Excessive Public Employment and Rent-Seeking Traps*

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Abstract

We propose an occupational choice model in which the quality of the state bureaucracy influences aggregate output and the level of entrepreneurial activity through its participation in the labour market. Agents differ in terms of their public service motivation. A "good" equilibrium arises when public service motivated agents self-select into the state bureaucracy. In such equilibrium, bureaucrats exert high effort and employ a limited number of workers, which in turn disciplines wages and sustains high profits, attracting self-interested agents into entrepreneurial activities. However, a different equilibrium arises if self-interested agents become bureaucrats. These agents will abuse their position to rent seek, by employing an excessive number of workers. This generates an upwards pressure on wages, which lowers profits and deters entrepreneurship. The model also shows that an inefficient public sector may gain political support from the working class, and hence arise endogenously from a standard median voter approach. We provide evidence supporting the mechanism in our model by confronting some of its main predictions to a variety of data sources.

Key Words: Rent Seeking, Allocation of Skills, Occupational Choice, Public Service Motivation.
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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 promoted the inclusion of governance and corruption issues on the development agenda since the late 90s[1]. The concern with public sector inefficiency and mismanagment is, however, not just one of wasted pecuniary 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 severly 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 over-sized and inefficient public sector will not only affect the economy's performance by wasting scarce 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 in the market for unskilled workers. When unskilled labour wages are inflated by excessive public sector demand, entrepreneurial 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, i.e. whether or not they exhibit the appropriate ethics or disposition for their jobs: e.g., Francois (2000, 2003), Murdock (2002), Besley and Ghatak (2005), Benabou and Tirole (2006), Prendergast (2007), Macchiavello (2008), Delfgaauw and Dur (2008). 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 state 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]

[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).

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 (or schooling), which is assumed to be publicly observable. Only highly skilled (or highly educated) individuals 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 willing 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 these 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 over-sizing public employment. For example, bureaucrats may bloat the public sector with excessive workers so as to extract different kinds of perks from them. Alternatively, overemployment may be the result of the creation of (unnecessary) jobs as a way to directly appropriate income from that or to transfer income to certain desired groups of people.[4]

Within this framework, we show that markets might coordinate activities in two (very) different types of equilibria. The key determinant for the kind of equilibrium that emerges is which types of agents self-select into the state bureaucracy. First, there exists an equilibrium in which *only* public service motivated agents become bureaucrats. These agents carry out their jobs ethically, working hard on keeping an efficient public sector, which employs the lowest possible number of workers, subject to providing all public goods needed for the correct functioning

[4] This idea of over-sizing the public sector to generate and extract rents is actually not new. For example, Gelb, Knight and Sabot (1991) argue that public employment is usually seen in underdeveloped economies as a rent-extraction device rather than as an input to produce public goods, and provide some anecdotal evidence linking public sector overmanning to different types of rent-seeking behaviour. See also Durden (1990), who measures rent-seeking behaviour across US states by the share of workers employed in federal and state government jobs. Our idea of public sector overmanning as a symptom of rent-seeking is also somehow related to Niskanen's (1971) theory: he argues that bureaucrats seek to maximise their own utility, which increases with the size of the budgets they manage.

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 entrepreneurial private sector.

However, the economy may also exhibit a different equilibrium in which the allocation of talents is not that one leading to the most efficient operation of the public sector. When profit-driven agents control high-rank positions in the public sector, they abuse their power in order to extract rents**,** which leads to overhiring public workers. More importantly, this (mis-)allocation of talents is self-sustaining. A bloated public sector inflates aggregate labour demand, pushing up the (unskilled) equilibrium wage, which in turn lowers entrepreneurial profits and deters self-interested agents from exercising their skills in the 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 intitutional 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 behaviour.

Our paper offers a novel theory for the joint determination of the size and skill composition of the public sector, the amount of rent seeking by bureaucrats and 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 by combining different datasets (Section 5). More specifically, one result of the model 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. As a result, regions with better working public sectors should also exhibit a larger fraction of skilled public employees. Using cross country variation of internationally comparable measures of public sector performance and skills composition in the public sector, we show that the predicted correlation between performance and skill composition holds, even when controlling for country and regional characteristics.

Another important feature of the model is that, by expanding the demand of unskilled workers (which, in turn, raises their wages), the public sector may end up crowding out the private sector. We provide evidence of a negative correlation between income per head and public employment by looking at cross-regional variation within four countries that show significant

heterogeneity in terms of regional development, namely Brazil, Italy, Spain and the US. We also use more detailed information from Argentine provinces to show this negative relationship between skill composition of public sector employment and private sector activity. Finally, the model predicts that 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 in *both* the public and private sectors would be lower than if the public sector was not bloated. 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 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 to explaining the following two phenomena: *i*) why a bloated public sector may adversely affect profits; *ii*) why a fraction of society (the working class) may be willing to support rent-seeking bureaucrats who sustain a large and inefficient state apparatus around them. 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 an additional 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 following 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 the 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 mainly studied the long-run consequences of financial markets imperfections.[5] More recently, some papers have

[5] E.g., Banerjee and Newman (1993), Aghion and Bolton (1997), Lloyd-Ellis and Bernhardt (2000), Ghatak, Morelli and Sjöström (2001), Erosa (2001).

especially focused on how financial markets imperfections may interact with the incapacity of markets to allocate agents into the occupations for which they are comparatively most suited [Ghatak, Morelli and Sjöström (2007) and Jaimovich (2009)]. Our paper sheds light on how imperfections in the allocation of public sector bureaucrats may result in market distortions which preclude full development of the private entrepreneurial sector, even in the absence of credit market imperfections.

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 $1+L$. A mass $L \in (1,2)$ 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 $\frac{1}{2}$ 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 the 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:

$$y(l) = \begin{cases} A\left(1 + l - \dfrac{l^2}{2}\right) & \text{if } \ 0 \leq l \leq 1, \\ \dfrac{3}{2}A & \text{if } \ l > 1. \end{cases} \tag{1}$$

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):[6]

$$l(w) = \begin{cases} 1 - \dfrac{w}{A} & \text{if } \ 0 \leq w \leq A, \\ 0 & \text{if } \ w > A. \end{cases} \tag{2}$$

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

$$\Pi(w) = \begin{cases} \dfrac{3}{2}A - w + \dfrac{w^2}{2A} & \text{if } \ 0 \leq w \leq A, \\ A & \text{if } \ w > A. \end{cases} \tag{3}$$

2.1.2 The Public Sector

The public sector is composed by a continuum of public offices with mass $b < 1$. In each office a *pure* public good is produced. Each public office is managed by a *bureaucrat*, who decides the number of unskilled workers to hire for his office. Bureaucrats are thus public employees with some degree of discretionary power over the allocation of the public budget. 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.

Each bureaucrat is appointed by the central administration with the mandate to guarantee that *one* unit of the public good is produced by his office.[7] Only skilled individuals may be appointed bureaucrats. Once an individual accepts a bureaucratic job, he cannot resign. The output produced by each office is publicly observable. If the task assigned to the bureaucrat is not fulfilled, the bureaucrat is subject to a punishment $\phi > 1$ (measured in terms of disutility).

Denote by g_i the amount of public good produced in office i. We assume the following production function in the public sector:

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

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 is publicly observable.

[6] None of the main results of the paper crucially depend on the specific production function assumed in (1). The reason for choosing (1) is that it yields a linear labour demand function, which in turn allows the model to deliver neat closed-form solutions. A more standard function with decreasing marginal productivity of labour, e.g., $Y(l) = l^{\alpha}$, with $\alpha \in (0, 1)$, would lead to similar results, but at the cost of more involved algebraic derivations.

[7] Think of this amount as the level of public good that has been somehow decided optimal by the central government and *must* be provided to the society (for example, the number of patients that can be taken care of in a public hospital per unit of time, or the number of roads and highways that must exist per squared mile in a certain municipality). Naturally, the nominal amount 1 is just a normalisation, measured in terms of private good units.

