Excessive Public Employment and Rent-Seeking Traps*

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Abstract

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

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

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1 Introduction

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

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

We focus on one particular aspect regarding the quality of bureaucrats that has attracted growing interest over the past few years, namely whether or not they exhibit the appropriate ethics or motivation for their jobs.[3] Commonplace in this literature is the presumption that monetary payoffs are not the only type of reward that individuals pursue and the idea that pro-social behaviour cannot be perfectly monitored by monetary incentives. In such a context, it proves desirable that bureaucrats display a sense of mission and commitment towards the society they must serve. Such a sense of social mission has long been explored by the public administration literature, which refers to it as *public service motivation*, and a large number of survey-based studies provide evidence of its relevance in explaining the efficiency of public offices.[4]

In Sections 3 and 4, we propose an occupational choice model with heterogeneous agents and two different sectors: the *public sector* managed by bureaucrats and the *private sector*

[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 Francois (2000), Murdock (2002), Besley and Ghatak (2005), Benabou and Tirole (2006), Prendergast (2007), Macchiavello (2008), Delfgaauw and Dur (2008, 2010), Ghatak and Mueller (2011), Bond and Glode (2011).

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

managed by entrepreneurs. There are two dimensions of heterogeneity among individuals. The first is the level of skills, which is assumed to be publicly observable (e.g. education). Only highly skilled individuals may become entrepreneurs or may be appointed state bureaucrats. The second source of heterogeneity is the individuals' intrinsic public service motivation, which is assumed to be private information. The advantage of filling the state bureaucracy with public service motivated agents is that they are less inclined to rent seek.

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

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

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

Bureaucratic rent seeking is clearly inefficient in our model. A crucial question that arises is then whether individuals may put in place an institutional setup that precludes such rent

seeking. At the end of Section 5 we argue against this possibility. In particular, we show that oversized public sectors may actually find the support of the unskilled fraction of the society. The reason for this is that unskilled workers *indirectly* benefit from bureaucratic rent seeking by seeing their (equilibrium) market wages inflated as a result of public sector overmanning.

Our paper offers a novel theory for the joint determination of the size, skill composition and efficiency of the public sector, together with the level of entrepreneurship, within a general equilibrium model. The model also provides us with a set of predictions that we are able to confront empirically (Section 6). One of these is that when the public sector becomes an attractive option for rent-seeking agents its composition would tilt towards a greater share of unskilled workers. Using cross country variation of measures of public sector performance and skills in the public sector, we show that the predicted correlation between governance quality and skill composition holds, even when controlling for country and regional characteristics. Another important result is that, by expanding the demand of unskilled workers (which raises their wages), the public sector may end up crowding out the private sector. We provide evidence of income per head being negatively correlated with public employment and positively correlated to the skill composition in the public sector by looking at regional data from Argentina. Finally, the model predicts that a bloated public sector will inflate blue collar wages. Using an Argentinean household survey, we show that the skill premium is indeed larger in cities that show features associated with an equilibrium where the public sector is lean and efficiently run.

In a related paper, Macchiavello (2008) also studies the possibility of multiple equilibria in an occupational choice model with public service motivated agents, but looks at a public sector whose size and educational composition is exogenously fixed, hence our setup allows us to deliver richer associations between public employment, rent seeking and aggregate income. Moreover, the key mechanism in our model, namely the wage distortion in the unskilled labour market, is also a novelty. In that regard, our model highlights the importance of accounting for skills (or educational) differences, since the wage distortion becomes a crucial feature in explaining the following two phenomena: *i*) why a bloated public sector may adversely affect profits and entrepreneurship; *ii*) why a fraction of the society (the working class) may be willing to support rent-seeking bureaucrats who sustain a large and inefficient state apparatus. The latter point above contributes 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 (2011)], by suggesting an additional channel that could generate political support for institutions that depress aggregate productivity. More recently, an interesting political economy mechanism complementary to our story has been proposed by Aney et al. (2011) within an occupational choice framework with credit market

frictions. Their model leads to a class structure that distorts institutions, by removing incentives to vote for surplus-maximising policies.

Our paper also relates to the growing literature on the quality of bureaucrats and politicians, e.g. Besley (2004), Caselli and Morelli (2004), Messner and Polborn (2004), Mattozi and Merlo (2008), Bond (2008). A key aspect of all this literature is that it studies the process of self-selection into bureaucratic and political jobs within a partial equilibrium approach: in particular, it assumes that the returns in the private sector are exogenous and remain unaffected by who end up in the public sector. By contrast, in our model, the interplay between self-selection into public bureaucracy and the returns to private entrepreneurship lies at the heart of our theory and its main predictions.

Finally, occupational choice models in the development literature have so far mostly studied the long-run consequences of financial markets imperfections.[5] As in Aney et al. (2011), Ghatak, Morelli and Sjöström (2007) have focused on how financial markets imperfections may interact with the inability of markets to allocate agents to the occupations for which they are comparatively most suited. Our paper sheds light on how imperfections in the sorting of bureaucrats may also result in market distortions which preclude full development of the entrepreneurial sector, even in the absence of credit market imperfections.[6]

2 Public Sector Overmanning and Rent Seeking: a brief preliminary discussion

Anecdotal evidence of public sector overmanning in underdeveloped regions is overwhelming [see, for example, Heller and Tait (1983), Gelb, Knight and Sabot (1991), Kikeri (1998)].[7] Interestingly, this phenomenon can also be found in poorer regions of developed economies with large degrees of cross-regional inequality. For example, Alesina, Danninger and Rostagno

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

[6] Other exceptions (besides the aforementioned article by Macchiavello) are Murphy, Shleifer and Vishny (1991) and Acemoglu and Verdier (1998, 2000). The first studies how the choice between entrepreneurship and rent-seeking activities by the most talented individuals determines technical change and growth. The second focuses on the effects of property rights enforcement in a context of entrepreneurial opportunistic behaviour. The third deals with optimal bureaucratic intervention when the central (benevolent) government is confronted with both market failures and potential bureaucratic corruption.

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

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

Table 1: Public Sector Employment and Income per capita - Regional Variation

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

Robust absolute t-statistics in parenthesis. * significant at 10%, ** significant at 5% and *** significant at 1%. Regressions exclude regions that consist only (or mainly) on the capital city, i.e. Lazio (Italy), Madrid (Spain), DC (US - Hawaii and Alaska are also excluded), Brasilia (Brazil), Stockholm (Sweden) and Copenhagen (Denmark).

(2001) report huge differences in size and productivity of postal offices across Italian regions: while in the relatively richer North 179 postal workers are needed to deliver 100,000 units of correspondence, the number rises to 566 in the Centre, and to 1,783 in the relatively poorer South.[8]

The link between regional inequality, public employment and development goes beyond pure anecdotal evidence. Table 1 reports some correlations between public employment and income per capita. We look at three developed economies (Italy, Spain and US) which exhibit the largest degree of regional inequality among the 11 industrialised economies reported in Barro and Sala-i-Martin (1995). We also look at Brazil, a federal developing country with high regional inequality. Table 1 shows that the public sector is consistently larger in poorer regions for these four economies.[9] In fact, these correlations uncover significant differences in public sector employment across regions within those countries with greater inter-regional inequality. The public employment shares in Italy (in 1996), vary from 10.8% in Lombardy (the second richest region in that year) to 23.6% in Calabria (the poorest region in that year). Similarly, in Spain (in 2004) public employment reaches 32.3% Extremedura (the poorest region in that year), while the share is around 14%-15% in richer regions like Basque Country and Catalonia. Even stronger differences are present in Brazil (in 1991), where some of the poorer states in the north like Rio Grande do Norte and Piaui exhibit public employment shares of 40%, while in Sao Paulo this share is 15%.

