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Excessive Public Employment and Rent-Seeking Traps*

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Abstract

We propose a model where the size of the public sector and the level of aggregate output are interconnected through the occupational choice of skilled agents, who differ in their degree of public-mindedness. Whenever the public sector attracts bureaucrats with low degree of public service motivation, they will use their position to rent seek by employing an excessive number of unskilled workers. This leads to an equilibrium with relatively high unskilled wages, which lowers profits and deters entrepreneurship. Conversely, an equilibrium with a lean public sector and greater private economic activity arises whenever public sector motivated agents populate the state bureaucracy. These agents exert high effort and employ a limited number of unskilled workers. We extend the model to show that a bloated public sector with high wages might result from the optimal voting behaviour of unskilled agents. Finally, we provide evidence documenting specific features of the model using cross-country and Argentinean data.

Key Words: Rent Seeking, Occupational Choice, Public Service Motivation, Political Economy.
JEL Codes: O10, J24, H11, H83.

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1 Introduction

Low quality and oversized public sectors are often perceived as an inefficient use of budgetary resources that, if redressed, could improve public service delivery or help reduce poverty. It is no surprise then that two of the biggest institutional lenders to developing countries, The IMF and the World Bank, have actively promoted the inclusion of governance and corruption issues on the development agenda since the late 90s[1]. The concern with public sector mismanagement goes, however, deeper than just an issue of wasting budgetary resources: poor bureaucratic quality appears to be so important because it may also largely distort the operation of markets. Indeed, cross-country studies show that corruption and rent seeking in the public bureaucracies can severely hurt private investment and are associated with lower income per head [Mauro (1995), Knack and Keefer (1995), and Keefer and Knack (1997)][2].

In this paper, we argue that an oversized and inefficient public sector will not only affect the economy's performance by wasting budgetary resources in the society, but also by misallocating human resources, through its participation in labour markets. In particular, we suggest that the quality of the top public bureaucracy determines the demand of unskilled workers by the public sector, which in turn affects the equilibrium wage. When unskilled wages are inflated by excessive public sector demand, profits will be reduced and the private sector will lose attractiveness to potential entrepreneurs.

We focus on one particular aspect regarding the quality of bureaucrats that has attracted growing interest over the past few years, namely whether or not they exhibit the appropriate ethics or motivation for their jobs, as in Francois (2000), Murdock (2002), Besley and Ghatak (2005), Benabou and Tirole (2006), Prendergast (2007), Macchiavello (2008), Delfgaauw and Dur (2008, 2010). Commonplace in this literature is the presumption that monetary payoffs are not the only type of reward that individuals pursue and the idea that pro-social behaviour cannot be perfectly monitored by monetary incentives. In such a context, it proves desirable that bureaucrats display a sense of mission and commitment towards the society they must serve. Such a sense of social mission has long been explored by the public administration literature, which refers to it as *public service motivation*, and a large number of survey-based studies provide evidence of its relevance in explaining the efficiency of public offices.[3]

Our starting point (in Sections 2 and 3) is an occupational choice model with heterogeneous agents and two different sectors: the *public sector* managed by bureaucrats and the *private sector* managed by entrepreneurs. There are two dimensions of heterogeneity among individuals. The first is the level of skills, which is assumed to be publicly observable (e.g. education). Only highly skilled individuals

[1] See for example, "Good Governance: The IMF's Role" (1998).

[2] This negative relationship is also highlighted by comparative studies that look at different regions in Italy [Putnam (1993) and Alesina, Danninger and Rostagno (2001)].

[3] See discussion in Francois (2000) and references therein (pp. 275 and 276).

may become entrepreneurs or may be appointed state bureaucrats. The second source of heterogeneity is the individuals' intrinsic public service motivation, which is assumed to be private information. The advantage of filling the state bureaucracy with public service motivated agents is that they are less inclined to rent seek.

In our model, bureaucrats and entrepreneurs need unskilled workers to carry out their productive activities, and must compete for the same pool of workers in the (competitive) labour market. Entrepreneurial activities yield profits, which are naturally a decreasing function of the labour cost. Bureaucrats earn a salary that follows the decision of a political process. Furthermore, since bureaucrats enjoy (some) discretionary power over the public budget, they could find ways to abuse this power in order to extract rents from the society.

An important issue in our model is then *how* rent seeking materialises in the economy. In that regard, we argue that several among the main channels used by bureaucrats to generate and extract rents require somehow oversizing public employment. For example, bureaucrats may bloat the public sector with excessive workers so as to extract different kinds of perks from some of them. Alternatively, overemployment may be the result of the creation of (unnecessary) jobs as a mean to directly appropriate income from it or to channel transfers to certain desired groups of people. Indirect sources of rents may also lead to an oversized public sector: for example, overmanning may be the result of clientelistic practices by state bureaucrats, as public jobs are somehow exchanged for political support (Robinson and Verdier, 2002).

Within this framework, we show that markets might coordinate activities in two (very) different types of equilibria, depending on which agents self-select into the state bureaucracy. First, there exists an equilibrium in which *only* public service motivated agents become bureaucrats. These agents keep an efficient public sector, which employs the lowest possible number of workers, subject to providing all public goods needed for the correct functioning of the economy. In turn, a lean public sector disciplines wages in the labour market, which sustains high entrepreneurial profits, attracting those agents whose main concern is their own consumption (profit-driven agents) into the entrepreneurship. A different equilibrium arises when profit-driven agents control high-rank positions in the public sector and use their discretionary power to extract rents by overhiring public workers. The resulting bloated public sector inflates aggregate labour demand, pushing up the equilibrium wage. This situation becomes also self-sustained because low profits deter skilled profit-driven agents from the private entrepreneurial sector.

Bureaucratic rent seeking is clearly inefficient in our model. A crucial question that arises is then whether individuals may find ways to device an institutional setup that precludes such rent seeking. In Section 4, we explicitly introduce the political economy dimension into our model, and show that equilibria that involve rent-seeking bureaucrats may actually result endogenously from a

simple democratic political process. This may happen because the unskilled workers *indirectly* benefit from the actions perpetrated by the rent-seekers, by receiving higher market wages. As a consequence, they may be willing to support institutions that leave room open for rent seeking.

Our paper offers a novel theory for the joint determination of the size, skill composition and efficiency of the public sector, together with the level of entrepreneurship, within a general equilibrium model that also incorporates the political process whereby bureaucrats salaries are set. The model also provides us with a set of predictions that we are able to confront empirically (Section 5). One of these is that when the public sector becomes an attractive option for rent-seeking agents its composition would tilt towards a greater share of unskilled workers. Using cross country variation of measures of public sector performance and skills in the public sector, we show that the predicted correlation between governance quality and skill composition holds, even when controlling for country and regional characteristics. Another important result is that, by expanding the demand of unskilled workers (which raises their wages), the public sector may end up crowding out the private sector. We provide evidence of income per head being negatively correlated with public employment and positively correlated to the skill composition in the public sector by looking at regional data from Argentina. Finally, the model predicts that a bloated public sector will inflate blue collar wages. Using an Argentinean household survey, we show that the skill premium is indeed larger in cities that show features associated with an equilibrium where the public sector is lean and efficiently run.

In a related paper, Macchiavello (2008) also studies the possibility of multiple equilibria in an occupational choice model with public service motivated agents, but looks at a public sector whose size and educational composition is exogenously fixed, hence our setup allows us to deliver richer associations between public employment, rent seeking and aggregate income. Moreover, the key mechanism in our model, namely the wage distortion in the unskilled labour market, is also a novelty. In that regard, our model highlights the importance of accounting for skills (or educational) differences, since the wage distortion becomes a crucial feature in explaining the following two phenomena: *i*) why a bloated public sector may adversely affect profits and entrepreneurship; *ii*) why a fraction of the society (the working class) may be willing to support rent-seeking bureaucrats who sustain a large and inefficient state apparatus. The latter point contributes then also to the political economy literature that has sought to endogenise the emergence and persistence of inefficient state institutions [e.g., Hassler et al. (2003) and Acemoglu, Ticchi and Vindigni (2008)], by suggesting another channel that could generate political support for institutions that depress aggregate productivity.

Our paper also relates to the growing literature on the quality of bureaucrats and politicians, e.g. Besley (2004), Caselli and Morelli (2004), Messner and Polborn (2004), Mattozi and Merlo (2008), Bond (2008). A key aspect of all this literature is that it studies the process of self-selection into bureaucratic and political jobs within a partial equilibrium approach: in particular, it assumes that

the returns in the private sector are exogenous and remain unaffected by who end up in the public sector. By contrast, in our model, the interplay between self-selection into public bureaucracy and the returns to private entrepreneurship lies at the heart of our theory and its main predictions.

Finally, occupational choice models in the development literature have so far mostly studied the long-run consequences of financial markets imperfections.[4] In particular, Ghatak, Morelli and Sjöström (2007) have focused on how financial markets imperfections may interact with the inability of markets to allocate agents to the occupations for which they are comparatively most suited. Our paper sheds light on how imperfections in the sorting of bureaucrats may also result in market distortions which preclude full development of the entrepreneurial sector, even without credit market imperfections.

Regional Inequality, Public Sector Overmanning and Rent Seeking: a brief discussion

Anecdotal evidence of public sector overmanning in underdeveloped regions is overwhelming [see, for example, Heller and Tait (1983), Gelb *et al* (1991), Kikeri (1998)].[5] Interestingly, this phenomenon can also be found in poorer regions of developed economies with large degrees of cross-regional inequality. For example, Alesina *et al* (2001) report huge differences in size and productivity of postal offices across Italian regions: while in the relatively richer North 179 postal workers are needed to deliver 100,000 units of correspondence, the number rises to 566 in the Centre, and to 1,783 in the relatively poorer South.[6]

The link between regional inequality, public employment and development goes beyond pure anecdotal evidence. Table 1 reports some correlations between public employment and income per capita. We look at three developed economies (Italy, Spain and US) which exhibit the largest degree of regional inequality among the 11 industrialised economies reported in Barro and Sala-i-Martin (1995). We also look at Brazil, a federal developing country with high regional inequality. Table 1 shows

[4] E.g., Banerjee and Newman (1993), Aghion and Bolton (1997), Lloyd-Ellis and Bernhardt (2000), Ghatak, Morelli and Sjöström (2001). Exceptions (besides the aforementioned article by Macchiavello) are Murphy *et al* (1991) and Acemoglu and Verdier (1998). The former studies how the choice between entrepreneurship and rent-seeking activities by the most talented individuals determines technical change and growth. The latter focuses on the effects of property rights enforcement in a context of entrepreneurial opportunistic behaviour.

[5] As an illustrative example, a New York Times article (April 15, 1987) entitled 'In Brazil, Battle of the Bloated Bureaucracy' recounts various examples of overmanned public offices in different states of Brazil. Probably, as one of the most eloquent ones, we can cite this fragment 'So bloated was the bureaucracy inherited by Miguel Arraes, the new Governor of Pernambuco, he concluded that he could administer the state with only 30 percent of the current employees'.

In some situations, public employment overmanning as a channel for extracting rents becomes even more extreme: for example, in Liberia, the national security sector is argued to be greatly overmanned by "ghost workers" – these are public employees who only report to work to collect their paycheck, RAND (2007).

[6] The same regional pattern holds for the fraction of postal workers among the total number of workers, and for similar measures of productivity among police officers, tax inspectors and railway workers (see Table 3, therein).

that the public sector is consistently larger in poorer regions for these four economies.[7] In fact, these correlations uncover significant differences in public sector employment across regions within those countries with greater inter-regional inequality. The public employment shares in Italy (in 1996), vary from 10.8% in Lombardy (the second richest region in that year) to 23.6% in Calabria (the poorest region in that year). Similarly, in Spain (in 2004) public employment reaches 32.3% Extremedura (the poorest region in that year), while the share is around 14%-15% in richer regions like Basque Country and Catalonia. Even stronger differences are present in Brazil (in 1991), where some of the poorer states in the north like Rio Grande do Norte and Piaui exhibit public employment shares of 40%, while in Sao Paulo this share is 15%.

The above phenomenon can find several explanations; the simplest probably being that the public sector steps in to provide employment in the absence of a vigorous private sector. Even though this is empirically plausible (and we do not dispute this argument), we propose a theory where the lack of opportunities in the private sector is an equilibrium result due to excessive public employment. In addition, the presumption that follows from the public sector being the employer of last resort is that its size would dwindle as new opportunities in the private sector arise for workers. Our model would instead suggest that the likelihood of a private sector resurgence is not ensured because its profitability is kept low in the presence of a bloated public sector. In that respect, unless there is an important shock (e.g. sudden rise in private sector productivity) a region would not (spontaneously) undo a configuration with a bloated public sector and little private activity.

Another key feature in our theory is the notion that an oversized public sector is somehow a symptom of underlying bureaucratic opportunistic behaviour. One of the first studies to propose a theoretical link between rent seeking and the size of the public sector is Niskanen (1971), which describes bureaucrats are self-interested agents whose objective is increasing the size of the budgets they manage as much as possible. In our model, such self-interested attitude by a fraction of the society leads to expanding public employment well beyond the level required to efficiently produce the public goods demanded by the society. A similar view is present in Gelb, Knight and Sabot (1991) who maintain that public employment is usually seen in underdeveloped economies as a rent-extraction device rather than as an input to produce public goods.[8] As mentioned before, a number of different motives, such as featherbedding, nepotism, or clientelistic practices, may all lead state bureaucrats to

[7] For illustrative purposes, Table 1 also includes the results for Sweden and Denmark; two developed economies with relatively low inter-regional inequality. Interestingly, the negative and significant correlation present for Italy, Spain, US and Brazil is not found either in Sweden or in Denmark.

