Labor Market Information Acquisition and Downsizing

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Abstract

The acquisition of labor market information about displaced workers’ opportunities in the private sector is indispensable to ensure a successful outcome of the public sector downsizing. In this paper, we formalize this information acquisition and study the optimal downsizing mechanism.

After analyzing how the optimal structure of downsizing is affected by an increase in the precision of the information about each worker’s opportunity in the private sector, we investigate its impact on social welfare and obtain the following result. When each worker’s productive efficiency in the public sector is known, an increase in the precision of the information always leads to an increase in social welfare. However, when each worker’s productive efficiency is his private information, an increase in the precision might result in a decrease in social welfare by increasing the information rents given up to workers.

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1 Introduction

The acquisition of labor market information is an indispensable step to ensure a successful outcome of public sector downsizing. First, proper estimations of workers’ outside opportunities, i.e. of the utilities that displaced workers are expected to obtain in the private sector after downsizing, allow us to identify the degree of labor redundancy in the public sector in question and to determine the desirable size of downsizing. Second, good estimations of the losses that displaced workers will experience from downsizing are necessary to efficiently implement the target size of downsizing. This is particularly true in countries in which only voluntary downsizing programs are feasible. On the one hand, an excessive over-estimation of the losses would lead to the use of too generous compensation packages, inducing the exit of too many workers and the waste of government revenue. Furthermore, it is not fair to favor the often already favored workers of the public sector by giving them too generous compensations. On the other hand, an excessive under-estimation of the losses will lead to the adoption of too low compensations, inducing workers to remain in the public sector instead of leaving it. Even in countries in which mandatory downsizing programs can be used, too low compensations can arouse harsh political resistance from the unions.

The loss that a worker experiences after downsizing can be defined as the difference between the utilities that he obtained in the public sector and in the private sector respectively. The latter will crucially depend on how successful his job search is in the labor market: for instance, in a country characterized by a high unemployment rate and a poor social safety net, it will mainly depend on the probability of finding a job. There exists a growing body of empirical work estimating the losses that displaced workers experience after downsizing.¹ This work typically attempts to capture how the losses from separation are related to workers’ observable characteristics such as wages received in the public sector, education, seniority, marital status, sex etc. The information generated from the estimations can be used to tailor downsizing packages to workers’ characteristics. In this way, compensations can be closely matched to losses from separation and the danger of using too high or too low compensations can be avoided.

Despite an increasing number of such empirical studies, there has been, to

our knowledge, no theoretical attempt to formally incorporate the acquisition of labor market information into the design of the optimal downsizing mechanism. In this paper, we study the optimal downsizing mechanism which makes the best use of the information acquired from labor market studies. More precisely, we study how the acquisition of labor market information affects the optimal structure of downsizing and social welfare.

To focus on workers’ heterogeneity in terms of productive efficiency, we assume that workers in the public sector are homogeneous in terms of observable characteristics except for their production costs. We distinguish the case in which each worker’s productive efficiency is known to the government (or to the managers of the public sector) from the case in which it is unknown. For simplicity, we assume that a displaced worker’s job search in the labor market can have only two outcomes: a successful outcome or an unsuccessful one.

In our model, the government can acquire two sorts of information. First, the government can acquire information about how a worker’s probability of having the successful job search outcome differs depending upon his productive efficiency in the public sector. The government can obtain this information from regressions on displaced workers’ achievements in the private sector. For instance, in the downsizing of the central bank in Ecuador, the government classified employees according to how redundant they were. Rama and MacIsaac (1999) showed that the group with the lower productive efficiency could have 40 percentage higher welfare loss from separation than the group with the higher productive efficiency. Second, the government can acquire further information about the heterogeneity affecting the probability of having the successful outcome in the private sector. For instance, consider the case in which a displaced worker pursues an investment project. Then, by introducing tests that evaluate the worker’s skill or aptitude necessary for running the project, the government can update his probability of having the successful outcome from the project. We note that the acquisition of the second information is specific to each worker, while the acquisition of the first information is general in that the government expects in average the same relationship between the productive efficiency in the public sector and the success in job search to hold for all workers.

In our analysis, we assume that the first information is already acquired.

\[\text{However, this difference may come partly from the fact that the government used compulsory downsizing for the first group while it used voluntary downsizing for the latter.}\]
and focus on how the precision of the second information affects the optimal downsizing mechanism. Precisely, we assume that the government can receive either a good or bad signal about each worker’s job search outcome. We study how an increase in the precision of the signal affects the optimal structure of downsizing and social welfare.

In our paper, we mainly focus on the case in which there is weak positive correlation between a worker’s efficiency in the public sector and his job search outcome in the private sector. Define the full marginal cost of retaining a worker in the public sector as the sum of his production cost and his expected opportunity cost in the private sector. When there is complete information on each worker’s efficiency, it is optimal to start laying off the workers with the highest full cost. The optimal order of downsizing has two regimes depending on the precision of the signal: for low precision, the order is determined first by the productive efficiency and then by the signal, and for high precision, the order is determined first by the signal and then by the productive efficiency. For instance, in the first regime, it is optimal to lay off first the inefficient workers having the good signal (meaning good outside job opportunity), second the inefficient workers having the bad signal, third the efficient workers having the good signal etc. When there is asymmetric information on each worker’s efficiency, the social marginal cost of retaining an inefficient worker is larger than the one under complete information because of information rents. This makes the second regime shrink. It also makes the optimal size of downsizing larger under asymmetric information than under complete information.

Concerning the impact on social welfare, under complete information on workers’ efficiencies, an increase in the precision of the signal always leads to an increase in social welfare. In other words, Blackwell’s theorem can be applied to this case. However, in the presence of asymmetric information on worker’s efficiency, since a change in information structure affects the rent given up to workers, in general, we cannot apply Blackwell’s theorem except the case in which the probability of having a successful job search outcome is independent of the productive efficiency in the public sector. In this case, we show that Blackwell’s theorem can still be applied. When there is positive correlation between a worker’s efficiency in the public sector and his job search outcome, whether an increase in the precision leads to an increase or decrease in social welfare depends on the size of downsizing. If the social

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3The case of strong correlation is briefly discussed in Section 5.
value of public production is small and thus a massive downsizing is desirable, an increase in the precision is good for social welfare. In contrast, if the social value of public production is high and thus a mild downsizing is desirable, an increase in the precision could be bad for social welfare.

To give the intuition of why the value of information can be negative, consider the extreme case in which all the workers are induced to remain in the public sector. Suppose first that the precision of the signal is zero. Then, the difference between an inefficient worker’s full cost and an efficient one’s full cost is smaller than the difference in their production costs in the public sector since the first has a lower opportunity cost in the private sector than the latter does. Suppose now that the precision is one. Then, the signal gives a perfect prediction of the job search outcome. Hence, given a signal, the difference between an inefficient worker’s full cost and an efficient one’s full cost is equal to the difference in their production costs in the public sector. Therefore, the difference in their full costs increases as the precision increases. This implies that the government has to give up more rent to workers as the precision increases and consequently social welfare decreases.\footnote{We assume that government revenue is raised through distortionary taxation. Hence, it is socially costly to give up rents to workers.}

By continuity, the same argument will hold when the size of downsizing is small enough.

