The Economics of Public Employment:
An Overview for Policy Makers [*]

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September 19, 2020

Abstract

This report has three objectives. First, it aims at establishing key facts linked to public employment by analysing several data sources, both aggregate macro data and micro survey data. Second, it critically reviews the literature on public employment and wages from the last two decades, from the fields labour economics, macroeconomics of fiscal policy, public economics and political economy. Third, it provides a set of policy recommendations and a road map for macroeconomic reforms.

JEL Classification: E24; E62l; J20; J24; J31; J45.

Keywords: Public-sector employment; public-sector wages.

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Executive Summary and Policy Implications

In most advanced economies, public(-sector) employment plays center stage on many dimensions. First, the public sector is the single largest employer in the country, representing approximately 15 to 20 percent of employment. Second, during the yearly preparation of the budget, public employment is often the key item of public spending considered in the political arena. Third, most key public goods are provided by the state through public employment, and notably justice, defence and security in general, and health and education to a great extent. Fourth, public employment is often a political issue during electoral campaigns, and it is used as a way to gain political support (either in favor by social oriented parties, or against by more liberal political platforms). Finally, the debate on austerity in the aftermath of the great recession was largely linked to the role of public employment.

Perhaps not surprisingly, the economic literature on public employment is staging a renaissance. While there was a large academic interest between the 1970s and the 1990s, well summarized in two Handbook of Labour Economics' chapters by Ehrenberg and Schwarz (1986) and Gregory and Borland (1999), this interest diminished in the following decade. At the beginning of the new century, there was limited research on public employment. Between 2000 and 2010, in the National Bureau of Economic Research (NBER) working paper series only 2 out of 10510 papers mentioned public sector employment in their title or abstract. In the Institute for the Study of Labor (IZA) discussion paper series 16 papers out of 5418 did so. Essentially, the study of public sector employment and its impact has all but disappeared from macroeconomics. Recently, sparked by the fiscal policy responses to the Great Recession and the Euro Area crisis, there has been a new wave of theoretical research that uses search and matching models to study the effects of public employment and wages on unemployment and other labour market outcomes.

In the real life economies, the political debate on public employment is vibrant but most often too simple. If we focus on the public debate on fiscal policy in the aftermath of the great recession, all the complexity is reduced to an uninteresting fight between the supporters of austerity and those of public spending. Similarly, when discussing public employment, the debate is limited to a sterile confrontation between those who view it "bunch of lazy bureaucrats to be cut" versus those that believe that modern economies need "public sectors with more generous wages to deliver high-quality public services". Further, as it is often the case when social media take center stage, the debate is based on perceptions rather than on facts. While it is true that "tweets" and "fake news" represent the "zeigest" of contemporary societies, we still think that evidence based social science should be natural fueling to informed public decision making. The resurgent of the economic literature mentioned above and reviewed in this report, should hopefully provide tools to governments to help understand the main trade-offs and assess the effects of different policies. The goal of this report, is to provide a step in this dimension.

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The empirical evidence and literature review on public employment is divided in two main parts. The first part focuses on fiscal dimension of public employment, that is explored in the more macroeconomic literature on fiscal policy. Public employment and wages are two components of expenditure. Additionally, the government decides on investments, purchases of goods and services and transfers. The government wage bill represents the majority of government consumption expenditures. While the analysis of public employment in the labour market tends to be static, much of the interest from the literature in on the dynamics of public employment, looking at the impacts of different fiscal rules determining the evolution of public employment or wages. We show that the cyclical properties of public employment or wages is very different from other components of spending. This first part also concentrates on public economics and political economy issues of public employment. The labour and macroeconomic literature focuses on the effects of certain employment and wage policies, on the level or volatility of unemployment, aggregate activity or private wages. It worries less about how governments choose these policies in the first instance. A substantial fraction of the public economics and political economy literature tries exactly to establish how government decide on their employment and wage policies. In general, the explanations put a strong emphasis on the role of unions, preferences for redistribution, electoral purposes and budget considerations.

The second part looks at the labor market dimension of public employment. We provide evidence on both labour market stock and flows, using comparable microdata from labour force surveys for the US, UK, Spain, France, together with more aggregate OECD data. Data suggests that public employment varies significantly across advanced economies, in between 10 and 30 percent of employment. With respect to flows across market status, there is robust evidence that public employment jobs are more stable and people employed in the public sector experience lower flows in and out of non employment. The bulk of this

section reviews the evidence on the composition of public employment in terms of gender, age, education, as well as geographical distribution. Despite few different across countries, public employment tends to be biased toward female employment, toward older workers, and toward more educated workers. These three "biases" (gender, education and age) are very robust and hold also within narrowly defined industry as well as occupations in the labor force survey of the three countries. While the report does not provide original evidence on wage schedule, it reviews the existing evidence with some details. Wage compressions in the public sector is an encompassing and well documented phenomenon in the literature. The wage compression is particularly robust across educational groups, with a positive public sector wage premium for low educated jobs, and a negative wage premium for highly educated jobs. We also review other aspects of public employment such as unionization rates, nepotism and its importance in developing countries.

We also include in this report a third part that focusses on Italy as a case study. Unfortunately, the Italian labour force survey hides to researcher the question on public employment. It is a very unfortunate circumstance that concerns the country with the largest public debt in Europe. To address this problem, the reports uses Bank of Italy survey to provide original evidence on Italy, even though the empirical evidence is not as detailed as for other countries.

The last part of the report focuses on the policy implications of the research. Our main reading of the evidence provided and the literature reviewed is that "Quantities are policy variables, wages should not!". Government should have flexibility in choosing the level of employment, but the setting of wages should be left out of the policy space. Note that we do not think that all government instruments should be set by technocrats following a specific rule. On the one hand, investment, purchases of goods and services and employment involve a political choice reflecting society's preferences regarding the supply of public goods. Transfers also reflect the extent to which society wants to protect its weakest members. On the other hand, public sector wages have different characteristics. They do not directly affect the supply of government services and they are essentially a payment to a factor of production. However, because public wages are often perceived by policymakers as a transfer from society to a specific group of citizens, they are vulnerable to manipulation for electoral reasons, the possibility of which can partly explain the heterogeneity of wage policies in OECD countries. Any reform must instead view public wages only as a payment to a factor of production. In keeping with this spirit, governments should use private sector wages as their benchmark when deciding public sector pay, both across workers and over time.

Our policy prescription thus points toward a better alignment of public wages with the private sector. How should government implement such reform? The first step of wage policy reform is to review the pay schedule and progression structure of public sector workers by occupation, education and experience. Many European governments have obsolete pay structures that do not evolved as fast as in the private sector. For each occupation and

level of education, the offered public-sector wage should have the private sector counterpart as a benchmark, with a similar tenure profile. An evaluation scheme should be in place to reward unobservable skills and avoid wage compression. The wages should also vary by region to reflect regional variation in private sector conditions. When we say that public and private wages should be aligned, we do not mean they should be equal. Public wages should be adjusted downwards to compensate for job security or if the government offers other significant perks and benefits (i.e. medical care, work-life balance, pensions). One way to monitor whether the alignment with the private sector is correct is to use data on job application as mechanism for adjusting wages. If the number of job applications for a given job opening falls below or rises above a certain level, is an indicator that the wages are too low or too high. The second step of the reform is to delegate to a specialized institution - a Public Wage commission - the setting the overall annual growth rate of public wages, inspired by the working of Low Pay Commission of the UK. The commission should set the growth rate of public sector wages to maintain the target ratio for the public wage bill relative to its employment and the one in the private sector.

Given the size of public employment, one cannot implement this reform overnight. First, we think that direct wage cuts are not politically feasible nor desirable from a social perspective. Second, one has to have a longer implementation horizon, not by cutting wages but by changing the expectation of the whole wage schedule profile for all layers. One likely consequence of such policy highlighted in the literature is that the change in the wage schedule would lead to a re-composition of public employment, in as much as different government departments are cost minimizing, lower relative wages for some types of workers, would naturally lead to a higher demand for those workers. We could expect an increasing demand of workers with lower education, younger workers and workers in poorer regions. This expected endogenous response, should be used and announced in the political implementation. For instance, promising increasing hiring of public-sector workers over a given horizon without increasing spending and improving the quality of public services. The proposed policy resembles the one followed by Nordic countries. Across the 1970's and 1980's, these countries reformed the public sector, simultaneously reducing the wage premium and employing more unskilled workers. The policy allowed these countries to have large public sectors without asphyxiating the private sector and maintain low levels of unemployment.

1 Introduction

In most advanced economies, public sector employment plays centre stage on many dimensions. First, the public sector is the single largest employer, representing about 18 percent of employment. Second, during the yearly preparation of the budget, public employment is often the key item of public spending considered in the political arena. Third, most key public goods are provided by the state through public employment, and notably justice, defence and security in general and health and education to a great extent. Fourth, public employment is often a political issue during electoral campaigns, and it is used as a way to gain political support (either in favor by social oriented parties, or against by more liberal political platform). Fifth, the debate on austerity in the aftermath of the great recession was largely linked to the role of public employment. Finally, the recent Covid-19 pandemic put again focus on the importance of having a modern public sector, with a employment force prepare to face difficult, unpredictable and unlikely crisis, but its aftermath with high public debt, also puts emphasis on the costs of the public-sector workforce.

Perhaps not surprisingly, the macroeconomic literature on public employment is staging a renaissance. While there was a large academic interest between the 1970s and the 1990s, well summarized in two Handbook of Labour Economics' chapters by Ehrenberg and Schwarz (1986) and Gregory and Borland (1999), and in edited collections by Hamermesh (1975), Haveman (1982) and Rose (1985), this interest diminished in the following decade. At the beginning of the new century, there was limited research on public sector employment. Between 2000 and 2010, in the National Bureau of Economic Research (NBER) working paper series only 2 out of 10510 papers mention public sector employment in their title or abstract. In the Institute for the Study of Labor (IZA) discussion paper series 16 papers out of 5418 do so. The 4th Volume of the Handbook of Labour Economics of 2011 does not have a chapter dedicated to public employment. Essentially, the study of public sector employment and its impact has all but disappeared from macroeconomics. Recently, sparked by the fiscal policy responses to the Great Recession and the Euro Area crisis, there has been a new wave of theoretical research that uses search and matching models to study the effects of public employment and wages on unemployment and other labour market outcomes.

In the real life economies, the political debate on public employment is vibrant but most often too simple. If we focus on the public debate on fiscal policy in the aftermath of the great recession, all the complexity is reduced to an uninteresting fight between the supporters of austerity and those of public spending. Similarly, when discussing public employment, the debate is limited to a sterile confrontation between those who view it "bunch of lazy bureaucrats to be cut" versus those that believe that modern economies need "larger public employment with more generous wages". Further, as it is often the case when social media take centre stage, the debate is based on perceptions rather than on facts. While it is true that "tweets" and "fake news" represent the "zeigest" of contemporary societies, we think

that evidence based social science should be the natural fuel to informed public decision making. The resurgent of the economic literature mentioned above and reviewed in this report, should hopefully provide tools to governments to help understand the main trade-offs and assess the effects of different policies. The goal of this report, is to provide a first step in this dimension.

The report has three objectives. First, it aims at establishing key facts linked to public employment by analysing several data sources, both aggregate macro data and micro survey data. Second, it critically reviews the literature on public employment and wages from the last two decades. Third, it provides a set of policy recommendations and a road map for macroeconomic reforms. Before summarizing the results, a few caveats are in order. From an academic perspective, public employment is a particular interesting subject because it lies in the intersection of different economic fields: labour economics, macroeconomics of fiscal policy, public economics, political economy, public administration and personnel economics. The report covers a large part of the material but does not cover everything. We approach the topic from a macroeconomic angle, with a tripartite focus on the literature on labour economics, fiscal policy, and public and political economy. We leave aside for the companion report the more micro literature on public administration and the personnel economics of the government, that analyses the role of financial incentives for recruitment and performance, efficient practices in the public sector, measurement of productivity, decentralization, privatization and outsourcing, as well as issues of selection on unobserved characteristics. This literature is reviewed in the second part of this report and is discussed in Finan, Olken, and Pande (2015) or Sørensen (2016).

Our view is that sound macroeconomic policies on public-sector employment and wages can create the right set of conditions to sustain effective microeconomic human-resource practices. Yet, not even the best microeconomic practices in the public sector can survive a poor macroeconomic policy. In 2009, to stimulate the economy thrown into recession by the financial crisis, the Portuguese government increased public-sector pay by 3 percent. In the following year, because of budgetary problems, the government was forced to implement wage cuts, that were asymmetric: 0 percent for the lowest wages and 10 percent for the highest wages. By 2012, the wage cuts for the highest earners had accumulated cuts amounting 22 percent. Without any change in composition of workers or their productivity, the pay structure was overhauled. This is a typical example of how macroeconomic decisions on public employment and wages can place a constraint for the effective management of human resources in the public sector.

The empirical evidence and literature review on public employment is divided in two main parts. The first part focuses on fiscal dimension of public employment, that is explored in the more macroeconomic literature on fiscal policy. Public employment and wages are two components of expenditure. Additionally, the government decides on investments, purchases of goods and services and transfers. The government wage bill represents the ma-

jority of government consumption expenditures. While the analysis of public employment in the labour market tends to be static, much of the interest from the literature in on the dynamics of public employment, looking at the impacts of different fiscal rules determining the evolution of public employment or wages. We show that the cyclical properties of public employment or wages is very different from other components of spending. This first part also concentrates on public economics and political economy issues of public employment. The labour and macroeconomic literature focuses on the effects of certain employment and wage policies, on the level or volatility of unemployment, aggregate activity or private wages. It worries less about how governments choose these policies in the first instance. A substantial fraction of the public economics and political economy literature tries exactly to establish how government decide on their employment and wage policies. In general, the explanations put a strong emphasis on the role of unions, preferences for redistribution, electoral purposes and budget considerations. The key aspect that we learn from this literature is that the public-sector wage is a policy rather than an allocation mechanism. In the private sector, economists see the wages as the allocation mechanism, determined within a market and responding to changes in labour demand and supply. In the public sector however, the discretionary centralized component of public wage, controlled by politicians and bureaucrats, turns it into a policy variable.

The second part looks at the labor market dimension of public employment. We provide evidence on both labour market stock and flows, using comparable microdata from labour force surveys for the US, UK, Spain, France, together with more aggregate OECD data. Public employment varies significantly across advanced economies, in between 10 and 30 percent of employment. With respect to flows across market status, there is robust evidence that public employment jobs are more stable and people employed in the public sector experience lower flows in and out of non employment. The bulk of this section reviews the evidence on the composition of public employment in terms of gender, age, education, as well as geographical distribution. Despite few different across countries, public employment tends to be biased toward female employment, toward older workers, and toward more educated workers. These three "biases" (gender, education and age) are very robust and hold also within narrowly defined industry as well as occupations in the labor force survey of the three countries. While the report does not provide original evidence on wage schedule, it reviews the existing evidence with some details. Wage compressions in the public sector is an encompassing and well documented phenomenon in the literature. The wage compression is particularly robust across educational groups, with a positive public sector wage premium for low educated jobs, and a negative wage premium for highly educated jobs.

From the perspective of the labour market, given that the public wage does not work as an allocation mechanism, we have to think about both demand and supply. What determines how many and which workers the government wants to hire? How many and which workers want to work in the public sector? The choice of education, experience and location is

largely a choice of the government, which can set these dimensions in the job-requirements. In addition, gender and unobservable characteristics of workers and important characteristics that determine which type of workers select into the public sector. Understanding these two dimensions, demand and supply, and the absence of wages as an allocation mechanism, is the key to understand the public-sector labour market. We also review other aspects of public employment such as unionization rates, nepotism, state-owned companies and its importance in developing countries.

The report has also a special focus on Italy. Unfortunately, the Italian labour force survey hides to researcher the question on public employment. It is a very unfortunate circumstance that concerns the country with the largest public debt in Europe. To address this problem, the reports uses Bank of Italy survey to provide original evidence on Italy, even though the empirical evidence is not as detailed as for other countries.

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Our policy prescription thus points toward a better alignment of public wages with the private sector. How should government implement such reform? The first step of wage policy reform is to review the pay schedule and progression structure of public sector workers by occupation, education and experience. Many European governments have obsolete pay structures that do not evolved as fast as in the private sector. For each occupation and level of education, the offered public-sector wage should have the private sector counterpart as a

benchmark, with a similar tenure profile. The wages should also vary by region to reflect regional variation in private sector conditions. An evaluation scheme should be in place to reward unobservable skills and avoid wage compression. When we say that public and private wages should be aligned, we do not mean they should be equal. Public wages should be adjusted downwards to compensate for job security or if the government offers other significant perks and benefits (i.e. job-security, fewer hours, medical care, work-life balance, pensions). This requires an effort, from academics and technocrats, to quantify the monetary value of the different compensating benefits, and how it varies for different workers. On the other hand, an efficiency wage premium can be offered for sensitive types of jobs, such as those involving national security or prone to be targets of corruption. Occupations with main incidence of public sector employment (for instance, judges) should be comparable to occupations in the private sector with similar career trajectories and education. Such occupations offer some scope for political choices.

Regarding gender differential there is a subtle byproduct to be discussed. Although there are different public sector wage premia for men and women, we don't think this is a dimension to be targeted by the reform. Let's be explicit. We think the public sector should have equal pay, which in presence of gender wage gap in the private sector, will always imply an asymmetric public sector wage premia by gender. On this dimension, the public wage will not mimic the private and, ex-post, we should expect a positive public-sector wage differential for women and a negative one for men. These differences will tend to diminish if policies to reduce gender wage gaps in the private sector are successful.

One way to monitor whether the alignment with the private sector is correct is to use data on job application as mechanism for adjusting wages. If the number of job applications for a given job opening falls below or rises above a certain level, is an indicator that the wages are too low or too high. One common mindset in the public sector is that for a given position it should aim for "the best person for the job." We think the right mindset should be to aim for "the right person for the job." We mean that having vacancies with too many suitable applicants is a sign of too high wages, and wastes resources in selection, but also wastes skills of workers.

The second step of the reform is to delegate to a specialized institution - a Public Wage commission - the setting the overall annual growth rate of public wages, inspired by the working of Low Pay Commission of the UK. The commission should set the growth rate of public sector wages to maintain the target ratio for the public wage bill relative to its employment and the one in the private sector.

Given the size of public employment, one cannot implement this reform overnight. First, we think that direct wage cuts are not politically feasible nor desirable from a social perspective. Second, one has to have a longer implementation horizon, not by cutting wages but by changing the expectation of the whole wage schedule profile for all layers. One likely consequence of such policy highlighted in the theoretical literature is that the change in the

wage schedule would lead to a re-composition of public employment, in as much as different government departments are cost minimizing, lower relative wages for some types of workers, would naturally lead to a higher demand for those workers. We could expect an increasing demand of workers with lower education, younger workers and workers in poorer regions. This expected response from the government should be used and announced in the political implementation. For instance, promising increasing hiring of public-sector workers over a given horizon without increasing spending and improving the quality of public services. The proposed policy resembles the one followed by Nordic countries. Across the 1970's and 1980's, these countries reformed the public sector, simultaneously reducing the wage premium and employing more unskilled workers (see Domeij and Ljungqvist (2019) for Sweden and Pederson, Schmidt-Sorensen, Smith, and Westergard-Nielsen (1990) for Denmark). The policy allowed these countries to have large public sectors without asphyxiating the private sector and maintain low levels of unemployment.

Part A

Public Employment: A View From the Government

2 Preliminary considerations

2.1 A Macroeconomic Taxonomy of Public Employment

The public sector is different from the private sector. It does not sell its goods or services, but supplies them directly to the population. The type of services and the technology used to produce them are likely to differ from the private sector. Since the public sector has minimal revenues from sales, it finances its production through the power of taxation. Further, the public sector does not have shareholders, it does not maximize profits and does not go (often) into bankruptcy. The decisions regarding employment are taken by governments. On the one hand, they partly reflect the preferences of society about the scope of the public sector and whether their services should be produced directly or outsourced to the private sector. These decisions are the outcome of a political process and vary across countries.

The usual taxonomies of public employment have a microeconomic view. They either involve the different functions of the government: judiciary, security, health and education; or consider the NACE industry split, considering "public administration and defence; compulsory social security," sometimes together with "education" and "health and social work". Alternative taxonomies, further consider different branches of the government (central, regional or local) or the distinction between civil servants and front-line providers.

Given our macroeconomic prespective, we will focus on the entire sphere of public employment. Our taxonomy is based on two dimensions. First, there is a dimension of whether the management is from the private or public sector. Second, there is a dimension of the existence of an activity with a well define market price (whether for profit). See the table below. The public-sector employment that we consider in the paper falls in the bottom right cell. A typical private-sector firm, would fall into the top corner. An example of a state-owned company usually falls in the top-right corner, because their management is public but they produce a good with a market price, are more subject to competitive forces and still have profits. We will review the work on state-owned companies in Section 8.4.

Table 1: A Macroeconomic Taxonomy

	Management	
	Private	**Public**
For profit (with market price)	Traditional private sector	Public-sector companies
Not-for-profit (no price)	Non-profit (charities)	Public sector

There are many grey areas in determining the public sector. One interesting example is the employees of the The Federal Reserve Banks in the United States. Employees of the Board are federal workers, but employees of the regional Federal Reserve Banks are not. The Federal Reserve Banks have an intermediate legal status, with some features of private corporations and some features of public federal agencies. The Federal Reserve Banks are not operated for profit. In 2017, when the US president declared a 90-day federal hiring freeze, they were not legally affected, but they "voluntarily complied". This shows the difficulty of drawing a separation between the public-sector and the private sector not-for profit, specially when it financially relies on public sources.

In our report, conceptually we take a conservative definition of the public sector, excluding both not-for-profit private entities and publicly-owned enterprizes, but including all other dimensions and activities. In practice, we are restricted by the different data sources that we use. Some micro surveys allow the clear distinction of these four groups. Other surveys only have available the employment by industry classification. Aggregate macro data tend to be restricted to government employment, which is the the most important, yet only a subset of all public-sector employment.

2.2   Public Employment and Wages and Government Spending

Although public-sector employment is a wider, and perhaps blurry, definition, macroeconomists tend to analyse aggregate data on government employment. From the perspective of the government, the main interest is its link with government spending. The purpose of this section is to provide a detailed descriptive analysis of what we call the macroeconomic-relevant components of government spending. We start with a discussion of the national accounts of the data and then study compositional changes in government expenditures over time, as well as changes in stability, volatility, persistence and co-movement with other variables.

The US national accounts provide mainly two measures of government spending. The first measure is the contribution of the government sector to GDP, referred as "Government consumption expenditures and gross investment". Government consumption expenditures include intermediate goods and services purchased and the value added of the sector which is measured at the costs of production: *compensation paid to general government employees* plus *consumption of government owned fixed capital*, also known as depreciation. From the aggregate, the BEA subtracts a part of production which is sold to the private sector (*sales to other sectors*) and *own-account investment*.[1]

Additionally, there is a broader measure of total expenditures. This includes the government consumption expenditures and gross investment plus transfers and interest payments.

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[1]Own-account investment is investment in structures and in software produced by Federal government employees and are included in general government gross investment. On average, it corresponds to only 5 percent of government gross investment.

It also includes two other categories: *Capital transfer payments* and *Net purchases of non-produced assets* (that sum up to 0.5% of total expenditure) and subtracts the depreciation of fixed capital, included in *Government consumption expenditures*, but which is not an actual expenditure.

We have two definitions of total spending, to encompass most of the papers in the literature. One, is the sum of three components: the public sector wage bill which can be decomposed into the product between the wage (ω_t^g) and employment (l_t^g), purchases of intermediate goods and services (c_t^g) and investment (i_t^g). The second definition, also includes transfers (t_t^g) and interest payments (r_t^g).

$$Gov_t^1 = \omega_t^g l_t^g + c_t^g + i_t^g. \tag{1}$$

$$Gov_t^2 = \omega_t^g l_t^g + c_t^g + i_t^g + tr_t^g + r_t^g. \tag{2}$$

All data are taken from the National Income and Product Accounts of the Bureau of Economic Analysis (BEA): Government purchases of intermediate goods and services, Gross Government Investment, Government transfers, Government Interest payments and Compensation of General Government Employees. One common method in the literature to calculate the average wage is to by divide total compensation by *All Employees: Government*. However, all changes in the quality of employment contaminate the wage measure. We therefore also use the price index of Compensation of General Government Employees, as a measure of nominal wages. This deflator is available in the US statistics but we could not find it in the European national accounts. We deflate all government variables using the CPI, with the exception of employment.[2]

Many of the empirical studies of the macroeconomic effects of government spending, focus simply on government consumption. In theoretical papers, government consumption usually refers to goods and services bought from the private sector. However, the official definition of government consumption includes the public sector wage bill, purchases of intermediate goods and services minus goods and services sold to the private sector and the consumption of fixed capital (depreciation). This last category is purely an accounting value, and it is not an actual expenditure. We refer to purchases of intermediate goods and services (c_t^g) as consumption. This component is the one consistent with the theoretical models when referring to government consumption.