[8] Even in the cases of developed economies, the size of public employment seems to raise suspicion of opportunistic behaviour. For example, Durden (1990) measures rent-seeking behaviour across US states by the share of workers employed in federal and state government jobs.

use public employment as a channel to generate and extract rents. A good summary of these issues is provided by Geddes (1994, page 27) with reference to Latin America:

> 'Administrators and politicians under traditional arrangements have the power to decide who will be hired to fill government posts. These officials have the choice of hiring the people who will contribute most to the officials' personal welfare (usually members of their own families); hiring the people who will contribute most to consolidating political support for themselves or their parties; or hiring the people who will contribute most to administrative effectiveness (the most technically qualified applicants). For the administrator or politician involved, choosing the applicant most likely to contribute to improving the administration often involves a certain and immediate loss of either personal or political benefits.'

2 Setup of the Model

2.1 Environment

We consider a single-period economy with two productive sectors: *i*) the public sector, and *ii*) the private sector. The economy is inhabited by a continuum of risk-neutral individuals with mass equal to $2 + \varepsilon$, where $\varepsilon > 0$. A mass $1 + \varepsilon$ of the individuals are unskilled; the remainder unit mass are skilled. Individuals' skills are publicly observable. Every individual (regardless of his skill) is endowed with one unit of unskilled labour time, which he could supply in the labour market.

2.1.1 The Private Sector

The private sector is perfectly competitive. Firms produce a *private good* using two types of inputs: one unit of entrepreneurial skills and unskilled labour (in variable amount). (From now on we will use the terms *unskilled labour* and *labour* interchangeably; likewise for the terms *unskilled workers* and *workers*.) Entrepreneurial skills are possessed *only* by skilled agents, who are all identically endowed with one unit of these skills. An individual who chooses to become an entrepreneur cannot simultaneously supply labour (i.e., he must specialise in one of the two occupations).

A firm owned by a skilled agent produces output (the private good) according to the following production function, where l denotes the amount of labour employed by the entrepreneur:[9]

$$y(l) = A\, l^{\alpha}, \quad \text{where } 0 < \alpha \leq 0.5. \tag{1}$$

[9] Setting the upper bound at $\alpha = 0.5$, rather than the usual restriction $\alpha \in (0, 1)$, allows an easier (and speedier) exposition of our main results. However, we should stress that relatively low values of α are instrumental for our proposed wage mechanism. Intuitively, a smaller α implies a less elastic labour demand function, which in turn means a stronger response by equilibrium wages to a bloating public sector.

The labour market is competitive. Hence, entrepreneurs must pay the market wage, w, for each unit of labour they hire. As a result, the optimisation problem of the entrepreneurs yields the following labour demand function (from now on, we normalise the price of the private good to unity):

$$l(w) = \left(\frac{\alpha A}{w}\right)^{\frac{1}{1-\alpha}}. \tag{2}$$

Entrepreneurial profits, $\Pi \equiv Y(l) - wl$, will accrue to the skilled agents running the firms, and represent their payoff as entrepreneurs. By using (1) and (2), we then obtain the profits as a decreasing function of w:

$$\Pi(w) = A^{\frac{1}{1-\alpha}}(1-\alpha)\left(\frac{\alpha}{w}\right)^{\frac{\alpha}{1-\alpha}}. \tag{3}$$

2.1.2 The Public Sector

The public sector is composed by a continuum of public offices with mass $b \in (0,1)$. Each public office is managed by a bureaucrat, who is appointed by the central administration and receives a fixed salary from them. Only skilled individuals may be appointed bureaucrats. Once an individual accepts a bureaucratic job, he cannot resign. Bureaucrats organise the production of public goods in each office; without them public offices cannot produce public goods. In addition, bureaucrats decide the number of unskilled workers to hire for their offices. Throughout the paper, we assume that the entire public sector is fully financed by lump-sum taxes collected by the central administration and distributed among the public offices according to their needs.

We suppose that the objective of the public sector (as a whole) is to ensure that $b(1+\gamma)$ units of the public good are produced, where $\gamma > 0$. The central administration will aim to achieve this by setting production targets among the mass b of offices, subject to the informational and institutional constraints described below.

Let g_i denote the amount of public good produced in office i. Conditional on being managed by a (skilled) bureaucrat, the production function for g_i is as follows:

$$g_i(e_i, n_i) = \min\left\{2(n_i + \theta_i e_i) + \gamma\,,\ (2+\gamma)\right\}, \tag{4}$$

where $e_i = \{0,1\}$ is the level of effort exerted by bureaucrat i and n_i equals the amount of labour hired by this bureaucrat. Bureaucratic effort is unobservable, while n_i and g_i are publicly observable. The variable θ_i is an idiosyncratic office-productivity shock that can take two possible values, namely $\theta_i = \{0,1\}$, each one with probability one-half. Given the same number of workers and bureaucratic effort, an office with $\theta_i = 1$ is (weakly) more productive than an office with $\theta_i = 0$. The amount γ is produced by the office whenever a (skilled) bureaucrat is present, regardless of his effort level. Finally, $2+\gamma$ equals the maximum amount of public good any office may possibly generate.

The realisation of θ_i is learned by the bureaucrat only after he has accepted the job in office i, but remains unobservable to the central administration. After observing the value taken by θ_i, the bureaucrat announces $\widetilde{\theta}_i = \{0, 1\}$ to the central administration. We assume the central administration has no means to corroborate whether announcements by bureaucrats are true or false. After receiving bureaucrats' announcements, the central administration decides how to organise the production of the desired $b(1+\gamma)$ units of public goods, setting a specific production target for each office. If a bureaucrat fails to meet his production target, the central administration may choose to subject the non-complying bureaucrat to a punishment $\phi > 0$ (measured in terms of disutility).

The central administration will seek to produce $b(1+\gamma)$ at the lowest fiscal cost. Therefore, if a mass of bureaucrats no smaller than $b/2$ announce $\widetilde{\theta}_i = 1$, the central administration will set a production target equal to $(2+\gamma)$ in a subset of with mass $b/2$ among those offices, and a production target equal to γ elsewhere.[10] The central administration does not distribute any additional funds to any office, since no unskilled labour is required to meet their respective production targets.

On the other hand, if only a fraction $f < \frac{1}{2}$ of bureaucrats announce $\widetilde{\theta}_i = 1$, the central administration will also have to resort to offices with $\widetilde{\theta}_i = 0$ in order to meet the desired total production of public goods. More precisely, the central administration will set a production target equal to $(2+\gamma)$ in all offices announcing $\widetilde{\theta}_i = 1$, giving them no additional funds. At the same time, it will select a subset with mass $b(1-2f)/2$ among the offices with $\widetilde{\theta}_i = 0$, setting a production target $(2+\gamma)$ there too, but in this case it will have to grant them enough additional funds to hire one unskilled worker each. Finally, the central administration will set a production target equal to γ for all remaining offices, with no additional funds for hiring unskilled workers.

2.1.3 Preferences: Public Service Motivation

Skilled agents differ in terms of their level of public service motivation.[11] A fraction $\mu \in (0, 1)$ among those individuals are *public service motivated* agents (henceforth, PSM). The remainder, $1-\mu$, are referred to as *profit-driven* agents (henceforth, PD). We model PSM agents as individuals who display some intrinsic motivation to fulfill a public task and derive some utility from doing so. We assume that agents' preferences (i.e., whether an agent is PSM or PD) are private information. In addition, henceforth, we assume that there exist enough PSM agents in the economy to (possibly) manage all

[10] The central administration could actually set a production target $(2+\gamma)$ in all the offices with $\widetilde{\theta}_i = 1$. Ruling this out by assumption is without loss of generality though, since by the law of large numbers the probability that a mass strictly larger than $b/2$ receives $\theta_i = 1$ equals zero, and (as we show later in Lemma 1) only bureaucrats with $\theta_i = 1$ actually announce $\widetilde{\theta}_i = 1$.

[11] The distribution of public service motivation among the unskilled is irrelevant to our model since they cannot become bureaucrats and only bureaucrats public sector preferences affect equilibrium outcomes.

the public offices; that is, we impose:

Assumption 1 $\mu \geq b$.

Bureaucrats derive utility from their income and disutility from the effort they exert at work. In addition, a public service motivated bureaucrat derives some extra utility from the act of delivering public goods produced within his office. In particular, conditional on having met the production target, the payoff function of bureaucrat i's is given by (5), where B denotes the salary of bureaucrats:[12]

$$U_i = B + \lambda_i \, g_i - 2 \, c \, e_i; \tag{5}$$

$$\text{where: } c > 0 \text{ and } \lambda_i = \begin{cases} 0 & \text{if } i \text{ is a PD agent,} \\ \lambda > 0 & \text{if } i \text{ is a PSM agent.} \end{cases}$$

Remark 1 For completeness, all payoff functions should also include two additional terms: *(i)* a positive term capturing the utility derived from public goods consumption, *(ii)* a negative term equal to the lump-sum taxes paid by each individual. Since both *(i)* and *(ii)* will affect all agents equally (irrespective of their skills), for the time being, there is no harm to our results by not explicitly including any of these two terms in the payoff functions, because neither *(i)* nor *(ii)* will have any impact on the optimal occupational choices of the individuals. We will have take this into account when we study agents' welfare, though.

In order for the allocation of public mindedness to noticeably influence the operation of the economy, not only we need a sufficient mass of PSM agents relative to the size of the public sector (Assumption 1), but also that their intrinsic motivation is sufficiently strong relative to their disutility of effort. The following assumption deals with this issue.

Assumption 2 $\lambda > 2c$.

As previously described, a bureaucrat may either end up managing an office with $\theta_i = 0$ or one with $\theta_i = 1$. A bureaucrat who runs an office where $\theta_i = 0$ will optimally announce $\widetilde{\theta}_i = 0$; otherwise he will risk failing to comply with the production target $2 + \gamma$ and be subjected to the punishment ϕ. However, truth-telling is not guaranteed if a bureaucrat finds out that $\theta_i = 1$: in this case the bureaucrat i may wish to understate the real productivity and announce $\widetilde{\theta}_i = 0$, so as to give himself

[12] Our payoff function (5) closely resembles that in Francois (2000) who assumes PSM agents derive some utility from the act of *producing* public goods and disutility from the effort they exert at work. See also Delfgaauw and Dur (2008) who assume motivated agents derive some utility directly from their effort when they work in the public sector, and Besley and Ghatak (2005) who postulate that mission-oriented agents obtain a non-pecuniary return when succeeding in a task that matches their intrinsic motivation.

room to shirk in case of being picked out to produce $2+\gamma$ units of public good. The following lemma states the optimal announcements by each type of bureaucrat.

Lemma 1

(i) PD bureaucrats always announce $\widetilde{\theta}_i = 0$.
(ii) If Assumption 2 holds, PSM bureaucrats always announce $\widetilde{\theta}_i = \theta_i$.

Proof. In Appendix. ■

Intuitively, PD bureaucrats have no incentive to ever declare $\widetilde{\theta}_i = 1$, since this increases the chances that they have to exert high effort. The situation is different though for PSM bureaucrats who face a trade-off. On the one hand, when announcing $\widetilde{\theta}_i = 1$, they are more likely to have to exert $e_i = 1$; on the other hand, they are also more likely to end up managing an office that will produce $g_i = 2+\gamma$, which they appreciate owing to their intrinsic motivation. Assumption 2 ensures that the latter always dominates the former, no matter the expectations that PSM bureaucrats hold regarding other bureaucrats' announcements.

From the previous discussion and Lemma 1, it follows that, given the production targets set by the central administration, the amount of employment in each of the public offices will depend both on the productivity shock and on the bureaucrat's type. In particular, a PSM bureaucrat will hire public workers according to:

$$n_{PSM} = \begin{cases} 0 \quad \text{if} \begin{cases} \theta_i = 1, \text{ or} \\ \theta_i = 0 \text{ and } g_i = \gamma; \end{cases} \\ 1 \quad \text{if } \theta_i = 0 \text{ and } g_i = 2+\gamma. \end{cases} \tag{6}$$

On the other hand, PD bureaucrats will hire public workers according to:

$$n_{PD} = \begin{cases} 0 \quad \text{if } g_i = \gamma; \\ 1 \quad \text{if } g_i = 2+\gamma. \end{cases} . \tag{7}$$

Notice that, since PD bureaucrats always announce $\widetilde{\theta} = 0$, we sometimes observe $g_i = \gamma$ when the unobserved productivity of the office is $\theta_i = 1$. Also, because of such false announcements, in some occasions when $\theta = 1$ a PD bureaucrat sets $n_{PD} = 1$ (which means that he exerts $e_{PD} = 0$). In these cases, the same production could alternatively be obtained by setting $n = 0$ and $e = 1$, as done by PSM bureaucrats according to the first line of (6). Finally, notice that whenever $\theta = 1$, a PSM bureaucrat will exert effort $e_{PSM} = 1$, while setting $e_{PSM} = 0$ only when $\theta = 0$. On the other hand, PD bureaucrats will always set $e_{PD} = 0$. Using these results, we can lastly write down the level of expected utility achieved by each type of bureaucrat (where, recall, f denotes the fraction of

bureaucrats who announce $\widetilde{\theta}_i = 1$):

$$U_{PSM} = \begin{cases} B + \lambda(1+\gamma) - c, & \text{if } f \geq \frac{1}{2}; \\ B + \lambda\left(1 + \gamma + \frac{0.5-f}{1-f}\right) - c, & \text{if } f < \frac{1}{2}. \end{cases} \quad (8)$$

$$U_{PD} = B. \quad (9)$$

2.2 Timing of the Events

The events in the model occur in six different stages, according to the following sequence:

1. **Bureaucrats salary decision:** The central administration fixes B once-and-for-all.

2. **First-stage occupational choice of skilled agents:** Each skilled agent decides whether or not to apply for a bureaucratic job. Applying for a bureaucratic post is costless.

3. **Allocation of bureaucratic posts:** If the total mass of applicants to bureaucratic jobs is no larger than b, all the applicants obtain the job. Otherwise, the mass b of bureaucratic posts is assigned by a draw among all the applicants.

4. **Second-stage occupational choice of skilled agents:** Each skilled agent who did not apply (in stage 2) or did not get (in stage 3) a bureaucratic job decides whether or not to start a private entrepreneurial project.

