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Abstract

We present a simple model of bureaucracy under imperfect information, with a public manager and many public officials, some of whom may have the incentive to shirk. We show that the level of shirking in the bureaucracy may be non-monotone in the initial proportion of potential shirkers in the population. Namely, provided the utility from leisure is not too large, the equilibrium level of shirking can be first increasing and then decreasing in the proportion of potential shirkers. A corollary result is that the equilibrium can be efficient only when potential shirkers are particularly numerous.

Keywords: bureaucracy, asymmetric information, shirking.

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1 Introduction

Shirking on the job is considered as a "sin" of which every person has been guilty of.[1] In the economics literature, shirking, social loafing or free riding are generally interpreted as the tendency to withhold effort or divert working time to personal needs, at the expense of more general goals. This tendency is more pronounced when employees can easily substitute labor time with leisure time, and when their interests do not perfectly match those of the employers. In other terms, employees will shirk whenever the utility they can obtain from sitting back, weighted by the risk of punishment, is larger than the utility accrued from working hard.

This type of opportunistic behavior is observed both in the private and the public sphere. But it is in the latter that this has the worst reputation, especially because people expect that public servants should perform their tasks with a certain dedication and decorum. And, more often than not, public sectors are perceived as an inefficient use of taxpayer monies. Probably for the lack of proper monitoring or excessive legal protection, it is not infrequent to hear of public employees who carry out their day-to-day activities, such as shopping, homemaking or picking up children during their working hours. Italian bureaucracy is a prime example. There are seemingly countless cases of absenteeism, social loafing and other job withdrawal

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[1]For example, the three authors of this article have repeatedly messed around switching from writing to less demanding activities. The expected "outcome" of this paper will of course depend on that.

behaviors in the Italian public sector, with the resulting poor measures of service quality and citizen satisfaction. In one now infamous episode, which has gone viral in recent years, a traffic policeman, living in the same building as the office, was secretly videotaped while he clocks into work in his briefs and then goes back upstairs to bed (*Policeman clocks into work in underwear and returns to bed* - Daily Mail, 26 October, 2015). In another disturbing case, a hospital employee managed to skip work for no less than fifteen years, but continued to receive his monthly salary (*Italian king of absentees allegedly skipped work for 15 years* - The Guardian Mail, 21 April, 2021).

For the literature on interest groups (or Leviathan theory), originating from Tullock (1967), and emerged as a radical critique of the Weberian paradigm, bureaucrats have an inherent propensity to under-supply outputs and extract unearned rents for themselves. The seminal papers by Niskanen (1971), Posner (1975) and Brennan and Buchanan (1980) cast serious doubts that rational-legal public structures at the macro level can ensure the proper micro-level conduct on the part of rank and file bureaucrats. The same argument is supported, more recently, by a growing body of research arguing, as Banerjee (1997) puts it, that although "the manager has the best of intentions and is subject to no special sociological constraints [lower-tier bureaucracies are characterized by] agents who are more interested in their own welfare than in any collective goals". Now, the prevalent view is that bureaucracy can also be explained in terms of individual rent-seeking, either from outside or from within the organization. In this respect, our paper is related to the literature on agency theory and, in particular, to the problem of designing intra-organizational contracts

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that maximize the net benefits accruing to the principal from the activities carried out by agents (Alchian and Demsetz, 1972).[2]

Here, we present a two-tier bureaucracy model with a public manager (principal), interested in maximizing the expected revenue from the administration of a public service, and many would-be public servants/bureaucrats (agents). We focus on an organizational context in which it is prohibitively costly to measure the true effort exerted by agents, and where they can strategically decide to consume on-the-job leisure. For instance, a pyramidal structure where some agents are involved in the production of a certain public good or service, but only the outcome of this activity can be observed by the principal.[3] Bureaucrats are distinguished in "dedicated" to work and potential "shirkers". The latter bureaucrats have the inherent tendency to goof off and divert a certain fraction of their labor time to on-the-job leisure, enjoying private utility, if not properly incentivized to do otherwise. In our case, the incentive scheme used by the public manager consists in paying bonus wages when the output produced exceeds a given threshold. This mechanism can serve as an effective disciplining device, similar to the threat of dismissal of Shapiro and Stiglitz (1984) (in other words, with contingent wages, we can assume no penalties for being laid-off). In this respect, the model is also related to the gift-exchange argument of Akerlof (1982), where workers reciprocate the "gift" of an above-market wage with

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[2]As emphasized by Aidt (2016), the terms rent-seeking and corruption are often used interchangeably, although the two types of literature have proceeded in parallel. For some examples, see the recent contributions by Choi and Storr (2019) and Caserta et al. (2022).

[3]Supervision and control are in general very costly because public officials are given a certain degree of latitude and discretion in their job duties. In some cases, monitoring can even have detrimental effects, for example to effort or work morale, as argued by Cowen and Glazer (1996). Agents may assume they are not trusted or treated respectfully, and engage in retaliatory behavior, such as absenteeism, sabotage, union-organized strikes or work to rule.

excess effort (less leisure in our case). According to this theory, workers will exert effort in equilibrium even if there is no monitoring and no threat of dismissal. In our model, we implicitly consider that the disutility of labor is zero, so on-the-job leisure is consumed not because bureaucrats dislike work itself but because of their self-seeking tendency to gain additional utility from leisure. Therefore, the model we present is essentially an extension of the linear agency framework of Holmstrom and Milgrom (1987), in which there is a trade-off between risk and incentives in a stochastic environment.