Another fact related to the national accounts is how the BEA estimates these two measures in real terms. While price indexes for most components are standard, the real compensation of general government employees is calculated based on a volume indicator. The BEA creates a government employment index, and adjusts it for changes in experience and

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[2]When we add these categories in nominal terms, the second measure of total government spending is on average 5 percent above the official value from the Bureau of Economic Analysis. This originates from the fact that, on top of the current expenditures and gross government investment, the BEA includes capital transfer payments and deduces the sale of goods and services to the private sector.

education, while all other changes in the costs of labour inputs are included in the deflator, and therefore do not enter any measure of real government spending. This means that increases in government wages, do not enter in the measure of real government consumption as they simply enter the implicit price deflator, nor they enter directly in the measure of real GDP if we use the GDP implicit price deflator.

Before looking at the data, we should start by making a simple typology of the fundamental properties of the different types of spending. The first distinction we make, it that not all types of expenditure use resources. On the one hand, consumption and investment use final goods and employment uses inputs of the economy. On the other hand, like transfers and interest payments, public-sector wages simply reallocate resources from the general taxpayer to a specific group of people, in this case public-sector workers. A second important distinction between the components is that while the transmission mechanism of consumption and investment affect the final goods market, wage and employment work mainly through the labour market.

3 Public Employment From a Budgetary Perspective

3.1 Evidence from the United States

Figure 1 shows the evolution of government spending with its several components. All the five components of government spending are important. On average, the public sector wage bill and transfers correspond to 30 percent of total spending, purchases of intermediate goods and services is 20 percent of spending, investment corresponds to 13 percent while interest payments are close to 10 percent. Total government spending as a share of GDP has increased throughout the sample from 20 to 35 percent of GDP. This was mostly driven by the increase in transfers and in purchases of intermediate goods. The weight of the public

Figure 1: Evolution of government expenditure and its components
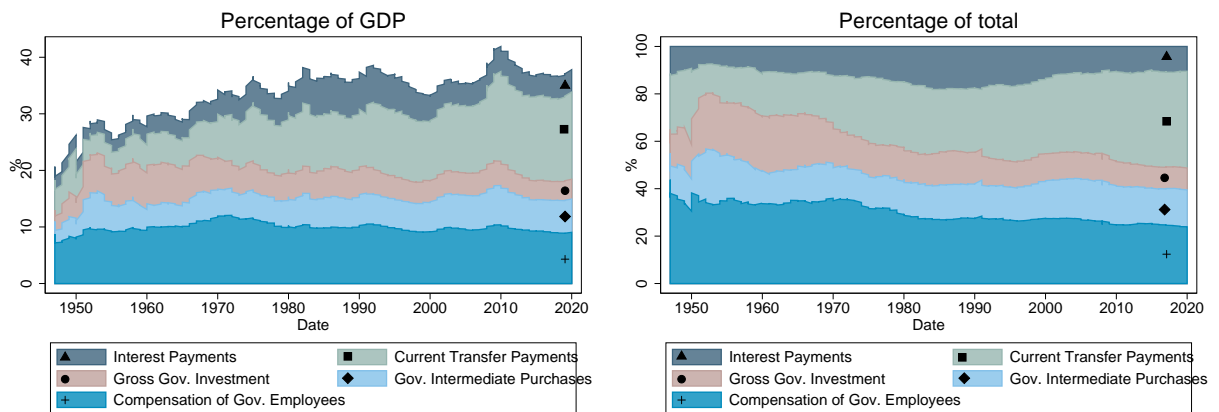
Note: For the United States the data is take from NIPA tables (3.1 and 1.1.5).

Figure 2: Evolution of government employment and aggregate wage ratio
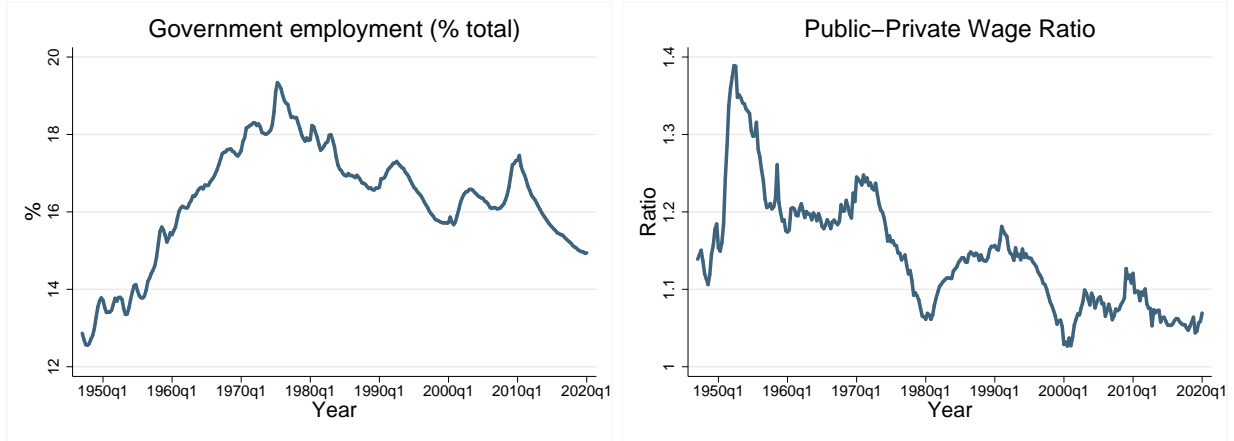
Note: The graph on the left plots Government employment (USGOVT) over All Employees, Total Nonfarm (PAYEMS) from FRED database. The graph on the right plots the aggregate public-private wage ratio dividing the total Wages and salaries in the Government over the number of government workers, divided by the total wages and salaries of the private industries over private employment. The data is take from NIPA tables (2.1).

sector wage bill and investment on total spending decreased by around 6 and 10 percentage points, while transfers have increased by almost 20 percentage points.

Figure 2 shows the evolution of the share of government employment out of total employment and of the aggregate public-private wage ratio, as usually calculated in the macroeconomic literature. We can see from the left panel two distinct phases. In the period between the end of the Second World War until the late 1970s, coinciding with a Keynesian domination of macroeconomic though, government employment increased from 13 to 19 percent of total employment. This trend was shared with many OECD countries and put public employment in the center of economic research trying, both trying to understand the causes and implications of larger governments. Coinciding with a change of the macroeconomic paradigm from a more Keynesian interventionism to more free-markets, there was a shift in the behaviour of government employment, that has been declining since 1980s. After a spike during the Great Recession, government employment is now below 16 percent, a level not seen since 1960. This is particularly interesting because, we haven't observed a decline of the government in terms of total spending over GDP, that kept increasing since the 1980s. In terms of the evolution of the aggregate public-private wage ratio we observe a long-run decline, but we are cautious in interpreting this fact, given that the composition of both private and government employment is likely to have changed substantially in the last 70 years. We prefer to highlight the large cyclical, short run, fluctuations that we observe.

Lane (2003) and Lamo, Pérez, and Schuknecht (2013) have shown that, for OECE countries, the cyclical properties of the different spending categories are very heterogeneous. In particular, that wage consumption is more procyclical than non-wage consumption. To show the evidence for the US, we analyse the properties of the different types of spending,

Table 2: Correlations and standard deviations on the 1955:2006 sample

Correlations	Wage	Employment	Consumption	Investment	Transfers	Interest	Stddev	AR(1)
Wage	1						0.013	0.819
Employment	-0.277	1					0.008	0.893
Consumption	-0.072	0.350	1				0.036	0.588
Investment	-0.212	0.495	0.357	1			0.041	0.673
Transfers	0.094	-0.013	0.152	0.069	1		0.032	0.633
Interest	-0.134	-0.100	-0.322	-0.063	-0.297	1	0.042	0.730
Gov 1	0.140	0.468	0.820	0.702	0.172	-0.276	0.018	0.791
Gov 2	0.113	0.341	0.703	0.594	0.600	-0.177	0.015	0.793
Unemp.Rate	-0.051	-0.226	0.048	-0.112	0.575	-0.375	0.116	0.885
GDP	0.316	0.149	-0.052	0.126	-0.403	0.212	0.016	0.848
GDP lead(4)	-0.347	0.525	0.042	0.226	-0.397	0.189		
GDP lead(1)	0.123	0.238	-0.043	0.086	-0.533	0.285		
GDP lag(1)	0.479	0.070	-0.080	0.084	-0.223	0.051		
GDP lag(4)	0.591	-0.224	0.001	-0.072	0.105	-0.217		

Notes: variables in logs were previously detrended using an HP filter with parameter 1600. AR(1) corresponds to the autocorrelation coefficient of order 1. Gov 1 is real government consumption expenditures and gross investment, while Gov 2 also includes transfers and interest payments. GDP is deflated using the GDP deflator, while the government variables are deflated using CPI.

we first detrend the data using an HP-filter. Table 2 shows the correlation between each component of spending, as well as with aggregate measures of government spending and economic activity. The last two columns show the standard deviation and the first-order autocorrelation coefficient of the series.

The first relevant fact is that, with the exception of interest payments, all other components are positively correlated with the aggregate measures of government spending. The correlation of total spending with consumption or investment is high but far from perfect. It is between 0.6 and 0.8 depending on the measure of spending. Transfers have a correlation of 0.6 with total expenditure. On the other hand, the correlation it is much lower for employment (0.34 to 0.47) and, particularly for wages (between 0.11 to 0.14). Another striking fact is that the correlation among the different types of expenditures is not very high. All correlations are below 0.5, and particularly wages and interest payments have a negative correlation with all other components.

The volatility of the series is also quite different. Consumption, investment and interests are the most volatile components with standard deviations around 0.04, followed closely by transfers. The wage and employment are less volatile with standard deviations between 0.008 and 0.013. Wages and employment are also more persistent with an autocorrelation coefficients of 0.8 and 0.9, while for investment it is 0.7 and for consumption 0.6.

Finally, we can relate each component with two measures of economic activity: unemployment rate and real GDP growth. Wage, employment and investment are procyclical but with low correlation. On the other hand, transfers have a correlation of -0.40 with real GDP growth and of 0.58 with unemployment. Government wage is more correlated with the lags of GDP, while employment has a correlation of 0.53 with the 1 year lead of GDP.

3.2 Evidence from the OECD Countries

The increase in the share of government employment between 1950 and 1980 observed in the United States is common to most OECD countries, as reported in Rose (1985). In Britain, in the same period public employment increased from 26.6 to 31.4 percent. In France it increased from 17.5 to 29.1 percent. In Germany it increased from 14.4 to 25.8 percent. In Italy it increased from 11.4 to 24.4 percent. In Sweden it more than doubled from 15.2 to 38.2 percent.

As in the United States, public employment in now lower than it was 40 years ago. The left graph in Figure 3 show the employment in general government, taken from OECD for 2015. Nordic countries still have the largest government employment, close to 30 percent. France has just above 20 percent. Italy has about 13.6 percent and Germany is about 10 percent. Standing out, are Japan and Korea, countries with very small level of government employment of about 6 to 8 percent. Notice that this numbers are only for employment in general government. The right graph shows the corresponding general government wage bill as a fraction of GDP, taken from AMECO. It varies from 5 to 16 percent of GDP. For the majority of countries the wage bill represent the majority of government consumption expenditures.

The left graph of Figure 4 plots the two series together. We observe a positive association between the share of government workers in total employment and the share of the wage bill in GDP. This is natural: the more workers the government hires, the more expensive it becomes. What is more interesting is that there is a quite a large variation of countries with the same wage bill, different levels of employment. For instance, with a wage bill close to 10 percent of GDP, there is Italy with 13.6 percent of government employment and Lithuania with 22.8 percent or Latvia with 20.1 percent of government employment. The right graph shows how both the government employment and the wage bill have changed after the Great Recession. Here, the correlation between the two series is only 0.2. Most countries increased the wage bill and employment. Countries like Italy, Turkey and the UK reduced both. Countries like Latvia and Portugal reduced the the government wage bill but increased employment. A few countries, like Germany, Austria and France decreased the weight of government employment in total employment but its wage bill increased in relation to GDP.

This variation of policies during the Euro Area crisis, should be put in perspective with data prior to the crisis. Figure 5 displays the government's wage bill as a fraction of the private sector wage bill and the size of government employment relative to private sector employment, of OECD countries in 2008. Six countries stand out for having a high public sector wage bill relative to their level of public employment: Greece, Cyprus, Ireland, Portugal, Italy and Spain. These countries would end up in the centre of the Euro area crisis due their poor public finances and sclerotic labour markets. The implemented austerity

Figure 3: Government Employment and Wage Bill, cross-country, 2015
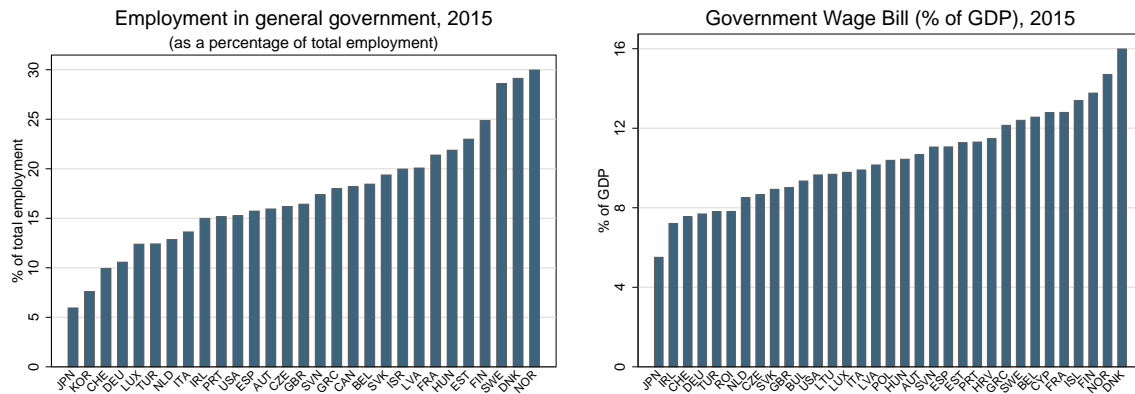
Note: the left-graph shows government employment as a fraction of total employment, OECD data. The graph on the right shows the government wage bill (Compensation of employees: general government) as a fraction of GDP (from AMECO).

Figure 4: Relation between government employment and wage bill
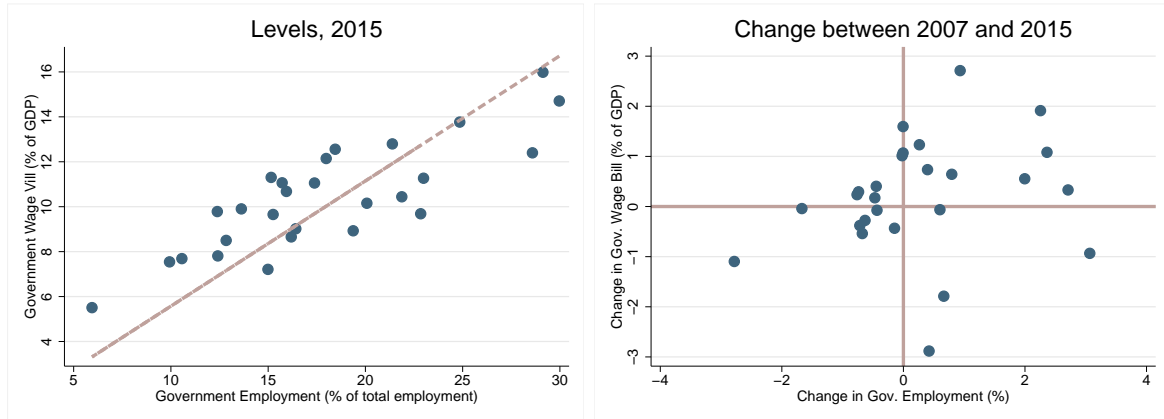
Note: the left-graph shows the scatter plot of government employment as a percentage of total employment and government wage bill as a percentage of GDP, for 2015. The right-graphs shows the change in the two variables between 2007 and 2015. Data from OECD and AMECO.

Figure 5: Government Employment and The Wage Bill, 2008
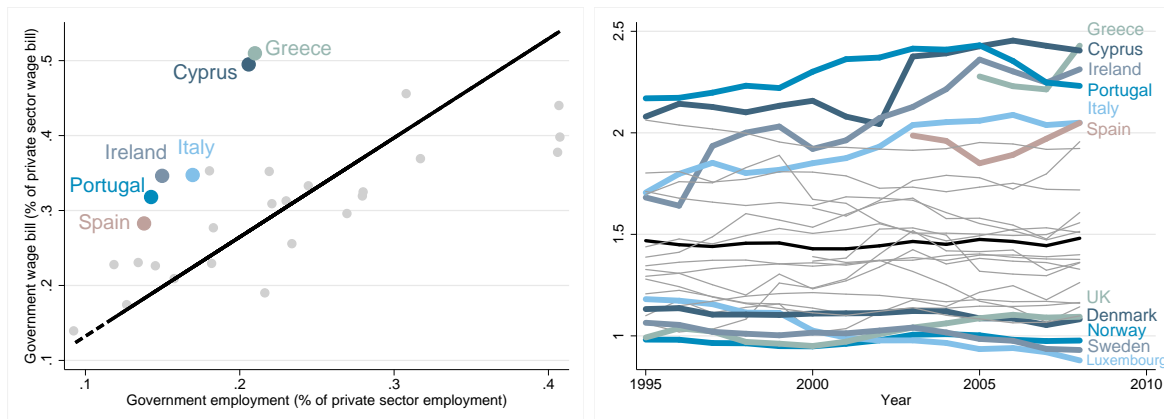
Note: Source: EUROSTAT, AMECO and OECD. The left graphs shows the government wage bill and employment in 2008. The regression line in black. The right graph shows the ratio of gov. wage bill (% private wage bill) over gov. employment (% of private employment).

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measures naturally included public sector wage cuts.

The motivation for examining the dynamic side of the government's wage policy is shown in the right graphs of Figure 5. This figure demonstrates the evolution of the ratio between the two variables, which is simply the ratio of average wages in the two sectors. How could government wages grow by such a large factor relative to the private sector, in so many countries? The next section explains the different objectives the governments might have when determining employment and wages. Section 5.2 analysis their macroeconomic effects.

- **Fact 1.** Government employment in the US represents about 16 percent of total employment. Government employment increased between 1950 and 1980, from 13 to 19 percent but has declined since.

- **Fact 2.** The government wage bill in the United States represents about 10 percent of GDP, varying over time from 7 to 12 percent.

- **Fact 3.** There are cyclical fluctuations in public employment and wages are different from other government spending categories, but their pattern varies across countries and over different samples

- **Fact 4.** Government employment represents on average approximately 18 percent of total employment in OECD countries but vary substantially, from 6 to 30 percent.

- **Fact 5.** Government wage represents on average approximately 10 percent of GDP in OECD countries but vary substantially, from 6 to 16 percent.

- **Fact 6.** Countries that were more affected by the Euro Area crisis, had large government wage bill's relative to their level of employment. They also had large variation of their aggregate public-private wage ratio.

4 How do government make decisions?

4.1 What determines public employment?

Musgrave (1982) classifies two roles of the public sector as an employer. First, governments hire workers to produce public goods. Second, governments might hire workers because of the intrinsic nature of the public sector. He explains the first role as "public employment as simply a byproduct of public production". The size of public employment reflects, to a large extent, the preferences of society about the scope of the public sector and whether their services should be produced directly or outsourced to the private sector. Musgrave (1982) makes a sharp distinction between *public provision* and *public production.* The government may decide to provide some goods, but let the private sector be in charge of production. Some goods can be produced by both sectors, for instance education, child care or health. The reason for public employment cannot be found exclusively in the usual view of the characteristics of public goods: non-rival and non-excludable. Instead, he viewed two main reasons for public production. One is is when production characteristics of the product which, if left to the private sector, would involve extensive regulation, such that public ownership offers an easier solution. He gives the example of natural monopolies, in which profit maximization will not yield efficient results. He argues that between public ownership or regulation, the distinction is "one of degree only". The market structure of the private sector should play a role in determining the types of public goods and services to be outsourced. The second there are innate characteristics that call for public production. Some goods, because of their nature, have to be produced by the government. The law enforcement or the military establishment can not be purchased by private sector. Musgrave (1982) also gives the example of vaccines that, if outscored to a private clinic might require such expensive monitoring that it would be better run in house.

So societies decide, through politicians and bureaucrats, what should the government produce and how many workers they should hire. Within this view, there are two leading explanations for changes in public employment. One explanation is *Wagner's law* - the argument that economic development creates demand for new types of government services, requiring more manpower. In other words, public services are more labour intensive and over time, there would be the tendency to expand. One can re-interpret this mechanism in the light of the theory of structural change, extensively study in macroeconomics. As productivity in agriculture and manufacturing increases at a faster pace than in services, with economic growth comes a change in the structure of employment, with fewer people employed in the fast-growing sectors, the fields and the factories, and more people employment in the service sector, including the government. Another possible determinant is the demographics change that might call for more or less publicly provided goods (Reder, 1975). A younger population might require more teachers, or an older population might require more carers,

and these feed in to more public employment.

The second role of the public sector as an employer, attributed by Musgrave (1982), arises not because of the goods produced, but because of the intrinsic nature of the public sector. Another rationale for public employment arise, if workers themselves prefer to be employed publicly, either by better working environment, greater security or a pure preference. By offering their services at a lower wage, it gives an extra incentive for governments to employ more workers, but only if this translates effectively into lower pay. A further rationale is public employment as employment creation. Keynes (1936), of course, formulated the argument that public employment should be use as a macroeconomic stabilization tool. If there are externalities in the job creation, that cannot be internalized by a private firm, there is a good reason to use public employment. The Keynesian dominance in macroeconomics between 1940s and 1970s, was strongly rooted in this idea. Musgrave himself was sceptical of public employment as a stabilizer of aggregate demand. But he did see it as a useful as a targeted policy to overcome structural problems in the labour market. As unemployment varies widely across industries, types of workers and locations, targeted public employment programs can provide relief, while avoiding disincentive effects of income-support of transfers. Related to this role is another hypothesis by Rodrik (2000) that government jobs represent partial insurance against undiversifiable external risk, faced by countries, that spillovers to income and consumption risk faced by its citizens.

Within the reasons for the existence of public employment, there is one natural constraint: the government budget. Ehrenberg (1973), in a pioneer study of the determinants of demand of government worker, argues that the demand for government workers of different types depends on the budget of the hiring institutions. There is a unavoidable link between between employment and the budget. Poterba and Rueben (1995), using US state variation in laws governing limits on the growth of local property-tax revenues, found slower local government employment growth in states with property-tax limits. One possible interpretation is that different government institutions or departments try to maximize their output, to produce the most goods or services, within a certain budget. If the budget is relaxed than they can expand and hire more workers.

These reasons for public employment arise from a setting with an benevolent government, that acts under a budgetary constraint. But, there is a long standing view in economics, in public finance, that politicians and public employees themselves act and vote in their self interest. These was put by Buchanan (1977) as "Bureaucrats are no different from other persons, and, like others, they will rationally vote to further their own interest as producers when given the opportunity. Clearly their interest lie in an expanding governmental sector and especially in on that expands the number of its employees. Salaries can be increased much more rapidly in an expanding agency than in a declining or stagnant one." The fact that public employment can sometimes respond to pressure groups is very present in the economic literature.

Gelb, Knight, and Sabot (1991) argue that there is a strong aspect of rent-seeking behaviour in public employment. They view the government not as a maximiser of social welfare but a provider of political favours to pressure groups. The creation of rents is an easy way of acquiring political resources, at the cost of lower aggregate income. In their model, government employment can response to unemployment, by creating unproductive jobs, which divert resources from the private sector. In the same spirit, but in a model of occupational choice, Jaimovich and Rud (2014) find that when the public sector attracts bureaucrats with low degree of public service motivation, they will use their position to rent seek by employing an excessive number of unskilled workers.

One of the pressure groups is public-sector unions. The dual role of government employees, as employees and voters, was also highlighted by Courant, Gramlich, and Rubinfeld (1979), claiming that it might be intensified by the role of unions as political agents. As argued by Freeman (1986), union political activities may enable unions to shift labor demand curves outward by increasing the allocation of resources to their department. If so, then public-sector bargaining will increase public-sector employment and wages O'Brien (1994), using a direct measure of police and fire union political activity, found that increased union political activity leads to greater department expenditures through higher employment, but not necessarily to greater municipal expenditures or revenues. Valletta (1993) also finds, in a cross-section of 900 U.S. cities between 1977 and 1980 that higher unionism raised employment in fire-fighters and sanitation.