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

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

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

Another important feature in our theory is the notion that an oversized public sector is somehow a symptom of underlying bureaucratic opportunistic behaviour. One of the first studies to propose a theoretical link between rent seeking and the size of the public sector is Niskanen (1971), which describes bureaucrats as self-interested agents whose objective is increasing the size of the budgets they manage as much as possible. In our model, such self-interested attitude by a fraction of the society leads to expanding public employment well beyond the level required to efficiently produce the public goods demanded by the society. A similar view is present in Gelb et al. (1991) who maintain that public employment is usually seen in less developed economies as a rent-extraction device rather than as an input to produce public goods.[10] As mentioned before, a number of different motives, such as featherbedding, nepotism, or clientelistic practices, may all lead state bureaucrats to use public employment as a channel to generate and extract rents. A good summary of these issues is provided by Geddes (1994, page 27) with reference to Latin America:

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

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

Some preliminary evidence on the link between public employment and institutional quality is presented below by looking at a cross section of European regions in 2009. We obtained the public employment data from the European Commission (2010) and standardised measures of perception of quality of government from Charron et al. (2011). In particular, we use measures of control of corruption and impartiality in law enforcement, health and education that are increasing with quality. In addition, we control for country fixed effects to capture country level differences.

In columns (1) and (4) in Table 2 we fail to find a significant correlation between public sector employment and institutional quality (if anything, the point estimate is positive). However, in the remaining columns we combine the regional-level data on corruption with the country-level Corruption Perception Index (CPI) taken from Transparency International. By using the CPI, we split the set of 18 European countries into two separate subsets according to their value of perceived corruption at the country level. In particular, we create a country-level dummy variable denoted as "Rent-Seeking", which equals one for countries with worse performance.[11] In this way, when we look at countries with poor institutional quality (i.e. those for which the variable "Rent Seeking" equals one), we can immediately observe that higher regional public employment is associated more corruption. However, in the best performing countries the opposite happens: regions with bigger public sectors are perceived as having better and fairer institutions.[12] These results suggest the model we present below is actually not a general model of the size and efficiency of public sector that may be applied without any further considerations. In particular, our model should be seen as one that applies to institutionally weak economies, which are then not immune to pervasive bureaucratic corruption. It is exactly in those economies with weaker institutions that we may expect bureaucrats to abuse their power, and oversize the public sector in order to generate and extracts rents, as seems to be reflected by the correlations presented in columns (2), (3), (5) and (6) of Table 2.

[11] More precisely, "Rent-Seeking" is a dummy equal to 1 for countries with a score lower than 7 in the 2006 Corruption Perception Index (Bulgaria, Czech R., Greece, Hungary, Italy, Poland, Portugal, Romania, Spain and Slovakia) and 0, otherwise (Austria, Belgium, Denmark, France, Germany, Netherlands, Sweden, UK). Results do not change qualitatively if we group countries according the median score for the CPI or the median GDP per capita, or if we use other measures of institutional quality.

[12] This opposing sign is what actually explains the lack of a significant correlation in columns (1) and (4).

Table 2: Public Sector Employment and Institutional Quality - Regional Variation

	(1)	(2)	(3)	(4)	(5)	(6)
	Control of Corruption			Impartiality		
Public Sector Employment (%)	1.26	4.00	4.13	1.75	4.06	4.64
	(0.98)	(8.09)***	(5.13)***	(1.43)	(6.81)***	(5.31)***
Public Sector Employment * Rent-Seeking		-6.45	-8.74		-5.60	-8.83
		(2.81)***	(2.58)***		(2.93)***	(4.34)***
Countries (Fixed Effects)	18	18	18	18	18	18
Number of Observations	172	172	172	172	172	172
Regional Controls	Yes	No	Yes	Yes	No	Yes
R-squared	0.87	0.87	0.89	0.86	0.86	0.87

Robust absolute t-statistics in parenthesis. * significant at 10%, ** significant at 5% and *** significant at 1%. Data is for 2009. All regressions use country fixed effects. Control variables are log population, log area, and indicator variables for capital cities, autonomous and bilingual regions. "Rent-Seeking" is a dummy equal to 1 for countries with a score lower than 7 in the 2006 Corruption Perception Index (Bulgaria, Czech R., Greece, Hungary, Italy, Poland, Portugal, Romania, Spain and Slovakia) and 0, otherwise (Austria, Belgium, Denmark, France, Germany, Netherlands, Sweden, UK). "Control of Corruption" and "Impartiality" are measures of perception of corruption and favoritism, respectively, in the provision of law enforcement, health and education. Increasing values reflect lower corruption and more impartiality. More details in Charron et al. (2011).

3 Setup of the Model

3.1 Environment

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

3.1.1 The Private Sector

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

A firm owned by a skilled agent produces output (the private good) according to the following

production function, where l denotes the amount of labour employed by the entrepreneur:[13]

$$y(l) = A\, l^{\alpha}, \quad \text{where } 0 < \alpha \leq \tfrac{1}{2}. \tag{1}$$

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):

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

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

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

3.1.2 The Public Sector

The public sector is composed by a continuum of public offices with mass $b \in (0,1)$. Each office is managed by a bureaucrat. Bureaucrats are appointed by the central administration with the mandate to ensure that *one* unit of the public good is produced in their offices. Bureaucrats receive a fixed salary $B > 0$ provided they fulfil their mandate; otherwise they receive no payment. Only skilled agents may be appointed bureaucrats. Once an individual accepts a bureaucratic job, he cannot resign.

Bureaucrats organise the production of public goods in each office; without them public offices cannot produce any public goods. In addition, bureaucrats decide the number of unskilled workers to hire for their offices. Throughout the paper, we assume that the entire public sector is fully financed by lump-sum taxes collected by the central administration and distributed among the public offices according to their needs.

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

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

[13]Setting the upper-bound at $\alpha = 0.5$, rather than the usual restriction $\alpha \in (0,1)$, allows an easier (and speedier) exposition of our main results. However, we should stress here that relatively low values of α are instrumental for our proposed wage mechanism, so some of our results will not straightforwardly extend to cases in which α is sufficiently close to 1 (see footnote to Proposition 2 later on). Intuitively, a smaller α implies a less elastic labour demand function, which in turn means a stronger response by equilibrium wages to a bloating public sector.

where $e_i = \{0, 1\}$ is the level of bureaucratic effort and n_i equals the amount of labour hired by office i. Bureaucratic effort is publicly unobservable. The variable θ_i is an idiosyncratic office-productivity shock that can take two possible values, namely: $\theta_i = \{1, 2\}$, 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 $\widetilde{\theta}_i = \{1, 2\}$ to the central administration in order to ask for the needed funds to meet the production target $g_i(\cdot) = 1$.

Bureaucrats may try to lie to the central administration: they may wish to announce $\widetilde{\theta}_i = 1$ when actually $\theta_i = 2$, so as to receive funds to hire $n_i = 1$ while putting $e_i = 0$. For that reason, we assume that the central administration will audit offices for which $\widetilde{\theta}_i = 1$. In order not to be caught misrepresenting θ_i, a bureaucrat has got to spend some (unproductive) effort to hide his misdeeds. In particular, we suppose that if a bureaucrat spends an amount of (unproductive) effort ε_i, he will be able to avoid being caught understating the actual θ_i with probability $3\varepsilon_i$. Finally, we assume that if auditors find out that $\theta_i = 2$ after an announcement $\widetilde{\theta}_i = 1$, they force the bureaucrat to set $e_i = 1$.