The literature on incentive pay (piece rates) generally supports the hypothesis that the impact of incentive schemes on desired outcomes is positive. For example, in the windscreen experiment of Lazear (2000), a group of workers were offered piece-rate salaries for 19 months and this simple switch raised average output by 44%, with half of this increase attributable to incentive effects. Kahn et al. (2001) present a cost-benefit analysis of bonus payments on the performance of tax inspectors in Brazil, and report a remarkable 75% increase in fine collections in a period of three years. In Lavy (2002), the experiment is conducted on teachers in Israeli schools to assess the outcome of a tournament incentive scheme, and the result is a significant positive effect on pupil achievement. Similarly, Duflo et al. (2012) use a randomized experiment in India and show that monetary incentives reduce teacher absenteeism and increase children's test scores (differently from our theoretical setup, in their test, teachers are also monitored daily with cameras).

On the topic of work withdrawal behavior, Burda et al. (2020) use data from the American Time Use Survey and estimate the time devoted by workers to non-work

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activities while on the job. Their results are consistent with our theoretical model, as they show that workers refrain from loafing when are paid efficiency wages. Of course, other motivations may also influence the choice of shirking in addition to monetary compensation. One is the quality of what people can do in their non-work time. For example, Connolly (2008) observes that outdoor activities are less enjoyable during rainy days. Through US data, she shows that on such days individuals prefer to devote more time to work and less time to leisure. In the empirical analysis of sickness absenteeism in Canada of Shi and Skuterud (2015), the authors find that the propensity of workers to ask for sick leave is positively linked to favorable weather conditions, especially during non-winter months. Similarly, Thoursie (2004, 2007) finds that the sickness rate in Sweden increases during major sports events, and in the days close to birthdays. And, of course, the tendency to shirk is also determined by moral and cultural principles. Using an extensive US survey, Minkler (2004) reports that the main motivation for respondents to work hard is maintaining their moral integrity, and then their strict economic interest and the fear of being monitored and punished.

In the model, we show that, depending on the weight of leisure utility, there can be three or two equilibrium intervals that correspond to different incentive bonus regimes. Specifically, if leisure utility is relatively small, there are three intervals. The first is when the proportion of shirkers is low. In this case, the bonus paid to bureaucrats is the lowest possible and shirkers will devote all their work time to leisure. In this interval, the amount of shirking is increasing in the initial proportion of shirkers. In the second regime, the proportion is intermediate, and the manager

will tend to pay increasingly higher bonuses for higher proportions of potential shirkers to hedge against the risk of a major failure in the production of public services. In turn, shirkers will respond by consuming less and less leisure. In this case, the amount of shirking is decreasing in the proportion of potential shirkers. The third regime is for a relatively high proportion of potential shirkers. In this last case, the bonus paid is the highest possible, and shirking will not occur in equilibrium. Thus, individual leisure consumption and the total amount of shirking are first increasing and then decreasing in the proportion of potential shirkers in the population of bureaucrats. Therefore, the conclusion, which is more of an empirical prediction of the model, is that, provided the value of leisure utility is not too large, the level of "observable" shirking in the bureaucracy can be decreasing, in an interval, in the initial proportion of potential shirkers, in particular when this proportion is relatively high. For instance, in contexts where the level of potential shirking is supposed to be high (as measured for example by the degree of trust, social capital or cooperative behavior), this does not necessarily translate into a higher level of observed shirking. When, instead, leisure utility is relatively large, there will be just the first two intervals, so shirking cannot be totally eliminated, and we obtain the more standard result that total shirking is increasing in the proportion of potential shirkers.

Though it should not of course be viewed as empirical evidence, in Figure 1, we report some descriptive data on the relationship between the degree of social capital in Italian provinces (in the horizontal axis, we use a measure of *anti*-social capital, from the highest to the lowest value of social capital), and the average monthly absen-

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teeism for the employees of the Italian national institute of social security in 2015.[4] In Figure 1a, we consider provinces with above (below) median annual rainfall.[5] In each plot we separate with a vertical line provinces with below and above median anti-social capital. The differences in social capital scores of provinces follow the well-known North-South divide in Italy. And, though it is just suggestive data, and the analysis would clearly need a thorough empirical investigation, panel 1a shows that, when rainfall is higher, the trend of absenteeism is decreasing for provinces with above-median anti-social capital.[6] For example, in plot 1a, southern provinces such as Salerno (SA), Potenza (PZ) and Campobasso (CB) had an above-median rainfall year but a relatively low absenteeism rate, despite their very high anti-social capital index. And, in general, provinces with above-median anti-social capital seem to exhibit a decreasing trend of absenteeism. In contrast, in plot 1b, southern provinces, such as Matera (MT), Bari (BA) and Lecce (LE) had a below-median rainfall year and a very high absenteeism rate, and the overall trend of provinces is increasing, as

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[4]The Italian national institute of social security (INPS) is the largest public provider of social welfare programs in Italy and has a capillary distribution in nearly all Italian provinces, with 136 departments, including 102 provincial offices and more than 20,000 employees. We consider exclusively provincial offices, excluding metropolitan or regional departments which may happen to be located in the same jurisdiction. We use data on the absenteeism rate of INPS own employees, available online at the personnel website.