Borjas (1982) argues that the only objective of politicians is the maximization of political support, which can justify particular aspects of the employment in the public sector, in particular the larger employment of women and minorities. Along this lines Alesina, Baqir, and Easterly (2000) argue that politicians might depart from "productive efficiency" and use public employment as a way of directing income toward disadvantaged groups and for politically privileged groups, to avoid the backlash of tax-transfer schemes. They show this in a political economy, two-period model, voters have to decide whether or not to reelect the incumbent at the end of the first period. They show evidence that across U.S. cities, employment is significantly higher in cities where income inequality and ethnic fragmentation are higher. This result is reinforced, by Alesina, Danninger, and Rostagno (2002) that calculate that at least one-third of the central government wage bill spent in the southern regions of Italy can be defined as redistributive flow from the north.

Sometimes it is hard to distinguish between support of minorities and pure patronage, the use of state resources to reward individuals for their political support. There is some evidence. Matsusaka (2009) examine the initiative process, a form of direct democracy that is becoming popular in American cities, in which individuals outside the legislature can propose laws that are voted directly by the population. The initiative process allow individuals and groups outside the government to propose policies, breaking the agenda control of elected officials, in particular, when the incentive of politicians to inflate the

public payroll with patronage employees is large. In a sample of more than 650 cities in 2000, comparing the policies of cities with and without initiatives, he finds that the initiative is associated with employment cuts in situations where theory suggests patronage is likely to be a problem. The study shows that it is possible to design political institutions to curb the use patronage.

There are other papers that find some aspects of patronage in public sector employment. 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, Mounu, and Teso (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. 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.

Gimpelson and Treisman (2002) highlights another aspect of public employment which is the interaction between different layers of government. They consider that public employment is the outcome of a *fiscal game* played between central and local officials in democracies with weak legal and administrative systems. Martinez-Vazquez and Yao (2009) using a large panel data of 74 countries for the period between 1985 and 2005, find that fiscal decentralization is associated with higher level of public employment. The decline in central government employment with decentralization, is more than offset by the increase in employment at the sub-national level accompanying the decentralization. Two other papers, studying Spain and India, found similar results. Sevillano and Villallonga (2004) found that the increase in the number of public employees at the regional government level was 1.6 times the reduction in the number of public employees at the central government during the period of decentralization between 1990 and 2003. Rajaraman and Saha (2008) found that horizontal fragmentation of the federation into smaller sub-national governments increased the total size of the civil service.

One crucial aspect that is commonly forgotten in the literature is that the size and the composition of public employment depend, to a large extent, on past decisions and the usual persistence that is inherit. As argued by Rose (1985), "to understand the level of public employment today, we must understand how past programme commitments have gradually caused some groups of workers to increase in number, whilst others remain constant or decrease." Governments do not decide on the level of public employment. At most, they

have control over changes of public employment, the hiring of public-sector workers.

Finally, and coming back to the budgetary aspect of public employment, the pioneer study of Ehrenberg (1973) also shows that public employment depends negatively on wages. The elasticity with respect to wages, estimated for workers in different parts of the government, like education, health, sanitation or policing, was smaller that 1. There is a trade-off between wages and employment. The authors conclude that state and local governments do respond to market forces in choosing their employment portfolios, these market forces do not appear to be sufficiently strong to limit the size of real wage increases which state and local government employees may seek in the future. This opens the question, how do governments determine government wages?

4.2   What determines public wages?

In a well-function private-sector labour market, the wage is an allocative mechanism that adjusts to equate supply and demand and clears the market. This system guarantees that marginal productivity of labour valued at market prices is equal across all firms and sectors, say manufacturing and services, and is reflected on the equilibrium wage. Behind it is the assumption of perfect competition. Whenever one firm pays a wage higher than equilibrium, another firm will come offering a lower price to consumers and pricing the other firm out of the market.

There are two fundamental differences when thinking about the public sector. First, we should not view the wages as an allocation mechanism, but rather as a policy variable, determined together with employment. The government has power to unilaterally determine changes in the conditions of many of its labour contracts. We should not expect another government to come in, undercutting the prices and taking over. Second, public wages are paid in money – dollars, pounds, euros – that is used by workers to pay for private-sector goods. However, because there is no market price for much of public-sector production, it is impossible in practice to measure their marginal productivity at market prices.

Many economists talk about a measurement curse in the public sector. The difficulty, but not impossibility, in practice of measure the productivity in the public sector. Measuring the productivity of *public-sector workers* is an important microeconomic question for the determination of *relative* compensation across workers. Measuring the productivity of the *public sector itself* is important for the determination of public employment, but not of the compensation of public sector workers relative to the private sector. If the public sector becomes less productive than the private sector in activities that the private sector can perform (similar goods), than the public sector should hire fewer workers and let the private sector produce. If the public sector become less productive in activities that the private sector cannot perform (different goods), than the public sector should hire more workers, analogous to the structural change theory. In neither way, should the productivity of the

public sector be a determinant of public-sector wages. For the same reason that two equally productive hairdressers, in Indian and in France, have a very different wage. Their wage is indexed to the overall productivity of the economy.

In a perfect world, policymakers, should set the employment level enough to produce the public goods that the citizens wish and pay an appropriate wage, that would *clear* the market. If principle, this would be the wage paid by the private sector, except in the case workers have an intrinsic preference for the public-sector, or the sector offered some other benefits, which in that case, the public sector wage that would clear the market should be lower. The only reason for the government to pay higher wages would be if there was a intrinsic cost – a stigma – of working in the public sector. However, the question of the wage determination in practice is much more complex. There are many forces that can create wage differentials vis-a-vis the private sector.

Public wages respond to the tightness of the budget. Gyourko and Tracy (1991) found, that US cities with access to sales taxes and without limits to property-tax, had significantly higher public wages. In their study of the impacts of property-tax limits on local government employment and wage policies, Poterba and Rueben (1995) also found that such limits, also slowed the growth rate of government wages. This result was confirmed in a follow up study, Poterba and Rueben (1998), using Current Population Survey data, for the period 1979 and 1986, found that public wages grew more slowly in places with limitations on local property taxes and tax and expenditure caps. The austerity during the Euro Area crisis paved the way to substantial changes in public-sector pay. The restraining effect of budgetary conditions on public wage growth, was also found, using aggregate data for a panel of OECD countries by Afonso and Gomes (2014).

Reder (1975) emphasis on the role of unions as a determinant of public-sector wages. He explains that to rationalize wage differentials between the public and private sectors, "it would be necessary to posit either a relative taste (nonpecuniary advantage) for being employed in the public sector or a differential impact of unionism in the public sector. While it is possible that a relative taste for public-sector employment per se does exist, such an hypothesis has never been proposed and I see no reason to consider it seriously. Differential impact of unionism is the explanation of public-private wage differentials most in keeping with the spirit of the recent empirical work on public-sector wage behavior." The role of unions as a leading explanation for public-private wage differentials, predominant in the literature in the 1970s and 1980s. However, the importance of unions has declined in the last decades, but we still observe large public-private wage differentials across countries or regions. Furthermore, as we shall see in Part B of this report, many of the countries with high unionization rates, like Nordic countries, are the ones where wages in the public sector are lower than the private sector. Even if stronger public-sector unions cannot be the only justification, they are still present in the economics literature. Blanchflower and Bryson (2010) found, using the UK Workplace Employment Relations Survey of 2004, found that

the union membership wage premium is twice higher in the public sector than in the private sector.

Buchanan and Tullock (1977) make the first reference to political economy aspects of public employment and wage determination. They describe how the wages of civil servants have risen more rapidly than those of private-sector workers between 1954 and 1974. They argue that the explanation was the political power of civil servants, that would be directed toward expanding toward raising their own salaries. They call it the Wagner Squared, hypotheses, saying that the government spending would increase by the double tendency or hiring more workers and paying them more. Along this line, Borjas (1980) study the role of political considerations in the wage-setting process of the government, namely the political influence exhibited by the constituencies and bureaucracies of federal agencies. The theoretical framework assumes that the objective of the government is to maximize its total political support, subject to a budget constraint. Bureaucrats will hinder the flow of agency output when their wage is low and will increase the flow when the wage is high. The pay will be set different across different federal agencies. The model abstracts from the labour market. The empirical results indicate that employees in federal agencies with small and well-organized constituencies and with bureaucracies that apparently share common interests generally receive higher wage rates. In fact, a small number of variables measuring these political factors explains about two-thirds of interagency wage differentials.

The political considerations can be even more notorious. Public sector wages are vulnerable to manipulation for electoral reasons, in the spirit of Nordhaus political cycles. Borjas (1984) finds that, in the United States, pay rises in federal agencies are two to three percent higher in election years. Matschke (2003) also finds systematic public wage increases of two to three percent prior to federal elections in Germany. In Portugal in 2009 - year of crisis and three elections - public sector workers saw their real wage increase by four percent.

Wages may be too high if public sector workers are able to organize and bring political pressure. Matsusaka (2009) additional finding is that the initiative process is also associated with wage cuts in situations where excessive compensation is likely to be a problem, suggesting that these interest group problems are real and that the initiative does help to control them. In particular, in cities with collective bargaining, the initiative is associated with statistically significant wage cuts on the order of 4 percent. Since collective bargaining is estimated to increase wages by 18 percent, the initiative appears to undo about one-quarter of the union premium. In cities without collective bargaining, on the other hand, where wages are less likely to be excessive, the initiative is associated with large cuts in the number of public sector jobs, but not with reductions in wages, consistent with the idea that voters use initiatives to roll back patronage hires. Thus, the initiative appears to change policies in a way that counteracts specific political economy problems in public sector employment.

The argument about the inertia of public employment made by Rose (1985) can also be reproduced for wages. Public wages are a slow-moving institution, as divergencies from the

private sector can arise, not because of specific actions from the government, but by inability to respond fast enough to developments in the economy. This is particular true during the business cycles but also following structural changes in the economy. Governments accumulating wage rises above the private sector for several years, will find it very hard to correct the public-private wage differentials in one go.

While most of the literature considers high public wages as an inefficient outcome, there are some economists that view some advantages. Earlier worker by Becker and Stigler (1974) on setting the high enough wage to discourage corruption. The argument, akin to the argument of efficiency wages, requires that the problems of corruption are higher in the public than the private sector. While theoretically the argument is appealing, it offers in practice a very limited justification for public-private wage differentials. The reason being that, as we shall see in Part B, the highest public-private differentials are observe for workers in lower-rank occupations.

The common feature in all these papers is the fact that have a very specific setting, and do not consider the labour market implications of the choices of government, or more generally the general equilibrium implication of policies. Borjas (1980) acknowledges this limitation. He wrote that "the wage differentials documented in this paper must lead to some job rationing among applicants. A careful study of applications for civil service jobs would be useful in further documenting the civil service wage structure." We will analyse the role of public employment in the labour market in Part B, but before we will look at the wider macroeconomic effects of public employment.

- **Insight 1.** Public employment is used for the production of public goods, but it is not a requirement. Many public goods can be provided for free, but produced by the private sector.

- **Insight 2.** Public production, beyond public provision, can be economically justified if the production by the private sector involves too much monitoring from the government, or if the private sector is not perfectly competitive.

- **Insight 3.** Public employment can also be justified if workers themselves prefer working for the public sector and are willing to do so at lower wages than in the private, or to correct externalities in job creation, namely to perform macroeconomic stabilization policy or for targeted labour market intervention to reduce unemployment in particular industries, regions, or types of workers.

- **Insight 4.** The benefits of public employment are be evaluated against the costs of government spending. Budget restrictions tend to lower public employment.

- **Insight 5.** Public employment is determined by politicians and bureaucrats, so it can also be used, in their best interest, for vote-buying, or for their own personal enhancement, stimulation rent seeking activities or for redistribution. It is also vulnerable to pressures from unions.

- **Insight 6.** Ideally, public wages should equate the private sector wages, or be lower if workers prefer to work for the public rather than the private sector and are willing to do that at a wage penalty.

- **Insight 7.** In practice, wages are partially determined by politicians so they can also be used to achieve budgetary targets, vote-buying, for their own personal enhancement, stimulate rent-seeking activities, or to satisfy union pressure.

- **Insight 8.** There is a strong inertia in public employment and wage policies, so to a great extent, they are the outcome of past decisions.

5   Macroeconomic effects of public employment

5.1   Aggregate effects of public employment

We have seen that the cyclical properties of the different components of government spending are quite different. We will now see if their macroeconomic effects are also different. In his handboock chapter, Perotti (2008) in one exercise, distinguishes between government employment and a goods spending shock and find that both GDP and private consumption respond much more to the employment component of government spending. In a series of papers in the 1990s by Alesina and Perotti, they analyse the impacts of fiscal adjustments in OECD countries and find that they depend crucially on the composition.[3] Alesina, Perotti, Giavazzi, and Kollintzas (1995) find that the most successful episodes were based on spending cuts on transfers and on the wage bill. These ones were also more likely to foster growth and private investment. There are also findings that the wage component of government consumption causes much stronger contractions in exports (Lane and Perotti, 1998), as well as in private investment and profits (Alesina, Ardagna, Perotti, and Schiantarelli, 2002).

To show some of the evidence of heterogeneous effects of government spending components, we are going to estimate the impact multiplier and the 5 year present value multiplier when we use an aggregate measure of spending (*gov*1 which includes the wage bill, purchases of intermediate goods and services and investment). We will then use in turns the individual components to compute the multipliers. We then shock each variable such that the increase in government spending is equal to 1 percent of GDP. For instance, government investment corresponds to 4 percent of GDP on average, so a shock of 25 percent to investment is equivalent to 1 per cent of GDP. For the wage bill, it corresponds to 12 percent of GDP on average, so a shock of the size of 1 per cent of GDP is equivalent to a shock of 8.4 percent to either the average wage or employment. Because the literature usually abstracts from transfers, we follow the common procedure of including taxes net of transfers. We use four different identification procedures from the literature.

The results are shown in Table 3. All the details regarding the specification of the VAR are described the the notes of the table. First, the differences of both the impact and the 5-year present value multiplier across identification strategies is smaller than the differences across components for each identification strategy. While the impact multiplier of total spending varies between 0.67 and 1.75, the the impact multiplier using Blanchard and Perotti varies between 0.4 for consumption to 3 of government employment. While the point estimate of the present value multiplier are quite heterogeneous, the error bands are very large.

Given these results, the applied macroeconomic literature tried to explore more the transition mechanisms of public employment in the labour market, quantifying the impact

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[3]See Perotti (1996) for a brief summary.

Table 3: Effects of 1% of GDP fiscal shocks on GDP following different methodologies

Type	Impact multiplier			Present Value Multiplier (20 qt)			
	B&P	P	R	B&P	P	R	R&S
Total Spending	1.08	0.67	1.75	1.84	1.75	1.18	0.53
	[0.80;1.38]	[0.43;0.96]	[1.07;2.57]	[1.23;2.43]	[1.00;2.54]	[-1.29;4.02]	[-0.30;1.47]
Employment	2.97	3.46	25.05	3.69	1.94	-0.81	4.57
	[0.64;4.98]	[1.33;5.62]	[-10.80;78.35]	[1.49;5.37]	[-1.47;4.34]	[-11.29;5.24]	[-4.31;13.07]
Consumption	0.40	0.38	2.08	2.34	3.40	-0.19	1.10
	[0.02;0.81]	[0.02;0.74]	[1.13;3.30]	[0.21;4.19]	[1.73;5.22]	[-9.09;5.79]	[-2.20;4.48]
Investment	1.77	0.99	3.80	2.09	0.80	3.29	0.87
	[1.09;2.40]	[0.45;1.55]	[2.32;5.79]	[-0.26;4.53]	[-1.87;3.52]	[-4.45;11.40]	[-7.22;10.00]

Notes: For Blanchard and Perotti the VAR is estimated with 4 lags, linear and quadratic time trend. The VAR includes government spending (rotating each component in turns), taxes net of transfers and GDP. We assume that the contemporaneous elasticity of government spending to output is zero, that the elasticity of net taxes to output is 2.08 and that the decision of spending are taken before the decision on taxes. The sample starts in 1955:1 and runs until 2000:4. Standard deviations are bootstrapped based on 1000 repetitions. For Perotti the VAR is estimated with 4 lags, linear and quadratic time trend. The VAR includes government spending (rotating each component in turns), the Barro-Sahasakul average marginal income tax rate, GDP, private consumption on non-durables and services, private gross fixed investment, hours worked in the non-farm business sector and the real product hourly compensation in the non-farm business sector. The sample starts in 1955:1 and runs until 2000:4. As the marginal tax rate is a political variable, it is assume not to respond contemporaneously to other macroeconomic variables. Standard deviations are bootstrapped based on 1000 repetitions. For the Ramey, we use the same VAR as Perotti, add the news shock based on the survey of professional forecasters and compute the impulse responses of spending and output to a shock in this variable,. The sample is restricted to 1969:1 to 2006:4. Standard deviations are bootstrapped based on 1000 repetitions. For the dummy approach we extend the sample from 1950:1 to 2006:4 to include the four dates. Standard deviations are bootstrapped based on 1000 repetitions. In all cases the error bands are at 16% and 84%. For Ramey and Shapiro, we estimate a VAR with 6 lags, linear and quadratic time trend. The sample starts in 1950:1 and runs until 2010:3. We include a dummy that assumes value 1 at the following four dates: Korean war (1950:3), Vietnam war (1965:1), the Carter-Reagan buildup (1980:1) and the September 11 (2001:3) To compute the response to an episode, we exclude the estimated dummy from the output equation.

of public sector employment on unemployment and private employment, using aggregate data. The empirical challenge is to disentangle the reverse causality and endogeneity of public employment which, using aggregate data, is particularly difficult. Still, there has bee a few attempts. Edin and Holmlund (1997), using data for 22 OECD countries from the end of the 1960s to 1990, find that a rise in public sector employment reduces unemployment by about 0.3 percent in the short-run, whereas there is no significant long-run effect. Boeri, Nicoletti, and Scarpetta (2000) estimate that 10 additional public jobs crowd out 3 private jobs using a sample of 19 industrialized OECD countries over the period 1985-1992. Algan, Cahuc, and Zylberberg (2002) validate some of the results in their model, using a panel of 17 OECD countries between 1960-2000. They find that the creation of 10 public sector jobs tend to destroy 15 private sector jobs, and raises unemployment. Sill, they find that the increase in unemployment is stronger in countries with high public sector wage. Behar and Mok (2019), using a larger panel including 194 countries over the period 1988–2011, estimate a one-to-one crowding out. The mix results suggest that different factors are at play.

Other papers, have studied single countries using time series data, but found similar

mixed results. Malley and Moutos (1996) perform cointegration analysis in a VAR setting, for Sweden during the period 1964-90. They find that increases in government employment have more than completely crowded-out private employment. Linnemann (2009), Pappa (2005) and Cavallo (2005), all look estimate VAR with US aggregate time-series data, using different identification strategies. Linnemann (2009) uses a standard Cholesky decomposition, Cavallo (2005) uses the Ramey-Shapiro military build-ups and Pappa (2005) identified the VAR using sign restrictions concerning the effects of output and budget deficits to fiscal shocks. Linnemann (2009) finds that the responses of private employment, as well as real output, to public employment shocks are be positive, suggesting a crowding in effect. Pappa (2005) finds more mixed response, with positive contemporaneous effect, but a negative effect, statistically significant after the second period.

5.2 Aggregate effects of public wages

The applied macroeconomic literature has also interested on the effects of public wages. In particular, several papers are interested on the interaction between public and private wages, using time-series data. In general, although there is evidence of some pro-cyclicality of public wages, their developments may be less aligned with those of the private sector. Whether a government acts as a wage leader, placing pressure on private-sector wages (more open to competition), or whether it plays a passive role and merely follows wage negotiations in the private sector, is important for our understanding of both the determinants of public wages and their effects.

Most of the literature has focused on single countries, with Sweden attracting much interest, with Holmlund and Ohlsson (1992), Jacobson and Ohlsson (1994), Tagtstrom (2000), Friberg (2007) and Lindquist and Vilhelmsson (2006). Methodologically, this is studied using a Granger causality setting, or through a cointegration and error correction analysis. Holmlund (1993), Jacobson and Ohlsson (1994) and Lindquist and Vilhelmsson (2006) find that the private sector leads central government and municipality wages. Tagtstrom (2000) finds that the manufacturing industry is a wage leader in relation to the other sectors to central and local government wages, but that central government does Granger causes wages in other business sectors. Central government also caused private sector in the Holmlund (1993). Friberg (2007), finds no evidence of particular wage leadership from a specific sector. Instead he finds that it runs in various directions. Studies for other counties include Demekas and Kontolemis (2000) for Greece or Mizala and Romaguera (1995) for Chile.

Lamo, Pérez, and Schuknecht (2012) analysis the problem using a Granger Causality using annual data for 18 OECD countries. They find that the private sector, on the whole, have a stronger influence on the public sector, rather than vice versa. However, they also find evidence of feedback effects from public wage setting into private-sector wages in a number of countries, namely Ireland, Norway, Denmark, Finland, Germany, France, the

Netherlands, and Belgium.

Afonso and Gomes (2014) analyse aggregate data in a panel of OECD countries for the period between 1973 and 2000. They estimate the relation through a system of linear equations on public and private sector wage growth. They discuss the econometric challenges involved, particularly the problem of endogeneity. They find that a number of variables affect private sector wage growth, for instance: changes in the unemployment rate (negative relationship), total factor productivity growth and changes in the urbanisation rate. Moreover, public sector wages and employment growth also affect private sector wage growth. A 1 percent increase in public wages raises the wages in the private sector by 0.3 percent.

5.3 Effects of public employment in models with frictionless labour markets

To understand the macroeconomic effects of public employment, we have focus more on the labour market than on the output market. Finn (1998) is the classical example of the analysis of public employment as a fiscal policy instrument, within a Real Business Cycle model. Within the Dynamic Stochastic General Equilibrium framework, the literature as has looked at public employment in the context of a frictionless labour markets, or in other words in the absence of any type of barriers or frictions. Finn (1998) finds that public employment crowds out of private employment, but less than one-to-one, because of a positive effect on labour supply. This positive effect is achieved because public employment has a positive general equilibrium effect on private sector wages, because by reducing private employment, it raises its marginal productivity. This contrasts with purchases of goods and services by the government, that in this type of models, have a negative effect on private wages.

Ardagna (2001) extends the model to include government debt and distortionary taxation. She also considers public employment to increase the productivity of the private sector. As in Finn (1998), government purchases raise private investment and lower real wages and higher return on capital, leading to a fall in consumption and leisure. In contrast, a shock to public employment, private employment decreases in impact, the real wage increase and the return on capital fall.

Linnemann (2009) contrasts the results of Finn (1998) with his own VAR evidence that in the US, private employment was crowded in, following government employment shocks. He then extends the basic RBC model, viewing the government as combining public employment and goods purchases to produce a stream of public services that is useful to households. If public services are complementary to private consumption goods in the representative household's utility function, an increase in public employment raises private consumption, which in equilibrium requires private sector employment to increase, too. Cavallo (2005) and Pappa (2005), instead, consider public employment to enter the private sector production function. Pappa (2005), considers not only an RBC model, but also a New Keynesian

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model with added nominal rigidities. She finds that government employment shocks tend to reduce private sector employment for both model types, though to a different degree. One common aspect of these papers, is that to enrich the interactions of public and private employment beyond the labour market, they assume other channels, like the productivity of public employment or complementarities in preferences, which are very hard to access quantitatively in the data. Other papers within a neoclassical model include Domeij and Ljungqvist (2019), de Córdoba, Pérez, and Torres (2010) or Nalban and Smădu (2020).

The most elementary macroeconomic theory considers a pure frictionless markets. This is probably enough to have a benchmark to analyse public employment. However, notice that a stark implication of a pure frictionless model is that the wages in the two sectors always have to equate, which essentially takes out public wages from the policy space. The public-sector wage policy becomes implicity connected to developments in the private sector. To think about the effects of public wages we have to introduce some barriers or frictions in the labour market.

5.4   What is the role of public wages in macro models?

The second modeling approach sets a unionized labour market, where public wages above market clearing, generating rationing unemployment. The key reference is Algan, Cahuc, and Zylberberg (2002), together with Ardagna (2007). The main results, by having rationing unemployment, the crowding out effects of public employment are now different. Even in the absence of labour supply adjustments, public employment can crowd out private employment more or less than one-to-one, depending on their effect on unemployment. Algan, Cahuc, and Zylberberg (2002) find that the effect on unemployment depends crucially on the level of public wages. If they are small, then unemployment goes down after an increase in employment. If wages are very high, unemployment goes up. Another results, is that public wages raise unemployment, in the model by Algan, Cahuc, and Zylberberg (2002), because it increases the queues for public-sector jobs.