The variable θ_i is an idiosyncratic office-productivity shock that can take two possible values, namely: $\theta_i = \{0.5, 1\}$, each one with probability one-half. The realisation of θ_i is learned by the bureaucrat only *after* he has accepted the job in office i. The bureaucrat i is the only agent who is able to observe the realisation of θ_i. After observing the value taken by θ_i, the bureaucrat announces $\widetilde{\theta}_i$ to the central administration in order to ask for the needed funds. If a bureaucrat announces $\widetilde{\theta}_i = 0.5$, the central administration audits the office to check whether this is actually true. A false announcement $(\widetilde{\theta}_i \neq \theta_i)$ is detected with probability $\delta \in (0, 1)$, in which case the bureaucrat is subject to the punishment ϕ.

The function (4) stipulates that bureaucratic effort and labour are substitutes in the production of the public good. The substitutability between e and n is a *key* assumption in our model, hence it is worth discussing in further detail the sorts of phenomena that it intends to capture.[8] Essentially, substituting effort for outside workers is how bureaucrats rent-seek in our model. In other words, rent seeking materialises as bureaucrats hiring a relatively large number of public employees, without that leading to a larger provision of public goods, but actually allowing bureaucrats to reduce their own effort. Such a phenomenon may be occurring through a variety of channels; for example:

1. The bureaucratic task may be thought of monitoring workers in the office, and e can accordingly be interpreted as *monitoring effort*. In that regard, a larger e_i would allow to produce $g_i = 1$ with a lower n_i owing to better monitoring of the workforce. For example, more intense monitoring might imply that the bureaucrat is able to reduce shirking in the workplace and thus less workers would be needed to fulfill a given task.

2. The bureaucrat may choose to hire workers in excess in order to use some of them to do (part of) the bureaucrat's job. In that way, the bureaucrat would be able to reduce his effort/time in the public office, and use this "saved" effort/time for his *own* private businesses or leisure (thereby, increasing his private income and/or consumption).[9]

3. The bureaucrat may simply overhire workers as a way to achieve extra perks. For instance,

[8] Function (4) assumes perfect substitutability between e and n; this is mainly for algebraic tractability. In qualitative terms, what is essential for our model is that there exists *some* degree of substitutability among these two inputs.

[9] Gagliarducci, Nannicini and Naticchioni (2008) show that a substantial share of the members of the Italian Parliament supplement their parliamentary salaries with income derived from private activities. More importantly for our purposes, the authors also show that a significant fraction of these bureaucrats raise their income from private activities by concomitantly reducing their "effort" exerted in the parliament (the authors measure effort exerted in the parliament by the number of absences in electronic votes that lacked a legitimate reason).

the bureaucrat may claim to need two private drivers, when he actually needs only one for his task, so as to use the second driver to drive his children to school. Additionally, he may hire one extra secretary or gardener and use them for his private matters. To be precise, these perk-seeking behaviour is not exactly decreasing the level of e_i within the public goods production function (4) above. However, they can still be understood as reducing the bureaucrat's effort in his home-production function (by passing some of his home-production effort cost onto other individuals hired as "public" workers).

4. Another possible interpretation is that the bureaucrat overhires workers by creating unnecessary public jobs as a way to increase the income of members of his family or certain desired groups of people. Again, this would not exactly lower e_i in (4), but it would reduce the effort cost per earned income of certain agents the bureaucrat may care for.[10]

More generally, the substitutability of e for n in (4) could be simply interpreted as a reduced-form for a variety of channels whereby bureaucrats may extract rents from the society by bloating their public offices. In that regard, *anything* that allows the bureaucrat to somehow lower his effort cost (or that of certain desired groups of people), by concomitantly loading this cost on the society via increasing n_i, could be interpreted in our model as reflecting some sort of rent-seeking behaviour.

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). In short, a PSM agent is more willing to exert effort if he is appointed for a bureaucratic post. Agents' preferences (i.e., whether an agent is PSM or PD) are private information.

Bureaucrats derive utility from their income and disutility from the effort they exert at work. In particular, conditional on having fulfilled the task $g_i = 1$, the bureaucrat i's utility function

[10] As a real-life example of this particular channel, an article in The Economist (2008) raises the issue of nepotism and favouritism in Italian universities, mentioning that 'The creation of jobs for relatives and friends has helped to inflate the number of Italian academics', where 13,000 junior positions had been advertised in the past 7 years, but 26,000 actually filled.

[11] The distribution of public service motivation among the unskilled is irrelevant to our model, hence we leave it unspecified. (The unskilled cannot become bureaucrats, which is the only occupation for which the degree of public service motivation affects equilibrium behaviours.)

reads as follows:

$$U_i = B - \frac{e_i}{1+\lambda_i}; \tag{5}$$

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

In (5), B denotes the bureaucrats salary and λ_i is the degree of public service motivation of bureaucrat i.

Remark 1 For completeness, the utility function (5) should also include two additional terms: *(i)* a positive term capturing the utility derived from the consumption of the public goods, *(ii)* a negative term equal to the lump-sum taxes paid by each individual. Since both *(i)* and *(ii)* will affect all agents in the economy equally (irrespective of their skills and preferences), there is no harm to our results by not explicitly including any of these two terms in any of the payoff functions of the model, because neither *(i)* nor *(ii)* will have any impact on the optimal occupational choices of the individuals.

As previously described in Section 2.1.2, a bureaucrat may either end up managing an office with $\theta_i = 0.5$ or one with $\theta_i = 1$. A bureaucrat who runs an office where $\theta_i = 0.5$ will optimally announce $\widetilde{\theta}_i = 0.5$, and set $e_i = 1$ and $n_i = 2$. To see this, notice first that there is no reason to announce a higher productivity than the actual one (as that would necessarily leave the bureaucrat with less workers than those needed to achieve $g_i = 1$). Second, if the bureaucrat sets $e_i = 0$, he will not be able to produce $g_i = 1$ (even if having announced $\widetilde{\theta}_i = 0.5$ and hired $n_i = 2$), and he will thus be subjected to the punishment $\phi > 1$, which is larger than his disutility of effort.

However, truth-telling is not guaranteed if a bureaucrat finds out that $\theta_i = 1$: in this case the bureaucrat may wish to lie about the real productivity of office i and announce $\widetilde{\theta}_i = 0.5$, so as to give himself room to shirk.

From now onwards we assume the following holds:

Assumption 1 $\quad \dfrac{1}{1+\lambda} < \delta\phi < 1.$

The first inequality in Assumption 1 entails that PSM bureaucrats will always truthfully announce $\widetilde{\theta}_i = 1$, and set $e_i = 1$ and $n_i = 0$, accordingly. The second inequality in Assumption 1 implies that, after PD bureaucrats observe $\theta_i = 1$, they will announce $\widetilde{\theta}_i = 0.5$ so as to allow

themselves to set $n_i = 2$ and, hence, $e_i = 0$.[12] In essence, on the one hand, Assumption 1 states that PSM bureaucrats are sufficiently motivated to always 'do the right thing' in their jobs. On the other hand, it states that the probability of detection of cheaters (or the level of punishment that can be inflicted on them) is not large enough to deter PD bureaucrats from rent-seeking.

From the previous discussion it follows that the amount of employment in each of the public offices will depend both on the productivity shock and on the bureaucrat's type. A PSM-bureaucrat will hire public workers according to the following labour demand function:

$$n_{PSM} = \begin{cases} 0 & \text{if } \theta_i = 1, \\ 2 & \text{if } \theta_i = 0.5. \end{cases} \tag{6}$$

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

$$n_{PD} = 2, \text{ regardless of the value of } \theta_i. \tag{7}$$

PSM-bureaucrats always exert effort $e_{PSM} = 1$, whereas PD-bureaucrats put $e_{PD} = 1$ if and only if $\theta_i = 0.5$, setting instead $e_{PD} = 0$ when $\theta_i = 1$. By using these results, we can write down the level of (expected) utility achieved by each type of bureaucrats:

$$U_{PSM} = B - \frac{1}{1+\lambda}, \tag{8}$$

$$U_{PD} = B - \frac{1}{2}(1 + \delta\phi). \tag{9}$$

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 position in the public sector. 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.