The social capital index is built following the procedure of Dystopia Country, using the World Happiness Reports. In particular, we use the variables blood donation and answers to *trust* of the World Value Survey. The variables are specified at the provincial level (for a detailed description of how each variable is measured, see Guiso et al., 2004). We measure social capital as the distance, in terms of summed squared deviations between the vector of scores of each province and the overall best scores (the same technique used in the Reports, with the difference of considering the worst scores among all countries). Due to heterogeneous units of measures in raw data, all variables and the anti-social capital scores are normalized between 0 and 1.

[5]The source for annual rainfall data is the Italian Ministry of agriculture and forestry.

[6]The trend in other years is quite similar, though with marked differences in some cases.
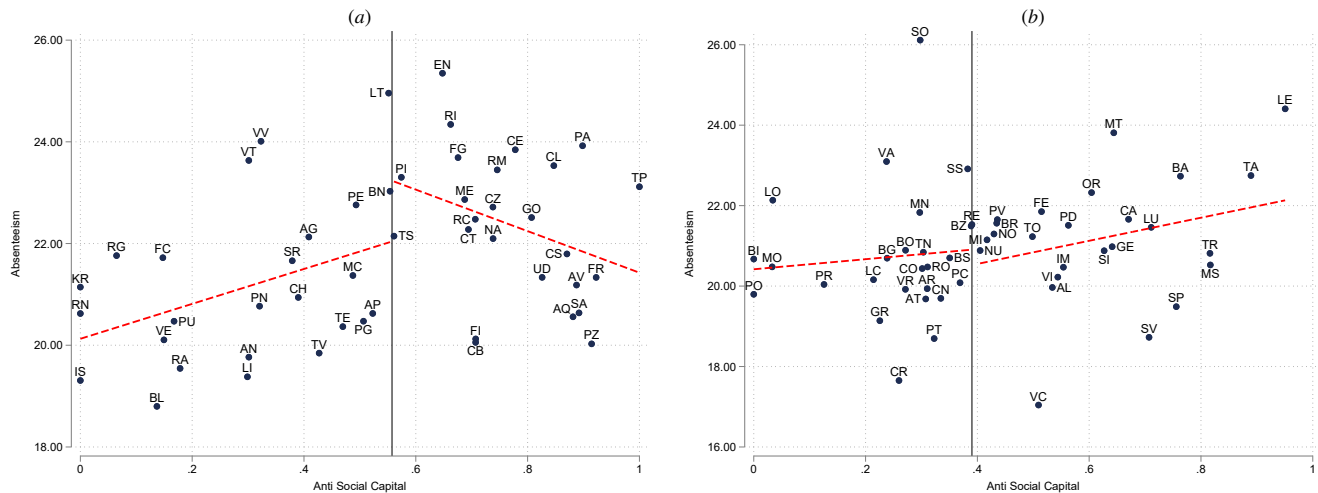
expected.[7]

Figure 1. *Anti*-social capital and average monthly absenteeism for employees of the Italian national institute of social security in 2015.
a) Provinces with yearly rainfall above the median.
b) Provinces with yearly rainfall below the median.

We conjecture that a low leisure utility can negatively affect shirking activities. Namely, even if bureaucrats with lower social capital are expected to shirk more, there may be circumstances in which "distractions" are not easily available and such that there is a lower utility from non-work activities. In such cases, potential shirkers may be, in a sense, indirectly forced to do their job properly. This suggests that other factors, different from culture and social norms, may have an impact on shirking behavior. As suggested by this paper, one determinant can be the (real)

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[7]While we do not intend that every absence from work is attributed to shirking behavior, the labor economics literature reports evidence that, for example, sick leaves may not be merely due to medical conditions (Barmby et al., 2002; Johansson and Palme, 2005; Cornelißen et al., 2011).
It is beyond the scope of this simple descriptive data to consider social attributes, such as the willingness of local doctors to sign false medical certificates (see Ichino and Maggi, 2000), and the territorial differences in law enforcement and compliance (see D'Amuri, 2017).

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wage received by bureaucrats and its incentive effect to elicit more effort. For the Italian case, the law prescribes that public employees must receive the same salary for the same job category, regardless of the relevant difference in the cost of living between the more expensive North and the less expensive South.[8] This may result in a more "effective" efficiency wage for southern public employees.

A popular joke of a famous Italian stand-up comedian is something along the lines of: "it's easy not to shirk in Milan, as all your friends are working hard and you wouldn't find anyone at the bar to talk with; it is difficult in Sicily where everyone is fooling around, having fun at the beach". We share, in part, his view, but we add that even in Sicily, where the *potential* level of shirking behavior is high, it is possible to observe a relatively low level of *actual* shirking, as bars may not be readily available in the vicinity of any public office or workplace. You can't go fishing if there is no water around.

In the model, a policy can restore the first best, for example, by setting the bonus at the no-shirking level. But, if leisure utility is highly valuable, it is extremely costly to incentivize shirkers to do their job properly and the payment can be above the end-of-period productivity of bureaucrats, a possibility that never occurs in equilibrium. Of course, this kind of policy is feasible if the manager is endowed with enough budgetary resources, and when the public good or service is to be provided despite operating at a loss (as in the case of essential services or basic welfare programs).

The next section introduces the setup. The equilibrium analysis follows. Finally, brief conclusions are drawn.