5. **Announcements, assignment of public funds, and labour market transactions:** Each bureaucrat i observes $\theta_i \in \{0,1\}$ and announces $\widetilde{\theta}_i \in \{0,1\}$. The central administration sets production targets for every public office and distributes any required additional funds. Bureaucrats and entrepreneurs hire workers in the labour market. All remaining agents supply their unit-time labour endowment in the market.

6. **Production stage:** Production takes place and all payments are made. Bureaucrats who failed to comply with their production target are subjected to a punishment $\phi > 0$.

3 Market Equilibrium Analysis

In this section, we study the joint determination of the individuals' optimal occupational choices and the (unskilled) workers market-clearing wage. For the moment, we abstract from studying the determination of the bureaucrats salary B, which, throughout this section, is taken exogenously given (with the only restriction that it must be high enough to ensure that all bureaucratic positions are filled when individuals choose their occupations optimally). The reason for taking B initially as given

is that we first wish to focus *only* on interactions operating through markets. In the next section, we proceed to endogenise B, by letting it be decided by majority voting.[13]

3.1 Optimal Occupational Choice

Before proceeding to study the general equilibrium results of the model, it proves instructive to first characterise the optimal occupational choice of the individuals, given the wage w (and the bureaucrats salary B). From now on, and without any loss of generality, we assume that whenever agents are indifferent between a bureaucratic job and any other occupation, they always choose the former.

In order to facilitate the exposition, for the remainder of Section 3, we will often assume that $B > \widetilde{A}$, where $\widetilde{A} \equiv \alpha^{\alpha}(1-\alpha)^{1-\alpha} A$. This condition implies that there exists a wage threshold, $\widehat{w}$, where $0 < \widehat{w} < \widetilde{A}$, such that: if $w < \widehat{w}$, PD agents choose not to apply for a bureaucratic post since they are better off as private entrepreneurs; whereas, if $w \geq \widehat{w}$, these agents actually prefer a bureaucratic job to running a private firm. In other words, $\widehat{w}$ is the wage level at which $\Pi(\widehat{w}) \equiv B$, hence $\Pi(w) < B$ for all $w > \widehat{w}$. Using (3), it is easy to observe that :

$$\widehat{w} = \alpha A^{\frac{1}{\alpha}} \left(\frac{1-\alpha}{B} \right)^{\frac{1-\alpha}{\alpha}} . \tag{10}$$

(Notice that if $B < \widetilde{A}$, PD agents would never choose bureaucracy as an occupation, switching from entrepreneurial activities to supplying unskilled labour when the market wage rises above $\widetilde{A}$.)

Figure 1 plots the payoff functions of bureaucrats, entrepreneurs and workers, for a varying w, given Assumption 2 and $B > \widetilde{A}$. These payoff functions correspond to those elicited before in (3) for the entrepreneurs, (8) for PSM bureaucrats, and (9) for PD bureaucrats; the w-line portrays the payoff of any agent in the economy who becomes a worker. From Figure 1, one can immediately pin down the optimal occupational choice of the skilled at each level of w.[14]

- For all $0 \leq w < \underline{w}$: No agent applies for a bureaucratic post. All skilled agents in the economy become entrepreneurs.

- For all $\underline{w} \leq w < \widehat{w}$: Only PSM agents apply for a bureaucratic post. All the skilled agents that did not apply or get a bureaucratic job become entrepreneurs.

[13] More precisely, in the next section, we assume that people vote for the B to be paid to state bureaucrats. This will be decided *before* all the market interactions analysed in this section take place. We also assume that the level of B cannot be renegotiated or changed afterwards. Notice then that, once B is chosen by majority voting, this variable becomes exogenous from the individuals' viewpoint: in that regard, the analysis of this section can be interpreted as the subgame that follows the decision over B.

[14] The optimal occupational choice of the unskilled is trivial: the only two occupations they can undertake are either working for the entrepreneurs or for the bureaucrats, among which they are in fact indifferent since wages in both occupations must be equal in equilibrium.

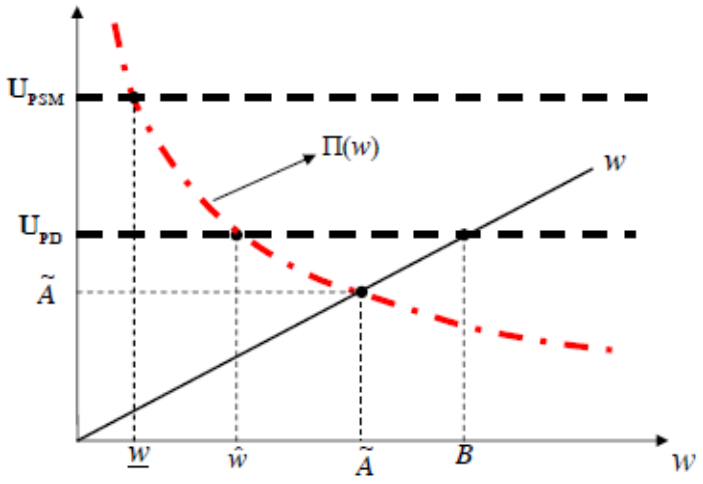

Figure 1: Payoff functions by different occupations

- For all $\widehat{w} \leq w \leq \widetilde{A}$: Both PSM and PD agents apply for a bureaucratic post. If $\widehat{w} \leq w < \widetilde{A}$, all the skilled agents that did not get a bureaucratic job become entrepreneurs; if $w = \widetilde{A}$, they choose indifferently between becoming either entrepreneurs or workers.

- For all $\widetilde{A} < w \leq B$: Both PSM and PD agents apply for a bureaucratic post. All the skilled agents that did not get a bureaucratic job become workers.

- For all $B < w \leq B + \lambda(1+\gamma) - \frac{1}{2}$: Only PSM agents apply for a bureaucratic post. All the skilled agents that did not apply or get a bureaucratic job become workers.

- For all $w > B + \lambda(1+\gamma) - \frac{1}{2}$: No agent applies for a bureaucratic post. All agents in the economy become workers.[15]

The main result that we wish to stress here is the existence of a wage threshold, $\widehat{w}$, at which PD agents change their minds regarding their most desired occupation. Below $\widehat{w}$, PD agents optimally self-select away from the public sector, since they are better off making profits in the private sector, which are relatively high due to low labour cost. However, for $\widehat{w} \leq w$, profits are not high enough to attract PD agents, who turn out to be better off as (rent-seeking) bureaucrats. Finally, notice that $\underline{w}$ is determined by $\Pi(\underline{w}) \equiv U_{PSM} = B + \lambda(1+\gamma) - c$, hence:

$$\underline{w} = \alpha A^{\frac{1}{\alpha}} \left(\frac{1-\alpha}{B + \lambda(1+\gamma) - c} \right)^{\frac{1-\alpha}{\alpha}}. \tag{11}$$

[15] To avoid cluttering Figure 1, we have drawn only $U_{PSM} = B + \lambda(1+\gamma) - 0.5$ from (8). Notice, though, that $U_{PSM} = B + \lambda\left[1 + \gamma + (0.5 - f)(1-f)^{-1}\right] - \frac{1}{2}$, with $m = 0.5\mu$, will only apply within the interval $w \in [\widehat{w}, B]$ and, since this lies strictly above the plotted U_{PSM} line, the choices by PSM agents specified above remain unaltered.

3.2 General Equilibrium Analysis

Two additional conditions must be satisfied in the general equilibrium analysis: first, the labour market must clear; second, no bureaucratic post must remain unfilled. More formally:

Definition 1 (Market General Equilibrium) *A market general equilibrium is characterised by: i) a market wage, w, ii) a bureaucrats salary, B, and iii) an occupational choice by each agent in the economy; such that the following three conditions are simultaneously satisfied:*

1. *All individuals choose their occupations optimally.*
2. *The labour market clears (i.e. the aggregate labour demand by the bureaucrats and the entrepreneurs must equal the sum of the labour endowments across all the remaining individuals).*
3. *All bureaucratic posts are filled (i.e. the mass of applicants for a bureaucratic post must be at least equal to b).*

Condition 1 has been illustrated in the previous subsection. Condition 2 stipulates the labour market clearing condition. Condition 3 simply requires that, in equilibrium, there must be enough applicants to fill all bureaucratic positions in the public sector. Regarding this last condition, one additional remark applies: although it restricts the range of values that B may possibly take in equilibrium (in particular, B cannot be too low, otherwise not even PSM agents will apply for bureaucratic jobs), it does not fully endogenise B (in other words, as it is specified, our model is not able to pin down the exact B solely by means of market-clearing conditions and optimal occupational choices).

Our main focus here is on the interplay between the optimal occupational choice of the skilled and the equilibrium wage in the labour market, and how this may give rise to equilibria exhibiting very different allocations of skills and productive efficiency. Bearing in mind the optimal occupational choice of the individuals, and using the equations (6) and (7), we can write down the analytical expressions for the (aggregate) labour demand and labour supply functions, respectively (again, to

ease the exposition, when writing down (12) and (13), we implicitly let $B > \widetilde{A}$):

$$L^D(w) = \begin{cases} \left(\frac{\alpha A}{w}\right)^{\frac{1}{1-\alpha}} & \text{if } 0 \leq w < \underline{w}, \\ (1-b)\left(\frac{\alpha A}{w}\right)^{\frac{1}{1-\alpha}} & \text{if } \underline{w} \leq w < \widehat{w}, \\ (1-b)\left(\frac{\alpha A}{w}\right)^{\frac{1}{1-\alpha}} + \frac{b}{2}(1-\mu) & \text{if } \widehat{w} \leq w < \widetilde{A}, \\ \left[\frac{b}{2}(1-\mu), (1-b)\frac{\alpha}{1-\alpha} + \frac{b}{2}(1-\mu)\right] & \text{if } w = \widetilde{A}, \\ \frac{b}{2}(1-\mu) & \text{if } \widetilde{A} < w \leq B \\ 0 & \text{if } w > B \end{cases} \tag{12}$$

$$L^S(w) = \begin{cases} 1+\varepsilon & \text{if } w < \widetilde{A}, \\ [1+\varepsilon, 2+\varepsilon-b] & \text{if } w = \widetilde{A}, \\ 2+\varepsilon-b & \text{if } \widetilde{A} < w \leq B + \lambda(1+\gamma) - c, \\ 2+\varepsilon & \text{if } w > B + \lambda(1+\gamma) - c. \end{cases} \tag{13}$$

From (12), we can observe that the labour demand function is non-monotonic in w. In particular, $L^D(w)$ "jumps up" at the wage level $w = \widehat{w}$ by the (strictly positive) amount $b(1-\mu)/2$. This happens because, at $w = \widehat{w}$, PD agents' most desired occupation switches from entrepreneurship to state bureaucracy. Whenever $w < \widehat{w}$ all the public offices end up managed by PSM bureaucrats, who properly fulfill their tasks (i.e. they exert high effort when $\theta_i = 1$) and keep their offices lean, without any unnecessary workers. Instead, just above $w = \widehat{w}$, a fraction $(1-\mu)$ of bureaucratic jobs end up in the hands of PD agents, who (whenever they are able to) abuse their positions to extract rents by hiring more workers per office than really needed.[16]

Proposition 1 *Suppose Assumptions 1 and 2 hold. Then:*

(i) An equilibrium in which only PSM agents become bureaucrats exists if and only if:

$$\widehat{B} \equiv A(1-\alpha)\left(\frac{1+\varepsilon}{1-b}\right)^{\alpha} - [\lambda(1+\gamma) - c] \leq B < A(1-\alpha)\left(\frac{1+\varepsilon}{1-b}\right)^{\alpha} \equiv \overline{B}. \tag{14}$$

(ii) An equilibrium in which a fraction μ of the bureaucratic jobs go to PSM agents, while the remaining fraction $(1-\mu)$ go to PD agents exists if and only if:

$$B \geq A(1-\alpha)\left[\frac{1+\varepsilon - b(1-\mu)/2}{1-b}\right]^{\alpha} \equiv \underline{B}(\mu). \tag{15}$$

Proof. (i) An equilibrium in which only PSM agents apply for bureaucracy exists only if $L^D(w)$ crosses $L^S(w)$ at a wage strictly below $\widehat{w}$ and (weakly) above $\underline{w}$. This requires $(1-b)[\alpha A/\widehat{w}]^{\frac{1}{1-\alpha}} < 1+\varepsilon \leq (1-b)[\alpha A/\underline{w}]^{\frac{1}{1-\alpha}}$, which using (10) and (11) leads to (14). Finally, we still need to prove that

[16] Notice that this behaviour by PD bureaucrats has also an indirect bloating effect on the amount of labour in public offices, since it forces the central administration to set a high-output target ($g_i = 2+\gamma$) on some of the low-productivity offices ($\theta_i = 0$) in order to keep the total production of public goods at the desired level, $b(1+\gamma)$.

PSM agents prefer bureaucracy to supplying unskilled labour and entrepreneurial profits are larger than wages. Denoting by w^* the wage that solves $(1-b)\left[\alpha A/w^*\right]^{\frac{1}{1-\alpha}} = 1+\varepsilon$, we can observe that $\widehat{B}+\lambda(1+\gamma)-c > w^*$, hence recalling (8) it follows that $U_{PSM} > w^*$ for any $\widehat{B} \leq B < \overline{B}$; moreover, since $w^* < \widetilde{A}$, it follows that $w^* < \Pi(w^*)$.