The paper is organized as follows. In Section 2, we present the model. In Section 3, we analyze the optimal downsizing mechanism when there is complete information about each worker’s efficiency in the public sector. In Section 4, we study the case of asymmetric information about each worker’s efficiency in the public sector. In Section 5, we discuss desirable extensions. Concluding remarks are gathered in Section 6.

2 Model

2.1 Public sector

The economy is composed of two sectors: the public sector and the private sector. There is a continuum of workers of mass 1 employed in the public sector before downsizing. The set of workers in the public sector is denoted by \( I \). The workers are heterogeneous in terms of their productive efficiency in the public sector. Worker \( A_i \)’s type, with \( i \) in \( I \), is denoted by \( \theta_i \). The \( \theta_i \)s are independently and identically distributed and take the value \( \theta \) with...
probability $\nu(\overline{\theta}) = \nu$ and $\overline{\theta}$ with probability $\nu(\overline{\theta}) = 1 - \nu$. Let $\Delta \theta \equiv \overline{\theta} - \overline{\theta} > 0$. We call type $\overline{\theta}$ the efficient type and type $\overline{\theta}$ the inefficient type. We consider two cases: when the government or the managers of the public sector know all the $\theta_i$s or when $\theta_i$ is worker $A_i$’s private information for each $i$ in $I$. We assume that workers are risk neutral.

For expositional simplicity, we consider mandatory downsizing in the sense that the government has the right to lay off any worker in the public sector.\(^5\) However, when the government wants to keep a worker in the public sector, it has to guarantee him at least the utility level that the worker can obtain in the private sector. We assume that monitoring in the public sector is so inefficient that the quantity produced by a worker is not a controllable instrument. In particular, we assume that the quantity produced by each worker is normalized to 1 both before and after downsizing.\(^6\)

The government maximizes social welfare, denoted by $W$, defined as follows:

$$W \equiv S(q) - (1 + \lambda) \left[ \sum_{i \in I} t_i \right] + \sum_{i \in I} U_i,$$

where $S(\cdot)$ represents the social surplus generated by public production, which is a function of the total quantity produced by the public sector, denoted by $q$; $\lambda(> 0)$ represents the shadow cost of public funds; $t_i$ is the monetary transfer from the government to worker $A_i$; and $U_i$ represents worker $A_i$’s utility. $S(\cdot)$ is increasing and strictly concave with $S'(0) = \infty$. We assume that $S'(1)$ is low enough so that it is optimal to lay off some workers.

### 2.2 Labor market

A worker with type $\theta$ in $\{\overline{\theta}, \overline{\theta}\}$ has an expected utility $U^m(\theta)$ when he enters the labor market in the private sector. More precisely, when a worker enters the private sector, the outcome of his job search can be either a success or a failure. In the case of success, he obtains utility $U^H$ while in the case of failure, he obtains utility $U^L(< U^H)$. As an example, consider the case in which a displaced worker pursues an investment project and the project can either succeed or fail. The probability of having the successful outcome can

\(^5\)Under voluntary downsizing, there exist countervailing incentives which make the analysis more complex. (See Jeon and Laffont (1999)).

\(^6\)So we do not envision any reform of incentive schemes in the public sector.
depend on the worker’s efficiency in the public sector. A worker with type $\theta$ will succeed with probability $\mu(\theta)$. We assume that the government already acquired information on $\mu(\theta)$ through labor market studies. Hence, we have:

$$U^m(\theta) = \mu(\theta)U^H + (1 - \mu(\theta))U^L.$$ 

Another example which fits well the above description of job search in the labor market is the case in which the difference between the utility of an employed and that of an unemployed is large. Then, to find a job or not will be a worker’s primary concern while which kind of job to find will be a secondary concern. This will be particularly true in a country with a poor social safety net as it is often the case in LDCs (Less Developed Countries).

For simplicity, we introduce the following notation:

$$\mu = \mu(\theta), \bar{\mu} = \mu(\bar{\theta}), \Delta \mu = \mu - \bar{\mu}.$$ 

We usually expect $\Delta \mu \geq 0$ to hold: an efficient worker in the public sector has a higher probability to be successful in the labor market than an inefficient worker. Let $\mu \equiv \nu \mu + (1 - \nu)\bar{\mu}$. $\mu$ represents the probability for a worker to be successful in the labor market when his efficiency in the public sector is unknown.

In what follows, we introduce two assumptions.

**Assumption 1**: $\Delta \theta < U^H - U^L$.

When the public sector is so inefficient that it cannot use any incentive scheme discriminating workers according to their efficiency, $\Delta \theta$ represents the difference between an efficient worker’s rent and an inefficient worker’s one in the public sector. $U^H - U^L$ represents the difference between the utility of a worker whose job search was successful and the utility of a worker whose job search was unsuccessful. In general, assumption 1 will hold since $\Delta \theta$ refers to the difference in rents between workers having a job in the public sector while $U^H - U^L$ would represent the difference in utilities between those having a job and those not having any job when the unemployment rate is high. Even when the unemployment rate is low, assumption 1 will hold in general since

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$^7$More generally, the utility conditional on an outcome of job search may depend on type as well and, in this case, we have $U^m(\theta) = \mu(\theta)U^H(\theta) + (1 - \mu(\theta))U^L(\theta)$. Extension of the analysis to this general case is straightforward.

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the public sector is usually more egalitarian than the private sector.

**Assumption 2:** \( \Delta \theta > \Delta \mu \geq 0. \)

Assumption 2 says that \( \Delta \mu \) is positive but not large.\(^8\) Assumption 2 will hold when workers in the public sector have sector-specific human capital instead of having general human capital which is transferable to the private sector. Then, the probability of having a successful job search outcome will not greatly depend on workers’ efficiency in the public sector.

### 2.3 Information Acquisition

Either the government or an international organization like the World Bank can spend resources to obtain information about the labor market in the private sector. In particular, this can generate more accurate estimations of displaced workers’ job search outcomes in the labor market after downsizing. This information is quite useful for the design of socially optimal downsizing mechanisms.

We formalize this information acquisition on the labor market as follows. The government, after incurring some cost, receives a signal \( \sigma_i \) about worker \( A_i \)'s probability of being successful in the labor market. The signal \( \sigma_i \) is assumed to be publicly observable and can take two values: either \( \sigma^G \) or \( \sigma^B \). \( \sigma^G \) is a good signal and \( \sigma^B \) is a bad signal in the following sense: given a type, the probability of being successful in the labor market is higher when \( \sigma_i = \sigma^G \) than when \( \sigma_i = \sigma^B \). In other words, we have

\[
P(U^H | \sigma^G, \theta) \geq P(U^H | \sigma^B, \theta) \text{ for all } \theta \text{ in } \{\theta, \overline{\theta}\}.
\]

Suppose that there is incomplete information on workers’ types. We define the relative improvement in the precision of the signal \( \sigma^G \), denoted by \( \xi \), as follows:

\[
\xi \equiv \frac{P(U^H | \sigma^G) - \mu}{1 - \mu}.
\]

If the signal \( \sigma^G \) does not give any information on the probability of success in the labor market, we have \( P(U^H | \sigma^G) = \mu \), implying \( \xi = 0 \). If the signal

\(^8\)See Section 5 for a brief discussion of the other case.
\(\sigma^G\) gives perfect information on that probability, we have \(P(U^H \mid \sigma^G) = 1\), implying \(\xi = 1\). Hence, we have \(\xi\) in \([0, 1]\).