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[8]The regional index of purchasing power is published by the Italian Institute od Statistics (IS-TAT).

2   Preliminaries

Consider a one-period, risk-neutral public sector with a manager (principal) and a large number of would-be bureaucrats (agents). The manager can appoint bureaucrats for the administration of a public office. Each public position (job) can be broadly interpreted as an activity providing benefits to citizens in the form of public goods or services. The public job requires, for example according to law provision, 1 unit of labor time, say a day, and its outcome is stochastic: it yields a positive output y with probability p and 0 with probability $1 - p$. The labor contracts is based on a bonus-payment scheme (to simplify we normalize the fixed component to 0), which pays a bonus, β, at the end of the period, but only if the final output produced is positive, and 0 otherwise (this contract structure is consistent with the increasing focus, in many countries, on public sector performance measurement and accountability).[9]

Agents are of two types, differentiated by their commitment to work and attitude toward opportunism or shirking activities. Specifically, there are dedicated (D) bureaucrats, who are fully motivated and committed to work, so they are expected to meet all their job duties. The other bureaucrats are potentially shirkers (S), as they can have the incentive to spend a fraction, σ, of their work time in on-the-job leisure, enjoying private utility $l(\sigma)$, increasing and concave in σ. Shirking lowers the probability of positive output down to $p(1 - \sigma)$. The expected output (expected productivity) of each D bureaucrat is thus $p\,y$, which also corresponds to that of

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[9]As shown by Lin (2004), a system of bonds posted by workers when are initially hired and forfeited if caught shirking can work as substitutes for efficiency wages in terms of effort incentives.

each S type when there is no shirking.

To make the analysis tractable, we will use the following specific form for the leisure utility function:

$$l(\sigma) = \tfrac{\eta}{2}[1 - (1 - \sigma)^2], \quad \text{with} \quad \eta > 0. \tag{1}$$

The parameter η can be interpreted as the utility weight of leisure activities, and can reflect a number of aspects associated with shirking, such as social stigma or acceptance, personal guilt, shame or even smug self-satisfaction for being viewed as "crafty".[10] This interpretation follows the rational choice theory, applied to public administration and bureaucracy. In our case, public servants, as any other rational self-regarding individual, will choose how much to work or shirk depending on what generates the highest expected personal utility. This is not to say that public officials are motivated solely by financial rewards and cannot intrinsically be guided by a sense of vocation and public-service ethos but rather that, in our formulation, these values are embedded in the leisure utility function, in particular in the parameter η. Hence, the lower η, the higher the degree of social responsibility of public servants; if, at the extreme, $\eta = 0$ (as for D types), S bureaucrats will not devote any working time to their personal interests.

The manager's objective is to maximize the expected revenue from the provision of the public service.[11] The model involves both hidden action and hidden informa-

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[10]The functional form for leisure utility is similar to that used in the paper by Repullo and Suarez (2000), but in a model of loan diversion in the credit market.

[11]The assumption of revenue maximization is quite standard in the literature. See, for example, Besley and McLaren (1993), Druk-Gal and Yaari (2006), Wadho (2016), and Strîmbu and González (2018).

tion. The principal cannot distinguish D from S types, but knows their proportions, $1 - \pi$ and π, in the population. We assume that monitoring is not feasible, so the effort exerted by bureaucrats cannot be a controllable signal. At the end of the period, the manager can perfectly observe the final output produced, but not whether an output of 0 is due to shirking or simply "bad luck". To simplify, we consider limited liability on the part of bureaucrats and an autarky payoff of 0.

The timing of the game is: 1) the manager offers the bonus β; 2) D and S individuals decide whether to accept or not; 3) if S types accept, they choose σ and obtain $l(\sigma)$; 4) the output is realized and state-contingent payments are made.

We will denote the expected revenue (per bureaucrat) of the manager, at the bonus β, by $u_M(\beta)$, and the payoff of each D and S type by $u_i(\beta)$, with $i = \{D, S\}$.

With full information, agent type and leisure would be both observable, so the public manager would force S types not to shirk ($\sigma = 0$), and set the bonus to 0. Bureaucrats would obtain the reservation payoff, $u_D(0) = u_S(0) = 0$, and the manager the full-information revenue, $u_M(0) = py$, corresponding to the full-information social welfare.[12] So, with perfect information, the manager would be able to extract all the rent from labor contracts. This result may provide a rationale as to why S individuals may want to shirk when information is asymmetric.

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[12]In the welfare conclusions, to simplify, we consider neither the leisure utility obtained by shirkers, nor the potential positive or negative externalities that may result from shirking on the well-being of third parties, such as citizens, taxpayers and society as a whole. Including on-the-job leisure utility in the social welfare function, other than being a potential thought-provoking exercise, can lead to the somewhat unsurprising conclusion that social welfare can be higher when equilibrium shrirking is postive.

2.1 Bonus levels

Under asymmetric information, the expressions for the expected utilities of D and S bureaucrats, under the labor contract, are:

$$u_D(\beta) = p\ \beta; \tag{2}$$

$$u_S(\beta) = l(\sigma) + p(1 - \sigma)\beta. \tag{3}$$

Each D type obtains a payoff equal to the expected bonus, whereas each S type the leisure utility plus the expected bonus corrected for the shirking risk adjustment factor. The fraction of working time allocated to leisure derives from the maximization of (3), yielding (the second-order condition is satisfied)

$$\sigma = 1 - \tfrac{p\beta}{\eta}, \tag{4}$$

so, as β decreases, shirking will tend to increase. Note from (4) that S bureaucrats will indulge in leisure activities whenever the maximum expected bonus they can receive, $p\ \beta$, is lower than the utility weight of shirking, η.

