Jumping the queue: nepotism and public-sector pay*

Andri Chassamboulli — University of Cyprus[†]

Pedro Gomes — Birkbeck, University of London[‡], Universidad Carlos III de Madrid[§], Center For Macroeconomics

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Abstract

We set up a model with search and matching frictions to understand the effects of employment and wage policies, as well as nepotism in hiring in the public sector, on unemployment and rent seeking. Conditional on inefficiently high public-sector wages, more nepotism in public-sector hiring lowers the unemployment rate because it limits the size of queues for public-sector jobs. Wage and employment policies impose an endogenous constraint on the number of workers the government can hire through connections.

JEL Classification: E24; J31; J45; J64.

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[†]Department of Economics, University of Cyprus, CY-1678 Nicosia, Cyprus. Email: andricha@ucy.ac.cy.

[‡]Department of Economics, Mathematics and Statistics, Birkbeck, University of London, Malet Street, WC1E 7HX London, United Kingdom, E-mail: p.gomes@bbk.ac.uk.

[§]Department of Economics, Universidad Carlos III de Madrid, Calle Madrid 126, 28903 Getafe, Spain.

1 Introduction

Governments hire workers to produce public goods, but they do not face the same competitive forces as private firms. As a result, governments use their employment and wage policies to accomplish a multitude of goals: to attain budgetary targets (Gyourko and Tracy, 1989); to implement a macroeconomic stabilization policy (Keynes, 1936); to redistribute resources (Alesina et al., 2000); or to satisfy interest groups for electoral gains (Gelb et al., 1991). This paper builds on the observation that, in several countries, government hiring practices are sometimes based on nepotism.

We define nepotism as the restriction that some jobs in the public sector are reserved for a subset of workers that have political or personal connections. By having access to this subset of jobs, some workers can use their connections to "jump the queue" and find jobs in the public sector faster. One dimension that is common to all countries is political appointments. Whenever there is a change in government, there is a subsequent turnover of jobs. The report Government at a Glance by OECD (2017) highlights the cross-country differences in staff turnover following a change of government. In countries such as Germany and the UK, there is little turnover, mainly in advisory posts. In countries such as Greece and Spain, the turnover extends to layers of senior and middle management. A second dimension is the influence that politicians or civil servants use to hire friends or family members. Besides vast anecdotal evidence of such practices, it is also backed by survey evidence.[1] In Section 2 we analyse data from the *Quality of Government Survey* and the *European Quality of Government Index* and find that these practices are present in the public sector, more than in the private sector, and that they vary widely across European countries. In particular, they are more prevailing in countries where the public-private wage differential is larger.

Our objective is to study the interaction between public-sector policies, nepotism and unemployment. First, we want to understand the effects of nepotism in the public sector on unemployment. We find a silver lining to nepotistic hiring. Although it is inefficient and is absent in the first-best equilibrium, conditional on inefficiently high public-sector wages, more nepotism lowers the unemployment rate by shortening the queues for these jobs and increasing employment in the private sector. Second, we want to understand how employment and wage policies influence incentives to use political and personal connections to get a job. We show that nepotism only exists if public(-sector) wages are too high and

[1]The anecdotal evidence is particularly widespread in Southern European or developing countries, but not exclusively. The current US president hired his daughter and son-in-law, and a leading French presidential candidate was found to have put his wife, son and daughter employed on the public payroll. In Spain, the press exposed that in the "Tribunal de Cuentas", the institution in charge of invigilating economic and financial irregularities in the public sector, close to 100 of its 700 workers were family members or friends of the directors or of important politicians.

that it can be restricted if the government sets an efficient wage.

Given the amount of anecdotal and survey evidence of such practices, it is perhaps surprising that research documenting evidence of nepotism or cronyism in the public sector is limited. Scoppa (2009) finds that the probability of working in the public sector in Italy is 44 percent higher for individuals who have a parent also working there. Durante et al. (2011) find a higher concentration of last names in universities in Italy relative to the overall population, and that this concentration increased in regions with low civic capital, after a reform decentralizing the university hiring choices in 1998. Martins (2010) finds that in Portugal, between 1980 and 2008, over the months preceding an election, appointments in state-owned firms increased significantly compared to private-sector firms. Hiring also increased after elections, but only if a new government took office.

On top of these papers that provide suggestive evidence of nepotism and cronyism in the public sector, two recent papers by Fafchamps and Labonne (2017) and Colonnelli et al. (2018) have a better identification strategy. Fafchamps and Labonne (2017) find that, following the 2007 and 2010 municipal elections in Philippines, individuals who shared one or more family names with a local elected official were more likely to be employed in better-paying occupations, compared to individuals with the loosing candidates' family names. The magnitude of the effect is consistent with preferential treatment of relatives as managers in the public sector. Colonnelli et al. (2018) apply a regression discontinuity design in close electoral races in Brazil to matched employer-employee data on the universe of public employees. They find that politically connected individuals enjoy easier access to public-sector jobs, but are less competent. Despite these empirical efforts to identify nepotism, given the nature of this activity, it is difficult to empirically measure its aggregate effects.

We study the conditions that allow for nepotism in hiring in the public sector, and its consequences, from a theoretical angle. In Section 3 we set up a search model in which workers can search for jobs in either the private or the public sector. Employment and wages in the private sector are determined through the usual channels of free entry and Nash bargaining. This ensures that job-finding rates reflect nothing but match surplus so that identical workers have equal chances of finding a job. In the public sector, by contrast, employment and wages are exogenous. We account for the possibility of nepotism or cronyism by assuming that job seekers can use their personal relationships and connections to find a public-sector job. We assume that prior to entering the labor market, workers can pay a cost to get "connections" that is drawn from an exogenous distribution across workers. In our setting, nepotism means that the government reserves some of its jobs for workers with those connections. Under such practices, in equilibrium, workers with connections can more easily find public-sector jobs than similar workers that do not have connections.

This paper contributes to the recent labor market search literature that analyzes the role and effects of public-sector employment and wages. Burdett (2012) includes the public sector in a job-ladder framework where firms post wages. Bradley et al. (2017) further introduce on-the-job search and transitions between the two sectors to study the effects of public-sector policies on the distribution of private-sector wages. Albrecht et al. (2018) consider heterogeneous human capital and match specific productivity in a Diamond-Mortensen-Pissarides model. Michaillat (2014) shows that the crowding-out effect of public employment is lower during recessions, giving rise to higher government spending multipliers. Navarro and Tejada (2018) analyse the interaction between public employment and the minimum wage. These papers' objective is to determine how employment and wage policies affect private employment and wages, as well as the unemployment rate. They assume that the unemployed randomly search across sectors, and, hence, policies affect the equilibrium only by affecting the outside option of the unemployed and their reservation wage.

Hörner et al. (2007) study the effect of turbulence on unemployment when wages in the public sector are insulated from this volatility. Quadrini and Trigari (2007) analyze the effects of exogenous business cycle rules on unemployment volatility. Gomes (2015) emphasizes the role of the wage policy in achieving the efficient allocation, while Afonso and Gomes (2014) highlight the interactions between private and public wages. Gomes (2018) examines the heterogeneity of public-sector workers in terms of education. These papers assume that the two sectors's labor markets are segmented, and that the unemployed choose which of the sectors to search in, depending on the government's hiring, separation and wage policies.

We add to this literature by considering the choice of finding a public-sector job through connections and by analyzing how government policies affect this rent-seeking activity. Moreover, while we assume segmented markets, in Section 7 we contrast the transmission mechanism and our results with those from a model with random search. We prefer the assumption of segmented markets because it portrays a realistic mechanism of selection into the public sector, documented empirically by Krueger (1988), Nickell and Quintini (2002) or experimentally by Bó et al. (2013), lying at the heart of current policy discussions. High pay attracts many unemployed to queue for public-sector jobs. Conversely, if pay is too low, few unemployed search in the public sector, which then faces recruitment problems.

Our first main finding is perhaps surprising. Conditional on inefficiently high wages, more nepotism in the public sector lowers the unemployment rate. When the value of a public-sector job is higher than that of a private-sector job (because of either high wages or a low separation rate), more of the unemployed queue for these jobs, moving away from the private sector. If most of these jobs are available only through connections, fewer unconnected unemployed are going to queue and will search in the private sector instead. Although it fosters an inefficient rent-seeking activity, nepotism mitigates the adverse effects that high public wages have on employment. The evidence from survey data, shown in Section 2, is consistent with this result. A corollary of this first result, shown in Section 5, is that, although it entails itself a cost, nepotism might reduce the welfare losses of inefficiently high public-sector wages.

Although the mechanism is different, this result echoes those found in papers studying referrals – e.g., Horvath (2014), Galenianos (2014) or Bello and Morchio (2017) – which have focused exclusively on the private sector. These papers argue that social networks can improve the matching process by working as an information channel or increasing the efficiency of search. We argue that hiring through connections works differently in the public sector. In the private sector, free entry of firms ensures that the gains of alternative hiring channels translate into job creation, and wage bargaining guarantees that the surplus generated is shared between firms and workers. On the contrary, we view the public sector as having a fixed number of jobs that are safer and better paid, which induces workers to find alternative ways to get them. The mechanism does not involve a better search technology or better information about vacancies, but the knowledge that some vacancies are reserved for a subset of workers with connections, which shortens the queues for public-sector jobs.

Focusing on the public rather than the private sector allows us to understand how policies affect nepotistic hiring. In our setting, the government can hire through connections, provided that it pays high enough wages to attract enough searchers. In other words, government employment and wage policies impose an endogenous limit on how many workers it can hire through connections. The constrained-efficient allocation can be achieved with an optimal wage that simultaneously limits the queues for public-sector jobs and makes it impossible to hire through connections. This second result is supported by the evidence from the survey data that non-meritocracy in the public sector is associated with higher wage premium. It rationalizes why evidence of nepotism in the public sector is common in Southern European countries, in which public sectors pay substantial premia relative to the private sector, while it is absent in Nordic countries, which tend to pay a negative premium.

Given the common perception that workers hired through political connections are less competent, supported by Colonnelli et al. (2018), we consider in Section 7 an extension where workers have heterogeneous ability. The importance of wage and human resource policies on the quality of public-sector workers has attracted much interested from an empirical micro literature, summarized by Finan et al. (2015). It has also been recently studied theoretically by Geromichalos and Kospentaris (2020). We find that, when the government prioritizes high-ability workers in the recruitment, low-ability workers face lower changes of getting a job, so they have stronger incentives to get connections to jump the queue.

In our model we take the government policies as being exogenous in order to isolate the effects of each of the policies. In Section 6 we provide one possible microeconomic foundation for the government's policy choices. The government's employment, wages and use of nepotism in hiring workers are chosen to maximize an objective function that includes the production of government services, the preferences of a union, a benefit of nepotism, which could reflect general corruption or vote buying and a cost of nepotism in terms of possible media backlash. The simple model of government choices highlights possible interdependencies of policies and generates the different particular cases that we study.

2 Survey evidence

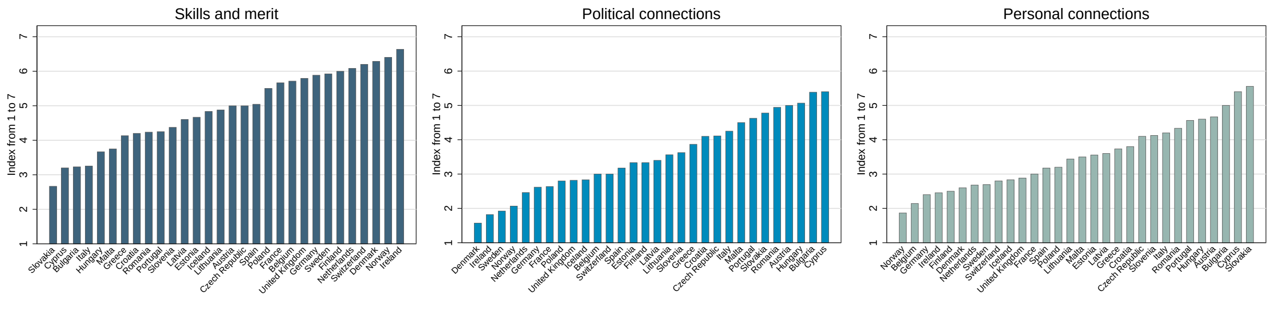
While the economics literature on nepotism in the public sector is limited, there is a compelling survey evidence that the hiring practices of the government are non-meritocratic in many countries. This survey evidence is commonly used in the political science literature studying corruption, such as Charron et al. (2017). We use data from two of such surveys.

2.1 Quality of Government Survey

The first one is the *Quality of Government Survey* (QoG). This is a survey of 1294 public sector experts in 159 countries. They ask experts on the structure and behavior of public administration, such as, hiring practices, politicization, professionalization, and impartiality. See Dahlström et al. (2015) for a description of the dataset. We use three questions in a section on recruitment and careers of public employees. The survey asks the experts whether when recruiting public-sector workers, the (a) skills and merits of the applicants decide who gets the job, (b) political connections decide who gets the job, or (c) personal connections of the applicants (for example kinship or friendship) decide who gets the job. The experts are asked to rate from 1 (hardly ever) to 7 (almost always).

Figure 1 shows how nepotism is an important dimension of public-sector hiring, and that it varies substantially across 30 European countries. The average score for "skills and merits" is 4.9, varying from 2.7 to 6.6. The average scores for "political" or "personal" connections" are around 3.5, varying from 1.57 to 5.5. As expected, skills matter in hiring workers in the public sector, but what is perhaps more noteworthy is that experts consider political and personal connections to be also important in deciding who gets hired in the public sector. There is, however, a large variation in recruitment practices. In seven countries - Italy, Portugal, Cyprus, Bulgaria, Hungary, Romania and Slovakia - the score for "skills and merit" is lower than both other scores. The 8 countries where the score of skills and

Figure 1: Recruitment practices in European public sectors



(a) (b) (c)

Source: Indexes of recruitment practices are takes from the Quality of Government Survey. *See data in Appendix G.*

merits is highest includes the Nordic countries (Denmark, Finland, Sweden and Norway) plus Luxembourg, Switzerland, Netherlands and Ireland. In those countries, the average index for political or personal connections is lower than 2.5.[2]

2.2 European Quality of Government Index

The second survey is based in an EU regional level governance survey, used to construct the *European Quality of Government Index* (EQI). The survey was first ran in 2010 and then repeated in 2013 and 2017. The index focuses on both perceptions and experiences with public-sector corruption, along with the extent to which citizens believe various public-sector services are well allocated and of good quality. See Charron et al. (2014).

An advantage of this survey is the more disaggregated level of information at a regional level - NUTS 1 and 2 - albeit for only 21 countries. The disadvantage is the absence of a specific question about recruitment. Instead, the survey asks a more general question on whether workers in the public sector can succeed, varying from 1 ("most people can succeed if they are willing to work hard") to 10 ("Hard work is no guarantee of success – it's more a matter of luck and connections"). Interestingly, it also asks the same question about the private sector where the score also varies between 1 to 10.

The average score at country level is 5.6 for the private sector and 6.4 for the public sector, suggesting non-meritocracy is a more relevant problem there. The six countries

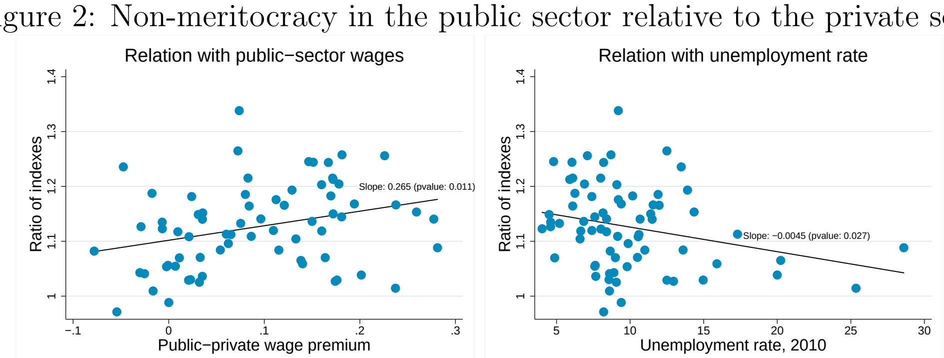
[2]While there is a substantial variation in recruitment practices across European countries, there are even larger variation across the other 129 countries. As shown in Appendix F, only in Western Europe and North America, East Asia and The Caribbean the score for "skills and merits" is higher than "personal connections". In the remaining 100 countries, personal and political connections matter more than skills and merits when recruiting public-sector workers. Non-meritocratic practices seem to be more widespread Sub-Saharan Africa, South Asia and Latin America with average scores above 4.5.

with lower score for the public sector (more meritocratic) are Austria, United Kingdom, Germany, Denmark, Finland and Sweden. The six countries with higher score for the public sector (less meritocratic) are Bulgaria, Greece, Croatia, Slovakia, Romania and Portugal. The correlation between the scores of the public and private sector is high (0.8), suggesting the behavior in the two sectors go in parallel. As such, we create a new relative index of non-meritocracy, which is the ratio of the score of the public relative to the private sector.

We correlate this index with a measure of public-sector wage premium and of unemployment rate. The wage premium at a regional level is estimated using microdata from the 2010 *Structure of Earnings Survey*. Relative to the aggregate measures of public-sector premium, these regressions allow us to control for worker's characteristics. Following the literature, i.e. Katz and Krueger (1991), Disney and Gosling (1998) or Christofides and Michael (2013), we regress the log of the gross hourly wage on a gender dummy, region, age, education, occupation and a part-time dummy. To measure the premium, we include a public-sector dummy interacted with the available region. Some small countries do not have the regional (NUTS 1) identifiers, while for other countries the NUTS 1 are aggregated into larger regions. We end up with 70 observations.

The first graph in Figure 2 shows a positive association between non-meritocracy and wages, statistically significant. Notice that the non-meritocracy index is larger than 1 in all but two observations, meaning that it is perceived as more widespread in the public sector. The second graph shows a negative association between non-meritocracy in the public sector and unemployment that is predicted with our model. We claim that hiring based on connections limits the negative effect on unemployment by reducing the queues for public-sector jobs, particularly when they offer high wages.

Figure 2: Non-meritocracy in the public sector relative to the private sector



(a) (b)

Source: The y-axis has the ratio of the index for the public over the index for the private. A number larger than 1 means the public sector is perceived to be less meritocratic than the private sector. Both indexes are taken from European Quality of Government Index dataset. The public-sector wage premium is estimated with microdata from the 2010 Structure of Earnings Survey*. Unemployment rate is taken from Eurostat.*

We show these associations more rigorously in Table 1. Column (1) shows the positive association between public-sector wage premium and unemployment. Regions with higher public-sector premium have higher unemployment. Column (2) reflect the negative association between the unemployment rate and the ratio of the indexes of non-meritocracy, shown in Figure 2. Countries with less meritocratic practices in the public sector have lower unemployment. When regressing the unemployment rate on both variables, they are both statistically significant at 1 percent, as shown in column (3). In column (4) we interact the ratio of indexes of non-meritocracy with dummies for countries above and below the median public-sector wage premium. The negative relation with unemployment rate is stronger in countries with a high premium. In columns (5) and (6) we calculate our index in a different way. In column (5) we calculate the index in differences of public and private sector scores, rather than in ratio. In column (6) we calculate the public-sector score based only on respondents working in the public sector and the private sector score based on respondents working in the private sector only, before computing the ratio. In both alternatives we have similar results. In Appendix G, we show the regressions of the index of non-meritocracy on unemployment rate on public wages. Mirroring these results, unemployment is negatively associated with non-meritocracy in the public-sector, particularly when its wages are high.

The evidence in this section, based on survey data, finds a positive association between public-sector wages and nepotism and a negative association between nepotism in the public

Table 1: Regression of the unemployment rate

	Baseline variables				**Alternative variables**	
	(1)	(2)	(3)	(4)	(5)	(6)
Public-sector wage premium	19.2***		24.6***	49.0***	43.0***	41.8***
	(3.31)		(4.29)	(4.93)	(5.78)	(4.23)
Ratio of indexes of non-meritocracy		-20.4***	-20.4***			
		(-1.71)	(-3.12)			
× High public wage				-23.2***	-6.51***	-18.1***
				(-3.70)	(-4.24)	(-3.61)
× Low public wage				-18.8***	-0.21	-14.1*
				(-3.02)	(-0.17)	(-2.73)
Observations	70	70	70	70	70	70
R-squared	0.14	0.041	0.248	0.335	0.343	0.325

*Notes: The t-statistics are shown in brackets.*** indicates significance at the 1% level, ** at 5% level, and * at the 10% level. The dependent variable is the unemployment rate. The ratio of the non-meritocracy index for the public sector over the index for the private sector, increases when the public sector is perceived to be less meritocratic than the private sector. The index is constructed with data taken from European Quality of Government Index dataset. The public-sector wage premium is estimated with microdata from the 2010* Structure of Earnings Survey*. Unemployment rate is taken from Eurostat. In column (5) we use an alternative index which is the difference between the index for the public over the index for the private. In column (6) we use an alternative index which is the ratio between the index for the public sector (answer by only public sector workers) over the index for the private sector (answered by only private sector workers).*

sector and the unemployment rate, stronger in regions with a higher premium. Clearly, the association between these variables can have several explanations. Given the problems to design an empirical strategy that identifies nepotism in the public sector and its effects, we develop a model that provides one interpretation of these associations.

3 Model with nepotism in the public sector

3.1 Preliminary considerations

The defining characteristic of the public sector is that it does not sell its goods or services - it supplies them directly to the population. There is no market price. Governments finance employment, not by selling goods, but by using the power of taxation. As such, the public sector does not have shareholders and it does not maximize profits. The decisions regarding employment reflect different government objectives. Even in determining wages (or wage growth) there is a discretionary component that can create widely documented wage differentials vis-à-vis the private sector. As such, the usual mechanisms that drive the private sector adjustments studied by economists do not map into the public sector.