[12] To see this, notice that the expected utility for a bureaucrat that announces $\widetilde{\theta}_i = 0.5$ and sets $e_i = 0$ equals $B - \delta\phi$. A PSM bureaucrat then prefers to announce $\widetilde{\theta}_i = 1$ and set $e_i = 1$, since this yields utility equal to $B - (1+\lambda)^{-1} > B - \delta\phi$. On the other hand, if a PD bureaucrat announces $\widetilde{\theta}_i = 1$ and sets $e_i = 1$, he will obtain utility equal to $B - 1 < B - \delta\phi$.

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 and labour market transactions:** Each bureaucrat i observes $\theta_i \in \{0.5, 1\}$ and announces $\widetilde{\theta}_i \in \{0.5, 1\}$. Bureaucrats and entrepreneurs hire workers in the labour market. All remaining agents supply their half unit-time labour endowment in the market.

6. **Production stage, auditing and punishments:** Production takes place and all payments are made. The central administration audits all offices that announced $\widetilde{\theta}_i = 0.5$ in stage 5, and subjects all bureaucrats who are detected with $\widetilde{\theta}_i \neq \theta_i$ or who failed to produce $g_i = 1$ to a punishment $\phi > 1$.

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 so as 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 among all individuals in the economy.[13]

Henceforth, we impose the following two parametric restrictions:

Assumption 2 $\mu \geq b$.

Assumption 3 $\frac{1}{2}(1 + \delta\phi) - \frac{1}{1+\lambda} \geq \frac{1}{2}A$.

Assumption 2 states that are enough PSM agents in the economy to possibly cover all bureaucratic positions in the public sector: this assumption ensures that equilibria where *only*

[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.

PSM agents become bureaucrats may (in principle) exist. Assumption 3 is easier to interpret by noticing from (8) and (9) that it can also be written as: $U_{PSM} - U_{PD} \geq \frac{1}{2}A$. This assumption thus can be interpreted as saying that the different types of skilled agents are not too similar (or, alternatively, sufficiently heterogeneous) in terms of their preferences for bureaucratic jobs relative to entrepreneurial activities.

3.1 Optimal Occupational Choice (Partial Equilibrium Analysis)

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 addition, for the remainder of Section 3, we will restrict the values that B may take, such that the following condition holds:

Assumption 4 (wage-dependent bureaucrats pool) $A+\frac{1}{2}(1+\delta\phi) \leq B < \frac{3}{2}A+\frac{1}{2}(1+\delta\phi)$.

Assumption 4 implies that there exists a wage cut-off value, $\widehat{w} \in (0, A)$, 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.[14] Notice that, if $B \geq \frac{3}{2}A + 0.5(1+\delta\phi)$, then even PD agents would always wish to apply for a bureaucratic post, no matter the value of w. As we want to allow (in principle) for equilibria in which PD agents *self-select* away from the bureaucratic positions in the public sector, we impose that upper bound on B. On the other hand, the lower bound $B \geq A + 0.5(1+\delta\phi)$ allows (in principle) equilibria where both PSM and PD agents wish to apply for bureaucratic jobs. Notice finally that, given this lower bound on B, Assumption 3 ensures that PSM agents will always prefer bureaucratic jobs to entrepreneurship.

Figure 1 plots the payoff functions of bureaucrats, entrepreneurs and workers, for a varying w, given Assumptions 1, 3, and 4. These payoff functions correspond to those elicited before in (3) for the entrepreneurs, (8) for PSM bureaucrats, and (9) for PD bureaucrats; the 45^0 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.[15]

[14] The exact value for the wage threshold is $\widehat{w} = A - \sqrt{2A\left[B - \frac{1}{2}(1+\delta\phi) - A\right]}$; which given Assumption 4 is strictly positive and smaller than A.

[15] 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.

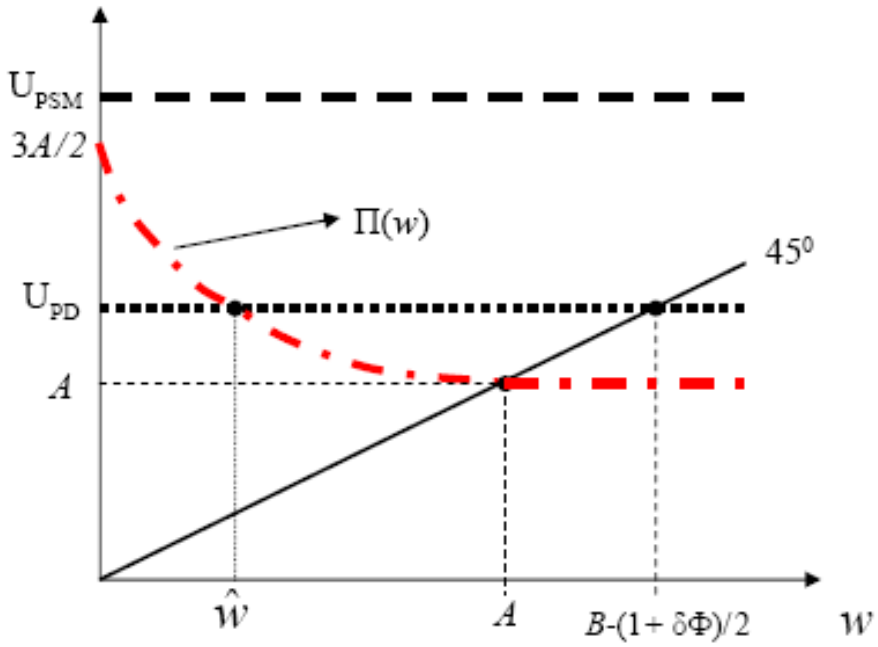

Figure 1: Payoff functions by different occupations

- For all $0 \leq w < \widehat{w}$: Only PSM agents apply for a bureaucratic post. All the skilled agents that did not apply or get a bureaucratic job become entrepreneurs and hire $l(w) > 0$ workers in the market.

- For all $\widehat{w} \leq w \leq A$: Both PSM and PD agents apply for a bureaucratic post. If $w \in [\widehat{w}, A)$, all the skilled agents that did not get a bureaucratic job become entrepreneurs and hire $l(w) > 0$ workers; if $w = A$, they choose indifferently between becoming (self-employed) entrepreneurs or workers.

- For all $A < w \leq B - 0.5\,(1 + \delta\phi)$: 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 $B - 0.5\,(1 + \delta\phi) < w \leq B - (1 + \lambda)^{-1}$: 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 $w > B - (1 + \lambda)^{-1}$: No agent applies for a bureaucratic post. All agents in the economy become workers.

The main partial equilibrium 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. However, for $\widehat{w} \leq w \leq B - 0.5\,(1 + \delta\phi)$, entrepreneurial profits are not high enough to attract PD agents, who turn out to be better off as rent-seeking bureaucrats.