(ii) First, notice from (12) and (13) that $L^D(\widetilde{A}) < L^S(\widetilde{A})$, hence in equilibrium $w < \widetilde{A}$. As a result, an equilibrium in which both PSM and PD agents apply for bureaucracy exists if $L^D(\widehat{w}) \geq 1+\varepsilon$, which using the third line in (12) and (10) leads to (15). Finally, we still need to prove that PD agents prefer bureaucracy to supplying unskilled labour and profits are larger than wages. Denoting by w^{**} the wage that solves $(1-b)\left[\alpha A/w^{**}\right]^{\frac{1}{1-\alpha}} = 1+\varepsilon$, we can observe $\underline{B}(\mu) > w^{**}$, hence recalling (9) it follows that $U_{PD} > w^{**}$ for any $B \geq \underline{B}(\mu)$; moreover, since $w^{**} < \widetilde{A}$, then $w^{**} < \Pi(w^{**})$. ■

Proposition 1 (i) shows that a *necessary* condition for keeping PD agents away from the state bureaucracy is that the bureaucrats salary is not too large ($B < \overline{B}$). However, as shown in part (ii), $B < \overline{B}$ is actually not *sufficient* to ensure such a goal is achieved. In particular, when $B \geq \underline{B}(\mu)$, an equilibrium (possibly not unique) exists in which *all* skilled agents in the economy apply for a bureaucratic job. Notice that $\underline{B}'(\mu) > 0$, implying that an economy with a larger fraction of PSM agents exhibits a smaller range of values of B for which such an equilibrium exists.

From (14) and (15), we can immediately observe that $\underline{B}(\mu) < \overline{B}$; however, nothing guarantees that $\underline{B}(\mu) > \widehat{B}$. In fact, none of our parametric restrictions imposed so far ensures that there may exist a unique equilibrium where *only* PSM agents apply for bureaucratic jobs. For $\underline{B}(\mu)$ to be greater than $\widehat{B}$, so that there exists a range of B low enough that it only attracts PSM agents to the state bureaucracy and is also consistent with a general equilibrium, PSM and PD agents must be sufficiently different in their preferences regarding bureaucratic jobs vis-a-vis entrepreneurial activities. It turns out that, for any given A, there always exists a value of λ sufficiently large such that $\underline{B}(\mu) > \widehat{B}$ holds:[17]

Lemma 2 *If* $[\lambda(1+\gamma)-c] > \Gamma\,(1-\alpha)\,A$, *then* $\underline{B}(\mu) > \widehat{B}$, *where*

$$\Gamma \equiv \frac{(1+\varepsilon)^{\alpha} - [1+\varepsilon-b(1-\mu)/2]^{\alpha}}{(1-b)^{\alpha}} \tag{16}$$

and (16) features a positively valued function with an upper bound $\overline{\Gamma}(\alpha) < 1$. *Moreover, the upper bound decreases as* α *gets smaller, and in the limit equals zero, that is:* $\overline{\Gamma}'(\alpha) > 0$ *and* $\lim_{\alpha \longrightarrow 0} \overline{\Gamma}(\alpha) = 0$.

Proof. In Appendix. ■

[17] The minimum level of λ that ensures $\underline{B}(\mu) > \widehat{B}$, for any $b \in (0,1)$, $\mu \in [b,1)$ and $\varepsilon > 0$, is increasing in A. The intuition behind this is simply that profits in (3) are increasing in A; as a result, the greater A the larger the degree of motivation, λ, required for PSM agents to choose bureaucracy over entrepreneurship.

Notice that since Γ in (16) is bounded above, it follows from the lemma that there always exists a λ large enough such that $\underline{B}(\mu) > \widehat{B}$ obtains. The following corollary combines the previous results in Proposition 1 and Lemma 2, and describes the different types of equilibria that may arise in the model. Figure 2 illustrates each of the three cases when $[\lambda(1+\gamma)-c] > \Gamma(1-\alpha)A$ holds.

Corollary 1 *If $[\lambda(1+\gamma)-c] > \Gamma(1-\alpha)A$, three different equilibrium cases are possible depending on the value of B:*

(i) Lean public sector unique equilibrium: *If $\widehat{B} \leq B < \underline{B}(\mu)$, the equilibrium is unique. In the equilibrium, only PSM agents apply for (and obtain) bureaucratic jobs, the mass of unskilled public employees equals zero, and the wage of unskilled workers is*

$$w^* = \alpha A \left(\frac{1-b}{1+\varepsilon}\right)^{1-\alpha}. \tag{17}$$

(ii) Bloated public sector unique equilibrium: *If $B \geq \overline{B}$, the equilibrium is unique. In the equilibrium, both PSM and PD agents apply for bureaucratic jobs, a fraction μ of these jobs go to PSM agents, a fraction $1-\mu$ go to PD agents, the mass of unskilled public employees equals $b(1-\mu)/2$, and the wage of unskilled workers is*

$$w^{**} = \alpha A \left(\frac{1-b}{1+\varepsilon-b(1-\mu)/2}\right)^{1-\alpha}. \tag{18}$$

(iii) Multiple equilibria: *If $\underline{B}(\mu) \leq B < \overline{B}$, there exist two equilibria in the model. One of the equilibria features a 'lean public sector equilibrium', with identical characteristics as that of case (i) above. The other equilibrium features a 'bloated public sector equilibrium', with identical characteristics as that of case (ii) above.*

If $[\lambda(1+\gamma)-c] \leq \Gamma(1-\alpha)A$, then $\underline{B}(\mu) \leq \widehat{B}$, and only cases (ii) and (iii) above are possible.

Henceforth, for brevity, we will often refer to each of the two types of equilibria described above, respectively, as *lean equilibrium* and *bloated equilibrium*.[18]

The lean equilibrium is characterised by an *efficient* allocation of agents to activities, in the sense that all bureaucratic jobs end up in the hands of the agents who display a comparative advantage for these jobs: the PSM agents. PSM bureaucrats manage their offices ethically, not abusing their power to bloat their office with excessive workers as a mean to extract rents. This disciplines wages in the labour market, which in turn means that entrepreneurial profits remain attractive enough to keep PD agents away from rent seeking in the public sector.

[18] All the equilibria in Figure 2 are stable. In addition, if assumed that, whenever the skilled agents are indifferent between becoming bureaucrats or entrepreneurs, they randomise among the two occupations, Figure 2 (*iii*) would exhibit a third equilibrium at $w = \widehat{w}$. Notice, though, that this equilibrium would be unstable.

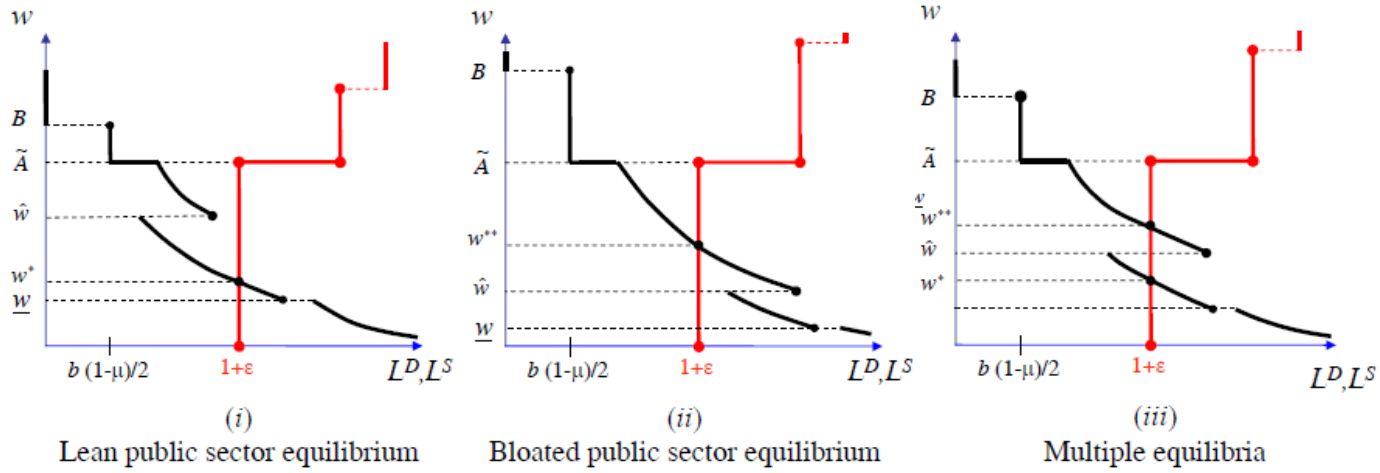

Figure 2: Labour Market Equilibria – three different cases.

The three cases are plotted for a given configuration of A,α, λ, μ, ε and b, and different values of B.

However, the economy may well fail to coordinate the allocation of agents correctly, ending up in a bloated equilibrium, as those where the market wage is $w^{**} \geq \widehat{w}$. In such cases, it becomes optimal for *all* skilled agents (both PSM and PD) to try to get a bureaucratic job in the public sector. As a result, in a bloated equilibrium, a fraction $1-\mu$ of the public offices end up managed by PD bureaucrats who abuse their discretionary power to rent seek by hiring an excessive number of public workers. This (mis-)allocation of agents is self-sustaining since a bloated public sector inflates aggregate labour demand, pushing up the equilibrium wage, which in turn lowers profits and discourages the PD agents from exercising their skills in the private sector.[19]

3.3 Total Output and Welfare Analysis

3.3.1 Aggregate Output

How do the two equilibria in Figure 2 (*iii*) compare to one another in terms of aggregate output? Aggregate output in the lean equilibrium (Y^*) is strictly larger than in the bloated equilibrium (Y^{**}). In equilibrium, total output is given by – where we are using the expressions in (1) and (2):

$$Y = \int_0^b g_i \, di + \int_b^1 y(l(w)) \, di = b\,(1+\gamma) + (1-b)\, A^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{w}\right)^{\frac{\alpha}{1-\alpha}}, \tag{19}$$

[19] Our model focuses on the effect of B on the self-selection into bureaucracy, and rules out (by construction) any effect B might have on incentives once an agent accepts a bureaucratic job. Notwithstanding, even if a higher B carries some efficiency-wage component, as long as PSM agents are intrinsically more attracted to bureaucratic jobs than PD agents are, our self-selection mechanism should remain at play. Furthermore, empirical evidence on the incentive-effect suggests this effect may in fact be quite weak: see for example Rauch and Evans (2000) and Van Rijckenghem and Weder (2001).

From (19), it immediately follows that the output gap, $Y^* - Y^{**}$, is strictly positive due to $w^* < w^{**}$. Also, it can be readily observed that the output gap is solely explained by lower private output in the bloated equilibrium, as aggregate public output equals, by construction, $b(1+\gamma)$ in both equilibria. Yet, the underlying *cause* why $Y^* > Y^{**}$ actually rests on the public sector behaviour. More precisely, the output gap is a consequence of the inefficient allocation of skills in the state bureaucracy. Intuitively, PD bureaucrats tend to expand public employment (relative to PSM bureaucrats), which reduces the labour supply left available for other activities in the economy and thus (partly) crowds out the private sector. However, PD bureaucrats expand the size of the public sector workforce as a mean to extract rents from it; hence, although public employment is higher, public output remains constant, implying that aggregate output is smaller in an equilibrium with a fraction $(1-\mu)$ of PD bureaucrats than in one where all bureaucrats are PSM.

The previous paragraph compares aggregate output in situations where multiple equilibria are feasible for a specific economy. However, the result is in fact more general than that, as it can be extended to any equilibrium that may arise for a *given* parametric configuration of the model.

Corollary 2 *Take an economy with a given set of parameters: $A, \alpha, \mu, \varepsilon, \lambda, \gamma$ and b, and which satisfies Assumptions 1 and 2. Depending on the specific level of B, two broad types of equilibria may arise in the economy: (i) equilibria in which only PSM agents apply for bureaucratic jobs; (ii) equilibria where both PSM and PD agents apply for bureaucratic jobs.*
In (i), aggregate output is given by: $Y^* = b(1+\gamma) + (1-b)^{1-\alpha} A (1+\varepsilon)^{\alpha}$.
In (ii), aggregate output is given by: $Y^{**} = b(1+\gamma) + (1-b)^{1-\alpha} A \left[1+\varepsilon - \frac{b}{2}(1-\mu)\right]^{\alpha}$.

Corollary 2 then states that, given a specific parametric configuration of the economy, aggregate output is always larger in an equilibrium without rent-seeking bureaucrats (where it equals Y^*) than in one where a certain fraction of the bureaucrats take opportunity of the public sector to extract rents (where it equals Y^{**}).[20]

3.3.2 Welfare Analysis

Let us focus again on the cases in which multiple equilibria are feasible – i.e., Figure 2 (*iii*). Although under multiple equilibria output is higher in the lean equilibrium, it turns out that this equilibrium

[20] Notice that although wages in a bloated equilibrium are larger than in a lean equilibrium ($w^{**} > w^*$), equilibrium wages are still a function of several other parameters in the economy; in particular, they are increasing in the technological parameter A. For this reason, our model should not be read as saying that wages in a poorer region with a bloated public sector will be larger than in a richer region with a lean public sector, as the technology (and other factors) may vary as well between those two regions. Quite differently, our model only implies that to avoid the inefficiencies brought about by the bloated equilibrium, the market wage in the poorer region should be lower than it actually is.

does not Pareto dominate the bloated one. As a consequence, an aggregate welfare assessment would first require postulating some specific social welfare function. This goes beyond the scope of this paper. However, with the model as it stands, welfare comparisons *within* groups of individuals are still feasible, and moreover they yield some further interesting insights.

Before proceeding to such analysis, one issue that we now need to take properly into account is the fact that the total amount of (lump-sum) taxes levied on individuals will differ across the two equilibria. Let T^* and T^{**} denote the tax on each individual in the lean and in the bloated equilibrium, respectively. It is straightforward to notice that $T^* < T^{**}$.[21]

PSM agents. In the lean equilibrium, a fraction b/μ become bureaucrats and get utility equal to $U_{PSM} - T^*$; the remaining fraction $(1 - b/\mu)$ start a private firm and their payoff equals $\Pi(w^*) - T^*$, where $\Pi(w^*) < U_{PSM}$. In the bloated equilibrium, only a fraction b manage to obtain a bureaucratic job, which yields $U_{PSM} - T^{**}$ as a payoff; the remainder fraction $(1 - b)$ receive a payoff equal to $\Pi(w^{**}) - T^{**}$, where $\Pi(w^{**}) < \Pi(w^*)$ due to $w^{**} > w^*$. Therefore, all PSM agents are (in expectation) better off in a lean public sector equilibrium.