Our modeling choices reflect this view. We discuss two particular assumptions. As in Bradley et al. (2017) or Albrecht et al. (2018), we assume that the public-sector wage is exogenous. We view it not as an equilibrium outcome (i.e. private wages, which may reflect match productivity and outside option) but a policy variable (i.e. unemployment benefits or government spending, which may reflect various objectives). Notice that public wages are a payment in units of the private good (financed with taxation), not in units of the public goods, hence they are not necessarily associated to the productivity of the worker. Wage and employment policies might be influenced by several factors, such as unions, inequality or elections. In our model we take the government's choices of wages and employment as given, in order to characterize the labour market effects of changes in policies. The only role of the government is to maintain its employment constant by hiring in enough workers to replace those that separate. Still, in Section 6 we provide one possible microfoundation for the government's choices, which helps understand our modeling choices.

The second assumption is that we consider homogeneous workers in terms of education, ability and productivity. Given the role of the public sector as a large-scale employer, our focus is to study the effects of nepotism and wages on the labour market and unemployment, which we believe are of first-order importance. Still, we study the common argument that workers that get jobs though connections are of worse quality in subsection 7.2, where we extend the model to include workers of heterogeneous ability.

3.2 General setup

We consider a search and matching model with firms and a public sector. Workers can be either employed and producing or unemployed and searching for a job. Each firm is endowed with a single vacancy that can be vacant or filled (job). At each instant, τ individuals are born (enter the labor market) and die (retire) so that the working population is constant and normalized to unity. All agents are risk-neutral and discount the future at rate $r > 0$, and time is continuous.

All individuals, prior to entering the labor market, can obtain connections by paying a cost c. The cost is distributed across individuals according to the cumulative distribution function $\Xi(\cdot)$ on $[0, \bar{c}]$. If a family member works in the public sector, the cost of connections is low. If getting connections requires the affiliation with a political party, it is more costly. Some jobs in the public sector are reserved for workers with connections. By obtaining connections workers can gain access to these "connected" jobs and thus have priority – a higher job-finding rate – for public-sector jobs.

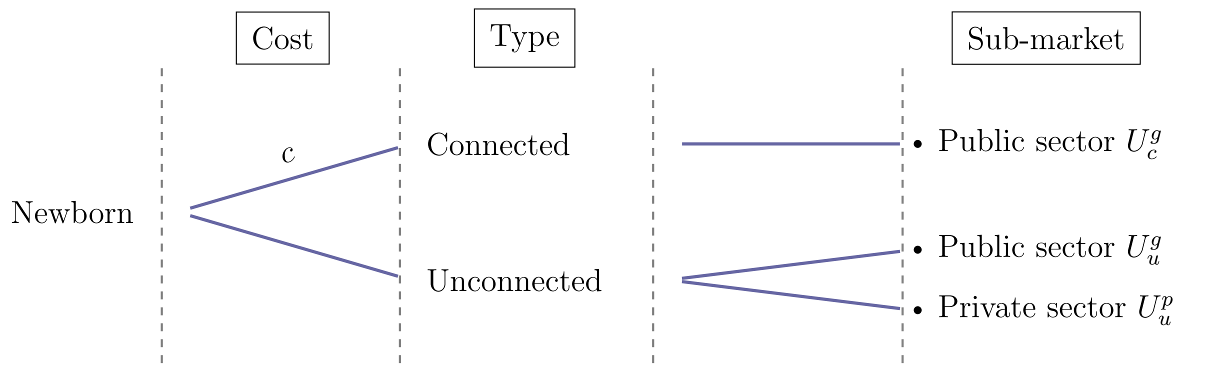
An endogenous proportion of the population (those whose connection cost is sufficiently low) become "connected". For a connected individual, using his/her connections to find a job in the public sector job strictly dominates all other options. But, if an individual is unconnected, then she has a further decision of whether to search for jobs in the private or in the public sector through standard search.[3] The two sectors are segmented. In Section 7.1, we consider the case in which workers without connections search randomly for jobs in both sectors. Figure 3 depicts these choices. In total, there are three active markets: the private sector and the two public-sector submarkets, one for connected and one for unconnected workers. Variables are indexed by the superscript $x = [g, p]$, where g refers to the public (government) sector and p to the private sector, and the subscript $j = [c, u]$, where c refers to connected and u to unconnected. A searching (unemployed) worker receives a flow of income b, which can be considered the opportunity cost of employment. We abstract from on-the-job search following the evidence by Chassamboulli et al. (2020) that the substantial majority of new hires in the public-sector come from non-employment.

3.3 The Private sector

The private and public sectors differ in two aspects: hiring practices and wage-setting. The rate at which workers are hired into firms is endogenous. In particular, firms open vacancies

[3] Throughout the paper, we use the terms "connected jobs/vacancies" to refer to the jobs that the government reserves for job seekers with connections. We use the term "unconnected jobs/vacancies" to refer to the remaining government jobs that are filled by workers without connections. We use the terms "connections sector" and "no-connections sector" to refer to these two public sub-sectors.

Figure 3: Decision of newborn



and search for suitable workers until all rents are exhausted. The rate at which workers find private-sector jobs depends positively on the tightness, $\theta = \frac{v^p}{u^p}$, where v^p is the measure of private-sector vacancies, and u^p is the number of unemployed searching for those vacancies. They are hired at Poisson rate $m(\theta)$, while firms fill vacancies at rate $q(\theta) = \frac{m(\theta)}{\theta}$.

The output of a match between a worker and a firm is y (we later consider worker heterogeneity). Wages in the private sector, denoted as w^p, are determined by Nash bargaining, such that the worker gets a share β of match surplus. With higher match surplus, firms expect larger profits from creating jobs; firm entry is higher; and workers can more easily find jobs and earn higher wages. Hence, the private-sector hiring and wage-setting procedures are, in a sense, meritocratic. Individuals have equal chances of finding jobs.

A vacant firm bears a recruitment cost κ, related to the expenses of keeping a vacancy open and looking for a worker. When a vacancy and a worker are matched, they bargain over the division of the produced surplus. The surplus that results from a match is known to both parties. After an agreement has been reached, production commences immediately. Matches in the private sector will dissolve at the rate s^p. Following a job destruction, the worker and the vacancy enter the market and search for a new match.

3.4 Government

In the public sector, by contrast, policies are taken to be exogenous. To produce some services, the government employs an exogenous number of workers. In each period, it has to hire enough workers to replace the workers that exogenously separate or retire. That means hiring $(s^g + \tau)e^g$ workers, where s^g is the separation rate. A fraction μ of jobs are reserved for workers who have connections.

The matching function in the public sector is $M_j^g = \min\{v_j^g, u_j^g\}$. To maintain its employment level, the government must be able to attract a number of searchers in each segment,

u_j^g, at least equal to the number of job openings, v_j^g, meaning that $M_j^g = v_j^g$. Otherwise public-sector services break down. As we show in Lemma 2, this imposes a condition on public wages to be high enough to attract at least the same number of searchers as of vacancies. We choose this particular functional form for the matching technology for simplicity and clarity. First, it makes the concept of queues in the public sector clearer. When there are more unemployed than vacancies, the vacancy filling rate for the government is 1, and all the unemployed in excess are queuing. As we will show, this makes the efficient wage a clear and intuitive object, easy to calculate. Second, such assumption has been used in other papers, i.e. Quadrini and Trigari (2007) and there is evidence that the elasticity of matches with respect to unemployed is much lower in the public sector than in the private (Gomes, 2015). This does not mean that there are no matching frictions, only that they are one-sided.

We assume that the recruitment is part of the role of the government and is done by its workforce. Since the government's objective is to maintain employment level (e^g) by hiring enough workers to replace those that separate or retire, it follows that $v_u^g = (1-\mu)(s^g+\tau)e^g$ and $v_c^g = \mu(s^g+\tau)e^g$. Connected and unconnected workers find public-sector jobs at rate $m_c^g = \frac{\mu(s^g+\tau)e^g}{u_c^g}$ and $m_u^g = \frac{(1-\mu)(s^g+\tau)e^g}{u_u^g}$, respectively.[4] For the moment, we set $\mu = \bar{\mu}$, where $\bar{\mu}$ is an exogenous parameter reflecting the target fraction of jobs the government aims to fill through connections. In Section 4.2, we analyze the case in which the government cannot reach its target because there are not enough workers with connections.

As will become clearer below, because public employment is exogenous, the productivity of workers in the public sector is not important for our results. We assume that the separation rates, as well as other labor market friction parameters, are exogenous. In this setting, where the government has a fixed employment level, the separation rates s^g play a double role: they reflect the expected duration of the match but also determine the number of new hires. Lower separations increase the value of employment but, at the same time, reduce the vacancies and make an unemployed worker less likely to find a job there. Finally, the public wage, w^g is the other exogenous policy variable. We ignore the issue of how the government finances its wage bill and assume that it can tax its citizens in a non-distortionary lump-sum tax.

[4] We considered a less segmented way to model the connected and unconnected market. In particular, we considered a setting with only one public-sector market in which both connected and unconnected workers were searching randomly for jobs. Connected workers have higher efficiency of search (which would be the exogenous variable reflecting nepotism) and hence a higher job-finding rate. In such setting, the composition of the public employment of connected and unconnected workers would be endogenous. All the results and intuition would be similar to our baseline setting, but at a cost of more mathematical complexity.

3.5 Value functions, Free entry, Wages

Let U_u^p and E_u^p be the values (expected discounted lifetime incomes) associated with unemployment (searching for a job) and employment in the private sector, defined by:

$$
\begin{aligned}
(r+\tau)U_u^p &= b+m(\theta)\left[E_u^p-U_u^p\right], &(1)\\
(r+\tau)E_u^p &= w^p-s^p\left[E_u^p-U_u^p\right]. &(2)
\end{aligned}
$$

The values associated with unemployment in the public sector with and without connections are given, respectively, by:

$$
\begin{aligned}
(r+\tau)U_u^g &= b+m_u^g\left[E_u^g-U_u^g\right], &(3)\\
(r+\tau)U_c^g &= b+m_c^g\left[E_c^g-U_c^g\right]. &(4)
\end{aligned}
$$

We assume the wage in the public sector does not depend on connections. In Appendix F we consider a case where workers with connections also have a wage premium. Despite equal wages, the values of being employed are different for workers with and without connections:

$$
\begin{aligned}
(r+\tau)E_u^g &= w^g-s^g\left[E_u^g-U_u^g\right], &(5)\\
(r+\tau)E_c^g &= w^g-s^g\left[E_c^g-U_c^g\right]. &(6)
\end{aligned}
$$

On the firm's side, let J_u^p be the value associated with a job and V_u^p be the value associated with posting a vacancy and searching for a worker to fill it, given by:

$$
\begin{aligned}
rJ_u^p &= y-w^p-(s^p+\tau)\left[J_u^p-V_u^p\right], &(7)\\
rV_u^p &= -\kappa+q(\theta)\left[J_u^p-V_u^p\right]. &(8)
\end{aligned}
$$

In equilibrium, free entry drives the value of a private vacancy to zero:

$$V_u^p=0. \tag{9}$$

Wages are determined by Nash bargaining between the matched firm and worker. Their outside options are the value of a vacancy and the value of being unemployed. Let $S_u^p \equiv J_u^p-V_u^p+E_u^p-U_u^p$ denote the surplus of a match. With Nash bargaining, the wage w^p is set to a level such that the worker gets a share β of the surplus, and the share $(1-\beta)$ goes to the firm. This implies two equilibrium conditions:

$$\beta S_u^p=E_u^p-U_u^p \qquad (1-\beta)S_u^p=J_u^p-V_u^p. \tag{10}$$

Setting $V_u^p = 0$ in (8) and imposing the Nash bargaining condition in (10) gives:

$$\frac{\kappa}{q(\theta)} = (1-\beta)S_u^p. \tag{11}$$

Using (1)-(7) together with (10) and the free-entry condition $V_u^p = 0$, we can write:

$$S_u^p = \frac{y-b}{r+\tau+s^p+\beta m(\theta)}, \tag{12}$$

and the free-entry condition as

$$\frac{\kappa}{q(\theta)} = \frac{(y-b)(1-\beta)}{r+\tau+s^p+\beta m(\theta)}. \tag{13}$$

This job-creation condition sets the expected costs of having a vacancy equal to the expected gain from a job. It can be used to determine the equilibrium market tightness θ and, in turn, the rates at which workers find jobs in the private sector, $m(\theta)$. Imposing the free-entry condition (11) for private-sector vacancy creation, the Nash bargaining solution implies that

$$w^p = b + \beta(y - b + \kappa\theta). \tag{14}$$

Lemma 1 *Tightness and wages in the private sector are independent of the government employment and wage policies (e^g, w^g, s^g and μ).*

This lemma is a useful intermediate result and follows directly from equations (13) and (14). Government employment and wage policies do not affect wages and tightness in the private sector. It implies that they affect the equilibrium only by affecting the connections decision of the newborn or the scale of the private sector through the number of unemployed directing their search towards the private sector. Given a constant tightness, policies that make the public sector more attractive will drain workers from the private sector and reduce, one-to-one, the number of vacancies, leaving private wages unchanged.

3.6 Newborn‘s Decisions

We can summarize the three options of the newborn as

$$
\begin{aligned}
(r+\tau)U_u^p &= b + \frac{m(\theta)}{r+\tau+s^p+m(\theta)}[w^p - b], &(15)\\
(r+\tau)U_u^g &= b + \frac{m_u^g}{r+\tau+s^g+m_u^g}[w^g - b], &(16)\\
(r+\tau)U_c^g &= b + \frac{m_c^g}{r+\tau+s^g+m_c^g}[w^g - b]. &(17)
\end{aligned}
$$

These three options were depicted in Figure 3. Workers without connections can search in either the public or the private sector. In equilibrium, the two values have to equate:

$$U_u = U_u^g = U_u^p. \tag{18}$$

This condition determines the number of unconnected searchers in the public sector, u_u^g, which is the variable that compensates any asymmetry in the value of the job in the two sectors. An increase of the value of a public-sector job, E_u^g, (driven by either higher wages or lower separations) raises the number of unemployed searching for openings and lowers their job-finding probability (m_u^g), such that its effect on U_u^g is neutralized.

Alternatively, workers can use connections to find jobs only in the public sector. In what follows, we drop the superscript g in U_c^g and set $U_c \equiv U_c^g$. The newborn chooses the option that, given her c, gives the highest value between:

$$Max\{U_u, U_c - c\}. \tag{19}$$

A worker with a cost c chooses to obtain connections only if the benefit, $U_c - U_u$, exceeds the cost, that is, only if $c \leq U_c - U_u$. The threshold level of c at which a worker is indifferent between using and not using connections to find a job is, therefore, given by:

$$\tilde{c} = U_c - U_u. \tag{20}$$

Lemma 2 *There exists a public-sector unconnected market with employment level e^g, provided that it pays a sufficiently high wage $w^g \geq \underline{w}_u^g$. There exists a public sector of size e^g with a connected market where $\mu = \bar{\mu}$, provided that it pays a sufficiently high wage $w^g \geq \underline{w}_c^g > \underline{w}_u^g$*

The exact expressions for $\underline{w}_u^g$ and $\underline{w}_c^g$ are in Appendix A. This lemma, depicted graphically in Figure 4, states that the public sector needs to pay a sufficiently high wage in order to

Figure 4: Lemma 2: the role of public-sector wage

attract enough job seekers to fill its vacancies and maintain a constant employment level.[5] If the wage is above this threshold, $\underline{w}_u^g$, some unemployed will prefer to queue for public-sector jobs. This threshold depends positively on private-sector wages, w^p, and unemployment benefits, b. However, for the government to be able to fill $\bar{\mu}$ of its vacancies with workers that have connections, this wage has to be higher. The wage paid to a public employees is independent of how he/she was hired (with or without connections). Nevertheless, the benefit from using connections to jump the queue is larger when wages are higher, because then, more workers are searching for public-sector jobs and getting one of them without connections takes much longer. For the government to be able to attract enough workers with connections to fill $\bar{\mu}$ of its vacancies with such workers, the wage must be high enough, so that the benefit from having connections compensates the costs of acquiring them. This second threshold wage, $\underline{w}_c^g$, depends positively on $\underline{w}_u^g$ and on the size of the connections sector $\bar{\mu}$. In what follows, we assume that the wages are always above $\underline{w}_c^g$, meaning that the government can fill any target fraction $\bar{\mu}$ of its vacancies through connections. Note, however, that if the wage is lower but still above $\underline{w}_u^g$, the government is able to attract some connected job searchers, and fill some of its vacancies through connections, but not enough to fill its target fraction $\bar{\mu}$. We analyze this case in Section 4.2.

Lemma 3 *If a connections sector exists ($\tilde{c} > 0$), the job-finding rate in the connections sector is higher than in the unconnected sector ($m_c^g > m_u^g$).*

This lemma follows directly from equations (18) and (20). They imply that the value of searching for a job in the public sector is higher for connected than for unconnected workers which, given that wages and separation rates are the same for both types of workers, can only be achieved with a smaller queue for connected workers.

3.7 Equilibrium Allocations

Workers' cutoff $\tilde{c}$ determines their selection into two groups: those who use connections to find public-sector jobs (L_c^g) and those who do not have connections (L_u). We can measure

[5] Notice that what matters for the existence of a public sector unconnected and connected market is not the size of the wage per se, but the size of the surplus that jobs in the public sector generate to the worker. While the surplus increases with the wage, a higher public-sector surplus could also reflect higher job security and other fridge benefits.

each of these two groups' share in the labor force as:

$$L_c^g = \Xi(\tilde{c}) \tag{21}$$

$$L_u = 1 - \Xi(\tilde{c}) \tag{22}$$

Among the workers who do not have connections, some will be attached to the private sector (L_u^p) and some to the public sector (L_u^g). Hence, $L_u = L_u^p + L_u^g$.

Using (10)-(13) and (15)-(17), we can write the cutoff as:

$$\tilde{c} = \frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{u_c^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{u_c^g}}[w^g - b] - \frac{\beta\kappa\theta}{(1-\beta)}\right]. \tag{23}$$

Definition 1 *A steady-state equilibrium consists of a cut-off cost $\{\tilde{c}\}$, private sector tightness $\{\theta\}$, and unemployed searching in each market $\{u^p, u_c^g, u_u^g\}$, such that, given some exogenous government policies $\{w^g, e^g, \bar{\mu}\}$, the following apply.*

1. *Private-sector firms satisfy the free-entry condition (13).*
2. *Private-sector wages are the outcome of Nash Bargaining (14).*
3. *Newborns decide optimally their investments in connections (equation 19), and the population shares are determined by equations (21)-(22).*
4. *The search between the public and private sectors by the unconnected unemployed satisfies equation (18).*
5. *Flows between private employment and unemployment are constant:*

$$(s^p + \tau)e^p = m(\theta)u^p. \tag{24}$$

6. *Population add-up constraints are satisfied:*

$$L_u^g = (1-\mu)e^g + u_u^g, \tag{25}$$

$$L_c^g = \mu e^g + u_c^g, \tag{26}$$

$$L_u^p + L_u^g + L_c^g = 1 \tag{27}$$

7. *The government fills its target fraction of vacancies through connections $\mu = \bar{\mu}$, that is, $w^g \geq \underline{w}_c^g$.*
8. *The government budget balances: $w^g e^g = T$, where T is a lump-sum tax imposed uniformly on all individuals.*

4 Main results

This section details the main results, under three propositions. All the derivations and proofs are shown in Appendix A, including the proof that the equilibrium exists and is unique.

4.1 Nepotism, public-sector wages and unemployment

Proposition 1 *An increase in $\bar{\mu}$ decreases the number of workers searching for public-sector jobs (decreases $u^g = u^g_u + u^g_c$), increases the number of workers in the private sector (i.e., increases $L^p_u = 1 - L^g_u - L^g_c$) and increases the employment rate.*

This result is perhaps surprising but is quite logical and consistent with evidence in Figure 2. As shown in Lemma 2, the existence of a connections sector requires that the public-sector wage is high enough. Under this condition, there are large queues of unconnected workers for public-sector jobs. With a higher fraction of these jobs being reserved for workers with connections, the value of searching for one without connections decreases. Workers have more incentive to direct their search towards the private sector or to obtain connections. Since it is costly to obtain connections, some of them – those whose connection cost is high – abandon search in the public sector and search in the private sector instead. With a constant tightness in the private sector, job creation goes up one-to-one as the number of searchers and overall employment increases.

Proposition 2 *An increase in w^g increases the number of workers searching for public-sector jobs (increases $u^g = u^g_u + u^g_c$) decreases the number of workers in the private sector (i.e., decreases $L^p_u = 1 - L^g_u - L^g_c$) and decreases the employment rate. These negative effects are smaller when $\bar{\mu} > 0$ than when $\bar{\mu} = 0$.*

A higher wage in the public sector makes the value of searching for a job there higher and shifts workers away from the private sector, thereby lowering the employment rate. When a fraction of jobs in the public sector are reserved for workers with connections, the number of unconnected workers that queue for public-sector jobs is smaller. Some choose to use connections in order to get in. But because obtaining connections is costly, the total increase in the number of workers queuing up for public-sector jobs is smaller. The number of workers that abandon search in the private sector in response to the increase in w^g is therefore smaller. Hence, the recruitment through connections mitigates the negative effects of more generous compensation policies on employment. This proposition is consistent with evidence from Table 1.

4.2 When nepotism is bounded: a limit to μ

We now relax the assumption that μ is isolated from labor market conditions. We show that in situations in which the wage premium is large enough to maintain public employment, but not large enough to generate queues of connected jobs searchers, changes in wages can influence the size of the connected sector.

