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Transparency, Recuitment and Retention in the Public Sector

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Abstract
Although performance measurement systems are likely to have significant recruitment and retention consequences these have received much less attention that the individual incentive effects. This paper explores these recruitment and retention consequences in organizations, such as those in the public sector, which are characterized by rigidities in pay. We clarify when performance measurement increases the cost of recruiting and retaining public sector employees and when it does not. Within the same framework, we also show that traditional practices such as tenure based pay and ports of entry can be rationalized as an optimal response to rigidities in pay.

Keywords: performance measurement, disclosure, sorting, wage compression, public sector

JEL Classification: D73, H10, J31, J45

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1 Introduction

Performance measurement is becoming an inescapable part of life in the public sector. At program level, the Government and Performance Results Act 1993 requires all US federal agencies to prepare performance plans and report annually on progress towards program goals. Equally strong mandates exist in Canada, New Zealand and the UK, with similar initiatives, albeit with less top-down compulsion, in most OECD countries. At organization level, performance measurement also pervades most areas of delivery.[1] In 2002, 43 US States published school level report card data (Kane and Staiger 2002, Figure 1). In the UK, summary indicators are published for every secondary school under the Education Acts 1988, 1992. Lastly, even individual performance measurement is on the increase. In health care, pressure from insurance plans and consumer groups has resulted in public disclosure of report card data right down to individual clinicians.[2]

Since political enthusiasm is not always a perfect predictor of economic efficiency, it seems natural to ask whether governments and their agencies are designing their performance measurement (PM) systems correctly. Are the right data being collected? Should performance be measured at program, organization or individual level? Should performance statistics be fed back confidentiality to employees or published to all stakeholders? As usual, the answer is: it depends; in this instance on the impact PM systems have on recruitment and retention, and on incentives.

To date, the literature has focused almost exclusively on the relationship between PM systems and incentives.[3] This is unfortunate since there are good reasons to believe that recruitment and retention issues play an important role in the running of public services. In the UK the Department of Health recently commented that "the biggest constraint in the NHS today is no longer a shortage of financial resources. It is a shortage of human resources", NHS Plan (2000, cited in Audit Commission 2002). Recruitment and retention problems have also been identified in the US (see, for instance, GAO 2001 and Stinebrickner 2001) as well as in Canada, Denmark, Finland and Sweden, with crises imminent in Austria, Germany, Norway and Spain (Äijälä 2001).

[1] Mannion and Goddard (2000) provide a cross-sector survey of recent developments in the UK. For a comparative survey of US and UK organization and team level PMs see Propper and Wilson (2003).

[2] Schemes similar to New York's Cardiac Surgery Reporting System - in place since 1989 - now exist in a variety of US States. In Europe, the closest comparators are the operating room PMs published for the NHS and hospital level clinical outcome data published by the Scottish Executive (see Mannion and Goddard 2004).

[3] See, for instance, Dixit's (2002) discussion of the optimality of 'low-powered' incentives in the public sector or the burgeoning empirical literature that is documenting dysfunctional responses to incentive schemes (e.g. Courty and Marschke (1997), Heckman (2002)).

The objective of this paper is to study how PM systems affect the recruitment and retention of public sector employees. In doing so, we focus on a key characteristic of the public sector: wage rigidity. Rigidities in public sector pay make it hard for government agencies to recruit and retain high skill groups but also entail paying rents to low skill groups (see, for instance, Katz and Krueger 1991, Postel-Vinay and Turon 2005 and the discussion in Section 2). These rents, typically overlooked in policy circles, lie at the heart of our results.

To emphasize the forces other than effort incentives at work, we study the design of PM systems in the presence of adverse selection rather than moral hazard. In our model, which we set out more fully in Section 3, a public sector organization competes with the private sector labor market to hire a worker in each of two periods. The worker derives a non-pecuniary payoff from working in the public sector which is known to all. His productivity in both sectors is determined solely by his innate ability which is unknown to all. At the beginning of each period the market offers the worker a wage equal to its expectation of his productivity. If it hires him, his performance is publicly available. In contrast, the public sector organization is compelled to be more rigid, having to fix its pay and PM system up-front. If it chooses to be transparent the market learns the worker's performance, if it chooses to be opaque the market learns nothing.

As we show in Section 4, the choice of PM system affects the cost of recruitment and retention. A transparent public sector organization can recruit at the market's entry-level offer (net of the non-pecuniary pay off) because the worker's initial sector choice has no impact on his future income. However, a transparent public sector organization will then find it costly to retain a good performer because it must pay the market reward for success (again net of the non-pecuniary pay off). An opaque organization differs in that it must pay more to recruit the worker but less to retain a good performer. Recruiting is more expensive because the worker, recognizing that 'going private' has an option value, demands greater compensation up-front (what we term the *option-value* effect). The upside is that a good performer can then be retained at no extra cost (the *outside-offer* effect) which, in turn, reduces the expected transfer of rent. The public sector organization therefore faces the choice between (i) recruiting only in the second period, (ii) being transparent, recruiting the worker cheaply in the first period but losing him if he is successful and (iii) being opaque, compensating for the option-value effect and retaining with certainty.

We show that transparency is never optimal. Under transparency no rent is paid in period 1 but a poor performer is retained on the same wage in period 2. Under opaqueness the premium paid in period 1 nets out with the saving made on a good performer, leaving just the rent paid to a poor performer. Notice that the advantage of transparency is that it minimizes rent transfers, while the advantage of opaqueness is that it maximizes retention and hence the gain from non-pecuniary motivation. Transparency is never optimal because, whenever the public sector organization is willing to recruit in period 1 rather than 2, the worker's

non-pecuniary pay off is sufficiently high to ensure that the motivation effect dominates.

In Section 5 we extend the model in a number of directions. We first allow the public sector organization to adopt traditional public sector personnel policies such as service based pay (aka a retention bonus in the second period) and ports of entry (aka a commitment not to recruit in the second period). The main conclusion from the benchmark model is not altered. Transparency is never optimal in the presence of a port of entry or a small service bonus, although it can be weakly optimal if the service bonus is sufficiently high. More importantly, both policies, while increasingly maligned by government, can be rationalized as an optimal response to pay rigidity because they mitigate the transfer of rent to poor performers.

In Section 5 we also allow the market to 'pay for performance'. In this case, if the organization is not transparent but the worker observes his performance, the market will treat willingness to separate from the public sector as a sign of success. This inference drives up the market's second period wage and kills the outside offer effect. As we discuss in Section 6, the consequence is that optimal PM policies are likely to vary across government agencies. In "craft" organizations (Wilson 1989), where workers are aware of their own performance even in an absence of formal performance monitoring, managers may well find it optimal to introduce and then publish formal PMs. In other organizations recruitment and retention considerations will typically be best served by an opaque arrangement.

Related Literature Our approach relates to two strands of literature. The first strand - the adverse selection in labor markets literature - focuses on equilibrium wage profiles, holding the information structure constant.[4] The basic idea, first explored by Greenwald (1986), is that current employers will seek to prevent turnover of their better workers and hence prompt raiders to infer that job separations are disproportionately drawn from the *low* end of the productivity distribution. The resulting 'lemons' problem reduces turnover and shifts wages towards the entry-level market, with entry-level employers offering more than unconditional expected productivity as they compete to place each worker in a captive situation. Greenwald shows that the adverse selection problem intensifies in the three period version of the model as workers bear the scars of separation for longer and so have even less incentive to quit. This, in turn, produces a short-term return to separation as separated workers must be compensated for the consequences of scarring in period 3.

Our results echo several of Greenwald's findings. If our public sector employer fails to publish performance she must also increase her offer in the entry-level market. The reason is very different however: public sector pay must compensate for the option value effect. In a three period version of our model workers can also be scarred by the market. However, measuring but failing to publish performance prompts the market to infer that public sector

[4] A comprehensive review of this literature is provided by Gibbons (1999, Section 3.4) and is not repeated here. For a review of the more tangentially related papers in the job-assignments as signalling literature (e.g. Waldman 1984), see Gibbons (1999, Section 3.2).

quitters are drawn from the *high* end of the productivity distribution.[5] As a result, in our inter-sector setting, it is the period 2 public sector *stayers* rather than quitters that are scarred which, in turn, necessitates a higher level of public sector pay to secure retention in period 2.

The second strand - the nascent optimal performance disclosure literature - solves simultaneously for equilibrium wage profiles and information structures. Calzolari and Pavan (2004) and Koch and Peyrache (2003) assume workers/agents separate exogenously after period 1 and hence restrict attention to incentive and recruitment issues (interestingly both also find that transparency is rarely optimal). More closely related to our work is Mukherjee (2004) who extends Greenwald's analysis by allowing entry-level employers to commit to a disclosure rule and by giving entry-level employees an effort choice. The central point is that transparency *can* be optimal. Immediately publishing performance maximizes the trading surplus in period 2 by removing the winner's curse effect. This benefits the entry-level employer because the gain in surplus accrues to worker (by virtue of competition between raiders) and can therefore be appropriated up-front as a lower entry-level wage. In our setting transparency also enables the public sector employer to pay a lower entry-level wage - although by eliminating an option-value, rather than winner's curse, effect - but is not an optimal *public sector* PM system (i.e. in the presence of pay compression) because of the rents paid to poor performers.[6]

2 Evidence of Relative Pay Compression and Sorting

Anecdotal evidence of pay inflexibility in the public sector is common place (e.g. Äijälä 2001, OECD 2002) but is also borne out by the data. The wage gaps presented in Table A1 in Appendix A show that, across a wide range of countries, the unconditional wage distribution is indeed more compressed in the public sector than in the private sector. The 10th and 90th quantile regression estimates collated in Table A2 provide more compelling evidence that it is pay setting policies - rather than simply characteristics - that differ across sectors. With two exceptions (poorly educated British men and highly educated German women), the first number in each cell is higher than the second, indicating that the conditional wage distribution is more compressed in the public sector, both across and within education groups. More importantly, in many cells, the first number is positive and the second negative. This substantiates the claim that public sector pay is inflexible rather than simply ungenerous. To the extent that these are true premiums and penalties (see Disney and Gosling (1998) for a discussion), a public sector employee with given characteristics at the 10th percentile of wage distribution would, taken at

[5] Echoing the findings of Katz and Krueger (1991), Borjas (2002) and Hoxby and Leigh (2004) described in Section 2, in our model public sector pay inflexibility creates *favorable* selection into the labor market.