Still, this approach, is not compatible with a negative public-sector wage premium. Garibaldi, Gomes, and Sopraseuth (2019) present a more general framework that captures the essence of the public-sector labour market. They view the private sector labour market as perfectly competitive, where private wages adjust to equate demand and supply of labour (Walrasian). On the other hand, they argue that the usual economic mechanisms that drive the private sector adjustments do not map into the public sector. One of the missing adjustment channels is wages. When governments set their wages (or wage growth), there is a discretionary component that can create widely documented wage differentials vis-à-vis the private sector. Other government objectives can push wages above or below the market clearing wage, with the consequent labour market effects. As such, the government that acts with a wage schedule that does not equate demand and supply, in what they call a

Malinvaud sector in reference to the fixed price equilibrium theory. The consequence of this, is that when public wages are high, public employment is demand determined and jobs are rationed.In their framework there is no unemployment, so workers just go to the private sector. On the other hand, when public wages are too low, public employment is supply determined - it cannot attain its desired level of employment. What allows different wages in public and private sector, is a "non-pecuniary" value or cost, over these sectors, that is idiosyncratic.

The third, more recent, modeling approach that can be embedded in DSGE models, considers a labour market with search and matching frictions. With frictions, the labour market tolerates different wages. Even if wages in one sector is lower than the other, workers do not have the incentive to quit and change sectors because it takes time to find a new job. Quadrini and Trigari (2007), Gomes (2015) and Boeing-Reicher and Caponi (2017), in the absence of nominal rigidities, analyse how the cyclical rules of public wages and public employment affect the unemployment volatility. These papers have found a procyclical wage policy reduces unemployment volatility in response to technology shocks. Over the business cycles, the government should keep the wages in the two sectors aligned. In recessions, if private sector wage drops are not accompanied by similar falls in the public sector, the unemployed turn for jobs there, which further reduces job creation, thus amplifying the business cycle. The idea that public wage should be procyclical finds some resistance in policy circles, that do not distinguish public wages from other types of spending in the Keynesian view that procyclical spending amplify the fluctuations of aggregate demand, leading to wage spirals and higher volatility. This was argued by, for instance Holm-Hadulla, Kamath, Lamo, Pérez, and Schuknecht (2010) and restated in Lamo, Pérez, and Schuknecht (2013). Other papers that consider a labour market with search and matching friction within a DSGE model without nominal rigidities include Afonso and Gomes (2014) or Esteban-Pretel, Meng, and Tanaka (2020) and with nominal rigidities include Gomes (2016), Stähler and Thomas (2012) and Bermperoglou, Pappa, and Vella (2017).

Finally, a forth modeling framework, that allows for different wages across sectors, is a occupational choice model. Here the main reference is Cavalcanti and Santos (2020), that studies how the benefits in the public sector work to attract would-be entrepreneurs that opt for a career in the civil service instead. They argue that higher public wages might lead to misallocation of resources with a lower entrepreneurship rate. Other papers with public employment in different occupational choice models are Gomes and Kuehn (2017) and Marchiori, Pieretti, and Zou (2018).

From the more macro–fiscal literature we learn that the modeling of the labour market is key for our understanding of the effects of public employment. As such, in Part B of this report, we focus on the weight of the public employment in the labour market, reviewing the main facts using micro data, and listing the main insights from the macro–labour literature.

- **Insight 9.** Evidence from US VAR suggests public employment has a larger GDP multiplier than other government purchases of goods or investment.

- **Insight 10.** Evidence from panel data of OECD economies suggests public employment crowds out private employment, but the crowding out can be more or less than one-to-one, so the effect on unemployment is ambiguous.

- **Insight 11.** Theory suggests that public employment has a positive effect on labour supply. By absorbing part of the workforce, it raises wages in the economy and encourages workers to supply more hours.

- **Insight 12.** Evidence from aggregate cross-country data suggests that private wages have a stronger influence on public wages, but in some samples, there is also a feedback from public to private wages.

- **Insight 13.** We should not expect that public-sector wages clear the labour market (there are not obvious mechanisms for the adjustment). To analyse the effects of public wages, macro models have to incorporate some type of barriers or friction.

- **Insight 14.** Too high wages relatively to the private sector for the same occupation imply rationed jobs (demand determined).

- **Insight 15.** Too low wages relatively to the private sector for the same occupation imply jobs left unfilled (supply determined).

- **Insight 16.** Counter-cyclical or acyclical public wages raise unemployment volatility.

- **Insight 17.** Higher public sector wages relatively to the private sector might lead to misallocation of resources with a lower entrepreneurship rate.

Part B

Public Employment: A View From the Labour Market

6 Public employment and the labour market, exploring microdata

6.1 Data used

To analyse the various aspects of public employment in the labour market, aggregate data is of limited use, and we need instead to use microdata. We now examine microdata from the French, Spanish and UK *Labour Force Surveys* and the US *Current Population Survey* (CPS) over the past 15 years. We chose these four countries because they are large countries with sizable public sectors, and have been recently facing pressure to reform their public sectors. Furthermore, because they have different labour market institutions, public-sector hiring procedures and wage policies and various weights on different industries, facts that are found to be common across the four countries should be seen as intrinsic characteristics of the public sector.

With the survey data, the distinction between public- and private-sector jobs is based on a self-reported variable, which is in accordance with how official statistics in each country are drawn. During the survey, the interviewer asks the individual to classify his employer. In the UK, we include the following categories in our definition of public employment: i) Central Government, Civil Service; ii) Local government or council (incl. police, fire services and local authority controlled schools or colleges); iii) University or other grant-funded educational establishment; iv) Health authority or NHS trust; and v) Armed forces. A similar definition is used for France. For Spain, the survey asks directly whether respondents work for the public or the private sector. For the US, the definition of public sector is working for the government (federal, state or local government). See Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) for details.

Finally, for other specific aspects of public employment, we will use other data from the Structure of Earnings Survey, World Bureaucracy Indicators, Quality of Government Survey and the Survey of Adult skills.

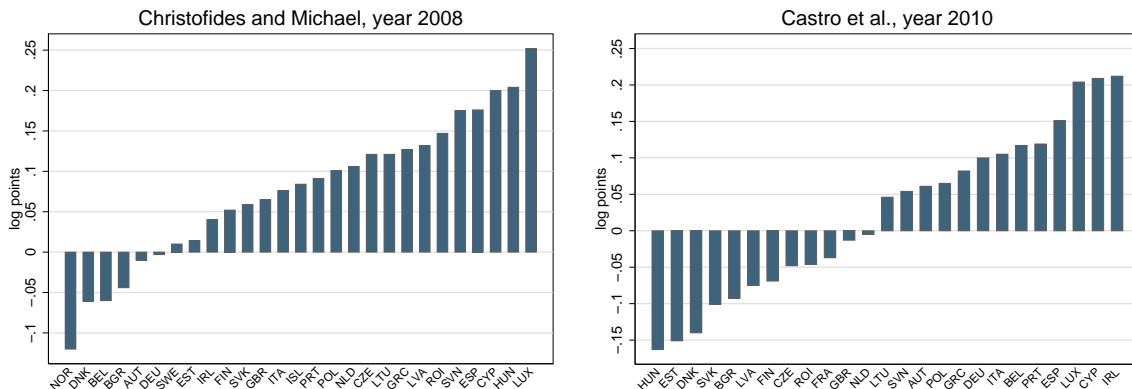## 6.2 Estimation the public-sector wage premium

Using the aggregate measure of public-private wage differential is commonly used in the macroeconomic literature, to evaluate the time-series evolution of relative pay, but given the the composition of employment is very different in the two sectors, it is a poor gauge

to access differences in relative pay. One significant branch of the literature estimates the public-private wage differentials from microdata, which provides a better answer as to whether the public sector pays higher or lower wages than the private sector. Even after one survey by Gregory and Borland (1999) and another, more specific, by Bender (2002), many papers still estimate these differentials for different countries, samples, and methodologies.

The simplest way is the dummy variables approach, which consist of simply including a public-sector dummy in an otherwise straightforward Mincer regression. The limitation of this approach is that it assumes the effect occurs through the intercept, and that the returns to other characteristics are the same. A second approach involves estimating separate earnings regressions for public sector and private sector employees, and using these regression results to decompose the difference in average earnings between workers in each sector into two effects: (a) different average worker characteristics and job attributes between sectors, and (b) different returns to the same attributes. These effects are disentangled using some type of decomposition, usually a Oaxaca-Blinder decomposition, or a variation. Finally, a third approach attempts to control for the bias that occurs if the selection into the public sector is not random. Finally, a third approach attempts to control for the bias that occurs if the selection into the public sector is not random. Less commonly used approaches include propensity score matching and structural models.

While there are several studies for particular countries, using different datasets for different time periods, there are fewer cross-country studies. Christofides and Michael (2013), using EU SILK data for the year 2008, accounting for selection. The same authors extend their analysis until 2013 to cover the period of fiscal adjustment in the Euro Area (Michael and Christofides, 2020). Castro, Salto, and Steiner (2013) applies the same approach to EU SES data for the year 2010, without accounting for selection. The results from the

Figure 6: Public-Sector Wage Premia, cross-country

Note: the left-graph shows estimates of the public-sector wage premium by Christofides and Michael (2013), using EU SILK data for the year 2008, accounting for selection. The graph on the right shows estimates of the public-sector wage premium by Castro, Salto, and Steiner (2013) using EU SES for the year 2010. Both papers decompose into explained and unexplained components. Figure plots unexplained component. The correlation between the two estimations is 0.27.

two studies are shown in Figure 6. The cross-country correlation in the two studies is only 0.27. For instance, while the first study finds that public sector wages are 6.5 percent higher than the private sector in the UK, the second study finds they are 1.3 percent lower. The differences can be driven by a combination of effective changes in policies between the two years, the datasets used, different methodologies or control variables. Other studies include Giordano, Depalo, Coutinho Pereira, Eugéne, Papapetrou, Pèrez, Reiss, and Roter (2011) and Campos, Depalo, Papapetrou, Pérez, and Ramos (2017).

Whatever the differences between studies, there are some facts that seem common. First, the public-sector wage premium varies substantially across countries, ranging from -10 to 25 percent. Second, in Nordic countries like Sweden, Norway, Finland and Denmark, the public-sector wage premium is usually negative. Third, the highest premia are usually found in South European countries, like Spain, Portugal or Italy.
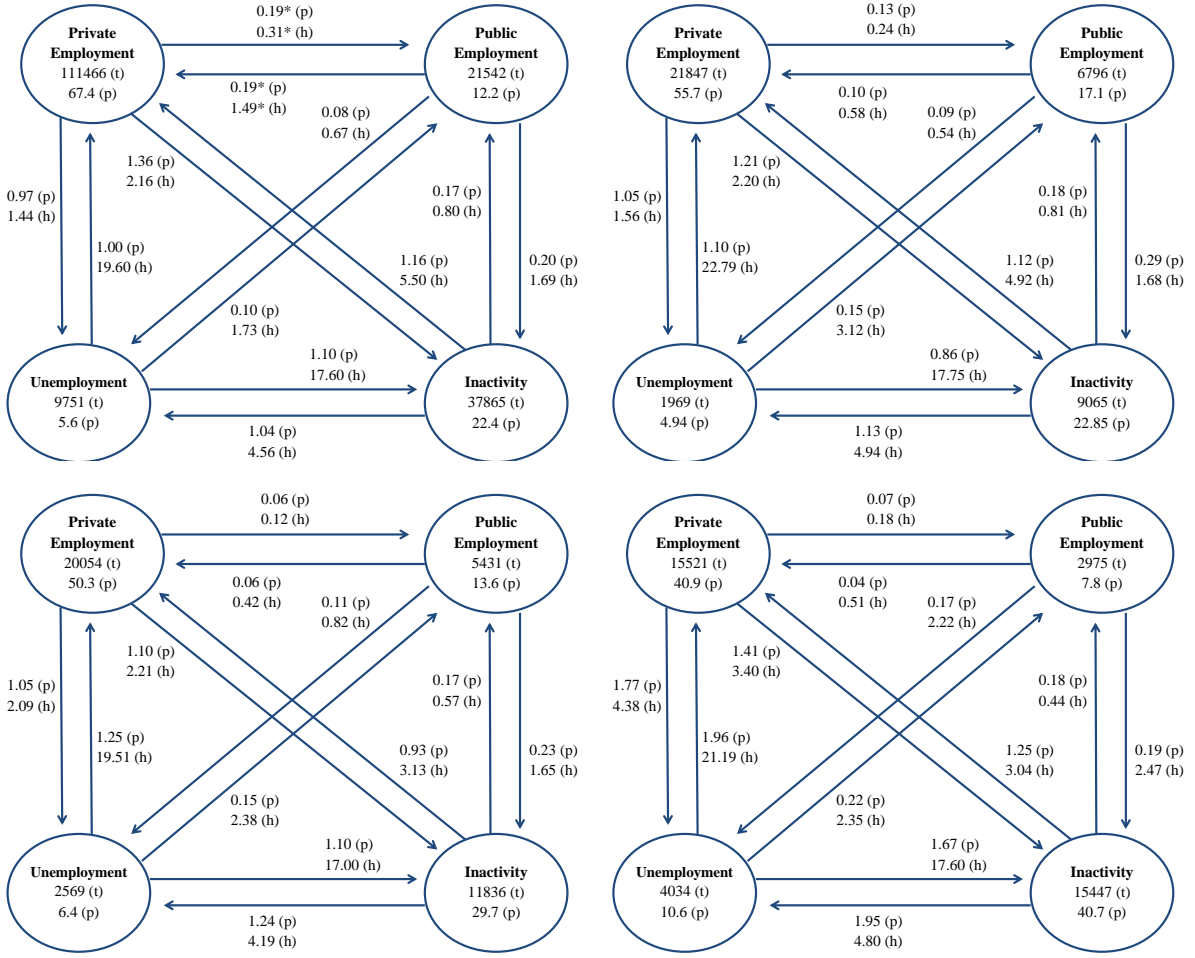
6.3 Flows

Given the policy role that public-sector employment played during the last decade, a new wave of research constructs search and matching models of unemployment to study the labour market effects of public-sector employment and wages. Lying at the heart of these state-of-the-art models are the worker gross flows between private- and public-sector employment, unemployment and inactivity. Using the microdata US, UK, France and Spain we calculate the stocks and transition rates between the different states. The data shown, and the facts extracted, are draw from Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) and Chassamboulli, Fontaine, and Gomes (2020).

Figure 7 summarizes the average quarterly (monthly) worker flows over the 2003-2018 period for the four countrie. It reports the stocks of workers in thousands (t) and as a percentage of the working-age population (p), as well as the number of people that change status every quarter (month) as a percentage of the working-age population (p) and as a transition probability or hazard rate (h). We restrict our analysis to the working-age population (16 to 64 years old). The public sector employs 17.0 percent of the working-age population in the UK, 13.7 percent in France, 12.0 percent in the US and 7.8 percent in Spain. It represents 23, 21, 16 and 16 percent of total employment, respectively.

Labour turnover, between employment and non-employment, is lower in the public sector. In each quarter in the UK and France, flows in and out of private-sector employment represent around eight percent of its stock, but only 4.5 percent for the public sector. In the United States, monthly turnover represents seven percent in the private sector and 4.6 percent in the public. In Spain, the turnover is larger, with 15.4 percent in the private sector and 9.3 percent in the public sector.

Fewer people separate from the public sector. The probability of moving from employment to unemployment is more than two times higher if working in the private sector in the

Figure 7: Labour market stocks and flows, US, UK, France and Spain

US (top left):

Private Employment 111466 (t) 67.4 (p)

Public Employment 21542 (t) 12.2 (p)

Unemployment 9751 (t) 5.6 (p)

Inactivity 37865 (t) 22.4 (p)

Flows: 0.19* (p) / 0.31* (h); 0.19* (p) / 1.49* (h); 0.08 (p) / 0.67 (h); 1.36 (p) / 2.16 (h); 1.00 (p) / 19.60 (h); 0.97 (p) / 1.44 (h); 0.17 (p) / 0.80 (h); 1.16 (p) / 5.50 (h); 0.20 (p) / 1.69 (h); 0.10 (p) / 1.73 (h); 1.10 (p) / 17.60 (h); 1.04 (p) / 4.56 (h)

UK (top right):

Private Employment 21847 (t) 55.7 (p)

Public Employment 6796 (t) 17.1 (p)

Unemployment 1969 (t) 4.94 (p)

Inactivity 9065 (t) 22.85 (p)

Flows: 0.13 (p) / 0.24 (h); 0.10 (p) / 0.58 (h); 0.09 (p) / 0.54 (h); 1.21 (p) / 2.20 (h); 1.10 (p) / 22.79 (h); 1.05 (p) / 1.56 (h); 0.18 (p) / 0.81 (h); 1.12 (p) / 4.92 (h); 0.29 (p) / 1.68 (h); 0.15 (p) / 3.12 (h); 0.86 (p) / 17.75 (h); 1.13 (p) / 4.94 (h)

France (bottom left):

Private Employment 20054 (t) 50.3 (p)

Public Employment 5431 (t) 13.6 (p)

Unemployment 2569 (t) 6.4 (p)

Inactivity 11836 (t) 29.7 (p)

Flows: 0.06 (p) / 0.12 (h); 0.06 (p) / 0.42 (h); 0.11 (p) / 0.82 (h); 1.10 (p) / 2.21 (h); 1.25 (p) / 19.51 (h); 1.05 (p) / 2.09 (h); 0.17 (p) / 0.57 (h); 0.93 (p) / 3.13 (h); 0.23 (p) / 1.65 (h); 0.15 (p) / 2.38 (h); 1.10 (p) / 17.00 (h); 1.24 (p) / 4.19 (h)

Spain (bottom right):

Private Employment 15521 (t) 40.9 (p)

Public Employment 2975 (t) 7.8 (p)

Unemployment 4034 (t) 10.6 (p)

Inactivity 15447 (t) 40.7 (p)

Flows: 0.07 (p) / 0.18 (h); 0.04 (p) / 0.51 (h); 0.17 (p) / 2.22 (h); 1.41 (p) / 3.40 (h); 1.96 (p) / 21.19 (h); 1.77 (p) / 4.38 (h); 0.18 (p) / 0.44 (h); 1.25 (p) / 3.04 (h); 0.19 (p) / 2.47 (h); 0.22 (p) / 2.35 (h); 1.67 (p) / 17.60 (h); 1.95 (p) / 4.80 (h)

Note: For the United States the data is take from CPS (1996-2018), for the United Kingdom from the UK Labour Force Survey (2003-2018), for France for the French Labour Force Survey (2003-2018) and from Spain from the Spanish Labour Force Survey (2005-2018). For details on the methodology see Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020).

four countries. It is almost three times in the UK, where the probability is 1.47 percent in the private sector and only 0.52 in the public sector. Fewer separations means that there are fewer hires. In the European countries, while roughly 20 percent of the unemployed find a job in the private sector each quarter, only two to three percent find one in the public sector. In the United States, each month, 20.73 percent of the unemployed find a job in the private sector, while only 1.88 percent find a public-sector job.

When separating from a public-sector job, workers are more likely to withdraw from the labor force. In France, 67 percent of outflows from the public sector (to non-employment) are directed to non-participation (51 percent in the private sector). The finding is stronger in the UK and the US, where more than 72 percent of public-sector separations are to inactivity. Likewise, returns to public jobs from non-participation are also more frequent. In France and the UK, more than 50 percent of new hires in the public sector come from inactivity, whereas

in the private sector, that number is less than 50 percent. Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) use a multinomial logit model to reevaluate these differences in separation probabilities between sectors, controlling for observable characteristics, and find they still remain.

There are few direct transitions between employment in the two sectors. Each quarter in the France and Spain, only 0.12 percent of private-sector workers switch sector without a measured spell of unemployment. This represents less than 15 percent of all inflows into the public sector. In the UK and US these flows seem more important. In each quarter, 31 and 38 percent of the new hires in the public sector come directly from private employment.

- **Fact 7.** Public-sector wage premium varies substantially by countries. It can be positive and negative. It is the lowest in Nordic countries and highest in South European countries.

- **Fact 8.** There is 30 to 50 percent less turnover in the public sector.

- **Fact 9.** The probability of a worker moving to unemployment is 2-3 times higher in the private sector.

- **Fact 10.** In each quarter (month in the US), an unemployed worker has a 20 percent probability of finding a job in the private sector and a 2-3 percent in the public sector.

- **Fact 11.** There are few direct transitions between the public and private sectors: they account for 10 to 30 percent of all inflows and outflows of public employment. The importance of the direct flows between sectors for the dynamics of public employment are even lower. They only account for 6 percent of the fluctuations in Spain, 14 in the US and France and 25 in the UK.

- **Fact 12.** Between 70 to 90 percent of the new hires in the public sector come from non-employment, the majority of those are from inactivity.

6.4 Search and matching models of the labour market

The most recent wave of research constructs search and matching models of unemployment to study the labour market effects of employment, wages and recruitment practices in the

public sector, adopt different assumptions regarding the interaction between private and the public sector in the labour market: segmented markets, random search and job ladder. These three approaches highlight the different transmission mechanisms of employment and wage policies.

The first approach assumes segmented markets and descends from the unionized market of Algan, Cahuc, and Zylberberg (2002). It was used in Gomes (2015, 2018), Quadrini and Trigari (2007), Hörner, Ngai, and Olivetti (2007), Chassamboulli and Gomes (2019, 2020), Gomes and Kuehn (2019), Gomes and Wellschmied (2020) and Geromichalos and Kospentaris (2020). This approach extends the Diamond–Mortensen–Pissarides model, by assuming that the two sectors are segmented, with the workers having the active choice of which sector to search. Segmented markets portrays a realistic mechanism of selection into the public sector in several countries, documented empirically by Krueger (1988) and Nickell and Quintini (2002) and experimental by Bó, Finan, and Rossi (2013).

In the simplest model, by Gomes (2015), the choice depends of the comparison of values of employment in the two sectors, itself driven by wage differentials, but also by differences in job-separation rates. Lower job-separation rates or higher in the public-sector raise the value of a public-sector job. When making the choice, the unemployed, equate the value of searching in either sector. If the value of a job is higher in the public sector, more people are going to queue in that sector so the probability of finding a job there will be lower. Crucial to understanding the mechanism, is understanding how the public-sector works differently from the private sector. For private firms, an endogenous job creation condition – free entry – mean that vacancies adjust to the number of unemployed searching in the market. For the government, the absence of a free entry condition, means that job-creation does not respond (at least in the same fashion) to the number of unemployed. As such, it is the conditional job-finding rate in the public-sector that adjust to equate the values of unemployment. Higher public-sector wages are compensated by longer queues for those jobs, and lower probability of getting a job. Indeed, in the baseline model, the effect of the queues completely neutralize the effect of higher public-sector wages, so there are no spillovers, into private sector wages. The crowding out effect in the private sector, is proportional to the size of the public-sector queue. One additional worker searching in the private sector, means one fewer worker in the private, and one fewer vacancy. Regarding the effects of public employment, they reduce unemployment if the public wages are low (and hence the effect on the queue is low) and increase unemployment if public wages are high because it induces too many people to search for these jobs.

Other paper introduce other level of unobserved heterogeneity that contributed for the selection. Gomes (2018) and Gomes and Kuehn (2019) include an idiosyncratic preference for the public sector; Chassamboulli and Gomes (2019) introduce a cost of entering the public sector, i.e. an entry exam; and in Gomes and Wellschmied (2020), within an incomplete markets version, selection is based on existing wealth, and past accumulated earnings in the

two sector.

The segmented markets opens up a very clear concept of optimal public wages. Too high wages generates a queues for the public sector and higher unemployment, which is quantitatively very sizable. Low wage generates recruitment problems for the public sector and vacancies that are left unfilled. As shown by Gomes (2015), the optimal public-sector wages show be equal to the private sector wage, but adjusted for other differences that reflect labour market frictions (for instance differences in job separation). A generalization of this principle, suggests that the public wages should reflect other compensating differentials, such as better pensions, better work-life balance or better health care plan.

A second approach, also within the Diamond–Mortensen–Pissarides framework, assumes that unemployed apply to vacancies randomly, descendent of Ardagna (2007), so that the probability of getting in in the public sector depends on the number of vacancies in the total. Key recent references include Holmlund and Linden (1993), Albrecht, Robayo-Abril, and Vroman (2018), Michaillat (2014), Bermperoglou, Pappa, and Vella (2017), Caponi (2017), Navarro and Tejada (2019) or Boeing-Reicher and Caponi (2017)

The key difference between the model with random search and segmented markets is the value of unemployment. Under random search there is no active decision of which sector to search. Under random search, by contrast, the outside option of the unemployed is a convex combination of the value a public-sector job and the value of a private-sector job with weights reflecting the relative number of vacancies in the two sectors. Thus, public-sector wages, employment and separation rate affect private-sector wages and job creation. 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.