We interpreted $\bar{\mu}$ as the government's target fraction of vacancies to be filled through connections. The government is able to meet its target – fill a fraction $\mu = \bar{\mu}$ of jobs through connections – if it pays a sufficiently high wage. According to Lemma 2, there exists a wage, $\underline{w}_c^g$, at which the government is able to attract exactly $u_c^g = \bar{\mu}(s^g + \tau)e^g$ connected job searchers. Hence, for any wage $w^g \geq \underline{w}_c^g$, the government is able to attract an even larger number of connected job searchers so that $u_c^g \geq \bar{\mu}(s^g + \tau)e^g$. Consequently, some of the connected searchers also queue up waiting for jobs. If the government wage is lower, i.e. $\underline{w}_c^g > w^g > \underline{w}_u^g$, the number of connected job searchers, u_c^g, is lower, but still positive: $0 < u_c^g < \bar{\mu}(s^g + \tau)e^g$. In this case also, a connections sector exists, but the government is restricted to fill only a fraction $\mu < \bar{\mu}$ of vacancies through connections, where μ is such that $u_c^g = \mu(s^g + \tau)e^g$ and there are no connected workers queuing for jobs. The remaining vacancies $(1 - \mu)$ are filled by unconnected workers. Using (26), we can solve for μ and write: $\mu = \frac{L_c^g}{e^g(s^g+\tau+1)}$.

In the limiting case, where $w^g = \underline{w}_u^g$, no worker has the incentive to use connections to find a public-sector job; hence, $u_c^g = 0$, which means that $\mu = 0$. To sum up, we generalise Condition 7 in Definition 1, by replacing it with

$$\mu = \begin{cases} \bar{\mu} & \text{if } w^g \geq \underline{w}_c^g \\ \frac{L_c^g}{e^g(s^g+\tau+1)} & \text{if } \underline{w}_c^g > w^g > \underline{w}_u^g \\ 0 & \text{if } w^g = \underline{w}_u^g. \end{cases} \tag{28}$$

Proposition 3 *Provided that the public wage is high enough to attract some connected job searchers, but not high enough to generate queues of connected job searchers i.e.* $\underline{w}_c^g > w^g > \underline{w}_u^g$*, the fraction of vacancies that the government fills through connections,* μ*, is smaller, the smaller the public wage* w^g *and the larger the size of public employment,* e^g*. If* $w^g = \underline{w}_u^g$*, there is no nepotism* ($\mu = 0$)*.*

The government can fill a higher fraction of jobs through connections when the public wage is higher because the supply of connected job searchers is larger. But for a given public-sector wage, larger public employment means that the proportion of government jobs filled by connected job searchers is smaller. This proposition tells us how government policies place a constraint on nepotism. Governments that have large employment levels but offer low premia to their workers – such as those in Nordic countries – will have endogenous limits on hiring through connections.

5 Efficiency

5.1 Efficient allocation

The social planner's problem and the first-order conditions are shown in Appendix B. There are three types of inefficiencies in this model: i) the existence of a connections sector that propels newborns to take on rent-seeking activities; ii) the existence of queues for public-sector jobs; and iii) the usual thick-market and congestion externalities.

Inefficiencies i) and ii) are both solved by setting the optimal wage. To avoid queues and given the assumption of the min matching function in the public sector, the government should set a public-sector wage such that $u_u^g = v_u^g = (s^g + \tau)e^g$. In other words, at any instant both the job-finding rate for government jobs and its vacancy-filling rate should be 1, which implies setting $\underline{w}_u^g$. This same wage, according to equation (28), eliminates the connections sector ($u_c^g = v_c^g = 0$). This shows that the connections sector is inefficient only when the public wage is set optimally.

We then show that the inefficiency iii) is solved with the Hosios condition. The Hosios condition in private-sector bargaining guarantees that the thick market and the congestion externalities are internalized.

5.2 Optimal μ conditional on inefficient public-sector wage

Suppose, now, that the government sets a high enough wage to fill its target fraction $\bar{\mu}$ of vacancies through connections; that is, $w^g > \underline{w}_c^g$. In this case, a connections sector exists, as some workers find it optimal to use connections. The question that arises is whether or not the existence of a connections sector, under inefficient government policies, improves welfare. To address this question, we discuss the impact of increasing $\bar{\mu}$ ($\mu = \bar{\mu}$) on net surplus. Net surplus is total private output net of vacancy posting costs, plus unemployment income, minus the resources spent in connections. Since public employment is fixed, an increase in total output can be achieved by an increase in private employment.

As summarized in Proposition 1, an increase in $\bar{\mu}$ raises employment in the private sector and, thus, increases output and net surplus. However, we cannot conclude that a larger connections sector means higher net surplus overall, because an increase in $\bar{\mu}$ also induces some workers to use connections, thus increasing the total resources wasted. If obtaining connections is difficult and costly for most workers, relative to the benefit of being employed in the public sector, then an increase in $\bar{\mu}$ is more likely to drive workers away from the public sector and cause a large shift in workers' search towards the private sector, resulting in a large increase in private employment, but naturally also a larger waste of resources with connection costs. If, on the other hand, obtaining connections is easy and the benefit of a public-sector job large, then an increase in $\bar{\mu}$ will have a small impact on private employment and will, instead, cause a larger shift towards forming connections.

We cannot establish that an increase of $\bar{\mu}$ is optimal, given an inefficient wage policy. As discussed above, the connections costs, the size of public wages, and other benefits are important. However, the interesting point here is that we cannot rule out that nepotism in the public sector can increase welfare when wages are inefficient, because it raises output production and shortens public-sector queues. Hence, we try to clarify this question in a quantitative exercise.

5.3 Quantitative analysis: effects of nepotism on welfare

We now inspect whether under a reasonable calibration, conditional on an inefficient wage policy, nepotism increases or decreases welfare. We calibrate the model to match the Spanish economy at a quarterly frequency, drawing largely on the *Spanish Labour Force Survey (SLFS)* and the *Structure of Earnings Survey (SES)* microdata. A set of parameters is directly fixed to values taken from the data, while a second set of parameters targets steady-state values. We chose Spain because it is one of the countries where there is widespread anecdotal evidence of nepotism and chronism, together with a well-documented large public-sector wage premium. Table 2 lists all the parameters, their values and the data sources.

From the *SLFS*, we calculate the stocks and flows of public- and private-sector workers and the unemployed, for the period 2005-2015. These are shown in Figure G4. Around 13.2 percent of the labour force works in the public sector ($e^g = 0.132$). Following Fontaine et al. (2020), we construct data on worker flows to calibrate the separation rates by sector. The numbers are $s^g = 0.022$ and $s^p = 0.044$, imply that the private sector has a higher separation rate than the public sector.

We consider, in the private sector, a Cobb-Douglas matching function with matching efficiency ζ and matching elasticity with respect to the unemployment of η. As the matching efficiency and the cost of posting vacancies are not separable, we normalize the matching efficiency $\zeta = 1$. The costs of posting vacancies, κ is set to target the unemployment rate of 18 percent, the average of the sample. The matching elasticity is set to the common value of 0.5, and the Hosios condition is assumed to hold ($\eta = 0.5$).

Table 2: Calibration of segmented markets model

Fixed parameters	**Source**	**Values**
Government employment	*Spanish LFS*	$e^g = 0.132$
Job-separation rate (private)	*Spanish LFS*	$s^p = 0.044$
Job-separation rate (public)	*Spanish LFS*	$s^g = 0.022$
Matching elasticity	Standard	$\eta = 0.5$
Bargaining power of workers	Hosios Condition	$\beta = 0.5$
Discount rate	Standard	$r = 0.012$
Retirement rate	Standard	$\tau = 0.006$
Matching efficiency	Normalization	$\zeta = 1$
Productivity	Normalization	$y = 1$
Fraction of connected government jobs	Quality of government survey	$\bar{\mu} = 0.40$
Connections costs upper bound	Set exogenously	$\bar{c} = 55$
Other parameters	**Target (Source)**	**Values**
Public-sector wage	Public-sector wage premium (*SES*)	$w^g = 1.027$
Cost of posting vacancies	Unemployment rates (*LFS*)	$\kappa = 6.31$
Unemployment benefit	Replacement rate (*EC*)	$b = 0.398$

We use microdata from the *SES*, for the waves of 2002, 2006, 2010 and 2014, to calculate the public-sector wage premium. We run regressions of the log gross hourly earnings on a dummy for the public sector, controlling for region, gender, age, occupation, year and part-time and find that the premium is 13.9 percent. We set the public-sector wages such that $\frac{w^g}{w^p} = 1.139$. A recent paper by Dickson et al. (2014) argues that the lifetime premium in the public sector is lower than that measured by standard cross-section methods. They report that, in Spain, it is 7.17 percent. We report exercises using their numbers. We also report the equilibrium under the efficient public-sector wage premium: $\frac{w^g}{w^p} = 0.91$. The fact that the optimal wage premium is negative reflects mainly the facts that the expected duration of a job in the public sector is longer.

Salomäki and Munzi (1999) find that the unemployment benefit net replacement rate is 44 percent in Spain. We set $b = 0.398$ to target this number. Additionally, $r = 0.012$ and $\tau = 0.006$ target a yearly interest rate of about four percent and an average working life of 40 years.

The most relevant parameters are the fraction of jobs reserved for people with connections, $\bar{\mu}$, and the distribution of connections costs, $\Xi(\cdot)$, but identifying them is subject to the difficulties that prompted us to approach this question from a theoretical angle. Regarding $\bar{\mu}$, we proxy it with data from the *Quality of Government Survey*. For Spain, the index for "skills and merit" is 5 while for both "political" and "personal connections" is 3.2. Dividing one by the sum of the two, we get $\bar{\mu} = 0.4$.[6], we calculate $\bar{\mu}$ of the remain-

[6]Alternatively, we use the wider Corruption Perception Index for 2006. The index varies from 1 (more corrupt) to 10 (least corrupt). We select 30 European countries and normalize the least corrupt country (Finland, with 9.6 points) to a $\bar{\mu} = 0$ and the most corrupt country (Romania, with 3.1) to $\bar{\mu} = 1$. As shown

ing countries by mapping their index in the relative position within the maximum and the minimum. Spain, with an index of 6.8, is attributed a $\bar{\mu}$ equal to 0.43, close to our baseline value. The distribution of connections costs, denominated in present value, is assumed to be uniformly distributed between 0 and 55, set exogenously. This distribution implies that the deadweight cost of corruption is 0.1 percent of the total consumption of private-sector goods. A report prepared for the European Commission (Hafner et al. 2016) places the wider costs of corruption in Spain, both private and public, in between 6 and 9.6 percent of GDP. Our numbers suggest we could account for 2 percent of these costs, which we find reasonable. The exercises consist of varying these parameters. We vary the parameter $\bar{\mu}$ from 0 to 1 and consider high and low values for the upper bound of the distribution of connections costs of $\bar{c} = 10$ and $\bar{c} = 100$. In the baseline steady-state, the government can achieve its target fraction $\bar{\mu}$ of jobs, meaning that μ is unconstrained.

We start by analyzing the effects of nepotism in public-sector hiring for different combinations of public-sector wages. We take into account that changes in policies or parameters might trigger the endogenous limit of μ to bind, as determined by equation 28. Sometimes the government might not be able to fill its targeted $\bar{\mu}$ fraction of jobs through connections. Figure 5 shows how different variables vary with $\bar{\mu}$ for three different wage policies: the benchmark policy with premia of 13.9 percent; an intermediate wage policy with premia of 7 percent; and the efficient wage policy consisting of premia of -9 percent. We examine the effects on unemployment rates, the fractions of connected workers, and welfare, calculated as private-sector production net of the connections costs (as in Section 5), relative to the efficient allocation. As in Gomes (2015), the optimal policy is a negative public-sector wage premium in order to compensate for the higher relative job security.

Under the efficient wage policy, μ is constrained to be zero. There are no queues for public-sector jobs and no connections sector. Unemployment rate is roughly 3 percentage points lower. The higher public-sector wages are responsible for the higher unemployment and a 2.5 percent lower welfare relative to the efficient scenario.

The graphs reveal that the effects of nepotism seem to be larger the more inefficient the public-sector wage is. In the calibrated model, hiring through connections indeed raises welfare. As shown in Proposition 1, it lowers the unemployment rate. By restricting access to public-sector jobs to those with connections, workers are discouraged from searching for unconnected vacancies in the public sector, and turn to the private sector. As tightness is constant, there is a one-to-one effect on private vacancies. While, indeed, the fraction of connected workers increases - with the respective increase in deadweight loss - this is outweighed by the increase in private-sector employment. Thus, welfare increases.

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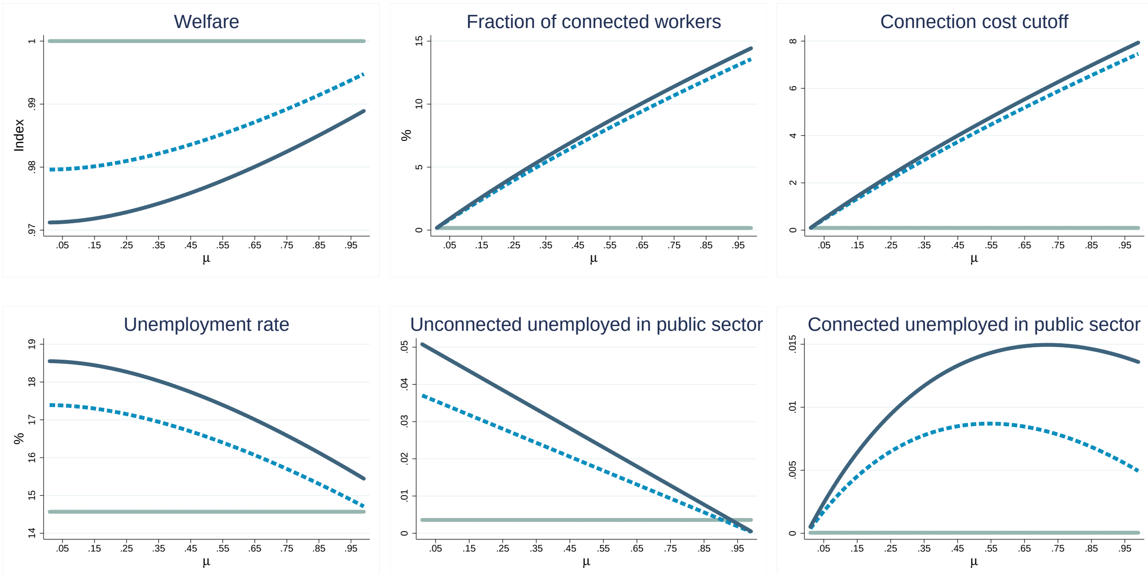
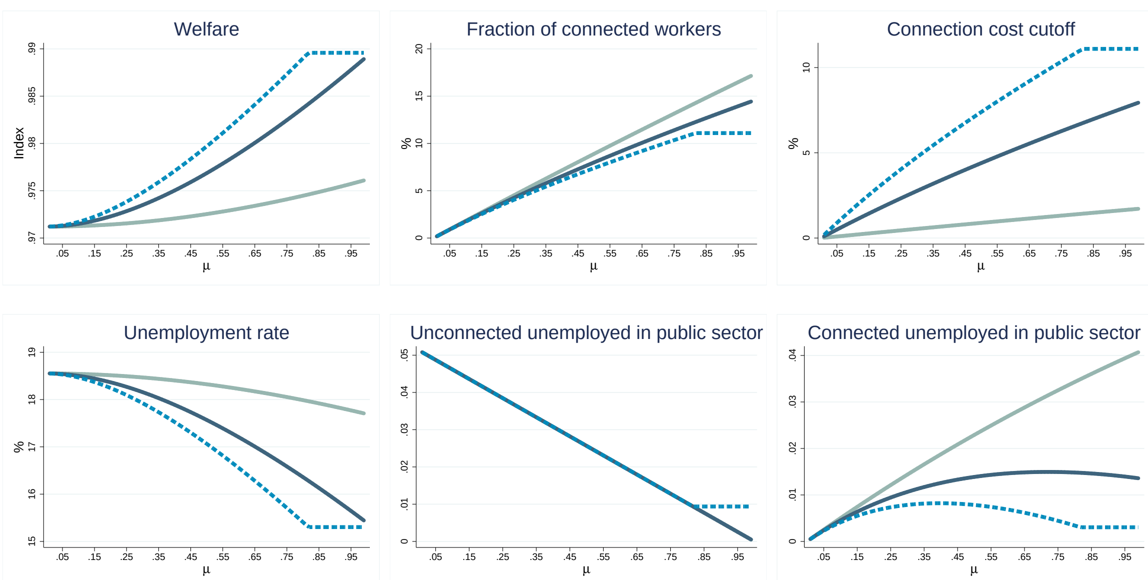
in the figure in Appendix G

Figure 5: Effects of nepotism, role of public-sector wages



Note: We vary $\bar{\mu}$ along the x-axis. The ***dark blue line*** *is the benchmark calibration ($w^g/w^p = 1.139$). The* ***light green line*** *is the scenario with efficient public-sector wages ($w_h^g/w_h^p = 0.908$). The* ***bright blue dashed line*** *is the scenario with an intermediate public-sector wage premium ($w^g/w^p = 1.072$). Welfare is expressed as a fraction of the efficient steady state. In the scenario with efficient public-sector wages, μ is constrained to zero. In all the other scenarios μ is unconstrained. Tightness and wages in the private sector are constant and independent of public-sector wages or nepotism ($\theta = 0.06$, $w^p = 0.901$).*

Figure 6: Effects of nepotism, role of connections costs



Note: We vary $\bar{\mu}$ along the x-axis. The ***dark blue line*** *is the benchmark calibration ($\bar{c} = 55$). The* ***light green line*** *is the scenario with low connections costs ($\bar{c} = 10$). The* ***bright blue dashed line*** *is the scenario with high connections costs ($\bar{c} = 100$). Welfare is expressed as a fraction of the efficient steady state. In the scenario with high connections costs, μ becomes constrained. Tightness and wages in the private sector are constant and independent of public-sector wages or nepotism ($\theta = 0.06$, $w^p = 0.901$).*

Figure 6 reproduces the same exercise for three levels of connections costs. Again, for this set of parameters, an increase in $\bar{\mu}$ increases welfare. The increase is larger for high levels of connection costs. When the connections costs are higher, the connections market becomes more exclusive. When increasing $\bar{\mu}$, more workers are pushed into the private sector, which implies larger decreases in unemployment and larger increases in welfare.

In Figure 6, the kink observed for high connections costs reflects the fact that, because it is so costly to get connections, the endogenous limit binds for μ. As shown in Lemma 2, the minimum wage for the government to be able to fill a fraction $\bar{\mu}$ of jobs through connections – $\underline{w}_c^g$ – is increasing in $\bar{\mu}$. If the public-sector wage is not high enough to sustain a large connections sector (that is $w^g < \underline{w}_c^g$), the endogenous limits bind and μ is determined by $\mu = \frac{L_c^g}{e^g(s^g+\tau+1)}$ (see 28), and hence changes in $\bar{\mu}$ do not affect the equilibrium.

6 A microfoundation of public-sector policies

In the preceding analysis we considered the effects of changes in government policies without taking a stance on how governments decide on these policies. We also studied three different cases: (i) the case in which the government sets the efficient wage and there is no hiring through connections ($\mu = 0$); (ii) the case in which the government targets to fill a certain fraction of jobs through connections ($\bar{\mu}$) and faces no restrictions in achieving this target ($\mu = \bar{\mu}$); and (iii) the case in which the government cannot achieve its target and fills a smaller fraction of jobs through connections ($\mu < \bar{\mu}$). We now provide one possible microeconomic foundation for the public-sector policies, which highlights possible interdependencies of policies and can generate the different particular cases analysed so far.

Consider a government that is limited in its amount of spending to ω, exogenous, that arises from budgetary constraints. The government has an objective function with three components. The first, $\log(e^g)$ is the preference for government services that are produced using its workforce. The second, is the preferences of a union represented by $\varsigma \log(a)$. Here ς represents the weight of the union in the government preferences and a is the extra payment to public-sector workers on top of the minimum required wage for the existence of the public sector ($w^g = \underline{w}_u^g + a$). The union knows what the minimum required wage is and tries to push for wages above it. The third element, $\varphi \log(e_c^g) - \vartheta e_c^g$, reflects nepotism and has two parts. φ represents the weight attributed to hiring connected workers, e_c^g, that could reflect general corruption, cronyism or vote buying. In other words, the government can offer jobs in order to favor certain groups, gain influence or buy votes. ϑ represents the cost of nepotism for the government, for instance the public backlash when cases are denounced by the media. Stronger media in the country should raise the cost of such practices, i.e. raise ϑ.

The government's problem can be written as:

$$\max_{e^g, e^g_c, a} \log(e^g) + \varsigma \log(a) + \varphi \log(e^g_c) - \vartheta e^g_c$$

$$s.t.$$

$$(\underline{w}^g_u + a)e^g = \omega,$$

$$\chi e^g_c \leq a$$

where $\chi e^g_c \leq a$ is the restriction that the wage is high enough for a connections sector to exist. It is basically the restriction $w^g \geq \underline{w}^g_c$ and is derived using the expression $\underline{w}^g_c = \underline{w}^g_u + \Xi^{c,-1}(\mu(s^g + \tau)e^g)(r + \tau + s^g + 1)$, in Appendix A. Assuming that the distribution of connections is uniform we get a linear relation between a and the number of connected public sector workers, represented by the parameter χ. The three first-order conditions determining government policies are given by:

$$\frac{1}{e^g} = \Lambda_1 w_g, \tag{29}$$

$$\frac{\varsigma}{a} = \Lambda_1 e^g - \Lambda_2, \tag{30}$$

$$\frac{\varphi}{e^g_c} - \vartheta = \Lambda_2 \chi, \tag{31}$$

plus the complementary-slackness condition:

$$\Lambda_2(a - \chi e^g_c) = 0, \tag{32}$$

where Λ_1 and Λ_2 are the multipliers in both constraints. These first-order conditions show the possible interdependence between the government policies.

We are going to distinguish the three cases that mimic the special cases discussed in the paper. In the absent of unions or vote buying ($\varphi = \varsigma = 0$), the government sets the minimum wage that would guarantee hiring enough workers and maximize government production. This would be the efficient solution discussed in Section 5.1, where there are no distortions in the labour market and the government maximizes the provision of its services, given its budget constraint. This is the outcome of a benevolent government that never hires through connections.