For simplicity, assume that the technology of information acquisition is such that it improves the precision of each signal by the same degree:

\[
\xi = \frac{P(U^H \mid \sigma^G) - \mu}{1 - \mu} = \frac{P(U^L \mid \sigma^B) - (1 - \mu)}{1 - (1 - \mu)}.
\]

Let \(C(\xi)\) represent the cost of information acquisition. We assume \(C' > 0\) and \(C'' > 0\). Given \(\xi\), the precision of each signal is given by:

\[
P(U^H \mid \sigma^G) = \xi + (1 - \xi)\mu; P(U^L \mid \sigma^B) = \xi + (1 - \xi)(1 - \mu).
\]

When \(\mu = \frac{1}{2}\), both signals have the same precision:

\[
P(U^H \mid \sigma^G) = P(U^L \mid \sigma^B) = \frac{1}{2}(1 + \xi).
\]

When there is complete information on workers’ types, we can similarly define the relative improvement in the precision of the signal \(\sigma^G\), denoted by \(\xi(\theta)\), as follows:

\[
\xi(\theta) \equiv \frac{P(U^H \mid \sigma^G, \theta) - \mu(\theta)}{1 - \mu(\theta)}.
\]

We will assume that the technology of information acquisition is such that the improvement in the precision is the same regardless of the signal and the type:

\[
\xi = \frac{P(U^H \mid \sigma^G, \theta) - \mu(\theta)}{1 - \mu(\theta)} = \frac{P(U^L \mid \sigma^B, \theta) - (1 - \mu(\theta))}{1 - (1 - \mu(\theta))} \text{ for all } \theta \in \{0, \theta_0\}.
\]

Given \(\xi\), the precision of each signal is given by:

\[
P(U^H \mid \sigma^G, \theta) = \xi + (1 - \xi)\mu(\theta); P(U^L \mid \sigma^B, \theta) = \xi + (1 - \xi)(1 - \mu(\theta)).
\]

For the workers of different types, the \(\sigma_i\)s are independently distributed. For the workers of the same type \(\theta\), the \(\sigma_i\)s are independently and identically distributed. A worker with type \(\theta\) receives \(\sigma^G\) with probability \(\mu(\theta)\) and \(\sigma^B\) with probability \(1 - \mu(\theta)\). Since we have workers of mass 1, the measure of the signal \(\sigma^G\) that all the workers of type \(\theta\) will receive is given by \(\nu(\theta)\mu(\theta)\).
2.4 Downsizing mechanism

When $\theta_i$ is worker $A_i$’s private information, according to the revelation principle, we can restrict our attention to the set of direct revelation mechanisms. A downsizing mechanism is then defined by:

$$\left\{ p(\hat{\theta}_i, \sigma_i), t(\hat{\theta}_i, \sigma_i) \right\},$$

where $\hat{\theta}_i$ represents worker $A_i$’s report on his type, $p$ the probability to retain the worker in the public sector and $t$ the monetary transfer from the government to the worker. Since $\sigma_i$ is publicly observable, worker $A_i$ is not requested to make a report on $\sigma_i$. When $\theta_i$ is known to the government, we can just replace $\hat{\theta}_i$ with $\theta_i$ in the above mechanism.

We introduce the following definition:

$$U_m(\theta, \sigma) = P(U_H | \theta, \sigma)U_H + P(U_L | \theta, \sigma)U_L.$$

$U_m(\theta, \sigma)$ represents the expected utility that a worker with type $\theta$ and signal $\sigma$ expects to obtain by entering the labor market.

Let $U(\theta, \sigma)$ represent the expected utility that a worker can obtain by accepting the mechanism, i.e.:

$$U(\theta, \sigma) = t(\theta, \sigma) - p(\theta, \sigma)\theta + (1 - p(\theta, \sigma))U_m(\theta, \sigma).$$

For simplicity, we introduce the following notation:

$$\bar{p}_G = p(\theta, \sigma^G), \bar{p}_B = p(\theta, \sigma^B), \bar{p}_G^* = p(\hat{\theta}, \sigma^G), \bar{p}_B^* = p(\hat{\theta}, \sigma^B).$$

$$\left( t^G, t_B, t^G_B, \bar{t}^G_B \right), \left( U_{mG}, U_{mB}, \bar{U}_{mG}, \bar{U}_{mB} \right)$$

and

$$\left( U^G, U^B, \bar{U}^G, \bar{U}^B \right)$$

are similarly defined.

3 Complete information case

In this section, we study the case when there is complete information on the $\theta_i$s. For example, managers may know workers’ abilities. Hence, if the government (or the agency implementing downsizing) can elicit this information, complete information on the $\theta_i$s can be a good approximation of reality.\(^9\)

\(^9\)For instance, in the downsizing of the central bank in Ecuador, the government classified employees into three categories according to how redundant an employee was (Rama and MacIsaac, 1999).
In order to induce participation, the mechanism should satisfy participation constraints. The acquisition of labor market information on $\mu(\theta)$ and $\sigma$ allows the government to discriminate workers at the participation stage since the participation constraints are written as follows:

$$
(I\!\! R : \theta, \sigma^G) \quad U^G \equiv t^G - \bar{p}^G \theta + (1 - \bar{p}^G)U^{mG} \geq U^{mG}, \quad (1)
$$

$$
(I\!\! R : \theta, \sigma^B) \quad U^B \equiv t^B - \bar{p}^B \theta + (1 - \bar{p}^B)U^{mB} \geq U^{mB}, \quad (2)
$$

$$
(I\!\! R : \bar{\theta}, \sigma^G) \quad \bar{U}^G \equiv \bar{t}^G - \bar{p}^G \bar{\theta} + (1 - \bar{p}^G)\bar{U}^{mG} \geq \bar{U}^{mG}, \quad (3)
$$

$$
(I\!\! R : \bar{\theta}, \sigma^B) \quad \bar{U}^B \equiv \bar{t}^B - \bar{p}^B \bar{\theta} + (1 - \bar{p}^B)\bar{U}^{mB} \geq \bar{U}^{mB}. \quad (4)
$$

The government will maximize social welfare given below subject to the participation constraints (1) to (4):

$$
S \left[ \nu(\mu\bar{p}^G + (1 - \mu)p^B) + (1 - \nu)(\bar{\mu}\bar{p}^G + (1 - \bar{\mu})\bar{p}^B) \right] 
- (1 + \lambda) \left[ \nu(\mu\bar{t}^G + (1 - \mu)t^B) + (1 - \nu)(\bar{\mu}\bar{t}^G + (1 - \bar{\mu})\bar{t}^B) \right] 
+ \left[ \nu(\mu\bar{U}^G + (1 - \mu)\bar{U}^B) + (1 - \nu)(\bar{\mu}\bar{U}^G + (1 - \bar{\mu})\bar{U}^B) \right]. \quad (5)
$$

Social welfare depends upon the surplus from public production, the transfers to the workers and the utilities of the workers. The surplus depends upon the level of public production, which is equal to the number of the retained workers after downsizing. In what follows, we will analyze how an incremental increase in the precision of the signal affects the optimal order of downsizing, the size of downsizing and social welfare.