3.1.3 Preferences: Public Service Motivation

Skilled agents differ in terms of their level of public service motivation.[14] A fraction $\mu \in (0, 1)$ among those individuals are *public service motivated* agents (henceforth, PSM). The remainder, $1 - \mu$, are referred to as *profit-driven* agents (henceforth, PD). We assume agents' preferences (i.e., whether an agent is PSM or PD) are private information. In addition, henceforth, we assume that there exist enough PSM agents in the economy to (possibly) manage all the public offices; that is, we impose:

Assumption 1 $\mu \geq b$.

Bureaucrats derive utility from their income and disutility from the effort they exert at work. We assume that disutility of bureaucratic effort is decreasing in the degree of public mindedness. In particular, conditional on having met the production target, the (ex-post) payoff function of bureaucrat i is given by

$$U_i = B - \frac{3}{2}\left(\frac{e_i}{1+\lambda_i} + \varepsilon_i\right); \tag{5}$$

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

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

Remark 1 For completeness, payoff functions (3) and (5) should also include two additional terms: *(i)* a positive term capturing the utility derived from public goods consumption, *(ii)* a negative term equal to the lump-sum taxes paid by each individual. Since both *(i)* and *(ii)* will affect all agents equally, for the time being, there is no harm to our results by not explicitly including any of these two terms in the payoff functions, because neither *(i)* nor *(ii)* will have any impact on the optimal occupational choices of the individuals.[15]

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

Assumption 2 $\lambda > 2$.

As previously described, a bureaucrat may either end up managing an office with $\theta_i = 1$ or one with $\theta_i = 2$. A bureaucrat who runs an office where $\theta_i = 1$ will optimally announce $\widetilde{\theta}_i = 1$; otherwise he will fail to comply with the production target $g(\cdot) = 1$ and, consequently, lose his salary B. However, truth-telling is not guaranteed if a bureaucrat finds out that $\theta_i = 2$. In this case, the bureaucrat may wish to announce $\widetilde{\theta}_i = 1$, so as to give himself room to shirk with probability $3\varepsilon_i$, by spending ε_i units of (unproductive) effort to cover up his misdeeds. The following lemma states the optimal announcements and ε_i, by each type of bureaucrat.

Lemma 1
(i) PD bureaucrats always announce $\widetilde{\theta}_i = 1$*, setting* $\varepsilon_i = 1/3$ *when* $\theta_i = 2$*, and* $\varepsilon_i = 0$ *when* $\theta_i = 1$.
(ii) If Assumption 2 holds, PSM bureaucrats always announce $\widetilde{\theta}_i = \theta_i$*, setting always* $\varepsilon_i = 0$.

Proof. In Appendix. ■

The result in Lemma 1 is, admittedly, a mechanical implication of the parametric assumptions in (5) and Assumption 2. However, the essence of the lemma is somewhat more general: since PSM agents are more willing to exert bureaucratic effort, they are in general also less prone to cheat about θ_i so as to extract rents by overmanning their offices with unnecessary workers.

From the previous discussion and Lemma 1, 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

[15]Notice also that since bureaucrats are of measure zero, individual bureaucratic effort has no impact on the aggregate amount of public good, which is then seen as exogenous by each bureaucrat. For that reason, the only effect of effort on (5) is via the effort disutility, as explicitly stated therein.

type. In particular, a PSM bureaucrat will hire public workers according to:

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

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

$$n_{PD} = 1, \text{ always.} \tag{7}$$

PSM bureaucrats always exert effort $e_{PSM} = 1$, whereas PD bureaucrats put $e_{PD} = 1$ only if $\theta_i = 1$, setting instead $e_{PD} = 0$ when $\theta_i = 2$. By using these results and Lemma 1, we can write down the level of (expected) utility achieved by each type of bureaucrat:

$$U_{PSM} = B - \gamma, \tag{8}$$

where $\gamma \equiv 3/\left[2\left(1+\lambda\right)\right]$, and

$$U_{PD} = B - 1. \tag{9}$$

Notice that Assumption 2 implies $\gamma < 1$, hence $U_{PSM} > U_{PD}$.

3.2 Timing of the Events

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

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

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

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

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

5. **Announcements, assignment of public funds, and labour market transactions:** Each bureaucrat i observes $\theta_i \in \{1, 2\}$ and announces $\widetilde{\theta}_i \in \{1, 2\}$. The central administration audits offices announcing $\widetilde{\theta}_i = 1$ and, subsequently, distributes to each office the

required funds. Bureaucrats and entrepreneurs hire workers in the labour market. All remaining agents supply their unit-time labour endowment in the market.

6. **Production stage:** Production takes place and all payments are made.

4 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 a given bureaucratic salary B.

4.1 Optimal Occupational Choice

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

In order to facilitate the exposition, for the remainder of Section 4, we will often let $B > \widetilde{A}+1$, where $\widetilde{A} \equiv \alpha^{\alpha}(1-\alpha)^{1-\alpha} A$. This condition implies that there exists a wage threshold, $\widehat{w}$, where $0 < \widehat{w} < \widetilde{A}$, such that: if $w < \widehat{w}$, PD agents choose not to apply for a bureaucratic post since they are better off as private entrepreneurs; whereas, if $w \geq \widehat{w}$, these agents actually prefer a bureaucratic job to running a firm. In other words, $\widehat{w}$ is the wage level at which $\Pi(\widehat{w}) \equiv B-1$. Using (3), it is easy to observe that:

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

(Notice that if $B < \widetilde{A}+1$, PD agents would never choose bureaucracy as an occupation, switching from entrepreneurial activities to supplying unskilled labour when the market wage rises above $\widetilde{A}$.)

We can also define the threshold $\underline{w}$, such that when $w < \underline{w}$ entrepreneurial profits are also greater than $B-\gamma$, implying that not even PSM agents wish to apply to bureaucratic jobs. Namely:

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

Figure 1 plots the payoff functions of bureaucrats, entrepreneurs and workers, for a varying w, given Assumption 2 and $B > \widetilde{A}+1$. These payoff functions correspond to those elicited before in (3) for the entrepreneurs, (8) for PSM bureaucrats, and (9) for PD bureaucrats; the

w-line portrays the payoff of any agent in the economy who becomes a worker. From Figure 1, one can immediately pin down the optimal occupational choice of the skilled at each level of w.[16]

- For all $0 \leq w < \underline{w}$: No agent applies for a bureaucratic post. All skilled agents in the economy become entrepreneurs.
- For all $\underline{w} \leq w < \widehat{w}$: Only PSM agents apply for a bureaucratic post. All the skilled agents that did not apply or get a bureaucratic job become entrepreneurs.
- For all $\widehat{w} \leq w \leq \widetilde{A}$: Both PSM and PD agents apply for a bureaucratic post. If $\widehat{w} \leq w < \widetilde{A}$, all the skilled agents that did not get a bureaucratic job become entrepreneurs; if $w = \widetilde{A}$, they choose indifferently between becoming either entrepreneurs or workers.
- For all $\widetilde{A} < w \leq B - 1$: 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 $B - 1 < w \leq B - \gamma$: 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 $w > B - \gamma$: No agent applies for a bureaucratic post. Everyone becomes a worker.

