)$) but can hire A_{gsf} at less than her FIMV (i.e., $w(f) < w(s,f)$). Similarly, from part (i) A_{gs} and A_{gf} go public for any $\overline{w} \geq \overline{w}^{ER}_s$. P_m then offers $w(g,g) = w(y_1, y_2)$. Thus, given that $\overline{w}^{ER}_s < w(s,s)$, it follows from (23) that P_g can only hire A_{gss} at her FIMV. ■

Proof of Lemma 5.

Define $\overline{w}^{ER}$ such that $\overline{w}^{ER}(\overline{w}^{ER}) = 0$. Our aim is to show that $\overline{w}^{ER} \in (w_0, \overline{w}^C)$. First, note that $\Delta^{ER} < 0$ for any $\overline{w} \leq \overline{w}^{ER}_s$. To see this recall from Lemma 3 that $\sigma^0_{gs} = \sigma^0_{gf} = 0$ and $w(g) = w_0$ and $w(g, y_2) = w(y_2)$. From Lemma 1, if $\overline{w} < w(f)$ then we also have $\sigma^0_{ms} = \sigma^0_{mf} = 0$ implying that (26) simplifies to $\Delta^{ER} = \overline{w} - w_0 < 0$. While, if $\overline{w} \in [w(f), \overline{w}^{ER}_s]$, then $\sigma^0_{ms} = 0$ and $\sigma^0_{mf} = 1$ and (26) simplifies to $\Delta^{ER} = \overline{w} - w_0 + (\Pr(f) + \Pr(f,s))(w(f) - \overline{w}) < 0$. Second, note that $\Delta^{ER} > 0$ for any $\overline{w} > \overline{w}^C_s$. That is, from Lemmas 1 and 3 $\sigma^0_{gy_1} = \sigma^0_{my_1} = 1$ implying that (26) simplifies to $\Delta^{ER} = \overline{w} - w_0 + \Pr(s,s)(\max\{\overline{w}, w(s,s)\} - \overline{w}) > 0$. Now suppose that $\overline{w} \in (\overline{w}_s^{ER}, \overline{w}_s^C)$. From Lemmas 1 and 3, $\sigma_{gs}^0 = \sigma_{gf}^0 = \sigma_{mf}^0 = 1$ and $\sigma_{ms}^0 = 0$. Thus given that $w(g,g) = w(y_1, y_2)$, (26) simplifies to $\Delta^{ER} = \overline{w} - w_0 + \Pr(s)(\overline{w} - w(s))$ and hence

$$\overline{w}^{ER} \equiv \frac{1}{1+\Pr(s)} w_0 + \frac{\Pr(s)}{1+\Pr(s)} w(s). \tag{35}$$

Clearly, $\overline{w}^{ER} > w_0$. We prove that $\overline{w}^{ER} < \overline{w}^C$ by contradiction.

Suppose that $\overline{w}^{ER} > \overline{w}^C$. Since $\overline{w}^{ER} \in (\overline{w}_{gf}^C, \overline{w}_{gf*}^C)$ and $\Delta^C(\cdot)$ is an continuous and strictly increasing function in the same interval, it must be the case that $\Delta^C(\overline{w}^{ER}) > 0$. This inequality can be rewritten as follows:

$$\begin{aligned}
\overline{w}^{ER} - w_0 &> \Pr(s)[w(s) - w(g; \sigma_{gf}^0(\overline{w}^{ER}))] + \Pr(s,s)[w(s,s) - w(g,s; \sigma_{gf}^0(\overline{w}^{ER}))] \Leftrightarrow \\
\frac{\Pr(s)}{1+\Pr(s)}(w(s) - w_0) &> \Pr(s)[w(s) - w(g; \sigma_{gf}^0(\overline{w}^{ER}))] + \Pr(s,s)[w(s,s) - w(g,s; \sigma_{gf}^0(\overline{w}^{ER}))] \Leftrightarrow \\
\frac{1}{1+\Pr(s)}(w(s) - w_0) &> w(s) + \Pr(s \mid s) w(s,s) - w(g; \sigma_{gf}^0(\overline{w}^{ER})) - \Pr(s \mid s) w(g,s; \sigma_{gf}^0(\overline{w}^{ER})) \qquad (36)
\end{aligned}$$

