The Unintended Consequences of Meritocratic Government Hiring

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ABSTRACT ———
In an attempt to mitigate the negative effects of clientelism, many governments around
the world have adopted meritocratic hiring of public employees. This paper challenges
the effectiveness of this common practice by showing that meritocratic government hir-
ing can have unintended negative consequences on macroeconomic aggregates. In many
countries, public employees enjoy considerable job security and generous compensation
schemes; as a result, many talented workers choose to work for the public sector, which
deprives the private sector of productive potential employees. This, in turn, reduces
firms' incentives to create jobs, increases unemployment, and lowers GDP. To quantify
the effects of this novel channel, we extend the standard Diamond-Mortensen-Pissarides
model to incorporate workers of heterogeneous productivity and a government that fills
public sector jobs based on merit. We calibrate the model to aggregate data from Greece
and perform a series of counterfactual exercises. We find that the adverse effects of our
mechanism on the economy's TFP, GDP, and unemployment are sizable.
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1 Introduction

In all OECD countries, the government is by far the largest employer. Thus, whether public employees are hired by merit or on partisan criteria ("clientelism") has important implications for political and economic outcomes (Alesina, Danninger, and Rostagno (2001); Robinson and Verdier (2013)). In an attempt to ameliorate the negative effects of clientilism, many governments have adopted means of meritocratic hiring. Selecting the best available employees through non-partisan procedures is believed to promote not only fairness but also economic efficiency. In this paper, we challenge this commonly held view by highlighting that meritocratic government hiring can have unintended negative consequences on macroeconomic aggregates. We do so by focusing on a channel that has been so far overlooked in the literature. In many countries, public employees enjoy considerable job security and generous compensation schemes; as a result, many talented workers choose to work for the public sector, which deprives the private sector of productive potential employees. This, in turn, reduces firms' incentives to create jobs, increases unemployment, and lowers GDP. The goal of this paper is to model and quantify the effects of this novel channel.

We develop a version of the Diamond-Mortensen-Pissarides (DMP) model, extended to include a meritocratic public sector and workers of heterogeneous productivity. As is standard in DMP models, wages in the private sector are negotiated through Nash bargaining and, hence, reflect workers' productivity. In contrast, the public sector can pay its workers any wage it wishes (even one that does not reflect economic fundamentals, like productivity), since it finances public sector compensation with taxes. In this environment, workers choose whether to apply for public or private sector jobs, understanding that the private sector rewards higher productivity, but the public sector offers higher job security. Once workers' participation decisions have been made, the government hires the most productive workers who applied for public sector jobs. Taking the behavior of workers and the public sector as given, private firms decide whether to open a vacancy and search for a worker. Firm entry is driven by expectations about profitability, which, in turn, depends on workers' productivity. Therefore, if the public sector attracts a large pool of high-quality workers, the incentives of firms to create jobs deteriorate.

To highlight the main forces at work in our model, consider an increase in the generosity of public sector compensation. This increase reduces private firm entry for two reasons. First, and more obviously, it implies a higher tax burden on firms. Second, it leads to an improvement in the quality of workers who apply for public sector jobs, which through the aforementioned channel weakens the incentives of firms to enter the

labor market and open vacancies. Subsequently, workers expect a lower job-finding rate in the private sector, which reinforces the decision of high-productivity workers to abandon the private for the public sector and further reduces firms' incentives to create jobs. The vicious circle just described generates a *multiplier effect*, whereby a wage premium in the public sector (in conjunction with the high job security) can affect the economy's productivity, unemployment, and GDP. If, moreover, the public sector is less efficient than the private (an assumption supported by a large body of empirical evidence), the attractiveness of the public sector can result in severe misallocation of talent that amplifies the negative consequences of our mechanism.

The description of our mechanism so far suggests that a meritocratic government that pays a high wage premium to public employees can have negative effects on macroeconomic aggregates. To quantify these effects, we calibrate our model to the Greek economy before the 2009 sovereign debt crisis and use it to perform a number of policy-relevant counterfactual exercises. We start by studying the consequences of a reduction in the size of the public sector. We find that a 25% drop in the number of public sector employees leads to a 2.1% increase in private sector's productivity, a 4% drop in unemployment, and a 2% increase in GDP.[1] These results are sizable but somewhat expected: any model that features a relatively less efficient public sector would deliver a (qualitatively) similar improvement in macroeconomic performance when that sector is downsized.

To highlight the *unique* implications of our mechanism, we carry out two more exercises. First, keeping the size of the public sector fixed, we study the consequences of removing meritocratic hiring. In particular, we assume that rather than selecting the most productive applicants, the government fills public sector positions by hiring a representative set of all worker types. The calibrated model predicts a 4% increase in private sector's productivity, a 4.8% drop in unemployment, and a 1% increase in GDP. Second (and, again, keeping the size of the public sector fixed), we examine the effects of a reduction in public sector compensation. We find that a 10% drop in public sector wages results in a 4% increase in private sector's productivity, a 7.3% drop in unemployment, and a 1.3% increase in GDP. We conclude that the mechanism identified in this paper is not only theoretically novel but also quantitatively significant. Our analysis also delivers a policy-relevant message: a government that is simultaneously inefficient, generous, and meritocratic can have detrimental effects on the economy. It goes without saying that increasing public sector efficiency is desirable, but if this is not realistic in the short run, at least the government should not be excessively generous and meritocratic at once.

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[1] This reduction in the size of the public sector large as it may seem is smaller than the actual reduction of 28.3% observed in the Greek economy in the period 2009-2013; see Section 5.1.

We think that Greece is a particularly good example to highlight the relevance of our mechanism. Public sector jobs in Greece are especially attractive because public employees' absolute job security is established by the Constitution, and the public sector wage premium is between 20 and 35 percent (Lyberaki, Meghir, and Nicolitsas (2017)). Moreover, the Greek government has adopted two meritocratic ways to hire public employees. The first is through the general college-entry examination and the second is through examinations organized by the Supreme Council of Civil Personnel Selection (ASEP). The former is particularly interesting for us because it conveys information about the attractiveness of various career paths. All high school graduates take the general exam, and each school's entry cutoff point (is endogenous and) reflects the score of the marginal student admitted to that school. Strikingly, the 2019 cutoffs for air force, fire, and police academies were 18.6 (out of 20), 18.4, and 18.3, respectively, while the cutoff for the nation's best engineering schools were 18.3, 17.5, and 16.4.[2] This evidence suggests that young talented Greek students value very highly the "job-for-life" prospect (and the wage premium) that comes with a public sector job. Despite attracting so many capable individuals, the Greek public sector is also highly inefficient (see Section 2.1 for details), which results in severe misallocation of talent.

Even though our motivation and data come from Greece, the mechanism identified in this paper is arguably relevant for a large number of countries. The first key ingredient of our mechanism is an attractive public sector. Public sector jobs around the world are attractive for many reasons, the main one being substantial job security.[3] Additionally, in the vast majority of countries public sector employees also receive a significant wage premium; see Gregory and Borland (1999) for developed and Finan, Olken, and Pande (2017) for developing countries.[4] Even for the few exceptions where the public sector wage premium is negative, as in certain developing countries, there are other factors that make

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[2] We report the cutoffs for the most attractive engineering school, namely electrical engineering, for the top three universities: National Technical University of Athens, Aristotle University of Thessaloniki, and University of Patras. As another example, the cutoff for military economists was 18.6, while the cutoff for the nation's best economics department, Athens University of Economics and Business, was 15.8 (https://www.minedu.gov.gr/exetaseis-2/baseis-an/43010-27-08-19-oi-vaseis-kai-ta-sygkritika-ton-vaseon-2).

[3] Job security in the public sector is significant even in countries where it is not established by law, like Greece. For instance, Ohanian (2011) estimates that in the U.S. "workers would be willing to work for about 10 percent less compensation in the public sector, given the additional benefit of much higher job security". See also Section 2.1 for an example that demonstrates the great desirability of a "job-for-life" in Italy.