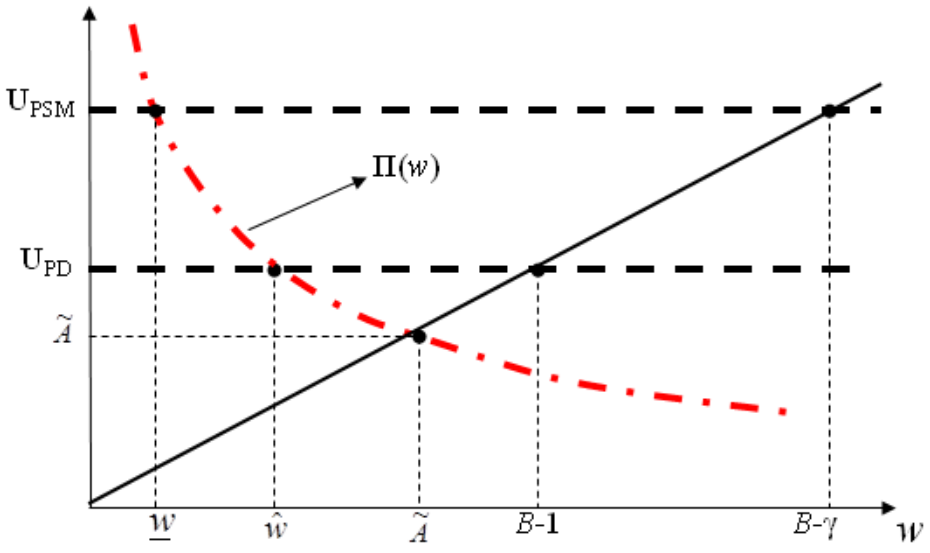

Figure 1: Payoff functions by different occupations

[16]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.

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

4.2 General Equilibrium Analysis

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

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

1. *All individuals choose their occupations optimally.*
2. *The labour market clears (i.e. the aggregate labour demand by the bureaucrats and the entrepreneurs must equal the sum of the labour endowments across all the remaining individuals).*
3. *All bureaucratic posts are filled.*

Condition 1 has been illustrated in the previous subsection. Condition 2 stipulates the labour market clearing condition. Condition 3 simply requires that, in equilibrium, there must be enough applicants to fill all bureaucratic positions in the public sector. Regarding this last condition, one additional remark applies: it will somehow restrict the range of values that B may possibly take (in particular, B cannot be too low, otherwise not even PSM agents will apply for bureaucratic jobs). In that respect, notice that Condition 3 implies neither $0 \leq w < \underline{w} = \alpha A^{\frac{1}{\alpha}} \left[(1-\alpha) / (B-\gamma)\right]^{\frac{1-\alpha}{\alpha}}$ nor $w > B - \gamma$ may hold in equilibrium, as they would both lead to a situation in which no one applies to bureaucratic jobs. For this reason, and to reduce algebraic expressions to a minimum without any loss of generality, henceforth we will carry on with our analysis letting $\underline{w} \leq w \leq B - \gamma$.

Our main focus here is on the interplay between the optimal occupational choice of the skilled and the equilibrium wage in the labour market. Bearing in mind results in Section 4.1, and using the equations (6) and (7), we can write down the analytical expressions for the

(aggregate) labour demand and labour supply functions, respectively:

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

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

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

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

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

$$\widehat{B} \equiv A\left(1-\alpha\right)\left(\frac{1-b/2}{1-b}\right)^{\alpha} + \gamma \leq B < A\left(1-\alpha\right)\left(\frac{1-b/2}{1-b}\right)^{\alpha} + 1 \equiv \overline{B}. \tag{14}$$

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

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

Proof. (i) An equilibrium in which only PSM agents apply for bureaucracy exists only if $L^D(w)$ crosses $L^S(w)$ at a wage strictly below $\widehat{w}$ and (weakly) above $\underline{w}$. This requires $(1-b)\left(\alpha A/\widehat{w}\right)^{\frac{1}{1-\alpha}} + b/2 < 1 \leq (1-b)\left(\alpha A/\underline{w}\right)^{\frac{1}{1-\alpha}} + b/2$, which using (10) and (11) leads to (14). Finally, we still need to prove that PSM agents prefer bureaucracy to supplying unskilled labour and entrepreneurial profits are larger than wages. Denoting by w^* the wage that solves $(1-b)\left(\alpha A/w^*\right)^{\frac{1}{1-\alpha}} + b/2 = 1$, we can observe that $\widehat{B} - \gamma > w^* = \alpha A\left[\left(1-b\right)/\left(1-b/2\right)\right]^{1-\alpha}$, hence $U_{PSM} > w^*$ for any $\widehat{B} \leq B < \overline{B}$; moreover, since $w^* < \widetilde{A}$, it follows that $w^* < \Pi(w^*)$.

(*ii*) First, notice from (12) and (13) that $L^D(\widetilde{A}) < L^S(\widetilde{A})$, hence in equilibrium $w < \widetilde{A}$. As a result, an equilibrium in which both PSM and PD agents apply for bureaucracy exists if $L^D(\widehat{w}) \geq 1$, which using the second line in (12) and (10) leads to (15). Finally, denoting by w^{**} the wage that solves $(1-b)\left(\alpha A/w^{**}\right)^{\frac{1}{1-\alpha}} + b\left(1-\mu/2\right) = 1$, we can observe $\underline{B}(\mu) - 1 > w^{**} = \alpha A\left[(1-b)/(b-b\mu/2)\right]^{1-\alpha}$, hence $U_{PD} > w^{**}$ for any $B \geq \underline{B}(\mu)$; moreover, since $w^{**} < \widetilde{A}$, then $w^{**} < \Pi(w^{**})$. ■

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

From (14) and (15), we can immediately observe that $\underline{B}(\mu) < \overline{B}$. However, nothing guarantees that $\underline{B}(\mu) > \widehat{B}$. In fact, none of our parametric restrictions imposed so far ensures that a unique equilibrium where *only* PSM agents apply for bureaucratic jobs actually exists. For $\underline{B}(\mu)$ to be greater than $\widehat{B}$, so that there exists a range of B low enough that it only attracts PSM agents to the state bureaucracy and is also consistent with a general equilibrium, PSM and PD agents must be sufficiently different in their preferences regarding bureaucratic jobs vis-a-vis entrepreneurial activities. It turns out that, for values of A which are not too large, there always exists a value of λ large enough (implying a value of γ sufficiently close to zero) such that $\underline{B}(\mu) > \widehat{B}$ holds:

Lemma 2 *If* $1-\gamma > A\left(1-\alpha\right)\Gamma$, *then* $\underline{B}(\mu) > \widehat{B}$, *where*

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

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

Proof. In Appendix. ■

Notice that since Γ in (16) is bounded above at $\overline{\Gamma}(\alpha) < 1$, then when A is not too large so that $A\left(1-\alpha\right)\overline{\Gamma}(\alpha) < 1$, there will always exist a λ large enough leading to $\underline{B}(\mu) > \widehat{B}$. The following corollary combines the previous results in Proposition 1 and Lemma 2, and describes

the different types of equilibria that may arise in the model. Figure 2 illustrates each of the three cases when the parametric condition $1-\gamma > A(1-\alpha)\Gamma$ actually holds.

Corollary 1 *If $1-\gamma > A(1-\alpha)\Gamma$, three different equilibrium cases are possible depending on B:*

(i) Lean public sector unique equilibrium: *If $\widehat{B} \leq B < \underline{B}(\mu)$, the equilibrium is unique. In the equilibrium, only PSM agents apply for (and obtain) bureaucratic jobs, the mass of unskilled public employees equals $b/2$, and the wage of unskilled workers is*

$$w^* = \alpha A \left(\frac{1-b}{1-b/2} \right)^{1-\alpha}. \tag{17}$$

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

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

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

If $1-\gamma > A(1-\alpha)\Gamma$, then $\underline{B}(\mu) \leq \widehat{B}$, and only cases (ii) and (iii) above are feasible.