### 3.1 Order of downsizing

In this section, we study how an incremental increase in the precision affects the optimal order of downsizing.
Define the full marginal cost as follows:

\[ MC^f(\theta, \sigma) = \theta + U^m(\theta, \sigma). \]

When the government retains a worker in the public sector, it has to compensate his production cost in the public sector and his opportunity cost in the private sector. Therefore, the optimal number of workers to retain in the public sector is determined by equalizing the marginal social value of public production to the marginal social cost of keeping a worker in the sector. The latter is given by:

\[ SMC^c(\theta, \sigma) \equiv (1 + \lambda)MC^f(\theta, \sigma), \tag{6} \]

where the superscript \( c \) indicates complete information. From (6), it is clear that the optimal order of downsizing is such that the government has to start laying off the workers with the highest full marginal cost.

Straightforward computations lead to:

\[ MC^f(\theta, \sigma^G) = \theta + U^L + [\xi + (1 - \xi)\mu(\theta)](U^H - U^L), \]

\[ MC^f(\theta, \sigma^B) = \theta + U^H - [\xi + (1 - \xi)(1 - \mu(\theta))](U^H - U^L). \]

First, we fix the type of a worker and examine how a change in \( \xi \) affects his full marginal cost. We have:

\[ MC^f(\theta, \sigma^G) - MC^f(\theta, \sigma^B) = \xi(U^H - U^L) \geq 0, \]

\[ \frac{dMC^f(\theta, \sigma^G)}{d\xi} = (1 - \mu(\theta))(U^H - U^L) > 0; \quad \frac{dMC^f(\theta, \sigma^B)}{d\xi} = -\mu(\theta)(U^H - U^L) < 0. \tag{7} \]

Therefore, an increase in the precision of the signal increases the full cost of the worker having the good signal and decreases that of the worker having the bad signal.

Second, we fix the signal and examine how a change in \( \xi \) affects the difference between the inefficient worker’s full cost and the efficient worker’s full cost. We have:

\[ \Delta MC^f \equiv MC^f(\bar{\theta}, \sigma) - MC^f(\bar{\theta}, \sigma) = \Delta \theta - (1 - \xi)\Delta \mu(U^H - U^L) > 0, \tag{8} \]
The difference between the inefficient worker’s full cost and the efficient worker’s one does not depend upon the signal and increases with the precision of the signal. Since, from assumption 2, \( \Delta MC_f = \Delta \theta - \Delta \mu(U^H - U^L) > 0 \) when \( \xi = 0 \), (9) implies that the inefficient worker’s full cost is always larger than the efficient worker’s one.

Last, it is interesting to compare the full cost of the inefficient worker having the bad signal with that of the efficient worker having the good signal. We have:

\[
MC_f^I(\bar{\theta}, \sigma^B) - MC_f^I(\bar{\theta}, \sigma^G) = \Delta \theta - [\Delta \mu + \xi(1 - \Delta \mu)](U^H - U^L),
\]

\[
\frac{d}{d \xi} \left[ MC_f^I(\bar{\theta}, \sigma^B) - MC_f^I(\bar{\theta}, \sigma^G) \right] = -(1 - \Delta \mu)(U^H - U^L) < 0.
\]

From assumption 2, when \( \xi = 0 \), \( MC_f^I(\bar{\theta}, \sigma^B) - MC_f^I(\bar{\theta}, \sigma^G) = \Delta \theta - \Delta \mu(U^H - U^L) > 0 \). From assumption 1, when \( \xi = 1 \), \( MC_f^I(\bar{\theta}, \sigma^B) - MC_f^I(\bar{\theta}, \sigma^G) = \Delta \theta - (U^H - U^L) < 0 \). Therefore, we can define \( \xi^* \) in (0, 1) by

\[
\Delta \theta \equiv [\Delta \mu + \xi^*(1 - \Delta \mu)](U^H - U^L).
\]

Then, we have

\[
MC_f^I(\bar{\theta}, \sigma^B) \overset{\xi \geq \xi^*}{\geq} MC_f^I(\bar{\theta}, \sigma^G) \quad \text{for} \quad \xi \overset{\xi \leq \xi^*}{\geq} \xi^*.
\]

In the next proposition, we summarize the results on the optimal order of downsizing:

**Proposition 1 (order of downsizing)** Under assumptions 1 and 2 and under complete information on each worker’s efficiency in the public sector, the optimal order of downsizing changes as the precision increases as follows:

<table>
<thead>
<tr>
<th>Regime</th>
<th>I ( \xi \leq \xi^* )</th>
<th>II ( \xi \geq \xi^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order</td>
<td>((\bar{\theta}, \sigma^G))</td>
<td>((\bar{\theta}, \sigma^G))</td>
</tr>
<tr>
<td></td>
<td>((\bar{\theta}, \sigma^B))</td>
<td>((\bar{\theta}, \sigma^B))</td>
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<td></td>
<td>((\bar{\theta}, \sigma^G))</td>
<td>((\bar{\theta}, \sigma^B))</td>
</tr>
</tbody>
</table>
It is optimal to start to lay off the workers with the highest full cost. Given a type, a worker having the good signal always has a higher full cost than a worker having the bad signal. Given a signal, the inefficient worker always has a higher full cost than the inefficient worker. When the precision is zero, the signal does not affect the full cost and an inefficient worker’s full cost is higher than an efficient one’s cost. Therefore, by continuity, when the precision is low (Regime $I$), the order is first determined by the type and then by the signal as in Figure 1. When the precision is high (in Regime $II$), an efficient worker having the good signal has a higher full cost than an inefficient worker having the bad signal. Therefore, the order is first determined by the signal and then by the type as in Figure 1.

![Social marginal cost of retaining a worker under complete information](image)

**Figure 1:** Social marginal cost of retaining a worker under complete information

### 3.2 Size of downsizing

We now examine how the change in the precision affects the size of downsizing. Suppose that we are initially in Regime $I$. We will distinguish four cases according to how high the social value of the public production is as is illustrated by four different shapes of $S'(\cdot)$ in Figure 2.
Consider, first, the case in which the public production has very high social value. Then, the number of the workers to retain in the public sector is determined by equalizing the marginal value of public production \( S'(\cdot) \) to \( SM^c(\bar{\theta}, \sigma^G) \) as in Figure 2. In this case, since \( SM^c(\bar{\theta}, \sigma^G) \) is increasing in \( \xi \), the size of downsizing will become large as the precision of the signal increases.