The public manager whishes to maximize the expected revenue (per bureaucrat),

$$u_M(\beta) = \pi p(1 - \sigma)(y - \beta) + (1 - \pi)p(y - \beta), \tag{5}$$

where, if the agent is of type S (D), the principal obtains $y - \beta$ with probability $p(1 - \sigma)$ (p). The manager must take into account the participation constraints, $u_i(\beta) \geq 0$, and the reaction function of S types in (4).

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There are three relevant levels for the bonus payment, which will be derived and discussed below.

The first is the bonus such that the participation constraint of D types is binding and that of S types is slack, that is

$$\beta = 0, \tag{6}$$

corresponding to that paid under symmetric information. Note that, since with limited liability a bonus below 0 is not feasible, this implies that, in equilibrium, there will be no adverse selection. For the bonus $\beta = 0$, the fraction of shirking is $\sigma = 1$, that is S types choose to shirk all day long.

The second bonus level derives from the maximization of the public manager's expected revenue in the range where $\sigma \in (0,1)$. The solution is

$$\beta = \frac{\pi(py+\eta)-\eta}{2\pi p} \equiv \beta^*,$$

with $\partial \beta^*/\partial \pi = \eta/2\pi^2 p > 0$, so the higher the proportion of S types, the higher the bonus payment. In addition, $\partial \beta^*/\partial \eta = -(1-\eta)/2\pi p < 0$, which means that the higher the utility from leisure, the higher the fraction of working time diverted from (3), and thus the lower the contract remuneration for both types of bureaucrats. For the bonus β^*, the fraction of shirking is

$$\sigma = \frac{\eta-\pi(py-\eta)}{2\pi\eta} \equiv \sigma^*.$$

The third bonus level is such that S types have no incentive to divert any fraction of their working time, that is $\sigma = 0$ in (4), yielding

$$\beta = \frac{\eta}{p} \equiv \overline{\beta}.$$

If $\beta > \overline{\beta}$, S types would still choose not to shirk, but the expected revenue to the manager would be lower, so $\overline{\beta}$ will be the highest possible equilibrium bonus.

3   Equilibrium regimes

In equilibrium, the prevailing equilibrium bonus will depend on the relative proportion of S types. In other words, the manager must take into account that, depending on π, β^* may be either lower than 0 or higher than $\overline{\beta}$. Hence, we derive two critical thresholds for π:

$$\beta^* = 0 \Leftrightarrow \pi = \frac{\eta}{py+\eta} \equiv \underline{\pi};$$

$$\beta^* = \overline{\beta} \Leftrightarrow \pi = \frac{\eta}{py-\eta} \equiv \overline{\pi},$$

with $\underline{\pi} < \overline{\pi}$. Therefore, the intrinsic propensity to shirk of S types, in particular their proportion in the population, can lead to one of the following three scenarios.

a) $\pi \leq \underline{\pi} \implies \beta^* \leq 0$. The equilibrium bonus is 0, for which $\sigma = 1$.

b) $\underline{\pi} < \pi < \overline{\pi} \implies 0 < \beta^* < \overline{\beta}$. The equilibrium bonus is β^*, for which $\sigma = \sigma^*$.

c) $\pi \geq \overline{\pi} \implies \beta^* \geq \overline{\beta}$. The equilibrium bonus is $\overline{\beta}$, for which $\sigma = 0$.

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The threshold $\underline{\pi}$ is positive and below 1, whereas $\overline{\pi}$ is below 1 when $\eta < py/2$, and above 1 when $\eta > py/2$. So, an equilibrium with $\beta = \overline{\beta}$ turns out to be possible only for relatively low values of η. Namely, if $\eta > py/2$, the equilibrium at $\overline{\beta}$ does not exist and the equilibrium bonus is β^* in the wider interval $(\underline{\pi}, 1)$.

To summarize, if $\eta < py/2$, the fraction of time diverted is

$$
\sigma = \begin{cases}
1 & \text{if } \pi \in (0, \underline{\pi}], \\
\sigma^* & \text{if } \pi \in (\underline{\pi}, \overline{\pi}), \\
0 & \text{if } \pi \in [\overline{\pi}, 1).
\end{cases}
$$

If, instead, $\eta \geq py/2$, the fraction of time diverted is

$$
\sigma = \begin{cases}
1 & \text{if } \pi \in (0, \underline{\pi}], \\
\sigma^* & \text{if } \pi \in (\underline{\pi}, 1).
\end{cases}
$$

Therefore, there can be either two or three relevant regimes characterizing the equilibrium. These possibilities will be discussed in the next three sub-sections.

3.1 Equilibrium at $\beta = 0$

When $\pi \in (0, \underline{\pi}]$, the bonus chosen by the manager is $\beta = 0$, and $\sigma = 1$. The expected revenue is the expected output produced by D types,

$$u_M(0) = (1 - \pi)py, \tag{7}$$

decreasing in π.

The payoff of D types is $u_D(0) = 0$, equal to their outside option, whereas S types obtain $u_S(0) = \eta/2$, corresponding to the highest possible utility from leisure.