3.2 General Equilibrium Analysis

Two additional conditions must be satisfied in the general equilibrium analysis, compared to the partial one above: 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 half unit-time 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. Concerning the occupational choices, it is important to notice the following though: despite individuals choosing their occupations optimally in equilibrium, this does not necessarily mean that they will all end up in their (*ex ante*) most preferred occupation; in fact, for any $w \leq B - (1 + \lambda)^{-1}$, only a fraction of those who apply for bureaucratic posts will eventually get these jobs. Condition 2 (the labour market clearing condition) represents the natural way to endogenise w, given the assumption that this market is competitive. Finally, the third condition simply requires that, in equilibrium, there must be enough applicants to fill all bureaucratic positions in the public sector. Regarding this last condition, two remarks apply. First, given Assumptions 2, 3 and 4, it is immediately satisfied for any w, that may clear the labour market. Second, although Condition 3 restricts the range of values that B may possibly take in equilibrium, it does not fully endogenise it (more precisely, as it is specified, our model is not able to determine the exact value of 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 multiple 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:

$$L^D(w) = \begin{cases} (1-b)\left(1-A^{-1}w\right)+b & \text{if } w<\widehat{w}, \\ (1-b)\left(1-A^{-1}w\right)+b\,(2-\mu) & \text{if } \widehat{w}\leq w\leq A, \\ b\,(2-\mu) & \text{if } A<w\leq B-0.5\,(1+\delta\phi)\,, \\ b & \text{if } B-0.5\,(1+\delta\phi)<w\leq B-(1+\lambda)^{-1}\,, \\ 0 & \text{if } B-(1+\lambda)^{-1}<w. \end{cases} \tag{10}$$

$$L^S(w) = \begin{cases} L/2 & \text{if } w<A, \\ [L/2,(1-b)+L/2] & \text{if } w=A, \\ (1-b)+L/2 & \text{if } A<w\leq B-(1+\lambda)^{-1}\,, \\ 1+L/2 & \text{if } w>B-(1+\lambda)^{-1}\,. \end{cases} \tag{11}$$

From (10), 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 $b\,(1-\mu)$. 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) and hire (on average) one unit of unskilled labour each. On the other hand, just above $w=\widehat{w}$, a fraction $(1-\mu)$ of the mass b of bureaucratic jobs end up in the hands of PD agents, who (whenever they are able to) abuse their positions by hiring more workers per office than that is really needed. As a result, at $w=\widehat{w}$ the total mass of public workers abruptly rises from b to $b\,(2-\mu)$.

Henceforth, we restrict the mass of public offices, such that the following condition holds:

Assumption 5 $2b(2-b)\leq 1$.

Assumption 5 puts an upper bound on b. Its role is to ensure that, no matter the parametric configuration of $(L,\mu)\in(1,2)\times[b,1)$, skilled agents will never work as unskilled workers in equilibrium.[16] It is important to clarify that Assumption 5 is by no means necessary or crucial

[16] For w infinitesimally smaller than A, labour demand approaches $b(2-\mu)$ while labour supply tends to $L/2$. The former is decreasing in μ, hence (given Assumption 2) it reaches a maximum when $\mu=b$. Assumption 5 then ensures that, for any $L\in(1,2)$, labour demand is never larger than labour supply whenever $w\geq A$. Notice, too, that Assumption 5 can simply be written as: $b\leq 1-\sqrt{\frac{1}{2}}$.

for our main results in the model. Yet, we prefer to pose this assumption, as it simplifies the analysis by reducing the number of general equilibrium cases to those which seem more illustrative and interesting for our purposes.[17]

Proposition 1 *Suppose Assumptions 1 - 5 hold. Then:*

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

$$B < \left[\frac{1}{8}\left(\frac{L-2b}{1-b}\right)^2 + 1\right] A + \frac{1}{2}(1+\delta\phi) \equiv \overline{B}. \tag{12}$$

(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:

$$B \geq \left[\frac{1}{8}\left(\frac{L-2b(2-\mu)}{1-b}\right)^2 + 1\right] A + \frac{1}{2}(1+\delta\phi) \equiv \underline{B}(\mu). \tag{13}$$

Proof. Part (i). An equilibrium in which only PSM agents apply for a bureaucratic post exists if and only if $L^D(w)$ crosses $L^S(w)$ at a wage level (strictly) below $\widehat{w}$. This happens if and only if $(1-b)\left(1-A^{-1}\widehat{w}\right)+b < L/2$, which using $\widehat{w} \equiv A - \sqrt{2A\left[B - \frac{1}{2}(1+\delta\phi) - A\right]}$ leads to (12).

Part (ii). First, notice from (10) and (11) that the highest possible wage that may hold in equilibrium is $w = A$, since for any $w > A$ labour supply necessarily exceeds labour demand. As a result, a necessary and sufficient condition for the existence of an equilibrium in which both PSM and PD agents apply for a bureaucratic position is that $L^D(\widehat{w}) \geq L$. Again, using (10) and (11), this requires $(1-b)\left(1-A^{-1}\widehat{w}\right)+b(2-\mu) \geq L/2$. Finally, from this inequality the condition in (13) obtains after some algebra. ■

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. Yet, as we show next, condition (12) is actually not *sufficient* to ensure such a goal is achieved. In particular, Part (ii) of the proposition shows that, when $B \geq \underline{B}(\mu)$, an equilibrium where all skilled agents apply for a bureaucratic job exists in the economy. 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.

The following corollary combines the previous two results and describes the different types of equilibria that may arise in the model, given its parametric configuration. Figure 2 illustrates each of the three cases.

[17] A extension of our results when Assumption 5 is dropped is available from the authors upon request.

Corollary 1 *Depending on the specific parametric configuration of the model, three different equilibrium cases are possible:*

(i) Lean public sector unique equilibrium: *If $B < \underline{B}(\mu)$, the equilibrium in the economy is unique. In the equilibrium, only PSM agents apply for (and obtain) bureaucratic jobs, the mass of unskilled employees equals b, and the wage of unskilled workers is $w^* = A\,(2-L)\,/\,[(2(1-b)]$.*

(ii) Bloated public sector unique equilibrium: *If $B \geq \overline{B}$, the equilibrium in the economy 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 employees equals $b\,(2-\mu)$, and the wage of unskilled workers is $w^{**} = A\,[(2-L)+2b\,(1-\mu)]\,/\,[(2(1-b)]$.*

(iii) Multiple equilibria: *If $\underline{B}(\mu) < B < \overline{B}$, 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.*

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

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, exerting always high effort and hiring relatively few workers. 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.

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.[18]

[18] Our model focuses on the effect of B on the self-selection into bureaucracy, and rules out (by construction) any effect that a higher 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

Remark 2 All the equilibria in Figure 2 are stable, if we consider standard walrasian price-adjustment dynamics where the wage must increase (decrease) whenever there is excess labour demand (supply). In addition, if we were to assume 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 the wage level $w = \widehat{w}$. Notice, though, that this equilibrium would be unstable.

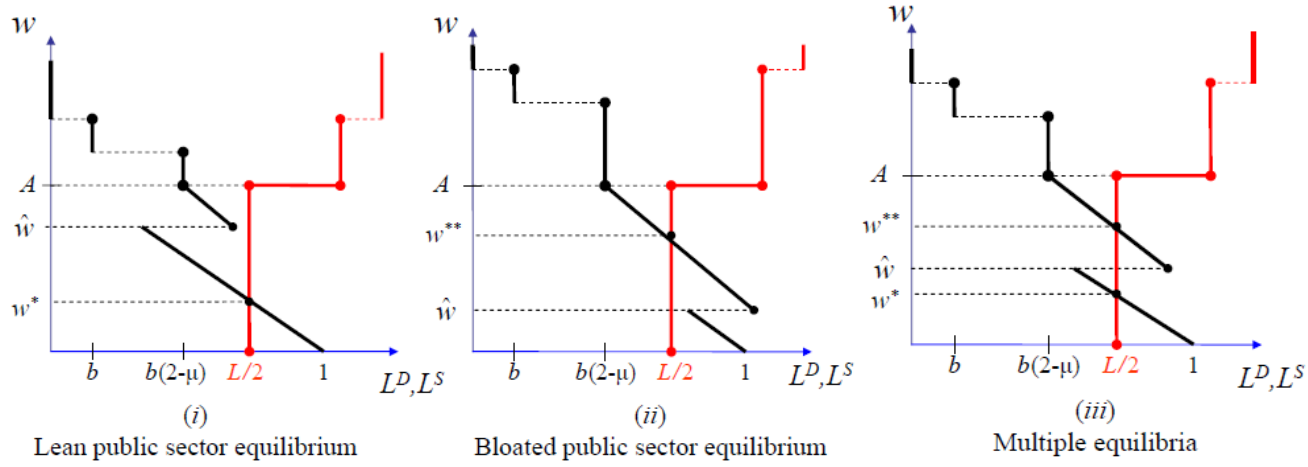

Figure 2: Labour Market Equilibria – three different cases.