Consider a second case where there is no intrinsic cost of nepotism, $\vartheta = 0$, i.e. the government has a tight control over the media. In such case, the second constraint always holds with equality, generating the constrained case in Section 4.2. In this case the government wants to use connections at the maximum. In other words, since there is no cost of nepotism, it wants to set $\mu = \bar{\mu} = 1$, but budgetary constraints prevent the government from doing so.

The government cannot set the wage high enough to attract enough connected job searchers and is restricted to fill only a smaller fraction of jobs through connections ($\mu < \bar{\mu} = 1$). Substituting out the multipliers, we get a the solution for the three variables:

$$e^{g*} = \frac{\omega(1-\varphi-\varsigma)}{\underline{w}_u^g} \tag{33}$$

$$a^* = \underline{w}_u^g \frac{\varphi+\varsigma}{1-\varphi-\varsigma} \tag{34}$$

$$e_c^{g*} = \frac{\underline{w}_u^g}{\chi} \frac{\varphi+\varsigma}{1-\varphi-\varsigma} \tag{35}$$

Both φ and ς raise wages and nepotism, and lower employment, relative to the efficient case. High wages and nepotism in the public sector can therefore reflect two different situations. Consider first a scenario where ς is low, so unions do not have much power, but where φ is high - the government has a strong interest in nepotism. The government wants to hire a larger number of connected workers, so it lowers employment and sets the wage higher in order to attract a higher number of connected job searchers. Consider an alternative scenario, where φ is low so there is no intrinsic interest in cronyism, but the weight of unions is high (represented by an increase in ς). This induces the government to free up resources for raising wages by lowering employment. Government jobs are now fewer and better paying. This relaxes the constraint on the nepotism, lowering the multiplier which raises e_c^g even if φ is very close to zero (because there is no other cost of nepotism). This reflects the case in which nepotism exists in the public sector mainly because union pressures set the wage high, which in turn, generates large queues of unemployed seeking to get public jobs and induces workers to find alternative ways to get them. In the two scenarios, both wages and nepotism would be high, but for different reasons.

If there is an additional cost of nepotism $\vartheta > 0$, there are two solutions depending on whether the second constraint holds with equality or not. The third case, which mimics the baseline version of the model, exists when the second constraint holds with strict inequality. The interior solution is given by:

$$e^{g*} = \frac{\omega(1-\varsigma)}{\underline{w}^g} \tag{36}$$

$$a^* = \underline{w}_u^g \frac{\varsigma}{1-\varsigma} \tag{37}$$

$$e_c^{g*} = \bar{e}_c^g \tag{38}$$

where $\bar{e}_c^g = \frac{\varphi}{\vartheta}$ is the unconstrained choice, which we assume it is smaller than optimal choice of e^{g*}. In this case, the pressure from the media constrains nepotism, more than the wages. The government's targeted fraction of connected jobs is small enough so that the restriction that wages are high enough never binds. The government is able to get its target number of connected workers, given by $\bar{\mu} = \frac{\bar{e}_c^g}{e^{g*}}$, and nepotism does not affect government's choice of the number of workers nor their wage. An increase in $\bar{\mu}$ could reflect an increase in governments' intrinsic interest in nepotism (an increase in φ) or stronger control over the media (a decrease in ϑ). Such changes would increase $\bar{\mu}$ but would not affect public employment or wages. Wages could increase because of an increase in union power, which would drain resources from the production of services. This would increase $\bar{\mu}$, as $\bar{e}_c^g$ would be the same but employment lower.[7]

We think there could be alternative ways of modeling the government that could generate different interactions between policies. For instance, one could consider that the government incorporates the effects of policies on the labour market, for instance on unemployment, when deciding. In the absence of a consensual theory, we prefer to analyse the effects of each policy variable on the labour market in isolation.

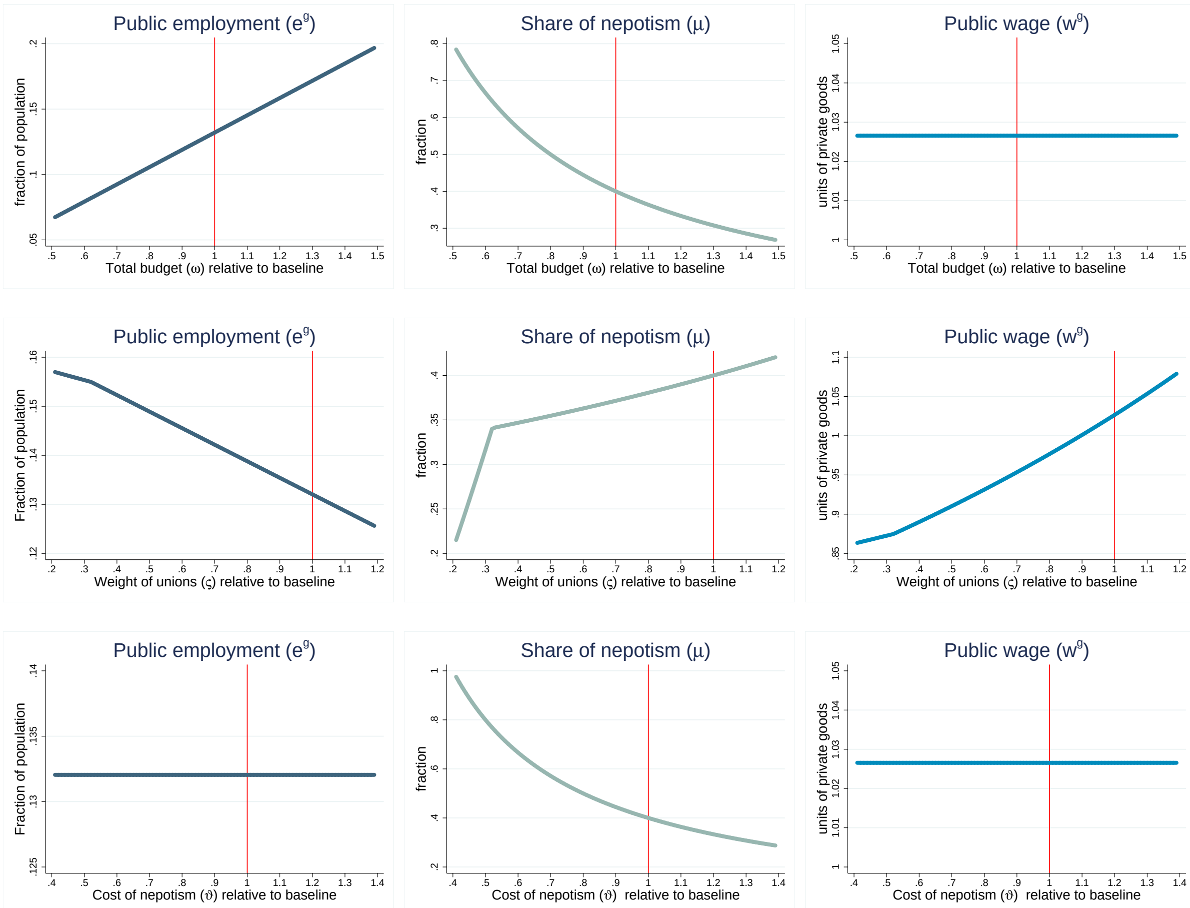
Using the quantitative model, we can back out the deep parameters that generate the calibrated policies, and can see their effects. These are shown in Figure 7. An increase of the government budget, shown in the first row, is reflected only on the size of public employment, but, as it does not affect the optimal number of connected workers, it also implies a reduction in μ. Varying the role of unions, shown in the second row, illustrates well the potential interdependence of policies. Raising union power, puts an upward pressure on the public wages. Because of the budgetary constraint, higher wages have to be compensated by lower size of employment. As total public employment falls, the share of connected workers increases. The kink we observe for low levels of union power, is the change in case. For low levels of wages, the number of connected workers is constrained. Finally, in the last row, we plot how the three policy variables change with the intrinsic cost of nepotism (ϑ). We can see, that it does not affect wages or employment, but has a one-to-one effect on μ. We can, therefore, validate the exercises in Section 5.3.

7 Extensions

In this section, we discuss and compare the effects of nepotism and government policies on employment under two alternative model assumptions: (i) random search in the unconnected market; (ii) heterogeneous workers. The assumption of random search generates different

[7] The constrained solution when $\vartheta > 0$, involves solving a quadratic equation in a: $\underline{w}^g \frac{\varphi}{\vartheta} a^2 + (1 - \varphi - \varsigma)a - \underline{w}^g(\varphi + \varsigma)$. Beside a more complicated algebra it is conceptually similar to the constrained case with $\vartheta = 0$.

Figure 7: Joint determination of public policies



Note: From the baseline calibration we can back out the parameters $\underline{w}_u^g = 0.817$*,* $\omega = 0.136$ *and* $\varsigma = 0.204$*. We can also back out* $\chi = 1.081$ *as an approximation. We can back out* $\frac{\varphi}{\vartheta} = 0.053$*, but we cannot separate the two. As we only analyse the cost of nepotism, we normalize* $\varphi = 1$*. The graphs show how* e^g *(**dark blue line**),* μ *(**light green line**) and* w^g *(**bright blue line**) change with the deep parameters* ω*,* ς *and* ϑ *(shown relative to baseline values. The baseline is shown in the vertical (red) line.*

transmission mechanisms of employment and wage policies. While it is also used in the literature, there is no clear evidence whether it is a more or less realistic assumption when compared to segmented markets. Introducing worker heterogeneity allows us to characterize how the selection of the workers into the public and private sector interacts with wages and the existence and use of nepotism in the public sector. It allows us to capture the common notion/belief that nepotism is associated with non-meritocratic hiring, i.e. not selecting the best workers but those who have connections.

7.1 Random search between the private sector and the unconnected public sector

We now analyze the case in which the workers without connections cannot direct their job search exclusively towards the public or the private sector. We assume that these workers search randomly for jobs in the two sectors. A matching function $m(v_u, u_u)$ determines the total number of matches between unconnected workers and jobs and $m(\theta)$, where $\theta = \frac{v_u}{u_u}$, gives the rate at which unconnected workers match with a given vacancy. Since they search randomly for jobs, the total number of vacancies available to them, consists of both private-sector v^p and government unconnected vacancies v_u^g, $v_u = v^p + v_u^g$. They find jobs in the private sector at rate $m(\theta)\gamma^p$ and in the public sector at rate $m(\theta)(1-\gamma^p)$, where $\gamma^p = \frac{v^p}{v_u}$ is the fraction of private-sector vacancies in the total number of vacancies available to workers without connections.

The key difference between the model with random search and segmented markets is the value of unemployment for unconnected workers. It changes because they now randomly search for jobs in both sectors. Specifically,

$$(r+\tau)U_u = b + m(\theta)\gamma^p \left[E_u^p - U_u\right] + m(\theta)(1-\gamma^p)\left[E_u^g - U_u\right]. \tag{39}$$

Under segmented markets, tightness in the private sector is independent of any government policy (see Lemma 1) because the outside option (unemployment value) of workers searching in the private sector is independent of government policy. Under random search, by contrast, the outside option of unconnected workers is a convex combination of the value a public-sector job (E_u^g) and the value of a private-sector job (E_u^p) with weights reflecting the relative number of vacancies in the two sectors, as seen in equation (39). Thus, public-sector wages, employment, separation rate and nepotism affect private-sector wages, that are given by

$$w^p = b + \beta\left[y - b + \gamma^p\theta\kappa\right] + (1-\beta)D(w^g - b), \tag{40}$$

where $D = \frac{(1-\gamma^p)m(\theta)}{r+\tau+s^g+(1-\gamma^p)m(\theta)}$ measures how much public wages influence private-sector wage bargaining. A free-entry condition as in (11) determines the number of vacancies posted by firms. But now the match surplus, $S_u^p = \frac{p-w^p}{r+s^p+\tau}$, depends also on public-sector policies and nepotism. In addition, the cutoff connection cost, $\tilde{c} = U_c^g - U_u$, changes to reflect that the value of unemployment to unconnected workers is now given by (39). The full set of equations describing the model with random search, a formal definition of a steady-state equilibrium and conditions for existence of a steady-state equilibrium are in Appendix C.

Under random search, the effects of government policies work through: i) the selection into connected and non-connected workers (as in segmented markets); and ii) the outside option of unconnected workers and its impact on private wages. We show in Appendix C that:

Proposition 4 *An increase in w^g lowers job creation (lowers θ), induces more workers to obtain connections and queue for connected public-sector jobs (i.e., increases L_c^g and lowers L_u) and lowers the employment rate.*

The increase in the public wage improves a worker's payoff from getting a job in the public sector. This improves the outside option of searching workers pushing their wage in the private sector up and reducing firm's incentives to create jobs. At the same time, it induces more workers to obtain connections and queue for connected jobs. Both the decrease in θ ($m(\theta)$) and the decrease in L_u lower the employment rate. If $\mu = 0$, meaning that no connections sector exists, then all effects work only through the outside option. In the other extreme case, where $\mu = 1$ (meaning that $v_u^g = 0$, $\gamma^p = 1$, $D = 0$, and all government vacancies are for connected workers), tightness and wages in the private sector become identical to those obtained under segmented markets, and all effects work through the selection into connected and non-connected workers, as in segmented markets.

Under random search, public-sector policies work not only through the selection into connected and unconnected workers, but also through their impact on private-sector wages and in turn, tightness. For this reason, the effect of nepotism on employment can be either positive or negative. With a higher fraction of public-sector jobs being retained for workers with connections, a larger fraction of workers who do not have connections end up in private- instead of public-sector jobs (i.e., γ^p increases, shifting weights in (39) from E_u^g to E_u^p). Assuming that government jobs are more valuable to workers than private jobs are (that is, $E_u^g > E_u^p$), the presence of nepotism in the public sector worsens the outside option of unconnected workers; private wages decrease; and job creation of firms increases with a positive impact on employment. In addition to this job-creating effect, an increase of nepotism makes the option of investing in connections more attractive. More workers seek public-sector jobs through their connections, queuing up, with a negative impact on employment.

In segmented markets, a decrease in the fraction of government jobs available to non-connected workers has a positive impact on employment because some workers, those whose cost of obtaining connections is large, will direct their search towards the private sector. Under the assumption of random search this positive effect is not present, because workers cannot direct their search towards the private sector. On the other hand, under random search there is an additional positive effect on employment, which is not present under segmented markets: nepotism hurts the outside option of workers thereby increasing private-sector job creation.

We carried a quantitative exercise with the random search model, similar to the one in Section 5.3. We show it in Appendix H. In this alternative setting, we find that welfare has a U-shape relation with nepotism. For low levels of nepotism, welfare falls with μ, but above levels around 0.5, it increases with μ.

7.2 Heterogeneous Workers

We assume that a fraction X_h of the labor force has high ability and the remaining has low ability. Since the total labor forced is normalized to 1 we can write $X_l = 1 - X_h$, where X_l is the share of low-ability workers in the labor force. High-ability workers are more productive than low-ability workers, that is, $y_h > y_l$. To avoid problems of adverse selection, we assume that ability is observable. In the private sector, there are two separate submarkets, one for high- and one for low-ability workers. In the public sector we assume only one submarket in which the government opens vacancies and both types of workers can apply. We further assume that it pays the same wage to both types of workers, reflecting the fact that wages in the public sector are more compressed (even within education categories) than in the private sector. But the chances of being hired differ between the two types. Since ability is observable, the government can perfectly screen candidates and gives priority to the high-types. Perfect screening and unique wages in the public sector were also assumed by Geromichalos and Kospentaris (2020). We differ on the assumption on the private sector. While they assume random search from the firm side, which creates more intricate interactions between composition of ability and job creation, given our assumption that ability is observed, we have segmented markets, meaning that firms can direct their search towards either high- or low-type workers.

Both high- and low-ability workers prior to entering the labor force, they decide which sector to join and whether or not to obtain connections. In the connected public sector the job finding rate is independent of ability. As above, by obtaining connections workers can gain access to a subset of jobs reserved for connected workers, but in addition, can avoid being screened based on ability.[8] As it will be further discussed below, the low-types have an additional incentive to use connections, which is to avoid screening, whereas, the only reason why the high ability workers might use connections is to jump the queue when the queue for public jobs is too long.

Since the two types differ in terms of productivity, the value of searching for a job as

[8] We should not think about the heterogeneity in this extension as education. While it is possible for the government to hire a bad teacher/civil servant with connections instead of a more able one, it is institutionally hard to hire someone without a college degree to be a teacher/civil servant, even with connections. Most public-sector jobs have strict education requirements, and those are hard to avoid.

well as the value of being employed in the private sector also differ. On the firm size, there are now two free-entry conditions, two different surpluses, and hence different tightness and wages for high- and low-ability workers, given by:

$$\frac{\kappa}{q(\theta_i)} = \frac{(y_i - b)(1-\beta)}{r + \tau + s^p + \beta m(\theta_i)}. \tag{41}$$

$$w_i^p = b + \beta(y_i - b + \kappa\theta_i). \tag{42}$$

where $i = [h, l]$ denotes high- and low-ability. It can be verified that $\theta_h > \theta_l$ because $y_h > y_l$. It follows also that $w_h^p > w_l^p$ and high-ability workers enjoy higher values in the private sector than lower ability workers. That is, $E_{u,h}^p > E_{u,l}^p$ and $U_{u,h}^p > U_{u,l}^p$. Moreover, following Lemma 1, θ_h and θ_l are both independent of employment and wage policies.

In the public sector also, the values of being employed or unemployed for workers that do not have connections differ by ability. Despite wages being the same for all workers, irrespective of ability, because the government screens candidates and gives preference to the high-types, workers have different job-finding rates, $m_{u,i}^g$. In the connection market, we assume that ability does not affect a worker's probability of being hired, given by m_c^g. Since the wages are also equal for the two types, the values of unemployment and employment for connected workers are the same irrespective of ability and remain as in (4) and (6). The full set of equations describing the model with heterogeneous workers is in Appendix D.

7.2.1 Workers' selection and public-sector wages

High- and low-ability workers without connections can search in either the public or the private sector. In an equilibrium where both markets are active, the values of these two options would have to equate:

$$U_{u,h} = U_{u,h}^p = U_{u,h}^g \tag{43}$$

$$U_{u,l} = U_{u,l}^p = U_{u,l}^g \tag{44}$$

These two conditions would determine the numbers of high- and low-ability unconnected searchers in the public sector, $u_{u,h}^g$ and $u_{u,l}^g$. Given our setup, only one of the two types of workers will be active in the unconnected public-sector market. We show that the presence of high- and low-ability workers in each of the two segments of the public sector depends on the wage. If wages are low, only low-ability workers are interested in the public-sector and no high-type will apply. Thus, $u_{u,h}^g = 0$ and $u_{u,l}^g$ is pinned down by condition (44). If wages are high enough to attract high-ability workers, as they have priority, given the perfect screening, the low-ability have no chance to get a job. Hence, $u_{u,l}^g = 0$ and $u_{u,h}^g$ is pinned down by condition (43).

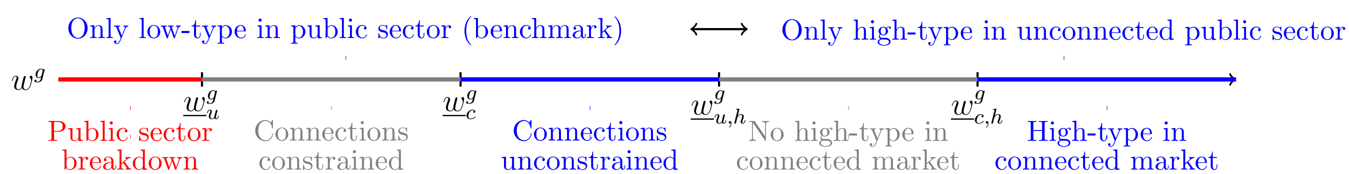
Alternatively all workers can use connections to get into the public sector after paying the cost c drawn from $\Xi(\cdot)$. The threshold cost at which a worker of type-i is indifferent between using and not using connections to find a government job is $\tilde{c}_i = U_c - U_{u,i}$. These two thresholds determine the allocation of each type of worker into connected or unconnected. The following lemma, depicted graphically in Figure 8, summarizes the results on selection.

Lemma 4 *The (unconnected) public sector will attract high-ability workers only if* $w^g > \underline{w}^g_{u,h}$*. If* $w^g > \underline{w}^g_{u,h}$ *there are no low-ability workers in the unconnected public-sector and all low ability workers attached to the public sector have connections. Some high-ability workers will use connections to get a public-sector job only if* $w^g > \underline{w}^g_{c,h}(> \underline{w}^g_{u,h})$*.*

The exact expressions for $\underline{w}^g_{u,h}$ and $\underline{w}^g_{c,h}$ are in Appendix D. Since high-ability workers enjoy higher wages and can find jobs in the private sector faster than low-ability workers, there is a cutoff wage below which high-ability workers ignore the public sector. Below this cutoff, $\underline{w}^g_{u,h}$, the wage is too low to attract better workers, even when their chances of getting one are at the maximum ($m^g_{u,h} = 1$). It follows that if $w^g \leq \underline{w}^g_{u,h}$ then only the low types are attached to the public sector, while all high-type workers are in the private sector. This case corresponds to our benchmark model where all workers searching in the public sector are identical. The only difference here is that an additional "high-ability" market exists in the private sector, which is, however, completely isolated from the public sector or the "low-ability"market of the private sector. So results in Propositions 1-3 carry through to this case and, following Lemma 2, two additional cutoffs, $\underline{w}^g_u$ and $\underline{w}^g_c$, below $\underline{w}^g_{u,h}$, determine the existence of a public sector of size e^g and the existence of a connections sector of size $\bar{\mu}e^g$, given that the public sector attracts only low-ability workers.