Henceforth, for brevity, we will often refer to each of the two types of equilibria described above, respectively, as *lean equilibrium* and *bloated equilibrium*.[17]

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

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

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

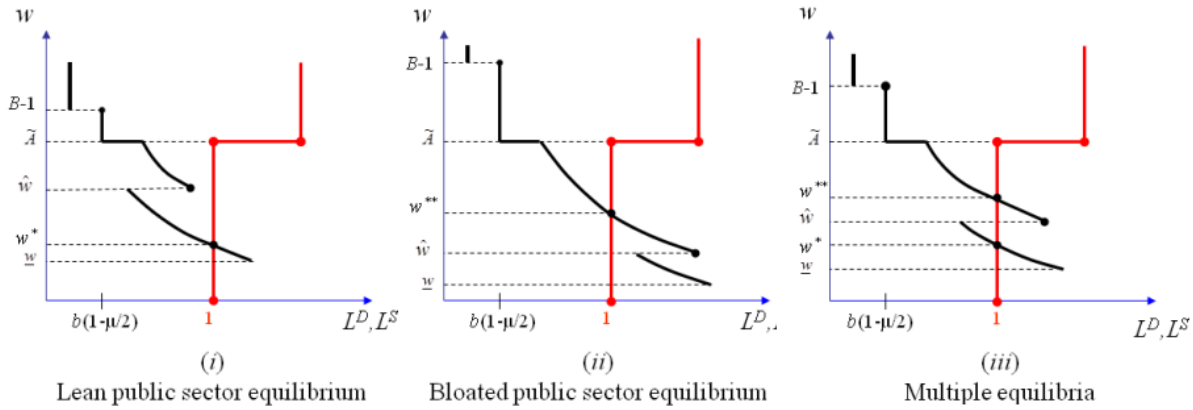

Figure 2: Labour Market Equilibria - three different cases

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.

Finally, notice that when $1-\gamma > A(1-\alpha)\Gamma$, the lean equilibrium does not exist as a unique equilibrium. This implies that in such cases the correct allocation of skills in the public sector cannot be ensured even if bureaucrats salaries were set sufficiently low, as a way to screen skilled agents with heterogeneous levels of public service motivation.[18]

5 Total Output and Welfare Analysis

In this section we compare, first, the level of aggregate output and, second, individuals' welfare, across the different types of equilibria that may arise in the model.

5.1 Aggregate Output

Let us first look at the case where multiple equilibria are feasible. How do the two equilibria in Figure 2 (*iii*) compare to one another in terms of aggregate output? Aggregate output in the

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

lean equilibrium (Y^*) is strictly larger than in the bloated equilibrium (Y^{**}). In equilibrium, total output is given by

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

where to obtain (19) we are using the expressions in (1) and (2). From (19), it immediately follows that the output gap, $Y^* - Y^{**}$, is strictly positive due to $w^* < w^{**}$. Also, it can be readily observed that the output gap is solely explained by lower private output in the bloated equilibrium, as aggregate public output equals, by construction, b in both equilibria. Yet, the underlying *cause* why $Y^* > Y^{**}$ actually rests on the public sector behaviour. More precisely, the output gap is a consequence of the inefficient allocation of skills in the state bureaucracy. Intuitively, PD bureaucrats tend to expand public employment (relative to PSM bureaucrats), which reduces the labour supply left available for other activities in the economy and thus (partly) crowds out the private sector. However, PD bureaucrats expand the size of the public sector workforce as a mean to extract rents from it; hence, although public employment is higher, public output remains constant, implying that aggregate output is smaller in an equilibrium with a fraction $(1-\mu)$ of PD bureaucrats than in one where all bureaucrats are PSM.

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

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

Corollary 2 then states that, given a specific parametric configuration of the economy, aggregate output is always larger in an equilibrium without rent-seeking bureaucrats (where it equals Y^*) than in one where a certain fraction of the bureaucrats take opportunity of the public sector to extract rents (where it equals Y^{**}).[19]

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

5.2 Welfare Analysis

Let us focus again first on the case in which multiple equilibria are feasible – i.e., Figure 2 (*iii*). Although under multiple equilibria output is higher in the lean equilibrium, it turns out that this equilibrium does not Pareto dominate the bloated one. As a consequence, an aggregate welfare assessment would require postulating some specific social welfare function. This actually goes beyond the scope of this paper. However, with the model as it stands, welfare comparisons *within* groups of individuals are still feasible, and moreover they yield some further interesting insights.

Before proceeding to such analysis, one issue that we need to take properly into account now 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 $T^* < T^{**}$.[20]

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 bu-

avoid the inefficiencies brought about by the bloated equilibrium, the market wage in the poorer region should be lower than it actually is.

[20]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.

reaucrats. In that regard, in situations where multiple equilibria are feasible, if *all* PD agents could simultaneously coordinate to stay away from the public sector, they would all agree to do that, as it makes every one of them better off. (In addition, no PD agent will find any incentive to unilaterally deviate from the agreement, since $\Pi(w^*) > U_{PD}$.)

Unskilled agents. In this case the welfare comparison is less straightforward than before. On the one hand, the excessive labour demand resulting from PD bureaucrats rent-seeking behaviour drives up the 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. Proposition 2 shows that, given our parametric restrictions, for any bureaucratic salary $B \in \left(\underline{B}(\mu), \overline{B}\right)$ the former effect dominates the latter, hence: $w^{**} - T^{**} > w^* - T^*$.

Proposition 2 *Suppose Assumptions 1 and 2 hold and* $\underline{B}(\mu) < B < \overline{B}$*, implying that there exist two equilibria in the economy: one in which the wage equals* w^* *(the lean equilibrium), and one in which it equals* w^{**} *(the bloated equilibrium). Let* T *denote the amount of (lump-sum) taxes that each individual must pay in order to finance public sector expenditures. Then,* $w^{**} - T^{**} > w^* - T^*$ *holds for any* $b \in (0,1)$ *and any* $\alpha \in \left(0, \frac{1}{2}\right)$.[21]

Proof. *In Appendix.* ■

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

Given that Proposition 2 deals with the cases in which $\underline{B}(\mu) < B < \overline{B}$, we focus our attention now on the cases in which the equilibrium is unique. The following proposition stipulates conditions under which, even if a unique lean equilibrium exists in the economy (that

[21] We should stress here that the result $w^{**} - T^{**} > w^* - T^*$ will not hold for values of α sufficiently close to 1. The intuition for this lies in the link between α and the wage elasticity of (2): the larger the elasticity of labour demand by private entrepreneurs, the weaker the upwards pressure on wages caused by a bloating public sector (because a smaller increase in the wage is needed to restore the equilibrium in the labour market).

is, even when conditions in Lemma 2 hold and, thus, $\underline{B}(\mu) > \widehat{B}$), the unskilled may turn out to be better off in a unique bloated equilibrium with $B = \overline{B}$.

Proposition 3 *There exist thresholds* $\overline{b} \geq 2 - \sqrt{2} \simeq 0.586$ *and* $\overline{\alpha} > 0$*, such that when* $0 < b < \overline{b}$ *and* $0 < \alpha < \overline{\alpha}$*, there are feasible parametric configurations for which:* $\underline{B}(\mu) > \widehat{B}$*, hence a unique lean equilibrium exists when* $\widehat{B} \leq B < \underline{B}(\mu)$ *and, nonetheless, the utility obtained by the unskilled workers in a lean equilibrium with* $\widehat{B} \leq B < \underline{B}(\mu)$ *is smaller than the utility they obtain in the unique bloated equilibrium that arises when* $B = \overline{B}$*.*

Proof. *In Appendix.* ■

The unskilled may prefer a bloated public sector paying high bureaucratic salaries to a lean public sector with lower B when b is not too large and α is sufficiently small. Regarding b, notice that the cost per taxpayer of all bureaucratic salaries equals $bB/2$, thus a sufficiently large b turns the cost of inducing PD agents to apply to bureaucracy too high for the unskilled to be willing to bear it. Concerning α, the intuition is analogous to that in Proposition 2: the smaller α, the stronger upwards pressure on unskilled wages by a bloating public sector.