[6] Blanes i Vidal (2002) focuses on a rather different 'career concerns for experts' setting but makes a similar point. Delegating decision-rights (akin to not measuring performance in our or Mukerjee's setting) restores symmetry and hence kills the winner's curse. This benefits the entry-level employer by strengthening career concern incentives.

random, lose from a move to the private sector while the converse would be true at the 90th percentile.

Turning to the implications of pay rigidity, Katz and Krueger (1991) report that, over the course of early 1980's, application rates per hire rose for blue-collar US federal jobs but fell for white-collar federal jobs, the median Math SAT score of new scientists and engineers at the US Department of Defence (DOD) declined relative to the student population and the separation rate for DOD scientists and engineers scoring above 650 on the Math SAT was 50% greater than those below that level. Exploiting better data (CPS-ORG files 1979-2002), Borjas (2002) estimates the partial effect of relative wage compression on the private sector wage gap (acting as a proxy for the skill gap) between US public sector quitters and prospective public sector entrants. Controlling for observable worker characteristics and year effects, Borjas suggests that the 15% drop in the inter-sector ratio of standard deviations of weekly log income between 1979-2002 increased the wage gap by about 4%. Hoxby and Leigh (2004) narrow their focus to education and attempt to apportion the blame for the decline in the aptitude of US public school teachers between improved job opportunities for females and the compression of teaching wages due to unionization. Using state labor laws as instruments to isolate wage effects due to unionization, they suggest that pay compression explains about 80% of the decline of the share of teachers in the highest aptitude group (SAT scores in the top 5 percentiles).

A variety of explanations for rigidities in public sector pay have been mooted, ranging from the economic (higher rates of unionization, larger employer size, non-profit status, inelastic/monopsonistic demand for labor) to the political (narrow nationwide pay scales, affirmative action/minium wage policies, electoral wage cycles) but there have been few rigorous attempts to pursue the issue. While this leaves the root causes of public sector pay inflexibility as an important open question, its concomitant effects appear clear: pay rigidities make it hard for the public sector to recruit and retain the best, rather than worst, employees.

3 The Benchmark Model

A public sector employer (she) and a private sector labor market compete to hire a worker (he) to a series of tasks. Each task takes one period to complete. The worker is productive for 2 periods and so can complete at most 2 tasks. All tasks either succeed or fail, with the outcome in period $t = 1, 2$ denoted by $y_t \in \{s, f\}$. The value of task success is normalized to 1 and the value of failure to 0. The probability of task success in period t is determined solely by the worker's innate skill level θ, i.e. $\Pr(y_t = s \mid \theta) = \theta$ for all $t = 1, 2$. The realization of θ is unknown to everybody. In the entry-level market all players share the prior belief that the worker is as likely to be 'high-skilled' ($\theta = \theta_h$) as 'low-skilled' ($\theta = \theta_l$), where $\theta_h > \theta_l$ and, to economize on parameters, we set $\theta_h = 1 - \theta_l$.[7]

[7]The practical implication of the assumption $\theta_h = (1 - \theta_l)$ is that $\Pr(y_t = s) = \Pr(y_t = f) = \frac{1}{2}$.

Each period the worker chooses a sector $c_t \in \{g, m\}$ to maximize his (undiscounted) expected utility. The choice $c_t = g$ will be termed *going public* and the choice $c_t = m$ *going private*. His per-period payoff to going public in period t is $w_{gt} + \alpha$, while his per-period payoff to going private in period t is w_{mt}. The wage offers w_{gt} and w_{mt} are discussed below. The exogenous parameter $\alpha \in \Re$ is common knowledge and denotes the worker's non-pecuniary payoff to working in the public sector relative to the private sector. It will be termed his *intrinsic motivation*.

The public sector employer (P_g) moves once at the beginning of the game, committing to a PM policy and a pay policy to maximize total expected public sector profit (the undiscounted sum of expected output less wages). For reasons discussed at the end of this Section we focus on just two PM policies. P_g can either commit to abstain from performance measurement (no one observes y_1) or to measure and publish y_1 (everyone observes y_1). We will term the former a policy of *opaqueness* and the latter a policy of *transparency*. Turning to her pay policy, we model the rigidities described in Section 2 as follows.

A1 *Public sector pay in period t is determined by the formula* $w_{gt} = \gamma \overline{w} + (1 - \gamma)(w_{mt} - \alpha)$.

P_g chooses the fixed component $\overline{w}$ once, alongside the PM policy, at the beginning of the game. The weighting term $\gamma \in (0, 1]$ is exogenous and parameterizes pay compression. When γ is equal to 1 public sector pay is constant through time. As γ approaches 0 public sector pay responds to the market's outside offer to leave the worker indifferent between sectors. Increments in pay for length of service are considered in Section 5.1.

A2 *The worker cannot be fired from, or denied entry to, the public sector in any period.*

P_g employs the worker whenever he is willing to work for a wage of w_{g_t}. The assumption that the worker cannot be fired is consistent with the low public sector dismissal rates reported by Wilson (1989) and Postel-Vinay and Turon (2005) and will be maintained throughout.[8] The assumption that the worker cannot be denied entry is necessary to generate the transitions from the private sector documented by both Katz and Krueger (1991) and Postel-Vinay and Turon (2005). For intermediate values of $\overline{w}$, a worker who has failed in the private sector in period 1 will switch to the public sector in period 2. This assumption is potentially contentious, however, and will be relaxed in Section 5.2 where we allow P_g to operate a 'port of entry' (or equivalently deny entry to low skill groups).

To enable us to focus on public sector performance measurement, the market is treated as a passive player. It is assumed that private sector task outcomes cannot be hidden from the worker or outsiders (for instance due to profit signals from a marketed good). If the worker

[8] Wilson (1989) devotes an entire chapter to the constraints US government agencies face when acquiring and disposing of factors of production and notes that "improving service... may require replacing slow or surly workers with quick and pleasant ones. But the manager can neither hire nor fire them at will" (p. 135).

spent period 1 in the private sector, all players will have observed y_1 by the start of period 2. It is also assumed that the market cannot write contingent contracts, but instead makes offers as set out in Assumption 3.

A3 *Private sector pay in period t is given by $w_{mt}(H_t) = \Pr(y_t = s \mid H_t) = \Pr(\theta_h \mid H_t) \cdot \theta_h + \Pr(\theta_l \mid H_t) \cdot \theta_l$, where H_t is the worker's observable history prior to period t.*

The market's period t offer is equal to its conditional expectation of the worker's period t productivity. To ease notation the wage w_{m1} will be written as w_0, $w_{m2}(y_1 = s)$ as $w(s)$, and $w_{m2}(y_1 = f)$ as $w(f)$.[9] The prohibition on contingent contracts will be relaxed in Section 5.3 where we also consider the possibility that the worker, but not the market, observes y_1.

To summarize, the timing of the game is as follows.

Period 0. Nature chooses the worker's ability θ. P_g commits to a (PM, $\overline{w}$) pair to maximize total expected public sector profit.

Period $t = 1, 2$.

Stage 1 The worker is offered w_{gt} and w_{mt}.

Stage 2 The worker makes a sector choice $c_t \in \{g, m\}$ to maximize expected utility and is paid w_{gt} or w_{mt}. The task outcome $y_t \in \{s, f\}$ is realized. If $c_t = m$, all players observe y_t; if $c_t = g$, y_t is measured and published in accordance with the PM policy.

Our interest lies in solving for the optimal (PM, $\overline{w}$) pair as a function of the exogenous parameters of the model α, γ and θ_h. Since the worker moves without private information we solve for the sub-game perfect equilibrium by backwards induction. Before doing so, however, we briefly return to three of our modelling choices.

The set of PM policies. In our benchmark model we abstract from situations where y_1 is observed by insiders but not outsiders. The situation where P_g (but not the market) observes y_1 is identical to opaqueness simply because her only strategic move is in period 0. In the benchmark model, a worker who knows he was unsuccessful in period 1 will find the market's period 2 offer as attractive as a worker who knows he was successful. Since this prevents the market from screening, the situation where the worker (but not the market) observes y_1 is also identical to opaqueness. We are, of course, implicitly assuming that P_g can prevent the worker from observing y_1. The possibility that the worker observes y_1 by default is discussed in the context of "craft" organizations in Section 6.

Exogenous pay compression. We take γ to be exogenous for simplicity but also because, lacking any empirical evidence, we are agnostic about the root cause of the pay compression

[9] Given our assumption that $\theta_h = 1 - \theta_l$ and applying Bayes' Rule, these wages are $w(s) = 1 - 2(\theta_h - 1)\theta_h > w_0 = \frac{1}{2} > w(f) = 2(\theta_h - 1)\theta_h$.

described in Section 2. It is possible to micro-found pay inflexibility by re-specifying P_g's objective function as an isoelastic social welfare function with an inequality aversion parameter and/or including a concern for political support from labor groups that increases with γ.