If $w^g > \underline{w}^g_{u,h}$, the number of high-type unconnected workers wanting a public-sector job is greater than the number of vacancies ($m^g_{u,h} < 1$) and some of them will be queuing up. This means that if $w^g > \underline{w}^g_{u,h}$ a low-type can never get a public job without connections, because the high-types will be given priority. Low-ability workers will either go to the private sector or try to get a public-sector job through connections. If wages are just above this cut-off, no high-type would get connections and all workers hired through connections are of low-type. But if the wage is much higher then large queues of high-ability workers waiting to get

Figure 8: Lemma 4: The role of public-sector wage



jobs in the public sector may make it worthwhile for some of them to invest in connections to jump the queue. In particular, there is a wage $\underline{w}^g_{c,h}(> \underline{w}^g_{u,h})$, such that if $w^g > \underline{w}^g_{c,h}$, then $U_c > U_{u,h}$ ($\tilde{c}_h > 0$) and some high-type workers will try to get public jobs through connections ($L^g_{c,h} = X_h \Xi(\tilde{c}_h) > 0$), whereas, if $w^g \leq \underline{w}^g_{c,h}$, then $U_c \leq U_{u,h}$ ($\tilde{c}_h \leq 0$) and no high-ability worker obtains connections ($L^g_{c,h} = 0$).

7.2.2 The effects of public-sector wages and nepotism

When the wage is below $\underline{w}^g_{u,h}$ the model looks very much like the baseline model. An increase in $\bar{\mu}$ increases total employment by shortening public sector queues, while more generous wages have the opposite effect, as summarized in Propositions 1 and 2. The only difference here is that these changes affect only the low-ability workers since for $w^g \leq \underline{w}^g_{u,h}$ there are no high-ability workers in the public sector.

In Appendix D we also derive results for the effects of an increase in $\bar{\mu}$ on employment in the case where $w^g > \underline{w}^g_{u,h}$, and there are both high- and low-ability workers in the public sector. We explore, in addition, the effect of changes in $\bar{\mu}$ on the composition (in terms of ability) of private- and public-sector labor force and employment. Results are summarized in the following two Propositions.

Proposition 5 *If $w^g > \underline{w}^g_{c,h}$ an increase in $\bar{\mu}$ decreases the number of workers searching for public-sector jobs (decreases $u^g = u^g_u + u^g_c$), increases the number of workers in the private sector (i.e., increases $L^p_u = 1 - L^g_u - L^g_c$) and increases the employment rate (as in Proposition 1). But, if $\underline{w}^g_{c,h} \geq w^g \geq \underline{w}^g_{u,h}$ these effects are ambiguous.*

At higher $\bar{\mu}$, more workers use connections to get jobs in the public sector, but also more workers go to the private sector. To be worthwhile for some high-ability workers to use connections to get public jobs ($w^g > \underline{w}^g_{c,h}$), it must be the case that the public sector is too crowded; queues for government jobs are so long so that incentives to use connections to get one are strong. If queues are long, an increase in $\bar{\mu}$, will drive more high-ability workers away from the (unconnected) public sector and into the private sector than workers from the private towards the (connections) public sector. As a consequence, the total labor force attached to the private sector increases.

In the intermediate case where high-ability workers have no incentive to use connections ($\underline{w}^g_{c,h} \geq w^g \geq \underline{w}^g_{u,h}$), it is not clear if an increase in $\bar{\mu}$ will drive more high-ability workers from the (unconnected) public sector towards the private sector or more low-ability workers from the private sector towards the connections sector. Additionally, an increase in $\bar{\mu}$ effects the two types of workers differently through its impact of the relative size of the public sector (decreases it for high-ability and raises it for low ability). As the public sector has lower separation rate, there is an additional effect through frictional unemployment. Hence, the impact on private-sector labor force in this case is ambiguous.

Proposition 6 *If $w^g > \underline{w}^g_{u,h}$ an increase in $\bar{\mu}$ increases (decreases) the average ability of workers in the private (public) sector.*

When the government attracts both low- and high-ability workers ($w^g > \underline{w}^g_{u,h}$), those discouraged by the presence of nepotism are the high-ability ones. The low types benefit the most from the use of connections because they can avoid screening and competition from the high types and in addition, their wage premium is greater than that of high-type workers. Low-types have more incentives to get connections so that an increase in the fraction of jobs available through connections will attract more of them. Although through a different mechanism, this result echoes the findings in Geromichalos and Kospentaris (2020) that meritocratic hiring of public employees decreases private sector's productivity. This raises another question of where is it better to have the best workers: in the private or the public sector? An open and difficult question to be answered with future research.

7.3 Further analysis

We consider three additional exercises presented in Appendixes E, F and H. First, we consider a version with competitive search in the private sector. We show that the equilibrium conditions are identical to those obtained in the benchmark model when the Hosios condition holds. Second, we assume that the newborn pay connections costs to current connected public-sector workers so that current workers will help fast-track them into the public sector. These payments are a "connections premium", which will further raise the value of working in the public sector for connected workers. Finally, we use the quantitative model calibrated to the Spanish economy and perform some additional exercises, changing public employment and wages. Besides confirming the results of propositions, we also compare the transmission mechanisms under the assumptions of segmented markets and random search.

8 Conclusion

This paper provides a benchmark model to understand how public-sector hiring and wage policies affect rent-seeking decisions and employment. The model takes in account one pervasive characteristic in many public sectors - hiring practices are sometimes based on nepotism. Our results provide insights that can explain some European cross-country facts. Previous literature has highlighted the problems of setting high public-sector wages. For example, Gomes (2015) and Afonso and Gomes (2014) shown that they generate higher unemployment. Cavalcanti and Santos (2017) argue that higher wages might lead to misallocation of resources with a lower entrepreneurship rate. We highlight an additional negative effect. Higher public-sector wages might lead workers to pursue rent-seeking activities.

We have shown that the existence of a "connections" market for public jobs requires that public-wages are very high compared to those in the private sector. This result is consistent with evidence that Southern European countries, known for having non-meritocratic hiring, have a higher public-sector wage premium, while Nordic countries, in which governments follow more meritocratic hiring, tend to have a lower or a negative premium. The results also suggest why Southern European governments might maintain the status quo of the hiring process. Conditional on high wages and long queues for public-sector jobs, the existence of nepotism actually lowers unemployment.

The connections market that we have emphasized could not exist in the private sector in the same form. We have shown that in the public-sector connected workers are given priority for jobs even if the surplus they generate is not larger than that of workers without connections. In the private sector this is not possible. Wage bargaining and free-entry of firms would ensure that job-finding rates would reflect nothing but match surplus. Obtaining connections would help find jobs in the private sector faster only if connections could help improve the match surplus or only if employers could somehow benefit more from hiring through connections than through standard search. If not, the endogeneity of job-creation – that is absent in the public sector – would eliminate any incentive to become connected.

We have also shown that, if low-ability workers face lower chances of entering the public sector, the existence of nepotism induces the high-ability workers to search for private jobs and low-productivity workers to invest in connections, reflecting another common perception of nepotism: that connected workers are of worse quality. To further evaluate the welfare effects in a model with heterogeneous workers, we would need a metric on the productivity of the public sector and of workers in the public sector, as well as the value of public-sector services, for which there is little empirical evidence. Note that if nepotism drains lower quality workers away from the private and into the public sector, the effect on welfare is not necessarily negative if high-quality workers are more important in the private- instead of public-sector production.

While this paper was motivated by differences across European countries, several of the results are useful to think more widely about public sectors in developing countries. Finan et al. (2015) describe a growing body of field experiments in developing countries exploring the personnel economics of the state. Our model can provide a theoretical foundation to help designing field experiments. The literature commonly argues that higher wages for civil servants are necessary to avoid corruption in the public sector. We show that, on the other hand, higher wages for civil servants creates an asymmetry with the private sector, which might itself create an incentive for a different type of corruption.

Although we have emphasized the role of nepotism in recruiting government employees, our model is very general, and some of the results can be extrapolated to other country-specific public-sector characteristics. Dickson et al. (2014) find that countries with a positive lifetime premium of the public sector, France and Spain in their sample, are also the countries that require costly entry procedures, such as national exams. We could reinterpreted the model, considering the cost of connections as the cost of preparing for an exam, and μ the fraction of civil servants hired through an exam. In this case, high ability workers would have more incentive to take the exam, and national exams would further discourage low-ability workers from applying to the public sector. We would conclude that, although this channel could be inefficient, conditional on an inefficient wage policy, it might be one way to not only screen candidates and improve the quality of public-sector labor force, but also to minimize the effects on unemployment.

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COMPANION APPENDIX

Jumping the queue: nepotism and public-sector pay

Andri Chassamboulli and Pedro Gomes

A Proofs of propositions

A.1 Lemma 2

We consider that the public-sector unconnected labour market breaks down if the government is not able to hire enough workers to replace the workers that have lost their job. At the limit, it means the government needs to post a wage, defined as $\underline{w}_u^g$, such that it attracts at least $(1-\mu)(s^g+\tau)e^g$ job searches. This means $u_u^g = (1-\mu)(s^g+\tau)e^g$ and the job-finding rate is 1 ($m_u^g = 1$). Applying this to (16) and then setting $U_u^p = U_u^g$ gives

$$b + \frac{1}{r+\tau+s^g+1}[\underline{w}_u^g - b] = (r+\tau)U_u^p$$

Substituting the $(r+\tau)U_u^p$ by equation (15) we get

$$\underline{w}_u^g = \frac{(r+\tau+s^g+1)m(\theta^*)}{r+\tau+s^p+m(\theta^*)}[w^{p,*} - b] + b$$

where θ^* and $w^{p,*}$ are the equilibrium tightness and wages in the private sector.

If $\mu = 0$ then no connections sector exists and all workers hired into the public sector are unconnected. If, on the other hand, a connections sector exists then a share μ of public-sector workers are hired through connections. For the existence of a connections sector, through which the government is able to hire a fraction μ of its employees the government needs to attract at least $\mu(s^g+\tau)e^g$ connected job searchers. This occurs when the government pays a higher wage, $\underline{w}_c^g$, so that queues in the public sector are long enough to induce enough job searchers to use connections to get government jobs.

$$\underline{w}_c^g = \underline{w}_u^g + \Xi^{c,-1}(\mu(s^g+\tau)e^g)(r+\tau+s^g+1)$$

where $\Xi^{c,-1}$ is the inverse of the distribution of connection cost. What it means is that, at the margin, the government has to pay high enough wages such that public-sector queues are long enough and a sufficiently high mass of newborns decide to pay the cost and obtain connections.

Notice that $\underline{w}_c^g$ is increasing in μ, while $\underline{w}_u^g$ is independent of μ. If $\mu = 0$ then we get $\underline{w}_c^g = \underline{w}_u^g$, whereas if $\mu = \bar{\mu}$ then $\underline{w}_c^g = \underline{w}_c^g$ where

$$\underline{w}_c^g = \underline{w}_u^g + \Xi^{c,-1}(\bar{\mu}(s^g+\tau)e^g)(r+\tau+s^g+1)$$

A.2 Proof of Existence and Uniqueness of a Steady-State Equilibrium

It can be easily verified that the free-entry condition in (13) pins down a unique equilibrium value for tightness in the private sector θ^*. To complete the proof of existence and uniqueness we need to show that with θ^* substituted in, the threshold condition in (23) gives a unique equilibrium value for $\tilde{c}$.

Let us write (23) as:

$$\frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}(w^g-b)\right]-\tilde{c}=\frac{1}{r+\tau}\frac{\beta\kappa\theta}{(1-\beta)} \tag{A.1}$$

where $L_c^g = \Xi(\tilde{c})$. The left-hand-side of (A.1) decreases with $\tilde{c}$. This means that with θ^* substituted in we can use (A.1) to solve for the equilibrium value of $\tilde{c}$. The equilibrium conditions (13) and (23) thus give a unique set of equilibrium values $\tilde{c}^*$ and θ^*. This completes the proof of existence and uniqueness.

A.3 Proof of Proposition 1

First, we show that $\frac{dL_u^p}{d\mu} > 0$ (where $\mu = \bar{\mu}$):
Let $L^g = L_u^g + L_c^g$ denote the total number of workers that are either employed or are searching in the public sector. Using conditions (18) and (20) to solve, respectively, for L_u^g and L_c^g, and then adding them up gives:

$$L^g = e^g\left[\lambda+(1-\lambda)(w^g-b)\left[\frac{\mu}{\tilde{c}(r+\tau)+\frac{\beta}{1-\beta}\kappa\theta}+\frac{1-\mu}{\frac{\beta}{1-\beta}\kappa\theta}\right]\right] \tag{A.2}$$

where $\lambda = \frac{r}{r+s^g+\tau}$. Recall that the equilibrium value of θ is given by equation (13) and is independent of μ; thus $\frac{d\theta}{d\mu} = 0$. Given this, we can write:

$$\frac{dL^g}{d\mu} = \frac{\partial L^g}{\partial \mu} + \frac{\partial L^g}{\partial \tilde{c}}\frac{\partial \tilde{c}}{\partial \mu} \tag{A.3}$$

and using (A.1) we can derive that

$$\frac{\partial \tilde{c}}{\partial \mu} > 0 \tag{A.4}$$

Moreover, it can be easily verified from (A.2) that $\frac{\partial L^g}{\partial \mu} < 0$ and $\frac{\partial L^g}{\partial \tilde{c}} < 0$, implying from (A.3) that

$$\frac{dL^g}{d\mu} < 0.$$

Given that $L_u^p = 1 - L^g$, it follows that $\frac{dL_u^p}{d\mu} > 0$.

Next we show that $\frac{du^g}{d\mu} < 0$. The number of workers searching in the public sector with and without connections are given, respectively, by $u_c^g = L_c^g - \mu e^g$ and $u_u^g = L_u^g - (1-\mu)e^g$. By adding them up we get $u^g = u_u^g + u_c^g = L^g - e^g$. The number of workers employed in the public sector, e^g, is exogenous and independent of μ, while, as shown above, $\frac{dL^g}{d\mu} < 0$. It follows that $\frac{du^g}{d\mu} < 0$.

Finally, we show that the employment rate (e) increases. That is, $\frac{de}{d\mu} > 0$. The total employment rate is given by $e = e^g + e^p$, where e^g is exogenously set by the government, while e^p can be derived from (24) and (27): $e^p = \frac{m(\theta)L_u^p}{s^p+\tau+m(\theta)}$. Adding them up gives:

$$e = e^g + \frac{m(\theta)(1 - L^g)}{s^p + \tau + m(\theta)} \tag{A.5}$$

Evidently, $\frac{de}{d\mu} > 0$, since θ is independent of μ, while $\frac{dL_u^p}{d\mu} > 0$.

A.4 Proof of Proposition 2

First, let us show that the number of workers searching in the public sector increases as the public-sector wage increases; that is $\frac{dL^g}{dw^g} > 0$, which ultimately implies that $\frac{dL^p}{dw^g} < 0$, since $L_u^p = 1 - L^g$.

Using condition (18) we can solve for L_u^g and obtain:

$$L_u^g = (1 - \mu)e^g \left[\lambda + (1 - \lambda)\left(\frac{w^g - b}{\frac{\beta}{1-\beta}\kappa\theta}\right)\right] \tag{A.6}$$

where λ is as defined above (in Proposition 1).

The total number of workers attached to the public sector is given by $L^g = L_u^g + L_c^g$ where L_u^g is as derived above and $L_c^g = \Xi(\tilde{c})$. Taking the derivative with respect to w^g gives:

$$\frac{dL^g}{dw^g} = \frac{dL_u^g}{dw^g} + \frac{dL_c^g}{d\tilde{c}}\frac{d\tilde{c}}{dw^g} \tag{A.7}$$

It is straightforward to verify from (A.6) that $\frac{dL_u^g}{dw^g} > 0$. Moreover, $\frac{dL_c^g}{d\tilde{c}} = \xi(\tilde{c}) > 0$ and using (A.1) we can derive that:

$$\frac{d\tilde{c}}{dw^g} = \frac{M}{r + \tau + \frac{M(1-M)(w^g-b)}{L_c^g - \mu e^g}\frac{dL_c^g}{d\tilde{c}}} > 0 \tag{A.8}$$

where $M = \frac{\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}$. It follows from (A.7) that:

$$\frac{dL^g}{dw^g} > 0 \tag{A.9}$$

Using (A.1), (A.2) and (A.8) we can further show that:

$$\frac{dL^g}{dw^g} = e^g(1-\lambda)\left[\frac{\mu}{\tilde{c}(r+\tau) + \frac{\beta}{1-\beta}\kappa\theta}\left(1 - \frac{r+\tau}{r + \tau + \left(\tilde{c}(r+\tau) + \frac{\beta}{1-\beta}\kappa\theta\right)\frac{(1-M)}{L_c^g - \mu e^g}\frac{dL_c^g}{d\tilde{c}}}\right) + \frac{1-\mu}{\frac{\beta}{1-\beta}\kappa\theta}\right] \tag{A.10}$$

Note that if $\mu = 0$ then

$$\frac{dL^g}{dw^g} = e^g(1-\lambda)\left[\frac{1}{\frac{\beta}{1-\beta}\kappa\theta}\right] \tag{A.11}$$

Comparing (A.10) to (A.11) shows:

$$\left.\frac{dL^g}{dw^g}\right|_{\mu=0} > \left.\frac{dL^g}{dw^g}\right|_{\mu>0} \tag{A.12}$$

and the increase in the number of workers searching in the public sector due to an increase in the public-sector wage is larger when $\mu = 0$ than when $\mu > 0$.

Since $L_u^p = 1 - L^g$ and $u^g = L^g - e^g$, the decrease and increase, respectively, in L_u^p and u^g, is also larger when $\mu = 0$ than when $\mu > 0$.

B Efficiency

As also mentioned in the text, the existence of a connections sector and of queues for public-sector jobs are both inefficient. These two types of inefficiencies can be eliminated by setting $\mu = 0$, which implies $L_c^g = 0$, and $w^g = \underline{w}^g$, which ensures that $u_u^g = (s^g + \tau)e^g$ and the job-finding rate for government jobs is 1. We next compare the central planner's solution to the decentralized one, described in the text, and show that the remaining inefficiency, the congestion externalities can be eliminated with the Hosios condition.

We follow Hosios (1990), Charlot and Decreause (2005), among others, and set $r = 0$, so that the central planner maximizes the steady-state surplus. The planner's problem is to choose θ, u^p to maximize total output, plus unemployment income, minus job creation costs. Given that public sector employment is fixed. The planner's objective is to

$$\max(1 - L^g)\left[(1 - u^p)y + u^p b - \theta\kappa u^p\right]$$

s.t

$$u^p = \frac{s^p + \tau}{s^p + \tau + m(\theta)}$$

We set the Langrangian

$$\mathcal{L} \;=\; (1 - L^g)\left[(1 - u^p)y + u^p b - \theta\kappa u^p\right] + \phi\left[u^p - \frac{s^p + \tau}{s^p + \tau + m(\theta)}\right] \tag{B.1}$$

The three optimality conditions are

$$\frac{\partial \mathcal{L}}{\partial \theta} = 0 \;\Rightarrow\; \phi\frac{m'(\theta)}{s^p + \tau + m(\theta)} = (1 - L^g)\kappa \tag{B.2}$$

$$\frac{\partial \mathcal{L}}{\partial u^p} = 0 \;\Rightarrow\; \phi = (1 - L^g)\left[y - b + \kappa\theta\right] \tag{B.3}$$

$$\frac{\partial \mathcal{L}}{\partial \phi} = 0 \;\Rightarrow\; u^p = \frac{s^p + \tau}{s^p + \tau + m(\theta)} \tag{B.4}$$

Substituting (B.3) into (B.2) gives:

$$\frac{\kappa}{q(\theta)} = \frac{\eta(y - b)}{s^p + \tau + m(\theta)(1 - \eta)} \tag{B.5}$$

where it may be useful to recall that $m(\theta) = \theta^\eta$ and $m'(\theta) = \eta q(\theta)$. It is easy to verify by comparing (B.5) to (13), that given $r = 0$, if $\beta = (1 - \eta)$, then the decentralized equilibrium is identical to the central planner's solution.

C Random search

C.1 Setup

In this appendix we give the full set of equations of the model with random search and characterize its steady-state equilibrium. Further, we show that in the limiting case where $\mu = 1$ the model with random search becomes identical to the model with segmented markets and we provide proofs of Proposition 4.

The values of being unemployed and employed for connected workers remain as in the Benchmark model; given by (4) and (6). The same holds for the values of being employed in either the private or the public sector for unconnected workers (equations 2 and 5), and the values of a private-sector filled jobs and vacancies (equations 7 and 8). The cutoff connection cost as well as the selection of workers into the two groups, L_c^g, L_u, also remain as given in equations (21) and (22). As discussed in the text, only the value of unemployment for unconnected workers changes. It is now given by equation (39). The Nash bargaining wage of the private sector changes accordingly and is as given in (40).

Both government and private firms that seek to hire workers through regular search in the market meet with workers at rate $q(\theta) = \frac{m(\theta)}{\theta}$, where $\theta = \frac{v_u^p + v_u^g}{u_u}$. The number of vacancies in the private sector is determined endogenously by free entry that drives the value of a private-sector vacancy to zero, $V_u^p = 0$. The government needs to post enough vacancies for workers without connections to ensure that the total number of matches with such workers, $q(\theta)v_u^g$, equals the number of unconnected workers that it needs to hire. Hence, the government posts v_u^g vacancies to ensure $q(\theta)v_u^g = (1-\mu)\left(s^g + \tau\right)e^g$.