The three cases are plotted for a given configuration of $A, L, \lambda, \mu, \delta, \phi$ and b, and different values of B.

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 public sector equilibrium (Y^*) is strictly larger than in the bloated equilibrium (Y^{**}). The following two equations make this point apparent, where $y(\cdot)$ is the entrepreneurial production function in (1) and $l(\cdot)$ is the entrepreneurial labour demand in (2).

$$Y^* = \int_0^b g_i \, di + \int_b^1 y(l(w^*)) \, di = b + \frac{1-b}{2}\left[3A - \frac{(w^*)^2}{A}\right], \tag{14}$$

$$Y^{**} = \int_0^b g_i \, di + \int_b^1 y(l(w^{**})) \, di = b + \frac{1-b}{2}\left[3A - \frac{(w^{**})^2}{A}\right]. \tag{15}$$

bureaucratic jobs than PD agents are, our self-selection mechanism should remain at play. Furthermore, empirical evidence on the incentive-effect suggest this effect is, at best, weak. See for example Rauch and Evans (2000) and Van Rijckenghem and Weder (2001).

From (14) and (15) it follows that the output gap, $Y^* - Y^{**}$, equals $(1-b)\left[(w^{**})^2 - (w^*)^2\right]/2A$, which is strictly positive. Also, from those two equations 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 b 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 *only* with the intention to rent-seek 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 agents.

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 on the model.

Corollary 2 *Take an economy with a given set of parameters: $A, L, \lambda, \mu, \delta, \phi$ and b, and which satisfies Assumptions 1, 2, 3 and 5. 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: $Y^* = b + \frac{1-b}{2}\left[3A - \frac{(w^*)^2}{A}\right]$, where $w^* = \frac{A(2-L)}{2(1-b)}$.
In (ii), aggregate output is given by: $Y^{**} = b + \frac{1-b}{2}\left[3A - \frac{(w^{**})^2}{A}\right]$, where $w^{**} = \frac{A[(2-L)+2b(1-\mu)]}{2(1-b)}$.

Corollary 2 then states that, given the parametric configuration of the economy (i.e., given $A, L, \lambda, \mu, \delta, \phi$ and b), aggregate output is always larger in an equilibrium without rent-seeking bureaucrats (where it equals Y^*) than in one where a fraction $1-\mu$ are rent-seeking bureaucrats (where it equals Y^{**}).

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 public sector equilibrium, it turns out that this equilibrium does not Pareto dominate the bloated one. As a consequence, an aggregate welfare assessment would first require postulating some specific social welfare function. Such an aggregate welfare assessment is beyond the scope of this paper. However, with the model

as it stands, welfare comparisons *within* groups of individuals are still possible, 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 $T^* < T^{**}$.[19]

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 $U_{PD} - T^{**} < \Pi(w^*) - T^*$; 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, if such an agreement is reached, no PD agent will find any incentive to unilaterally deviate from the agreement, since $\Pi(w^*) > U_{PD}$.)

Unskilled agents. In this case the welfare comparison is less straightforward than before. On

[19] 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.

the one hand, the excessive labour demand that originates from the PD bureaucrats drives up the equilibrium wage, which is beneficial to the those agents whose only choice is to supply their labour endowment. On the other hand, like anybody else in the economy, they must pay higher taxes, which lowers their welfare. Lemma 4 in the Appendix shows that, for any given $B \in \left(\underline{B}(\mu), \overline{B}\right)$, in our specific setup, the former effect always dominates the latter, hence: $w^{**} - T^{**} > w^* - T^*$. Therefore, whenever multiple equilibria are feasible, the unskilled prefer the bloated public sector equilibrium to the lean one, as the higher wage they receive in the former more than compensates the higher taxes they must pay.

The fact that the unskilled receive higher wages when there are rent-seeking bureaucrats is actually a general result that 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 case discussed in the above paragraph. 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 in the unskilled labour market means that the unskilled might in some cases be sympathetic to paying higher salaries to the bureaucrats, even if that means paying higher taxes. This particular trade-off is what we proceed to study in the next section, where we endogenise B as the political outcome of majority voting.

4 Political Economy General Equilibrium: endogenous B

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.[20] From now onwards, we drop Assumption 4, and let B take any non-negative value.[21]

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)*

[20] Obviously, this should 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). Notice that alternative policy variables that seem plausible to be altered and would also affect self-selection into bureaucracy are δ (cheating detection probability) and ϕ (punishment severity).

[21] Assumption 4 was introduced in Section 3 *only* with the intention to facilitate the description of the different types of market general equilibria that may arise in the model. However, there is clearly no reason why B should actually be restricted *a priori* in such a way.

an occupational choice by each agent in the economy; such that:

1. *The level of B is determined by universal majority voting before the 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. Since the mass of unskilled agents L is larger than one, the unskilled represent the median voter. As a result, in a *PEGE*, the salary of bureaucrats will be equal to the level of B that maximises the *expected* utility of the unskilled.

As voting will be repeated until the offered B is able to attract at least a mass b of skilled agents to the state bureaucracy; in a *PEGE*, B cannot be too low. More precisely, the lowest B that could be offered is that one that would make PSM agents indifferent between entrepreneurship and state bureaucracy, at the wage that clears the unskilled labour market when *only* PSM agents apply for bureaucratic jobs (that is, at w^*).

Lemma 1 *The lowest B that the unskilled would possibly vote for in a PEGE is:*

$$\widehat{B} \equiv \left[\frac{1}{8}\left(\frac{L-2b}{1-b}\right)^2 + 1\right] A + \frac{1}{1+\lambda}; \tag{16}$$

where $\widehat{B}$ stems from solving $\Pi(w^*) = B - (1+\lambda)^{-1}$ for B, and $\widehat{B} < \underline{B}(\mu)$ for any $\mu \in [b, 1]$.

Proof. In Appendix. ■

From Corollary 1, we can observe that, given the set of parameters ($A, L, \lambda, \mu, \delta, \phi$ and b), the wages $w^* = A(2-L)/[(2(1-b)]$ and $w^{**} = A[(2-L)+2b(1-\mu)]/[(2(1-b)]$, which would prevail in the different equilibrium cases, are both independent of the specific level of B (although the value of B does affect whether w^* or w^{**} are indeed equilibrium wages).[22] Notice, too, that any $B \in \left[\widehat{B}, \underline{B}(\mu)\right)$ will lead, with probability one, to an equilibrium wage equal to 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 $B = \widehat{B}$.

Lemma 2 *Voting for a* $B \in \left(\widehat{B}, \underline{B}(\mu)\right)$*, where* $\underline{B}(\mu)$ *was specified in* (13)*, is a strictly dominated strategy for the unskilled agents.*

Proof. Any $B \in \left[\widehat{B}, \underline{B}(\mu)\right)$, leads to a unique market general equilibrium with wage w^*. For $B \in \left[\widehat{B}, \underline{B}(\mu)\right)$, individual taxes equal $b(w^* + B)/(1+L)$, 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 $B = \widehat{B}$. ■

With a similar reasoning, we can also find an upper bound for the B that the unskilled would vote for. Intuitively, no unskilled agent will ever vote for a $B > \overline{B}$, since setting $B = \overline{B}$ turns out to be the "cheapest" way to guarantee an equilibrium wage equal to w^{**}.