[4] For specific Eurozone countries, Giordano, Depalo, Pereira, Eugène, Papapetrou, Perez, Reiss, and Roter (2011) estimate a public sector wage premium between 20 and 30 percent for Italy, Spain, Ireland, and Slovenia, and above 50 percent for Portugal. Outside of Eurozone, the estimates include a premium close to 50% for Turkey (Tansel (2005)), 18% for Australia (Mahuteau, Mavromaras, Richardson, and Zhu (2017)), and over 60% for India (Glinskaya and Lokshin (2005)).

public sector jobs attractive, including generous retirement benefits and informal income through corruption. For instance, Gorodnichenko and Peter (2007) document that bribery is a substantial source of income for public sector employees in Ukraine. The second key ingredient of our mechanism, namely, meritocratic hiring, also seems highly relevant: most developed and developing countries hire public employees through examinations overseen by an independent authority.[5] This discussion clarifies that our mechanism is relevant for a large number of countries. Whether it is also quantitatively important depends on a number of factors, including, the relative inefficiency of the public sector, which is highly supported by empirical evidence.[6]

This paper contributes to a recent strand of search and matching literature that analyzes the role and effects of public sector employment and wages. Two papers build on the canonical job ladder model of Burdett and Mortensen (1998): Burdett (2012) introduces a public sector which posts a unique wage; Bradley, Postel-Vinay, and Turon (2017) consider a public sector wage distribution and study worker transitions between the two sectors. A few other papers use the DMP framework. Quadrini and Trigari (2007) study how the introduction of a public sector raises the volatility of unemployment over the business cycle. Hörner, Ngai, and Olivetti (2007) analyze how turbulence interacts with workers' risk aversion to explain the relatively high European unemployment rates. Michaillat (2014) shows that the crowding-out effect of public sector employment is lower during recessions, giving rise to higher government spending multipliers. Gomes (2014) computes the optimal public sector compensation policy.

There are few studies that incorporate worker heterogeneity in the DMP framework with a public sector. Gomes (2018) assumes that workers differ along two dimensions in a binary fashion (a worker is either of high or low quality and either has or does not have a college degree) and evaluates a reform connecting the public to the private sector wages. Chassamboulli and Gomes (2019b) use a similar framework to analyze the education choices of workers. Albrecht, Robayo-Abril, and Vroman (2018) incorporate heterogeneous human capital and match specific productivity in the model to analyze various

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[5] For instance, in Spain public workers are selected through a set of exams known as oposiciones; in France, as concours or Grands Corps de l'Etat; in Italy, as concorso pubblico; in India, as the Staff Selection Commission - Combined Graduate Level Examination (SSC CGL); and in Turkey, as the Public Personnel Selection Examination (KPSS).

[6] For a comprehensive academic reference see Megginson and Netter (2001). In many countries, public sector inefficiency is monumental; one can bring forth lots of informal support but our all-time favorite is the case of the Spanish civil servant who did not show up for work for at least 6 years (and possibly as many as 14) and was routinely on the payroll until he retired without any trouble (https://www.theguardian.com/world/2016/feb/12/long-lunch-spanish-civil-servant-skips-work-for-years-without-anyone-noticing).

distributional questions, such as what types of workers tend to work in the public versus the private sector. Finally, Chassamboulli and Gomes (2019a) enrich the model with a "nepotistic" public sector that offers jobs to workers with political connections, which is the opposite from our meritocratic government. Interestingly, we find a result with a similar flavor to theirs, namely, that less meritocracy (i.e., more nepotism) in the public sector lowers unemployment. However, the channels through which this result arises are different: in their model, unemployment drops because less meritocracy leads to fewer workers applying to the public sector; in our model, unemployment drops because less meritocracy improves the average quality of workers matching with private firms.

Our mechanism touches upon the important insight of Murphy, Shleifer, and Vishny (1991), namely, that the choice of talented individuals to sort into rent-seeking occupations instead of productive entrepreneurial activities hurts economic growth. The idea that a generous public sector may distort the occupational choice of individuals is explored qualitatively in Jaimovich and Rud (2014) and quantitatively in Santos and Cavalcanti (2015). Gomes and Kuehn (2017) investigate how differences in educational endowments and public employment account for differences in the average firm size and productivity between the United States and Mexico. A crucial difference with this line of work is that we highlight the importance of talent absorption by the public sector for firm entry and job creation in the private sector, a channel not analyzed so far. Finally, since our mechanism speaks to how career choices of individuals affect GDP, our paper is also related to the vast literature on the misallocation of production inputs, surveyed by Restuccia and Rogerson (2017). The focus on unemployment and job creation distinguishes our approach from this very important research agenda.

The rest of the paper is organized as follows. In Section 2, we describe the model and provide a justification for some key modeling choices. In Section 3, we analyze the equilibrium of the model. In Section 4, we describe and implement the calibration strategy. In Section 5, we perform the counterfactual exercises and provide quantitative results. Finally, in Section 6, we conclude.

2   The model

We start with a description of the economic environment. Since modeling a meritocratic public sector is not standard in the literature, some of our modeling choices deserve further discussion. This task is performed in Section 2.1.

We develop a version of the Diamond-Mortensen-Pissarides (Pissarides (2000)) model

in discrete time, extended to include a public sector. The labor force consists of a measure of heterogeneous workers normalized to the unit. When employed by a firm in the private sector, a worker produces p units of the numeraire good, where p is a random draw from a cumulative distribution function $F(x)$ that is continuous (no mass points) and has support in the interval $P \equiv [\underline{p}, \overline{p}]$. When employed in the public sector the same worker produces αp units of the numeraire, where $\alpha \in (0, 1)$. All workers enjoy a benefit z while unemployed. There exists a large set of homogeneous firms that can enter the labor market and search for a worker. Firms can post one vacancy each and while waiting to recruit a worker, they occur a search/recruiting cost κ per period. The equilibrium measure of firms is determined by a free entry condition. All agents discount future at rate $\beta \in (0, 1)$. Throughout the paper we focus on steady state equilibria.

The wage of a worker with productivity p in the private sector, $w(p)$, is determined through Nash bargaining, with $\eta \in (0, 1)$ denoting the worker's bargaining power. Unlike the private sector, where a worker's wage is contingent on productivity, the public sector pays *all* of its workers the common wage $\tilde{w}$ (as a mnemonic rule, symbols with a "tilde" are associated with the public sector). This is a simplifying assumption that can be easily relaxed: all we need for our results to go through is that the public sector rewards higher productivity *less* than the private.[7] To raise funds for wage payments the government can use a fraction $\phi \in [0, 1]$ of the product generated by the public sector. If this source is not enough, the government can impose a flat tax τ on each operating firm/match.

All workers (employed or not) die/retire at the end of each period with probability δ, and deceased/retired workers are replaced by a "clone", i.e., a worker of identical productivity. Clones start their life in the state of unemployment. Additional to the mortality rate δ, private sector jobs are subject to a negative productivity shock. More precisely, existing matches are terminated at the end of each period with probability λ; we often refer to λ as the job destruction rate. The public sector does not suffer from the job destruction shock: a public sector job is terminated only if the worker dies/retires.

We move on to the description of the matching process in the private sector. Suppose there are ν vacant firms and u unemployed workers in the labor market. Then, the total number of matches per period is given by $m(\nu, u)$; as is standard in the literature, we assume that the matching function m exhibits constant returns to scale (CRS) and is increasing in both arguments. With CRS matching the probability with which the typical firm matches with a worker is $q(\theta) \equiv m(1/\theta, 1)$, where $\theta \equiv \nu/u$ is the market tightness in the private sector. Similarly, the probability with which the typical worker matches

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[7] For a justification of this claim see the discussion in footnote 14 .

with a firm is $\theta q(\theta)$. As is standard in the DMP model, $q(\theta)$ is decreasing in θ and $\theta q(\theta)$ is increasing. We do not consider on-the-job search.

There is a fixed number of public sector jobs in any given period, denoted by $\mu \in (0,1)$. Since at the end of every period a fraction δ of workers die, in steady state, the government must hire $\delta\mu$ new workers to replace the deceased ones. Hiring in the public sector does not involve search and matching frictions. The meritocratic government simply chooses the best, i.e., most productive, workers who apply for these jobs. Thus, rather than searching for the right match, the public sector carries out a large scale screening process/examination that helps them select the workers with the highest p. An unemployed worker who applies to a public sector job in period t gets screened/takes the exam in $t+1$ and, if chosen (i.e., if "good enough"), starts working in $t + 2$. However, workers must "specialize": if they seek a job in the public sector they cannot match with private firms (i.e., they will not belong to the set u described in the previous paragraph). All agents have perfect foresight and perfect information about all aspects of the model.

2.1   Discussion of modeling choices

To the best of our knowledge, this is the first paper that develops a DMP model with a *meritocratic public sector*. Therefore, we think it is important to provide justification for some of the model's novel ingredients. In particular, we discuss the following assumptions: (i) a worker's productivity is lower in the public than the private sector, (ii) hiring in the public sector is conducted through a general examination and not through a matching function, (iii) wages in the public sector do not reflect worker productivity as much as in the private sector, and (iv) the government needs to resort to taxes to finance public sector wages. We argue that these assumptions are not only realistic, but also interrelated and reinforcing each other.