The fact that $T^{**} > T^*$ naturally reduces PSM agents' welfare in the bloated equilibrium relative to the lean equilibrium. In addition to paying higher taxes, lower PSM agents' welfare in a bloated equilibrium stems from two additional sources. First, a smaller fraction of PSM agents are able to obtain a bureaucratic job, which represents their most desired occupation. Second, those who become entrepreneurs make lower profits. The first source is simply the result of more competition for a fixed number of bureaucratic posts. The second is a negative externality generated by the PD bureaucrats who, by bloating their offices, push up the market wage, hurting entrepreneurial profits accordingly.

PD agents. In the lean equilibrium, all PD agents become entrepreneurs and receive a payoff equal to $\Pi(w^*) - T^*$. In the bloated equilibrium, a fraction b of them obtain a bureaucratic job, which yields utility $B - T^{**} < \Pi(w^*) - T^*$; the remainder fraction $(1 - b)$ receive a payoff equal to $\Pi(w^{**}) - T^{**}$. Therefore, all PD agents are better off in a lean equilibrium.

Notice that the only culprits of the PD agents' lower welfare are, in the end, the PD bureaucrats. In that regard, in situations with multiple equilibria as in Figure 2 (*iii*), if *all* PD agents could simultaneously coordinate to stay away from the public sector, they would all agree to do that, as it makes every one of them better off. (In addition, no PD agent will find any incentive to unilaterally deviate from the agreement, since $\Pi(w^*) > B$.)

Unskilled agents. In this case the welfare comparison is less straightforward than before. On the one hand, the excessive labour demand resulting from PD bureaucrats rent-seeking behaviour drives

[21] This is the case because of two (related) reasons. In the bloated equilibrium: (*i*) the number of unskilled workers in the public sector is larger, and (*ii*) their wages are higher.

up the wage, which is beneficial to the those whose only choice is to supply their labour endowment. On the other hand, like anybody else in the economy, they must pay higher taxes. Proposition 2 shows that there exist feasible parametric configurations for which, for any given $B \in \left(\underline{B}(\mu), \overline{B}\right)$, the former effect dominates the latter, hence: $w^{**} - T^{**} > w^{*} - T^{*}$. In particular, this tends to occur (more generally) when α is relatively small. The intuition for this lies in the link between α and the wage elasticity of (2): the lower the elasticity of labour demand by private entrepreneurs, the stronger the upwards pressure on wages caused by a bloating public sector (because a larger increase in the wage is needed to restore the equilibrium in the labour market).

Proposition 2 *Suppose Assumptions 1 and 2 hold and* $\underline{B}(\mu) < B < \overline{B}$*, implying that there exist two equilibria in the economy: one in which the wage equals* w^{*} *(the lean equilibrium), and one in which it equals* w^{**} *(the bloated equilibrium). Let* T *denote the amount of (lump-sum) taxes that each individual must pay in order to finance public sector expenditures.*

There exists a threshold function $\overline{\alpha}(\varepsilon) : \mathbb{R}_{+} \to (0,1)$*, such that, given* ε *and any* $b \in (0,1)$*, the condition* $w^{**} - T^{**} > w^{*} - T^{*}$ *holds for all* $\alpha < \overline{\alpha}(\varepsilon)$*. Furthermore, the function* $\overline{\alpha}(\varepsilon)$ *satisfies the following conditions: (i)* $\overline{\alpha}(0) > \frac{1}{2}$*, (ii)* $\overline{\alpha}(\underline{\varepsilon}) = \frac{1}{2}$ *where* $\underline{\varepsilon} > 0$*, (iii)* $\overline{\alpha}'(\varepsilon) < 0$*, and (iv)* $\lim_{\varepsilon \to \infty} \overline{\alpha}(\varepsilon) = 0$.[22]

Proof. *In Appendix.* ■

The fact that the unskilled receive higher wages when there are rent-seeking bureaucrats is actually a general result, as can be readily observed from Corollary 1. Their welfare comparison across the *different* cases described in Corollary 1 is, though, more complex than that between the two possible equilibria *within* the multiple equilibria presented in Proposition 2. The reason being that comparing different cases involves comparing welfare in situations where the bureaucrats salary B also differs, which in turn affects the total amount of taxes in the economy too. Nevertheless, the fact that larger B tend to give room to equilibria with rent-seeking bureaucrats and, consequently, higher wages means that the unskilled may in some cases be sympathetic to paying higher salaries to the bureaucrats, even if that means paying higher taxes. We now proceed to study this particular trade-off.

[22] The fact that a higher ε shrinks the set of values of α for which $w^{**} - T^{**} > w^{*} - T^{*}$ holds is not straightforwardly intuitive, since that encompasses two counteracting effects: on the one hand, it dilutes the cost of a bloated public sector in terms of taxation among more unskilled agents; on the other hand, it lowers the elasticity of the wage with respect to public sector demand. Given our specific production function in (1), it turns out that the dampening effect on the wage elasticity more than compensates the tax-dilution effect.

4 Political Economy General Equilibrium

In this section, we endogenise the salary of the bureaucrats within a framework where individuals vote for B before all market interactions described up to now take place.

Definition 2 (Political Economy General Equilibrium) *A political economy general equilibrium (PEGE) is characterised by: i) a market wage, w, ii) a bureaucrats salary, B, and iii) an occupational choice by each agent in the economy; such that:*

1. *The level of B is determined by majority voting before agents make their occupational choices.*
2. *The economy is in a market general equilibrium according to Definition 1.*

In order to make the above definition instrumental to our analysis, we need to be a bit more precise in terms of the voting process and how individuals make their voting choices. Regarding the former, our majority voting works as follows: each agent in the economy votes for a particular $B \in \mathbb{R}_+$, and the B that gathers the largest number of votes is offered to the bureaucrats. If the level of B that receives the largest number of votes does not attract enough applicants to cover all the bureaucratic jobs, the suffrage is repeated until a B that is able to do so is offered (note that otherwise we would be violating condition 3 in Definition 1). Voting is costless, both in terms of time and utility.

Concerning how agents choose which B to vote for, we follow Alesina and Rosenthal (1995), and assume that individuals are conditionally sincere, in the sense that no agent prefers a decrease in the expected vote for the B he has voted for. This implies that all individuals behave as if they were pivotal, and thus vote for the B that maximises their expected payoffs. Finally, individuals have rational expectations and, hence, they bear in mind that the level of B will influence the market general equilibria that may possibly arise. In particular, when choosing which B to vote for, individuals take into account the fact that different levels of B will be linked with: *i*) different (possible) equilibrium wages, and *ii*) different (possible) levels of taxation needed to finance total public expenditure.

Such voting scheme should, obviously, not be taken literally. Rather, we could think of it as a shortcut for a more general democratic process in which individuals vote for parties which are associated to different policies in terms of the organisation of the state (which includes, among other things, setting the remuneration of bureaucrats). In particular, we can interpret it as some sort of reduced form, resulting from agents facing a supply of political parties advertising different levels of (lump-sum) taxation, which in turn would set the budget constraint and determine the different remunerations to public servants and, subsequently, the type of equilibrium.

The unskilled agents represent the median voter. Hence, in a *PEGE*, the salary of bureaucrats will be equal to the level of B that maximises the *expected* utility of the unskilled, and is consistent with a

general equilibrium. Concerning the latter, the lowest B that may possibly hold in a *PEGE* is given by $\min\{\widehat{B}, \underline{B}(\mu)\}$, where recall that $\widehat{B} < \underline{B}(\mu)$ if and and only if $[\lambda(1+\gamma) - c] > \Gamma(1-\alpha)A$ holds.

From Corollary 1, we can observe that the wages w^* and w^{**}, which would prevail in the different equilibrium cases, are both independent of the specific level of B (although, of course, the value of B does affect whether w^* or w^{**} are indeed equilibrium wages). Notice, too, that when $[\lambda(1+\gamma) - c] > \Gamma(1-\alpha)A$ any $\widehat{B} \leq B < \underline{B}(\mu)$ will lead with probability one to an equilibrium wage w^*. As a result, since agents internalise the fact that a larger B means paying higher taxes, it follows that no unskilled agent will ever vote for a $B \in \left(\widehat{B}, \underline{B}(\mu)\right)$: intuitively, the same equilibrium wage, w^*, can be achieved at a "cheaper price" by voting for $B = \widehat{B}$. With a similar reasoning, we can also find an upper bound for the B that the unskilled would vote for: no unskilled agent will ever vote for a $B > \overline{B}$, since setting $B = \overline{B}$ guarantees the same equilibrium wage, w^{**}, at lower cost in terms of taxation.

Lemma 3

(i) If $[\lambda(1+\gamma) - c] > \Gamma(1-\alpha)A$*, voting for a* $B \in \left(\widehat{B}, \underline{B}(\mu)\right)$*, where* $\underline{B}(\mu)$ *was specified in* (15)*, is a strictly dominated strategy for the unskilled.*

(ii) Voting for a $B > \overline{B}$*, where* $\overline{B}$ *was specified in* (14)*, is a strictly dominated strategy for the unskilled.*

Proof. *In Appendix.* ■

Lemma 3 implies that we can restrict the set of B which the unskilled agents would possibly vote for quite drastically. In particular, if the unskilled would like to steer the economy towards an equilibrium where w^* (w^{**}) holds as a *unique* equilibrium, they will vote for $\widehat{B}$ ($\overline{B}$). Whether the unskilled prefer voting for $\widehat{B}$ or for $\overline{B}$ depends on how the trade off between 'higher wages vs. higher taxes' resolves. In particular, when a unique lean equilibrium exists –which requires $[\lambda(1+\gamma) - c] > \Gamma(1-\alpha)A$–, the unskilled still strictly prefer choosing $\overline{B}$ over $\widehat{B}$ when the following condition holds:

$$w^{**}\left[1 - \frac{b(1-\mu)/2}{2+\varepsilon}\right] - w^* > \frac{b}{2+\varepsilon}\left(\overline{B} - \widehat{B}\right); \tag{20}$$

where notice from (14) that $\overline{B} - \widehat{B} = \lambda(1+\gamma) - c$, and w^* are w^{**} are given by (17) and (18), respectively. The following proposition stipulates conditions under which, even if a unique lean equilibrium exists in the economy, the unskilled may turn out to be better off in a unique bloated equilibrium with $B = \overline{B}$.

Proposition 3 *Suppose Assumptions 1 and 2 hold. If* $b < \frac{1}{2}$ *and* $\alpha < \widehat{\alpha}(\varepsilon)$*, where* $0 < \widehat{\alpha}(\varepsilon) < \overline{\alpha}(\varepsilon)$*; then, there exist feasible parametric configurations, such that: (i) there exists a unique lean equilibrium where* $B = \widehat{B}$*, and (ii) the utility obtained by the unskilled workers in that equilibrium is smaller than that they obtain in the unique bloated equilibrium that arises when* $B = \overline{B}$*.*

Proof. *In Appendix.* ■

The unskilled may prefer a bloated public sector paying high bureaucratic salaries to a lean public sector with lower B when b is not too large and α is sufficiently small. Regarding b, notice that the cost per taxpayer of all bureaucratic salaries equals $bB/(2+\varepsilon)$, hence a sufficiently large b turns the cost of inducing PD agents to apply to bureaucracy too high for the unskilled to be willing to bear it. Concerning α, the intuition is analogous to that in Proposition 2; the lower α, the stronger upwards pressure on unskilled wages by a bloating public sector. Notice that $\widehat{\alpha}(\varepsilon)$ is strictly smaller than $\overline{\alpha}(\varepsilon)$, since a higher payoff to the unskilled in a bloated equilibrium when multiple equilibria are feasible is necessary for that to happen as well when choosing between $\widehat{B}$ or $\overline{B}$.

Proposition 3 would complete our analysis if agents were constrained to vote for bureaucratic salaries that lead to market general equilibria which are unique for a given B – that is, cases (i) and (ii) in Corollary 1. However, we are not setting such a constraint anywhere in our model, and the unskilled agents may well hold expectations under which they would optimally choose to vote for some $B \in \left[\underline{B}(\mu), \overline{B}\right)$. It goes beyond the scope of this paper to study the full set of equilibria that may arise under different plausible expectations concerning PD agents actions. Yet, it should be quite straightforward to observe that: if, for some $\underline{B}(\mu) \leq B < \overline{B}$, the probability assigned by the unskilled that PD agents will coordinate their actions on a bloated equilibrium is sufficiently high, then the unskilled may find it optimal to vote for an "intermediate" B, gambling on the chance that the bloated equilibrium will ex-post materialise at such B.

In summary, this section shows that equilibria featuring a bloated public sector may arise endogenously from a rather standard median-voter approach. The reason is that the unskilled workers may be willing to support rent-seeking bureaucrats, since the former indirectly benefit from the actions perpetrated by the latter in the form of inflated market wages. Oversized and inefficiently run public sectors have been commonplace in the past populist governments in Latin America. In that regard, our model may then shed light on the underlying reasons that have made them so successful. These governments had strongly relied on widespread support coming from the working class population as a whole. Moreover, this was the case despite being generally perceived as running largely ineffective public sectors, as summarised by the following fragment taken from Geddes (1994, p. 26):

> Survey evidence [for Argentina and Brazil] indicates the existence of a widespread latent interest in administrative reform. Most people believed they would benefit from reforms that improved the quality of state intervention in the economy and the quality of government services to the public. Nevertheless, during democratic periods, when widespread political participation should have made it possible to make effective demands for an end to corruption, governments in Latin America rarely passed reform laws. Quite the contrary, the preferences that actually found expression in law strongly opposed administrative reform.

5 Empirical Analysis

So far we have presented a model that allows us to jointly determine the size and skill composition of the public sector, the scope for private sector development and the resulting labour market outcomes, within a general equilibrium model that allows for endogenous bureaucratic remuneration.