Second, consider the case in which the public production has high social value. Then, the number of the workers to retain is determined by equalizing \( S'(\cdot) \) to \( SM^c(\bar{\theta}, \sigma^B) \) as in Figure 2. Then, the size of downsizing will become small as the precision increases since \( SM^c(\bar{\theta}, \sigma^B) \) is decreasing in \( \xi \). However, if the precision continues to increase, we move from Regime I to Regime II when \( SM^c(\bar{\theta}, \sigma^G) \) becomes larger than \( SM^c(\bar{\theta}, \sigma^B) \). Once we reach Regime II, the size of downsizing will become large as the precision increases since the size of downsizing is now determined by equalizing \( S'(\cdot) \) to \( SM^c(\bar{\theta}, \sigma^G) \).

Third, in the case in which the public production has low social value, the number of the workers to retain is determined by equalizing \( S'(\cdot) \) to \( SM^c(\bar{\theta}, \sigma^G) \) as in Figure 2. This case is opposite to the second case.

Finally, in the case in which the public production has very low social value, the number of the workers to retain is determined by equalizing \( S'(\cdot) \) to \( SM^c(\bar{\theta}, \sigma^B) \) as in Figure 2. This case is opposite to the first case.

We summarize the results in the next proposition:

**Proposition 2 (size of downsizing)** Under assumptions 1 and 2 and under complete information on each worker’s efficiency in the public sector, the size of downsizing changes as follows as the precision increases from \( \xi (< \xi^*) \):

a. When the value of public production is very high: the size increases.

b. When the value of public production is high: the size first decreases and then increases.

c. When the value of public production is low: the size first increases and then decreases.

d. When the value of public production is very low: the size decreases.
3.3 Value of information

We now examine how an incremental increase in the precision affects social welfare. The next proposition states that, from Blackwell’s theorem, an increase in the precision has a positive social value.

**Proposition 3 (value of information)** Under complete information on each worker’s efficiency in the public sector, social welfare is increasing in the precision of the signal.

**Proof.** We can apply Blackwell’s theorem at the level of each worker. To apply the theorem, we have to show that the government’s optimization program is well defined and that an increase in the precision improves the information structure in the Blackwell’s sense.

Given a worker with type \( \theta \) and signal \( \sigma \), the only uncertainty concerning him is whether or not he will be successful in the labor market. Let \( \omega \) denote

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10For the statement of the theorem, see Laffont (1989, p.64).
the state of nature in terms of job market performance, with \( \Omega \equiv \{ \omega\} = \{H, L\} \).

The government’s program at the level of a worker is given by:

\[
\max_{p, t} \quad E_{(\omega|\theta, \sigma)} \left\{ pS'(q) - (1 + \lambda)t + \left[ t - p\theta + (1 - p) \left[ U^L + (U^H - U^L)1_{[\omega=H]} \right] \right] \right\}
\]

subject to

\[
E_{(\omega|\theta, \sigma)} \left\{ t - p\theta + (1 - p) \left[ U^L + (U^H - U^L)1_{[\omega=H]} \right] \right\} \geq E_{(\omega|\theta, \sigma)} \left[ U^L + (U^H - U^L)1_{[\omega=H]} \right],
\]

where \( q \) represents the quantity produced at the public sector by all the other workers. Since the transfer is determined by the binding participation constraint, the government can only choose the probability to retain the worker in the public sector (\( p \)) to maximize social welfare. Therefore, the government’s program can be equivalently written as follows:

\[
\max_{p} \quad E_{(\omega|\theta, \sigma)} \left\{ p \left[ S'(q) - (1 + \lambda)\theta \right] + (1 - p(1 + \lambda)) \left[ U^L + (U^H - U^L)1_{[\omega=H]} \right] \right\}.
\]

The information structure with precision \( \xi \) is better in the Blackwell’s sense than the information structure with precision \( \xi - \Delta \xi \), with \( \Delta \xi > 0 \). To show this, let \( F^1 \) (respectively, \( F^2 \)) denote the matrix of conditional probabilities when precision is \( \xi \) (respectively, \( \xi - \Delta \xi \)):

\[
F^j = \begin{bmatrix}
P(\sigma = \sigma^G \mid \theta, \omega = H) & P(\sigma = \sigma^G \mid \theta, \omega = L) \\
P(\sigma = \sigma^B \mid \theta, \omega = H) & P(\sigma = \sigma^B \mid \theta, \omega = L)
\end{bmatrix}
\]

for \( j = 1, 2 \).

We have

\[
F^1 = \begin{bmatrix}
\xi + (1 - \xi)\mu & (1 - \xi)\mu \\
(1 - \xi)(1 - \mu) & \xi + (1 - \xi)(1 - \mu)
\end{bmatrix},
F^2 = F^1 - \Delta \xi \begin{bmatrix}
1 - \mu & -\mu \\
-(1 - \mu) & \mu
\end{bmatrix}.
\]

Then, there exists a matrix \( B \) such that \( F^2 = BF^1 \), where \( B \) is given by:

\[
B = \begin{bmatrix}
b_{11} & b_{12} \\
b_{21} & b_{22}
\end{bmatrix} = I - \frac{\Delta \xi}{\xi} \begin{bmatrix}
1 - \mu & -\mu \\
-(1 - \mu) & \mu
\end{bmatrix},
\]

16
where \( b_{ij} \geq 0 \) and \( b_{1j} + b_{2j} = 1 \) for all \( i \) and \( j \in \{1, 2\} \). ■

We note that this result is valid even if assumptions 1 and 2 do not hold.

Proposition 3 says that the society gains from an increase in the precision but does not say where the gains come from. To identify the source of the gains, we assume that the target size of downsizing is fixed. This implies that the quantity of public production is fixed. Then, we have:

\[
\frac{dW}{d\xi} = (1 + \lambda) \sum_{\theta=\bar{\theta}} \left[ p(\theta, \sigma^B) - p(\theta, \sigma^G) \right] \nu(\theta)\mu(\theta)(1 - \mu(\theta))(U^H - U^L),
\]

which is positive since we have \( p(\theta, \sigma^B) \geq p(\theta, \sigma^G) \).

Intuitively, an increase in the precision affects social welfare through two channels: monetary transfers and worker’s reservation utilities. Concerning the reservation utilities, after an increase in the precision, the reservation utility of the workers having the good signal increases while that of the workers having the bad signal decreases. It turns out that the net effect from the two changes in opposite directions is zero. Concerning the monetary transfers, under complete information on each worker’s efficiency, the government pays transfers only to the workers remaining in the public sector to keep their utilities equal to their reservation utilities. After an increase in the precision, the transfers to the workers having the good signal will increase while those to the workers having the bad signal will decrease. Since, given a type, the probability of retaining a worker having the bad signal is larger than the probability of retaining a worker having the good signal, there will be a net decrease in the total monetary transfer.