Setting $V_u^p = 0$ and using the Nash bargaining conditions in (10), we can write the surplus of a private-sector match as

$$S_u^p = \frac{y - b - D(w^g - b)}{r + \tau + s^p + (1-D)\beta m(\theta)\gamma^p} \tag{C.1}$$

and the zero-profit condition that determines job creation in the private sector becomes:

$$\frac{\kappa}{q(\theta)} = \frac{(1-\beta)(y - b - D(w^g - b))}{r + \tau + s^p + (1-D)\beta m(\theta)\gamma^p} \tag{C.2}$$

We can write the threshold level of connection costs, $\tilde{c} = U_c^g - U_u$, as:

$$\tilde{c} = \frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{u_c^g}}{r + \tau + s^g + \frac{\mu(s^g+\tau)e^g}{u_c^g}}(w^g - b) - D(w^g - b) - (1-D)\frac{\beta\kappa\theta\gamma^p}{(1-\beta)}\right] \tag{C.3}$$

As in the benchmark model we treat public sector employment as an exogenous policy variable. There are e^g workers employed in the public sector. Among these workers, μ^g are workers who were hired through connections (e_c^g) and the remaining $(1-\mu)e^g$ are workers hired through regular search in the market (e_u^g). The number of workers employed in the private sector is endogenous and depends on job creation in the private sector as well as conditions in the public sector. The labor force of workers without connections consists of those employed in the public sector, those employed in the private sector (e_u^p), and the unemployed (u_u). Hence, $u_u = L_u - (1-\mu)e^g - e_u^p$. By equating the flows in, $m(\theta)\gamma^p u_u$, to the flows out of the state where a worker is employed in the private sector, $e_u^p(s^p+\tau)$ we obtain:

$$\begin{aligned} e_u^p &= \frac{m(\theta)\gamma^p\left[L_u-(1-\mu)e^g\right]}{m(\theta)\gamma^p+\tau+s^p} && \text{(C.4)}\\ u_u &= \frac{(\tau+s^p)\left[L_u-(1-\mu)e^g\right]}{m(\theta)\gamma^p+\tau+s^p} && \text{(C.5)}\end{aligned}$$

Given $\theta = \frac{v_u^p+v_u^g}{u_u}$ and $q(\theta)v_u^g = (1-\mu)\left(s^g+\tau\right)e^g$, we can use (C.5) to write:

$$\gamma^p = \frac{s^p+\tau}{m(\theta)}\left[\frac{m(\theta)\left[L_u-(1-\mu)e^g\right]-(1-\mu)(s^g+\tau)e^g}{(s^p+\tau)\left[L_u-(1-\mu)e^g\right]+(1-\mu)e^g(s^g+\tau)}\right] \tag{C.6}$$

Using (C.4) and (C.6) we can write the total employment of workers without connections, $e_u = e_u^p + (1-\mu)e^g$ as:

$$e_u = \frac{m(\theta)L_u+(1-\mu)e^g(s^p-s^g)}{s^p+\tau+m(\theta)} \tag{C.7}$$

C.2 The case $\mu = 1$

If $\mu = 1$, then, as can be seen from (C.6), $\gamma^p = 1$, which implies $D = 0$. Setting $\gamma^p = 1$ and $D = 0$ in (40), (C.2) and (C.3) gives:

$$\begin{aligned} w^p &= b+\beta\left[y-b+\theta\kappa\right] && \text{(C.8)}\\ \frac{\kappa}{q(\theta)} &= (1-\beta)\left(\frac{y-b}{r+s^p+\tau+\beta m(\theta)}\right) && \text{(C.9)}\\ \tilde{c} &= \frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}(w^g-b)-\frac{\beta\kappa\theta}{(1-\beta)}\right] && \text{(C.10)}\end{aligned}$$

The zero-profit condition in (C.9) gives a unique equilibrium values for θ which is independent of government policy or conditions in the government sector. Moreover, the zero-profit condition in (C.9), private-sector wages in (C.8) and the cut-off cost in (C.10) are identical to those obtained under segmented markets (equations 13, 14 and 23, respectively). Hence, if $\mu = 1$, private-sector job creation and tightness, wages, as well as the composition of the labor force in terms of connections in the model with random search are identical to those obtained under segmented markets.

C.3 Definition of Equilibrium

A steady state equilibrium consists of a cut-off cost $\{\tilde{c}\}$, tightness $\{\theta\}$, and unemployed $\{u_u, u_c^g\}$, such that, given some exogenous government policies $\{w^g, e^g, \mu\}$, the following apply.

1. Private-sector firms satisfy the free-entry condition (C.2).
2. Private-sector wages are the outcome of Nash Bargaining (40).
3. Newborns decide optimally their investments in connections and the population shares are determined by equations (21)-(22).
4. Flows between private employment and unemployment are constant

$$(s^p + \tau)e^p = m(\theta)\gamma^p u_u^p,$$

5. Population add up constraints are satisfied:

$$L_u = e^p + (1-\mu)e^g + u_u \tag{C.11}$$
$$L_c^g = \mu e^g + u_c^g \tag{C.12}$$
$$L_u + L_c^g = 1 \tag{C.13}$$

C.4 Proof of Existence and Uniqueness

To prove the existence and uniqueness of a steady state equilibrium under random search we show below that the free-entry condition in (C.2) gives a unique equilibrium value for θ. The equilibrium values of the cut-off costs can then be determined by substituting the equilibrium value of θ in equation (C.3). Then using (21) and (22) we can determine L_u and L_c^g, which in turn, together with the equilibrium value of θ can be substituted in equations (40), (C.4), (C.5), (C.11) and (C.12) to determine wages and employment in the private sector.

The job creation condition in (C.2) and the cut-off connection cost in (C.3) can be written as:

$$\frac{\kappa}{q(\theta)} = \frac{(y - b - OO)}{r + \tau + s^p} \tag{C.14}$$

$$\tilde{c} = \frac{1}{r+\tau}\left[A_c - OO\right] \tag{C.15}$$

where $A_c \equiv \frac{\frac{\mu(s^g+\tau)e^g}{L_c^g - \mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}(w^g - b)$,

$$OO = D(w^g - b) + (1-D)\frac{\beta}{1-\beta}\kappa\theta\gamma^p \tag{C.16}$$

is the expression for the outside option of workers, and $D = \frac{(1-\gamma^p)m(\theta)}{r+\tau+s^g+(1-\gamma^p)m(\theta)}$.

Taking the derivative of (C.16) and (C.15) with respect to θ we obtain:

$$\frac{dOO}{d\theta} = \frac{\partial OO}{\partial\theta} + \frac{\partial OO}{\partial\tilde{c}}\frac{d\tilde{c}}{d\theta} \tag{C.17}$$
$$\frac{d\tilde{c}}{d\theta} = \frac{1}{r+\tau}\left[\frac{\partial A_c}{\partial L_c^g}\frac{dL_c^g}{d\tilde{c}}\frac{d\tilde{c}}{d\theta} - \frac{dOO}{d\theta}\right] \tag{C.18}$$

where

$$\frac{\partial OO}{\partial \tilde{c}} = -\frac{(1-D)m(\theta)\left(E_u^g - E_u^p\right)(s^p+\tau)(1-\gamma^p)}{(s^p+\tau)\left[L_u-(1-\mu)e^g\right]+(1-\mu)e^g(s^g+\tau)}\frac{dL_u}{d\tilde{c}} \tag{C.19}$$

$$\frac{\partial OO}{\partial \theta} = (1-D)q(\theta)\left[(1-\gamma^p)\eta\left(\frac{E_u^g m(\theta)+E^P(s^p+\tau)}{s^p+\tau+m(\theta)} - U_u\right) + \gamma^p\left(E_u^p - U_u\right)\right] \tag{C.20}$$

Recall that $L_c^g = \Xi(\tilde{c})$ and $L_u = 1-\Xi(\tilde{c})$ so that $\frac{dL_c^g}{d\tilde{c}} = \xi(\tilde{c}) > 0$ and $\frac{dL_u}{d\tilde{c}} = -\xi(\tilde{c}) < 0$ (where ξ is the pdf of the distribution of connection costs). It can also be easily verified that $\frac{\partial A_c}{\partial L_c^g} < 0$.

Equations (C.17) and (C.18) can be used to solve for $\frac{d\tilde{c}}{d\theta}$:

$$\frac{d\tilde{c}}{d\theta} = \frac{-\frac{\partial OO}{\partial \theta}}{r+\tau-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})+\frac{\partial OO}{\partial \tilde{c}}} < 0 \tag{C.21}$$

Plugging the above into (C.17) we get:

$$\frac{dOO}{d\theta} = \frac{\partial OO}{\partial \theta}\left[\frac{r+\tau-\frac{\partial A_c}{\partial L_c^g}}{r+\tau-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})+\frac{\partial OO}{\partial \tilde{c}}}\right] > 0 \tag{C.22}$$

For private and unconnected public-sector jobs to exist it must be the case that $E_u^p - U_u > 0$ and $E_u^p - U_u > 0$, respectively, which ensures that they generate positive profits. This ensures that $\frac{\partial OO}{\partial \theta} > 0$. As can be seen from (C.19) sufficient (but not necessary) condition to ensure also that $\frac{\partial OO}{\partial \tilde{c}} > 0$ is $E_u^g - E_u^p > 0$ meaning that the value to an unconnected worker is higher when that worker is working for the government than in the private sector. If this condition holds then we know for sure that the term in the bracket of (C.22) is positive and thus, $\frac{dOO}{d\theta} > 0$, while as shown in (C.21) $\frac{d\tilde{c}}{d\theta} < 0$. If $\frac{dOO}{d\theta} > 0$ holds, then the right-hand-side of (C.14) is decreasing while its left-hand-side is increasing in θ. Equation (C.14) thus pins down a unique equilibrium value for θ, which can then be used to solve for $\tilde{c}$ and the rest of the endogenous variables.

C.5 Proof of Proposition 4

From (C.14) and (C.15) we get:

$$\frac{d\theta}{dw^g} = -\left[\frac{\frac{\partial OO}{\partial w^g}\left(r+\tau-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})\right)+\frac{\partial OO}{\partial \tilde{c}}\frac{\partial A_c}{\partial w^g}}{\left(r+\tau-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})\right)\frac{\partial OO}{\partial \theta}-\frac{\kappa q'(\theta)}{q^2(\theta)}(r+s^p+\tau)\left(r+\tau-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})+\frac{\partial OO}{\partial \tilde{c}}\right)}\right] \tag{C.23}$$

$$\frac{d\tilde{c}}{dw^g} = \frac{\frac{\partial A_c}{\partial w^g}-\frac{\partial OO}{\partial w^g}(1-B)}{r+\tau+\frac{\partial OO}{\partial \tilde{c}}(1-B)-\frac{\partial A_c}{\partial L_c^g}\xi(\tilde{c})} \tag{C.24}$$

where $B \equiv \frac{\frac{\partial OO}{\partial \theta}}{\frac{\partial OO}{\partial \theta} - \frac{\kappa q'(\theta)}{q^2(\theta)}(r+s^p+\tau)}$.

As shown above (in Section C.4) $\frac{\partial OO}{\partial \theta} > 0$ and $\frac{\partial OO}{\partial \tilde{c}} > 0$ while $q'(\theta) < 0$. These imply that the denominators in the above expressions are always positive. We know in addition that $\frac{\partial A_c}{\partial w^g} > 0$, $\frac{\partial A_c}{\partial L_c^g} < 0$ and $\frac{\partial OO}{\partial w^g} > 0$, meaning that the numerator in the bracket of (C.23) is positive also. Further, from (C.15) we can verify that for $\tilde{c} > 0$ it must be the case that $\frac{\partial A_c}{\partial w^g} - \frac{\partial OO}{\partial w^g} > 0$, which ensures, also, that the numerator of (C.24) is positive. It follows, then, that

$$\frac{d\theta}{dw^g} < 0 \tag{C.25}$$

$$\frac{d\tilde{c}}{dw^g} > 0 \tag{C.26}$$

Using (C.7) we can easily verify that total employment $e = e_u + \mu e^g$ will decrease with an in increase in w^g since:

$$\frac{de}{dw^g} = \frac{de}{d\tilde{c}}\frac{d\tilde{c}}{dw^g} + \frac{de}{d\theta}\frac{d\theta}{dw^g}$$

and

$$\frac{de}{d\tilde{c}} < 0$$

$$\frac{de}{d\theta} > 0 \tag{C.27}$$

Since $L_c^g = \Xi(\tilde{c})$, $L_u = 1 - \Xi(\tilde{c})$ and $\frac{d\tilde{c}}{dw^g} > 0$, it follows that $\frac{dL_c^g}{dw^g} > 0$ and $\frac{dL_u}{dw^g} < 0$.

D Heterogenous Workers

D.1 Setup

Since the two types differ in terms of productivity, the value of searching for a job as well as the value of being employed in the private sector both differ depending on the worker's ability. Thus,

$$(r+\tau)U^p_{u,i} = b + m(\theta_i)\left[E^p_{u,i} - U^p_{u,i}\right] \tag{D.1}$$
$$(r+\tau)E^p_{u,i} = w^p_i - s^p\left[E^p_{u,i} - U^p_{u,i}\right] \tag{D.2}$$

where $i = [h, l]$ denotes high- and low-ability.

The value of a private-sector vacancy and job, respectively, of type-i is given by

$$rV^p_i = -\kappa + q(\theta_i)\left[J^p_i - V^p_i\right] \tag{D.3}$$
$$rJ^p_i = y_i - (s^p + \tau)\left[J^p_i - V^p_i\right] \tag{D.4}$$

Using the Bellman equations and the Nash bargaining conditions $\beta S^p_{u,i} = E^p_{u,i} - U^p_{u,i}$, $(1-\beta)S^p_{u,i} = J^p_{u,i} - V^p_{u,i}$ we can write the surplus of a private job of type i as:

$$S^p_{u,i} = \frac{y_i - b}{r + \tau + s^p + \beta m(\theta_i)} \tag{D.5}$$

There are now two free-entry conditions one for each private-sector market, $V^p_i = 0$. Imposing the free-entry and Nash bargaining conditions gives the conditions shown in the main text:

$$\frac{\kappa}{q(\theta_i)} = \frac{(y_i - b)(1-\beta)}{r + \tau + s^p + \beta m(\theta_i)}. \tag{D.6}$$

$$w^p_i = b + \beta(y_i - b + \kappa\theta_i). \tag{D.7}$$

It can be easily verified that $\theta_h > \theta_l$ because $y_h > y_l$. It follows also that $w^p_h > w^p_l$ and high-ability workers enjoy a higher value when applying to the private sector than lower ability workers. That is, $E^p_{u,h} > E^p_{u,l}$ and $U^p_{u,h} > U^p_{u,l}$. Moreover, following Lemma 1, θ_h and θ_l are both independent of public-sector employment and wage policies.

In the public sector, despite wages being the same for all workers irrespective of ability, the values of being employed or unemployed for workers that do not have connections differ by ability, because the government screens candidates and gives preference to high-ability workers.

$$(r+\tau)U^g_{u,i} = b + m^g_{u,i}\left[E^g_{u,i} - U^g_{u,i}\right] \tag{D.8}$$
$$(r+\tau)E^g_{u,i} = w^g - s^g\left[E^g_{u,i} - U^g_{u,i}\right]. \tag{D.9}$$

In the connection market, we assume that ability does not affect your probability of being hired, as long as workers have connections. Since in the connections sector not only both types receive the same wage, but have also equal chances of getting a job, given by m^g_c. As such, the values of unemployment and employment for connected workers are the same irrespective of ability and remain as in (4) and (6).

High- and low-ability workers without connections can search in either the public or the private sector. In an equilibrium where both markets are active, the values of these two options would have to equate:

$$U_{u,i} = U^p_{u,i} = U^g_{u,i} \tag{D.10}$$

These two conditions would determine the numbers of high- and low-ability unconnected searchers in the public sector, $u^g_{u,h}$ and $u^g_{u,l}$. Using the Nash bargaining conditions and (41) we can write

$$(r+\tau)U_{u,i} = b + \frac{\beta\theta_i\kappa}{(1-\beta)} \tag{D.11}$$

Alternatively they can use connections to get into the public sector after paying the cost c drawn from $\Xi(\cdot)$. The threshold level of cost at which a worker of type-i is indifferent between using and not using connections to find a government job is

$$\tilde{c}_i = U_c - U_{u,i} \tag{D.12}$$

These two thresholds determine the allocation of each type of worker into those who use connections to get government jobs and those who search either in the private or in the public sector without connections. We can measure each of these four groups' share in the labor force as:

$$\begin{aligned} L^g_{c,i} &= X_i \Xi(\tilde{c}_i) \\ L_{u,i} &= X_i(1-\Xi(\tilde{c}_i)) \end{aligned} \tag{D.13}$$

where it may be recalled that $L_{u,i} = L^g_{u,i} + L^p_i$ and X_i is the fraction of type-i workers in the labor force. Finally, population add up constraints are satisfied so that

$$\begin{gathered} L^g_{u,i} = (1-\mu)e^g + u^g_{u,i} \\ L^g_{c,i} = \mu e^g + u_{c,i} \\ L^p_{u,h} + L^g_{u,h} + L^g_{c,h} = X_h \\ L^p_{u,l} + L^g_{u,l} + L^g_{c,l} = X_l \end{gathered} \tag{D.14}$$

and by equating the flows in to the flows out of unemployment in the private sector we obtain

$$u^p_i = \left(\frac{s^p+\tau}{s^p+\tau+m(\theta_i)}\right) L^p_{u,i} \tag{D.15}$$

D.2 Wage Cutoffs

The cutoff wage $\underline{w}^g_{u,h}$ is such that a high-ability (unconnected) worker is indifferent between searching for a public or a private job, given $m^g_{u,h} = 1$. Setting $m^g_{u,h} = 1$ in (D.8) and using (D.10), (D.11) gives

$$\underline{w}^g_{u,h} = \frac{\beta\kappa\theta_h}{(1-\beta)}(r+s^g+\tau+1) + b \tag{D.16}$$

If the public sector wage equals $\underline{w}^g_{c,h}$ then $U^g_{u,h} = U^g_{c,h}$ and a high-ability worker is indifferent between using connections or not. Setting (D.11) equal to (4) and solving for the wage gives:

$$\underline{w}^g_{c,h} = \frac{\beta\kappa\theta_h}{(1-\beta)}\left(\frac{r+s^g+\tau}{m^g_c}+1\right)+b \tag{D.17}$$

Comparing (D.16) to (D.17) reveals that $\underline{w}^g_{c,h} > \underline{w}^g_{u,h}$ since $m^g_c < 1$. We know that at any wage above $\underline{w}^g_c$ connected workers will be queuing up for government jobs, meaning that $m^g_c < 1$.

Note that for $\underline{w}^g_{c,h}$ to exist it must be the case the $\bar{\mu}$ is large enough. Incentives for high ability workers to use connections are at the maximum when queues for government jobs through the regular (unconnected) channel are as long as possible. This occurs when $L^g_{u,h} = X_h$, meaning that all high ability workers search in the public sector. The threshold wage $\underline{w}^g_{c,h}$ will not exist, if, even in this case, where the unconnected public market is as crowded as possible, $U^g_{u,h} > U^g_{c,h}$, meaning that no high type wants to obtain connections. Notice that $U^g_{u,h} > U^g_{c,h}$ implies $m^g_{u,h} > m^g_c$, which gives $\bar{\mu} < \frac{L^g_c}{L^g_c + L^g_{u,h}}$. Setting $L^g_{u,h} = X_h$ gives $\bar{\mu} < \frac{L^g_c}{L^g_c + X_h}$. If $\bar{\mu} \leq \frac{L^g_c}{L^g_c + X_h}$ then no matter how large w^g is, the high-type workers will never opt for connections; in other words, $\underline{w}^g_{c,h}$ does not exist. This threshold wage exists only if $\bar{\mu} > \frac{L^g_c}{L^g_c + X_h}$.

D.3 Proof of Proposition 5

Using (D.10) (with (D.8) and (D.11) substituted in) to solve for $L^g_{u,i}$ we obtain:

$$L^g_{u,i} = (1-\bar{\mu})e^g\left[\lambda + (1-\lambda)\left(\frac{w^g - b}{\frac{\beta}{1-\beta}\kappa\theta_i}\right)\right] \tag{D.18}$$

where $\lambda = \frac{r}{r+s^g+\tau}$. Using (D.12) with either $i = l$ or $i = h$ and (4) and (D.11) substituted in to solve for L^g_c, we get:

$$L^g_c = \bar{\mu}e^g\left[\lambda + (1-\lambda)\left(\frac{w^g - b}{\tilde{c}_l(r+\tau) + \frac{\beta}{1-\beta}\kappa\theta_l}\right)\right] \tag{D.19}$$

$$L^g_c = \bar{\mu}e^g\left[\lambda + (1-\lambda)\left(\frac{w^g - b}{\tilde{c}_h(r+\tau) + \frac{\beta}{1-\beta}\kappa\theta_h}\right)\right] \tag{D.20}$$

which implies:

$$\tilde{c}_l(r+\tau) + \frac{\beta\kappa}{(1-\beta)}\theta_l = \tilde{c}_h(r+\tau) + \frac{\beta\kappa}{(1-\beta)}\theta_h \tag{D.21}$$

Given $w^g > \underline{w}^g_{u,h}$, meaning that all unconnected workers attached to the public sector are of high ability ($L^g_u = L^g_{u,h}$), the total number of workers in the public sector is $L^g = L^g_{u,h} + L^g_c$. Thus, $\frac{dL^g}{d\bar{\mu}} = \frac{dL^g_{u,h}}{d\bar{\mu}} + \frac{dL^g_c}{d\bar{\mu}}$.