Teams. There is no conceptual problem in aggregating the analysis up to team level; the same trade offs exist irrespective of whether the decision is to collect and publish a noisy team-based statistic or a more informative individual-based PM. A thornier issue is that different PM systems may be used at different tiers of the same organization. For instance, Wilson et al (2004) report that UK head teachers engage in extensive internal performance measurement in addition to publishing organization level PMs. We conjecture that this is a sub-optimal arrangement (as we show in Section 5, internal PMs inhibit both recruitment and retention) but leave a thorough analysis of multi-dimensional PM systems to future research.

4 Analysis

To clarify the role played by pay rigidity, we first present a Lemma that describes the equilibrium when public sector pay is fully responsive to outside offers ($\gamma = 0$) and, as result, P_g chooses whether to enter the labor market rather than $\overline{w}$.

Lemma 1. *Assume A1-A3 but that $\gamma = 0$. If the worker is pre-disposed to the private sector ($\alpha < 0$) P_g withdraws from the labor market, otherwise she recruits and retains with certainty and makes a total expected profit of 2α under any PM policy.*

The proof of Lemma 1 is given in Appendix B. The intuition is the following. PM systems have no impact because, in expectation, P_g does not transfer any rent to the worker. To see why this is the case, it is helpful to distinguish between three different 'types' of worker: the worker yet to complete a task (A_0), the worker whose period 1 task was a success (A_s) and the worker whose period 1 task was a failure (A_f). When P_g adopts a policy of transparency the market's period 2 offer depends on the worker's initial performance but not on his sector choice. A_0 therefore knows that his sector choice has no bearing on his future payoff and so chooses between sectors on the basis of his current offers. Consequently, P_g hires all types - including A_f - at a wage equal to their future productivity less their intrinsic motivation and so makes a total expected profit of 2α.[10]

Under a policy of opaqueness, however, the market's period 2 offer depends on the worker's period 1 sector choice. If A_0 goes private opaqueness obviously has no bite, but if he goes public, the market offers w_0 to both A_s and A_f. A_0 therefore anticipates that going private rather than public results in a higher wage in period 2 if he is successful, but that going public rather than private results in a higher wage in period 2 if he fails. In the absence of

[10]Here and in what follows we say that P_G can hire the worker 'at' the wage that leaves him indifferent between sectors. Of course, she would need to offer ε more than this wage to do so with certainty.

pay rigidities, however, these effects wash out, prompting A_0 to choose a sector on the basis of his current offers. Now P_g hires A_0 at $w_0 - \alpha$, A_s at less than $w(s) - \alpha$ and A_f at more than $w(f) - \alpha$. Since the saving on A_s of $w(s) - w_0$ and the rent paid to A_f of $w_0 - w(f)$ cancel out in expectation, P_g again makes a total expected profit of 2α.[11]

Having shown that PM systems have no impact on the expected costs of recruitment and retention when $\gamma = 0$, we now turn to the more interesting case where $\gamma > 0$. To establish the optimal PM policy in the presence of pay compression we need to know which, if any, (PM, $\overline{w}$) pair achieves each of the 8 hiring alternatives listed in Table 1 at the lowest cost.

Table 1: Hiring Alternatives under A1 and A2

Altn.	Period 1	Period 2	Feasible?	Reason
0	Do not recruit	Do not recruit	yes	$\overline{w}$
i	Do not recruit	Recruit A_f from market	yes	$\overline{w}$ & A2
ii	Recruit A_0	Retain only A_f	yes	$\overline{w}$
iii	Recruit A_0	Retain A_f & A_s	yes	$\overline{w}$
iv	Do not recruit	Recruit A_s from market	no	A1
v	Do not recruit	Recruit A_f & A_s from market	no	A1
vi	Recruit A_0	Do not retain	no	A1 & A2
vii	Recruit A_0	Retain only A_s	no	A1 & A2

This is less tedious than it sounds as the last four alternatives are not feasible for any (PM, $\overline{w}$) pair. Consider Alternatives iv and v. In the presence of pay compression (A1), setting $\overline{w}$ high enough to recruit A_s simply prompts A_0 to go public in the first place. Now consider Alternatives vi and vii. If $\overline{w}$ is high enough to recruit A_0, then A_f will wish to stay put (by A1) and so must be retained (by A2). This leaves us with the first four alternatives. Since Alternatives 0 and i can be achieved at the same cost under any PM policy (because there is no public sector performance to measure), all that remains is to establish which (PM, $\overline{w}$) pair minimizes the expected cost of Alternatives ii and iii.

When P_g adopts a policy of transparency the market always offers $w(y_1)$ in period 2. This implies that the worker will go public in period 2 if and only if $w_{g2} + \alpha \geq w(y_1)$. His date zero expected utility from going public in period 1 under a policy of transparency is therefore

$$\begin{aligned} E[U(c_1 = g, T)] &= \gamma\left(\overline{w} + \alpha\right) + (1-\gamma)w_0 \\ &\quad + \sum_{y_1 \in \{s,f\}} \Pr(y_1) \max\{\gamma\left(\overline{w} + \alpha\right) + (1-\gamma)w(y_1), w(y_1)\}, \end{aligned} \tag{1}$$

[11] We define rent as any payment in excess of the worker's true expected productivity less his intrinsic motivation. For instance, for A_f this is any payment above $w(f) - \alpha$.

while his date zero expected utility from going private in period 1 under *any* PM policy is

$$E[U(c_1 = m, .)] = w_0 + \sum_{y_1 \in \{s,f\}} \Pr(y_1) \max\{\gamma(\overline{w} + \alpha) + (1-\gamma)w(y_1), w(y_1)\}. \quad (2)$$

Equation (1) is equal to (2) when $\overline{w} = w_0 - \alpha$. Echoing the case where $\gamma = 0$, P_g can therefore recruit A_0 at a wage of $w_0 - \alpha$ but, having published y_1, will only be able to retain A_s at the higher wage of $w(s) - \alpha$. The key difference, of course, is that A_f now receives some rent.

Recall that when P_g adopts a policy of opaqueness the market's period 2 offers depends on the worker's sector choice. If the worker goes private in period 1, the PM policy has no bite but, if he goes public, his outside offer remains at w_0. Being opaque therefore saves P_g the expense of having to offer $w(s) - \alpha$ to retain A_s. The downside is that, anticipating a lower reward for public sector success, the worker will require more compensation to go public in period 1. To see why, note that the worker's date zero expected utility from going public in period 1 under a policy of opaqueness is now given by

$$E[U(c_1 = g, O)] = \gamma(\overline{w} + \alpha) + (1-\gamma)w_0 + \max\{\gamma(\overline{w} + \alpha) + (1-\gamma)w_0, w_0\}. \quad (3)$$

Equation (3) is equal to (2), when $\overline{w} = \overline{w}^* - \alpha$ where

$$\begin{aligned} \overline{w}^* &\equiv \tfrac{1}{1+\Pr(s)} w_0 + \tfrac{\Pr(s)}{1+\Pr(s)} w(s) && (4) \\ \Rightarrow \overline{w}^* - w_0 &= \tfrac{\Pr(s)}{1+\Pr(s)} [w(s) - w_0] && (5) \\ \Leftrightarrow w(s) - \overline{w}^* &= \tfrac{1}{1+\Pr(s)} [w(s) - w_0]. && (6) \end{aligned}$$

Opaqueness therefore differs from transparency in two respects. On the one hand, it makes it harder to recruit by creating an option value to going private. Suppose that P_g sets $\overline{w} = w_0 - \alpha$. If the worker goes public in period 1 his expected utility in period 2 is w_0. However, he knows that if he goes private and fails he will receive $\gamma w_0 + (1-\gamma)w(f)$ in the public sector in period 2 but that if he succeeds he can exercise his option to stay in the private sector and earn $w(s)$. Going private therefore yields a higher expected period 2 wage and P_g fails to recruit at $\overline{w} = w_0 - \alpha$. The magnitude of this *option-value* effect is given in (5). Notice that the more likely the worker feels he is to succeed, the more likely this option is to be exercised and hence the larger the compensation needed in public sector pay to convince him to go public. On the other hand, since the worker is willing to go public in period 1 at $\overline{w}^* - \alpha < w(s) - \alpha$, opaqueness makes it easier to retain the worker if he is successful by driving down his outside offer. The magnitude of this *outside-offer* effect is given in (6).

The option-value and outside-offer effects are depicted by the solid and dashed arrows in Figure 1. A move from left to right illustrates that P_g can achieve: Alternative 0 and i at the same cost under any PM policy; Alternative ii by adopting a policy of transparency and setting $\overline{w} = w_0 - \alpha$; and Alternative iii (at least cost) by adopting a policy of opaqueness and setting $\overline{w} = \overline{w}^* - \alpha$.