The model being a general equilibrium one, together with the fact that multiple equilibria are feasible for some parametric configurations, poses a significant challenge in terms of providing meaningful evidence towards the presence of the mechanisms proposed in this paper. For this reason, we follow a reduced-form approach and confront separately a number of results derived from the model. Some of the most evident predictions of the model, such as the correlation between overall size of public sector employment and the level of development, could be argued to be driven by other mechanisms than that proposed by our model (for example, if the public sector acts as an employer where private activity is absent due to lack of entrepreneurial skills). However, in what follows we also make an effort to tackle some other subtler questions involving the skill composition of the public sector, its quality and the resulting effect on incomes at different educational levels, which are more specific to our specific setup. In particular, we concentrate on the following three implications of the model:

1. Quality and Composition of the Public Sector: the model predicts that when the public sector becomes an attractive option for rent-seeking agents its composition would tilt towards a greater share of unskilled workers. As a result, regions with better working public sectors should also exhibit a larger fraction of skilled public employees.

2. Public Sector and Development: the model implies that, by expanding the demand of unskilled workers, a bloated public sector may end up reducing private sector profitability. It follows that:

   (a) Regions that have a larger public sector employment tend to be poorer.

   (b) Private sector is stifled in areas with large and relatively unskilled public employment.

3. Skill Premium: from the previous result, areas with an oversized and unskilled public sector would pay relatively higher wages to blue collar workers. In that case, it follows that the skill premium should be lower than if the public sector was not bloated.

Prediction 1 is tested by exploiting cross country variation using internationally comparable measures of public sector performance and skills composition in the public sector. We provide evidence for Prediction 2a and 2b using data from Argentinian provinces where we test the relationship between level and composition of public employment and private sector activity. For Prediction 3, we also use

the Argentinian provinces data, combined with data on incomes from a household survey representative at the city level. We use these data to test whether the skill premium is indeed larger in capital cities of provinces that show features associated with a lean equilibrium, as described by the model.

5.1 Quality and composition of the public sector across countries

One of the main predictions of our model concerns how the skill composition and performance of the public sector vary depending on which type of equilibrium the economy is in. More precisely, if we take two economies with the same level of development, stock of skills and "natural" size of the public sector (i.e. the level of b in the model), the one with a public sector that is relatively more attractive to rent-seeking agents should exhibit a public administration that performs worse, and which grows by hiring a greater proportion of unskilled workers. To assess this, we run a series of regressions linking a measure of public sector performance to its proportion of unskilled workers, using a 5-year average cross-section of countries, for the period 2002-2006, and sequentially adding controls that account for the level of income, the overall size of the public sector and the stock of skills in the economy. Additionally, we include a set of dummy variables by continent for developing regions and a category for industrialised countries.

As a measure of public sector performance, we use Transparency International's Corruption Perception Index (CPI) and World Bank's Control of Corruption, Government Effectiveness and Regulatory Quality indices. The value of these indices rises the better the perception of government performance. GDP per capita is obtained from World Bank Development Indicators. We use labour statistics collected by the International Labor Organisation (ILO). The proportion of unskilled labour in the public sector is defined according to ISCO-88 classification and includes clerks, service workers, machine operators, etc. (codes 4 to 9). Skilled correspond to codes 1 to 3 and includes managers, professionals and technicians. Public sector comprises public administration and defence.

Table 2 shows the results. In column (1) we present the unconditional correlation between the CPI and the proportion of unskilled workers in the public sector. The correlation is negative and significant, suggesting that countries where the public sector is perceived as performing worse have also a more unskilled public sector. Some of this variation could result from common characteristics within continents. For example, if governments in Latin America are systematically perceived as more corrupt than those in Asia, or if Eastern European countries have systematically bigger public sectors than other regions. To address this, in column (2) we include regional dummies that control for average regional differences (i.e. we compare countries in the same region). The negative correlation between CPI and the share of unskilled workers in the public sector still holds.

In the following three columns we include progressively the above-mentioned country controls that

might be suspected to be driving our results. We start, in column (3), by controlling for the overall size of the public sector (which is related to our parameter b in the model) and regional fixed effects. For example, it may be that the previous correlation is driven by the fact that some countries prefer larger public sectors and that the perception of performance and the share of unskilled is simply reflecting an issue of scale: beyond a certain point, large governments might only be able to further increase their services provision by hiring unskilled workers and, simultaneously, be more subject to managerial difficulties that reduce the performance score. Column (3) shows that the coefficient on size of the public sector is positive and significant, i.e. that the public sector grows by hiring proportionally more unskilled workers. However, the correlation of interest remains significant and negative, suggesting that even when maintaining fixed the overall size of the public sector, its performance and proportion of unskilled remain negatively correlated, as predicted by the model.

In column (4) we also control for the proportion of skilled workers in the economy. The concern here would be that the availability of skills drives both public sector performance and the proportion of unskilled in the public sector. Unsurprisingly, the negative sign on the measure of skills suggests that the public sector tends to be more skilled when a larger stock of skills is available. However, it does not account fully for the negative correlation between performance and skill composition of the public sector. Similarly, this holds too when controlling for a GDP per capita, in column (5).

To account for the possibility of reverse causality, e.g. that a more unskilled public sector is more prone to corruption, in column (6) we instrument the Corruption Perception Index using measures of ethnic and religious fragmentation. The idea, as suggested by Alesina et al. (2003), is that the exogenous heterogeneity in the composition of a society might directly affect the quality of institutions. For the purposes of this exercise, the presumption is that, once we control for features of the country such as stock of skills and income per capita, fragmentation will affect the hiring process of unskilled workers in the public sector through its (negative) effect on the quality of institutions only. We find that fragmentation is indeed a good predictor of CPI and that its correlation with a more unskilled public sector remains robust. Finally, in columns (7) and (8) we use different measures of government performance (from the World Bank). Our results still hold when using these alternative measures of government performance.

To summarise, an important feature of our model is that bloated public sectors are not strictly defined by the size of the public sector in itself, but actually by *how* it grows. In particular, the model predicts that ill-performing public sectors end up bloated with unskilled workers, displaying thus a different composition in terms of skills compared to that of well-run public sectors. In line with the model, this section has shown that government performance is negatively correlated with the average skills in the public sector, even when controlling for country characteristics and regional dummies that could have been driving this correlation.

5.2 Public sector employment and development: regional analysis

Predictions 2a and 2b suggest a negative link between the share of public employment (and its composition) and measures of economic development, such as income per head or indicators of private sector activity. Unlike in the previous subsection, tracing this correlation using cross-country data does not seem a very promising approach, as the overall size of the public sector is itself a variable that differs substantially across countries. In terms of our model, this is captured by the b, which may be thought of as a country-specific parameter. For that reason we focus our attention in Argentina, a country with significant variation across provinces in terms of public sector size and income levels. We use data for four years over almost a decade (1995, 1998, 2000 and 2003) and look at two different measures of economic and private sector development, i.e. the log of product per capita and the log of foreign direct investment per capita (FDI). We also have data on public employment and its skill composition and on controls, that include government expenditure, secondary school enrolment, roads, and population.

Table 3 presents the results. Columns (1) to (5) look at the correlation between public sector employment and the indicators of development or private sector activity. In column (1) we find that provinces with larger public sector employment tend to be poorer, even though the correlation is not significantly different from 0. This could be explained by the presence of other mechanisms at play, that have different direction to the one we propose in our model and that average out the effects sought in the regression. For example, provinces with more natural resources tend to be richer and have bigger governments, as it happens in some southern provinces[23]. To control for this, we include the log of government expenditure per capita in column (2) and we find, as expected, that government expenditure per capita increases with income per capita. More importantly, the coefficient of public sector employment is still negative, becomes significant and greater in absolute magnitude. This result is in line with the model: if we compare two provinces with the same level of government expenditure, the province where the public sector employs relatively more workers tends to be poorer, since it is using more of their workers to create and extract rents.

Recall that an important feature of our model is the fact that public sector employment crowds out the private sector via the wage-effect. As an alternative measure of private sector development (and, possibly, more indicative of it), in column (4) we use a measure of FDI in the province and find the same negative correlation with the share of public employment.

In columns (3) and (5) we control for variables that might capture other features of the model. For example, population (that accounts for labour supply), secondary enrolment (controls for the stock of skills in the province) and roads (as a proxy for capital/productivity at the province level, measured

[23] For example, oil and natural gas rich Tierra del Fuego and Santa Cruz.

by A in the model). In both cases, we find a negative and significant correlation between the measure of economic activity and public sector employment.

Finally, in the next five columns, we replicate the same regressions, this time using the ratio of skilled to unskilled in the public sector. The model predicts a positive coefficient of the skills composition on the measures of economic activity at the province level. The results show the same pattern as in the regressions using public sector employment, suggesting that private activity and output are greater in provinces where the public sector looks lean and relatively more skilled.

5.3 Public employment and skill premium in Argentinean urban households

To test Prediction 3 in the model, we proceed in two steps. We first characterise different labour markets according to the predictions of the model, aiming to identify situations that resemble those featured in a *lean* or in a *bloated* public sector equilibrium. Then, we compare the skill premium across the different types of labour market outcomes. To do this, we use a representative household level dataset from urban areas in capital cities of provinces in Argentina for the year 1998. We only use information on regional capital cities, where the executive, legislative and judiciary branches of the province governments are located.

In the model, a lean equilibrium is associated with a low share of public employment. Additionally, in such equilibrium, the public sector tends to display a higher ratio of skilled to unskilled employees. To characterise different provinces' labour markets, we first identify a labour market that seems to satisfy those two key features of a lean equilibrium. This sets a benchmark for what would be "reasonable" public sector employment in the Argentine context. A good candidate seems to be the city of Córdoba, the second largest city after Buenos Aires and the capital city of the province of Córdoba. As shown in Table 4, among head of households that are employed, around 6.8% work in Córdoba's public sector. When broken down by skills, only 5.5% of heads of households with complete secondary school and 9.9% with further education are employed by the public sector in Córdoba. The average ratios for all other capital cities are 17.6%, 16.4% and 22%, respectively. The differences are statistically significant at 1% level. When looking at the average skills by sector, in Table 5, the public sector in Córdoba employs more than 42% of skilled workers. This contrasts sharply with the other capital cities' average of 27% skilled workers. The difference is significant even when taking away the difference between Córdoba's private sector and the rest of capital cities', in a difference in differences analysis that takes away province characteristics that affect private and public sector employment equally within a city, such as the pool of skilled workers available, and characteristics that affect differences in sectorial employment across all cities.

We set Córdoba as a benchmark and characterize the remaining capital cities using household level

data. In particular, we run a regression of the form

$$P_{hc} = \sum_c \beta_c D_c + \boldsymbol{\delta} \mathbf{X}_{hc} + \varepsilon_{hc}$$

where P_{hc} is a dummy equal to 1 if the head of household h in city c works in the public sector. D_c are a set of city dummies and their coefficients inform us about the probability that an individual living in that city works in the public sector, once we have controlled for economic and demographic characteristics $\mathbf{X}_{hc}$. These include age, age squared, educational attainment, number of income earners in the household, gender and dwelling characteristics. Since we set Córdoba as a benchmark (i.e. it is the omitted dummy), the estimates of β_c will give the percentage difference of a given city relative to Córdoba. All regressions use weights and cluster standard errors at the city level.

Table 6 summarises our results[24]. Only 4 other cities lie within 5 percentage points of Córdoba, in terms of public sector employment. These are San Luis, Tucumán, Salta and Mendoza. An individual in the other 16 cities in the survey is at least 7.5 percentage points more likely to work in the public sector than a resident of Cordoba is. That would imply that more than 15% of the head of households work for the government. In some cases, such as Rio Gallegos and Formosa, the difference with Córdoba is larger than 20 percentage points, implying that at least 1 in 5 heads of household work in the public sector. When divided by skills, the regressions show that cities where public employment is very high, the probability of working in the public sector is equally high for both skilled and unskilled. Similarly, cities with low public employment, show it for both levels of skills. Among the cities ranked in the middle, some of them show a high probability among skilled workers while not so high among unskilled, a symptom of a lean equilibrium, even though the level of public employment is high.

Finally, we also look at the composition of skills in the public sector, as the last feature to characterise the type of equilibrium across cities. The probability of being skilled in Córdoba among public sector workers differs little from low or medium public sector cities[25]. However, the high public employment cities show a substantially lower ratio of skilled to unskilled than Córdoba, most notably Santa Rosa (-14 percentage points lower ratio of skilled than Córdoba), La Rioja (-15 pp), Formosa (-17 pp), Neuquén (-24 pp), Río Gallegos (-31 pp) and Tierra del Fuego (-35 pp).

These results combined together lead us to identify a group that seems to feature characteristics of a *lean equilibrium* (Córdoba, Mendoza, Salta, Tucumán and San Luis), and a group that seems to be in a *bloated equilibrium* (Río Gallegos, Formosa, Tierra del Fuego, Santa Rosa, La Rioja and Neuquén)[26].

[24] Full results are available from the authors upon request.

[25] In one case, Santiago del Estero, the ratio of skill is 10 percentage points lower than in Córdoba. For all other low and medium public employment cities, the difference with Córdoba goes from -7 percentage points to +3.

[26] Cities not included in either of these two groups are: Catamarca, Corrientes, La Plata, Paraná, Posadas, Resistencia, San Juan, San Salvador de Jujuy, Santa Fé and Santiago del Estero.

Now, as a second step, we study income patterns across sectors and skills. In a bloated public sector equilibrium, the wage of the unskilled would be larger than it would be in an equilibrium without rent-seeking bureaucrats. To test this, we run the following regression of the log income of the head of household working in industry i in city c on $Educ$ (a dummy equal to 1 if the individual has at least started some tertiary studies) and its interaction with two dummies ($GroupL$ and $GroupB$), grouping cities in the *lean* or the *bloated* equilibrium, respectively. The omitted category includes all the cities for which the preliminary analysis did not provide any clear indication of the type of equilibrium where the city was. We include city and industry fixed effects, to control for characteristics that might set average incomes at different levels (e.g. productivity, amenities, etc.).

$$\begin{aligned} Logincome_{hci} &= \alpha_i + \beta_c + \boldsymbol{\delta}\mathbf{X}_{hci} + \lambda_M Educ_{hci} + \\ &\quad \lambda_L Educ_{hci} * GroupL_c + \lambda_B Educ_{hci} * GroupB_c + \varepsilon_{hc} \end{aligned}$$

The coefficients of interest are the λ's. λ_M provides information on the average income gap for people with at least some tertiary education in the unclassified cities with respect to people that have at most completed secondary school. λ_L and λ_B scale that gap up or down for people in cities classified as lean and bloated equilibrium, respectively.