Michael Jacobides' study in Meghir, Pissarides, Vayanos, and Vettas (2017) provides several reasons why the same worker would be less productive in the public than the private sector ($\alpha < 1$). First, the incentive structure of the public sector is extremely ineffective, because the performance measures used are crude and play almost no role for promotion decisions. Second, the human resource practices and the organizational structures are antiquated and very often irrational, leading to a severe mismatch between the skills needed and the skills public servants have.[8] Third, and most importantly, the Greek public sector is plagued by massive "legal formalism", an extended set of laws

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[8] As an example, in 2012 only seven of the more than one thousand employees of the IT department in the Greek Ministry of Finance were commissioned to write computer code.

and rules regulating all aspects of public administration. As a result, public employees fall back on formalistic rules at every turn and devote most of their energy and time in mindless procedural tasks. In our view, the question is not whether α is lower than one but *how much* lower; this is a quantitative issue that we discuss in detail in Section 4.[9]

Next, consider assumption (ii), i.e., public sector hiring is not subject to the usual search and matching frictions that characterize private sector hiring. The matching function used in DMP models is meant to capture the time and effort that firms spend in order to find a worker with the right skills for the job (and vice versa). In reality, this process consists of multiple rounds of application screening and interviews. Contrary to that, in many countries the government hires through nationwide exams, which is exactly what we assume here (see also footnote 5). These exams are often on general subjects that do not perfectly reflect the skill requirements of specific jobs. Hence, a meritocratic government that hires the highest-scoring candidates does not necessarily select the most fitting ones. This can in fact be viewed as another reason why α is less than one, which highlights the interdependence between assumptions (i) and (ii). It is also important to notice that assumption (ii) is not essential for our results, if anything, it mitigates their quantitative importance: the negative effects of meritocratic government hiring we report would only become larger if one were to add search frictions in public sector hiring.

Another important assumption is that public sector wages do not reflect worker productivity as much as in the private sector. This assumption is supported by empirical evidence, since public sector wages feature lower variability than private sector wages (e.g., see Christopoulou and Monastiriotis (2014)).[10] For the case of Greece, as Michael Jacobides puts it, "As in other countries, Greek civil servants enjoy greater (mostly, absolute) job security than their private-sector counterparts, but face *flatter pay conditions* and slower career progression" (Meghir et al. (2017), p. 641; emphasis added). Again, the assumption under consideration is consistent with assumption (i): the inefficiency of the incentive structure and the fact that performance plays minimal role for promotions in the public sector are among the reasons causing α to be less than one.

The last assumption discussed here is that the government cannot finance public employees' salaries exclusively with public sector output, so it needs to resort to taxes. First,

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[9]Megginson and Netter (2001) provide several references in support of a less efficient public sector. That said, note that if $\tilde{w}$ is generous enough, the public sector still attracts a lot of talent and has to use taxes to pay for it. Simply put, our mechanism is *relevant* even if the public sector is as efficient as the private; but lower values of α make it more *quantitatively significant*.

[10] This is not true only in Greece; the salary of the President of the US is $400,000, while the salary of football coaches at certain private colleges is in the order of 10 million. Also, one should not forget the Spanish civil servant (see footnote 6) who was receiving normal wages for 6 to 14 years even though his productivity was literally zero, as he did not show up to work.

many goods and services produced by public sector employees are customary provided to society free of charge. Second, even in the case of goods provided by state-owned enterprises, in which there is a price, that price is often well below the production cost. For example, in the case of Hellenic Railways Organization (OSE), the revenue is consistently below salary costs, which has resulted in a debt of 11 billion euros.[11] Once again, the assumption under consideration should be thought of in conjunction with assumption (i). The government must resort to taxes because it prices its services below cost; but an important reason why the government cannot price (at or) above cost is that the cost is unreasonably high, precisely due to the public sector inefficiency ($\alpha < 1$).

We conclude this section with a piece of informal yet extremely relevant evidence. In the summer of 2017 the Bank of Italy advertised 30 job openings; the number of applicants for these jobs reached the staggering number of 85,000. We quote a report on these news:[12]

> Italy's chronic unemployment problem has been thrown into sharp relief after 85,000 people applied for 30 jobs at a bank [...] The work is not glamorous - one duty is feeding cash into machines that can distinguish banknotes that are counterfeit or so worn out that they should no longer be in circulation. The Bank of Italy whittled down the applicants to a "shortlist" of 8,000, all of them first-class graduates with a solid academic record behind them. They will have to sit a gruelling examination in which they will be tested on statistics, mathematics, economics and English [...] The high level of interest was a reflection of the state of the economy but also of the Italian obsession with securing "un posto fisso" - a permanent job.

We find this quote particularly interesting because it highlights the relevance of certain assumptions and our mechanism as a whole:

1. First and foremost, the story highlights the desirability of public sector jobs, one of the pillars of our mechanism. ("[...] the Italian obsession of securing 'un posto fisso'.")

2. The story highlights the *attraction of talent* in the public sector ("[...] all of them first-class graduates with a solid academic record behind them.")

3. The story also highlights the *waste of that talent*. ("The work is not glamorous - one

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[11]http://www.ekathimerini.com/237481/article/ekathimerini/business/ose-is-on-track-for-more-losses

[12]https://www.smh.com.au/world/85000-apply-for-30-bank-jobs-in-italy-20170705-gx54dx.html

duty is feeding cash into machines that can distinguish banknotes that are counterfeit [...]")

4. The story highlights the relevance of assumption (ii) discussed earlier: the selection of applicants is meritocratic, i.e., through (tough) exams, but not necessarily targeted to finding 'the right person for the job'. ("They will have to sit a gruelling examination in which they will be tested on statistics, mathematics, economics and English", only to find themselves "[...] feeding cash into machines that can distinguish banknotes that are counterfeit [...]")

3 Analysis of the Model

3.1 Value functions and optimal behavior

We start with the description of the workers' value functions. Consider first a worker of productivity p employed by a private firm. This agent's Bellman equation satisfies

$$W(p) = w(p) + \beta(1 - \delta)\left[(1 - \lambda)W(p) + \lambda\hat{U}(p)\right], \tag{1}$$

where $\hat{U}(p)$ is the present discounted value of a worker with productivity p who just became unemployed and can choose to specialize either in the private or the public sector. Next, consider a worker of productivity p employed at the public sector. For this agent the Bellman equation is given by

$$\tilde{W}(p) = \frac{\tilde{w}}{1 - \beta(1 - \delta)}. \tag{2}$$

Obviously, a worker in the public sector keeps her job for as long as she is alive; also, her wage is independent of her productivity (see discussion in Section 2.1).

Consider next the value functions for unemployed workers, and let us start with a worker of productivity p who just entered the state of unemployment. This worker makes one of the most critical decisions in the model, namely, whether to specialize in the private or the public sector. Formally, this agent's Bellman equation satisfies

$$\hat{U}(p) = \max\{U(p), \tilde{U}(p)\},$$

where $U(p)$ is the value function of an unemployed worker who chooses to search for private sector jobs, and $\tilde{U}(p)$ is the analogous expression for a worker who decides to

apply to the public sector. Then, recalling that $\theta q(\theta)$ is the probability of a successful match in the private sector, the former value function must satisfy

$$U(p) = z + \beta(1 - \delta)\left[\theta q(\theta)W(p) + (1 - \theta q(\theta))U(p)\right],\qquad(3)$$

and the latter is given by

$$\tilde{U}(p) = z[1 + \beta(1 - \delta)] + \beta^2(1 - \delta)^2\left[\mathbb{1}\{\textit{if hired}\}\,\tilde{W} + \mathbb{1}\{\textit{if rejected}\}\tilde{U}(p)\right].\qquad(4)$$

The last expression is intuitive: a worker who decides to apply for public sector jobs will enjoy the benefit z in period t and (conditional on surviving) will take the screening exam in $t + 1$; during that time she will remain unemployed and again enjoy z. In $t + 2$ (conditional on surviving), the worker will obtain the value $\tilde{W}$ if she is good enough to be hired in the public sector; otherwise she will stay unemployed and obtain $\tilde{U}(p)$.[13]

The analysis so far suggests that in order to fully describe the workers' optimal behavior we need to understand what it means to be "good enough" for the public sector. To that end, two observations are critical. First, since $\tilde{W}$ does not depend on p (see equation 2), (4) implies that $\tilde{U}(p)$ will also be flat in p, for values of p representing workers who get accepted by the public sector. For these values of p, we have

$$\tilde{U}(p) = \tilde{U} = z[1 + \beta(1 - \delta)] + \beta^2(1 - \delta)^2\,\tilde{W}.\qquad(5)$$