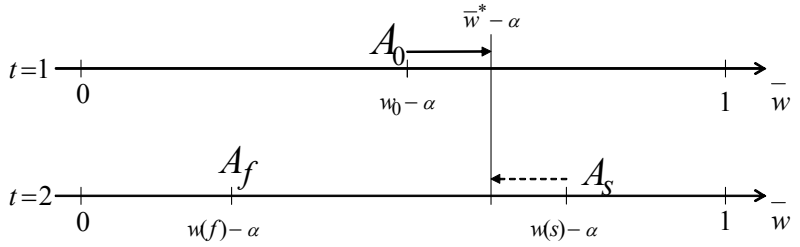

Figure 1: The Option-value and Outside-offer Effects

Table 2: Comparing Feasible Hiring Alternatives

Altn.	PM Policy	Minimum $\overline{w}$	Total Expected Profit
0	Arbitrary	0	0
i	Arbitrary	$w(f) - \alpha$	$\Pr(f)\alpha$
ii	Transparency	$w_0 - \alpha$	$[1 + \Pr(f)]\,\alpha - \Pr(f)\gamma\,[w_0 - w(f)]$
iii	Opaqueness	$\overline{w}^* - \alpha$	$2\alpha - \Pr(f)\gamma\,[\overline{w}^* - w(f)]$

Table 2 lists the total expected profit associated with each alternative. Under Alternative i P_g recruits A_f and pays him his (true) expected productivity less his intrinsic motivation (i.e. $w_{g2} = \gamma\,(w(f) - \alpha) + (1 - \gamma)\,(w(f) - \alpha) = w(f) - \alpha$). Total expected profit is therefore the saving (or loss if $\alpha < 0$) made on A_f arising from his intrinsic motivation. Under Alternative ii A_0 is paid her expected productivity less her intrinsic motivation but A_f now receives a rent of $\gamma\,[w_0 - w(f)]$. Total expected profit is therefore the saving/loss made on A_0 and A_f arising from their intrinsic motivation less the rent paid to A_f. Calculating the total expected profit under Alternative iii is more complicated as the option-value effect implies that A_0 is paid more than $w_0 - \alpha$, while the outside-offer effect implies that A_s is paid less than $w(s) - \alpha$. A pause for thought, however, confirms that these effects must wash out. Formally, $\gamma\,[\overline{w}^* - w_0] \equiv \Pr(s)\gamma\,[w(s) - \overline{w}^*]$. Consequently, total expected profit is the saving/loss made on A_0, A_f and A_s arising from their intrinsic motivation less the (now higher) rent paid to A_f of $\gamma\,[\overline{w}^* - w(f)]$. A comparison of these expected profit levels yields our first result.

Proposition 1. *Assume A1-A3. There exists a critical value of the worker's intrinsic motivation, $\alpha^*(\gamma, \theta_h) > 0$, such that if $\alpha < \alpha^*$ the choice of PM policy is arbitrary, while if $\alpha \geq \alpha^*$ it is strictly optimal for P_g to abstain from performance measurement.*

The proof of this 'no transparency' result,[12] including an explicit expression for $\alpha^*(\gamma, \theta_h)$,

[12]The statement 'no transparency' refers to the fact that transparency is not optimal whenever P_G recruits in period 1. A policy of transparency is, of course, weakly optimal for any $\alpha < \alpha^*$ simply because there is no public sector performance to measure.

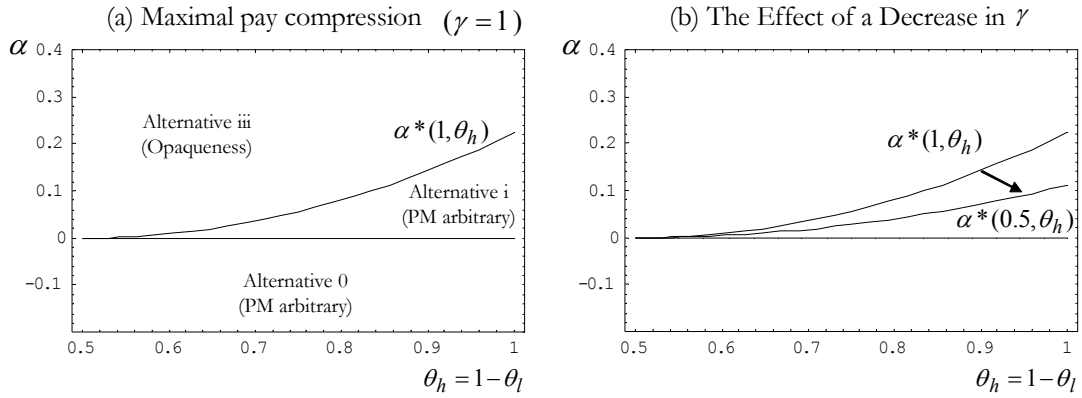

Figure 2: The Benchmark 'No Transparency' Result

is provided in Appendix B. The intuition is best seen in two steps. First, consider what happens when $\alpha \leq 0$. If the worker is pre-disposed to the private sector P_g will withdraw from the labor market, while if the worker has no intrinsic motivation she will recruit A_f from the private sector in period 2. In both cases there is no public sector performance to measure and so the PM policy is arbitrary. Now suppose that α is sufficiently high such that P_g is willing to recruit in period 1. Is it optimal to stop there or will P_g strive to recruit and retain with certainty? There are two opposing effects. On the one hand, retaining with certainty transfers more rent to A_f - the *rent* effect. On the other, P_g benefits from A_s's intrinsic motivation - the *motivation* effect. In the benchmark model the motivation effect always dominates. In short, if α is sufficiently high to prompt P_g to recruit in period 1, it is optimal for her to set $\overline{w}$ a little higher to retain with certainty.

Figure 2 provides an illustration of Proposition 1. The key point to note is that there is no region where it is optimal to pick Alternative ii. To fix this idea, consider a vertical slice through Figure 2, panel (a) with $\theta_h = 0.65$. If the worker is pre-disposed to private sector employment ($\alpha < 0$) then it is not optimal for P_g to hire in any period (Alternative 0). As the worker's antipathy towards the public sector decreases it will eventually become optimal to recruit in period 2 (Alternative i). This switch occurs at $\alpha = 0$. As the worker starts to display public service motivation ($\alpha > 0$) it will eventually become optimal to switch to recruiting and retaining with certainty (Alternative iii). This second switch occurs at $\alpha^*(\gamma, 0.65) = 0.02$. The function α^* is increasing in γ and θ_h because both parameters entail a greater transfer of rent to A_f under Alternative iii.

5 Alternative Personnel Policies

The finding that it is never optimal for P_g to commit to a policy of transparency is obviously a stark result. In this Section we explore whether this benchmark 'no transparency' result is robust to alternative personnel policies commonly found in the public and private sectors. The consequences of extending the model to more than two periods and levels of output are discussed in Section 6.

5.1 Service Based Pay in the Public Sector

Pay schemes that reward a worker's length of service are common place in the public sector (see, e.g., OECD 2002). In this Subsection we establish the optimal PM policy when P_g commits to supplement $\overline{w}$ by an amount $b > 0$ after one period of service. Formally, the model is the same as in Section 4 save for the fact that A1 is now replaced by:

A1′ *Public sector pay is determined by the formula*

$$\begin{aligned} w_{g_1} &= \gamma\overline{w} + (1-\gamma)(w_{m1} - \alpha) \\ w_{g_2} &= \begin{cases} \gamma(\overline{w} + b) + (1-\gamma)(w_{m2} - \alpha) & \text{if } c_1 = g \\ \gamma\overline{w} + (1-\gamma)(w_{m2} - \alpha) & \text{if } c_1 = m. \end{cases} \end{aligned}$$

Although we will ultimately allow P_g to choose b alongside the (PM, $\overline{w}$) pair at the beginning of the game, we first consider the case where b is exogenously set below $2[w_0 - w(f)]$. Doing so clarifies the intuition and, moreover, may be descriptive in settings where service bonuses are determined by negotiation between central government and unions.

If the worker goes private in period 1 the service bonus and PM policy have no bite and the worker's date zero expected utility from going private in period 1 is given in (2). Things change, however, when the worker goes public in period 1. Under a policy of transparency he will go public in period 2 if and only if $w_{g2} + \alpha \geq w(y_1)$ and so his date zero expected utility from going public in period 1 is

$$\begin{aligned} E[U(c_1 = g), T] &= \gamma(\overline{w} + \alpha) + (1-\gamma)w_0 \\ &\quad + \sum_{y_1 \in \{s,f\}} \Pr(y_1) \max\{\gamma(\overline{w} + \alpha + b) + (1-\gamma)w(y_1), w(y_1)\}. \end{aligned} \tag{7}$$

Under a policy opaqueness, he will go public in period 2 if and only if $w_{g2} + \alpha \geq w_0$ and so his date zero expected utility from going public in period 1 is

$$E[U(c_1 = g), O] = \gamma(\overline{w} + \alpha) + (1-\gamma)w_0 + \max\{\gamma(\overline{w} + \alpha + b) + (1-\gamma)w_0, w_0\}. \tag{8}$$

Equation (7) is equal to (2) when $\overline{w} = w_0 - \alpha - \Pr(f)b$, while equation (8) is equal to (2) at $\overline{w} = \overline{w}^* - \alpha - \frac{b}{1+\Pr(s)}$, where $\overline{w}^*$ is given in (4).

Just as in Section 4, a policy of opaqueness makes it harder to recruit A_0 by creating an option value to going private but easier to retain A_s by driving down his outside offer. Table 3 lists the total expected profit associated with each of the four feasible hiring alternatives.