Notice that $L^g_c = L^g_{c,l} = X_l\Xi(\tilde{c}_l)$ ($L^g_{c,h} = 0$) if $w^g \leq \underline{w}^g_{c,h}$ ($\tilde{c}_h \leq 0$) and $L^g_c = L^g_{c,l} + L^g_{c,h} =$

$X_l\Xi(\tilde{c}_l)+X_h\Xi(\tilde{c}_h)$ if $w^g > \underline{w}^g_{c,h}$ ($\tilde{c}_h > 0$). As can be verified from (41) $\frac{d\theta_i}{d\tilde{c}_i}=0$, $i=[h,l]$ so that we know from (D.21) that $\frac{d\tilde{c}_l}{d\bar{\mu}}=\frac{d\tilde{c}_h}{d\bar{\mu}}$. We can then use either (D.20) or (D.19) to get:

$$\begin{aligned}\frac{dL^g_c}{d\bar{\mu}} &= \frac{L^g_c}{\bar{\mu}}\left[\frac{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)}{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)+\Delta}\right]=\frac{X_l\Xi(\tilde{c}_l)+X_h\Xi(\tilde{c}_h)}{\bar{\mu}}\left[\frac{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)}{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)+\Delta}\right]>0 \text{ if } w^g > \underline{w}^g_{c,h}\\ \frac{dL^g_c}{d\bar{\mu}} &= \frac{L^g_c}{\bar{\mu}}\left[\frac{X_l\xi(\tilde{c}_l)}{X_l\xi(\tilde{c}_l)+\Delta}\right]=\frac{X_l\Xi(\tilde{c}_l)}{\bar{\mu}}\left[\frac{X_l\xi(\tilde{c}_l)}{X_l\xi(\tilde{c}_l)+\Delta}\right]>0 \text{ if } w^g \leq \underline{w}^g_{c,h}\end{aligned} \tag{D.22}$$

where $\Delta=\frac{\bar{\mu}e^g(1-\lambda)(w^g-b)(r+\tau)}{(\tilde{c}_l(r+\tau)+\frac{\beta}{1-\beta}\kappa\theta_l)^2}=\frac{\bar{\mu}e^g(1-\lambda)(w^g-b)(r+\tau)}{(\tilde{c}_h(r+\tau)+\frac{\beta}{1-\beta}\kappa\theta_h)^2}>0$

From (D.18) we get:

$$\frac{dL^g_{u,h}}{d\bar{\mu}}=-\frac{L^g_{u,h}}{1-\bar{\mu}}<0 \tag{D.23}$$

Thus,

$$\begin{aligned}\frac{dL^g}{d\bar{\mu}} &= -\left[\frac{L^g_{u,h}}{1-\bar{\mu}}-\frac{L^g_c}{\bar{\mu}}\left(\frac{X_l\xi(\tilde{c}_l)}{X_l\xi(\tilde{c}_l)+\Delta}\right)\right] \text{ if } w^g \leq \underline{w}^g_{c,h}\\ \frac{dL^g}{d\bar{\mu}} &= -\left[\frac{L^g_{u,h}}{1-\bar{\mu}}-\frac{L^g_c}{\bar{\mu}}\left(\frac{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)}{X_l\xi(\tilde{c}_l)+X_h\xi(\tilde{c}_h)+\Delta}\right)\right] \text{ if } w^g > \underline{w}^g_{c,h}\end{aligned} \tag{D.24}$$

The terms in the parentheses of the above expressions are less than 1. Further, it can be easily verified from (D.18) (with $i=h$) and (D.20) that $\frac{L^g_{u,h}}{1-\bar{\mu}} \gtreqless \frac{L^g_c}{\bar{\mu}}$ when $\tilde{c}_h \gtreqless 0$ ($w^g \gtreqless \underline{w}^g_{c,h}$). Therefore,

$$\begin{aligned}&\tfrac{dL^g}{d\bar{\mu}}<0,\ \tfrac{du^g}{d\bar{\mu}}<0, \quad \text{if } w^g > \underline{w}^g_{c,h}\\ &\tfrac{dL^g}{d\bar{\mu}} \lesseqgtr 0,\ \tfrac{du^g}{d\bar{\mu}} \lesseqgtr 0, \quad \text{if } w^g \leq \underline{w}^g_{c,h}\end{aligned}$$

where it may be recalled that $u^g=u^g_u+u^g_c=L^g-e^g$.

The total employment rate in the model with worker heterogeneity is given by $e=e^g+e^p_h+e^p_l$, where e^g is exogenously set by the government, while e^p_h and e^p_l can be derived from (D.14) and (D.15): $e^p_i=\frac{m(\theta_i)L^p_i}{s^p+\tau+m(\theta_i)}$, $i=[h,l]$ so that

$$e=e^g+\frac{m(\theta_h)(X_h-L^g_h)}{s^p+\tau+m(\theta_h)}+\frac{m(\theta_l)(X_l-L^g_l)}{s^p+\tau+m(\theta_l)} \tag{D.25}$$

We know that for $w^g > \underline{w}^g_{u,h}$ all low-ability workers in the public sector are connected. Hence, $L^g_l=L^g_{c,l}=X_l\Xi(\tilde{c}_l)$, and clearly $\frac{dL^g_l}{d\bar{\mu}}>0$, since $\frac{d\tilde{c}_l}{d\bar{\mu}}>0$. But the composition of the high-ability workers attached to the public sector (L^g_h) in terms of connections depends on whether wages are above or below $\underline{w}^g_{c,h}$.

If $w^g > \underline{w}^g_{c,h} (> \underline{w}^g_{u,h})$, then $L^g_h=L^g_{c,h}+L^g_{u,h}$, where $L^g_{c,h}=X_h\Xi(\tilde{c}_h)$. Since $\frac{d\tilde{c}_h}{d\bar{\mu}}>0$ then $\frac{dL^g_{c,h}}{d\bar{\mu}}>0$, while, as shown above, $\frac{dL^g_{u,h}}{d\bar{\mu}}<0$. Moreover, as shown above, for $w^g > \underline{w}^g_{c,h}$,

$\frac{dL^g}{d\bar{\mu}} < 0$ which means that the decrease in $L^g_{u,h}$, dominates over increase in $L^g_{c,h}$ and $L^g_{c,l}$. It follows, then, that the decrease in L^g_h dominates over the increase in L^g_l. This, together with the fact that $m(\theta_h) > m(\theta_l)$ implies $\frac{de}{d\bar{\mu}} > 0$. That is, e^p_l decreases and e^p_h increases with the increase in $\bar{\mu}$ but the increase in e^p_h is larger than the decrease in e^p_l and thus total employment increases.

If $w^g \leq \underline{w}^g_{c,h}$ we can not show that $\frac{de}{d\bar{\mu}} > 0$ because the sign of $\frac{dL^g}{d\bar{\mu}}$ is ambiguous. In this case $L^g_l = L^g_{c,l}$ and $L^g_h = L^g_{u,h}$ and we have an increase in $L^g_{c,l}$ and decrease in $L^g_{u,h}$, but we do not know if the decrease in $L^g_{u,h}$ dominates over the increase in $L^g_{c,l}$. To sum up:

$$\begin{array}{l} \frac{de^p_h}{d\bar{\mu}} > 0, \frac{de^p_l}{d\bar{\mu}} < 0, \frac{de}{d\bar{\mu}} \lesseqqgtr 0 \text{ if } w^g \leq \underline{w}^g_{c,h} \\ \frac{de^p_h}{d\bar{\mu}} > 0, \frac{de^p_l}{d\bar{\mu}} < 0, \frac{de}{d\bar{\mu}} > 0 \text{ if } w^g > \underline{w}^g_{c,h} \end{array}$$

D.4 Effects of increasing w^g when $w^g > \underline{w}^g_{u,h}$

First, let us show that the number of workers searching in the public sector increases as the public-sector wage increases; that is $\frac{dL^g}{dw^g} > 0$, which ultimately implies that $\frac{dL^p}{dw^g} < 0$, since $L^p = 1 - L^g$. Recall also that for $w^g > \underline{w}^g_{u,h}$ all workers searching for public jobs without connections are of high ability. The total number of workers attached to the public sector is given by $L^g = L^g_u + L^g_c$ where $L^g_u = L^g_{u,h}$ and $L^g_{u,h}$ is as given in (D.18) (with $i = h$), while $L^g_c = L^g_{c,h} + L^g_{c,l} = X_h\Xi(\tilde{c}_h) + X_l\Xi(\tilde{c}_l)$ if $w^g > \underline{w}^g_{c,h} (> \underline{w}^g_{u,h})$ and $L^g_c = L^g_{c,l} = X_l\Xi(\tilde{c}_l)$ if $w^g \leq \underline{w}^g_{c,h}$.

$$\begin{aligned} \frac{dL^g}{dw^g} &= \frac{dL^g_{u,h}}{dw^g} + X_h\xi(\tilde{c}_h)\frac{d\tilde{c}_h}{dw^g} + X_l\xi(\tilde{c}_l)\frac{d\tilde{c}_l}{dw^g}, \text{ if } w^g > \underline{w}^g_{c,h} \\ \frac{dL^g}{dw^g} &= \frac{dL^g_{u,h}}{dw^g} + X_l\xi(\tilde{c}_l)\frac{d\tilde{c}_l}{dw^g}, \text{ if } w^g \leq \underline{w}^g_{c,h} \end{aligned} \tag{D.26}$$

It is straightforward to verify from (D.18) that $\frac{dL^g_{u,h}}{dw^g} > 0$. To show that $\frac{dL^g}{dw^g} > 0$ we need to show further that $\frac{d\tilde{c}_i}{dw^g} > 0$, $i = [h, l]$.

We can use (D.12), together with (4), (6) and (D.11) to derive:

$$\tilde{c}_i - \frac{1}{r+\tau}\left[\frac{\frac{\bar{\mu}(s^g+\tau)e^g}{L^g_c - \bar{\mu}e^g}}{r+\tau+s^g+\frac{\bar{\mu}(s^g+\tau)e^g}{L^g_c-\bar{\mu}e^g}}(w^g - b)\right] = \frac{1}{r+\tau}\frac{\beta\kappa\theta i}{(1-\beta)}, \quad i = [h,l] \tag{D.27}$$

and obtain:

$$\begin{aligned} \frac{d\tilde{c}_l}{dw^g} &= \frac{M}{r+\tau+\frac{M(1-M)(w^g-b)}{L^g_c-\bar{\mu}e^g}X_l\xi(\tilde{c}_l)} \geq 0, \text{ if } w^g \leq \underline{w}^g_{c,h} \\ \frac{d\tilde{c}_l}{dw^g} &= \frac{d\tilde{c}_h}{dw^g} = \frac{M}{r+\tau+\frac{M(1-M)(w^g-b)}{L^g_c-\bar{\mu}e^g}(X_l\xi(\tilde{c}_h) + X_h\xi(\tilde{c}_l))} \geq 0, \text{ if } w^g > \underline{w}^g_{c,h} \end{aligned} \tag{D.28}$$

where $M = \frac{\frac{\bar{\mu}(s^g+\tau)e^g}{L_c^g-\bar{\mu}e^g}}{r+\tau+s^g+\frac{\bar{\mu}(s^g+\tau)e^g}{L_c^g-\bar{\mu}e^g}}$. It is evident from the above equations that $\frac{d\tilde{c}_i}{dw^g} > 0$, $i = [h, l]$ only if $\bar{\mu} > 0$, while $\frac{d\tilde{c}_i}{dw^g} = 0$ if $\bar{\mu} = 0$.

It follows that:

$$\begin{aligned} \frac{dL^g}{dw^g} > 0, \frac{dL^g_{u,h}}{dw^g} > 0 \\ \frac{dL^g_c}{dw^g} > 0, \text{ if } \bar{\mu} > 0 \\ \frac{dL^g_c}{dw^g} = 0, \text{ if } \bar{\mu} = 0 \end{aligned}$$

Therefore $\frac{dL^g_h}{dw^g} > 0$ and $\frac{dL^g_l}{dw^g} > 0$ if $\bar{\mu} > 0$ and $\frac{dL^g_l}{dw^g} = 0$ if $\bar{\mu} = 0$. From (D.25) and given $u^g = L^g - e^g$ we can also write:

$$\begin{aligned} \frac{de}{dw^g} < 0, \frac{du^g}{dw^g} > 0, \frac{de^p_h}{dw^g} < 0 \\ \frac{de^p_l}{dw^g} < 0, \text{ if } \bar{\mu} > 0 \\ \frac{de^p_l}{dw^g} = 0, \text{ if } \bar{\mu} = 0 \end{aligned} \tag{D.29}$$

D.5 Proof of Proposition 6

Let us firs consider the case $\underline{w}^g_c < w^g \leq \underline{w}^g_{u,h}$ where there are only low-type workers in the public sector. As summarized in Proposition 1, the private-sector labor force and employment increase with an increase in $\bar{\mu}$ due to some workers who would otherwise search without connections for public jobs choosing to search for private jobs instead. Since all workers in the public sector are of low ability the additional workers entering the private sector are of low ability, thereby lowering average ability in the private sector, while all workers in the public sector remain of low ability.

Consider next the case where $\underline{w}^g_{c,h} \geq w^g > \underline{w}^g_{u,h}$ where all low ability workers attached to the public sector are connected while all high ability workers attached to the public sector have no connections. In this case, as shown above (see Section D.3) an increase in $\bar{\mu}$ will attract more low-ability workers into the public sector ($\frac{dL^g_{c,l}}{d\bar{\mu}} > 0$) and will drive high ability workers away from the public and into the private sector ($\frac{dL^g_{u,h}}{d\bar{\mu}} < 0$). This means that the skill composition of employment/labor force in the public sector deteriorates, while those in the private sector improve.

When $w^g > \underline{w}^g_{c,h}$, there are also some high-ability workers in the connections sector. An increase in $\bar{\mu}$ in this case will induce more of the high-ability workers to get connections and move into the public sector. However, as shown above (Section D.3), the decrease in the number of high-ability unconnected workers attached to the public sector dominates over the increase in the number of connected (high or low ability workers) attached to the public sector. Hence, in this case also, the skill composition in the public sector deteriorates while that in the private sector improves.

E Competitive Search in the Private Sector

Suppose now that, as in the benchmark model, the two sectors, private and public, are segmented. However, we depart from the assumptions of Nash bargaining and random search in the private sector. Instead, as in Moen (1997), we introduce a competitive search equilibrium in the private sector. To this end, we assume that the private-sector market consists of submarkets with different posted wages and equilibrium tightness.

In each submarket, there is a subset of unemployed workers and firms with vacant jobs that are searching for each other. A matching function determines the number of matches in each submarket. The number of matches in submarket n is $m(v_n, u_n) = (v_n)^\eta (u_n^p)^{(1-\eta)}$, $m(\theta_n)$ is the job finding rate and $q(\theta_n)$ the job filling rate. Unemployed workers are free to move between submarkets. They choose to search for a job in the submarket that yields the highest expected income. Since workers are ex-ante identical, and movement across submarkets is free, in equilibrium, the value of search is equal across submarkets. A market maker determines the number of submarkets in each market and the wage in each submarket. The wage is chosen to maximize the value of a vacancy, and since all vacancies in the same submarket are identical, they offer the same wage. There is free entry of vacancies in each submarket, which drives the value of a vacancy to zero, and determines the number of vacancies posted in each submarket.

We present next the full set of Bellman equations describing the optimal behavior of workers and firms, the equilibrium conditions and the model solution. For a worker in submarket n

$$(r+\tau)U_{u,n}^p = b + m(\theta_n)\left[E_{u,n}^p - U_{u,n}^p\right] \tag{E.1}$$

$$(r+\tau)E_{u,n}^p = w_n^p - s^p\left[E_{u,n}^p - U_{u,n}^p\right] \tag{E.2}$$

Unemployed workers are free to move between submarkets. They will choose to search for a job in the submarket that yields the highest expected income. Since workers are ex-ante identical and movement across submarkets is free, this means that $U_{u,n}^p = U_u^p$. Using (E.1) and (E.2) we can write:

$$m(\theta_n) = \left(\frac{(r+\tau)U_u^p - b}{w_n^p - (r+\tau)U_u^p}\right)(r+\tau+s^p) \tag{E.3}$$

The values of vacancies and filled jobs in submarket n satisfy

$$rV_{u,n}^p = -\kappa + q(\theta_n)\left[J_u^p(w_n^p) - V_{u,n}^p\right] \tag{E.4}$$

$$rJ_u^p(w_n^p) = y_n - w_n^p + (s^p+\tau)\left[V_{u,n}^p - J_u^p(w_n^p)\right] \tag{E.5}$$

Using (E.4) and (E.5) to solve for $V_{u,n}^p$ gives

$$rV_{u,n}^p = \frac{-\kappa(r+s^p+\tau) + q(\theta_n)(y_n - w^p)}{r + q(\theta_n) + s^p + \tau} \tag{E.6}$$

In a competitive search equilibrium a market maker determines the number of submarkets in each market and the wage in each submarket. The wage is chosen to maximize the value of a vacancy. All vacancies in the same submarket offer the same wage. Setting the derivative of (E.6) with respect to w^p_n equal to 0 we get the first order condition for optimal wages:

$$-(1-\eta)(r+s^p+\tau)\frac{d\theta_n}{dw^p_n}\left[y_n - w^p_n + \kappa\right] = \theta_n(r+s^p+\tau) + m(\theta_n) \tag{E.7}$$

There is free entry of vacancies in each submarket, which drives the value of a vacancy to zero. Setting $V^p_{u,n} = 0$ in (E.6) gives:

$$\frac{\kappa}{q(\theta_n)} = \frac{y_n - w^p}{r+s^p+\tau} \tag{E.8}$$

Taking the derivative of (E.3) with respect to w^p_n we obtain

$$\frac{d\theta_n}{dw^p_n} = -\left(\frac{\theta_n}{w^p_n - (r+\tau)U^p_u}\right)\frac{1}{\eta} \tag{E.9}$$

Using (E.8) and (E.9) to substitute for κ and $\frac{d\theta_n}{dw^p_n}$, respectively, in (E.7) and then solving for w^p_n we get

$$w^p_n = (1-\eta)y_n + \eta(r+\tau)U^p_u \tag{E.10}$$

Using (E.3) and (E.8) we can substitute for $(r+\tau)U^p_u$ in (E.10) and obtain

$$w^p_n = b + (1-\eta)\left(y_n - b + \theta_n\kappa\right) \tag{E.11}$$

Substituting w^p_n from (E.11) into (E.8) we get the job creation condition in each submarket

$$\frac{\kappa}{q(\theta_n)} = \frac{\eta(y_n - b)}{r+s^p+\tau+(1-\eta)m(\theta_n)} \tag{E.12}$$

Notice that if $y_n = y$, meaning that productivity is the same across all submarkets then $\theta_n = \theta$ and $w^p_n = w^p$. All submarkets offer the same wage and job finding rate. If in addition the Hosios condition holds, i.e. $1-\eta = \beta$, then job creation, market tightness and the Nash bargaining wage in the Benchmark model described in the text (see equations 13 and 14) are identical to those derived under competitive search. Hence, the results discussed in Sections 4 and 5 carry over to this alternative assumption of competitive search in the private sector.

F Connections Premium

In the benchmark model, we consider that connected and unconnected workers enjoy the same benefits of working in the public sector. We also assume that the costs incurred by the newborns to get connections were wasted. We now assume that newborn pay connections costs to current connected public-sector workers so that current workers will help fast-track them into the public sector. These payments are the "connections premium", Υ, which will further raise the value of working in the public sector for connected workers. We describe here the basic set up and in Section H we compare quantitative results in this alternative setup to those obtained in the benchmark model, in which no such connections premium exists.

$$(r+\tau)E_c^g \quad = \quad w^g + \Upsilon - s^g \left[E_c^g - U_c^g\right]. \tag{F.1}$$

In equilibrium, this connections premium depends on the threshold of connections costs, $\Upsilon = \Upsilon(\tilde{c})$. The total connections cost paid by newborns is $\tau \int_0^{\tilde{c}} c\xi(c)dc$, where ξ is the pdf of the distribution of connection costs. To avoid creating further interactions between sectors, we assume that newborns' total connections cost is divided equally among connected workers:

$$\Upsilon(\tilde{c}) = \frac{\tau \int_0^{\tilde{c}} c\xi(c)dc}{\bar{\mu}e^g}. \tag{F.2}$$

In principle, this extension could create multiple equilibria, with people expecting high returns of connections investing in connections (creating a lot of side payments) or people expecting low returns of connections not investing in connections (generating few side payments). We show, below, that provided some regularity conditions on the distribution of connections costs are satisfied, there are no multiple equilibria.

With the introduction of a connection premium all other Bellman equations but the value of being employed in the public sector for a connected worker (E_c^g) remain as in the Benchmark model described in Section 3. It follows that all equilibrium conditions remain the same, but equations (23) that determine the cut-off connection costs. The cut-off connection cost now change to take into account that the existence of a connection premium increases the value of being a connected and employed public employee. In particular, equation (23) becomes:

$$\tilde{c} = \frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}\left(w^g - b + \frac{\tau\int_0^{\tilde{c}} c\xi(c)dc}{\mu e^g}\right) - \frac{\beta\kappa\theta}{(1-\beta)}\right] \tag{F.3}$$

As shown in Appendix A.2, equations (13) gives unique equilibrium value for θ. To guarantee the existence and uniqueness of a steady-state condition we need to show that with the equilibrium value of θ substituted in, equation (F.3) gives a unique equilibrium value for $\tilde{c}$.