Second, a more productive worker is more likely to be drawn to the private sector because that sector will reward her high productivity. Formally, this means that $U'(p) > 0$, which for now is a conjecture, but it will be verified in Section 3.3. Therefore, as indicated in Figure 1, there exists a unique $p_H \leq \bar{p}$, such that $U(p_H) = \tilde{U}$. The term p_H plays a crucial role in our analysis since it denotes the productivity of the *most able* worker who chooses to apply to the public sector (also, by definition, the worker who is indifferent between the two sectors). Which other workers apply to the public sector? Any worker indexed by $p > p_H$ would *not want* to apply to the public sector, since for that worker $U(p) > \tilde{U}$. Workers with $p \leq p_H$ would happily work for the public sector, but some of them will not be good enough for the meritocratic government and, importantly, *they know it* because all agents have perfect foresight and perfect information about the fundamental parameters

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[13] Thus, a worker who applied for a public sector job and got rejected chooses to apply there again. We make this assumption because we need to specify the action of such worker off the equilibrium path. However, as we are about to see, *on the equilibrium path* such behavior will never be observed, since workers who are not good enough to be employed by the public sector will never apply in the first place.
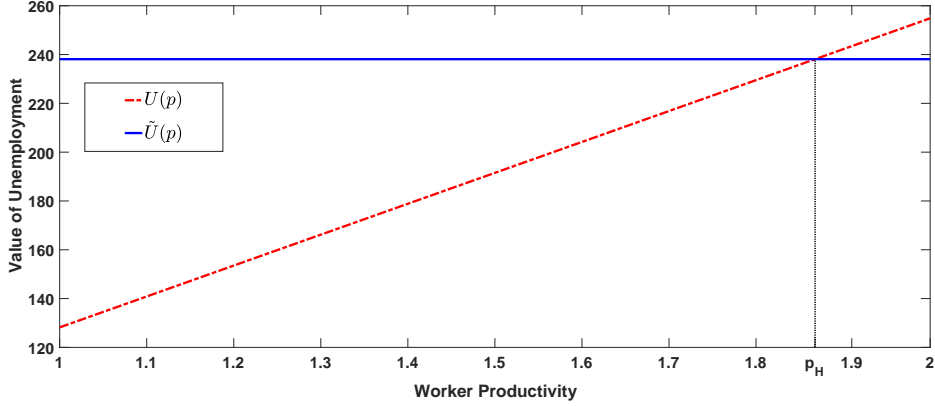
Figure 1. $U(p)$ versus $\tilde{U}$ for workers of various productivities.

of the model (crucially, $F(p), \mu$, and δ).

We conclude that the set of types who apply for public sector jobs (when unemployed) will be a connected set, $\tilde{P} \equiv [p_L, p_H] \subset P$, and the only thing that remains to be characterized is the lower bound of that set, p_L.[14] Since workers who are not good enough to be employed by the public sector will not bother applying, p_L will be determined so that the measure of workers who apply for public sector jobs are just enough to cover the demand for public employees. As we show in the appendix, p_L satisfies:[15]

$$F(p_L) = F(p_H) - \frac{\mu}{(1 - \delta)^2}. \tag{6}$$

The next proposition offers a summary of the workers' optimal behavior.

Proposition 1. *There exists a set of worker types $\tilde{P} \equiv [p_L, p_H]$, where p_H satisfies $U(p_H) = \tilde{U}$ and p_L solves equation (6), such that workers with $p \notin \tilde{P}$ never apply for public sector jobs. For workers with $p > p_H$ this is so because they prefer to go to the private sector. For workers with $p < p_L$ this is so because they correctly predict that they would not be accepted in the public sector. Workers with $p \in \tilde{P}$ can be distinguished in three groups. The first is workers who were just born*

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[14] In footnote 7 we claimed that one does not need $\tilde{w}$ to be constant, and that the main results of the paper would go through as long as the public sector rewards higher productivity *less* than the private sector. Figure 1 can help clarify that claim. Suppose that the term $\tilde{U}$ in the figure was not flat but increasing in p, only with a *lower slope* than $U(p)$. Then, it would still be true that the set of workers who apply to the public sector is a connected set $\tilde{P}$, and the upper bound of that set would still be marked by the marginal type who is indifferent between the public and the private sector.

[15] Equation (6) holds when the implied p_L is (weakly) greater than $\underline{p}$. In all our quantitative results, this is always satisfied. In theory, however, it is possible that we could have $p_L < \underline{p}$. In that case the public sector would not be able to attract enough workers to fill all its jobs. Thus, strictly speaking, the lower bound of the set $\tilde{P}$ is the minimum between the value of p_L implied by (6) and the lowest possible type, $\underline{p}$.

(to replace a deceased worker of identical productivity) and have just applied to the public sector. The second is workers who were born and applied for a public sector job in the previous period, and are currently being screened. The last group is the remaining workers in $\tilde{P}$ who are currently working for the public sector.

Proof. The proof follows immediately from the previous discussion and the proof of equation (6) in the appendix. □

We conclude this subsection with the firms' value functions. Let V denote the value function of a firm with an open vacancy and $J(p)$ the value of a firm that has matched with a worker of productivity p. Then, we have

$$
V = -\kappa + \beta q(\theta) \int_{p \notin \tilde{P}} J(p) dF(p), \tag{7}
$$

$$
J(p) = p - w(p) - \tau + \beta(1 - \delta)(1 - \lambda)J(p), \tag{8}
$$

where $q(\theta)$ is the matching probability for the typical firm and τ is the flat tax imposed by the government. Given free entry of firms, in any equilibrium we must have $V = 0$. Therefore, equations (7) and (8) imply

$$
\kappa = \frac{\beta q(\theta) \left[\mathbb{E}\left(p - w(p) | p \notin \tilde{P} \right) - \tau \right]}{1 - \beta(1 - \delta)(1 - \lambda)}. \tag{9}
$$

Equation (9) admits the standard interpretation, i.e., it states that the market tightness is such that the expected profit from a new job must be equal to the expect cost of filling the vacancy. Even though equation (9) is not very informative (as we have not yet solved for $w(p)$), it does highlight an important channel in our model. Firm entry is driven by profitability expectations and profitability depends on worker productivity; but firms correctly predict that the set of workers with whom they may match have $p \notin \tilde{P}$. Thus, when the set $\tilde{P}$ includes very productive workers (equivalently, when p_H is very high) the incentives for private firms to enter the labor market and create vacancies will be weak. Naturally, expectations of high taxes (in order to finance high wages in the public sector) also discourage firm entry.

3.2 Bargaining and the Wage Curve

With the value functions for all agents laid out, we can now move on to the bargaining problem. Consider a meeting between a firm and a worker of productivity $p \notin \tilde{P}$. The

bargaining problem can be expressed as follows:

$$\max_{w(p)} \left[W(p) - U(p) \right]^{\eta} J(p)^{1-\eta}.$$

As is standard in the DMP model, the first-order maximization condition reduces to

$$(1 - \eta)[W(p) - U(p)] = \eta J(p), \tag{10}$$

which simply states that the worker's surplus will be equal to a fraction η of the total surplus of the match. To solve for the wage $w(p)$, we first replace the value functions $W(p), U(p)$, and $J(p)$ from equations (1), (3), and (8), respectively.[16] After some algebra, we find that

$$
\begin{aligned}
w(p) &= (1 - \eta)z + \eta(p - \tau) + \beta(1 - \delta)\theta q(\theta)(1 - \eta)[W(p) - U(p)] \\
&= (1 - \eta)z + \eta(p - \tau) + \beta(1 - \delta)\theta q(\theta)\eta J(p),
\end{aligned}
$$

where the last equality follows from (10). Replacing $J(p)$ from (8) into the last expression delivers the final version of our private sector wage curve:

$$w(p) = \frac{[1 - \beta(1 - \delta)(1 - \lambda)](1 - \eta)z + [1 - \beta(1 - \delta)(1 - \lambda - \theta q(\theta))]\eta(p - \tau)}{1 - \beta(1 - \delta)[1 - \lambda - \eta\theta q(\theta)]}. \tag{11}$$

Clearly, the wage is increasing in the worker's idiosyncratic productivity, and also increasing in the unemployment benefit z, since the latter implies a higher outside option for the worker. Moreover, it is easy to show that, for any p, $w(p)$ is increasing in the market tightness θ because a higher θ implies an effective increase in the worker's bargaining position: a worker can threaten the firm that she will walk away from the negotiations, and the higher the θ (and the $\theta q(\theta)$), the more credible the threat.

3.3   Worker optimal behavior and firm free entry revisited

Having derived the wage curve allows us to characterize the workers' behavior and the firms' entry decision more sharply. This task is performed in the following two lemmas.