Lemma 3 *Voting for a* $B > \overline{B}$*, where* $\overline{B}$ *was specified in* (12)*, is a strictly dominated strategy for the unskilled agents.*

Proof. 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 $b[(2-\mu)w^{**} + B]/(1+L)$, which are strictly increasing in B. Hence, for the unskilled, voting for any $B > \overline{B}$ is strictly dominated by $B = \overline{B}$. ■

The previous lemmas imply that we can restrict the set of B which the unskilled agents would possibly vote for quite drastically: if the unskilled would like to induce a market general equilibrium in which a wage equal to w^* (w^{**}) holds as a *unique* equilibrium, they will vote for $\widehat{B}$ ($\overline{B}$). Whether the unskilled are better off by voting for $\widehat{B}$ or for $\overline{B}$ depends on how the trade off between 'higher wages vs. higher taxes' resolves. The following proposition states the conditions

[22] More precisely, by varying B, the only relevant change in the labour market equations (10) and (11) turns out to be the threshold wage $\widehat{w}$ at which labour demand becomes non-monotonic. (This can be visually observed from Figure 2, where the only thing that differs in the three cases is B.)

under which the higher wages earned by the uskilled when $B = \overline{B}$ more than compensate the higher taxes they have to pay in that case.

Proposition 2 *Suppose* $\frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda} < 3A/2$. *Then, there exist feasible parametric configurations for* $(L, b, \mu) \in (1,2) \times \left(0, 1-\sqrt{\frac{1}{2}}\right] \times [b, 1)$, *for which, if the unskilled agents had to choose between voting for* $\widehat{B}$ *or* $\overline{B}$, *they would vote for* $\overline{B}$. *In particular, the unskilled strictly prefer* $\overline{B}$ *to* $\widehat{B}$ *if and only if the following condition holds:*

$$\frac{[2L - 2b(2-\mu) - 1](1-\mu)}{2(1-b)} A > \frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda}. \tag{17}$$

Proof. In Appendix. ■

To grasp some intuition for Proposition 2, note firstly, that $\frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda} = \overline{B} - \widehat{B}$. In that sense, $\frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda} < 3A/2$ states that heterogeneity in preferences for state bureaucracy between PD and PSM agents must not be too large. Otherwise, the lowest salary needed to induce PD agents to apply for bureaucratic jobs as a *unique* equilibrium, $\overline{B}$, would be too big relative to $\widehat{B}$ and, hence, relatively too costly for taxpayers. Secondly, an increase in L (in μ) raises (lowers) the value of the LHS of (17), making it more (less) likely to hold. For the former, a higher L dilutes the cost of paying higher bureaucratic salaries among a larger mass of taxpayers. For the latter, a larger μ means that the fraction of PD bureaucrats in a bloated equilibrium will be lower, and so will be the ensuing upwards push on wages, making it then less appealing for the unskilled vote for $\overline{B}$ instead of for $\widehat{B}$.[23]

Proposition 2 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 3. 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 $B \in \left[\underline{B}(\mu), \overline{B}\right)$. For these cases, we will focus on sunspots equilibria: we will look at situations in which all the unskilled agents share the same expectation about the probability with which all PD agents will coordinate on whether or not to apply to bureaucracy. We will, however, place some restriction on these expectations. In particular, it seems reasonable to suppose that expectations about the probability of coordination failures are "monotonic": the higher B, the more likely it is that PD agents will apply for bureaucratic jobs. More explicitly:

Assumption 6 *Let* $B \in \left[\underline{B}(\mu), \overline{B}\right)$ *and denote by* $P(B) : \left[\underline{B}(\mu), \overline{B}\right] \to [0,1]$ *the probability that the equilibrium strategies of the PD agents are to apply for bureaucratic jobs. We assume:* $P'(B) \geq 0, P\left(\underline{B}(\mu)\right) = 0$, *and* $P\left(\overline{B}\right) = 1$.

[23] The wage gap between the two types of equilibria is: $w^{**} - w^* = b(1-\mu)/(1-b)$, which falls with μ.

For any $B \in \left[\underline{B}(\mu), \overline{B}\right]$, we can then write down the expected indirect utility of the unskilled:

$$\begin{aligned} E\left[V(B)\right] &= \left\{P(B)\left[2-L+2b\left(1-\mu\right)\right]\left[1+L-2b\left(2-\mu\right)\right]\right. \\ &\quad \left.+\left(1-P(B)\right)\left(2-L\right)\left(1+L-2b\right)\right\}\frac{A}{4\left(1-b\right)\left(1+L\right)}-\frac{bB}{1+L}. \end{aligned} \tag{18}$$

If the unskilled were restricted to vote for a $B \in \left[\underline{B}(\mu), \overline{B}\right]$, they would obviously choose that one that maximises (18), which we denote $\widetilde{B} = \arg\max_{B\in\left[\underline{B}(\mu),\overline{B}\right]} : \{E\left[V(B)\right]\}$. (We are implicitly assuming that the there is one single value that maximises $E\left[V(B)\right]$; this is just for simplicity and without any loss of generality.)

Given the expectations summarised by the function $P(B)$ in Assumption 6, the choice by the unskilled of which B to vote for reduces then to selecting one among the following three values: $\overline{B}$, $\widehat{B}$, or $\widetilde{B}$. We assume that in cases where two of them (or all of them) yield identical expected utility, the unskilled vote for the lower (lowest) value.

Corollary 3 *Given $P(B)$, when choosing which bureaucratic salary to vote for, B_{vote}, the unskilled solve:*

$$B_{vote} = \min_{B^*}\left\{B^* \in \underset{B\in\left\{\overline{B},\widehat{B},\widetilde{B}\right\}}{\arg\max} : \left\{E\left[V(B)\right]\right\}\right\}.$$

When $B_{vote} = \overline{B}$, the political outcome leads to a bloated public sector equilibrium with probability 1. *When $B_{vote} = \widetilde{B}$, the political outcome leads to a bloated public sector equilibrium with probability $P(\widetilde{B})$. When $B_{vote} = \widehat{B}$, the political outcome leads to a lean public sector equilibrium with probability* 1.

5 Empirical Analysis

So far we have presented a theoretical framework 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 introduce a reduced-form approach and confront separately a number of results derived from the model, making use of a variety of data sources, ranging from cross-country to household data. 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 subtler questions involving the skill composition of the public sector, its quality and the resulting effect on incomes at different educational levels, which are much more specific to our own setup. In particular, we concentrate on the following three main 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: another important feature of the model is that, by expanding the demand of unskilled workers (which, in turn, raises their wages), the public sector may end up crowding out the private sector. It follows that:

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

   (b) Private sector is stifled in areas with large and relatively unskilled public sector 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 in both the public and private sectors 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 looking at four countries with different levels of development that show significant heterogeneity in regional development, namely Brazil, Italy, Spain and the United States. A similar exercise is done using regional variation from Argentina's provinces where we test the relationship between level or composition of public sector employment and private sector activity, as described in Prediction 2b. To deal with Prediction 3, we also use the data on Argentinian provinces, and we first characterise the apparent equilibrium in different capital cities. Based on this characterisation, and using data on incomes from a household survey representative at the city level, we next test whether the skill premium is indeed larger in cities that show features associated with a lean public sector 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 composition and the performance of the public sector vary depending on which type of equilibrium the economy is in. More precisely, the model predicts that if we take two economies with the same level of development, availability of skills and "natural" size of the public sector (i.e. the level of b in the model), the country 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 test this, we run a regression 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, to control for regional characteristics, 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, whose value increase the better the perception of government performance. The measure of 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 1 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, on average. Some of this variation could result from common characteristics within continents that would explain the quality or composition of the public sector. For example, if governments in Latin America are systematically perceived as more corrupt on average than those in Asia, or if Eastern European countries have systematically bigger public sectors than other regions. To address this, in the following column we include regional dummies that control for average regional differences. That means that we exploit within regional variation, i.e. we compare countries in the same region. The negative correlation between CPI and the share of unskilled 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 (or, at least, affecting) 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 in the economy is what 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 country's GDP per capita, in column (5). Finally, in columns (6) to (8) we use different measures of government performance, provided by a different source that Transparency International, namely The World Bank. Our results still hold when using different measures of government performance, such as control of corruption, government effectiveness and regulatory quality.