Still, the pass-through effect of public-sector policies into private wages and job-creation, depend on the number of open vacancies in the public sector. This is an important point, that sheds light on the mechanism of the "leadership" or "demonstration" effects of public wages, discussed in Lamo, Pérez, and Schuknecht (2012). These effects can only be large, if there are many open vacancies, that can credible be used as a threat to workers. We have already seen that there is much lower turnover in the public-sector. Suppose that at the limit, there is no turnover - the public sector is a bubble, no one leaves, no one comes in. If the government increases pay, is it credible for any private sector worker to use it to bargain for higher wages? The employer could just say, go a head, try to get into the public-sector. Regarding the effects of public employment, again the crowding out effect on private employment will depend on the level of wage, and their spillovers to private-sector wage. Holmlund and Linden (1993) analyse the effect of public-sector relief jobs, and find that if they are offer to people that just lost their jobs, the effect on the private wage is lower than if offered to the unemployed.

Finally, the third approach uses the Burdett-Mortensen job-ladder model. This done by

Burdett (2012), Postel-Vinay and Turon (2007), Bradley, Postel-Vinay, and Turon (2017). This approach, puts emphasis on job-to-job transitions as determinants of wage growth, and of sector-to-sector transitions. Here, the public-sector wages affect to private-sector wages by affecting the reservation wage. The arrival rates in both sector are random, so there is no choice of sector. Postel-Vinay and Turon (2007) and Bradley, Postel-Vinay, and Turon (2017) most important insight, is that the comparison between public and private sectors, should not be based on naive wage comparison, as it commonly done in the micro literature. It should be done in life-time values, or present values, so they incorporate other elements such as the job-separation probability, the wage progression profile that tends to be flatter in the public sector, together with the probability of switching sector. While Postel-Vinay and Turon (2007) find (for males) "that measuring the premium in terms of wages rather than lifetime values leads one to overestimate the benefit of public sector employment," Bradley, Postel-Vinay, and Turon (2017) "find that the premia measured in lifetime values and in wages are roughly similar across the entire distribution for low-skill men, low-skill women, and high-skill women, while the lifetime-value premium is larger than the wage premium for high-skill men."

Perhaps the reason for different results, rely on the data treatment of sector-to-sector transitions, in particular, the problem of misclassification of the sector of work. Misreporting of the sector is not a serious problem in computing the overall stock of public and private sector employment, but it might overstate the transitions from public to private sector (and vice versa). Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) and Chassamboulli, Fontaine, and Gomes (2020), correct the transition between sector for spurious transitions and find that in the US, France, the UK and Spain, 17, 32, 55 and 87 percent of the flows, respectively are spurious. Bradley, Postel-Vinay, and Turon (2017) adjusts for spurious transitions but Postel-Vinay and Turon (2007) do not.

6.5   Illustration of the usefulness of these models

Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) provide an interesting illustration of the usefulness of these models. They try to have a metric to evaluate the differences in job-separation rates, using a simple back-of-the-envelope calculation, based on the Bellman equation of employment and unemployment, stipulated by search models:

$$rV^e = \frac{w^{1-\sigma}}{1-\sigma} - \delta(V^e - V^u), \tag{3}$$

$$rV^u = \frac{(z \times w)^{1-\sigma}}{1-\sigma} + f(V^e - V^u), \tag{4}$$

where the V^e and V^u are the value of employment or unemployment, w the wage rate, z the flow value of unemployment expressed as a replacement rate of the wage, f the job-finding

rate, δ the job separation rate, σ the degree of risk aversion and r the discount rate. Using these two equations, they can calculate the value of a lower job-separation rate. The exercise is to calculate what fraction of their wage private-sector workers would be willing to give up to have the same job-separation rate as public-sector workers.

They consider two cases. In the first case, workers are risk-neutral ($\sigma = 0$), meaning that the value from job security comes only from spending a smaller fraction of time unemployed. This provides a lower bound on the value of job security. In the second case, they consider risk-averse workers ($\sigma = 2$) with no method of savings, which they interpret as an upper bound. Using the two equations, they calculate $V^e - V^u$ and substitute back in equation 3 in order to get the value of employment as a function of wage, separation rate, job-finding rate, unemployment replacement rate, risk aversion and interest rate. For two different separation rates, δ^1 and δ^2, the ratio of wages that equate the value of employment is given by:

$$\frac{w^2}{w^1} = \left[\frac{(r + \delta^2 + f)}{(r + \delta^1 + f)} \frac{(r + \delta^1 \times z^{1-\sigma} + f)}{(r + \delta^2 \times z^{1-\sigma} + f)} \right]^{\frac{1}{1-\sigma}}, \tag{5}$$

which, under risk neutrality, collapses to:

$$\frac{w^2}{w^1} = \frac{(r + \delta^2 + f)}{(r + \delta^1 + f)} \frac{(r + \delta^1 \times z + f)}{(r + \delta^2 \times z + f)}. \tag{6}$$

The ratio of the two wages depends on the value of unemployment – in particular, how bad it is relative to employment replacement rate) and how persistent it is (job-finding rate). Notice that when the replacement rate is 1, the four terms cancel out, meaning that workers would not be willing to sacrifice any wage for a lower job-separation rate. Naturally, if the flow value on unemployment is exactly the same as the value of working, differences in job-separation rates do not matter.

For the back-of-the-envelope calculation, they have five scenarios for the value of unemployment, created with different values for the replacement rate ($z = 0.3$, $z = 0.5$ and $z = 0.7$) and for the job-finding rate (the mean, minimum and maximum of the sample for each country). They do not use the unconditional job-separation rates from Figure 8, but some conditional job-separation rate extracted using logit models. Their results are in the Table 4.

The lower bound of the value of job security varies between 0.1 and 2.5 percent of the wage for this range of realistic scenarios across the four countries, and the upper bound varies between 0.2 and 6.9 percent of the wage. For the medium scenario for the value of unemployment, workers would value this job security between 1.6 and 2.9 percent for France, 0.8 to 1.6 percent for the UK and 0.5 to 1.0 percent for Spain and the US. Using the unconditional rates, the job-security premium is roughly double from the baseline numbers.

To have an alternative metric, we can use national accounts data from AMECO and FRED datasets on "Compensation of employees: general government" for 2015. The com-

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Table 4: Back-of-the-envelope calculation on public-sector job-security premium

	Scenario for value of unemployment					Government budget		
	Very low	Low	Medium	High	Very high	(medium scenario)		
	$z = 0.3$	$z = 0.3$	$z = 0.5$	$z = 0.7$	$z = 0.7$	Millions	% of GDP	% of Gov
	$f = min$	$f = mean$	$f = mean$	$f = mean$	$f = max$			Spending
Lower bound: risk neutrality ($\sigma = 0$)								
France	2.5%	2.2%	1.6%	0.9%	0.8%	4422 (€)	0.20	0.39
UK	1.5%	1.2%	0.8%	0.5%	0.4%	1430 (£)	0.08	0.19
Spain	1.3%	0.9%	0.6%	0.4%	0.2%	716 (€)	0.07	0.16
US	1.4%	0.8%	0.5%	0.2%	0.1%	9963 ($)	0.05	0.16
Upper bound: risk aversion ($\sigma = 2$) and no insurance								
France	6.9%	6.3%	2.9%	1.3%	1.1%	8241 (€)	0.38	0.72
UK	4.5%	3.5%	1.6%	0.7%	0.6%	2741 (£)	0.15	0.37
Spain	2.8%	2.1%	1.0%	0.5%	0.3%	1241 (€)	0.11	0.28
US	3.7%	2.2%	1.0%	0.3%	0.2%	18854 ($)	0.10	0.30

Note: The first five columns of table report the fraction of the wage that a private-sector worker is willing to forgo to have the same conditional job-separation rate as a public-sector worker in each country, depending on the replacement rate and job-finding rate. The discount rate r is set to 0.005 for France, the UK and Spain and to 0.0017 for the US. The budgetary value of job-security is based on 2015 data on wage compensation of government workers, GDP and total government spending provided by AMECO and FRED datasets.

pensation to government employees represents, respectively, 12.8, 9.1, 11,1 and 10.3 percent of GDP in France, the UK, Spain and the US. The numbers from national accounts will bias the size of the public-sector wage bill downward, because they only account for a subset of the total number of public-sector workers. Using the medium value of unemployment scenario and risk neutrality, the value of a lower job-separation rate is equivalent to between 0.05 to 0.2 percent of GDP, or, alternatively, 0.16 to 0.4 percent of total government spending. The upper bound is roughly double: between 0.10 to 0.37 percent of GDP or 0.3 to 0.72 percent of total government spending.

This exercise provides only an interval for the value of job-security in the public sector, as we are considering two extreme scenarios. In the lower bound, with risk-neutral workers, the value arises from differences in expected duration of the match. In the upper bound, we do not allow any self-insurance mechanism. Also, it is based on two-equations and not in a full-blown model. But the idea has been applied by Chassamboulli and Gomes (2019) to measure the job-security premium for workers with and without a college degree, Gomes and Wellschmied (2020) to measure, in the context of an incomplete markets life-cycle model with savings, the job-security, pensions and wage premia for workers with different ages, and by Gomes and Kuehn (2019) to measure the work-life balance an job-security premium for men and women.

- **Insight 18.** High public-sector wages generate unemployment through the length of queues or spillovers to private sector.

- **Insight 19.** Low public-sector wages generate recruitment problems.

- **Insight 20.** Increases in public employment raises (lowers) unemployment when public-sector wages are high (low).

- **Insight 21.** Low turnover in public sector restricts the wage spillovers to the private sectors.

- **Insight 22.** Asymmetry between sectors should be evaluated in present values than wage comparisons.

- **Insight 23.** The public sector offers a compensating differential in the form of job security, which can be measured using search and matching models.

- **Insight 24.** The job-security premium is higher when the job-finding rate and unemployment benefits are low, and when risk aversion is higher.

# 7 Dimensions of Heterogeneity of Public Employment

7.1 Education

7.1.1 Deeper on the heterogeneity of public employment

The US government hires 16 percent of all employed workers. However, this number masks sizable heterogeneity across types of workers. The left panel of Figure 8 reports the government employment share for nine educational categories, from few years into primary education until tertiary education. The relationship is almost monotonic. The government hires fewer than 5 percent of workers without education beyond the 9th grade. At the very top, the government hires one third of all employed workers with Masters or Professional degree or who hold a PhD. Although this fact is not necessarily common knowledge, it has been previously documented. See, for instance the Handbook of Labour Economics chapter by Gregory and Borland (1999).

Using CPS data, we confirm the stylized fact in the literature that the wage schedule of the public sector is compressed across educational levels, with higher (lower) pay for low (high) educated workers vis-à-vis the private sector. This is shown in the right panel of Figure 8. The public-sector wage premium is higher than 10 percent for workers with little or no education and close to -10 percent for workers with a doctoral degree.

Following the literature that finds the great divide occurs for tertiary educated workers, we summarize education into two categories: college and no-college. College includes workers with an Associate degree, Bachelors, Master and Doctorate. We include workers that attended but not completed college in the no-college category. Still, one should keep

Figure 8: Public-Sector Employment Share and Wage Premia By Educational Levels, US
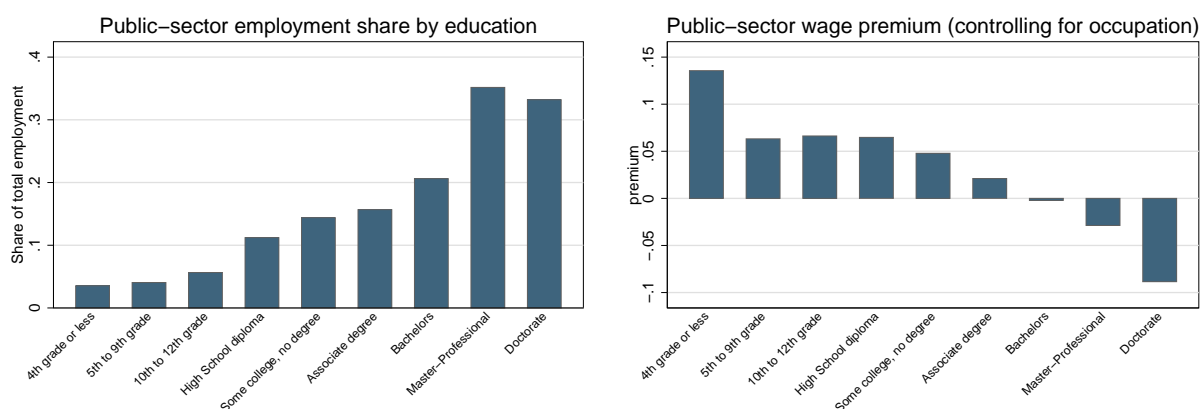
Note: Taken from Garibaldi, Gomes, and Sopraseuth (2019). The graph on the left shows the fraction of public-sector employment out of total employment for each educational level. Government workers (Federal, State and Local government), fraction of employment of workers age 16 to 64 with a given level of education. The graph of the right shows the public-sector wage premium, estimated by regressing the log of hourly wage on a public-sector dummy and controls (2-digit occupations, age, gender, region, year and a part-time dummy), separately for workers with different education levels. CPS data, average between 1996 and 2018.

in mind the further heterogeneity within these groups.

Table 5 reports the accounting definition used by Garibaldi, Gomes, and Sopraseuth (2019). We normalize the size of the employment pool by 1, and we let n and $1-n$ denote respectively the share of employed workers with and without a college degree. College workers are indicated with subscript 1 while no-college workers with subscript 2. Superscript g refers to the government/public sector while superscript p refers to the private sector. We thus indicate with l_1^g the stock of college workers employed in the public sector (similarly for the other 3 categories).

Figure 15 shows the bias of the public sector towards workers with higher education in the US, UK, France and Spain. The top-left panel shows the fraction of public employment out of total employment for workers with and without a college degree (l_1^g/n and $l_2^g/(1-n)$). The top-right panel shows the fraction of college graduates out of total public and private employment (l_1^g/l^g and l_1^p/l^p). UK and France have larger public sectors (more than 22 percent of total employment), while Spain has similar levels as the US. In all the four countries the public sector hires significantly more workers with at least a college degree.

Given the two-by-two matrix described in Table 5, we further summarize the education bias in the public sector with one of two indicators. The first indicator is the ratio of public employment shares r^g, simply defined as the ratio of public employment share for college workers over the public employment share for non-college workers. The second statistics is the education intensity ratio ei^g, defined as the ratio of the share of college graduates out of public sector workers over that of the private sector. Formally:

$$r^g = \frac{\frac{l_1^g}{n}}{\frac{l_2^g}{1-n}}, \qquad ei^g = \frac{\frac{l_1^g}{l^g}}{\frac{l_1^p}{l^p}}.$$

These two statistics, shown at the bottom of Figure 15 are complementary. In the case of perfect symmetry across sectors, both statistics would have a value of 1. The statistics are above 1.4 for the four countries reported. It is lower in France and higher in Spain. The US has a ratio of public employment shares of 2 and an education intensity ratio of 1.5. In the remaining of this section, we focus on the ratio of public employment shares.

To account for the education bias, a first candidate is to look at the types of services

Table 5: Basic Accounting With Two Sectors and Two Education Categories

	Public sector	Private sector	Total
College	l_1^g	l_1^p	n
No-college	l_2^g	l_2^p	$1-n$
Total	l^g	l^p	1

Note: Government (g), private (p), college (1), no-college (2). Total employment is normalized to 1. Share of college in total employment (n).

Figure 9: Public-Sector Education Bias: Two Simple Indicators
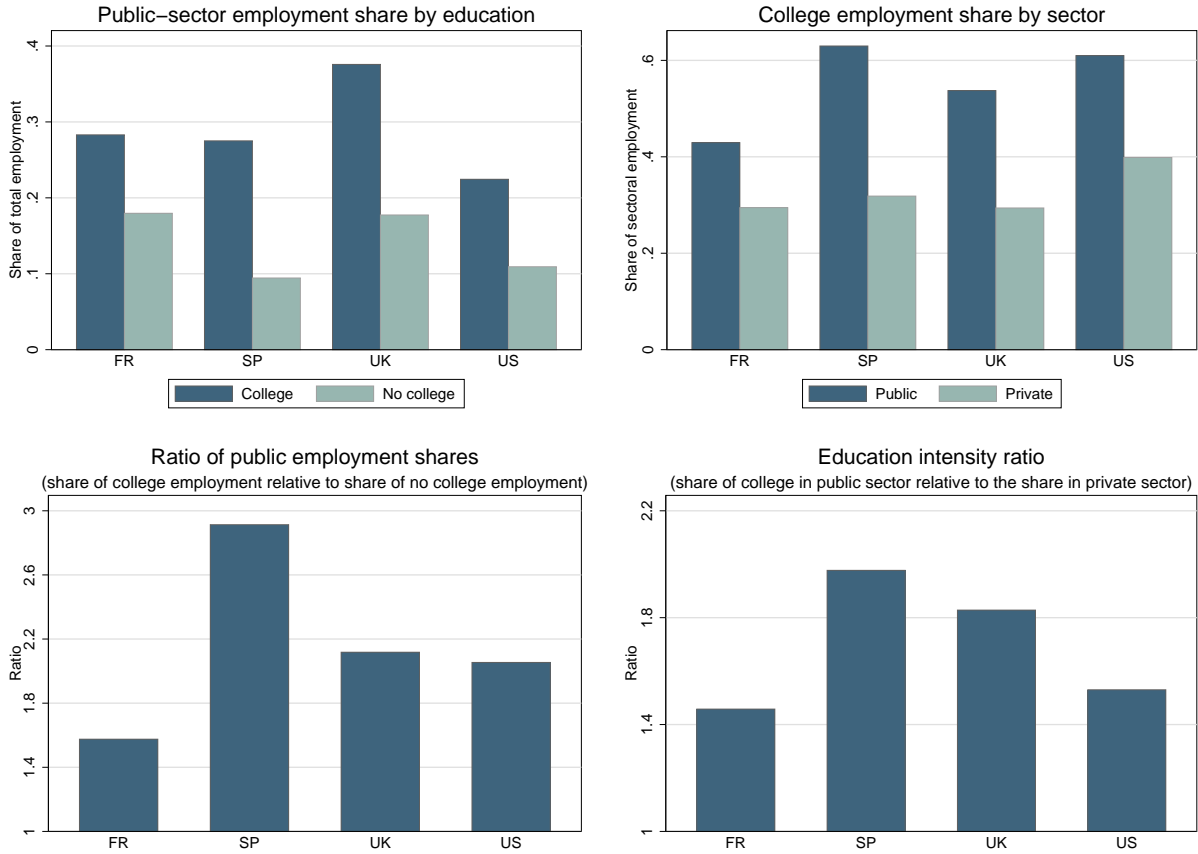
Note: the top-left graph shows the public employment shares, the fraction of public-sector employment out of total employment for college and not college graduates. The bottom-left graph shows the ratio of public employment shares (r^g). The top-right graph shows the education intensity by sector, the share of public-private workers that have a college degree. The bottom-right graph shows the education intensity ratio (ei^g). For the United States the data is take from CPS (1996-2018), for the United Kingdom from the UK Labour Force Survey (2003-2018), for France for the French Labour Force Survey (2003-2018) and from Spain from the Spanish Labour Force Survey (2005-2018). For details on the methodology for the European economies see Fontaine et al (2019).

that the government produces. One key empirical finding of this section is that the public-sector education bias holds across industries in the US, France and the UK (Figure 16).[4] On the one hand, even when excluding the Health and Education industries, industries that naturally employs a large share of graduates, the bias remains, although with lower ratio. The US ratio of public employment shares is 1.8 instead of 2. On the other hand, even within the health and education industries, the public sector hires a larger fraction of graduates than the private sector, leading to a ratio larger than 1.

To dig further into the composition of public-sector jobs, we look at the occupational classification from 3-digit ISCO-08 in the US.[5] We consider only occupations that are common to the two sectors, where the share of public employment in total employment is larger

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[4]The Spanish LFS does not allow for a disaggregation of public employment by industry.

[5]CPS occupational code is based on 2010 Census 3-digit occupational classification. We use a cross-walk in order to classify occupations based on 3-digit ISCO-08. This occupation classification provides clear guidelines for grouping occupations.

Figure 10: Public-Sector Employment Share Across Industries and Occupations

Industries

3-digit Occupations
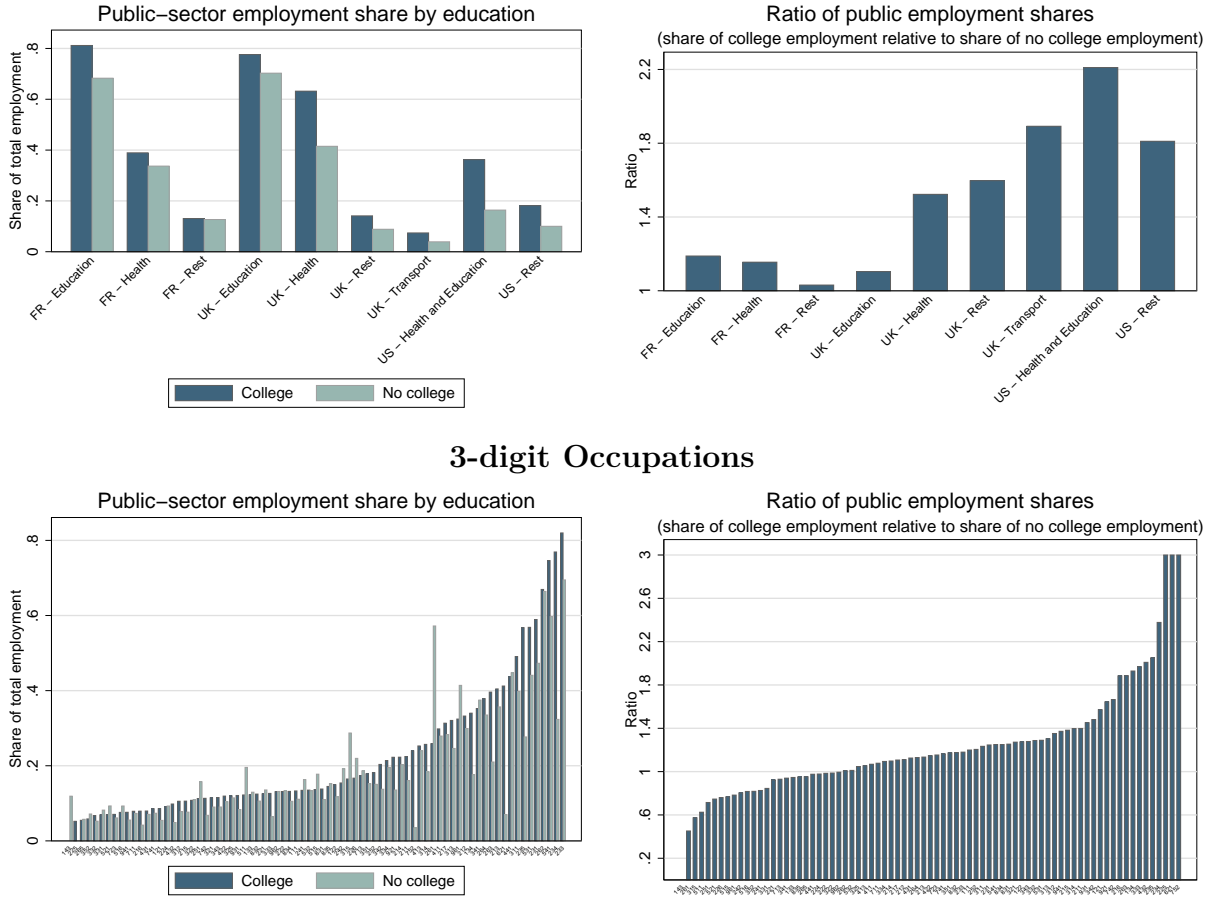
Note: 1st panel uses French, Spanish, UK Labour Force Surveys and the CPS. 2nd panel: CPS data, average between 1996 and 2018. 3-digit occupations that have an overall share of public-sector employment between 0.05 and 0.95. On the right-hand graph, the ratio was capped at 3 for readability.

than 5 and below 95 percent.[6] We find that, in total, two-thirds of the occupations have ratio of public-employment shares larger than 1.