4 Asymmetric information case

In this section, we assume that there is asymmetric information about each worker’s efficiency in the public sector. We characterize the optimal downsizing mechanism.

For the downsizing mechanism to induce truth-telling, it should satisfy the following incentive compatibility constraints:

\[
(\text{IC} : \hat{\theta}, \sigma^G) \quad t^G - p^G \hat{\theta} + (1 - p^G) U^{mG} \geq \bar{t}^G - \bar{p}^G \hat{\theta} + (1 - \bar{p}^G) U^{mG}, \quad (10)
\]

\[
(\text{IC} : \hat{\theta}, \sigma^B) \quad t^B - p^B \hat{\theta} + (1 - p^B) U^{mB} \geq \bar{t}^B - \bar{p}^B \hat{\theta} + (1 - \bar{p}^B) U^{mB}, \quad (11)
\]
\[
(IC : \bar{\theta}, \sigma^G) \quad t^G - p^G\bar{\theta} + (1 - p^G)U^mG \geq t^G - p^G\bar{\theta} + (1 - p^G)U^mG, \quad (12)
\]

\[
(IC : \bar{\theta}, \sigma^B) \quad t^B - p^B\bar{\theta} + (1 - p^B)U^mB \geq t^B - p^B\bar{\theta} + (1 - p^B)U^mB. \quad (13)
\]

We recall that the signal is public information.

The government will maximize the expected social welfare (5) subject to the participation constraints, (1) to (4), and the incentive compatibility constraints, (10) to (13).

As in the previous section, we analyze how an incremental increase in the precision of the signal affects the optimal order of downsizing, the size of downsizing and social welfare.

### 4.1 Order of downsizing

Under asymmetric information, it is easy to check that only the four following constraints are binding: given a signal, the participation constraint is binding for the inefficient type and the incentive compatibility constraint is binding for the efficient type: \((IR : \bar{\theta}, \sigma^G), (IR : \bar{\theta}, \sigma^B), (IC : \bar{\theta}, \sigma^G)\) and \((IC : \bar{\theta}, \sigma^B)\).

The relevant (virtual) social marginal cost of retaining a worker in the public sector is given by:

\[
SMC^a(\bar{\theta}, \sigma) \equiv (1 + \lambda)MC^f(\bar{\theta}, \sigma) = SMC^c(\bar{\theta}, \sigma) \quad \text{for} \quad \sigma \in \{\sigma^G, \sigma^B\},
\]

\[
SMC^a(\bar{\theta}, \sigma^G) \equiv (1 + \lambda)MC^f(\bar{\theta}, \sigma^G) + \lambda \frac{\nu}{1 - \nu} \frac{\mu(\theta)}{\mu(\bar{\theta})} \Delta MC^f \geq SMC^c(\bar{\theta}, \sigma^G),
\]

\[
SMC^a(\bar{\theta}, \sigma^B) \equiv (1 + \lambda)MC^f(\bar{\theta}, \sigma^B) + \lambda \frac{\nu}{1 - \nu} \frac{1 - \mu(\theta)}{1 - \mu(\bar{\theta})} \Delta MC^f \geq SMC^c(\bar{\theta}, \sigma^B).
\]

where the superscript \(o\) represents asymmetric information.
Under asymmetric information about $\theta_i$, each efficient worker having signal $\sigma$ obtains the information rent given by:

$$U(\bar{\theta}, \sigma) - U^m(\bar{\theta}, \sigma) = p(\bar{\theta}, \sigma)\Delta MC^f.$$ 

Since the rent is increasing in the probability of retaining an inefficient worker having the same signal ($p(\bar{\theta}, \sigma)$), the social marginal cost of retaining an inefficient worker is larger under asymmetric information than under complete information. Consider for instance the group of workers having the good signal. In this group, there are $\nu\mu(\bar{\theta})$ number of efficient workers and $(1 - \nu)\mu(\bar{\theta})$ number of inefficient workers. Therefore, an incremental increase in $p(\bar{\theta}, \sigma^G)$ results in an increase in the rent given up to the efficient workers by $
abla \frac{\nu \mu(\bar{\theta})}{1 - \nu \mu(\bar{\theta})}\Delta MC^f$, which explains the previous formula for the social marginal cost $SMC^a(\bar{\theta}, \sigma^B)$.

Since $\frac{\mu(\bar{\theta})}{\mu(\bar{\theta})} \geq \frac{1 - \mu(\bar{\theta})}{1 - \mu(\bar{\theta})}$, we always have $SMC^a(\bar{\theta}, \sigma^G) > SMC^a(\bar{\theta}, \sigma^B)$. Since $\Delta MC^f$ is increasing in $\xi$, $SMC^a(\bar{\theta}, \sigma^G)$ is always increasing in $\xi$ and $SMC^a(\bar{\theta}, \sigma^B)$ can be increasing in $\xi$ as well. Hence, $SMC^a(\bar{\theta}, \sigma^B)$ can be larger than $SMC^a(\bar{\theta}, \sigma^G)$ for all $\xi$, with $\xi \in [0, 1]$. In fact, when the following inequality holds

$$\left(1 + \lambda + \lambda \frac{\nu}{1 - \nu} \frac{1 - \mu}{1 - \mu}\right)\Delta \theta > (1 + \lambda)(U^H - U^L),$$

$SMC^a(\bar{\theta}, \sigma^B)$ is larger than $SMC^a(\bar{\theta}, \sigma^G)$ for all $\xi$. When the above inequality does not hold, there exists $\xi^{**} (> \xi^*)^{11}$ such that

$$SMC^a(\bar{\theta}, \sigma^B) > SMC^a(\bar{\theta}, \sigma^G) \text{ if } \xi \leq \xi^{**}.$$ 

We summarize our findings on the optimal order of downsizing in the next proposition (see also Figure 3):

**Proposition 4 (order of downsizing)** Under Assumptions 1 and 2 and under asymmetric information on each worker’s efficiency in the public sector, the optimal order of downsizing changes as follows as the precision in-

$^{11}$\(\xi^{**}\) is given by $\xi^{**} = \frac{(1 + \lambda + \lambda \frac{\nu}{1 - \nu} \frac{1 - \mu}{1 - \mu})(\Delta \theta - \Delta \mu(U^H - U^L))}{(U^H - U^L)(1 + \lambda - (1 + \lambda + \lambda \frac{\nu}{1 - \nu} \frac{1 - \mu}{1 - \mu})\Delta \mu)}.$
where \( \xi^{**} > \xi^{*} \) and regime \( II \) exists only if \( \left( 1 + \lambda + \lambda \frac{\nu}{1-\nu} \frac{1-\mu}{1-\mu} \right) \Delta \theta < (1 + \lambda) (U_H - U_L) \) holds.