Rearranging terms in (F.3) we can write:

$$\tilde{c} - \frac{1}{r+\tau}\left[\frac{\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}{r+\tau+s^g+\frac{\mu(s^g+\tau)e^g}{L_c^g-\mu e^g}}\left(w^g - b + \frac{\tau\int_0^{\tilde{c}} c\xi(c)dc}{\mu e^g}\right)\right] = \frac{1}{r+\tau}\frac{\beta\kappa\theta}{(1-\beta)} \tag{F.4}$$

Since the right-hand-side of the equation above is independent of $\tilde{c}$ a unique equilibrium value of $\tilde{c}$ exists if the left-hand-side of the equation above is increasing in $\tilde{c}$. Sufficient (but not necessary) condition for the left-hand-side of (F.4) to be increasing in $\tilde{c}$ is:

$$1 - \frac{m_c^g}{r+\tau+s^g+m_c^g}\frac{\tau}{r+\tau}\frac{\tilde{c}\xi(\tilde{c})}{\mu e^g} > 0$$

Sufficient but not necessary condition for the above inequality to be always satisfied is

$$\bar{c}\xi(\bar{c}) \leq \mu e^g$$

G Survey data

Table G1: Quality of government survey - European Countries

Country	**QoG Indexes**			**Aggregate public-**
	Skills and Merit	**Political connections**	**Personal connections**	**private wage ratio**
Austria	5.00	5.00	4.67	1.72
Belgium	5.71	3.00	2.14	1.40
Bulgaria	3.23	5.38	5.00	1.96
Croatia	4.20	4.10	3.80	
Cyprus	3.20	5.40	5.40	2.41
Czech Republic	5.00	4.11	4.10	1.33
Denmark	6.29	1.57	2.60	1.08
Estonia	4.67	3.33	3.56	
Finland	6.00	3.33	2.50	1.16
France	5.67	2.64	3.00	1.16
Germany	5.89	2.62	2.40	1.38
Greece	4.13	3.87	3.73	2.43
Hungary	3.67	5.07	4.60	1.36
Iceland	4.83	2.83	2.83	1.61
Ireland	6.64	1.82	2.45	2.31
Italy	3.25	4.25	4.20	2.05
Latvia	4.60	3.40	3.60	1.36
Lithuania	4.88	3.56	3.44	1.14
Luxembourg				0.88
Malta	3.75	4.50	3.50	1.48
Netherlands	6.08	2.46	2.68	1.92
Norway	6.40	2.07	1.87	0.98
Poland	5.50	2.80	3.20	
Portugal	4.25	4.63	4.56	2.23
Romania	4.24	4.94	4.33	
Slovakia	2.67	4.78	5.56	1.26
Slovenia	4.38	3.63	4.13	1.51
Spain	5.04	3.17	3.17	2.05
Sweden	5.92	1.92	2.69	0.93
Switzerland	6.20	3.00	2.80	
United Kingdom	5.79	2.82	2.88	1.09

Note: Indexes of recruitment practices are takes from the Quality of Government Survey*. Data on government and private sector employment is from EUROSTAT and OECD. Data on government wage bill and private sector wage bill is from AMECO.*

Table G2: Quality of government survey - World regions

Region	**QoG Indexes**		
(no of countries)	**Skills and Merit**	**Political connections**	**Personal connections**
Eastern Europe and post Soviet Union (25)	3.71	4.54	4.28
Latin America (16)	3.44	4.86	4.51
North Africa and the Middle East (11)	3.32	4.71	4.14
Sub-Saharan Africa (25)	3.60	4.92	5.11
Western Europe and North America (22)	5.51	2.92	1.99
East Asia (4)	5.32	2.87	3.08
South-East Asia (7)	4.35	4.44	4.57
South Asia (6)	3.78	4.78	5.67
The Pacific (1)	3.66	5.00	4.83
The Caribbean (3)	4.00	4.08	3.75

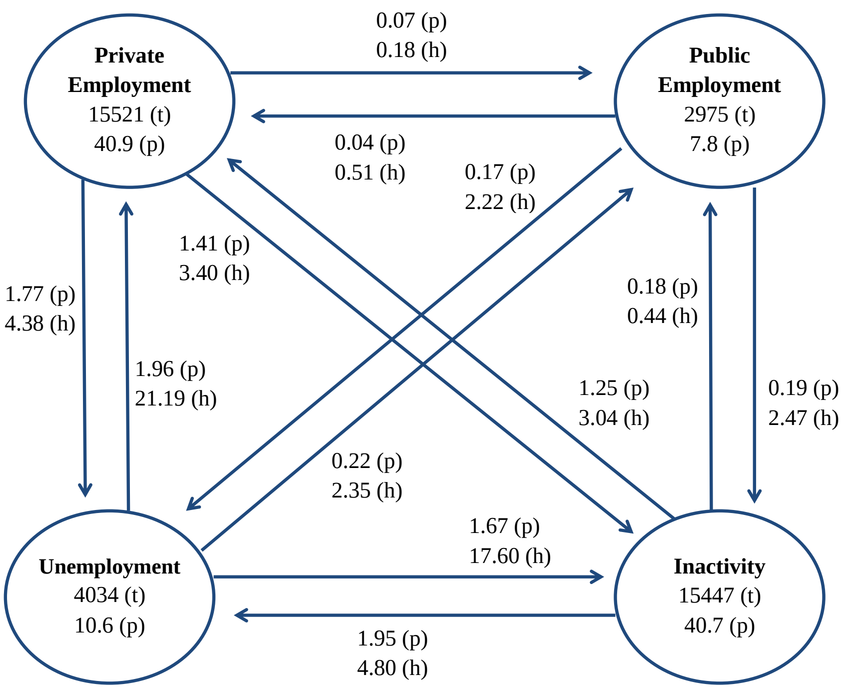
Note: Indexes of recruitment practices are takes from the Quality of Government Survey. *Average for different world regions.*

Table G3: Regression of the ratio of indexes of non-meritocracy

	Baseline variables				**Alternative variables**	
	(1)	(2)	(3)	(4)	(5)	(6)
Public-sector wage premium	0.265**		0.384***	0.723***	3.484***	0.459**
	(2.62)		(3.74)	(4.48)	(3.81)	(2.22)
Unemployment rate		-0.003*	-0.006***			
		(-1.71)	(-3.12)			
× High public wage				-0.009***	-0.038***	-0.010***
				(-4.16)	(-2.98)	(-3.51)
× Low public wage				-0.002	0.000	-0.006*
				(-0.95)	(0.02)	(-1.86)
Observations	70	70	70	70	70	70
R-squared	0.09	0.041	0.207	0.283	0.194	0.169

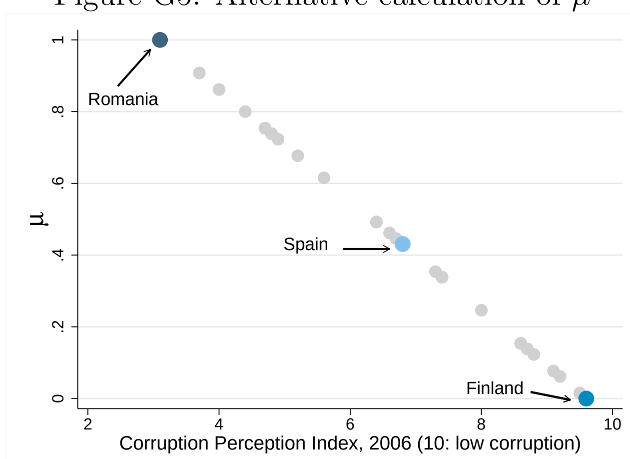
*Notes: The t-statistics are shown in brackets.*** indicates significance at the 1% level, ** at 5% level, and * at the 10% level. The dependent variable is the ratio of the non-meritocracy index for the public sector over the index for the private sector. It increases when the public sector is perceived to be less meritocratic than the private sector. The index is constructed with data taken from European Quality of Government Index dataset. The public-sector wage premium is estimated with microdata from the 2010* Structure of Earnings Survey. *Unemployment rate is taken from Eurostat. In column (5) we use an alternative index which is the difference between the index for the public over the index for the private. In column (6) we use an alternative index which is the ratio between the index for the public sector (answer by only public-sector workers) over the index for the private sector (answered by only private-sector workers).*

Figure G4: 4-state stocks and flows, Spain



Source: Spanish Labour Force Survey, average 2005-2015. The worker stocks and flows are expressed as total number of people in thousands (t), as a percentage of the working-age population (p) or as a hazard rate (h). See Fontaine et al. (2020) for details. For the calibration, we excluded the flows from and to inactivity.

Figure G5: Alternative calculation of $\bar{\mu}$



Source: Corruption Perception Index, 2006, Own calculations.

H Quantitative exercise

The purpose of this appendix is twofold. First, we want to extent our quantitative analysis in Section 5.3 by using our benchmark model with segmented markets calibrated to the Spanish economy to simulating also the effects of wage and employment policies. Given the endogenous limits that government policies place on μ discussed in Section 4.2, and given a set of parameters, we might be in a region where: (i) μ in not constrained and is equal to $\bar{\mu}$ or (ii) μ is constrained. Changes in government policy may switch the economy from one region to the other, making it difficult to solve for their effect in the full model analytically. In our quantitative exercise we account for such switches and are able to characterize the full effect of policy changes. Second, we want to compare the benchmark model with the alternative models proposed in Section 7 – in particular, to compare the transmission mechanisms under the assumptions of segmented markets and random search. We have also done simulations changing the deep parameters of the model is Section 6, but the effects simply boil down to combinations of different policies.

H.1 Effects of policies

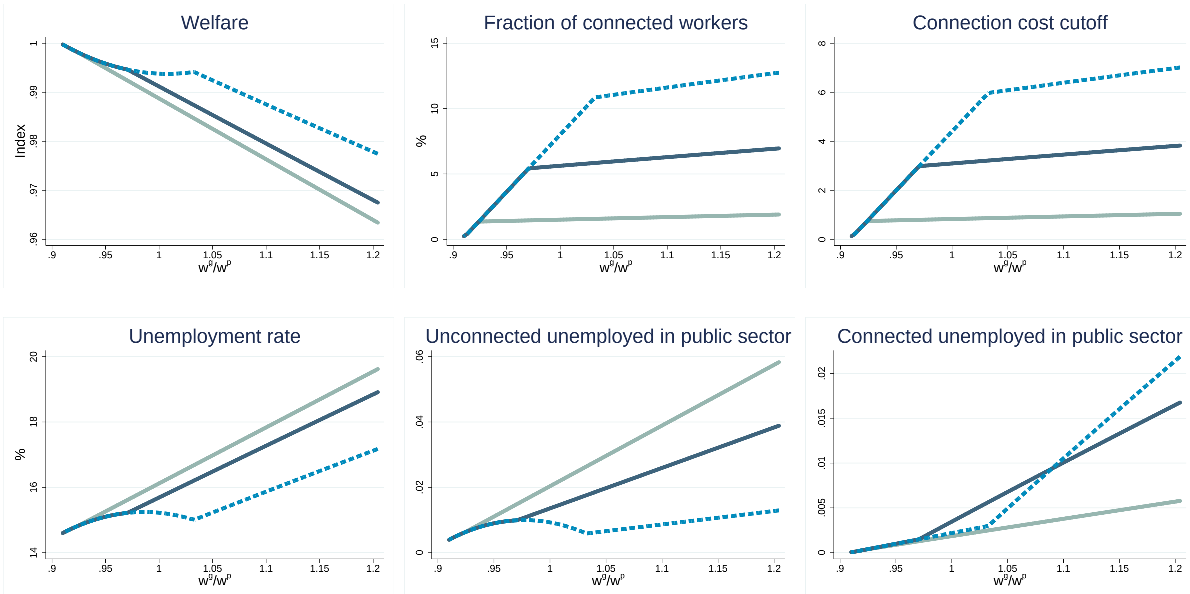
Figure H1 shows the effect of public wages, for three levels of target $\bar{\mu}$: 0.2, 0.40 and 0.8. In general, decreasing public wages raises welfare, since, as outlined in Proposition 2, cutting them has a positive effect on the employment rate. A 10 percent cut in the wages of public-sector workers lowers the unemployment rate by 1.5 percentage points. However, for some combination of parameters (high $\bar{\mu}$), there is a region in which μ becomes constrained. In that region welfare declines with wage cuts. This happens because, as shown in Proposition 3, in the constrained case μ decreases with wage cuts. Decreasing μ means freeing up public jobs for job searchers that do not have connections. This pushes more unemployed workers to queue for public-sector jobs, and increases the unemployment rate.

Figure H2 shows the effects of increasing public-sector employment. The effect of increasing public-sector employment on the selection of workers into the two sectors resembles those of increasing public-sector wages. In both cases the value of searching in the public sector goes up and this drains workers from the private to the public sector. The fact that higher public-sector employment lowers welfare follows trivially from the lack of assumption on the value of public-sector production. What is interesting to notice is that it can increase or decrease unemployment, depending on the level of nepotism. In line with the results outlined in Proposition 2 for the case of increasing w^g, high nepotism prevents large increases in the queues for public-sector jobs, which helps reduce unemployment. Conversely, when most public-sector jobs are available to unconnected workers, more job openings at high wages, attract a disproportionate number of searchers raising unemployment.

H.2 Comparing different models

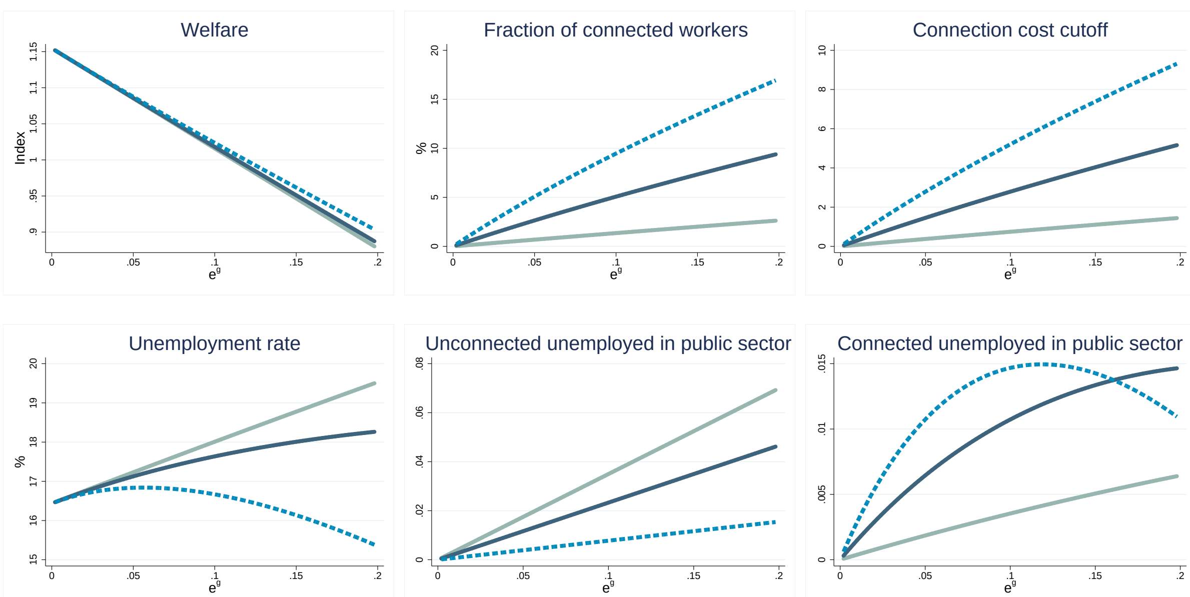
We now compare the results from the baseline segmented market model with those from the alternative models discussed in Section 7. For the model in which search in the public and private sectors is random, we reparameterize the cost of posting vacancies to target the steady-state unemployment rate ($\kappa = 7.31$). We follow the same procedure for the model

Figure H1: Effects of public-sector wages



Note: The ***dark blue line*** *is the benchmark calibration ($\bar{\mu} = 0.4$). The* ***light green line*** *is the scenario with low nepotism ($\bar{\mu} = 0.2$). The* ***bright blue dashed line*** *is the scenario with high nepotism ($\bar{\mu} = 0.8$). Welfare is expressed as a fraction of the efficient steady state. In all scenarios, when skilled public-sector wages are low, μ becomes constrained. Tightness and wages in the private sector are constant and independent of public-sector wages or nepotism ($\theta = 0.06$, $w^p = 0.901$).*

Figure H2: Effects of public-sector employment



Note: The ***dark blue line*** *is the benchmark calibration ($\bar{\mu} = 0.4$). The* ***light green line*** *is the scenario with low nepotism ($\bar{\mu} = 0.2$). The* ***bright blue dashed line*** *is the scenario with high nepotism ($\bar{\mu} = 0.8$). Welfare is expressed as a fraction of the efficient steady state. In all scenarios, μ is never constrained. Tightness and wages in the private sector are constant and independent of public-sector wages or nepotism ($\theta = 0.06$, $w^p = 0.901$).*

with a connections premium ($\kappa = 6.29$). Once recalibrated, the steady state of the remaining variables is very close to that of the benchmark model.

Table H1 shows the effects of three different policies: i) a decrease in $\bar{\mu}$ from 0.4 to 0.2; ii) an increase in $\bar{\mu}$ from 0.4 to 0.6; and iii) a ten-percent decrease in public-sector wages.

We start by comparing the model with segmented markets with the model of random search. Graphs with a more detailed comparison are shown in Figure H3. We can see in the table that random search in the labor market weakens the effects of policies on unemployment. Although the effects go in the same direction, the mechanisms at work are different. Under random search, nepotism affects tightness (θ) positively and private wages negatively. By having fewer unconnected vacancies, the outside option of an unemployed worker bargaining with a firm is weaker, pushing wages down and raising job creation. This effect on private wages raises the public-sector wage premium endogenously.

As discussed above, the effect of $\bar{\mu}$ on welfare are ambiguous. As Figure H3 shows, under this parametrization, and in contrast with segmented markets, the effect is negative. When we move from $\bar{\mu} = 0.40$ to $\bar{\mu} = 0.20$, welfare increases by 0.22 percent. When moving to $\bar{\mu} = 0.60$, welfare also increases but marginally.

Turning, now, to the model with connections premium, it tends to amplify the effects of policies on the number of connected workers, but because the premium represents only 1.3 percent of public-sector wages, the effects are quantitatively similar to those in the benchmark model.

To sum up, we can draw three main conclusions from this section. First, under the baseline model, parameterized to a country with a large public-sector wage premia, welfare is increasing in $\bar{\mu}$, but this is not always true in the random search model. Second, public-sector wage cuts have a large quantitative effect on reducing the unemployment rate. Third, in the random search model, the effects of policies on unemployment are qualitatively similar

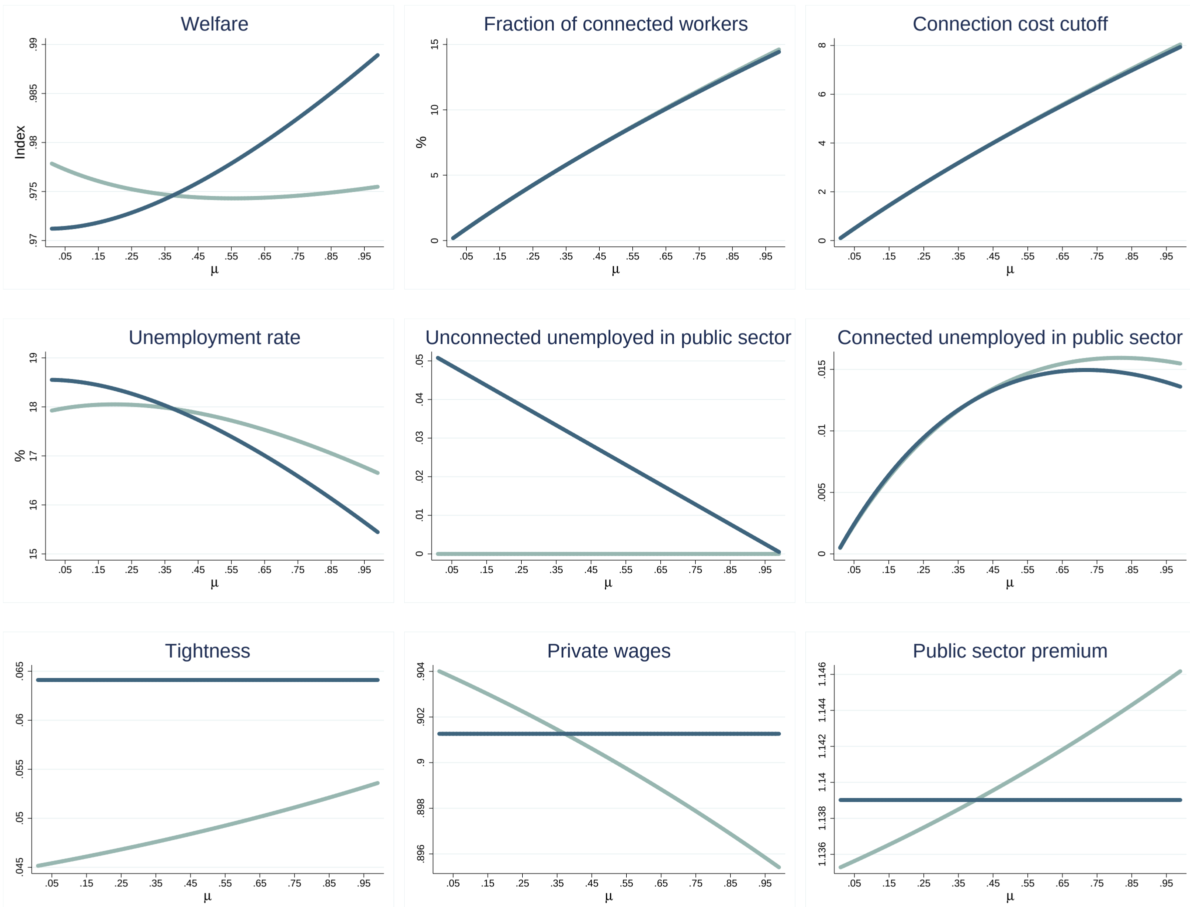
Table H1: Effects of policies under different models

Policy **Policy**	**Segmented** **markets**	**Random** **search**	**Connections** **premium**
Reduction of nepotism to $\bar{\mu} = 0.20$			
%Δ welfare	-0.28%	0.22%	-0.31%
Δ fraction of connected	-3.10 p.p.	-3.12 p.p.	-3.16 p.p.
Δ unemployment rate	0.48 p.p.	0.12 p.p.	0.42 p.p.
Increase of nepotism to $\bar{\mu} = 0.60$			
%Δ welfare	0.40%	0.00%	0.45%
Δ fraction of connected	2.85 p.p.	2.89 p.p.	2.94 p.p.
Δ unemployment rate	-0.68 p.p.	-0.30 p.p.	-0.61 p.p.
Reduction of public-sector wages by 10 percent			
%Δ welfare	1.36%	0.88%	1.35%
Δ fraction of connected	-0.74 p.p.	-0.68 p.p.	-0.76 p.p.
Δ unemployment rate	-1.80 p.p.	-1.03 p.p.	-1.82 p.p.

Note: The random search and connections premium models are recalibrated ($\kappa = 7.31$) and ($\kappa = 6.29$).

but quantitatively smaller than in the model with segmented markets. The same holds for the "connections premium" model.

Figure H3: Effects of nepotism



*Note: The **dark blue line** is the economy with segmented markets. The **light green line** is the economy with random search.*