Both Proposition 2 and Proposition 3 deal with the unskilled workers welfare comparison across lean and bloated equilibria. In the former, we compare their utility for a given B within the range in which multiple equilibria are feasible. In the latter, we do so for different levels of B consistent with a unique equilibrium (either bloated or lean). Pinning down which of all possible cases is the most preferred one from the unskilled viewpoint would require modelling how expectations about aggregate behaviours are formed. This goes beyond the scope of the paper. Yet, it is straightforwad to note that, if for some $\underline{B}(\mu) \leq B < \overline{B}$ the probability assigned by the unskilled that PD agents will coordinate their actions on a bloated equilibrium is sufficiently high, then the unskilled workers expected utility will turn out be highest at such intermediate level of B.

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

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

6 Empirical Analysis

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

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

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

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

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

Prediction 1 is tested by exploiting cross country variation using internationally comparable measures of public sector performance and skills composition in the public sector. We provide evidence for Prediction 2a and 2b using data from Argentinian provinces where we test the relationship between level and composition of public employment and private sector activity. For Prediction 3, we also use the Argentinian provinces data, combined with data on incomes from a household survey representative at the city level. We use these data to test whether the skill premium is indeed larger in capital cities of provinces that show features associated with a lean equilibrium, as described by the model.

6.1 Quality and composition of the public sector across countries

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

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

Table 3 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 nega-

Table 3: Quality and Composition of the Public Sector - Cross Country Evidence

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

Absolute values of Robust t-statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Corruption Perception Index (from Transparency International), Control of Corruption, Government Effectiveness and Regulatory Quality (from the World Bank) are indices whose value increase the better the perception of government performance. Unskilled labour is defined according to ISCO88 classification and includes clerks, service workers, machine operators, etc. (codes 4 to 9). Skilled correspond to codes 1 to 3 and includes managers, professionals and technicians. Public sector comprises public administration and defence. Regions include all continents and a category for industrialised countries. Column (6) instruments CPI with ethnic and religion fragmentation. The first stage F-test is 12.2. All data are averaged for the period 2002-2006.

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

In the following three columns we include progressively the above-mentioned country controls that might be suspected to be driving our results. We start, in column (3), by controlling for the overall size of the public sector (which is related to our parameter b in the model) and regional fixed effects. For example, it may be that the previous correlation is driven by the fact that some countries prefer larger public sectors and that the perception of performance and the share of unskilled is simply reflecting an issue of scale: beyond a certain point, large governments might only be able to further increase their services provision by hiring unskilled workers and, simultaneously, be more subject to managerial difficulties that reduce the performance score. Column (3) shows that the coefficient on size of the public sector is positive and significant,

i.e. that the public sector grows by hiring proportionally more unskilled workers. However, the correlation of interest remains significant and negative, suggesting that even when maintaining fixed the overall size of the public sector, its performance and proportion of unskilled remain negatively correlated, as predicted by the model.

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

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

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

6.2 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

Table 4: Public Sector Employment and Gross Product - Provinces in Argentina

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Gross Product per capita			FDI per capita		Gross Product per capita			FDI per capita	
Public Sector Employment (%)	-0.29	-0.88	-0.66	-0.91	-0.91					
	(0.70)	(2.61)**	(3.50)***	(2.17)**	(2.48)**					
Relative Skills (Public Sector)						0.16	1.07	0.80	1.93	1.53
						(0.35)	(3.28)***	(1.91)*	(3.53)***	(1.84)*
Government Expenditure (pc)		1.01	1.56	1.61	2.35		0.95	1.25	1.67	1.77
		(4.85)***	(7.45)***	(4.80)***	(6.11)***		(9.09)***	(6.04)***	(7.57)***	(5.32)***
Secondary Enrolment			-0.34		0.82			-0.51		0.64
			(0.68)		(0.84)			(0.85)		(0.56)
Roads (pc)			0.17		0.30			0.16		0.35
			(1.44)		(1.94)*			(1.06)		(1.70)
Population			0.43		0.68			0.27		0.35
			(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. "Relative Skills" is the ratio skilled-unskilled in the public sector, i.e. those with at least some tertiary or university studies.

is itself a variable that differs substantially across countries.[22] (In terms of our model, this is captured by the b, which may be thought of as a country-specific parameter.) For that reason we focus our attention in Argentina, a country with significant variation across provinces in terms of public sector size and income levels. We use data for four years over almost a decade (1995, 1998, 2000 and 2003) and look at two different measures of economic and private sector development, i.e. the log of product per capita and the log of foreign direct investment per capita (FDI). We also have data on public employment and its skill composition and on controls, that include government expenditure, secondary school enrolment, roads, and population.

Table 4 presents the results. Columns (1) to (5) look at the correlation between public sector employment and the indicators of development or private sector activity. In column (1) we find that provinces with larger public sector employment tend to be poorer, even though the correlation is not significantly different from 0. This could be explained by the presence of other mechanisms at play, that have different direction to the one we propose in our model and that average out the effects sought in the regression. For example, provinces with more natural resources tend to be richer and have bigger governments, as it happens in some southern provinces[23]. To control for this, we include the log of government expenditure per capita in

[22]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.

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

column (2) and we find, as expected, that government expenditure per capita increases with income per capita. Also note that the R-squared increases significantly. More importantly, the coefficient of public sector employment is still negative, becomes significant and greater in absolute magnitude. This result is in line with the model: if we compare two provinces with the same level of government expenditure, the province where the public sector employs relatively more workers tends to be poorer, since it is using more of their workers to create and extract rents.

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

In columns (3) and (5) we control for variables that might capture other features of the model. For example, population (that accounts for labour supply), secondary enrolment (controls for the stock of skills in the province) and roads (as a proxy for capital/productivity at the province level, measured by A in the model). In both cases, we find a negative and significant correlation between the measure of economic activity and public sector employment.

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

6.3 Public employment and skill premium in Argentinean urban households

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

In the model, a lean equilibrium is associated with a low share of public employment. Additionally, in such equilibrium, the public sector tends to display a higher ratio of skilled to unskilled employees. To characterise different provinces' labour markets, we first identify a labour market that seems to satisfy those two key features of a lean equilibrium. This sets a benchmark for what would be "reasonable" public sector employment in the Argentine context.

Table 5: Employment, by skills and sector - Córdoba and other capital cities

	Workers in Public Sector (%)			Skilled Workers per Sector (%)		
	Total	Unskilled	Skilled	Total	Private	Public
Córdoba	6.8	5.5	9.9	28.8	27.8	42.1
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.08)
Rest of	17.6	16.4	22.1	21.7	20.5	27.2
Capital Cities	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Difference	-10.8	-10.9	-12.2	7.1	7.3	14.9
	(0.02)***	(0.02)***	(0.03)***	(0.02)***	(0.02)***	(0.07)***

Robust standard errors in parentheses, clustered at the province level. * significant at 10%; ** significant at 5%; *** significant at 1%.

A good candidate seems to be the city of Córdoba, the second largest city after Buenos Aires and the capital city of the province of Córdoba. As shown in Table 5, among head of households that are employed, around 6.8% work in Córdoba's public sector. When broken down by skills, only 5.5% of heads of households with complete secondary school and 9.9% with further education are employed by the public sector in Córdoba. The average ratios for all other capital cities are 17.6%, 16.4% and 22%, respectively. The differences are statistically significant at 1% level. When looking at the average skills by sector, in Table 5, the public sector in Córdoba employs more than 42% of skilled workers. This contrasts sharply with the other capital cities' average of 27% skilled workers. The difference is significant even when taking away the difference between Córdoba's private sector and the rest of capital cities', in a difference in differences analysis that takes away province characteristics that affect private and public sector employment equally within a city, such as the pool of skilled workers available, and characteristics that affect differences in sectorial employment across all cities.