Lemma 1. *a) The value function $U(p)$ is strictly increasing in p.*

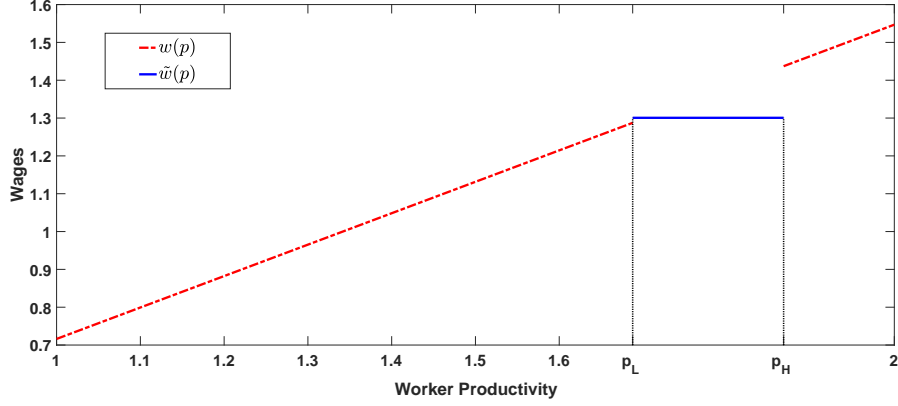[16] Also noting that for workers with $p \notin \tilde{P}$ we can replace $\hat{U}(p)$ with $U(p)$ in (1).

Figure 2. Equilibrium wages for workers of various productivities.

b) The upper bound of the set $\tilde{P}$ is given by

$$
\begin{aligned}
p_H \;=\;& \tau - \frac{1 - \beta(1-\lambda)(1-\delta)}{\beta(1-\delta)\eta\theta q(\theta)}z + \frac{[1 - \beta(1-\delta)\,(1-\lambda-\eta\theta q(\theta))]}{\beta(1-\delta)\eta\theta q(\theta)} \\
&\times\; \left[(1 + \beta(1-\delta))^2 z + \beta^2(1-\delta)^2\tilde{w}\right].
\end{aligned}
\tag{12}
$$

Proof. See the appendix. □

Part (a) of Lemma 1 formally verifies a conjecture made in Section 3.1, namely, that $U(p)$ is increasing, which helped us characterized the set $\tilde{P} \equiv [p_L, p_H]$ of workers who specialize in public sector jobs. Part (b) of the lemma provides a sharp characterization of p_H, the productivity of the most able worker who chooses the public sector. Although the formula provided in equation (12) is rather complex, one thing is quite obvious: a higher $\tilde{w}$ will undoubtedly lead to a higher equilibrium p_H. As already mentioned, the lower bound of $\tilde{P}$, p_L, is determined in equation (6), and its value is such that the measure of workers who apply for public sector jobs is equal to the mass of these jobs.

Figure 2 summarizes the equilibrium wage for all employed workers. Workers with $p \in \tilde{P}$ work in the public sector and receive $\tilde{w}$. The remaining workers work in the private sector and receive a wage $w(p)$, given by equation (11), and increasing in their productivity. Notice that while $U(p_H) = \tilde{U}$, we have $w(p_H) > \tilde{w}$. In words, the wage $w(p_H)$ that makes the critical worker indifferent between working in the private or the public sector must be higher than $\tilde{w}$; this is because $\tilde{w}$ is a wage that the (public sector) worker will keep for ever, while $w(p_H)$ is a wage that the worker will keep only for as long as the match with the private firm is active.

The next lemma provides a precise characterization of the firms' entry decision.

15

Lemma 2. *The free entry condition in this economy satisfies*

$$\kappa = \frac{\beta q(\theta)(1-\eta)\left\{\mathbb{E}\left[p|p \notin \tilde{P}\right] - \tau - z\right\}}{1 - \beta(1-\delta)\left[1 - \lambda - \eta\theta q(\theta)\right]}. \tag{13}$$

Proof. Substitute the wage function from (11) into equation (9). After some algebra one arrives at the desired result. □

Equation (13) is just a restatement of (9), using the specific functional form for the wage function, i.e., equation (11). Once again, we can see that the firms' entry decision will be affected by their expectations of the average productivity of workers in the (private sector) labor market. As firms predict that the workers with whom they can match come from the set $P \setminus \tilde{P}$, any economic factor that contributes to a high p_H (most notably a high $\tilde{w}$) will reduce the firms' incentives to enter the labor market and create jobs.

3.4 The Beveridge Curve

So far we have studied the optimal behavior and the value functions of workers in the various states of the world, but we have not specified the measures of workers in each of these states. This task is performed in this section. Let u denote the mass of unemployed workers in the private sector. In any given period the mass of agents who move out of the state of unemployment is:

$$[\delta + \theta q(\theta)]u.$$

How many agents move into unemployment in each period? The answer is given by[17]

$$(\delta + \lambda)\left[1 - u - \frac{\mu}{(1-\delta)^2}\right] + \delta u.$$

Equating these two flows (they must be equal in a steady state equilibrium) and solving with respect to u yields:

$$u = \frac{(\delta + \lambda)\left[1 - \frac{\mu}{(1-\delta)^2}\right]}{\delta + \lambda + \theta q(\theta)}. \tag{14}$$

---

[17] Recall from Section 3.1 and the appendix that $\mu/(1-\delta)^2$ is the measure of *all* agents who specialize in public sector jobs; this includes those who are currently working or being screened and those who just applied. Thus, $1 - u - \mu/(1-\delta)^2$ is the measure of all employed workers in the private sector. These workers either lose their jobs, with probability λ, and move to unemployment, or die, with probability δ, and get replaced by a clone who, by assumption, starts her life as unemployed. The term δu stands for the clones who came to replace workers who died while in the state of unemployment. Notice that the term δu also appears in the flow out of unemployment, so ultimately it is not going to affect the Beveridge curve.

Equation (14) is our version of the Beveridge curve. As is standard, steady state unemployment is decreasing in the market tightness θ and increasing in the job destruction rate λ (it is also increasing in the mortality rate δ). In our model, equilibrium unemployment also depends on the size of the public sector. More specifically, a large number of public sector jobs (μ) leads to lower steady state unemployment, other things equal, because getting a job in the public sector is not subject to search frictions.[18]

3.5   Government budget constraint and aggregate product

To conclude the analysis of the model we need to specify the government budget constraint. As we have discussed in Sections 2 and 2.1, to cover the public sector wage bill, $\mu\tilde{w}$, the government raises funds through two sources. First, it can use a fraction ϕ of the product generated by the public sector. Second, it can impose a flat tax τ on each operating firm/match. Therefore, the government budget constraint satisfies:

$$\mu\tilde{w} = \tau\left[1 - u - \frac{\mu}{(1-\delta)^2}\right] + \mu\phi\int_{p\in\tilde{P}}\alpha p\, dF(p). \tag{15}$$

Equation (15) is straightforward, once we observe that the term inside the square bracket is the mass of employed workers in the private sector (see footnote 17).

Finally, for future reference let us note that the GDP of this economy is given by

$$Y = \left[1 - u - \frac{\mu}{(1-\delta)^2}\right]\int_{p\notin\tilde{P}}p\, dF(p) + \mu\int_{p\in\tilde{P}}\alpha p\, dF(p). \tag{16}$$

3.6   Definition and characterization of equilibrium

Definition 1. A steady state equilibrium for the model of the meritocratic public sector consists of the objects $\left(u, p_L, p_H, \theta, \tau, \{w_p\}_{p\notin\tilde{P}}\right)$, and can be characterized as follows:

1. Given $\theta \Rightarrow u$ can be derived from the Beveridge curve, i.e., equation (14).

2. Given $(\theta, \tau) \Rightarrow p_H$ can be derived from the workers' optimal decision, i.e., equation (12).

3. Given $p_H \Rightarrow p_L$ can be chosen so that the demand for public sector employees is satisfied, i.e., equation (6).

---

[18] This is yet another manifestation of the fact that our assumption of no search and matching frictions in the public sector mitigates the quantitative importance of our results. Nevertheless, we adopt this assumption because we believe it is empirically relevant; see the discussion in Section 2.1.

4. Given $(\theta, p_L, p_H) \Rightarrow \tau$ can be derived from the government budget constraint, i.e., equation (15).

5. Given $(p_L, p_H, \tau) \Rightarrow \theta$ can be derived from the firm free entry condition, i.e., equation (13).

6. Given $(\theta, \tau) \Rightarrow \{w_p\}_{p \notin \tilde{P}}$ can be derived from the wage curve, i.e., equation (11).

Summary of the main channels at work: Before we move on to the next task of the paper, which is to calibrate the model to the Greek economy and carry out a number of counterfactual exercises, it is important to highlight the main channels of the model in an intuitive way. In particular, we demonstrate that an increase in the generosity of public sector wages, i.e., an increase in $\tilde{w}$, can generate a *vicious circle* or *multiplier effect*.