One element that has been pointed is that the education of workers, do not refer to the job that they perform. Another possible explanation for a over-representation of educated workers in the public sector is more underemployment. We refer to *underemployment u*, as to the stock of workers with college employed in jobs typically performed by no-college workers. This is a purely empirical construct. We provide more evidence of underemployment across countries, as well as across public and private sector. We need first some accounting. Similarly as above, n is the stock of employed college workers, and $1 - n$ is the stock of non college workers. Let j_1 be the stock of skilled related jobs, only filled by graduates, so that $j_1 = n - u$. Further, j_2 is the stock of unskilled jobs that is filled by workers without college

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[6]In doing so, some top-paid occupations are dropped (such as Manufacturing, mining, construction, and distribution managers; Architects, planners, surveyors and designers) as well as some low-paid jobs (such as Domestic, hotel and office cleaners and helpers, Vehicle, window, laundry and other hand cleaning workers, Waiters and bartenders).

or underemployed college workers, $j_2 = (1 - n) + u$. We define the *underemployment rate*, indicated with $\tilde{u}$, as the fraction of unskilled jobs performed by college graduates. Formally:

$$\tilde{u} = \frac{u}{j_2}.$$

Similarly, we define the underemployment rate in private and public sector as

$$\tilde{u^p} = \frac{u^p}{j_2^p} \quad , \quad \tilde{u^g} = \frac{u^g}{j_2^g}.$$

We use the Survey of Adult Skill (PIACC) data to calculate the underemployment rates. Our main approach is related to the methodology used by OECD. We identify well-matched individuals as those who neither feel they have the skills to perform a more demanding job nor feel the need for further training to be able to perform their current job satisfactorily. By occupation (isco 1), we calculate the average and standard deviation of the number of years of completed education for (self-reported) well-matched workers. The required educational attainment of a given occupation is calculated as the mean of completed schooling of all well-matched workers (with a symmetric band of 1.96 standard deviation). Workers are defined as underemployed when their years of completed education are 1.96 standard deviation above the mean of well-matched workers in their occupation.

More formally, for individual i in occupation j, with years of schooling e_{ij}, the dummy "underemployed" u_{ij} equals:

$$u_{ij} = \begin{cases} 1 & \text{if} & e_{ij} > \overline{e}_j^{wm} + 1.96\sigma_{e_j^{wm}} \\ 0 & \text{otherwise} \end{cases}$$

where $\overline{e}_j^{wm}$ ($\sigma_{e_j^{wm}}$) refers to the mean (standard deviation) years of completed education of

Figure 11: Underemployment Rate Across Countries
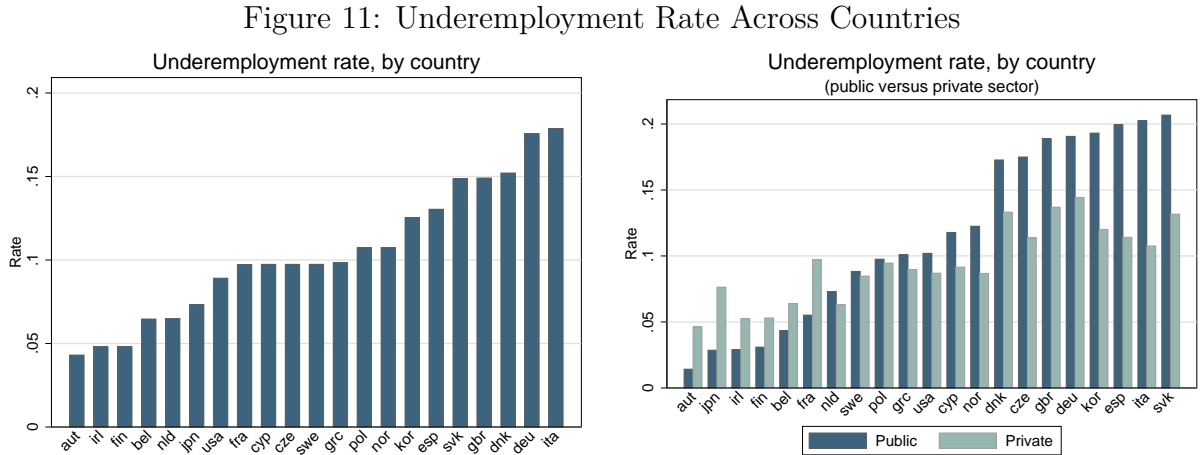
Note: PIAAC (Survey of Adult Skills). By occupation, we calculate the mean and standard deviation of the number of years of education of (self-reported) well-matched people. We consider as underemployed workers whose years of education are 1.96 s.d. above the mean years of education of well-matched workers in an occupation.

well-matched workers in occupation j.

The left graph in Figure 11 reports underemployment rate across countries. On average, more than 10 percent of unskilled jobs are held by people that have years of education well above those of well-matched people in that occupation. The minimum level is just below 5 percent in countries such as Austria and Ireland. The maximum is above 17 percent in Italy. Our key empirical evidence is in the graph on the right. In 15 out of 21 countries (more than 70% of our sample) the underemployment rate is larger in the public than in the private sector. In the US, the underemployment rate is 10.2 percent in the public sector and 8.7 percent in the private.

7.1.2 Deeper on the heterogeneity of public wages

Beside the heterogeneity in public employment in terms of education, there is also substantial heterogeneity in pay. The empirical literature finds that higher public-sector wage premia for workers with lower education. The wage compression between education categories is a stylized fact. Figure 12 shows the estimates of the public-sector wage premium by Christofides and Michael (2013) for workers with tertiary education and without. The average across countries premium of workers with college degree is 3.9 percent and for workers without is 10.6. percent. In their sample, the only exception to this pattern was found in Eastern European countries like Hungary, Estonia nd Romania, and in Norway. In some countries the difference can be huge. In Portugal, in 2008, workers without college were paid more than 20 percent compared to the private sector counterparts, while workers with college were paid less in the public sector. The pay rises in 2009 and the wage cuts to the highest earners that followed, further accentuated the wage compression.

Figure 12: Public-sector wage premium, by education, across Countries
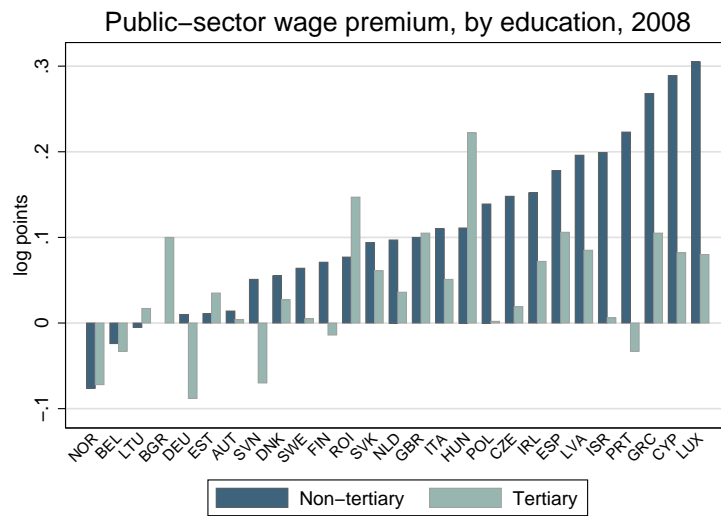

Note: The graph shows estimates of the public-sector wage premium by Christofides and Michael (2013), using EU SILK data for 2008. The authors decompose into explained and unexplained components. Figure plots unexplained component for workers with tertiary education and for workers without.

We should be careful when analysing results from studies estimating the public-private sector wage differentials, because they give us one picture in one specific point in time. The public-private sector wage differentials can change quickly. We use microdata from the CPS and the *Structure of Earnings Survey* (SES) for the waves of 2002, 2006, 2010 and 2014, to reproduce some findings of the empirical literature estimating public-private wage differentials. We calculate the public-sector wage premium by education for these four countries. We first split the sample for college graduates and workers without college. We then run regressions of the log gross hourly earnings on a dummy for the public sector, controlling for region, gender, age, occupation, finer education categories and a part-time dummy for each the two groups and for each year of the survey. The estimated premia alongside with a 95 percent confidence intervals are shown in Figure 13.

The first result confirms that the premium for workers with lower qualifications is always higher than for college graduates in all countries. This reflects the wage compression across education groups that has been found in the literature. The second result is that the average premium and the compression varies substantially across countries. For instance, the estimated premia for the UK are consistently 3 to 4 percentage points higher than for the US. The third result is the premia varies across time. This can reflect either a different evolution in the private sector of skilled and unskilled wages, that was not incorporated in the public-sector pay scale, or a deliberate policy. For instance, in the beginning of the

Figure 13: Labour market stocks and flows, US, UK, France and Spain
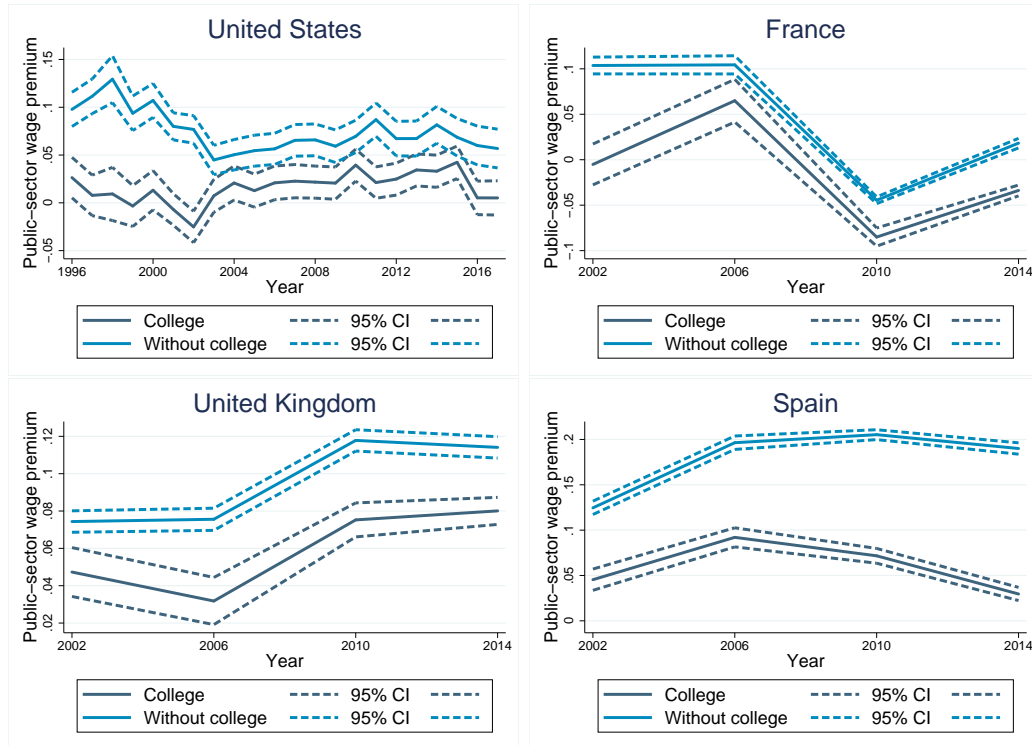
Note: *Structure of Earning Survey (2002, 2006, 2010, 2014) and CPS data between 1996 and 2017.* Chassamboulli and Gomes (2019)

Euro-Area crisis in Spain, the highest public-sector wages had a cut of 10 percent while the lowest wages did not face direct cuts. One can see the effects of this policy in the graph. The estimated premium for college graduates in Spain fell from close to 10 percent in 2006 to 3 percent in 2014, while the estimated premium for workers without college stayed roughly constant. In France, both premia fell by close to 15 percentage points between 2006 and 2010.

The fact that the premia can change rather quickly is relevant for our interpretation of the estimates of the public-private wage differentials, and brings a note of caution in the quantitative section and the drawing of policy conclusions. One should be aware that they refer to an average of the policy between 2002 and 2014 and do not reflect the current policy.

- **Fact 13.** Public employment is biased towards more educated workers.

- **Fact 14.** The education bias holds within industries and in two thirds of 3-digit occupations.

- **Fact 15.** In most countries, underemployment is higher in the public sector.

- **Fact 16.** Public-sector wages are compressed: higher premium for workers with lower education and lower premium for workers with higher education.

- **Fact 17.** Public-sector wages premia can change quickly either because of active government policies or because of developments in the private sector pay structure that are not reflected in the public-sector pay structure.

7.1.3 Insights from the literature

Gomes (2018) builds a quantitative macro model with search and matching frictions and segmented that incorporates heterogeneity in education. In the stylized two-sector search and matching model. If the government sets a high wage, it induces too many unemployed to queue for public sector jobs, thus, reducing private sector job creation and increasing unemployment. Conversely, if it sets a lower wage, few unemployed want a public sector job and the government faces recruitment problems. Gomes (2018) shows that, the heterogeneous public sector wage premium suggests that we may have the two inefficiencies operating simultaneously, with long queues and high unemployment for low-educated workers and recruitment problems for the more educated workers workers.

The phenomenon of long queues for public sector jobs is very realistic. In 2017 the Bank of Italy advertised 30 job openings. The number of applicants was 85,000. The following newspaper quote was take from Geromichalos and Kospentaris (2020):

> *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.*

This quote hints at the inefficiencies from the high wages for low-skilled positions, both in terms of the queues they generate, but also the fact that they foster underemployment. It also puts emphasis on the importance of job-security for workers in more unskilled positions.

Chassamboulli and Gomes (2019) study how public-sector employment and wage policies, heterogeneous across education groups, influence incentives to invest in formal education and the employment of high- and low-educated workers. The mechanisms and the quantitative effects depend on the labour market structure - segmented markets (with entry barriers) and random search (no entry barriers). If the two sectors are segmented, an increase of skilled public-sector wages has a small positive impact on the proportion of highly educated and a larger negative impact on skilled private employment. If search across the two sectors is random, it has a large positive impact on both education and skilled private employment. In segmented markets, when skilled public-sector wages increase, more people queue for these jobs. The consequent decrease in the job-finding rate partially offsets the increase in the gains of education. In the extreme case, were the two sectors are segmented but

entry into the public sector is free, the increase in unemployed queuing for public-sector jobs fully neutralizes the increase in the value of education and educational composition remains intact. However, if workers search randomly for jobs in both sectors such offsetting decrease in job-finding rate is not possible. The value of education goes up by more, leading to larger increases in the proportion of high-educated in the labor force. As unemployed search randomly for jobs, a higher pool of educated workers leads to a higher level of skilled private employment, but a lower level of unskilled private employment. Quantitatively, in the model calibrated to four economies - United States, United Kingdom, France and Spain - a 10 percent increase in skilled wages raises the number of educated workers by 0 to 0.18 percent under segmented markets, and by 2.5 to 6.9 percent under random search. Bottom line, under directed search the effects of wages is very large on employment and low on education. Under random search the effect are small on employment and larger on education.

These results are consistent with a recent empirical paper by Somani (2019) that exploits a public-university expansion in Ethiopia together with a shift of demand of public organizations from workers without college to workers with a college degree. Education attainment increased after the expansion, but only in districts where the public-wage premium is large.

Using the methodology of Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020), Chassamboulli and Gomes (2019) calculate the job-security premia for different types of workers. They find that this premia varies substantially across countries and is different for workers with and without college. It is larger in countries where unemployment is more persistent and the unemployment benefits are low, and it is larger for unskilled workers. For the United States, for instance, the job security premium varies between 0.5 to 1.1 percent for skilled workers and between 1.7 to 5.9 percent for unskilled workers. In Spain, the values range from 2.5 to 7.0 percent.

Other papers that consider explicitly consider heterogeneity in terms of education within a search and matching framework with random search are Chassamboulli and Gomes (2019), Albrecht, Robayo-Abril, and Vroman (2018) and Navarro and Tejada (2019). Navarro and Tejada (2019) study the interaction between public-sector employment and the minimum wage, more likely to arise in low-educated workers.

While search and matching frictions naturally allow the presence of wage differentials and the study particular aspects of public employment, such as the role of job security, some of its consequences can be more clearly understood with a frictionless labour market. More precisely, the skill mix chosen by the government is bound to affect the skill mix of the private sector, even in a full employment context. Domeij and Ljungqvist (2019) build a neoclassical model, in the spirit of Finn (1998), where the public sector hires an exogenous number of skilled and unskilled workers, to compare the evolution of the skill premium in US and Sweden. By absorbing a large fraction of workers with lower educational attainment, fewer workers are available in the private sector, which raises their wages. They point out

that the expansion of the Swedish public sector, that hired more low-skilled workers, can explain the divergence of the skill premium between the two countries. Gomes and Kuehn (2017) study, in a model of occupational choice, the effects of education-biased hiring in the public sector on the occupational choice of entrepreneurs and on firm size. Wilson (1982) uses a framework of optimal linear taxation to study whether the public sector should alter the composition of its workforce in favor of high or low-skilled individuals. As he shows, the optimal policy involves a distortion of the public workforce composition, but its direction depends crucially on whether human capital formation is endogenous or not.

Garibaldi, Gomes, and Sopraseuth (2019) follow Domeij and Ljungqvist (2019), but allow for wage differentials and endogeneise the government skill mix. They provide three possible explanations for why public employment is biased towards educated workers, two explanations related to demand of workers by the government and a third explanation related to the supply of workers and their selection into the public sector. In general the government has control over which education it wants its workers to possess, because it can set minimum education requirements for a particular job. Within view, the first explanation is technological – governments hire more educated workers because they are more important inputs in the production of their services. A second explanation is related to the wage schedule. A cost-minimizing government constrained to pay a compressed profile of wages (i.e. due to union pressures), shifts its ideal composition from the (relative more expensive) less qualified workers to the (relative less expensive) more qualified workers. The third explanation is underemployment (over-qualification), which is well described in the above newspaper article. If wages of unskilled public-sector jobs are very high, they attract workers with more qualifications. This last channel amplifies the role of the wage schedule.

The endogenous choice which workers to hire generates an important, but counter-intuitive result. During the Euro Area crisis, many governments reduced public-sector wage dispersion by cutting high wages while protecting low-wage workers. They find that such policies, turn out to raise private sector wage inequality. More wage compression alters the skill-mix in the public sector from unskilled to skilled jobs. The skill-mix in the private sector shifts towards low-educated workers, so their wages fall while wages of high-educated workers go up. In their quantitative results, a one percent increase in unskilled public wages raises skilled private wages by 0.07 percent and lowers unskilled private wages by 0.06 percent. In European countries the elasticities are up to four times larger. While decreasing wage inequality for workers in the public sector, well-intended policies can actually backfire by increasing wage inequality for everyone else in the economy.

- **Insight 25.** The negative effect of high public-sector wages on unemployment and queues are stronger for workers with lower education.

- **Insight 26.** The negative effect of low public-sector wages on recruitment problems are stronger for highly qualified workers.

- **Insight 27.** Asymmetric public employment and wage policies affect educational attainment.

- **Insight 28.** Job-security premium is higher for workers with lower education, reinforcing the compensation asymmetry.

- **Insight 29.** High public wages for low-skilled jobs shifts demand away from this workers by the government, increasing their supply to and lowering their wage in the private sector.

- **Insight 30.** High wages for low-skilled public-sector jobs fosters underemployment.

7.2 Gender

7.2.1 Stocks and wage premium

The public sector tends to hire significantly more women than men. The left graph in Figure 14 displays the fraction of women out of all workers in the public sector, as well as the fraction of women out of all workers in the total economy for 20 OECD countries. In all countries, women's share in public employment is larger than their share in total employment. With the exception of Greece and Luxembourg, the majority of public sector workers are women, their share reaching 70 percent in Sweden.

The over-representation of women in the public sector has been the subject of interest in the sociology literature, more than in the economics literature. See for instance Gornick and Jacobs (1998) for a cross-country study, Fuller (2005) for a case study in British Columbia, and Kolberg (1991) describing how the expansion of the Scandinavian welfare state and the consequent rise of public employment has led to more women participating in the labor market. In the economics literature, this well know fact has attracted less attention. de la Rica, Dolado, and Llorens (2007) find that unemployed and inactive women are much more likely to search for public sector jobs than their male counterparts. Other studies regarding public employment and gender tend to focus on one particular country or can be characterized as mostly descriptive. Rosen (1996) study on the expansion of the Swedish public sector is maybe one of the first to highlight the strong over-representation of women in public employment. His analysis reveals that between 1963 and 1993 employment of women in local government increased fourfold while that of men only doubled. Adserà (2004) suggests that higher fertility rates in Scandinavian countries are partly due to the higher share of women in stable public sector jobs. In line with this finding, Pertold-Gebicka, Pertold, and

Figure 14: Public-Sector Employment and Wage Premia, by gender, cross-country aggregate measure
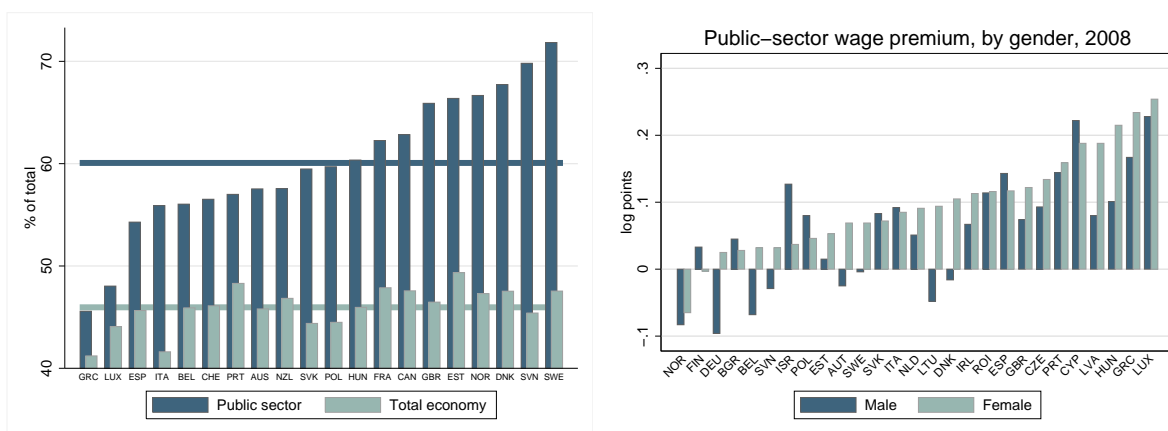

Note: the left-graph shows government employment as a fraction of total employment, OECD data. The graph on the right shows estimates of the public-sector wage premium by Christofides and Michael (2013), using EU SILK data. The authors decompose into explained and unexplained components. Figure plots unexplained component for men and women.

Datta Gupta (2016) highlight that after the birth of their first child, Danish women tend to switch from the private to the public sector, even accepting wage losses.

The right graph in Figure 14 shows the estimates of the unexplained component of the public-sector wages premium for men and women, by Christofides and Michael (2013). With a few exceptions, the public-sector offers a higher wage premium for women. The average across the countries in the sample if a premium on 9.7 percent for women and of 5.9 for men. This is likely a reflection of a lower gender wage gap in the public sector compared to the private. The higher public-sector wage premium for women has been found in many papers. For France, Italy, and the UK, Lucifora and Meurs (2006) find that for women, wages in the public sector are always higher compared to the private sector while for men in the upper part of the distribution the public-private wage gap turns negative. Panizza (2001) finds that, in Latin American countries between 1993 and 1999, the public-sector wage premium is about 8 percent for women and -1 percent for men.