We set Córdoba as a benchmark and characterize the remaining capital cities using household level data. In particular, we run a regression of the form

$$P_{hc} = \sum_{c} \beta_c D_c + \delta \mathbf{X}_{hc} + \varepsilon_{hc}$$

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

Table 6: Labour Market characterisation - Capital cities

Public Sector Employment - Argentine 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			
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

percentage difference of a given city relative to Córdoba. All regressions use weights and cluster standard errors at the city level.

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

Finally, we also look at the composition of skills in the public sector, as the last feature to characterise the type of equilibrium across cities. The probability of being skilled in Córdoba among public sector workers differs little from low or medium public sector cities[25]. However, the high public employment cities show a substantially lower ratio of skilled to unskilled than Córdoba, most notably Santa Rosa (-14 percentage points lower ratio of skilled than Córdoba),

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

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

La Rioja (-15 pp), Formosa (-17 pp), Neuquén (-24 pp), Río Gallegos (-31 pp) and Tierra del Fuego (-35 pp).

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

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

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

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

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

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

Table 7: Skill Premium by type of equilibrium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log Income							
Tertiary Education	0.11 (2.19)***	0.08 (1.61)*	0.34 (5.68)***	0.29 (4.46)***				
Tertiary * Lean	0.15 (2.69)***	0.14 (2.49)**						
Tertiary * Bloated	0.05 (0.93)	0.07 (1.18)						
Tertiary * City Public Employment			-0.11 (3.06)***	-0.10 (2.59)***				
Boss or Manager					0.38 (3.03)***	0.27 (1.99)**	0.79 (8.18)***	0.65 (6.29)***
Boss * Lean					0.31 (2.15)**	0.31 (2.01)**		
Boss * Bloated					0.17 (1.06)	0.22 (1.35)		
Boss * City Public Employment							-0.18 (2.46)**	-0.15 (1.91)*
Sample	All	Private Sector	All	Private Sector	Private Sector	No self-employed	Private Sector Sector	No self-employed
Observations	12502	10311	12502	10311	10308	7149	10308	7149
R-squared	0.45	0.45	0.45	0.45	0.33	0.37	0.33	0.36

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 is a dummy equal to 1 for the cities of C´ordoba, San Luis, S. M. de Tucumán, Salta and Mendoza. Bloated 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. "Boss or Manager" is a dummy for private sector workers that report being boss or managers (other categories include self-employed and employees). 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.

column (1): for the private sector, the skill income gap is greater in labour markets that show the characteristics associated with a lean equilibrium.

We also try using a continuous measure of public employment at the city level. In column (3) we interact household head's education with the proportion of heads of household employed by the public sector at the city level, and we find that the skill premium decreases with the size of public employment. Column (4) shows that this phenomenon is also present for the private sector[27].

Lastly, in columns (5) to (8) we substitute the education variable for a dummy equal to 1 if the head of household declares being a boss or manager for workers in the private sector. We present the regression results both with and without including self-employed individuals. In all cases we find similar results: the skill/boss premium is greater in labour markets associated with lower public employment (either by using our "lean equilibrium" definition or by using the continuous measure of public employment in the interaction term).

In brief, this section has shown that the skill premium is squeezed in capital cities where the public sector hires extensively, a result consistent with the model's idea of a unique unskilled labour market, that when distorted lowers returns to private activity.

7 Concluding Discussion

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

An alternative argument to ours is that poorer regions exhibit higher public employment shares as the result of income transfers from richer regions, or simply because there is too little private activity in the first place and the public sector steps in as an employer of last resort. We do not intend to downplay any of these two arguments, which are certainly very relevant from an empirical viewpoint. In fact, we see our theory as complementary (rather than a competing one), shedding new insights concerning the interaction between the public and

[27]Results are very similar when using only the proportion of *unskilled* head of households working in the public sector. Also, results found in this section are not sensitive to constraining the definition of public sector to Public Administration and Defence. We obtain qualitatively similar effects when using a broader definition of public sector that includes other industries such as health and education.

entrepreneurial sectors. In that regard, some of the correlations presented in Section 6 would not straightforwardly follow from a simple model of cross-regional transfers. More precisely, it is not straightforward that the level of perceived corruption should correlate positively with the fraction of unskilled workers in the public sector, as revealed by Table 2; especially after controlling for level of income and stock of skills in the economy. In addition to that, if high public employment is mainly explained by the fact that there is no private sector to absorb an excess supply of unskilled labour, then it is not obvious this should compress the skill premium in regions with bloated public sectors, as suggested by Table 7.

Similarly, we have worked with a frictionless labor market that assumes away unemployment. Generally, (short-term) unemployment should be the result of some sort of frictions or stickiness in the labour market preventing an immediate adjustment of the wage to restore the market-clearing equilibrium. Note, however, that the effect of a public sector absorbing the (temporary) excess supply of labour may still bring about some similar implications as those in our benchmark model, by preventing the eventual downward adjustment of wages.

Our model also shows that a bloated public sector, although hurting aggregate output, may actually enjoy the support of unskilled workers who indirectly benefit from it in the form of higher wages. In that regard, the model may shed new light on one of the underlying reasons that have made several populist governments so successful in the past, despite being widely perceived as running inefficiently large and ineffective public sectors (see Geddes, 1994).

The above political economy argument is closely linked to the choice of taxes and transfers in the economy. In our model individuals are taxed on a lump-sum basis. This is an issue that deserves some further discussion: under such circumstances a Pareto-dominating institutional arrangement may exist relative to the bloated public sector equilibrium. In particular, one could set bureaucratic salaries low enough to induce only PSM agents become bureaucrats and, at the same time, make transfers to the unskilled workers to keep their total income equal to that prevailing in the bloated equilibrium. In principle, this would be feasible to a central planner, however, institutional constraints or lack of sufficient trust in political bodies may well turn such a scheme impossible to implement in reality.

Note, too, that the way we model taxation simplifies the exposition, but also (and more importantly) allows us to isolate the wage-distortion effect from other types of distortions working through taxation. Introducing more realistic taxes into the model (e.g, income taxes) would in general mean that a bloating public sector would place an additional distortion, on top of that of inflated wages, on entrepreneurial incentives. In that respect, our previous results would be somehow reinforced in the presence of taxes that are increasing in earnings. Nonetheless, our results may be still interpreted as somewhat more general than that. The public sector may well

be financing itself, at least temporarily, by sources other than current taxation: for example, they may use borrowing. In that case, entrepreneurs should not see their (current) profits being affected by a bloating a public sector through excessive taxation; however, they would still have to face higher market wages as the public sector absorbs labour supply.[28]

One important lesson is that the economy has got a lot to gain from improving the sorting mechanisms into different occupations, in particular when it relates to state bureaucracy. Contrary to a standard view in the public debate, improving sorting may sometimes require paying bureaucrats less (and not more), so as to resort to the sense of mission of certain agents while keeping self-interested agents away.[29] In any case, by promoting policies attracting the right people or reducing the scope for opportunistic behaviour, the economy can avoid falling into a rent-seeking trap.