Table 3: Comparing Feasible Hiring Alternatives ('low' service bonus)

Altn.	PM Policy	Minimum $\overline{w}$	Total Expected Profit
0	Arbitrary	0	0
i	Arbitrary	$w(f)-\alpha$	$\Pr(f)\alpha$
ii	Transparency	$w_0-\alpha-\Pr(f)b$	$[1+\Pr(f)]\,\alpha-\Pr(f)\gamma\,[w_0-w(f)-\Pr(f)b]$
iii	Opaqueness	$\overline{w}^*-\alpha-\frac{b}{1+\Pr(s)}$	$2\alpha-\Pr(f)\gamma\left[\overline{w}^*-w(f)-\frac{b}{1+\Pr(s)}\right]$

Note that the expected return to Alternative ii and iii is higher than in Table 2 because the service bonus reduces the rent paid to A_f. To see why, consider Alternative ii. P_g can recruit A_0 on a lower wage because he expects to receive the service bonus in period 2 if he fails in period 1. Of course, this saving on A_0 is offset (in expectation) by the fact that P_g then has to pay b to A_f. Crucially, however, $\overline{w}$ is lower and so P_g transfers less rent to A_f. Notice that if P_g chooses Alternative iii she can recruit A_0 on an even lower wage as he now expects to receive the service bonus with certainty. Formally, $b/\left[1+\Pr(s)\right] > \Pr(f)b$. This latter observation implies that the service bonus reduces the magnitude of the option-value effect and, in turn, P_g's transfer of rent to A_f under Alternative iii. In fact, as b approaches $2\left[w_0-w(f)\right]$ the option-value effect disappears and P_g transfers the same rent under Alternatives iii and ii. A comparison of the expected profit levels listed in Table 3 establishes the optimal PM policy when $b<2\left[w_0-w(f)\right]$.

Proposition 2. *Assume A1′, A2, A3 and that the service bonus is low ($0<b<2\left[w_0-w(f)\right]$). There exists a critical value of the worker's intrinsic motivation, $0<\alpha'(\gamma,\theta_h,b)<\alpha^*(\gamma,\theta_h)$, such that if $\alpha\leq\alpha'$ the choice of PM policy is arbitrary, while if $\alpha>\alpha'$ it is strictly optimal for P_g to abstain from performance measurement.*

A low service bonus preserves our benchmark result: transparency is dominated whenever P_g recruits in period 1 and so has performance to measure. The intuition is simple and follows from the rent and motivation effects discussed in Section 4. Specifically, a positive service bonus reduces the rent effect. Since the motivation effect is unchanged, Proposition 1 therefore implies that it cannot be optimal for P_g to choose Alternative ii. The critical value is lower ($\alpha'<\alpha^*$) because less rent is transferred to A_f under Alternative iii.

Taken together, Propositions 1 and 2 imply that a policy of transparency is dominated whenever the service bonus is sufficiently low. Since it remains of interest to establish what

level of bonus P_g would commit to if free to do so, we conclude this Subsection by considering the case where $b \geq 2[w_0 - w(f)]$.

A commitment to pay a 'high' service bonus has two effects. First, under a policy of transparency, P_g can retain A_s at a wage below that needed to recruit A_f from the market, namely at $\overline{w} = w(s) - \alpha - b < w(f) - \alpha$. Second, it enables P_g to recruit A_0 at the same wage under both transparency and opaqueness. In short, a high bonus removes both the option-value and outside-offer effects. P_g therefore faces just two feasible hiring alternatives: she can withdraw from the labour market or she can recruit and retain with certainty by adopting *either* a policy of transparency or opaqueness and setting $\overline{w} = w_0 - \alpha - \frac{b}{2}$.

Table 4: Comparing Feasible Hiring Alternatives ('high' service bonus)

Altn.	PM Policy	Minimum $\overline{w}$	Total Expected Profit
0	Arbitrary	0	0
iii	Either	$w_0 - \alpha - \frac{b}{2}$	2α

A comparison of the total expected profit levels in Tables 2-4 yields the following result.

Proposition 3. *Assume A1′, A2 and A3. If $\alpha < 0$ the choice of PM policy is arbitrary, while if $\alpha \geq 0$ it is strictly optimal for P_g to commit to a service bonus $b \geq 2[w_0 - w(f)]$ and weakly optimal for her to abstain from performance measurement.*

There are two points to take away from Proposition 3. First, service based pay can be rationalized as an optimal response to exogenous compression in public sector pay. Setting a 'high' bonus enables P_g to achieve a payoff of 2α which, from Lemma 1, is the same pay-off that she could achieve in the absence of pay compression . Second, if P_g is free to commit to such a bonus, it is now only weakly optimal to abstain from performance measurement.

5.2 A Port of Entry in the Public Sector

Personnel policies restricting entry to certain grades/ages are also common in the public sector, particularly within the civil service.[13] In this Section we show that our 'no transparency' result persists in the presence of such a 'port of entry'.[14] Formally, the model is the same as in Section 4 save for the fact that we replace A2 with

A2′ *The worker cannot be fired but can only enter the public sector in period 1.*

[13]Ports of entry are clearly apparent in the data reported in OECD (1999). In 1997 the ratio of the percentage of entrants to serving staff in the UK Civil Service was more than 5 times higher for the 16-24 age bracket than for any other age group. A similar pattern was true for Australia (the only other country for which age at entry data was available).

[14]A similar result holds if P_G commits to deny entry to A_f but not A_s.

Since going private in period 1 necessarily implies staying in the private sector in period 2, the worker's date zero expected utility from going private in period 1 is, under any PM policy,

$$E[U(c_1 = m, .)] = w_0 + \sum_{y_1 \in \{s,f\}} \Pr(y_1) w(y_1). \tag{9}$$

When the worker goes public in period 1 the analysis is the same as in Section 4. Date zero expected utilities from going public in period 1 under a policy of transparency and opaqueness are therefore given in (1) and (3) respectively. Equation (1) is equal to (9) when $\overline{w} = \overline{w}^{pe} - \alpha$, where

$$\overline{w}^{pe} \equiv \tfrac{1}{1+\Pr(f)} w_0 + \tfrac{\Pr(f)}{1+\Pr(f)} w(f) \tag{10}$$

$$\Rightarrow w_0 - \overline{w}^{pe} = \tfrac{\Pr(f)}{1+\Pr(f)} \left[w_0 - w(f) \right]. \tag{11}$$

Equation (3) is equal to (9) when $\overline{w} = w_0 - \alpha$.

In the presence of a port of entry, a policy of transparency creates an option value to going public (the magnitude in (11)). The logic mirrors that in Section 4. The more likely the worker feels he is to fail, the more likely he is to exercise his option to stay in the public sector and hence the larger the amount by which P_g can undercut the market offer of w_0. Opaqueness therefore differs from transparency in two respects. On the one hand, it makes it harder to recruit by *removing* an option-value to going *public* (rather than by creating an option-value to going private). On the other hand, since the worker is willing to go public in period 1 at $w_0 - \alpha < w(s) - \alpha$, it makes it easier to retain the worker if he is successful by driving down his outside offer. When operating a port of entry, P_g can therefore achieve: Alternative 0 at the same cost under any PM policy; Alternative ii by adopting a policy of transparency and setting $\overline{w} = \overline{w}^{pe} - \alpha$; and Alternative iii (at least cost) by adopting a policy of opaqueness and setting $\overline{w} = w_0 - \alpha$.

Table 5: Comparing Feasible Hiring Alternatives (with a port of entry)

Altn.	PM Policy	Minimum $\overline{w}$	Total Expected Profit
0	Arbitrary	0	0
ii	Transparency	$\overline{w}^{pe} - \alpha$	$[1 + \Pr(f)]\,\alpha$
iii	Opaqueness	$w_0 - \alpha$	2α

Table 5 lists the total expected profit levels associated with each of the three feasible alternatives. Now all rent is offset in expectation. If P_g chooses Alternative ii the rent transferred to A_f is offset by the saving on A_0. Likewise if she chooses Alternative iii the rent transferred to A_f is offset by the saving made on A_s. Formally, $\gamma \left[w_0 - \overline{w}^*_{pe} \right] \equiv \Pr(f)\gamma[\overline{w}^*_{pe} - w(f)]$ and $\Pr(s)\left[w(s) - w_0\right] \equiv \Pr(f)\left[w_0 - w(f)\right]$. A comparison of the total expected profit levels in Tables 2 and 5 yields the following result.

Proposition 4. *Assume A1, A2′ and A3. If $\alpha < 0$ the choice of PM policy is arbitrary, while if $\alpha \geq 0$ it is strictly optimal for P_g to operate a port of entry and to abstain from performance measurement.*

The operation of a port of entry preserves our benchmark 'no transparency' result and can also be rationalized as an optimal response to exogenous compression in public sector pay. Again, the intuition is simple and follows from the rent and motivation effects. By committing not to recruit in period 2, P_g removes the rent effect. As a result, whenever she enters the labor market, it is optimal for her to choose Alternative iii, and hence a policy of opaqueness, to maximize the motivation effect. The critical value is now at zero because no rent is transferred to A_f under Alternative iii.

5.3 Performance Based Pay in the Private Sector

If pay is often based on length of service in the public sector, in the private sector it is common to find it explicitly linked to performance. In this Subsection we establish the optimal PM policy when the market offers a performance contingent bonus. Formally, the model is the same as in Section 4 save for the fact that we set $\gamma = 1$ and replace A3 with

A3′ *At the start of period t the market offers a contract that pays a strictly positive base wage w_t plus a bonus β_t iff $y_t = s$. This contract breaks even in expectation implying that $w_t = (1 - \beta_t) \Pr(y_t = s \mid H_t)$.*

The requirement that the market's contract break even in expectation has two consequences. First, it implies that β_t acts a parameter that determines the sensitivity of the worker's pay to his performance. When $\beta_t = 1$ the worker is paid the value of his period t output; as β_t approaches 0 his period t pay is independent of his period t output (as in Section 4). Second, for any $\beta_t < 1$, the worker's period t pay is increasing in the market's belief that he is likely to succeed in period t. Notice that a worker who knows he was successful in period 1 will now find any given contract $<w_t, \beta_t>$ more attractive than a worker who knows he was unsuccessful. Since this raises the possibility of the market screening for y_1, we now add a third PM policy to those discussed in Section 4. In addition to adopting a policy of transparency or opaqueness, P_g can now also commit to introduce an *internal PM* (the worker but not the market observes y_1).