Figure 15: Different measures for the over-representation of women in public employment
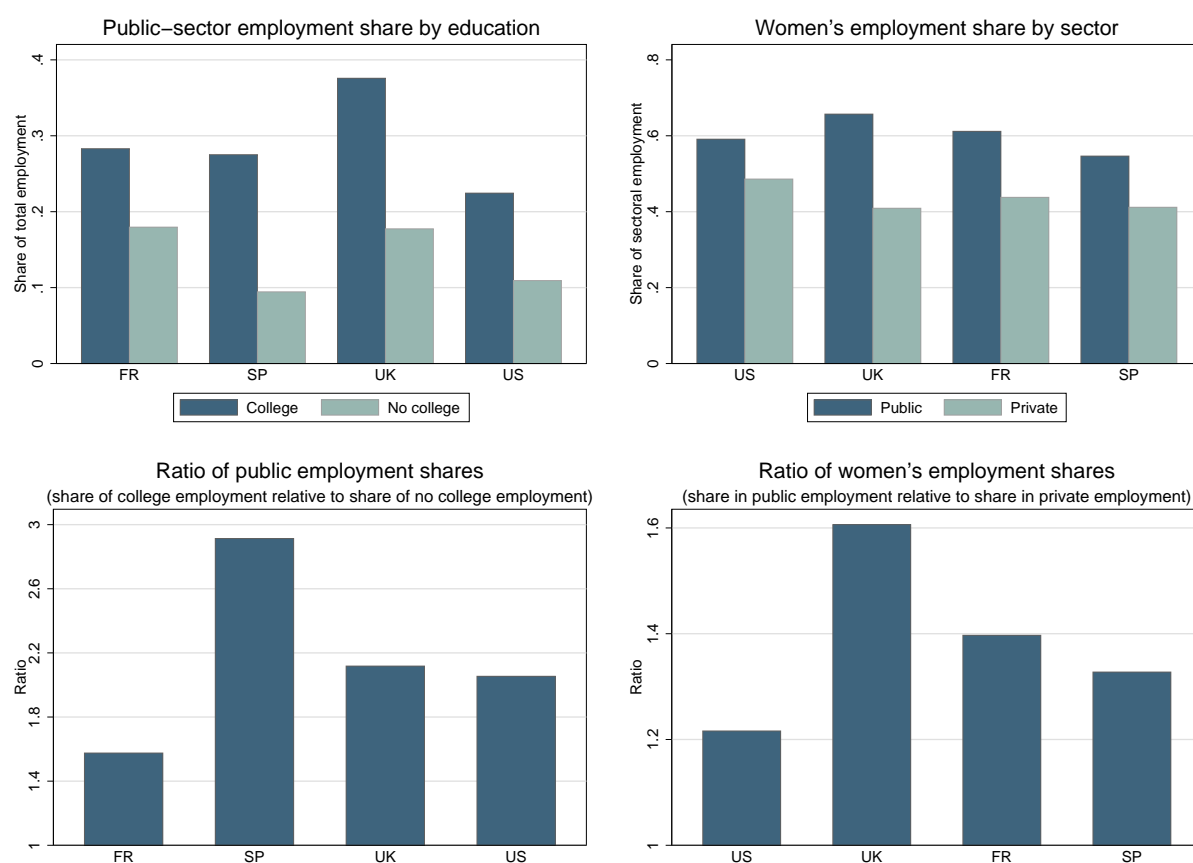
Note: Taken from Gomes and Kuehn (2019). At the top, the graph on the left shows the public sector employment shares by gender and the graph on the right the share of women in sectoral employment. At the bottom, the graph on the left shows the ratio of public employment shares (rg), and the graph on the right shows the ratio of women's employment shares (rf). For the United States the data is taken from the CPS (2003-2018), for the United Kingdom from the UK Labour Force Survey (2003-2018), for France from the French Labour Force Survey (2003-2017) and for Spain from the Spanish Labour Force Survey (2003-2018).

Figure 16: Over-representation of women in public employment by industry and occupation

Industries

3-digit Occupations
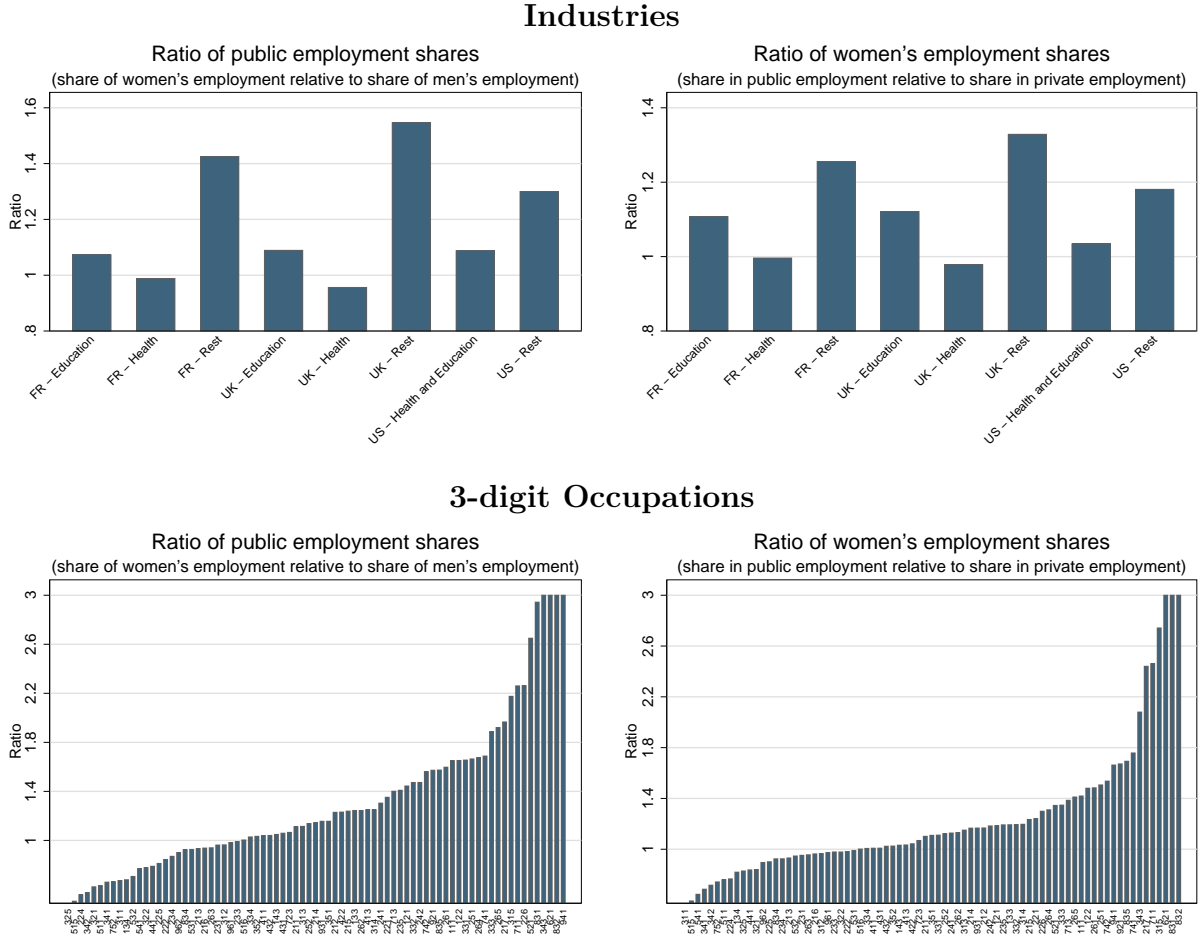
Note: the 1st panel uses the French and the UK Labour Force Survey and the CPS (2003-2018). The 2nd panel shows CPS data, average between 1996 and 2017. 3-digit occupations that have an overall share of public sector employment between 0.05 and 0.95. The ratios were capped at 3 for readability.

Using microdata, we can document further aspects of the over-representation of women. We can apply a similar accounting definition as we did with education. We denote the size of the employment pool by e, and e_m and e_f respectively are the number of men and women in total employment. In terms of sectors, an additional subscript g refers to the government/public sector while subscript p refers to the private sector. Hence for example $e_{g,f}$ indicates the stock of employed female workers in the public sector. The top two graphs of Figure 15 display what we call the raw statistics: the share of public sector employment by gender and the share of women in sectoral employment respectively.

The size of the public sector varies across countries, and is larger in the UK and France with public sector employment representing around 22 percent of total employment, and it is smaller in the US and Spain where it represents 16 percent of total employment. Despite differences in the size of the public sector, in all countries the share of public sector employment is larger for women who are the majority of all public sector workers.

We can again construct two indicators for the over-representation of women in public employment. The first indicator rg is the ratio of public employment shares, defined as the public sector employment share for women over the public sector employment share for men. The second indicator rf is the ratio of women's employment shares, defined as the share of women out of all public sector workers over the share of women out of all private sector workers. Formally:

$$rg = \frac{\frac{e_{g,f}}{e_f}}{\frac{e_{g,m}}{e_m}}, \qquad rf = \frac{\frac{e_{g,f}}{e_g}}{\frac{e_{p,f}}{e_p}}.$$

The two bottom graphs of Figure 15 display these two indicators for all four countries. In the case of perfect gender symmetry across sectors, both indicators would take on a value of 1. However, for the four countries the ratio of public employment shares lies above 1.4, and the ratio of women's employment shares lies above 1.2, indicating that women are clearly over-represented in public employment.

We think that the nature of the over-representation of women in public employment is related to supply rather than demand. We do not think governments are actively hire more women rather than men. In job requirement it is illegal to discriminate between men and women. Instead, we think that it relates to supply, meaning that women select themselves more to the public sector. Beside the fact that relative wages are higher in the public sector for women. Another natural explanation for the over-representation of women in public employment could be that certain types of jobs that are predominately carried out by the government could be preferred by women. However, as the two top graphs of Figure 16 reveal, for the US, the UK, and France, once we exclude health care and education, while somewhat lower, women's public employment is still 20-50% higher than men's. Also, two-thirds of the 3-digit occupations also have higher over-representation of women. This means that there are other factors that are pushing women to work in the public sector, magnets that are stronger for women than men.

7.2.2 Stocks and flows by gender

To characterize gender differences in transition probabilities we calculate stocks and flows of men and women between states of employment in each sector, unemployment, and inactivity. Table 6 summarizes the key statistics. In all four countries, women's inactivity rates are more than 10 percentage points higher than those of men. In the US and the UK the male unemployment rate is higher than the female rate, but the opposite is true for Spain and France. On average 16.3 and 22.3 percent of all women work in the public sector, in France and in the UK respectively. In Spain and the US, differences by gender are smaller. The Spanish and the US public sector hire 8 and 13 percent of all women respectively. These numbers are different from the ones previously reported that only considered employed workers. Public sector workers have a much lower probability of becoming inactive or

Table 6: Labor market stocks and hazard rates by gender

Targets	US		UK		France		Spain	
	Men	Women	Men	Women	Men	Women	Men	Women
Stocks								
Private emp.	0.672	0.574	0.667	0.454	0.585	0.441	0.498	0.334
Public emp.	0.102	0.133	0.118	0.222	0.108	0.165	0.069	0.080
Unemployed	0.057	0.044	0.054	0.040	0.069	0.064	0.105	0.097
Inactive	0.169	0.249	0.162	0.284	0.238	0.330	0.329	0.490
Rates								
Unemployment	0.067	0.059	0.064	0.056	0.090	0.096	0.156	0.190
Inactivity	0.169	0.249	0.162	0.284	0.238	0.330	0.329	0.490
Transition probabilities								
$P \rightarrow U$	0.0161	0.0121	0.0151	0.0132	0.0203	0.0217	0.0417	0.0437
$P \rightarrow I$	0.0189	0.0274	0.0159	0.0295	0.0187	0.0269	0.0245	0.0450
$G \rightarrow U$	0.0060	0.0076	0.0064	0.0045	0.0079	0.0083	0.0203	0.0227
$G \rightarrow I$	0.0148	0.0200	0.0144	0.0179	0.0142	0.0180	0.0191	0.0274

Note: French, Spanish, UK Labour Force Surveys and the CPS (2003-2018). The transition probabilities report the probability of an employed worker to be unemployed or inactive in the following quarter (month in the US).

unemployed compared to private sector workers. While the probability of dropping out of the labor force is much higher for women compared to men, it is much lower for women working in the public compared to the private sector. The probability of an employed woman to withdraw from the labor force is 40 to 65 percent higher if she works in the private compared to the public sector. We use these differences in hazard rates from public and private employment to inactivity, for men and women, to identify differences in work-life balance between sectors.

In all four countries, the probability of dropping out of the labor force is higher for women than for men. For women in all three European countries, however this probability is lower if they work in the public compared to the private sector. In the US, the difference for women across sectors is almost insignificant. This conditional analysis also shows that in all four countries, the probability of moving to unemployment is lower for public compared to private sector workers. This difference in job security across sectors is highest in France, followed by the UK and Spain, and lowest in the US.

Finally, possibly one important element related to the over-representation of women in the public sector, is that public sector workers have fewer working hours. Indirect evidence of lower working hours, can be seen by differences in the estimated public-sector wage premia using hourly or monthly wages. According to Christofides and Michael (2013), the average estimated hourly premium for the 27 countries in the sample is 7.3 percent when using hourly wages, but only 5.1 percent when using the monthly. Further evidence, from the SES based on a regression with public-sector dummy is shown in Table 7. On average, public-sector workers work between 2.5 to 4.6 percent fewer hours.

Table 7: Public-sector hours premium

	US	UK	France	Spain
Panel B: hours regressions				
Public sector hours premium				
Public-sector	-0.025***	-0.038***	-0.028***	-0.046***
	(-25.01)	(-34.61)	(-37.03)	(-54.25)
Controls				
Demographic	X	X	X	X
Region and year	X	X	X	X
Tenure (quadratic)		X	X	X
Occupation	X	X	X	X
Part-time	X	X	X	X
Observations	1,021,443	625,869	593,950	876,274
R-squared	0.602	0.569	0.471	0.563

Note: Estimated by OLS regressions of the log of yearly gross earnings on a female dummy and a female dummy interacted with a dummy for working in the public sector, controlling for region, year, occupation, education, age groups, part-time, tenure and tenure squared. **Data for UK, France, and Spain for 2002, 2006, 2010 and 2014; for US for 1996-2018.**

- **Fact 18.** There is over-representation of women in the public sector.

- **Fact 19.** Women enjoy a higher public-sector wage premia than men.

- **Fact 20.** Public-sector workers work fewer hours.

- **Fact 21.** Women in the public-sector are less likely to withdraw from the labour force.

7.2.3   Insights from the theory

In terms of economic theory, despite the importance of the public sector in the female labour market, there are few attempts to study. The notable exception is Gomes and Kuehn (2019) that aim to explain the over-representation of women in the public sector. They build a search and matching model where men and women decide if to participate and if to enter private or public sector labor markets. They view the over-representation of women in public employment as driven by supply, meaning that it is not the government that acts explicitly to hire more women, but it is women who choose the public sector more so than men. They attempt to distinguish what fraction is driven by a preference for particular (public-sector) occupations and what is explained by public sector job characteristics that are related to management, organization and human resource practices in the public sector, that are more valued by women than men. In particular: (i) lower gender wage gaps and thus relatively

higher wages for women in the public sector,, (ii) possibilities of better conciliation of work and family life for public sector workers, (iii) greater job security in the public compared to the private sector. They find an important role for the characteristics of public sector-employment, in particular for Spain and France, a less for the UK and US.

One characteristic of the public-sector that contributes to attract more men is the job-security. Higher job security in the public sector actually reduces the over-representation of women because it is valued more by men than by women. This is due to the fact that women have, in general, a higher opportunity cost of working and lower wages, and hence job losses are more painful for men.

They use the approach of Fontaine, Galvez-Iniesta, Gomes, and Vila-Martin (2020) to calculate the work-life balance and the job security premia offered by the public sector for women and men. They find that the work-life balance premium is very high in Spain (25 to 36 percent), high in France and the UK (7 to 15 percent) and lower in the US (7 to 9 percent). In all countries, the job security premium is in the range of 1-4 percent. Women are willing to pay more for work-life balance, while men are willing to pay more for job security.

- **Insight 31.** The public-sector offers an extra compensation in the form of work-life balance, valued more by women.

- **Insight 32.** Lower gender wage gap in the public sector and preferences will always make the public sector attract more women.

- **Insight 33.** Public-sector employment and wage policies will affect more women.

7.3 Age

7.3.1 Some facts

The importance of the public sector in employment and the compensation it pays to workers have a strong life-cycle component. Regarding public-sector employment, Figure 17 shows its percentage out of total employment by age for the United States, United Kingdom, France and Spain. Public-sector employment represents a small fraction of total employment for young workers, specially under 30, but progressively grows, peeking at ages 50 to 60, a feature shared in the four countries. This is not driven by cohort effect, as shown in Figure 18. In these countries, the average age of a new hire in the public sector is four years older than the average hire in the private sector.
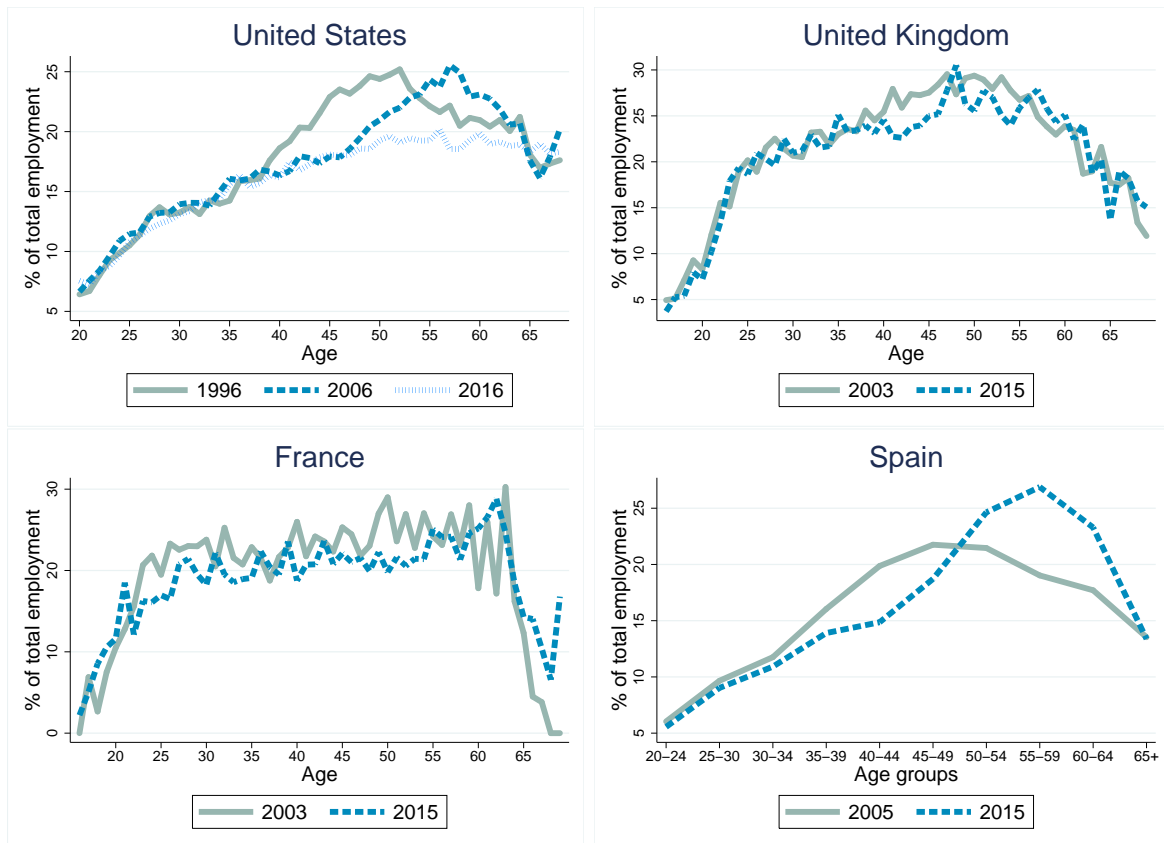
The empirical literature has documented heterogeneity in terms of pay. It finds, in general, higher public-sector wage premia for younger workers and flatter progression schedules. Figure 19 shows the estimated by Christofides and Michael (2013) for younger workers (aged 25 to 45) and older worker (aged 45 to 69). On average for the 27 countries, younger workers have a 9.1 percent wage premium in the public sector, but older worker only have 6.2

Figure 17: Public employment by age
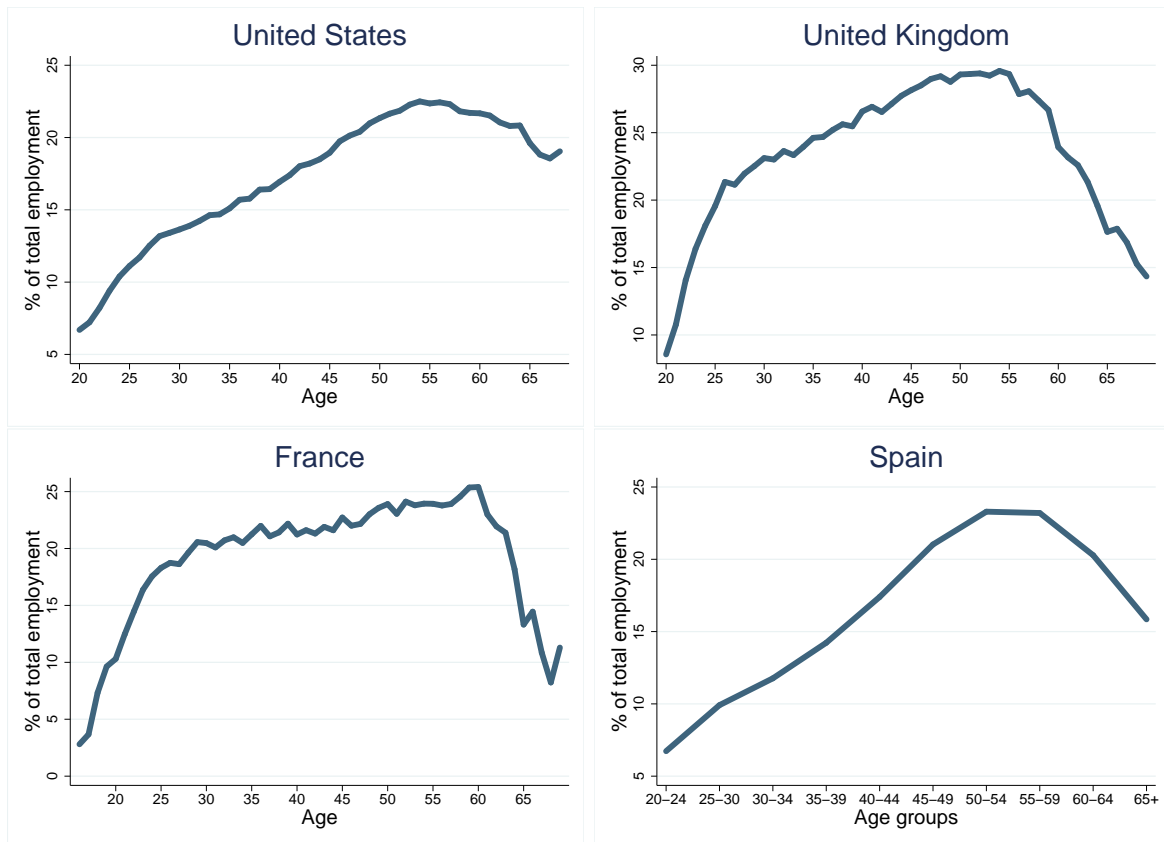
Note: The figure show public employment out of total employment by age. For the US the data is taken from CPS (1996-2017), for the UK from the UK Labour Force Survey (2003-2016), for France for the French Labour Force Survey (2003-2016) and from Spain from the Spanish Labour Force Survey (2005-2007). Taken from Gomes and Wellschmied (2020).

Figure 18: Public employment by age, cohort effects

percent.

However, wages are not the only form of compensation difference between the public and private sectors. Perhaps more relevant for older workers, is the fact that retirement benefits are often higher in the public sector. Traditionally, in many countries, public-sector workers have enjoyed separate pensions schemes with larger benefits and, sometimes with different retirement ages (see OECD (2016)). The OECD report describes the different regimes for civil-servants. Most countries now have fully integrated regime, but for many this followed a recent reforms from which newly hired civil servants are no longer covered by separate schemes, Greece (in 2011), Italy (in 2008) or Portugal (in 2006). Some countries like France or Germany have entirely separate regimes. Other countries are in between, either with separate regimes but with similar benefits like Sweden, Finland or Netherlands; of fully integrated but with top-up to civil servants, like UK, US, Canada, Australia, Ireland, Austria or Denmark.

The same report, shows some calculations by the OECD on the gross replacement rates for civil servants and private sector average earners, entering the respective sector at age 20 in 2014. Because they refer only to civil servants, only a subset of public-sector workers,

Figure 19: Public-sector wage premium, by age, across Countries
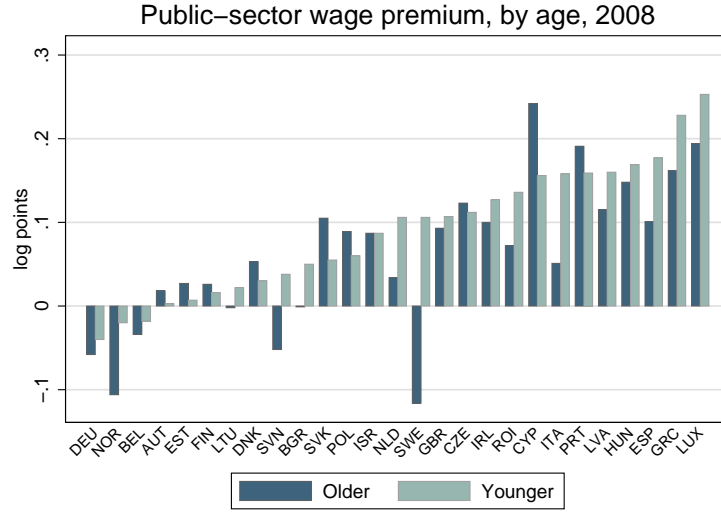
Public–sector wage premium, by age, 2008

Note: The graph shows estimates of the public-sector wage premium by Christofides and Michael (2013), using EU SILK data for 2008. The authors decompose into explained and unexplained components. Figure plots unexplained component for younger workers (25-45) and older workers (45-60) with tertiary education and for workers without. The average across countries public-sector premium of younger workers 9.1 percent and for older workers is 6.2 percent.

we should interpret the numbers with some caution. The comparison of the replacement rates are shown in Figure 20. We can see remarkable differences. In the UK, while civil servants get replacement rate of above 100 percent, private worker, even when considering the voluntary contributions, get less than 50 percent replacement rates.