**Figure 3:** Social marginal cost of retaining a worker under asymmetric information

### 4.2 Size of downsizing

We first examine how the introduction of the information asymmetry affects the size of downsizing. Since the government has to concede information
rents to the efficient workers, the social marginal cost of keeping an inefficient worker is larger in the presence of asymmetric information than in its absence. This makes the probability of keeping an inefficient worker smaller under asymmetric information than under complete information. Hence, the size of downsizing is larger in the presence of asymmetric information than in its absence. However, the size of downsizing is not affected by the introduction of informational asymmetry in the case in which the social value of public production is low enough that the government has to lay off all the inefficient workers.

Let us now examine how an increase in the precision of the signal affects the size of downsizing. The precision affects the size of downsizing by changing the degree of information asymmetry, defined as $\Delta MC_f$. $\Delta MC_f$ is increasing in $\xi$, which results in an increase of the full cost of retaining an inefficient agent. Therefore, when we isolate the impact through rent, the increase in the precision increases the size of downsizing.

The results are summarized in the next proposition:

**Proposition 5** (size of downsizing) Under assumptions 1 and 2,

a. The size of downsizing is larger in the presence of asymmetric information than in its absence.

b. The rent extraction consideration makes the size of downsizing increasing in $\xi$.

### 4.3 Value of information

We now study how an incremental increase in the precision affects social welfare. For this purpose, we distinguish two cases: when the probability of receiving the good signal is the same regardless of type ($\mu(\theta) = \mu(\overline{\theta})$) and when this probability is higher for an efficient worker than for an inefficient worker ($\mu(\theta) > \mu(\overline{\theta})$).

#### 4.3.1 When $\mu(\theta) = \mu(\overline{\theta})$

When the probability of receiving the good signal is the same regardless of type ($\mu(\theta) = \mu(\overline{\theta})$), we can still apply Blackwell's theorem. Hence, an increase in the precision has a positive social value.
Proposition 6 (value of information) When \( \mu(\bar{\theta}) = \mu(\bar{\theta}) \) holds, social welfare is increasing in the precision of the signal when there is asymmetric information on each worker’s efficiency in the public sector.

Proof. Given a worker with signal \( \sigma \), the government is facing two kinds of uncertainties about the worker: his type \( \theta \) and his performance in the labor market \( \omega \). The government has four instruments: \( p(\theta), t(\theta) \). Since the two transfers are determined by the binding inefficient type’ participation constraint and efficient type’s incentive compatibility constraint, the government can only choose \( p(\bar{\theta}) \) and \( p(\bar{\theta}) \) to maximize social welfare. Furthermore, the government’s program can be decomposed into two independent subprograms, the one for the efficient type and the one for the inefficient type, as follows:

\[
\max_{\bar{p}(\theta)} E_{(\omega|\sigma)} \left\{ p(\bar{\theta}) \left[ S'(q) - (1 + \lambda)\bar{\theta} + [1 - p(\bar{\theta})(1 + \lambda)] \left[ U_L + (U_H - U_L)1_{[\omega=H]} \right] \right] \right\},
\]

\[
\max_{\bar{p}(\theta)} E_{(\omega|\sigma)} \left\{ p(\bar{\theta}) \left[ S'(q) - (1 + \lambda)\bar{\theta} + [1 - p(\bar{\theta})(1 + \lambda)] \left[ U_L + (U_H - U_L)1_{[\omega=H]} \right] \right] \right\}
\]

\[-\lambda \frac{\nu}{1 - \nu} p(\bar{\theta}) \Delta \theta \}
\]

where \( q \) represents the quantity produced in the public sector by all the other workers. We can apply Blackwell’s theorem to each subprogram. Since the information structure with precision \( \xi \) is finer in the Blackwell’s sense than the information structure with precision \( \xi - \Delta \xi \), with \( \Delta \xi > 0 \), an increase in the precision has a positive value. ■

4.3.2 When \( \mu(\bar{\theta}) > \mu(\bar{\theta}) \)

Consider now the case in which an efficient worker has a higher probability of receiving the good signal than an inefficient worker \( (\mu(\bar{\theta}) > \mu(\bar{\theta})) \). Then, we cannot apply Blackwell’s theorem. To show this, we look at the government’s optimization program for the inefficient type, presented in the proof
of Proposition 6. This program now takes the following form:

$$\max_{p(\theta)} E_{(\omega|\sigma)} \left\{ p(\theta) \left[ S'(q) - (1 + \lambda)\bar{\theta} \right] + \left[ 1 - p(\theta)(1 + \lambda) \right] \left[ U^L + (U^H - U^L)1_{[\omega = H]} \right] \right\}$$

$$- \lambda p(\bar{\theta}) \left[ \Delta \theta - (1 - \xi)\Delta \mu(U^H - U^L) \right] + \frac{\nu}{1 - \nu} \left\{ \frac{\mu(\theta)}{\mu(\bar{\theta})} I_{[\sigma = \sigma^G]} + \frac{1 - \mu(\theta)}{1 - \mu(\bar{\theta})} I_{[\sigma = \sigma^B]} \right\},$$

where $p(\bar{\theta})$ is chosen after the realization of signal $\sigma$. Since both the precision $\xi$ and the signal enter directly into the objective function, we cannot apply Blackwell’s theorem. In contrast, in the previous section in which $\mu(\bar{\theta}) = \mu(\bar{\theta})$ holds, we have $\Delta \mu = 0$ and $\frac{\mu(\theta)}{\mu(\bar{\theta})} = \frac{1 - \mu(\theta)}{1 - \mu(\bar{\theta})} = 1$ and, therefore, we can apply Blackwell’s theorem.

Since finding the sufficient conditions for the value of information to be positive is beyond the scope of this paper, we just illustrate here a case in which an increase in the precision has a negative social value. For simplicity, we assume that the target size of downsizing is fixed such that the quantity of public production is given by $q^0$. As we have seen in Section 3.3, the net impact on social welfare through the changes in the reservation utilities is zero. In the presence of asymmetric information, the monetary transfer can be decomposed into two parts: first the compensation of the production cost and the reservation utility, and second the rent. As we have seen in Section 3.3, the impact on social welfare through the change in the first component is positive as long as $p(\theta, \sigma^H) \geq p(\theta, \sigma^G)$ holds. The impact on social welfare through the change in the rent is negative since $\Delta MC^T$ is increasing in $\xi$.

Suppose that $q^0$ is such that $1 - (1 - \nu)(1 - \bar{\theta}) = q^0$. Then, we have

$$\frac{dW}{d\xi} = \left\{ (1 + \lambda)(1 - \nu)(1 - \bar{\theta})\bar{\mu} - \lambda \bar{\mu} [1 - \mu(1 - \bar{\theta})] \right\} (U^H - U^L).$$

The first term represents the impact through the change in the transfer (abstracting from rent) and is positive and the second term represents the impact

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\[12\] Laffont and Tirole (1993, pp. 123-124) consider information acquisition about the agent’s type and find a sufficient condition under which a finer information structure results in an increase in the slope of the optimal incentive scheme.
through the change in the rent and is negative. Hence, \( \frac{dW}{d\xi} \) is negative when downsizing is mild \((1 - \mathcal{P}^{G} \text{ small})\): in this case, the first term is close to zero while the second is strictly negative. We note that when there is massive downsizing such that all the inefficient workers are laid off, the government does not pay any rent and consequently social welfare increases with precision.