Appendix

Proof of Lemma 1. Suppose a bureaucrat intends to announce $\widetilde{\theta}_i = 1$ when $\theta_i = 2$, so as to be able to set $e_i = 0$ with probability $3\varepsilon_i$. Then, the optimal level of ε_i is pinned down by solving:

$$\varepsilon_i^* \equiv \underset{0\leq\varepsilon_i\leq 1/3}{\arg\max} : E\left(U_i\right) = B - \frac{1}{2}\times\frac{3}{2}\frac{1}{1+\lambda_i} - \frac{1}{2}\times\frac{3}{2}\left[(1-3\varepsilon_i)\frac{1}{1+\lambda_i} + \varepsilon_i\right]. \tag{20}$$

Since (20) is linear in ε_i, the optimal level of ε_i can be found simply by checking the sign of $\partial E\left(U_i\right)/\partial\varepsilon_i$: if $\partial E\left(U_i\right)/\partial\varepsilon_i > 0$ then $\varepsilon_i^* = 1/3$, while if $\partial E\left(U_i\right)/\partial\varepsilon_i < 0$ then $\varepsilon_i^* = 0$. Noting that

$$sign\left\{\partial E\left(U_i\right)/\partial\varepsilon_i\right\} = sign\left\{3\left(1+\lambda_i\right)^{-1} - 1\right\},$$

then $\partial E\left(U_{PD}\right)/\partial\varepsilon_i > 0$ obtains, while Assumption 2 ensures $\partial E\left(U_{PD}\right)/\partial\varepsilon_i < 0$. ■

Proof of Lemma 2. Notice first that $\partial\Gamma/\partial\mu < 0$. Hence, $\Gamma(\cdot)$ reaches a maximum when $\mu = b$. Replacing $\mu = b$ into (16):

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

[28] Notice that even if entrepreneurs were not myopic, and take into account the future rise in taxation to pay for current public debt (Ricardian Equivalence), this would not be enough by itself to affect their current occupational choices – we need, in addition to that, a switching cost for occupations over the life cycle (or an important sunk cost for entrepreneurial activities), so that their current occupational choice is affected by future taxation as well.

[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.

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

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

A sufficient condition for (22) to hold is that: $1 - \frac{b}{2} < 2 - 2b + \frac{b^2}{2}$; which is necessarily true for any $b \in (0,1)$, since the function $\psi(b) = \frac{3}{2}b - \frac{b^2}{2}$ is strictly increasing within the interval $[0,1]$, with $\psi(1) = 1$. ■

Proof of Proposition 2. Using the results in Corollary 1, it follows that $w^{**} - T^{**} > w^* - T^*$ if and only if:

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

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

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

Notice that $\Phi'(\alpha) > 0$, since the expression within squared brackets is strictly smaller than 1. This, in turn, implies that we only need to prove that (24) holds for $\alpha = 0.5$. Setting $\alpha = 0.5$ into (24), leads to the following condition $\left[2 - b\,(1-\mu/2)\right]^2 (1 - b/2) > (2 - b/2)^2 \left[1 - b\,(1-\mu/2)\right]$,which after some simple, but tedious, algebra yields:

$$\left(1 - \frac{\mu}{2}\right)^2 \left(1 - \frac{b}{2}\right) > \frac{1}{4}\left[1 - b\left(1 - \frac{\mu}{2}\right)\right]. \tag{25}$$

Notice that (25) is always necessarily true, since $(1-\mu/2)^2 > 1/4$ for any $0 < \mu < 1$, and $b/2 < b\,(1-\mu/2)$ because $0 < \mu < 1$. ■

Proof of Proposition 3. First of all, note that any $\widehat{B} \leq B < \underline{B}(\mu)$ leads to a unique equilibrium with wage w^*. As consequence, since a larger B involves higher taxes, to prove the proposition it suffices to show that the utility of unskilled workers in the bloated equilibrium with $B = \overline{B}$ may be greater than their utility in the lean equilibrium with $B = \widehat{B}$. This occurs when the following condition holds:

$$w^{**}\left[2 - b(1-\mu/2)\right] - w^*\,(2 - b/2) > b(\overline{B} - \widehat{B}); \tag{26}$$

Using (26) we can observe that, when a unique lean equilibrium exists, the unskilled prefer

the bloated equilibrium with $\overline{B}$ rather than the lean equilibrium with $\widehat{B}$ when

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

In addition, a unique lean equilibrium exists –i.e. $\widehat{B}<B(\mu)$– if and only if $(1-\gamma)>\Gamma\left(1-\alpha\right)A$. Hence, using the expression for Γ in (16), it follows that configurations that lead a situation where the unskilled to prefer $\overline{B}$ over $\widehat{B}$ must necessarily satisfy the following condition

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

which after some algebra leads to the condition:

$$\begin{aligned}S(\alpha)\equiv\left(1-b/2\right)^{1-\alpha}&\left[\tfrac{\alpha}{1-\alpha}\tfrac{1-b}{b}\left(2-b+b\mu/2\right)+\left(1-b+b\mu/2\right)\right]\\&-\left(1-b+b\mu/2\right)^{1-\alpha}\left[\tfrac{\alpha}{1-\alpha}\tfrac{1-b}{b}\left(2-b/2\right)+\left(1-b/2\right)\right]>0.\end{aligned} \tag{28}$$

Letting $\alpha=0$ in (28), we can observe $S(0)=0$. Next, differentiate $S(\alpha)$, to obtain:

$$\begin{aligned}S'(\alpha)=&\left(1-\tfrac{b}{2}\right)^{1-\alpha}\tfrac{1-b}{b(1-\alpha)^2}\left(2-b+\tfrac{b\mu}{2}\right)-\ln\left(1-\tfrac{b}{2}\right)\left(1-\tfrac{b}{2}\right)^{1-\alpha}\left[\tfrac{\alpha}{1-\alpha}\tfrac{1-b}{b}\left(2-b+\tfrac{b\mu}{2}\right)+\left(1-b+\tfrac{b\mu}{2}\right)\right]\\&-\left(1-b+\tfrac{b\mu}{2}\right)^{1-\alpha}\tfrac{1-b}{b(1-\alpha)^2}\left(2-\tfrac{b}{2}\right)+\ln\left(1-b+\tfrac{b\mu}{2}\right)\left(1-b+\tfrac{b\mu}{2}\right)^{1-\alpha}\left[\tfrac{\alpha}{1-\alpha}\tfrac{1-b}{b}\left(2-\tfrac{b}{2}\right)+\left(1-\tfrac{b}{2}\right)\right].\end{aligned}$$

Let again $\alpha=0$, which simplifies the above expression to:

$$S'(0)=\frac{\left(1-b\right)\left(1-\mu\right)}{2}-\left(1-b+b\mu/2\right)\left(1-b/2\right)\ln\left[\frac{\left(1-b/2\right)}{\left(1-b+b\mu/2\right)}\right].$$

Now, denote $1+H\equiv\left(1-b/2\right)/\left(1-b+b\mu/2\right)$, which means that $H\equiv\left[\left(1-\mu\right)b/2\right]/\left(1-b+b\mu/2\right)$. In addition, by property of the natural logarithm, we have that $\ln(1+H)\leq H$; hence

$$S'(0)\geq 0.5\left(1-b\right)\left(1-\mu\right)-\left(1-b+b\mu/2\right)\left(1-b/2\right)H=0.5\left(1-\mu\right)\left(1-2b+b^2/2\right). \tag{29}$$

Lastly, notice that $\left(1-2b+b^2/2\right)\geq 0$ for any $b\leq 2-\sqrt{2}\simeq 0.586$. As a result, there exist $\overline{b}\geq 2-\sqrt{2}$, such that when $0<b<\overline{b}$, $S'(0)>0$ and thus, when $0<\alpha<\overline{\alpha}$ with $\overline{\alpha}>0$, we may find feasible parametric configurations such that (27) holds. ■

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