Recall from Lemma 2 that if A_{gf} is using a strictly mixed strategy then

$$\overline{w}^{ER} + \Pr(s \mid f)\overline{w}^{ER} = w(g; \sigma_{gf}^0(\overline{w}^{ER})) + \Pr(s \mid f) w(g,s; \sigma_{gf}^0(\overline{w}^{ER})),$$

which can be rewritten as follows

$$\begin{aligned}
w(g; \sigma_{gf}^0(\overline{w}^{ER})) + \Pr(s \mid s) w(g,s; \sigma_{gf}^0(\overline{w}^{ER})) &= \overline{w}^{ER} + \Pr(s \mid f)\overline{w}^{ER} \\
&\quad + [\Pr(s \mid s) - \Pr(s \mid f)] w(g,s; \sigma_{gf}^0(\overline{w}^{ER})). \qquad (37)
\end{aligned}$$

Plugging (37) in the right-hand side of (36) we get

$$\begin{aligned}
\frac{1}{1+\Pr(s)}(w(s) - w_0) &> w(s) + \Pr(s \mid s) w(s,s) - \overline{w}^{ER} - \Pr(s \mid f)\overline{w}^{ER} \\
&\quad -[\Pr(s \mid s) - \Pr(s \mid f)] w(g,s; \sigma_{gf}^0(\overline{w}^{ER})) \Leftrightarrow \\
\frac{1}{1+\Pr(s)}(w(s) - w_0) &> w(s) - \underbrace{\left(\frac{1}{1+\Pr(s)} w_0 + \frac{\Pr(s)}{1+\Pr(s)} w(s)\right)}_{\overline{w}^{ER}} + \Pr(s \mid s) w(s,s) - \Pr(s \mid f)\overline{w}^{ER} \\
&\quad -[\Pr(s \mid s) - \Pr(s \mid f)] w(g,s; \sigma_{gf}^0(\overline{w}^{ER})) \Leftrightarrow \\
0 &> \Pr(s \mid s) w(s,s) - \Pr(s \mid f)\overline{w}^{ER} - [\Pr(s \mid s) - \Pr(s \mid f)] w(g,s; \sigma_{gf}^0(\overline{w}^{ER})).
\end{aligned}$$

Since $\overline{w}^{ER} \in (\overline{w}_{gf}^C, \overline{w}_{gf*}^C)$ and $w(g,s; \sigma_{gf}^0(\cdot))$ is a strictly increasing function in the same interval, we can write

$$\begin{aligned}
0 &> \Pr(s \mid s) w(s,s) - \Pr(s \mid f)\overline{w}_{gf*}^C - [\Pr(s \mid s) - \Pr(s \mid f)] w(g,s; \sigma_{gf}^0(\overline{w}_{gf*}^C)) \\
&= \Pr(s \mid s) w(s,s) - \Pr(s \mid f)\overline{w}_{gf*}^C - \Pr(s \mid s) w(s,s) + \Pr(s \mid f) w(s,s) > 0, \qquad (38)
\end{aligned}$$

where in (38) we use the result from Lemma 2 that $w(g,s;\sigma^0_{gf}(\overline{w}^C_{gf*})) = w(s,s)$. Thus it must be the case that $\overline{w}^{ER} < \overline{w}^C$.■

Proof of Proposition 4.

The Public Sector faces 7 possible hiring alternatives. It will adopt: i) any disclosure to hire A_{ff}; ii) any disclosure to hire A_{sf}; iii) Interim reporting to hire A_f; iv) Interim reporting to hire A; v) either End of project reporting or Confidentiality to hire A_{fs}; vi) End of project reporting to hire A_s; vii) Confidentiality to hire A_{ss}. The Public Sector's payoffs under all hiring alternatives become:

$$
\begin{aligned}
H1 &\equiv E[V(w(f,f),any)] = \Pr(f,f)[w(f,f)(\alpha-1)],\\
H2 &\equiv E[V(w(s,f),any)] = \Pr(f)[w(f)\alpha - w(s,f)] + \Pr(f,f)[w(f,f)\alpha - w(s,f)]\\
&\quad + \Pr(s,f)[w(s,f)(\alpha-1)] + \Pr(f,s)[w(f,s)(\alpha-1)],\\
H3 &\equiv E[V(w(f),I)] = \Pr(f)[w(f)(\alpha-1)] + \Pr(f,f)[w(f,f)\alpha - w(f)],\\
H4 &\equiv E[V(w_0,I)] = \Pr(s)(\alpha-1) + \Pr(f)[w(f)\alpha - w_0]\\
&\quad + \Pr(f,f)[w(f,f)\alpha - w_0] + \Pr(s,f)[w(s,f)\alpha - w_0] + \Pr(f,s)[w(f,s)\alpha - w_0],\\
H5 &\equiv E[V(\overline{w}^C_f, ER\,or\,CF)] = \Pr(f)[w(f)\alpha - \overline{w}^C_f] + \Pr(f,f)[w(f,f)\alpha - \overline{w}^C_f]\\
&\quad + \Pr(f,s)[w(f,s)\alpha - \overline{w}^C_f],\\
H6 &\equiv E[V(\overline{w}^{ER}, ER)] = 2(w_0\alpha - \overline{w}^{ER}) + \Pr(f,f)[w(f,f)\alpha - \overline{w}^{ER}]\\
&\quad + \Pr(f,s)[w(f,s)\alpha - \overline{w}^{ER}] + \Pr(s,f)[w(s,f)\alpha - \overline{w}^{ER}],\\
H7 &\equiv E[V(\overline{w}^C_s, CF)] = 3(w_0\alpha - \overline{w}^C_s).
\end{aligned}
$$

Let's now fix $\theta_l = 1/2$ and $\theta_h \in (1/2, 1]$. The Public Sector's payoff in each possible hiring scenario depends upon two variables; θ_h and α. More precisely,

$$
\begin{aligned}
H1 &= \frac{1}{16}(\alpha-1)\left(1+8(\theta_h-1)^2\theta_h\right),\\
H2 &= \frac{1}{4}\left(1+\alpha+2(2\alpha-3)\theta_h - 4(\alpha-1)\theta_h^2 + \frac{4-4\theta_h}{4\theta_h(\theta_h-1)-1}\right),\\
H3 &= \frac{11+\alpha(3-2\theta_h)^2(-1-6\theta_h+4\theta_h^2)+8\theta_h(4+\theta_h(-11-2(\theta_h-4)\theta_h))}{32\theta_h-48},\\
H4 &= \frac{1}{32}\left((1+2\theta_h)(-21+4\theta_h(1+\theta_h)) - 2\alpha(-3+2\theta_h)(3+2\theta_h(5+2\theta_h))\right),\\
H5 &= \frac{1}{4}\left(3+\alpha+2(-3+2\alpha)\theta_h - 4(-1+\alpha)\theta_h^2 + \frac{30-24\theta_h}{-7+4\theta_h^2}\right),\\
H6 &= \frac{-\alpha(1+2\theta_h)(5+2\theta_h)(-11-2\theta_h+4\theta_h^2)+(4\theta_h^2-23)(3+4\theta_h(1+\theta_h))}{80+32\theta_h},\\
H7 &= \frac{3}{4}\left(\alpha+2(\alpha-2)\theta_h + \frac{12\theta_h-6}{3+4\theta_h(1+\theta_h)}\right).
\end{aligned}
$$

The remainder of the proof consists in characterizing which alternative among $H1 - H7$ yields the highest payoff to the Public Sector as function of pairs (α, θ_h). The numerical details are contained in two accompanying Mathematica files.[21] ■

Proof of Proposition 5.
When failure is perfectly informative (i.e, $\theta_h = 1$) P_m wage offers satisfy $w(f,f) = w(f) = w(s,f)$. Given thse wage offers it is easy to show that $\overline{w}_f^C = w(f)$ which, in turn, implies that P_g can hire A_{ff}, A_{fs}, A_{sf} and A_f at their FIMVs under *any* disclosure policy. P_g therefore faces the following 'hiring alternatives': $(H1)$ hire no performance type; $(H2)$ hire A_{ff}, A_{fs}, A_{sf} and A_f; $(H3)$ hire A, A_f, A_{ff}, A_{sf} and A_{fs}; $(H4)$ hire A, A_s, A_f, A_{ff}, A_{sf} and A_{fs}; $(H5)$ hire every performance type. Again, for any given hiring alternative, P_g maximizes her payoff by choosing the disclosure policy that enables her to hire the specified types at least cost. P_g highest payoffs for each alternative are therefore given by

$$H1 \;:\; E[V(\overline{w} < w(f), d)] = 0 \;\forall d \tag{39}$$

$$H2 \;:\; E[V(w(f), d)] = (\Pr(f) + (1 - \Pr(s,s)))(w(f)(\alpha - 1)) \;\forall d \tag{40}$$

$$H3 \;:\; E[V(w_0, I)] = w_0(\alpha - 1) + (\Pr(f) + (1 - \Pr(s,s)))(w(f)\alpha - w_0) \tag{41}$$

$$H4 \;:\; E[V(\overline{w}^{ER}, ER)] = 2(w_0\alpha - \overline{w}^{ER}) + (1 - \Pr(s,s))(w(f)\alpha - \overline{w}^{ER}) \tag{42}$$

$$H5 \;:\; E[V(\overline{w}_s^C, C)] = 3(w_0\alpha - \overline{w}_s^C). \tag{43}$$