The presence of performance pay in the market has no impact on P_g's ability to hire under transparency or opaqueness. Under a policy of transparency, date zero expected utilities are given in (1) and (2) and so the worker goes public in period 1 if and only if $\overline{w} \geq w_0 - \alpha$.[15]

[15] Under a policy of transparency the worker's expected income from going private in period t is $w_{m_t}(H_t) = \Pr(y_2 = s \mid H_t)$. That is, a base wage of $(1 - \beta_t) \Pr(y_2 = t \mid H_t)$ plus a bonus of β_t with probability $\Pr(y_2 = s \mid H_t)$.

Under a policy of opaqueness, date zero expected utilities are given in (2) and (3), implying that the worker will go public in period 1 if and only if $\overline{w} \geq \overline{w}^* - \alpha$. Things change, however, when P_g introduces an internal PM. If the worker spent period 1 in the private sector this PM policy has no bite but, if he spent period 1 in the public sector, the market will anticipate that its contract is more likely to be accepted by A_s than A_f. In the latter case the (perfect Bayesian) sub-game equilibria are as stated in Lemma 1.[16]

Lemma 2. *Assume A1, A2, A3′ and that the worker goes public in period 1. If P_g introduces an internal PM, she retains an unsuccessful worker (A_f) with positive probability iff $\overline{w} > \overline{w}' = (1-\beta_2)w_0 + \beta_2 w(f) - \alpha$ and certainty iff $\overline{w} \geq \overline{w}'' = (1-\beta_2)w(s) + \beta_2 w(f) - \alpha$, and a successful worker (A_s) iff $\overline{w} \geq w(s) - \alpha$.*

An internal PM increases the cost of retaining A_s by driving up both components of the market's outside offer. A_s's expected bonus increases because, having learnt he was successful in period 1, he is now more confident of success in period 2. His base wage increases because, for any $\overline{w} > \overline{w}'$, there is now favorable selection into the labor market.

When public sector pay is low ($\overline{w} < \overline{w}'$) the market anticipates that performance related pay will be attractive to A_f as well as A_s. This inference keeps the base wage at $(1-\beta_2)w_0$. Since the returns to public sector employment ($\overline{w} + \alpha$) are smaller than A_f's base wage and expected bonus, the unique sub-game equilibrium has both types going private. When public sector pay is higher ($\overline{w} \geq \overline{w}'$) the market anticipates that A_f will go public with positive probability. The inference that the market is more likely to hire A_s than A_f therefore drives the base wage upwards towards $(1-\beta_2)w(s)$. For any $\overline{w}' \leq \overline{w} < \overline{w}''$, the returns to public sector employment equate with A_f's expected income in period 2 and the unique equilibrium is semi-separating. As $\overline{w}$ increases above $\overline{w}''$ A_f, and eventually A_s, goes public.

Clearly, an internal PM cannot achieve Alternative iii at least cost. To see whether the same is true for Alternative ii we must turn to the worker's period 1 problem. Let σ denote the probability that the worker goes public in period 2 having failed in the public sector in period 1 and $\Pr(y_2 = s \mid c_1 = g, \sigma)$ the market's belief that a worker it recruits from the public sector will succeed in period 2 when A_f plays σ.[17] Then, for any $\overline{w} \in [\overline{w}', \overline{w}'']$, the worker's date zero expected utility from going public in period 1 under an internal PM is

$$E[U(c_1 = g, I)] = \overline{w} + \alpha + \Pr(s)\left[(1-\beta_2)\Pr(y_2 = s \mid c_1 = g, \sigma) + \beta_2 w(s)\right] + \Pr(f)\left[\overline{w} + \alpha\right], \quad (12)$$

while his date zero expected utility from going private in period 1 under an internal PM is

$$E[U(c_1 = m, I)] = w_0 + \Pr(s)\left[(1-\beta_2)\Pr(y_2 = s \mid y_1 = s) + \beta_2 w(s)\right] + \Pr(f)\left[\overline{w} + \alpha\right]. \quad (13)$$

[16] To remove the possibility of multiple sub-game equilibria when both A_s and A_f go public, we assume that the market attributes off equilibrium moves to A_s (the type with the greater incentive to deviate).

[17] Explicit formulae for σ and $\Pr(y_2 = s \mid c_1 = g, \sigma)$ are given in the proof of Lemma 2 in the Appendix.

Equation (12) is equal to (13) at $\overline{w} = \overline{w}^{prp} - \alpha$, where

$$\overline{w}^{prp} = \begin{cases} \overline{w}^* - \Delta & \text{for any } \beta_2 < \frac{1}{2} \\ w_0 & \text{for any } \beta_2 \geq \frac{1}{2} \end{cases} . \tag{14}$$

The term Δ is increasing in β_2 and is defined in proof of Proposition 5 in Appendix B, while $\overline{w}^*$ is given in (4).

For β_2 close to zero the option-value effect is the same as in Section 4 (i.e. $\Delta = 0$), while for any $\beta_2 \leq \frac{1}{2}$ the option-value effect disappears. To see why this is the case, suppose that P_g sets $\overline{w} = w_0 - \alpha$ when β_2 is low. Since A_f will quit the public sector with positive probability, the market keeps its period 2 base wage below $w(s)$ and so going private in period 1 has an option value. If β_2 is high, however, A_f will stay put. Since this drives the market's offer to A_s up to $w(s)$, going private in period 1 no longer yields any advantage enabling P_g to undercut the market's entry offer w_0 by α.

When the degree of performance pay in the market is sufficiently high ($\beta_2 \geq \frac{1}{2}$), the introduction of an internal PM has exactly the same impact on recruitment and retention as a policy of transparency and so, applying Proposition 1, this cannot be an optimal PM policy. When performance pay is lower ($\beta_2 < \frac{1}{2}$) matters are more complicated as P_g faces an additional hiring alterative. Specifically, if she sets $\overline{w} = \overline{w}^* - \Delta - \alpha$ and introduces an internal PM she can recruit A_0 and then retain A_f with probability $\sigma < 1$ (what we will call Alternative iia). A comparison of the expected costs and benefits across all five feasible alternatives gives us our final result.

Proposition 5. *Assume A1, A2 and A3′. When the market 'pays for performance' ($\beta_t > 0$) it is never optimal for P_g to introduce an internal PM. If $\alpha < \alpha^*$ the choice of PM policy is arbitrary, while if $\alpha \geq \alpha^*$ it is strictly optimal for her to abstain from performance measurement.*

Having already established that an internal PM is dominated when $\beta_2 \geq \frac{1}{2}$, this result simply confirms that it is not optimal for P_g to pay a premium to to rid herself of an unsuccessful worker when $\beta_2 < \frac{1}{2}$. True Alternative iia results in a lower expected wage bill than Alternative ii as P_g only retains (and hence pays rent to) A_f with positive probability. However, the option-value effect ensures that this cost saving is insufficient to outweigh the saving made from A_f's intrinsic motivation. Since this tells us that it is not optimal to introduce an internal PM for any β_2, the analysis in Section 4 continues to apply.[18] P_g will either choose not to recruit in period 1, in which case the PM policy is arbitrary, or she will recruit and retain with certainty and hence abstain from performance measurement.

[18]Note that internal PMs can be beneficial in settings where effort is a determinant of output. Ederer (2004), for instance, shows that tailoring of second period effort to beliefs can improve sorting in internal 'promotion' touraments when the production function is multiplicative in talent and effort.

6 Discussion

We begin our discussion by contemplating two further extensions that would take the model a little closer to reality, namely more periods and levels of output. A three period version of the benchmark model of Section 4 is analyzed in Albano and Leaver (2004). The analysis is substantially more involved but yields qualitatively similar results. Internal PMs are strictly dominated even in the absence of performance pay in the market because the extra period enables the market to screen. Specifically, internal PMs reward public sector quitters and scar public sector stayers thereby making it difficult to recruit and retain. Similarly, while a policy of transparency can be optimal, opaqueness dominates for almost all parameters. A version of the model with three levels of output also yields qualitatively similar results.[19] We conjecture that the same is true for continuous output but leave analysis of such a model for future research.

With these comments in mind, we now offer a series of remarks that draw out the main policy implications of the analysis in Sections 4 and 5.

Remark 1 *Performance measurement systems affect the cost of recruiting and retaining public sector employees.*

To some this statement may seem is self-evident; performance measurement, like all "red tape", affects recruitment and retention because it demotivates employees. This may or may not be true. We are making a different point however, namely that PM systems affect the cost of recruitment and retention due to rigidities in public sector pay.

In the absence of pay rigidities, recruitment costs are independent of the PM policy because initial sector choices have no bearing on future income. As a result, the only choice a public sector organization faces is how to retain a worker. It can be transparent retain with certainty and pay no rent; or it can be opaque, retain with certainty and make a saving on good performers that offsets the rent paid to poor performers. Because no rent is paid in expectation retention costs are also independent of the PM policy.

In the presence of pay rigidities, the option-value effect ensures that recruitment costs vary across PM policies. Likewise, the outside-offer effect ensures that retention costs vary across PM policies because any extra pay to good performers now transfers rent to poor performers. Crucially, it is no longer possible to be transparent, retain with certainty and pay no rent. The upshot is that a public sector organization faces a recruitment-retention trade off. It can be transparent, recruit cheaply but see its best employees leave or be opaque, recruit at a higher cost and (providing the market cannot screen) see its best employees stay. This trade off implies that the public sector should pay heed to recruitment and retention considerations, and not just incentives and accountability, when attempting to measure and manage performance.

[19] Available as an Appendix upon request.