Column (1) in Table 7 uses information on all sectors and shows a positive baseline gap between our definition of skilled and unskilled, controlling for other characteristics such as age and age squared, time in employment, gender and place of birth. The coefficient for the interaction with cities in the bloated equilibrium is not significantly different from zero, meaning that the average income gap across skills is similar to the one in the middle group of cities. However, the income gap in cities classified as being in a lean equilibrium is significantly greater, which is consistent with the predictions of our model, whereas the enlargement of the public sector is associated with a relative compression of the skill premium. Since the model predicts this result to show in the private sector, we run the regression for all workers, excluding those in Public Administration and Defence. Column (2) shows similar results to those obtained in column (1): for the private sector, the skill income gap is greater in labour markets that show the characteristics associated with a lean equilibrium.

We finally also try using a continuous measure of public employment at the city level. We run two specifications, one using the fraction of public employment and the other one using *only* the proportion of unskilled head of household working in the public sector. In column (3) we interact household head's education with the proportion of heads of household employed by the public sector at the city level, and we find that the skill premium decreases with the size of public employment. Column (4) shows that this phenomenon is also present for the private sector. Lastly, a variable that may capture better the degree public sector oversize, is the proportion of unskilled workers in the public sector. In that regard, Columns (5) and (6) show, again, that the skill premium is compressed

in labour markets where unskilled workers are more likely to work in the public sector[27].

In brief, this section has shown that the skill premium is squeezed in capital cities where the public sector hires extensively, especially among the unskilled. Most notably, and consistent with the idea of a unique unskilled labour market, this result is found also when looking only at wages paid by the private sector.

6 Discussion and Concluding Remarks

We have proposed a model in which the quality of the state bureaucracy crucially affects the level of aggregate output and private entrepreneurship. The key mechanism at work rests on the idea that rent-seeking behaviours lead to an oversized public sector, bloated with unskilled workers. When the public sector expands its demand of unskilled workers in order to create and extract rents, not only it wastes scarce budgetary resources, but it also stifles entrepreneurial incentives. In particular, an oversized public sector pushes up the wage of unskilled workers above the level that would prevail under an efficiently-run public sector, which squeezes profits and deters potential entrepreneurs from allocating their skills in the private sector.

An alternative argument to ours is that poorer regions exhibit higher public employment shares as the result of income transfers from richer regions, or simply because there is too little private activity in the first place and the public sector steps in as an employer of last resort. We do not intend to downplay any of these two arguments, which are certainly very relevant from an empirical viewpoint. In fact, we see our theory as complementary (rather than a competing one), shedding new insights concerning the interaction between the public and entrepreneurial sectors. In that regard, some of the correlations presented in Section 5 would not straightforwardly follow from a simple model of cross-regional transfers. More precisely, it is not straightforward that the level of perceived corruption should correlate positively with the fraction of unskilled workers in the public sector, as revealed by Table 2; especially after controlling for level of income and stock of skills in the economy. In addition to that, if high public employment is mainly explained by the fact that there is no private sector to absorb an excess supply of unskilled labour, then it is not obvious this should compress the skill premium in regions with bloated public sectors, as suggested by Table 7.

Similarly, we have worked with a frictionless labor market that assumes away unemployment. Generally, (short-term) unemployment should be the result of some sort of frictions or stickiness in the labour market preventing an immediate adjustment of the wage to restore the market-clearing

[27] Results found in this section are not sensitive to constraining the definition of public sector to Public Administration and Defence. We obtain qualitatively similar effects when using a broader definition of public sector that includes other industries such as health and education.

equilibrium. Note, however, that the effect of a public sector absorbing the (temporary) excess supply of labour may still bring about some similar implications as those in our benchmark model, by preventing the eventual downward adjustment of wages.

Our model also shows that an inefficient public sector may arise endogenously from a standard political process, because the unskilled workers may indirectly benefit from bureaucratic rent seeking in the form of higher wages. In that regard, our model may shed light on one of the underlying reasons that have made several populist governments so successful in the past, despite being widely perceived as running inefficiently large and ineffective public sectors (see Geddes, 1994).

This political economy argument is closely linked to the choice of taxes and transfers in the economy. In our model individuals are taxed on a lump-sum basis. This assumption involves an issue that deserves some further discussion: the fact that a Pareto-dominating institutional arrangement may exist relative to the bloated public sector equilibrium. In particular, one could set bureaucratic salaries low enough so that only PSM agents become bureaucrats and, at the same time, make transfers to the unskilled workers such that their total income would be equal to that in the bloated equilibrium. Although, in principle, this would be feasible with a central planner, such institutional scheme would require a whole amount of additional "trust" in political bodies, beyond that we have assumed so far. More precisely, our previous results arise as a subgame perfect equilibrium, where the unskilled population anticipate the optimal behaviour of rent-seeking bureaucrats. Instead, with such a lump-sum/transfer scheme, the unskilled population would have to expect the ruling class to stick to their before-election promises.[28]

Note, too, that the way we model taxation simplifies the exposition, but also (and more importantly) allows us to isolate the wage-distortion effect from other types of distortions working through taxation. Introducing more realistic taxes into the model (e.g, income taxes) would in general mean that a bloating public sector would place an additional distortion, on top of that of inflated wages, on entrepreneurial incentives. In that respect, our previous results would be somehow reinforced in the presence of taxes that are increasing in earnings. Nonetheless, our results may be still interpreted as somewhat more general than that. The public sector may well be financing itself, at least temporarily, by sources other than current taxation: for example, they may use borrowing. In that case, entrepreneurs should not see their (current) profits being affected by a bloating a public sector through excessive taxation; however, they would still have to face higher market wages as the public sector absorbs labour supply[29].

[28] Of course, such positive expectations could be aided by repeated games considerations, in the presence of periodical (re)elections. In any case, this would still require stronger coordination of expectations than simply delegating the managing of the public sector upon agents who bloat it in their own personal interest.

[29] Notice that even if entrepreneurs were not myopic, and take into account the future rise in taxation to pay for

One important lesson is that the economy has got a lot to gain from improving the sorting mechanisms into different occupations, in particular when it relates to state bureaucracy. Contrary to a standard view in the public debate, improving sorting may sometimes require paying bureaucrats less (and not more), so as to resort to the sense of mission of certain agents while keeping self-interested agents away[30]. In any case, by promoting policies attracting the right people or reducing the scope for opportunistic behaviour, the economy can avoid falling into a rent-seeking trap.

Appendix

Proof of Lemma 1.

(i) Suppose a fraction $f \in [0,1]$ announces $\widetilde{\theta}_i = 1$. Then, the probability that a bureaucrat who set $\widetilde{\theta}_i = 1$ is chosen to produce $2+\gamma$ equals $P(f) = \max\left\{1, (2f)^{-1}\right\}$. Hence, noting that if bureaucrat i announced $\widetilde{\theta}_i = 1$ and is selected to produce $2+\gamma$ he must exert $e_i = 1$, the expected utility of PD bureaucrat who set $\widetilde{\theta} = 1$ equals: $P(f)(B-1) + (1-P(f))B$. On the other hand, the expected utility of a PD bureaucrat who set $\widetilde{\theta} = 0$ equals B, which is larger than $B - P(f)$ for any $f \in [0,1]$.

(ii) Firstly, notice that no PSM bureaucrat whose $\theta_i = 0$ will announce $\widetilde{\theta}_i = 1$, as this will lead to $g_i = \gamma$ with probability 1 while it will put the bureaucrat at risk of being subjected to the punishment $\phi > 0$ (this is then strictly dominated by setting $\widetilde{\theta}_i = 0$ when $\theta_i = 0$). Secondly, suppose a fraction $f \in [0,1]$ announces $\widetilde{\theta}_i = 1$. Then, the probability that a bureaucrat who set $\widetilde{\theta}_i = 0$ is chosen to produce $2+\gamma$ equals $Q(f) = \max\left\{0, \frac{1-2f}{2(1-f)}\right\}$. Notice that $Q(f)$ reaches a maximum at $Q(0) = \frac{1}{2}$. Therefore, if i announces $\widetilde{\theta}_i = 0$, so as to allow himself to set $e_i = 0$, the maximum level of expected utility he may possibly obtain is: $\frac{1}{2}[B + \lambda(2+\gamma)] + \frac{1}{2}(B + \lambda\gamma) = B + \lambda(1+\gamma)$. On the other hand, since no bureaucrat with $\theta_i = 0$ will ever announce $\widetilde{\theta}_i = 1$, if i sets $\widetilde{\theta}_i = 1$ he will be chosen with probability one to produce $g_i = 2+\gamma$, hence the utility he will get is by this is: $[B + \lambda(2+\gamma) - 2c]$, which is strictly larger than $B + \lambda(1+\gamma)$ provided Assumption 2 holds. ■

Proof of Lemma 2.

Notice first that both $\partial\Gamma/\partial\varepsilon < 0$ and $\partial\Gamma/\partial\mu < 0$. Hence, $\Gamma(\varepsilon, b, \mu, \alpha)$ reaches a maximum at $\varepsilon = 0$ and $\mu = b$. Replacing these values into the defined function $\Gamma(\varepsilon, b, \mu, \alpha)$, we obtain:

$$\Gamma(0, b, b, \alpha) = \frac{1 - \left(1 - \frac{b}{2} + \frac{b^2}{2}\right)^{\alpha}}{(1-b)^{\alpha}}. \tag{21}$$

current public debt (Ricardian Equivalence), this would not be enough by itself to affect their current occupational choices – we need, in addition to that, a switching cost for occupations over the life cycle (or an important sunk cost for entrepreneurial activities), so that their current occupational choice is affected by future taxation as well.

[30] An example of this controversy is the debate about MPs pay in British Parliament after the expenses scandal [see The Economist (2009)]. Some argue that MPs should be paid more to avoid rent-seeking behaviour. Our paper suggests that this would hinge on the type of people attracted to such positions after a wage hike.

Notice now that, since $0 < b < 1$, the RHS of (21) is strictly increasing in α. Moreover, it is straightforward to observe that the RHS of (21) approaches zero as $\alpha \to 0$. Given that (21) is strictly increasing in α, it then suffices to focus on highest value allowed for α; that is $\alpha = \frac{1}{2}$. Plugging this value into (21), it follows that we need to prove that:

$$1 < (1-b)^{\frac{1}{2}} + \left(1 - \tfrac{b}{2} + \tfrac{b^2}{2}\right)^{\frac{1}{2}}, \quad \forall\, b \in (0,1) \tag{22}$$

Thus, denoting $\chi(b) \equiv (1-b)^{\frac{1}{2}} + \left(1 - \frac{b}{2} + \frac{b^2}{2}\right)^{\frac{1}{2}}$, and noting that $\chi'(b) < 0$ for all $b \in [0,1]$, it follows that a sufficient condition for (22) to hold is that $1 \leq (1-b)^{\frac{1}{2}} + \left(1 - \frac{b}{2} + \frac{b^2}{2}\right)^{\frac{1}{2}}$ holds at $b = 0$. ■

Proof of Proposition 2.

Using the results in Corollary 1, it follows that $w^{**} - T^{**} > w^* - T^*$ if and only if:

$$w^{**} - \frac{b\left[\frac{1}{2}(1-\mu)\, w^{**} + B\right]}{2+\varepsilon} > w^* - \frac{bB}{2+\varepsilon}. \tag{23}$$

Plugging (17) and (18) into (23) leads to, $w^{**} - T^{**} > w^* - T^*$, if and only if:

$$\frac{2+\varepsilon - \frac{b}{2}(1-\mu)}{(2+\varepsilon)} > \left[\frac{1+\varepsilon - \frac{b}{2}(1-\mu)}{1+\varepsilon}\right]^{1-\alpha} \equiv \Phi(\alpha). \tag{24}$$

Notice that $\Phi'(\alpha) > 0$, since the expression within squared brackets is strictly smaller than 1. This, in turn, implies that if (24) holds for some $\overline{\alpha}$, then it must necessarily hold for any $\alpha < \overline{\alpha}$ as well. Furthermore, notice that $\lim_{\varepsilon \to \infty} \Phi'(\alpha) = 0$, as the expression within squared brackets converges to 1.

Let us first look at one extreme case, when $\alpha \to 0$; in this case (24) becomes:

$$\frac{2+\varepsilon - \frac{b}{2}(1-\mu)}{(2+\varepsilon)} > \frac{1+\varepsilon - \frac{b}{2}(1-\mu)}{1+\varepsilon}, \tag{25}$$

which will actually hold for any $\varepsilon > 0$ and $b \in (0,1)$. Moreover, in the limit $\varepsilon \to \infty$, the RHS of (25) converges (from below) to the LHS (25), while they both converge to 1.

Let us now look at the other extreme case, when $\alpha = \frac{1}{2}$. Plugging this value into (24), after some algebra, we may obtain the following condition:

$$w^{**} - T^{**} > w^* - T^* \quad \Leftrightarrow \quad \Psi(\varepsilon) \equiv (2+\varepsilon)\left(\frac{2+\varepsilon}{1+\varepsilon} - 2\right) > -\frac{b(1-\mu)}{2}. \tag{26}$$

Condition (26) will hold for all $\varepsilon \in (0, \underline{\varepsilon})$, where $\underline{\varepsilon} > 0$ and finite. This is because: (i) $\lim_{\varepsilon \to 0} \Psi(\varepsilon) = 0 > -b(1-\mu)/2$, and (ii) $\Psi(\varepsilon)$ is strictly decreasing in ε for $\varepsilon > 0$ and $\lim_{\varepsilon \to \infty} \Psi(\varepsilon) = -\infty < -b(1-\mu)/2$. Hence, the LHS and RHS of (26) must cross each other once, and only once, at some $\varepsilon = \underline{\varepsilon} > 0$, below (above) which (26) holds (does not hold).