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 (that is, by the value of b), but actually by *how* it grows, both in terms of skills and quality. 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 to 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.[24] In terms of our model, this is captured by the b, which may vary along a certain interval and may be thought of as a country-specific parameter. A more promising approach appears to be then to look at regional variation within countries**,** under the presumption the role of the public sector tends to be much more homogeneous within countries than it is across countries. In that regard, since we are exploiting variation across regions, an important point is that we need to find countries that display substantial regional inequality (both in terms of income per head and level of industrialisation) and that are characterised by relatively decentralised political administration.

We choose three developed economies, Italy, Spain and US, which exhibit, in that order, the largest degree of regional inequality (measured by the Gini coefficient across regions) among the 11 industrialised economies for which Barro and Sala-i-Martin (1995) show regional income data. Additionally, we use data on Brazil and Argentina, two federal developing countries with substantial regional disparities. In particular, we use the three developed countries and Brazil to illustrate Prediction 2a by running a simple linear regression of the share of the public employment on income per capita. Subsequently, we make use of a more complete and detailed dataset for Argentina to investigate Prediction 2b, and to control for additional regional characteristics which according to the model could also influence the correlation between economic development and public employment.

Table 2 shows results for the first four countries. Across the board we find that public sector is substantially larger in poorer regions, as predicted by the model. The link seems to be strongest in Italy and weakest in the United States, a result somehow unsurprising, given the relative size and tasks allocated to the public sector in each of the countries.

We next use data on Argentine provinces for four years, to test Prediction 2b. As a measure of private sector development, we use two different measures: the log of product per capita

[24] For example, the public sector in the US clearly carries out a smaller set of activities than that of Sweden. It is natural to expect then the public employment share in Sweden to be larger than that in US. Yet, this comparison reveals nothing about the possibility that public employment is used in order to create and extract rents, which is the crucial argument in our paper.

and the log of foreign direct investment per capita (FDI). We have collected data on public sector employment and its skill composition. Province controls 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 indicators of development or private sector activity, namely provincial product per capita and FDI, respectively. 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[25]. 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 a straight implication of 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.

Remember 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, captured 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 bloating of the public sector that is associated with less private activity in the model would imply 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 and suggest that private activity and output are greater in provinces where the public sector looks lean and skilled. Or, in other words, if we compare two provinces with a similar level of government expenditure, population, skills and

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

productivity, the province with a public sector that is relatively more skilled tends to display higher income per head and more private economic activity.

5.3 Public sector 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 public sector* 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 public sector employment share. Additionally, in such equilibrium, the public sector tends to be relatively more skilled, i.e. it displays a high ratio of skilled to unskilled employees.

To characterise different provinces' labour markets, we first need to identify a labour market that seems to satisfy the key features of a lean equilibrium. This sets a benchmark for what would be "reasonable" public sector employment in the Argentine context. A good starting point 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 difference 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 capital 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 in the regression, the estimates of β_c will give the difference of a given city relative to Córdoba, in percentage points. All regressions use weights and cluster standard errors at the city level.

Table 6 summarises our results[26]. 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 public sector equilibrium, even though the level of public employment remains 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[27]. 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).

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

[27] 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.

All 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)[28].

We can now, as a second step, investigate patterns in income across sectors and skills. In the model, the public and private sector compete for blue collar workers. 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**.** That means that in the latter we should observe that the difference in incomes between a skilled and an unskilled worker is greater, both in the public and in the private sector. 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 good 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. We also run a regression where we simply interact the education dummy with the proportion of heads of households that are employed by the public sector in the city where the household is located, to check the model's prediction that the income gap across skills is smaller in cities with larger public sectors.

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 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

[28] 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.

cities classified as being in a lean equilibrium is significantly greater, which is consistent with the predictions of our model. Therefore, as predicted by the model, we find that the enlargement of the public sector is associated with a compression of the skill premium.

In columns (2) and (3) we divide the sample between workers in Public Administration and Defence and workers in all other sectors. According to the model, the income gap should be greater in *both* the public and private sector in the lean equilibrium, once we have controlled for characteristics of the labour markets that would affect the level of income for skilled and unskilled workers (the city fixed effect accounts for features such as the productivity of the private sector, A, or the bureaucrats wages, B). Columns (2) and (3) show similar results to those obtained in column (1): for both the public and the private sector, the skill income gap is greater in labour markets that show the characteristics that the model associates with a lean public sector equilibrium.

We next try using a continuous measure of public employment at the city level. Admittedly, this variable captures a feature that does not necessarily predict the type of equilibrium. However, if we assume that the number of skilled positions is similar across provinces, it could well proxy for the degree of bloating of the public sector. In column (4) we interact household head's education with the measure of public employment in the city and we find that the skill premium decreases with the size of public employment in the city. Columns (5) and (6) show that this phenomenon is again present for both the public and the private sector.

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 for both the private and the public sector when using a broader definition of public sector that includes other industries such as health and education. Similarly, results in columns (4) to (6) hold when using another continuous variable that might capture better the degree public sector oversize, i.e. the proportion of unskilled workers in the public sector.

In brief, this section has shown that the premium skilled workers get paid over the unskilled is squeezed in cities where the public sector hires extensively, especially among the unskilled labour force. Most notably, and consistent with the idea of a unique labour market for blue collar workers, this result is observed both in the public and the private sectors. Together with evidence in the previous section, we interpret this as evidence of the existence of a labour market mechanism across Argentine provinces through which public sector employment practices affect private sector development.

6 Conclusion

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 over-sized public sector, bloated with unskilled workers. The model shows that 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 over-sized public sector pushes up the wage of unskilled workers above the level that would prevail under an efficiently-run public sector, which squeezes entrepreneurial profits and deters potential entrepreneurs from allocating their skills in the private sector. In that regard, even if the delivery of public services does not suffer in quantity or quality, excessive employment in the public sector can prevent the development of economic activity.

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.

The specific type of equilibrium economies find themselves in depends to a large extent on the parametric configuration of the model. Since many of these parameters somehow reflect institutional features, an alternative way to read this result is that economies can aspire at reaching higher levels of public sector efficiency and private sector development if they manage to implement changes that would avert the public sector drawing an excessive amount of human resources.

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 public bureaucrats less (and not more), so as to resort to the sense of mission of certain agents while keeping self-interested agents away[29]. An important caveat, not addressed in this paper, is that of public sector capabilities: such a policy would only work if the payment gap is not too low to put off motivated people with a minimum level of ability needed to provide public services of a certain standard. Similarly, this might not be possible if the electorate vote for a

[29] 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.

policy of high wages in the public sector.

Another set of policy implications could be related to the organisation of the public sector. For example, by imposing employment standards in the public sector or improving their control and enforcement (in the model, represented by the probability of being caught and its penalty). Alternatively, many times countries have a bloated set of institutions, where competences and functions overlap. Addressing this, the number of bureaucratic posts available (b in our model), might reduce the scope for rent-seeking behaviour to substantially affect the labour market equilibrium. In any case, by promoting policies attracting the right type and quantity of people or reducing the scope for opportunistic behaviour, the economy can avoid falling into a rent-seeking trap.