The principal extracts all the rent from the contracts on D types, and nothing from S types. Through shirking, S agents are able to earn a positive surplus though, as will be soon clear, a relatively low π, that is a high average quality of the pool of bureaucrats, is the worst possible scenario for them, and especially for D types. In this equilibrium, each S type chooses to shirk all day long, and the level of actual shirking is equal to π, equal to and increasing in the fraction of potential shirkers in the population.

3.2 Equilibrium at $\beta = \beta^*$

The interval of π in which an equilibrium at β^* exists is either $(\underline{\pi}, \overline{\pi})$ or $(\underline{\pi}, 1)$, depending on whether $\eta < py/2$ or $\eta \geq py/2$. In both cases, the properties of the equilibrium are as described below.

In equilibrium, the manager obtains

$$u_M(\beta^*) = \frac{[\pi(py-\eta)+\eta)]^2}{4\pi\eta}, \tag{8}$$

which can be shown is a non-rectangular hyperbola with vertical asymptote at $\pi = 0$, and with the right branch decreasing and then increasing in π, reaching a minimum at $\pi = \overline{\pi}$. When $\eta < py/2$, then $\overline{\pi} < 1$ and the existence interval is $(\underline{\pi}, \overline{\pi})$, whereas when $\eta > py/2$, $\overline{\pi} > 1$ and the interval is $(\underline{\pi}, 1)$. So, in the relevant intervals, $u_M(\beta^*)$ is decreasing in π, as in the numerical cases of figures 2a and 2b. From the examples, as expected, the higher the proportion of S types, the lower $u_M(\beta^*)$, for the reason that the bonus paid to bureaucrats increases in π so as to reduce σ^* and mitigate the productivity loss from shirkers.

The equilibrium payoff by D bureaucrats is

$$u_D(\beta^*) = \frac{\pi(py+\eta)-\eta}{2\pi}, \tag{9}$$

equal to 0 if $\pi = \underline{\pi}$ and then increasing in π, as in figures 3a and 3b. Hence, D types obtain a positive surplus and increasing in the proportion of S types. This last result implies that a public office with a large presence of potential shirkers can be seen as a favorable working environment for D bureaucrats, at least for their monetary payoff. Thanks to the shirking propensity of S bureaucrats, D types can earn a positive payoff, more than under perfect information where $u_D(0) = 0$.

The equilibrium payoff of S types is

$$u_S(\beta^*) = \tfrac{\eta}{2} + \tfrac{[\pi(py+\eta)-\eta]^2}{8\pi^2\eta},\qquad(10)$$

equal to $u_S(0) > 0$ for $\pi = \underline{\pi}$, and then increasing in π, as illustrated in figures $3a$ and $3b$. It can be shown that their utility from leisure, $l(\sigma^*)$, reaches a maximum, $\eta/2$, for $\pi = \underline{\pi}$ (when all work time is devoted to leisure), then is decreasing in π and equal to 0 at $\pi = \overline{\pi}$ when $\eta < py/2$ and the equilibrium interval is $(\underline{\pi}, \overline{\pi})$, whereas it is positive at $\pi = 1$ when $\eta > py/2$ and the interval is $(\underline{\pi}, 1)$.
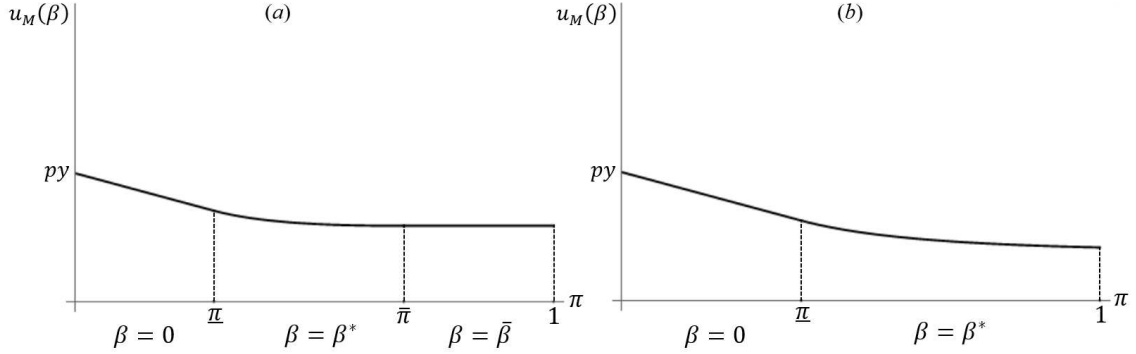

Figure 2. Revenue of the manager. Numerical example.
a) $\eta < py/2$. Parameters: $y = 2$; $\eta = 0.5$; $p = 0.4$.
b) $\eta \geq py/2$. Parameters: $y = 2$; $\eta = 1$; $p = 0.4$.

The fraction of time devoted to shirking by each S bureaucrat, σ^*, reaches a maximum, 1, for $\pi = \underline{\pi}$, then is decreasing in π, as $\partial\sigma^*/\partial\pi = -1/2\pi^2 < 0$, either when $\eta < py/2$ or when $\eta > py/2$, that is when the equilibrium range is either $(\underline{\pi}, \overline{\pi})$ or $(\underline{\pi}, 1)$. In the former case, σ^* is equal to 0 when $\pi = \overline{\pi}$, whereas, in the latter, it is positive for all $(\underline{\pi}, 1)$.