Given the above two results, and the fact that $\Phi'(\alpha) > 0$ while $\lim_{\varepsilon \to \infty} \Phi(\alpha) = 1 = \lim_{\varepsilon \to \infty} [LHS(24)]$, implies that, by continuity of $\Phi(\alpha)$, there must exist a function $\overline{\varepsilon}(\alpha) : (0,1) \to \mathbb{R}$, where $\overline{\varepsilon}(0.5) = \underline{\varepsilon} > 0$,

$\overline{\varepsilon}'(\alpha) < 0$ and $\lim_{\varepsilon \to 0} \overline{\varepsilon}(\alpha) = \infty$, such that: for any $0 < \alpha \leq \frac{1}{2}$, when $\varepsilon = \overline{\varepsilon}(\alpha)$, the LHS and RHS of (24) are equal to each other. Lastly, we may then denote by $\overline{\alpha}(\varepsilon) : \mathbb{R} \to (0,1)$ the inverse function of $\overline{\varepsilon}(\alpha)$, which thus satisfies: $\overline{\alpha}(0) > \frac{1}{2}$, $\overline{\alpha}(\underline{\varepsilon}) = \frac{1}{2}$, $\overline{\alpha}'(\varepsilon) < 0$, and $\lim_{\varepsilon \to \infty} \overline{\alpha}(\varepsilon) = 0$. In addition, because $\Phi'(\alpha) > 0$, then (24) will necessarily hold for all $\alpha < \overline{\alpha}(\varepsilon)$. ■

Proof of Lemma 3.

(*i*) When $[\lambda(1+\gamma) - c] > \Gamma(1-\alpha)A$, any $B \in \left[\widehat{B}, \underline{B}(\mu)\right)$, leads to a unique market general equilibrium with wage w^*. For $\widehat{B} \leq B < \underline{B}(\mu)$, taxes equal $bB/(2+\varepsilon)$, which are strictly increasing in B. Hence, for the unskilled, voting for any $B \in \left(\widehat{B}, \underline{B}(\mu)\right)$ is strictly dominated by voting for $B = \widehat{B}$.

(*ii*) Any $B \geq \overline{B}$, leads to a unique market general equilibrium where the wage equals w^{**}. For $B \geq \overline{B}$, individual taxes equal $b\left[w^{**}\frac{1-\mu}{2} + B\right]/(2+\varepsilon)$, which are strictly increasing in B. Hence, for the unskilled, voting for any $B > \overline{B}$ is strictly dominated by voting for $B = \overline{B}$. ■

Proof of Proposition 3.

Firstly, the fact that if $\alpha \geq \overline{\alpha}(\varepsilon)$, the unskilled prefer a lean equilibrium with $B = \widehat{B}$ over a bloated one with $B = \overline{B}$, follows immediately from the proof of Proposition 2, since $w^{**} - b\left[\frac{1}{2}(1-\mu)w^{**} + B\right]/(2+\varepsilon) \leq w^* - bB/(2+\varepsilon)$ implies $w^{**} - b\left[\frac{1}{2}(1-\mu)w^{**} + \overline{B}\right]/(2+\varepsilon) < w^* - b\widehat{B}/(2+\varepsilon)$.

Secondly, using (20) we can observe that, when a unique lean equilibrium exists, the unskilled prefer voting for $\overline{B}$ rather than for $\widehat{B}$ when:

$$\alpha A\left[\left(\frac{1-b}{1+\varepsilon-b(1-\mu)/2}\right)^{1-\alpha}\frac{2+\varepsilon-b(1-\mu)/2}{2+\varepsilon} - \left(\frac{1-b}{1+\varepsilon}\right)^{1-\alpha}\right] > \frac{b}{2+\varepsilon}\left[\lambda(1+\gamma) - c\right]. \quad (27)$$

In addition, a unique lean equilibrium exists –i.e. $\widehat{B} < B(\mu)$– if and only if $\lambda(1+\gamma) - c > \Gamma(1-\alpha)A$. Hence, using the expression for Γ in Lemma 2, it follows that configurations that lead the unskilled to choose $\overline{B}$ over $\widehat{B}$ when a unique lean equilibrium exists must necessarily satisfy the following condition:

$$\frac{\alpha}{1-\alpha}\left[\left(\frac{1-b}{1+\varepsilon-b(1-\mu)/2}\right)^{1-\alpha}\frac{2+\varepsilon-b(1-\mu)/2}{2+\varepsilon} - \left(\frac{1-b}{1+\varepsilon}\right)^{1-\alpha}\right] > \frac{b}{2+\varepsilon}\frac{(1+\varepsilon)^{\alpha} - [1+\varepsilon-b(1-\mu)/2]^{\alpha}}{(1-b)^{\alpha}};$$

which after some algebra leads to:

$$\begin{aligned}(1+\varepsilon)^{1-\alpha}\left[\frac{\alpha}{1-\alpha}\frac{1-b}{b}\left(2+\varepsilon-\tfrac{b}{2}(1-\mu)\right) + \left(1+\varepsilon-\tfrac{b}{2}(1-\mu)\right)\right] \\ - \left(1+\varepsilon-\tfrac{b}{2}(1-\mu)\right)^{1-\alpha}\left[\frac{\alpha}{1-\alpha}\frac{1-b}{b}(2+\varepsilon) + (1+\varepsilon)\right] > 0\end{aligned} \quad (28)$$

Denoting by $S(\alpha)$ the LHS of (28), we can observe that $S(0) = 0$ and $S'(0) = 0.5(1-\mu)(1-2b)$. As a consequence, when $b < 0.5$, $S'(0) > 0$ and, thus, there must exist $\widehat{\alpha} > 0$ such that for all $\alpha < \widehat{\alpha}$, $S(\alpha) > 0$ holds. Recall, that $\overline{\alpha}(\varepsilon)$ is a function of ε, and owing to the first part of this proof, $\widehat{\alpha} < \overline{\alpha}(\varepsilon)$; therefore $\widehat{\alpha}$ may well be a function of ε too, and we thus write $\widehat{\alpha}(\varepsilon)$. As a result, when $b < 0.5$ and $0 < \alpha < \widehat{\alpha}(\varepsilon)$, where $0 < \widehat{\alpha}(\varepsilon) < \overline{\alpha}(\varepsilon)$, we may find parametric configurations such that: (i) a unique lean equilibrium exists, and (ii) the unskilled are better off in a unique bloated equilibrium with $B = \overline{B}$ than in a unique lean equilibrium with $B = \widehat{B}$. ■

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	(1)	(2)	(3)	(4)	(5)	(6)
	Log Regional Income per capita					
	Italy	Spain	US	Brazil	Sweden	Denmark
Log Regional Public Sector Employment (% of total)	-1.01	-0.62	-0.50	-0.79	-0.19	0.15
	(7.69)***	(4.06)***	(3.04)***	(2.97)***	(1.34)	(0.54)
Number of Regions	19	16	48	26	21	10
Year	1996	2004	2007	1991	2007	2007
R-squared	0.67	0.45	0.59	0.27	0.69	0.27

Robust absolute t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Regressions exclude regions that consist only (or mainly) on the capital city, i.e. Lazio(Italy), Madrid (Spain), DC (US), Brasilia (Brazil), Stockholm (Sweden), Copenhagen (Denmark). Additionally, US data does not include Alaska and Hawaii.

Table 1: Public Sector Employment and Income per capita using regional variation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log Proportion of Unskilled in the Public Sector							
Corruption Perception Index	-0.041	-0.044	-0.060	-0.037	-0.072	-0.087		
	(2.72)***	(1.81)*	(2.61)**	(1.91)*	(3.46)***	(2.30)**		
Log Public Sector Employment (% of total)			0.147	0.190	0.127	0.152	0.163	0.178
			(3.02)***	(3.50)***	(2.16)**	(2.87)***	(3.42)***	(3.61)***
Log Skilled Workers in the Economy (% of total)				-0.205	-0.311	-0.293	-0.316	-0.308
				(2.84)***	(4.56)***	(4.71)***	(4.50)***	(4.28)***
Log GDP pc					0.189	0.170	0.156	0.115
					(2.89)***	(1.83)*	(2.85)***	(2.06)**
Government Effectiveness							-0.168	
							(3.15)***	
Regulatory Quality								-0.141
								(2.76)***
Region FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62	62	62	62	61	59	62	62
R-squared	0.11	0.36	0.44	0.51	0.57	0.59	0.58	0.57

Absolute values of Robust t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Corruption Perception Index (from Transparency International), Control of Corruption, Government Effectiveness and Regulatory Quality (from the World Bank) are indices whose value increase the better the perception of government performance. Unskilled labour is defined according to ISCO-88 classification and includes clerks, service workers, machine operators, etc. (codes 4 to 9). Skilled correspond to codes 1 to 3 and includes managers, professionals and technicians. Public sector comprises public administration and defence. Regions include all continents and a category for industrialised countries. Column (6) instruments CPI with ethnic and religion fragmentation. The first stage F-test is 12.2. All data are averaged for the period 2002-2006.

Table 2: Quality and composition of the public sector across countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Gross Product per capita			Foreign Direct Investment per capita		Gross Product per capita			Foreign Direct Investment per capita	
Public Sector Employment (% of total employment)	-0.286	-0.882	-0.657	-0.906	-0.908					
	(0.70)	(2.61)**	(3.50)***	(2.17)**	(2.48)**					
Public Sector Skilled Unskilled Ratio						0.161	1.067	0.798	1.931	1.528
						(0.35)	(3.28)***	(1.91)*	(3.53)***	(1.84)*
Government Expenditure per capita		1.012	1.555	1.610	2.350		0.953	1.253	1.669	1.774
		(4.85)***	(7.45)***	(4.80)***	(6.11)***		(9.09)***	(6.04)***	(7.57)***	(5.32)***
Secondary Enrolment			-0.343		0.823			-0.514		0.637
			(0.68)		(0.84)			(0.85)		(0.56)
Roads per capita			0.166		0.303			0.160		0.351
			(1.44)		(1.94)*			(1.06)		(1.70)
Population			0.426		0.679			0.270		0.353
			(4.28)***		(4.15)***			(2.26)**		(2.15)**
Observations	96	96	92	94	90	87	87	87	85	85
R-squared	0.03	0.49	0.69	0.46	0.54	0.01	0.57	0.64	0.49	0.52

Robust absolute t-statistics in parentheses, clustered at the province level. * significant at 10%; ** significant at 5%; *** significant at 1%. All data is for the 24 provinces in the years 1995, 1998, 2000 and 2003. All variables are in logs. All regressions include year fixed effects. "Public Sector Employment" refers to employees in the public administration and defence. "Skilled" are those with at least some tertiary or university studies.

Table 3: Public Sector Employment and Development across provinces in Argentina

	Proportion of workers in Public Sector		
	Total	Unskilled	Skilled
Córdoba	6.8%	5.5%	9.9%
	(0.011)	(0.011)	(0.023)
Rest of capital cities	17.6%	16.4%	22.1%
	(0.003)	(0.004)	(0.008)
Difference	-10.9%	-10.9%	-12.2%
	(0.016)***	(0.019)***	(0.033)***

Table 4: Public employment, by skills in Cordoba and other capital cities.

	Proportion of skilled workers by sector		
	Total	Private	Public
Córdoba	28.8%	27.8%	42.1%
	(0.019)	(0.019)	(0.081)
Rest of capital cities	21.7%	20.5%	27.2%
	(0.004)	(0.004)	(0.009)
Difference	7.1%	7.3%	14.9%
	(0.018)***	(0.018)***	(0.073)***

Table 5: Skilled workers by sector, in Cordoba and other capital cities

Public Sector Employment in Argentine Provinces' Capital Cities			
	Percentage points above Córdoba		
	Total	Unskilled	Skilled
Bloated Equilibrium			
Río Gallegos	24.8	23.4	26.8
Formosa	20.5	19.3	24.3
Tierra del Fuego	16.4	14.1	21.6
Santa Rosa	16	13.8	20.7
La Rioja	15.4	13.4	21.7
Neuquén	14.1	15	9.5
Lean Equilibrium			
Córdoba	n/a	n/a	n/a
San Luis	4.6	3.8	5.5
S. M. de Tucumán	3.8	3.4	3.3
Salta	2.6	1.2	6.7
Mendoza	0.0	-0.1	0.6

Table 6: Labour markets characterization in Argentinian provinces' capital cities.

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Income					
Tertiary Education	0.106	0.077	0.338	0.291	0.272	0.235
	(2.19)**	(1.61)*	(5.68)***	(4.46)***	(5.34)***	(4.16)***
Tertiary Education * Lean Equilibrium Group	0.150	0.141				
	(2.69)***	(2.49)**				
Tertiary Education * Bloated Equilibrium Group	0.053	0.069				
	(0.93)	(1.18)				
Tertiary Education * City Public Employment (%)			-0.11	-0.10		
			(3.06)***	(2.59)***		
Tertiary Education * Unskilled City Public Employment (%)					-0.10	-0.09
					(2.24)**	(1.85)*
Sample	All	Private Sector	All	Private Sector	All	Private Sector
Observations	12502	10311	12502	10311	12502	10311
R-squared	0.45	0.45	0.45	0.45	0.45	0.45

Robust absolute t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%, clustered at the city-sector level. "Tertiary Education" is a dummy if the head of household has some tertiary or university education. "Lean Equilibrium Group" is a dummy equal to 1 for the cities of Córdoba, San Luis, S. M. de Tucumán, Salta and Mendoza. The "Bloated Equilibrium Group" includes Río Gallegos, Formosa, Tierra del Fuego, Santa Rosa, La Rioja and Neuquén. The omitted group includes all other capital cities. "(Unskilled) City Public Employment" is the capital city proportion of (unskilled) heads of households that work in Public Administration and Defence. Individual controls include age and age squared, gender, time in job, other sources of household income, dwelling characteristics, industry, and place of birth. All regressions use city fixed effects. Data is from 1998.

Table 7: Skill Premium by type of equilibrium in Argentinian provinces' capital cities.