Remark 1 raises two questions. Can we say how the recruitment-retention trade-off should be resolved when only recruitment and retention considerations matter? And what happens when workers are aware of their achievements even in the absence of formal performance monitoring by managers? Our next remark answers these questions by drawing on a typology of organizations used in the public administration literature.

Wilson (1989, Ch. 9) suggests that, from a managerial point of view, government agencies differ along two dimensions. Whether managers can observe the *outputs* of their operators, i.e. "what teachers, doctors, lawyers, engineers, police officers, and grant-givers do on a day-to-day basis". And whether managers or operators can observe *outcomes*, i.e. "how, if at all, the world changes because of the outputs". The interesting case for our purposes is what Wilson terms a "craft" organization, where outcomes but not outputs are observable. A good example of such an organization is the Anti-Trust division of the Department of Justice: outcomes are readily observable as cases are either won or lost, but outputs (case initiation and preparation by lawyers and economists) are esoteric and are not. Since workers in a craft organization can observe both outputs and outcomes, they are likely to have a considerably better idea of their own performance (and hence future productivity) than their managers, even in an absence of formal PM systems.[20] Defining a "craft" organization as one where the worker observes y_1 even when P_g abstains from performance measurement, we have our second remark.

Remark 2 *Recruitment and retention considerations are likely to be best served by the introduction and publication of formal PMs in "craft" organizations but otherwise by abstention from performance measurement.*

The analysis of Section 4 and 5 can be applied to craft organizations simply by recognizing that abstaining from performance measurement is now equivalent to internal PM. If there is no performance pay in the market *and* the worker can only complete two tasks, it is still optimal for managers abstain from performance measurement. The market's inability to screen preserves the outside-offer effect, ensuring that the motivation effect dominates. In most real world settings, however, the market will infer that it is the most able who quit the public sector. In this case, recruitment and retention considerations will be best served by an active policy of transparency as this makes it cheaper to recruit and, given the market's ability to screen, has no adverse consequences for retention.

In other organizations, however, (i.e. those in which workers find it hard to judge their performance in the absence of formal PMs) Propositions 1-5 apply directly. The recruitment-retention trade off should be resolved in favour of retention, dictating an abstention from

[20]Contrast this situation with that of a "coping" agency such as a school (Wilson 1989, p. 168-170) where managers will find it hard to observe outputs (as they take place in classrooms out of view) *and* outcomes are hard to define / measure. Absent formal PMs such as SATs, teachers will know how well they have prepared but not how well they have performed.

performance measurement. To the extent that publishing performance fosters effort via, say, career concerns, this suggests that a balance may need to be struck between selection and incentives.

A caveat to the above discussion is that the recruitment-retention trade-off need not always exist. If employers pay a sufficiently high service bonus, it is possible to recruit and retain at the same cost under either PM policy. This observation brings us to our final remark.

Remark 3 *Service based pay and ports of entry can be rationalized as an optimal response to rigidities in public sector pay.*

Enthusiasm for traditional public sector personnel policies such as service based pay and ports of entry appears to be waning. In the UK Civil Service, for instance, senior posts were historically only accessible via promotion from the graduate Fast Stream, while pay and promotion were both service based.[21] Today, senior posts can be filled by "experienced professionals" from the private sector (30% of the intake in 2004) and annual pay increases are performance-related.[22] Our results sound a note of caution: policy-makers should think twice before removing service bonuses and ports of entry, particularly if the objective is to improve recruitment and retention. Both policies mitigate the transfer of rent to poor performers (at least in expectation) and are therefore an optimal response to exogenous rigidities in public sector pay.

7 Concluding Remarks

Governments have already begun to appreciate that incentive schemes can have perverse effects in public sector organizations. This paper points out that performance measurement may also have unexpected consequences.

Our findings suggests a number of directions for future research. Since performance measurement affects recruitment and retention through the existence of pay inflexibility it seems crucial to understand whether such rigidity is driven by top-down political forces or bottom-up organizational / labor market structures. Since some degree of pay inflexibility is likely to be here to stay, it would also be desirable to identify how far recruitment and retention considerations - *via à vis* incentives - should shape policy. One possibility would be to test the predictions of the model in relation to hazard rates. According to our model, public sector stayers in opaque organizations become scarred by the market and so, having failed to exit early on, find it less and less attractive to quit. If this force is important we should observe, not only

[21] Commenting on the pattern of promotions to the Senior Civil Service within the Government Economics Service over the period 1978-1999, the Performance Innovation Unit (2000) notes "this pattern of promotion can send out undesirable signals to those currently within the GES. It may create the perception that promotion within the GES is based on length of tenure rather than merit."

[22] Source: the Civil Service Recruitment Gateway at www.careers.civil-service.gov.uk.

that hazard rates decline with tenure (as is well known), but that they do so most steeply in opaque organizations characterized by a high degree of pay inflexibility. On a more theoretical note, the current debate concerning the use of non-consolidated bonuses in government agencies suggests that it would be interesting to explore the consequences of publishing performance when a fraction of public sector pay is linked to an explicit incentive scheme.

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Appendix

A Evidence of Relative Pay Compression

Table A1: 90-10 Percentile Wage Gap by Gender and Sector

	Men		Women	
	Public	Private	Public	Private
Germany (Melly 2003, GSOEP 2000, log hourly wage spread)	0.9	1.1	1.0	1.3
UK (Disney & Gosling 1998, BHPS 1991-95, weekly wage ratio)	2.7	3.0	2.8	3.1
US (Borjas 2002, CPS 2000, log weekly wage spread)	1.3	1.7	1.3	1.5
Zambia (Nielsen & Rosholm 2001, LCMS 1996, wage ratio)	5.5	7.9	-	-

Table A2: Quantile Regression Estimates of Public Sector Wage Premia and Penalties

	Public Sector Premium (%) at 10th & 90th Percentile					
	Men, Education Group			Women, Education Group		
	All	High	Low	All	High	Low
Canada (Mueller 1998, LMAS 1990, log hourly wage)[1]	10, -5	-	-	22, -7	-	-
Germany (Melly 2003, GSOEP 2000, log hourly wage)[2]	7, -20	-8, -30	14, 0	22, -8	-50, -10	50, -6
UK (Disney & Gosling 1998, BHPS 1991-95, log weekly wage)[3]	10, -5	0, -20	0, 0	25, 7	20, -13	12, 0
US (Poterba & Rueben 1994, CPS 1991, log hourly wage)[4]	7, -8	12, -20	0, -13	9, -4	26, -14	7, 0
Zambia (Nielsen & Rosholm 2001, LCMS 1996, log wage)[5]	44, 9	17, -28	41, 16	-	18, -39	42, 0

Notes:

Non-zero estimates were reported as statistically different from zero at 5% or below.

Mueller (1998) and Melly (2003) combine Oaxaca decomposition with quantile regression. The remaining studies use only quantile regression analysis and hence constrain the returns to observable characteristics to be equal across sectors.

1. Covariates include: education, province, marital status, age, mother tongue, union status, job-related pension, visible minority, disability, immigrant, occupation.

2. Covariates: experience, job tenure, marital status, part-time status, education and occupation. High = university, low = basic or intermediate schooling with no training

3. Covariates: age quadratics, year dummies. High = degree, low = normal formal qualification.

4. Covariates: experience, marital status, SMSA status, race. High = > 16 yrs, low = < 12 yrs.

5. 'All' does not condition on gender and age. Covariates in other columns: gender, age, marital status, rural and province dummies. High = senior secondary, low = no education, estimates calculated for 35 yr old.

B Proofs

Proof of Lemma 1. When $\gamma = 0$, P_g chooses whether to enter the labor market and, if she does, what PM policy to employ. We first derive her expected profit under each PM policy conditional on entry and then show when she will enter. Suppose that she enters and chooses a policy of transparency. The market offers w_0 to A_0, and, irrespective of where A_0 spent period 1, $w(s)$ to A_s and $w(f)$ to A_f. From A1, P_g commits to undercut every market offer by α, implying that the worker's date zero expected utility from going public or private in period 1 under a policy of transparency is

$$E[U(c_1 = g, T)] = E[U(c_1 = m, T)] = w_0 + \Pr(y_1 = s)w(s) + \Pr(y_1 = f)w(f). \tag{15}$$

P_g therefore recruits A_0 at $w_0 - \alpha$ and retains A_s at $w(s) - \alpha$ and A_f at $w(f) - \alpha$, making a total expected profit of

$$\Pr(y_1 = s) - (w_0 - \alpha) + \sum_{y_1 \in \{s,f\}} \{\Pr(y_2 = s \mid y_1) - (w(y_1) - \alpha)\} = 2\alpha. \tag{16}$$

Now suppose that she enters and chooses a policy of opaqueness. The market again offers w_0 to A_0. If he goes private it then offers $w(s)$ to A_s and $w(f)$ to A_f, while if he goes public it offers both types w_0. The worker's date zero expected utility from going public in period 1 under a policy of opaqueness is now,

$$E[U(c_1 = g, O)] = w_0 + w_0 \tag{17}$$

while his date zero expected utility from going private in period 1 under a policy of opaqueness is equal to the expression given in (15). Notice that, by the Law of Total Probability, (15) is equal to (17). P_g therefore recruits A_0 at $w_0 - \alpha$ and retains A_s both A_f at $w_0 - \alpha$, making a total expected profit of

$$\Pr(y_1 = s) - (w_0 - \alpha) + \Pr(y_2 = s) - (w_0 - \alpha) = 2\alpha. \tag{18}$$

It obviously follows from (16) and (18) that P_g's expected profits are independent of the PM policy and that she will enter whenever $\alpha \geq 0$. ■

Proof of Proposition 1. We first show that it is not optimal for P_g to choose Alternative ii for any α. Suppose that it is. From Table 2, for P_g to choose Alternative ii over i we require

$$\alpha \geq \Pr(f)\gamma\left[w_0 - w(f)\right], \tag{19}$$

while for P_g to choose Alternative iii and ii we require

$$\alpha < \tfrac{\Pr(f)}{\Pr(s)}\gamma\left[\overline{w}^* - w_0\right]. \tag{20}$$

It follows from the definition of $\overline{w}^*$ in (4) that

$$[\overline{w}^* - w_0] \equiv \tfrac{\Pr(f)}{1+\Pr(s)} [w_0 - w(f)], \tag{21}$$

implying that we require

$$\gamma [w_0 - w(f)] < \alpha < \tfrac{\Pr(f)}{\Pr(s)[1+\Pr(s)]} \gamma [w_0 - w(f)]. \tag{22}$$

So, given $\frac{\Pr(f)}{\Pr(s)[1+\Pr(s)]} < 1$, we have a contradiction. Accordingly, there cannot exist a value of α such that it is optimal to choose Alternative ii.