More precisely, consider an increase in the public sector wage, $\tilde{w}$. This increase will result in a lower equilibrium market tightness for two reasons, one *direct* and one *indirect*. To see the direct reason, note that with a higher $\tilde{w}$ firms realize that if they match they will have to pay higher taxes to fund the higher public wage bill. Too see the indirect reason, consider the behavior of the worker with productivity $p_H + \varepsilon$. This worker had initially chosen to search for jobs in the private sector, but now, with the higher $\tilde{w}$, she chooses to switch to the public sector, i.e., the set $[p_L, p_H]$ shifts to the right. Firms realize that the quality of workers with whom they can match has deteriorated, and this is the second force that discourages their entry. But we are not done. Workers also have rational expectations and realize that θ just dropped. This reinforces the decision of the marginal p_H type to abandon the private for the public sector: yes, the private sector rewards workers for their high p, but when θ is low workers will have to wait very long to find a job in the private sector. Thus, we obtain a further shift of the set $[p_L, p_H]$ to the right, which, in turn, further lowers firm entry.[19] The vicious circle just described (also depicted in Figure 3) goes on and on causing the initial increase in $\tilde{w}$ to generate a multiplier effect. Quantifying this effect is one of the tasks of the next section.

4   Calibration

Our focus is the Greek economy before the sovereign debt crisis of 2009, starting in early 1990's. We set a period in the model to be a month in calendar time. Several parameters

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[19] A subtle force at work here is that the initial decrease in θ reinforces a further decrease in that variable (on top of the one caused by the shift of $[p_L, p_H]$), because a lower θ implies fewer matches, and that means that the wage bill, $\mu \tilde{w}$, will be borne by fewer firms, yet another factor that discourages firm entry.
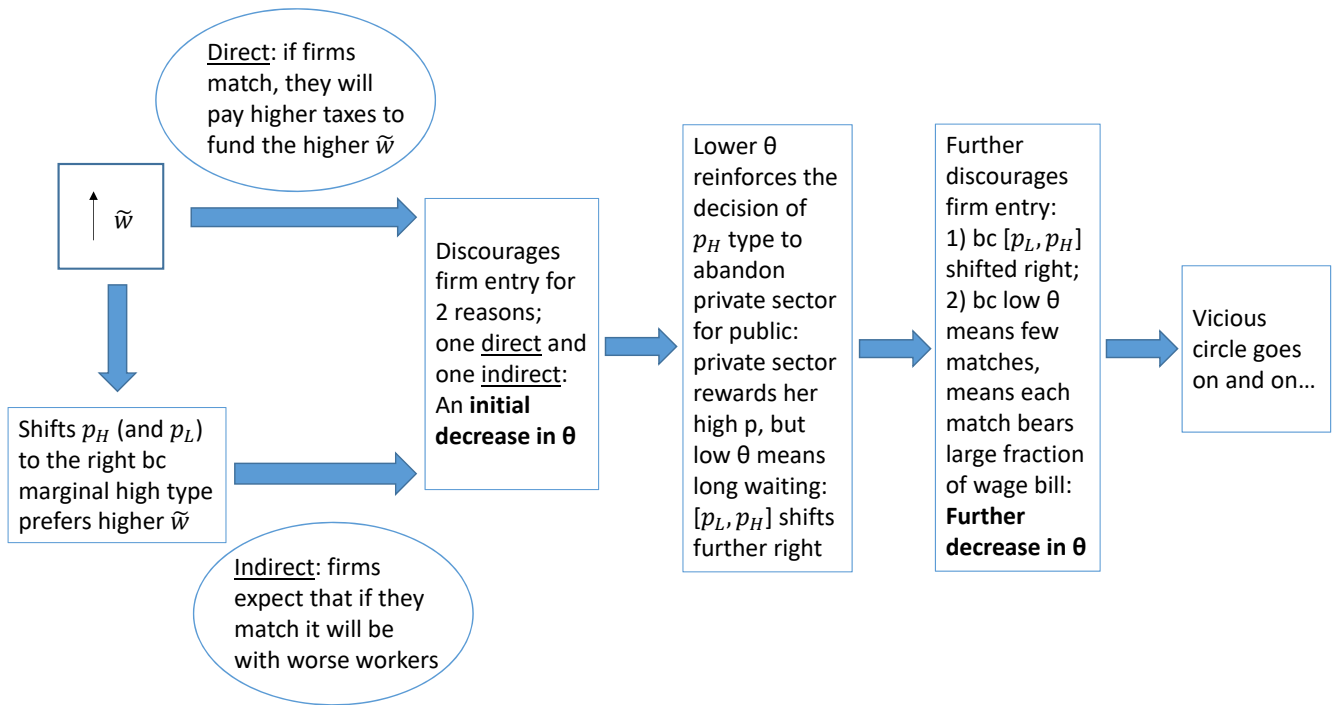
Figure 3. The main channels at work in our model.

that have direct empirical counterparts are set exogenously. The discount factor β is set to 0.9959, consistent with a 5% annual interest rate. We set the separation rate λ to 0.7 %, following the calculations of Hobijn and Şahin (2009). The distribution of worker productivity $F(p)$ is assumed to be uniform and we normalize its support to $[1, 2]$. Following Shimer (2005), we set the unemployment benefit z to 40% of average worker productivity. The average replacement rate in Greece is 35% of the worker's previous wage according to OECD. We choose a slightly higher value in accord with the literature.[20] Furthermore,

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[20] Actually, a 35% replacement rate for Greece is probably an overstatement. There are many eligibility constraints and recipients are eligible for at most twelve months. According to Hobijn and Şahin (2009), over half of the Greek unemployed are jobless for over a year, which means that half of the unemployed population at any point in time are not eligible for unemployment benefits. However, home production

we follow Hagedorn and Manovskii (2008) and set the vacancy creation cost κ to 58.4% of average worker productivity.[21]

We now move on to the calibration of α, the fraction of worker's productivity reflected in public sector jobs. To the best of our knowledge, there are no data sets on the actual productivity of Greek public sector employees; thus, we have decided to use estimates of the public-private productivity differential from the literature.[22] Schmitz (2001), using data from Egypt and Turkey, calibrates government TFP to be half of private TFP. Santos and Cavalcanti (2015), focusing on Brazil, calibrate the public sector TFP to be 72% of the private sector TFP.[23] Moreover, the literature on state-owned enterprises (SOEs), summarized in Megginson and Netter (2001), has provided many estimates on the public-private productivity differential. Depending on the productivity measure and data source, these estimates vary from a wedge of 13% (Frydman, Gray, Hessel, and Rapaczynski (1999)) to 73% (Boardman and Vining (1989)) in favor of the private sector. Based on these estimates, we choose α to achieve a 25% wedge in the productivity of a worker when employed in the public sector. This number is on the lower end of the available estimates and, in light of the evidence provided by Jacobides in Meghir et al. (2017), probably is a conservative choice. The values of externally calibrated parameters are summarized in Table 1.

Table 1: Exogenously Set Parameters

Parameter	Description	Value	Source
β	Discount Factor	0.9959	Annual Interest Rate of 5%
λ	Separation Rate	0.007	Hobijn and Şahin (2009)
$\underline{p}$	Lowest Worker Productivity	Normalization	1
$\overline{p}$	Highest Worker Productivity	Normalization of worker population	2
F	Worker Productivity Distribution	Uniform	$p \in [1, 2]$
z	Value of non-employment	40% of Average productivity	Shimer (2005) and OECD 2001-2009
κ	Vacancy Cost	58.4% of Average productivity	Hagedorn and Manovskii (2008)
α	Productivity Wedge in Public Sector	0.75	Literature on SOEs

and undeclared labor are sizeable in Greece (see Meghir et al. (2017), p.p. 635-637; Schneider and Enste (2000)), which reassures us that the choice of z is realistic.

[21] We cannot use empirical values of tightness in our calibration, as Hagedorn and Manovskii (2008), because there are no vacancy data for Greece. If actual values of θ were available, we could use them to calibrate κ from the job creation equation. Since we use the job-finding rate to calibrate the parameter of the matching function γ, setting κ exogenously amounts to a normalization, as explained in Shimer (2005).

[22] Michael Jacobides provides indirect evidence for the low performance of Greek public sector employees: i) Greece ranks below developing countries in international comparisons of citizens' satisfaction with key state services, such as health, education, and social protection; and ii) Greece has a very high gap between value-added tax due and value-added tax collected, indicating a serious inability to organize tax-collection government agencies more effectively. See Meghir et al. (2017), p.p. 632-643.