We summarize the results in the next proposition.

**Proposition 7 (value of information)** In the presence of asymmetric information, when \( \mu(\theta) > \mu(\bar{\theta}) \):

a. The social value of an incremental increase in the precision can be positive or negative.

b. When the target size of downsizing is fixed,

(i) When the social value of public production is high enough, social welfare decreases in the precision.

(ii) When the social value of public production is low enough, social welfare increases in the precision.

We have analyzed only how an incremental increase in the precision of the signal affects social welfare. Another question we should ask is how information acquisition itself affects social welfare compared to the case of no information acquisition. For this purpose, consider the extreme case of \( \xi = 0 \). Under complete information, obtaining a signal which gives no information about performance in the labor market is useless. However, under asymmetric information, when the probability of receiving a signal is different depending upon a worker’s type, information acquisition increases social welfare since the signal gives information about the type and allows the government to design finer downsizing mechanisms to extract more rent.

Therefore, under mandatory downsizing, we have two arguments favoring a certain level of investment in the acquisition of labor market information. First, information acquisition allows to save the monetary transfer necessary to induce the workers to remain in the public sector. Second, under asymmetric information, when the signal is correlated with the type, information acquisition allows to extract more rent.

\( ^{13} \)When it is optimal to lay off all the inefficient workers, the government can achieve the complete information outcome even in the presence of asymmetric information on \( \theta_i \).
5 Extensions

In this section, we discuss briefly interesting extensions.

Strong correlation between efficiency in the public sector and job search outcome in the private sector

Consider the case in which assumption 2 does not hold ($\Delta \mu \geq \Delta \theta U_H - U_L$): there is a strong positive correlation between productive efficiency in the public sector and job search outcome in the private sector. This case will hold when workers in the public sector accumulated general human capital which is easily transferable to the private sector. We continue to assume mandatory downsizing. We briefly sketch the results on the order of downsizing.

Suppose complete information about $\theta$'s. In the absence of any signal about workers’ job search outcomes, an efficient worker has a higher full cost than an inefficient worker since the first has a much higher probability of success in the labor market than the second. Hence, it is optimal to start to lay off first the efficient workers. By continuity, when the precision of the signal is low enough, the optimal order of downsizing is given as follows (see Figure 4): $(\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B)$. In this case, the order is determined first by type and then by signal.

As the precision increases, the full cost of a worker having the good signal increases while that of a worker having the bad signal decreases. Hence, the full cost of an efficient worker having $\sigma^B$ can be lower than that of an inefficient worker having $\sigma^G$. Therefore, for an intermediate value of the precision, the optimal order of downsizing is given as follows (see Figure 4): $(\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B), (\bar{\theta}, \sigma^B)$. In this case, the order is determined first by signal and then by type.

Finally, when the precision is high enough, the signal gives an accurate prediction of the job search outcome. Hence, workers having the same signal have similar probability of success in the labor market. This implies that given a signal, an inefficient worker has a higher full cost than an efficient worker. Therefore, when the precision is high enough, the optimal order of downsizing is given as follows (see Figure 4): $(\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B), (\bar{\theta}, \sigma^B)$. In this case, the order is still determined first by signal and then by type.
Suppose now asymmetric information about $\theta, s$. Then, two new regimes can appear because of the impact on rents. Consider first the case in which the precision is low enough. Since the inefficient workers have a larger proportion of them having $\sigma^B$ than having $\sigma^G$, the government will abandon more rents by retaining an efficient worker having $\sigma^B$ than by retaining an efficient worker having $\sigma^G$. In other words, the social marginal cost of retaining an efficient worker having $\sigma^B$ is higher than that of retaining an efficient worker having $\sigma^G$. Therefore, when the precision is low enough, the optimal order of downsizing is given as follows: $(\bar{\theta}, \sigma^B), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B)$.

Second, consider the case in which the precision is high enough. Since the difference between an inefficient worker’s full cost and an efficient worker’s full cost having the same signal ($\Delta MC^f$) is increasing in the precision, the social marginal cost of retaining an inefficient worker having $\sigma^B$ can be higher than that of retaining an efficient worker having $\sigma^G$. In this case, the optimal order of downsizing is given as follows: $(\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B), (\bar{\theta}, \sigma^G), (\bar{\theta}, \sigma^B)$.

Finally, for an intermediate value of the precision, the three regimes we have seen under complete information reappear.
Voluntary downsizing

The extension to voluntary downsizing case can proceed as follows. Under voluntary downsizing, each worker has the right to stay in the public sector refusing any downsizing offer. Therefore, the participation constraint to induce a worker to accept the downsizing offer is defined with respect to the utility that he expects to obtain by remaining in the public sector, denoted by $U_p(\theta)$, as follows:

$$(IR : \theta, \sigma) \quad t(\theta, \sigma) - p(\theta, \sigma)\theta + (1 - p(\theta, \sigma))U^m(\theta, \sigma) \geq U_p(\theta).$$

Private information on outside opportunities

Although we assumed for simplicity that both the government and a worker have the same level of information about the worker’s job opportunity in the private sector, workers, in reality, can have better information about their outside opportunities. Furthermore, the government can subsidize the activities of private agencies who help workers to acquire information on their job opportunities. For instance, the government can build websites containing relevant information for job search in the private sector and give workers free access to the websites.

It will be interesting to study how workers’ information acquisition on their job opportunities affect downsizing depending on the level of information that the government (or the agency implementing downsizing) has about each worker’s efficiency in the public sector. Usually, a superior would know his subaltern’s productive efficiency in the public sector but would not know his outside job opportunities. When the government tries to elicit information about a worker’s efficiency from his superior, the worker might offer a bribe to the superior to obtain a favorable report and the amount of the bribe will depend upon his level of efficiency in the public sector and his job opportunity in the private sector. Therefore, it would be interesting to study how the process of eliciting information about productive efficiency from a superior is affected by workers’ information acquisition on their job opportunities.

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15 For instance, Kahn (1985) studies optimal severance pays when workers have private information on their outside productivities. See also Estache, Laffont and Zhang (2001).
We have studied how the optimal structure of downsizing is affected by the acquisition of labor market information. We have identified three major gains justifying a certain level of investment in the acquisition of labor market information. First, the knowledge of the correlation between productive efficiency in the public sector and job search outcome in the private sector allows the government to discriminate workers at the participation stage. Second, by introducing tests, the government can capture some heterogeneity at the individual worker level and use this information to further discriminate workers at the participation stage. Last, when the results of the tests are correlated with productive efficiency in the public sector, the tests will allow the government to use a downsizing mechanism with finer screening and consequently to extract more rent from the workers.

Our studies can be extended to the case of voluntary downsizing. It seems also interesting to extend our model to incorporate worker’s private information on his job opportunity.

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