Appendix

Lemma 4 *Suppose Assumptions 1, 2, 3 and 5 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 the public sector expenditures. Hence:*

$$\frac{w^{**}}{2} - T^{**} > \frac{w^*}{2} - T^*. \tag{19}$$

Proof. Individual taxes must equal the summation of the wages of all the public workers and salaries of all bureaucrats, divided by the total mass of individuals in the economy. Hence, by using (6) and (7), we can write:

$$T^* = \frac{b(w^* + B)}{1 + L}, \tag{20}$$

$$T^{**} = \frac{b[(2-\mu)w^{**} + B]}{1 + L}. \tag{21}$$

As a result, plugging the RHS of (20) and (21) into (19), and recalling that $w^* = A(2-L)/[2(1-b)]$ and $w^{**} = A[2 - L + 2b(1-\mu)]/[2(1-b)]$, we may obtain:

$$w^* - T^* = \frac{(2-L)(1+L-2b)}{4(1-b)(1+L)}A - \frac{bB}{1+L}, \tag{22}$$

$$w^{**} - T^{**} = \frac{[2-L+2b(1-\mu)][1+L-2b(2-\mu)]}{4(1-b)(1+L)}A - \frac{bB}{1+L}. \tag{23}$$

From (22) and (23), it then follows that $w^{**}/2 - T^{**} > w^*/2 - T^*$ if and only if:

$$[2-L+2b(1-\mu)][1+L-2b(2-\mu)] > (2-L)(1+L-2b).$$

After some algebra, this inequality leads to $2L > 1 + 2b\,(2-\mu)$, which turns out to be always satisfied for any combination of: $(L,\mu) \in (1,2) \times [b,1)$ and b satisfying Assumption 5. ■

Proof of Lemma 1. Let's first start by proving that $\widehat{B} < \underline{B}(\mu)$.
Lemma. $\frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda} \geq \frac{1}{2}A \;\Rightarrow\; \underline{B}(\mu) > \widehat{B}$.
Proof. From (13) and (16), we can write:

$$\underline{B}(\mu) - \widehat{B} = \frac{A}{8}\frac{1}{(1-b)^2}\Phi(L,\mu,b) + \left[\frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda}\right],$$

where $\Phi(L,\mu,b) \equiv 12b^2 - 16b^2\mu + 4\mu^2b^2 - 4bL(1-\mu)$. Since $(1+\delta\phi)/2 - (1+\lambda)^{-1} \geq \frac{1}{2}A$, it suffices to prove that $\Phi(L,\mu,b) + 4(1-b)^2 > 0$. Next, by noting that for $\partial\Phi/\partial L < 0$, if then suffices to prove that it holds for $L = 2$, that is:

$$12b^2 - 16b^2\mu + 4\mu^2b^2 - 8b(1-\mu) + 4(1-b)^2 > 0 \tag{24}$$

Finally, noting that, for any $\mu \in [b,1]$, the LHS of (24) is strictly increasing in μ, it then suffices to prove that it holds for $\mu = b$; that is: $12b^2 - 16b^3 + 4b^4 - 8b(1-b) + 4(1-b)^2 > 0$, which simplifies to $(1-b)^4 > 0$, completing the proof. ‖

It then follows that if $\widehat{B} \leq B < \underline{B}(\mu)$, there exists a unique political economy general equilibrium, and in that equilibrium only PSM agents apply for the bureaucratic jobs and the equilibrium wage equals w^*. Furthermore, since $\widehat{B}$ solves $\Pi(w^*) = B - (1+\lambda)^{-1}$ for B, then for any $B < \widehat{B}$, PSM agents strictly prefer entrepreneurship to state bureaucracy, implying it does not exist a political economy general equilibrium in which $B < \widehat{B}$. ■

Proof of Proposition 2. Let $V(B)$ denote the indirect utility received by the unskilled agents in a political economy general equilibrium where the bureaucrats salary equals B. Then, since $\widehat{B}$ ($\overline{B}$) leads to a unique equilibrium wage w^* (w^{**}), using (22) and (23), we may write:

$$\begin{aligned} V(\overline{B}) &= \frac{[2-L+2b(1-\mu)]\,[1+L-2b(2-\mu)]}{4(1-b)(1+L)}A - \frac{b\overline{B}}{1+L}, \\ V(\widehat{B}) &= \frac{(2-L)(1+L-2b)}{4(1-b)(1+L)}A - \frac{b\widehat{B}}{1+L}. \end{aligned}$$

From those two expressions, it follows that:

$$V(\overline{B}) > V(\widehat{B}) \;\Leftrightarrow\; \frac{[2L-2b(2-\mu)-1](1-\mu)}{2(1-b)}A > \overline{B} - \widehat{B}. \tag{25}$$

Then, using the expressions in (12) and (16), we can see that $\overline{B} - \widehat{B} = \frac{1}{2}(1+\delta\phi) - \frac{1}{1+\lambda}$, from which the condition in (17) immediately obtains.

Now, denote the LHS in (17) as $\Psi(L,\mu,b) : (1,2) \times [b,1) \times \left(0,\overline{b}\right) \to \mathbb{R}^+$, where $\overline{b} \equiv 1 - \sqrt{\frac{1}{2}}$. Notice, first, that $\Psi(\cdot)$ is strictly increasing in L, hence in a global maximum $L \to 2$. Second, notice that $\Psi(2,\mu,b) = [4 - 2b(2-\mu) - 1](1-\mu)/2(1-b)$, which is strictly decreasing in $\mu \in [b,1)$, hence in a global maximum it must be that $\mu = b$. Finally, observing that $\Psi(2,b,b) = [4 - 2b(2-b) - 1]/2$ is strictly decreasing in $b \in \left(0,\overline{b}\right)$, it follows that $\Psi(L,\mu,b)$ reaches a global maximum when $L \to 2$, $\mu = b$ and $b \to 0$, in which case $\Psi(L,\mu,b) \to 3A/2$. ■

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	(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			
	(2.72)***	(1.81)*	(2.61)**	(1.91)*	(3.46)***			
Log Public Sector Employment (% of total)			0.147	0.190	0.127	0.148	0.163	0.178
			(3.02)***	(3.50)***	(2.16)**	(3.12)***	(3.42)***	(3.61)***
Log Skilled Workers in the Economy (% of total)				-0.205	-0.311	-0.308	-0.316	-0.308
				(2.84)***	(4.56)***	(4.55)***	(4.50)***	(4.28)***
Log GDP pc					0.189	0.151	0.156	0.115
					(2.89)***	(2.89)***	(2.85)***	(2.06)**
Control of Corruption						-0.153		
						(3.27)***		
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	62	62	62
R-squared	0.11	0.36	0.44	0.51	0.57	0.59	0.58	0.57

Robust absolute 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. All data are averaged for the period 2002-2006.

Table 1: Quality and composition of the public sector across countries

	(1)	(2)	(3)	(4)
	Log Income per capita			
	Italy	Spain	US	Brazil
Log Public Sector Employment (% of total)	-0.92 (6.65)***	-0.61 (3.52)***	-0.36 (2.95)***	-0.79 (2.97)***
Number of Regions	20	17	48	26
Year	1996	2004	1990	1991
R-squared	0.67	0.45	0.16	0.27

Robust absolute t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. US data does not include Alaska, Hawaii or Washington DC; Brazil data does not include Brasilia.

Table 2: Public Sector Employment and Income per capita using regional variation

	(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: Characterisation of labour markets in Argentinian provinces' capital cities.

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Income					
Tertiary Education	0.106	0.252	0.077	0.338	0.591	0.291
	(2.19)**	(4.95)***	(1.61)*	(5.68)***	(8.35)***	(4.46)***
Tertiary Education * Lean Equilibrium Group	0.150	0.216	0.141			
	(2.69)***	(3.81)***	(2.49)**			
Tertiary Education * Bloated Equilibrium Group	0.053	0.006	0.069			
	(0.93)	(0.09)	(1.18)			
Tertiary Education * City Public Employment (%)				-0.11	-0.17	-0.10
				(3.06)***	(3.60)***	(2.59)***
Sample	All	Public Administration	All Other Sectors	All	Public Administration	All Other Sectors
Observations	12502	2191	10311	12502	2191	10311
R-squared	0.45	0.46	0.45	0.45	0.46	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. "City Public Employment" is the capital city proportion of 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.