Proposition 1. *The higher the proportion of S bureaucrats, the lower the incentive*
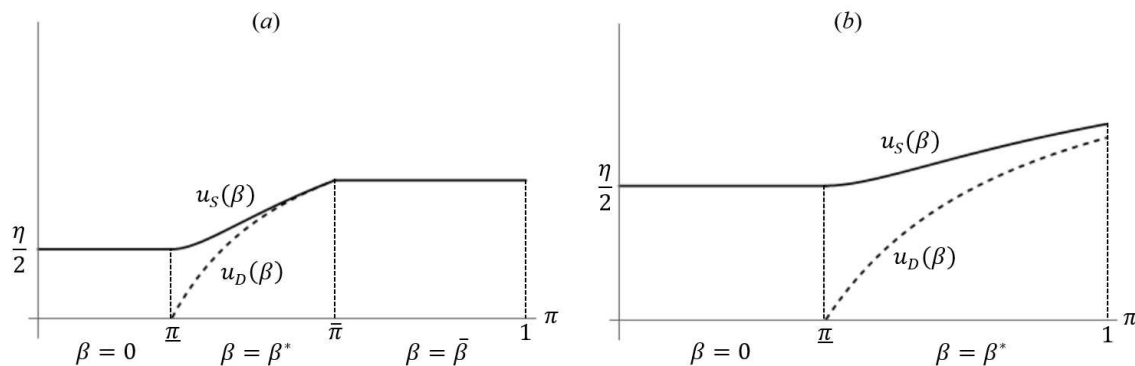
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Figure 3. Payoffs of D and S bureaucrats. Numerical example.
a) $\eta < py/2$. Parameters: $y = 2$; $\eta = 0.5$; $p = 0.4$.
b) $\eta \geq py/2$. Parameters: $y = 2$; $\eta = 1$; $p = 0.4$.

of each of them to shirk.

Concerning the equilibrium level of shirking, $\pi\sigma^*$, we have that $\partial\pi\sigma^*/\partial\pi = (\eta - py)/2\eta$. So, it can be either increasing or decreasing in π, depending on whether the leisure utility weight is larger or smaller than the expected productivity.

Proposition 2. *If $\eta < py$, the equilibrium level of shirking in the public sector is decreasing in the proportion of potential shirkers.*

The intuition for this result is that high levels of π force the manager to deter massive shirking by offering relatively high bonus premiums. In turn, such high remunerations will encourage S bureaucrats to commit more time to their job and increase both the probability of positive outcome and their end-of-period pay.

Two numerical examples are shown in figures 4a and 4b. In the first, $\eta < py$, and $\pi\sigma^*$ is decreasing in π. In the second plot, $\eta > py$, and $\pi\sigma^*$ is increasing.
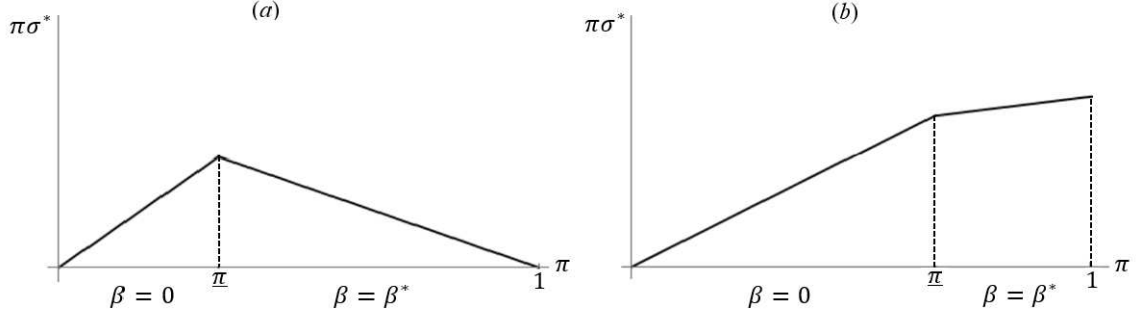
Figure 4. Equilibrium level of shirking. Numerical example.
a) $\eta < py$. Parameters: $y = 2$; $\eta = 0.5$; $p = 0.5$.
b) $\eta \geq py$. Parameters: $y = 2$; $\eta = 2$; $p = 0.5$.

3.3 Equilibrium at $\beta = \overline{\beta}$

As said, if $\eta > py/2$, $\overline{\pi} > 1$ and an equilibrium at $\overline{\beta}$ is not possible. So, in this subsection, we analyze the case $\eta < py/2$, which implies that $\overline{\pi} < 1$ and that there exists an interval, $[\overline{\pi}, 1)$, where the equilibrium bonus is $\overline{\beta}$ and the shirking fraction is $\sigma = 0$.

In equilibrium, the manager is able to obtain

$$u_M(\overline{\beta}) = py - \eta, \tag{11}$$

independent of the proportion of S types, as they do not shirk, so the probability of positive output is equal to the prior p.

The equilibrium payoff of D and S types is

$$u_D(\overline{\beta}) = u_S(\overline{\beta}) = \eta, \tag{12}$$

the highest possible payoff in this model setup. Note that, in this equilibrium, both

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types of bureaucrats receive a bonus equal to the leisure utility weight, η, of S types, and the higher the benefit of on-the-job leisure, the larger the payoff of bureaucrats. Namely, a workplace with attractive "distractions" can benefit also those workers who have no intention to shirk. In our specific case of this subsection (given the simple quadratic leisure utility), the upper bound for the payoff in (12) is $py/2$.