We proceed by solving for P_g's preferred alternative - and hence optimal disclosure policy - as a function of the project value α.

It follows immediately from $w(f) < w_0 < \overline{w}^{ER} < w(s) < \overline{w}_s^C$ that P_g is indifferent between disclosure policies for any $\alpha \leq 1$; that is, if $\alpha < 1$, then (45)-(48) are all negative ensuring that P_g chooses either $H1$ or $H2$.

To establish the optimal disclosure policy for $\alpha > 1$ define α^I such that $E[V(w_0, I; \alpha^I)] - E[V(w(f), d; \alpha^I)] = 0$ and α^{ER^*} such that $E[V(\overline{w}^{ER}, ER; \alpha^{ER^*})] - E[V(w_0, I; \alpha^{ER^*})] = 0$. Subtracting (45) from (46) and (46) from (47) we have

$$\alpha^I \equiv 1 + \frac{\Pr(f) + (1 - \Pr(s,s))}{\Pr(s)}(w_0 - w(f))$$

$$\alpha^{ER^*} \equiv \frac{\overline{w}^{ER}}{w(s)} + \frac{1 + \Pr(f) + (1 - \Pr(s,s))}{\Pr(s,s)}(\overline{w}^{ER} - w_0).$$

Thus P_g prefers $H3$ to $H2$ for any $\alpha > \alpha^I > 1$ and $H4$ to $H3$ for any $\alpha > \alpha^{ER^*}$. However,

$$\alpha^{ER^*} - \alpha^I = -\frac{(\theta_l - 1)^2(2 + \theta_l)(2 + \theta_l + 4\theta_l^2 + \theta_l^3)}{2(1 + \theta_l)(3 + \theta_l)(1 + \theta_l^2)} < 0 \;\; \forall \theta_l \in [0,1).$$

[21] The files are available from the authors upon request.

Thus, if α is sufficiently high to ensure that P_g $H3$ over $H2$, it must be sufficiently high to ensure that P_g chooses $H4$ over $H3$. Accordingly, interim reporting cannot be (strictly) optimal for any α.

Finally, define α^{ER} such that $E[V(\overline{w}^{ER}, ER; \alpha^{ER})] - E[V(w(f), d; \alpha^{ER}] = 0$ and α^C such that $E[V(\overline{w}_s^C, C; \alpha^C)] - E[V(\alpha^{ER}, ER; \alpha^C] = 0$. Subtracting (45) from (47) and (47) from (48) we have

$$\begin{aligned} \alpha^{ER} &\equiv \underbrace{\frac{\overline{w}^{ER} + \Pr(s)\overline{w}^{ER}}{w_0 + \Pr(s)w(s)}}_{=1} + \frac{\Pr(f) + (1 - \Pr(s,s))}{\Pr(s) + \Pr(s,s)}(\overline{w}^{ER} - w(f)) \\ \alpha^C &\equiv \frac{\overline{w}_s^C}{w(s,s)} + \frac{3 - \Pr(s,s)}{\Pr(s,s)w(s,s)}(\overline{w}_s^C - \overline{w}^{ER}), \end{aligned}$$

where

$$\alpha^C - \alpha^{ER} = -\frac{(\theta_l - 1)^3(2 + \theta_l)(3 + 2\theta_l(2 + \theta_l))}{(3 + \theta_l)(2 + \theta_l + \theta_l^2)(1 + \theta_l^3)} > 0 \ \ \forall \theta_l \in [0, 1).$$

It therefore follows that P_g will: (i) be indifferent between disclosure policies for any $\alpha \in (1, \alpha^{ER}]$; (ii) strictly prefer end of project reporting for any $\alpha \in (\alpha^{ER}, \alpha^C)$; (iii) strictly prefer confidentiality for any $\alpha > \alpha^C$. ■

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