[23] Although there are many similarities between these countries and Greece, there is no capital in our model. Hence, we need to interpret these estimates with caution and probably consider them as a lower bound for our calibration.

We calibrate the remaining parameters through the model. We use a CES matching function, inspired by Den Haan, Ramey, and Watson (2000), to make sure transition probabilities in our model are between zero and one: $q(\theta) = (1+\theta^\gamma)^{-\frac{1}{\gamma}}$ and $\theta q(\theta) = (1+\theta^{-\gamma})^{-\frac{1}{\gamma}}$. This leaves us with six internally calibrated parameters: $\tilde{w}$, γ, η, μ, δ, and ϕ. To pin down the public sector wage $\tilde{w}$, we use information about the public sector wage premium. As reported in Lyberaki et al. (2017), the available evidence shows that conditional on worker characteristics wages in the public sector have been between 20 and 35 percent higher than in the private sector. We use a public sector wage premium of 20% to be conservative. To pin down the parameter γ of the matching function, we use the job-finding rate of the Greek economy, estimated by Hobijn and Şahin (2009) at 6% per month.

We set workers' bargaining weight η equal to the elasticity of the matching function at the equilibrium tightness, imposing constrained efficiency to the equilibrium of the model (Hosios (1990)). We make this choice, following Shimer (2005), to focus on output and productivity losses due to government's meritocratic hiring and not due to inefficient levels of vacancy creation. This calibration choice, together with our conservative choices of α and $\tilde{w}$, and the lack of search frictions in public sector hiring imply that our counterfactual results in Section 5 should be interpreted as lower bounds of the effects of meritocratic government hiring on the labor market.[24] Moreover, we pin down the measure of public sector jobs μ using OECD data on the fraction of Greek workers employed in the public sector.[25]

We use an average unemployment rate of 10%, based on OECD data for 1998-2009, to pin down the probability a worker exits the labor market δ. Finally, we calibrate ϕ, the fraction of public employees' output used to pay public sector wages, as follows. In the OECD database, we can find the time series for total government revenue and tax revenue from 1995 to 2009. Through the lens of the model, the only source of government revenue other than taxes is the fraction of output produced in the public sector and not spent in other uses. Hence, we calibrate ϕ such that the ratio of tax revenue over total government revenue in the model is equal to the empirical one. The values of the pa-

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[24] There is another reason why our results should be thought of as lower bounds: agents' perfect foresight about all aspects of the environment implies that workers with $p < p_L$ will never apply for public sector jobs. However, in reality, many workers who are not 'good enough' for the public sector will participate in the screening process nevertheless. Incorporating this waste of resources in our model would only amplify the adverse effects of our mechanism.

[25] Unfortunately, the Government at a Glance series for public employment as a percentage of total employment goes back until 2007. The average for 2007-2009 is a bit less than 18%. We use 20% because the number of public employees was much higher in the period 1980-2000, as shown by Panagiotis Karkatsoulis and Efi Stefopoulou with data from the Ministry of Interior; see Meghir et al. (2017) p.p. 677-686. Interestingly, the OECD average of public sector employment as a percentage of total employment has also been close to 20% for at least the last ten years.

Table 2: Internally Calibrated Parameters

Parameter	Description	Value
$\tilde{w}$	Public Sector Wage	1.301
γ	Matching Function Parameter	0.278
η	Worker's Bargaining Power	0.458
μ	Public Sector Jobs	0.18
δ	Exit Probability	0.13%
ϕ	Fraction of Public Sector Output used for Wages	0.195

rameters calibrated through the model are summarized in Table 2. As shown in Table 3, our calibration strategy makes the model match the calibration targets almost exactly (the difference between model-implied and data moments is in the order of 10^{-4}).

Table 3: Matching the Calibration Targets

Target	Data	Model
Public/Private Wage Ratio	1.2	1.2
Job-Finding Rate	6%	6%
Percentage of Employment in Public Sector	20%	20%
Unemployemnt Rate	10%	10%
Tax Revenue/Total Revenue Ratio	80%	80%

5   Quantitative Results

We begin with the results for the baseline economy, which is the model of Section 2 evaluated at the calibrated parameter values of Section 4. We focus on the main macroeconomic variables of general interest: i) GDP (Y), given in equation (16); ii) unemployment rate (u), given in equation (14); iii) average private sector productivity, given by $E_{PR}(p) \equiv \int_{p \notin \tilde{P}} p \, dF(p)$; iv) average private sector wage, given by $E_{PR}(w) \equiv \int_{p \notin \tilde{P}} w(p) \, dF(p)$; and v) the level of taxes (τ), implied by equation (15). The quantitative results are summarized in Table 4 and analyzed in the rest of this Section.

The GDP of the baseline economy is equal to 1.2782, much lower than the unconditional aggregate worker productivity of 1.5. This reflects the fact that the private sector is plagued by matching frictions (which result in an unemployment rate of 10%), as well as that workers in the public sector face a productivity penalty. Average private sector productivity is equal to 1.443; this is much lower than the private sector-equivalent pro-

Table 4: Summary of Quantitative Results

Variable	Baseline	Reduced μ	Random Hiring	Reduced $\tilde{w}$
Y	1.2782	1.3040	1.2891	1.2947
u	10%	9.6%	9.52%	9.27%
$E_{PR}(p)$	1.4430	1.4735	1.5	1.4979
$E_{PR}(w)$	1.0838	1.1803	1.1286	1.1596
τ	0.2601	0.1848	0.2685	0.2318

ductivity of public sector workers (that is, $\int_{p \in \tilde{P}} p \, dF(p)$, which equals 1.778), indicating the distorted allocation of talent. The productivity of the indifferent worker, p_H, is equal to 1.8679 (Figure 1). To finance public sector wages, the government takes away 18% of output from each firm-worker match, a substantial fraction. The low productivity together with high taxes result in a low average wage for private sector workers equal to 1.08; as mentioned above, public sector wage is 1.3, yielding a 20% public sector premium (Figure 2). Finally, tax revenue is equal to 0.1872, which amounts to almost 15% of GDP.

5.1 Reduction in the number of public employees

The first exercise we consider is a 25% drop in the measure of public jobs μ. At first glance, the magnitude of this exercise may seem large. However, this number is very close to the actual drop in the number of public employees that Greece experienced in the period 2009-2013. The number of public sector employees decreased from 942,625 in 2009 to 675,530 in 2013, a 28.3% drop. As explained by Christopoulou and Monastiriotis (2015), this drop was due to a large number of public employees choosing to retire early, because of the forthcoming reforms in the pension system. Thus, one can view this exercise as an evaluation of the potential gains from the drastic reduction in the number of public employees observed in Greece during the recent crisis, through the lens of our model.

As we can see in the third column of Table 4, the economy experiences sizable gains after the decrease in the number of public employees. The government now pays fewer workers; hence, taxes drop by more than 30%. As a result, private sector matches are more profitable and higher-productivity workers apply to private sector jobs: the indifferent worker's productivity, p_H, is 1.7608, lower than the baseline economy, and average private sector productivity increases to 1.4735. Lower taxes and higher worker productivity in the private sector imply higher private sector wages: wages are 10% higher than in the baseline economy. The private sector employs more productive workers and, since their output fully reflects their productivity, this raises GDP by 2%.

The most striking implication of this exercise is the 4% drop in unemployment. This drop may seem relatively small at first sight; it is important, however, to pause for a moment and evaluate its significance. In the calibrated model, public sector jobs absorb 18% of the labor force. After the reform under consideration takes place, 4.5% of the labor force return to the unemployment pool and look for a job in the private sector. When there is such a large increase in the number of unemployed workers, one would expect an increase in the unemployment rate. However, the unemployment rate actually drops by 0.4 percentage points. The reason, of course, is the increase in job creation by firms: lower taxes, along with the improvement in the quality of the unemployment pool make hiring more attractive and firms respond by creating more vacancies. This increase in job creation is so large that it more than compensates for the massive increase in the number of unemployed workers and it actually reduces the unemployment rate compared to the baseline economy.[26]

5.2 Change of government hiring strategy

The second exercise we consider is a change in the hiring strategy of the public sector: the government hires a subset of all worker types, instead of the best types that apply for public sector jobs. We label this strategy "random hiring", because it could be implemented by the government hiring a random subset of all workers.[27] This strategy may seem a bit unorthodox but variations of it have been employed by the public sector. For example, the Greek Ministry of Education fills a small number of term teaching positions with teachers from a list that includes pretty much every person with the appropriate teaching degree; the main factor of selection is the applicant's seniority, so applicants who graduated earlier have a higher probability of selection. Merit plays a minimal role in this process, which implies that, conditional on the time spent in the list, every applicant has the same probability of being selected.