Since the equilibrium shirking fraction is $\sigma(\overline{\beta}) = 0$, we obtain that social welfare is equal to py.

Proposition 3. *If the equilibrium at $\overline{\beta}$ exists, it is socially efficient.*

When the bonus is $\overline{\beta}$, there is no on-the-job shirking in our stylized public sector. As long as $\eta < py/2$, whether or not leisure is enjoyable does not affect the welfare conclusions. From Proposition 3, we come to the rather counterintuitive conclusion that the equilibrium is efficient only when there is a high proportion of potential shirkers. Paying the highest bonus, $\overline{\beta}$, to a high number of potential slackers is the only scenario in which the public manager achieves the social optimum.

In contrast, if the conditions are such that leisure is particularly desirable, that is $\eta > py/2$, then the no-shirking equilibrium of this subsection is not possible, and we would end up in one of the scenarios described in subsections 3.1 and 3.2, in which welfare is lower than the first-best level.

4   Discussion and concluding remarks

In the model analyzed above, depending on π, the fraction, σ, of work time diverted by *each* S bureaucrat is decreasing in the initial proportion of potential shirkers. In

contrast, if leisure utility is lower than a given threshold, the *total* amount, $\pi\sigma$, of actual shirking in the bureaucracy can be first increasing and then can be decreasing.

The discussion of Section 2 leads to the additional conclusion that the higher (lower) the proportion of potential shirkers, the higher (lower) the payoff obtained by both types of bureaucrats. Thanks to the propensity of shirkers to divert their working time, even the most dedicated bureaucrats are able to capture some of the surplus from their contracts. So, it is "good" types that can benefit from the opportunistic tendency of "bad" types, and this result is in contrast to the main body of literature on information frictions. For instance, in Akerlof (1970), an equilibrium in which only lemons are sold is more likely to occur when their proportion is relatively high. In Stiglitz and Weiss (1981), a higher fraction of high-risk borrowers leads to an increase in the pooling interest rate, which is also charged to low-risk borrowers. In our case, the propensity to shirk of "bad" bureaucrats can force the revenue-maximizing manager to pay a bonus above the reservation level, and this benefits also "good" bureaucrats who obtain a positive surplus. This effect is intensified when bad bureaucrats are particularly numerous. Setting a low bonus is not revenuable for the manager when this provides perverse incentives for bureaucrats to engage in unproductive activities at work, and thus leads to a reduction in the performance of public projects. Except when the number of S types is very low, both types of agents earn a positive expected payoff, despite receiving a take-it-or-leave-it offer. This would not be possible under perfect information. Whereas, when information is imperfect, by behaving opportunistically, shirkers do not only benefit themselves, but also D bureaucrats.

Except when the initial proportion of S types is high, they will tend to shirk too much than what social optimality requires. And, optimality never arises when the value of leisure utility is particularly large. A policy intervention can set the bonus to the no-shirking level, $\overline{\beta} = \eta/p$, but if $\eta > py$, this implies that bureaucrats will receive a bonus payment above their productivity, y, in case of project success. A policy that sets a bonus payment above the productivity of bureaucrats is of course possible depending on the specificity of the public goods or services, and when the public manager is endowed with enough budget resources. This conclusion can have significant implications: if leisure is particularly enjoyable and it is not possible to assign enough resources to the payment of public officials, they will tend to shirk even if the bonus is at a relatively very high level. It is noteworthy that, in the equilibrium scenarios analyzed in the model, the bonus can never be above the productivity, y. When the equilibrium is at β^*, the highest bonus payment paid to bureauctas is when $\eta > py/2$, at the upper end of the relevant interval $(\underline{\pi}, 1)$, for which $\beta^* = y/2$. And, since the equilibrium at $\overline{\beta} = \eta/p$ exists when $\eta < py/2$, this implies that the highest bonus paid is when η approaches $py/2$, which gives again $\overline{\beta} = y/2$.

Note that, as in Prendergast (2007), the model allows for a potential *ex-ante* self-selection of job candidates, whereby only those with a higher degree of integrity and commitment to civic values are more likely to enter the public sector. For example, if we assume that bureaucrats are sanctioned in case of non-positive performance, a separating equilibrium is possible in which the manager achieves the full-information revenue. Denote the sanction with s. The full-information solution is obtained when the participation constraints of D and S types are satisfied with equality, that is

$u_D(\beta, s) = p\beta - (1-p)s = 0$ and $u_S(\beta, s) = l(\sigma) + p(1-\sigma)\beta - [1 - p(1-\sigma)]s = 0$. The system is satisfied when $\beta = y - (1-p)\eta/p$ and $s = \eta$. This solution requires that $s \geq \eta$, which can be difficult to implement for legal or other institutional restrictions, especially when the leisure utility weight is large or because the penalty would be imposed on D types, although they never misbehave.

Although we do not consider group-interaction effects, so each S bureaucrat's decision does not depend on the shirking level of others, the leisure utility they obtain from shirking is decreasing in the number (proportion) of fellow equals. This may have important behavioral socio-economic implications that can be explored by future research. See for example Loch et al. (2000), who propose a model with status competition in which group members value their status relative to their peers and choose to allocate their time between working and personal status-enhancement activities.

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