We complete the proof by deriving α^*. Since α^* is the level of intrinsic motivation that leaves P_g indifferent between Alternatives i and iii, from Table 2 we must have

$$2\alpha^* - \Pr(f)\gamma [\overline{w}^* - w(f)] = \Pr(f)\alpha^*. \tag{23}$$

Re-arranging gives

$$\alpha^*(\gamma, \theta_h) \equiv \tfrac{\Pr(f)}{1+\Pr(s)} \gamma [\overline{w}^* - w(f)] = \tfrac{2}{9} \gamma (2\theta_h - 1)^2. \tag{24}$$

■

Proof of Proposition 2. Subtracting the pay-off to Alternative ii from the payoff to Alternative iii in Table 3 gives

$$\Pr(s)\alpha + \Pr(f) b\gamma \left[\tfrac{1}{1+\Pr(s)} - \Pr(f) \right] - \Pr(f)\gamma [\overline{w}^* - w_0], \tag{25}$$

which, given $\frac{1}{1+\Pr(s)} > \Pr(f)$, is increasing in b. It therefore follows immediately from Proposition 1 that it cannot be optimal for P_g to choose Alternative ii for any α.

We complete the proof by deriving α'. Since α' is the level of public service motivation that leaves P_g indifferent between Alternatives i and iii, from Table 3 we must have

$$2\alpha' - \Pr(f)\gamma \left[\overline{w}^* - w(f) - \tfrac{b}{1+\Pr(s)} \right] = \Pr(f)\alpha'. \tag{26}$$

Re-arranging gives

$$\alpha'(\gamma, \theta_h, b) \equiv \tfrac{\Pr(f)}{1+\Pr(s)} \left[\overline{w}^* - w(f) - \tfrac{b}{1+\Pr(s)} \right] = \tfrac{2}{9} \gamma \left[(2\theta_h - 1)^2 - b \right]. \tag{27}$$

■

Proof of Proposition 3. Immediate from $\gamma > 0$ and Tables 2-4. ■

Proof of Proposition 4. Immediate from Table 5. ■

Proof of Lemma 2. We first show that P_g cannot retain A_f for any $\overline{w} < \overline{w}'$. Suppose that the market expects A_f to go public with probability σ and A_s to go private. Using Bayes' rule its base wage offer is $w_2 = (1 - \beta_2) \Pr(y_2 = s \mid c_1 = g, \sigma)$, where

$$\begin{aligned} \Pr(y_2 = s \mid c_1 = g, \sigma) = \quad & \Pr(y_2 = s \mid y_1 = s) \cdot \tfrac{\Pr(s)}{\Pr(s)+\Pr(f)(1-\sigma)} \\ + \quad & \Pr(y_2 = s \mid y_1 = f) \cdot \tfrac{\Pr(f)(1-\sigma)}{\Pr(s)+\Pr(f)(1-\sigma)}. \end{aligned} \tag{28}$$

For this to be equilibrium A_f must be willing to go public with probability σ. However, his expected utility from going public is

$$E[U(c_2 = g) = \overline{w} + \alpha \tag{29}$$

while his expected utility from going private is

$$E[U(c_2 = m) = (1 - \beta_2) \Pr(y_2 = s \mid c_1 = g, \sigma) + \beta_2 w(f). \tag{30}$$

So for any $\overline{w} < \overline{w}'$, we have $E[U(c_2 = m) > E[U(c_2 = g)$ implying that A_f has an incentive to deviate.

We now show that P_g can retain A_f with positive probability for any $\overline{w} > \overline{w}'$ and certainty for any $\overline{w} > \overline{w}''$. Clearly A_f will only play a mixed strategy when both sector choices yield the same expected utility. Substituting for (28) in (30) and equating with (29) we obtain an explicit expression for this mixed strategy

$$\sigma = \frac{2(\overline{w} + \alpha) - 1 + \beta_2(2\theta_h - 1)^2}{\overline{w} + \alpha + 2(\theta_h - 1)\theta_h}. \tag{31}$$

Using the fact that $\Pr(y_2 = s \mid c_1 = g, \sigma = 0) = w_0$ it is straightforward to show that $\sigma(\overline{w} = \overline{w}', .) = 0$. Similarly, using $\Pr(y_2 = s \mid c_1 = g, \sigma = 1) = w(s)$ it is straightforward to show that $\sigma(\overline{w} = \overline{w}'', .) = 1$.

Finally, we show that P_g cannot retain A_s for any $\overline{w} < w(s) - \alpha$. Suppose that the market expects A_s and A_f to go public. Using our assumption that deviations are attributed to A_s, the market's base wage offer is $w_2 = (1 - \beta_2) \Pr(y_2 = s \mid y_1 = s)$. For this to be an equilibrium A_s must be willing to go public. His expected utility from going public is given in (29) while his expected utility from going private is

$$E[U(c_2 = m) = (1 - \beta_2) \Pr(y_2 = s \mid y_1 = s) + \beta_2 w(s) = w(s). \tag{32}$$

So for any $\overline{w} < w(s) - \alpha$, we have $E[U(c_2 = m) > E[U(c_2 = g)$ implying that A_s has an incentive to deviate. Obviously, to complete the proof, we simply need to note that A_s has no incentive deviate for any $\overline{w} \geq w(s) - \alpha$. ■

Proof of Proposition 5. Having already shown in the text that internal PMs are dominated when $\beta_2 \geq \frac{1}{2}$, we focus on the case where $\beta_2 < \frac{1}{2}$ and first show that Alternative ii yields a higher pay-off to Alternative iia for any $\alpha > 0$.

To do so we need to derive an explicit expression for $\overline{w}^{prp}$ and $\sigma(\overline{w}^{prp})$. It follows from (12) and (13) that the term Δ is given by

$$\Delta = \tfrac{\Pr(s)}{1+\Pr(s)} [w(s) - w_0] + \Pr(s) (1 - \beta_2) [\Pr(y_2 = s \mid c_1 = g, \sigma) - w(s)]. \tag{33}$$

Substituting for (31) in (28) and then for $\Pr(y_2 = s \mid c_1 = g, \sigma)$ in (33) we have

$$\overline{w}^{prp} = \overline{w}^* - \tfrac{\Pr(s)}{1+\Pr(s)} [w(s) - w_0] - \Pr(s) (1 - \beta_2) \left[\tfrac{2\beta_2(\theta_h - 1)\theta_h + \overline{w}^{prp}}{1 - \beta_2} - w(s) \right] \tag{34}$$

or, collecting terms,

$$\overline{w}^{prp} = \frac{1}{1+\Pr(s)}\left[\overline{w}^{*} - \frac{\Pr(s)}{1+\Pr(s)}\left[w(s) - w_0\right] - \Pr(s)\left(1-\beta_2\right)\left[\frac{2\beta_2(\theta_h-1)\theta_h}{1-\beta_2} - w(s)\right]\right]. \tag{35}$$

Notice that $\overline{w}^{prp}$ is decreasing in β_2 on the interval $[w_0, \overline{w}^{*}]$. P_g can achieve Alternative iia at least cost by adopting an internal PM and setting $\overline{w} = \overline{w}^{prp} - \alpha$. Substituting for $\overline{w}^{prp} - \alpha$ in (31) gives $\sigma(\overline{w}^{prp}) = \frac{1+\beta_2}{2-\beta_2}$.

The expected net benefit of choosing Alternative iia is therefore

$$\Pr(s) + \Pr(f,s)\tfrac{1+\beta_2}{2-\beta_2} - \left[1 + \Pr(f)\tfrac{1+\beta_2}{2-\beta_2}\right]\left(\overline{w}^{prp} - \alpha\right), \tag{36}$$

while, from Table 2, the expected net benefit of choosing Alternative ii is

$$\Pr(s) + \Pr(f,s) - \left[1 + \Pr(f)\right]\left(w_0 - \alpha\right). \tag{37}$$

Subtracting (36) from (37) gives

$$\Pr(f)\tfrac{1-2\beta_2}{2-\beta_2}\left[w(f) + \alpha\right] - \left[1 + \Pr(f)\right]w_0 + \left[1 + \Pr(f)\tfrac{1+\beta_2}{2-\beta_2}\right]\overline{w}^{prp}. \tag{38}$$

Setting α to zero and substituting for $\overline{w}^{prp}$, (38) simplifies to

$$\tfrac{1}{12}\left(1-2\beta_2\right)\left(2\theta_h - 1\right)^2 > 0,$$

which in turn implies that for any $\alpha > 0$ P_g will choose Alternative ii over iia. Since we already know from Proposition 1 that P_g will choose either Alternative i or iii over ii this completes the proof. ■