Filling public sector jobs with random hiring has interesting implications for macroeconomic aggregates, as seen in the fourth column of Table 4. The productivity of both private and public sector employees is equal to the aggregate, since all worker types are represented in both sectors. As a result, wages in the private sector are 4.1% higher than in the baseline economy. Unemployment is also lower by 4.8%, reflecting the increase in

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[26] We should highlight that this is a comparison between steady states. Presumably, unemployment would take some time to adjust and, during the transition to the new steady state, it may be higher than 10%. In DMP models, however, vacancies are a jump variable and the response of firms is almost immediate, hence we do not expect this transitional period to last for long.

[27] We also have to assume that all worker types apply for public sector jobs.

firm entry due to the higher quality of the pool of unemployed workers in the private sector. Interestingly, however, taxes are slightly higher than in the baseline model. The reason is, of course, the 4.4% drop in public employees' productivity, resulting in a lower level of output produced by the public sector. Hence, the reform under consideration comes with a cost; the government needs to increase taxes to finance wages. However, our calibration implies that the increase in firm entry in the private sector is more than enough to compensate for the drop in public sector output, and GPD increases by 1%. This result emphasizes the quantitative importance of the change in government hiring: even though the value of a worker-firm match decreases (due to higher taxes), the productivity gains from the improvement of worker quality in the private sector are so large that they offset this decrease making job creation increase substantially.

5.3   Reduction of public sector wage

Finally, we consider a 10% drop in public sector compensation, $\tilde{w}$, which makes the public sector wage premium (almost) disappear. Again, although the magnitude of the reform may seem large, it is absolutely realistic. If anything, the magnitude of our exercise is smaller than the magnitude of the drop achieved by the Greek government during the recent crisis: Greek public employees experienced a 25% wage drop in the period 2009-2013, as documented by Christopoulou and Monastiriotis (2015).[28] Thus, this exercise provides a lower bound for the potential gains from the reduction in public sector compensation observed in Greece during the recent crisis, through the lens of our model.

We think that this exercise fully captures the essence of our mechanism. The reduction in $\tilde{w}$ wipes the public sector wage premium but keeps the number of public employees constant. This makes public-sector jobs more similar to the private-sector ones and changes the choice of sector trade-off for high-quality workers. Hence, any macroeconomic gains from the reform should be attributed to the improvement in the quality of the unemployment pool in the private sector. And the gains are indeed substantial: private sector productivity increases by 4%, almost eliminating the misallocation of talent in the economy, and private sector wages increase by 7.5%; taxes and unemployment drop by 10% and 7.3% respectively; and, most importantly, GDP increases by 1.3%. Keep in mind that, as in Section 5.2, the quality of the private-sector employees improves but the quality of public-sector employees deteriorates. The calibrated model, however, predicts that the positive effect of the private sector dominates and GDP increases substantially.

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[28] For a substantial part of this period, however, the public sector wage premium in Greece actually increased, since wages in the private sector experienced a more pronounced drop.

6 Conclusion

In this paper, we highlight a novel channel through which meritocratic government hiring can have unintended negative consequences on macroeconomic performance. A meritocratic, generous, yet inefficient government absorbs high-quality workers from the private sector, which, in turn, weakens the incentives of firms to create jobs, increases unemployment, and lowers GDP. Our model extends the Diamond-Mortensen-Pissarides framework to include workers of heterogeneous productivity and a government that fills public sector jobs based on merit. To evaluate the significance of each part of our mechanism, we calibrate the model to aggregate data from Greece and perform a series of counterfactual exercises. We find that: i) removing meritocratic hiring leads to a 4% increase in private sector's productivity, a 4.8% drop in unemployment, and a 1% increase in GDP; ii) lowering public sector wages by 10% leads to a 4% increase in private sector's productivity, a 7.3% drop in unemployment, and a 1.3% increase in GDP. While our motivation and data come from Greece, we argue that our mechanism is relevant for a large number of countries.

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A Appendix

Proof. Proof of equation 6.

Recall that in any period, and in the steady state, the government needs to hire $\delta\mu$ new workers. As we have established in the main body of the paper, due to perfect foresight and perfect information about all aspects of the environment, workers who are not good enough to be hired in the public sector will never apply there. Thus, if we knew p_H, we could find p_L by setting it in a way so that the measure of (unemployed) workers who apply to the public sector is enough to fill the demand for public sector jobs.

Next, recall that agents who start working in the public sector in period t must apply in period $t-2$ and get screened in period $t-1$. Also, recall that all agents die with probability δ at the end of every period. Thus, in order to have $\delta\mu$ new workers in period t, it must be that a mass of $\delta\mu/(1-\delta)^2$ workers applied to the public sector in $t-2$. Also, it must be that $\delta\mu/(1-\delta)$ of these workers (survived and) were being screened in period $t-1$. Since we are in steady state, that means that in *any* period t, there is a measure

$$\frac{\delta\mu}{(1-\delta)^2}$$

of workers who apply to the public sector (to start working in $t+2$); a measure

$$\frac{\delta\mu}{1-\delta}$$

of workers that are currently screened (to start working in $t+1$); and, of course, a measure μ of workers who are currently working in the public sector. Summing up these three masses we find that the measure of *all* workers who "specialize" in the public sector (in whatever stage) is $\mu/(1-\delta)^2$. Then, equation (6) simply states that p_L should be chosen so that the measure of all workers who specialize in public sector jobs, $F(p_H) - F(p_L)$, equals the measure $\mu/(1-\delta)^2$. $\square$

Proof. Proof of Lemma 1.

a) To simplify the notation and the proof, define the terms

$$
\begin{aligned}
D_U &\equiv 1 - \beta(1-\delta)\left(1 - \theta q(\theta)\right), \\
D_W &\equiv 1 - \beta(1-\delta)\left(1 - \lambda\right).
\end{aligned}
$$

Notice that $D_U, D_W \in (0,1)$, and that with these definitions we can rewrite the workers' value functions as

$$W(p) = \frac{w(p) + \beta(1-\delta)\lambda U(p)}{D_W}, \tag{17}$$

$$U(p) = \frac{z + \beta(1-\delta)\theta q(\theta)W(p)}{D_U}. \tag{18}$$

Applying total differentiation with respect to p in (17) and (18) yields (respectively)

$$\frac{\partial W(p)}{\partial p} = \frac{1}{D_W}\left[\frac{\partial w(p)}{\partial p} + \beta(1-\delta)\lambda\frac{\partial U(p)}{\partial p}\right], \tag{19}$$

$$\frac{\partial U(p)}{\partial p} = \frac{1}{D_U}\beta(1-\delta)\theta q(\theta)\frac{\partial W(p)}{\partial p}. \tag{20}$$

Combining the last two expressions allows us to write

$$\frac{\partial W(p)}{\partial p} = \frac{D_U\frac{\partial w(p)}{\partial p}}{D_W D_U - \beta^2(1-\delta)^2\lambda\theta q(\theta)}. \tag{21}$$

Inspection of the wage curve (equation 11) immediately reveals that $\partial w/\partial p$ is positive and so is D_U. Thus, $\partial W/\partial p > 0$ if and only if the denominator of (21) is positive. This, in turn, will be true if and only if

$$[1 - \beta(1-\delta)(1 - \theta q(\theta))][1 - \beta(1-\delta)(1-\lambda)] > \beta^2(1-\delta)^2\lambda\theta q(\theta).$$

After some algebra one can verify that the last expression is equivalent to

$$[1 - \beta(1-\delta)][1 - \beta(1-\delta)(1 - \lambda - \theta q(\theta))] > 0,$$

which is always satisfied. We conclude that $\partial W/\partial p > 0$, and then from (20), we must also have $\partial U/\partial p > 0$, which concludes the proof.

b) One needs to substitute the wage function from (11) into $U(p)$ and solve $U(p_H) = \tilde{U}$ with respect to p_H. Here is the easiest way to do that. In the bargaining solution described in (10), we can replace $W(p), U(p)$, and $J(p)$ from (1), (3), and (8), respectively, to obtain

$$U(p) = \frac{w(p) - \eta(p - \tau)}{(1 - \eta)[1 - \beta(1-\delta)]}.$$

Replacing $w(p)$ from (11) into the last expression yields:

$$U(p) = \frac{[1 - \beta(1 - \delta)(1 - \lambda)] z + \beta(1 - \delta)\theta q(\theta)\eta(p - \tau)}{[1 - \beta(1 - \delta)] [1 - \beta(1 - \delta)(1 - \lambda - \eta\theta q(\theta))]}.$$

The last step is to set the last expression equal to $\tilde{U}$, described in equation (5) and solve for p. After some algebra we arrive at the desired result. □