The higher replacement rates of public-sector workers was also documented for the UK by Disney, Emmerson, and Tetlow (2009) and Danzer and Dolton (2012). Disney, Emmerson, and Tetlow (2009) attribute the different to a higher prevalence of *defined benefits* plans in the public sector as opposed to *defined contributions*. They then compute a measure of pension accruals for the two sectors considering several detailed elements, such as job tenure and earnings profile, life expectancy, employee contributions or vesting rules. They find that one-period accruals in the public sector are, worth 6.6 percent of salary more in a public sector defined benefit plan than in a private sector. Danzer and Dolton (2012) goes one step further and calculate the total reward differentials, but including current earnings and pensions, but also hours of work, paid holidays, employer provided health care and probability of unemployment, using survey data from the UK. They find that that, for the period of analysis between 1997–2009 and only for college graduates, the total reward is broadly equalized over the lifecycle for men, while women have a clear total-reward advantage in the public sector.

Figure 20: Long-term gross replacement rates for civil service and private sector average earners, entering at age 20 in 2014
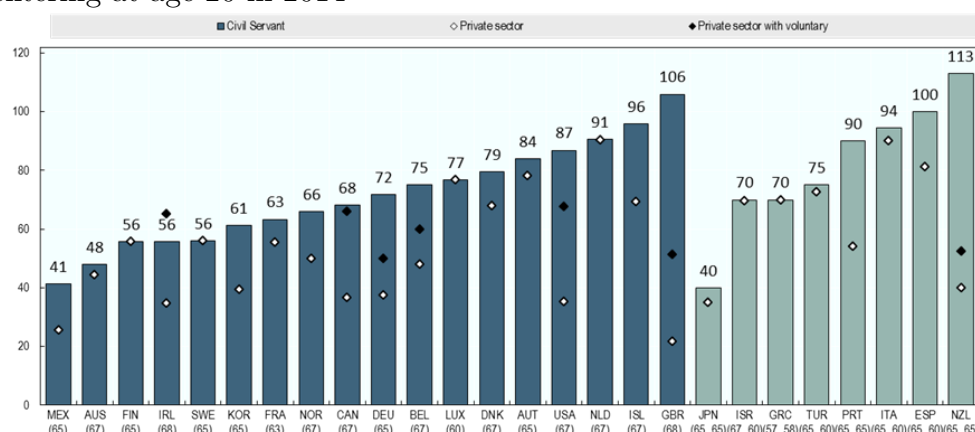
Note: In light green refers to countries that have recently harmonized the public and private systems, before the reform. Retirement ages are given in brackets, with private sector first. dark blue refers to all other countries. Retirement age (in brackets) is the same for both civil servants and private sector workers. Based on OECD (2016) calculations.

- **Fact 22.**   Public employment represents a higher fraction of employment of older workers.

- **Fact 23.**   The public sector hires few young workers.

- **Fact 24.**   Wage compensation in the public sector varies over the lifecycle.

- **Fact 25.**   There are higher retirement replacement rates in the public sector.

7.3.2   Insights from the theory

Cavalcanti and Santos (2020) set up an occupational-choice life-cycle model and argue that higher wages and better pensions in the public sector in Brazil lead to misallocation of resources with a lower entrepreneurship rate. They find that the better pensions is one of the ingredients necessary to get the flow of workers into the the public sector increasing with age. Also focusing on Brazil, Glomm, Jung, and Tran (2009) set up an overlapping generations model where workers are initially randomly assigned to each sector. They use it to study the effects of early retirement in the public sector.

Gomes and Wellschmied (2020), use a partial equilibrium, incomplete markets, life-cycle model, with a public and private sector, to quantify the total public-sector compensation premium over workers' life-cycles. They uncover an interesting interaction between wealth accumulation and the public-private sector dichotomy. On the one hand, the accumulated

wealth of an unemployed affects the choice of where to search. Because turnover is lower in the public sector and the conditions offered are better, it takes longer to find a job there, so only richer unemployed can afford to queue. On the other hand, as jobs are safer, wage profiles differ, and pension schemes are more generous, public-sector workers have different savings behaviours than their private sector counterparts (both for precautionary, life-cycle and retirement motives). They also find that, for the model calibrated to US, UK, France and Spain, the the age-averaged total public-sector compensation is substantially larger than suggested by the age-averaged wage premium, in particular for non-college workers.

The papers by Gomes and Wellschmied (2020), Disney, Emmerson, and Tetlow (2009) and Danzer and Dolton (2012) reinforce, the view of Postel-Vinay and Turon (2007) that we should focus on measures of lifetime values rather naive estimations of public-sector wage premium. Or, in other words, on top of the static public-private wage differentials, we should add quantifications of the other benefits of public employment.

- **Insight 34.**   The negative effect of high public-sector wages on unemployment and queues are stronger for younger workers.

- **Insight 35.**   High public wages for young workers shifts demand away from this workers.

- **Insight 36.**   The public-sector offers extra compensation in the form of a pensions premia.
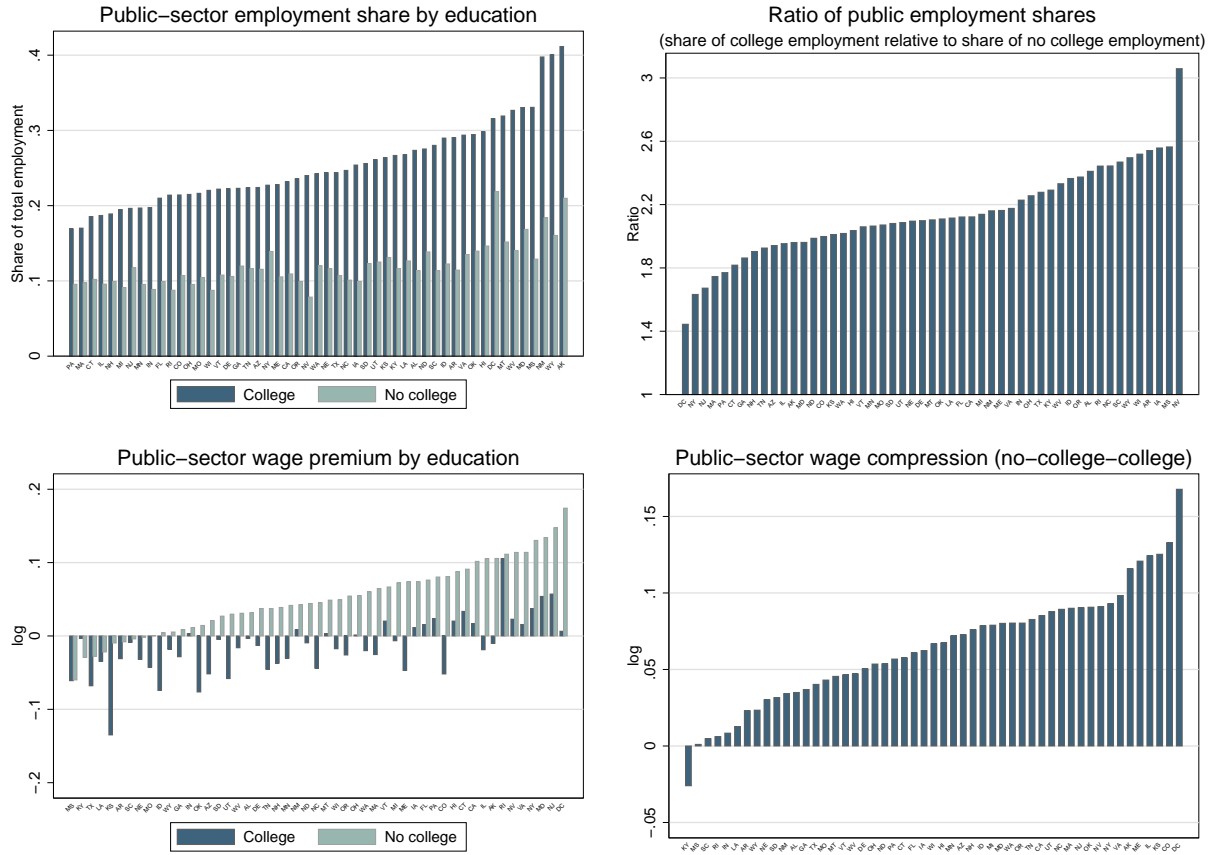
7.4   Region

7.4.1   Basic facts

Regional differences, is the fourth dimension of substantial heterogeneity in public-sector employment and wage policies. An illustration of the variation of policies, including the heterogeneity in education and gender, can be seen in Figures 21 and 22.

Figures 21 shows the regional heterogeneity, over the different US states, in public employment and wage policies, by education. States like Alaska, New Mexico or Wyoming hire more than 40 percent of all college workers, and other like Massachusetts or Pennsylvania hire about 18 percent. Some states hire more that 20 percent of workers without college and some less than 10 percent. The wage premium for workers without college varies from -5 to 18 percent, and that of workers with college varies from -13 to 10 percent. The wage

Figure 21: Regional Public-Sector Employment and Wage Premia By Educational Levels, United States

Public–sector employment share by education

Ratio of public employment shares
(share of college employment relative to share of no college employment)

Public–sector wage premium by education

Public–sector wage compression (no–college–college)

Note: Taken from Garibaldi, Gomes, and Sopraseuth (2019). The graph on the top left shows the fraction of public-sector employment out of total employment for each educational level in each US state. Government workers (Federal, State and Local government), fraction of employment of workers age 16 to 64. The graph of the top right shows the ratio of public employment shares of college over non-college workers. The bottom left graph shows the public-sector wage premium, estimated by regressing the log of hourly wage on a public-sector dummy and controls (2-digit occupations, age, gender, region, year and a part-time dummy), separately for workers with different education levels in each US state. The graphs on the bottom right shows the wage compression, the difference between the public-sector wage premium of non-college workers and that of college workers. CPS data, between 1996 and 2018.

compression across education groups can reach more than 15 log points, and is only absent in the state of Kentucky. 22 shows the regional heterogeneity in US, France, UK and Spain, in public employment by gender. Whatever the country, there is substantial regional variation in the size of employment, but also on the relative hiring of men and women.

These regional variations arises because of variations of demand of government workers in the different regions. This can arise because concentration of services in particular regions, for instance the capital of the countries, but can also reflect political differences over the quantity of services the government should provide.

Figure 22: Regional variation in public employment, by gender
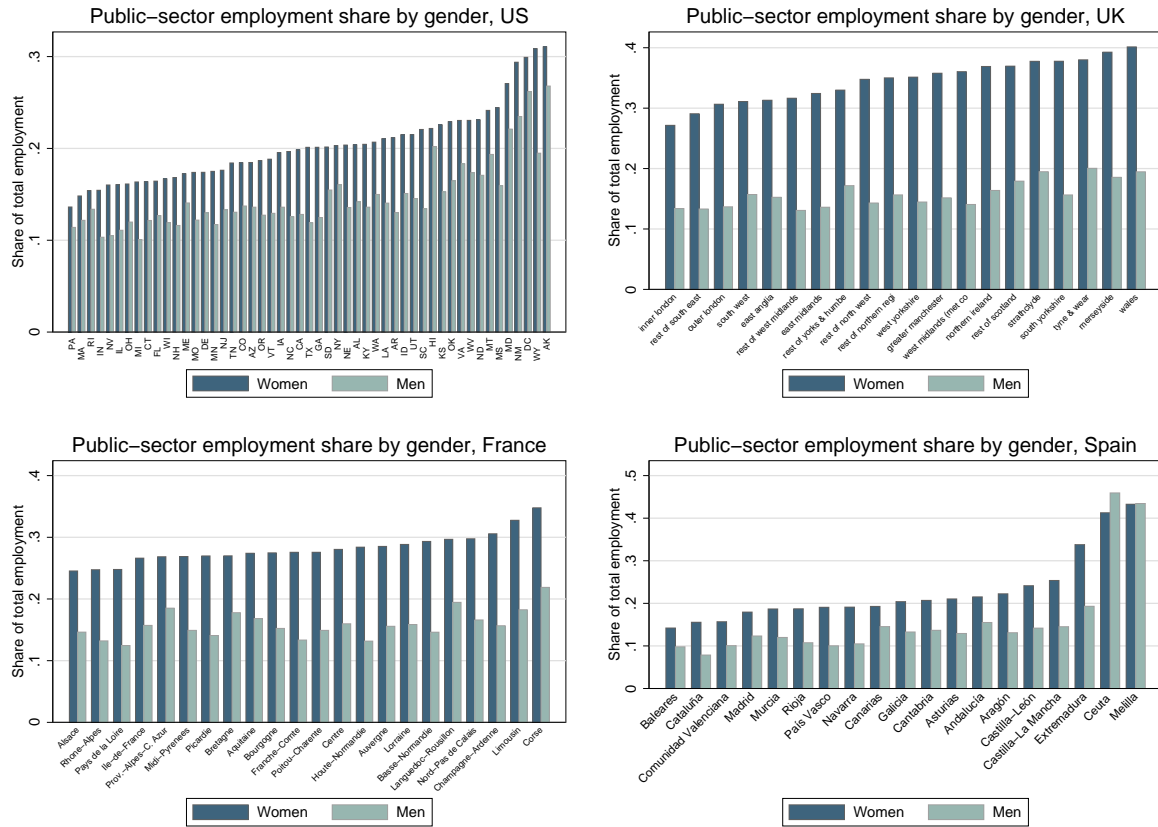
Note: The figure show public employment out of total employment by gender for different regions. For the US the data is taken from CPS (1996-2017), for the UK from the UK Labour Force Survey (2003-2016), for France for the French Labour Force Survey (2003-2016) and from Spain from the Spanish Labour Force Survey (2005-2007). Taken from Gomes and Kuehn (2019).

- **Fact 26.** Substantial regional variation of size and composition of public employment.

- **Fact 27.** Substantial regional variation of wage policies.

7.4.2 Insights from the literature

Another branch of the literature on public employment that has kept active over the past decade was the empirical literature on the regional effects of public employment. Essentially, the literature tries to measure the effect on private employment, but instead of looking at the aggregate if focusses on the local effects. While, labour theory suggests the crowding out of private employment, there could also be positive externalities, namely Keynesian effects by the increased demand for locally produced goods and services. Faggio and Overman (2014),

Faggio (2019), Faggio, Schluter, and vom Berge (2019), Jofre-Monseny, Silva, and Vázquez-Grenno (2018), Auricchio, Ciani, Dalmazzo, and de Blasio (2020a) and Becker, Heblich, and Sturm (2018) provide evidence for United Kingdom, Spain, Italy and Germany.

Faggio and Overman (2014) quantify impact of public sector employment on local labour markets in England. Using data at the Local Authority level, 352 units of observation, for the period 2003 to 2007. They deal with problems of endogeneity and reverse causality, by constructing an instrument using the "shift-share" approach, commonly used in the literature on the effects of migration. They find a small positive effect on private employment in the short run, that vanishes in the long run. They could not find evidence of weather the positive short run effect comes from increasing working age population (through migration), reduction of inactivity or unemployment. They do find that there is a big asymmetry on the effects across the tradable and non-tradable sector. Ten more public sector jobs creates 5 jobs in the non-tradable sector and destroys about 4 jobs in the tradable sector.

Faggio (2019), focus on a specific public-sector reallocation plan, that reallocated 25,000 jobs from London towards other cities, in between 2004 and 2010. Instead of Local Authority level, they had a much finer unit of analysis, consisting of 150,000 Census Output Areas covering Great Britain. They compare neighboring areas at increasing distance using a treatment intensity approach, analogous to a difference-in-differences approach with heterogeneous treatment effects. She finds that the arrival of 10 civil service jobs in an area spurs the creation of about 11 jobs in the private sector, all in services with no impact on manufacturing. She also find a tendency for private businesses to locate closer to a relocation site, moving out of areas at 1–2 km and 2–3 km distances into areas at 0–1 km distance. With a similar methodology, but for Germany, Faggio, Schluter, and vom Berge (2019) investigate whether the opening of federal ministries in Berlin in 1999 has resulted in faster private sector job creation in postcodes of Berlin that received a federal ministry relative to postcodes in other parts of Berlin. An arrival of 10 public-sector jobs into an area generates 5.5 additional jobs in the private sector. As in the paper for England, the gains are all in the service sector, while manufacturing employment is not influenced by the relocation.

Jofre-Monseny, Silva, and Vázquez-Grenno (2018), in an empirical exercise, use regression analysis to estimate the effects of Spanish public sector job expansions on between the 1980s and the 1990s, in the employment and population of Spanish cities. This period saw an increase from 1.4 to 3.2 million public-sector workers. These jobs were created in cities experiencing negative labor demand shocks. They were also created more jobs in regional capitals. Being a capital city implied an additional 1.6 public sector jobs each decade per 100 inhabitants in the base year. They use this as instruments, in addition to the "shift-share" approach of Jofre-Monseny, Silva, and Vázquez-Grenno (2018) They find that ten additional public sector jobs increases non-tradable employment by 9 jobs and and the workforce by 23 individuals. For the tradable jobs and unemployment rate are largely unaffected.

Becker, Heblich, and Sturm (2018) use the relocation of the German federal government, from Berlin to Bonn after the Second World War, as a natural experiment to evaluate the impact of public employment on private employment. They find that, in the long run, ten additional public sector jobs reduce employment in the manufacturing sector by 2 and creates about 10.5 jobs in the non-tradable sector.

Auricchio, Ciani, Dalmazzo, and de Blasio (2020a) use a shift-share instrument similar to Faggio and Overman (2014) to estimate the effect of a reduction, rather than expansion in public employment on private employment across Italian municipalities using data from the 2001 and 2011 census. Contrary to the previous cited studies, they find a strong crowding out effect of public employment. The reduction of 10 public jobs raises private employment by 6 to 8 jobs, with the effect being mainly in the tradable sector, whereas there is no impact on the non-tradable. These results are more in line with the effects found using aggregate data. A possible explanation for this difference is that the consequences of public employment downsizing are not simply the opposite of those of an increase. Another explanation, is the size of the unit of analysis. The smaller is the unit, the more positive at the effects, perhaps because potential general equilibrium effects (e.g., changes in housing prices or local wages) operating at a wider geography.

The idea that public employment can help reinvigorate decaying regions has been the subject of a strong debate. The UK has used it since the Second World War. Advocates of relocation programs believe that such policies help lagging regions through public investment. Opponents of this view consider relocation programs hinder the development of the private sector at a cost of taxpayers' money. The most prominent example is Alesina, Danninger, and Rostagno (2002), that suggest that public employment in the South of Italy is, for about a half of the wage bill, a redistributive device, from the North to the lagging South, that eventually discourages the development of the local private sector. By paying higher wages and providing secure jobs, they harm the competitiveness of local private firms, and affect individuals' attitudes toward job search, education, 'risk taking' activities etc. Some suggestive evidence of these effect was documented by Auricchio, Ciani, Dalmazzo, and de Blasio (2020b).

Alesina, Danninger, and Rostagno (2002) also puts an emphasis on the role of public wage. Several empirical studies estimating the public-sector wage premium, with a regional focus, find that in Western European countries, public wages are geographically more homogeneous than private sector wages. A special issue of *The Manchester School* presented evidence that public wages are more regionally homogenous than private wages for the U.K. (Bell, Elliott, Ma, Scott, and Roberts, 2007), Germany (Heitmueller and Mavromaras, 2007), France (Meurs and Edon, 2007), Spain (Garcia-Perez and Gimeno, 2007) and Italy (Dell'Aringa, Lucifora, and Origo, 2007). The last two papers also document a positive correlation between a wider wage gap between public and private wages and regional unemployment.

Caponi (2017) discuss the implications of the regional wage setting policy of the public sector, using a random search model calibrated to Italy. He finds they are crucial drivers of private employment and unemployment. In line with Alesina, Danninger, and Rostagno (2002), he finds that if the public sector sets geographically homogeneous wages across regions with different productivity, than public employment generates a substantial crowding out effect against private employment. Qualitatively, the uniform wage setting policy adopted by the central government, in the presence of productivity unbalance across regions, is responsible for up to 33 percent of the unemployment gap between the North and South. Nevertheless, this negative outcome is not inevitable. He shows that if the government pays wages according to local productivity the crowing out effect vanishes, as well as much of the unemployment differentials.

The idea of aligning public-sector pay with the private sector by regions that comes out of economic models, faces some opposition in practice because objectively, generates different pay for similar jobs. There are many examples of implementation of different regional pay to reflect different cost of living or opportunity costs, for instance with the London allowance in the UK. One additional benefit of aligning the pay by region, besides the reduction of the labour market distortions, is that it would encourage the government to decentralize some of its services to other poorer regions in order to save of the costs of providing public services.

Two other papers highlight the positive role of regional public employment policies. In a similar spirit, but within an an optimal taxation framework, Kessing and Strozzi (2016) show that differentiated public employment policy can be used to improve the equity efficiency trade-off. First, higher public employment in low productivity regions generates a direct targeted consumption of local goods and services, without violating incentive compatibility. Second, because public sector productivity is more homogeneous that private sector productivity, the opportunity costs of moving a worker from the private to the public sector tends to be lower in low productivity regions. Finally, a regional differentiation of public employment eases incentive compatibility, if regional private sector wages depend on regional public employment. Using regional data on European countries, they find that public employment per capita is higher in plow productivity regions.

Borge and Matsen (2004) consider the role of regional public employment policies, in improving risk sharing at the regional level. In an empirical analysis of regional risk sharing in Norway over the period 1977–90, they explicitly take in account public employment as a possible shock absorber, beside capital markets, commuting, taxes and transfers, and credit markets. They find that the degree of regional consumption insurance is very high and that public employment absorbs up to 25 percent of private sector output shocks.

- **Insight 37.** Public employment may crowd out private employment, particular in the tradable sector due to wage or housing price spillovers.

- **Insight 38.** Public employment may crowd in private employment, particular in the non-tradable sector by reducing unemployment and increasing aggregate demand.

- **Insight 39.** There is no consensus in the literature on which effects are stronger, and these are likely to depend on the type of public sector policy (expansion or reduction), the unit of analysis (large or smaller regions), and the country.

- **Insight 40.** The negative effect of high public-sector wages on unemployment are stronger for workers in poorer regions.

- **Insight 41.** The negative effect of public employment are higher in regions with high public-sector wages.

- **Insight 42.** The negative effect of public employment are higher in regions with high public-sector wages.

- **Insight 43.** Regional specific wage policies can reduce regional unemployment and allow for the reduction of the government wage bill.

- **Insight 44.** Regional public employment policies can improving risk sharing.

7.5 Unobserved Heterogeneity

We have looked so far at four dimensions of heterogeneity in public employment: education, gender, age and region. These four dimensions are all observable and, with the exception of gender, they are largely in control of the government, by setting particular requirements for jobs in terms of education and experience, and the location of the job. Besides these dimensions, there is a fifth one that is less in control of the government. The selection on unobservable characteristics. The issue of selection of unobservable characteristics is extensively discussed in microeconomic literature, reviewed in the second part of this report and in Finan, Olken, and Pande (2015) or Sørensen (2016). In general, the literature has discussed three unobservable factors: the intrinsic ability of workers, their pro-social motivation and their risk aversion (Buurman, Delfgaauw, Dur, and den Bossche, 2012).

Probably the most important one is the selection on ability. While we do not believe we can rationalize a Walrasian public-sector labour market by accounting for selection on ability (i.e. that all private-public wage differentials are due to selection on quality), we certainly share the view of the literature that the public-sector wage has important implications for which workers with a given observable characteristics select into the public sector. For each job opening, with a particular set of requirements, public wages above the average can induce workers with better outside option to apply. Assuming that their private sector alternative reflects their ability, there will be better workers. If public wages are low, only the workers with a worst outside option will apply. There is some empirical evidence of this. Nickell and Quintini (2002) document the fall in relative pay of British public sector workers during the 1980s and find that men entering the public sector had significantly lower test score positions compared with public sector entrants in the previous decade. Beside the average wage, the distribution of wages also matter. Gomes (2018) cites evidence from quantile regressions that show that public wages are also more compress within education groups. He then presents a quantitative model, in which the wage compression implies that the government will have permanent difficulties in hiring high-ability educated workers.

Usually, the microeconomic perspective, there is the implicit that the government "should hire the best person for the job," often associating "best" with "more productive." This idea is usually advanced when arguing for higher public sector wages. Macroeconomics gives us a slightly different perspective. Having the "best" workers in the public sector means that they won't be in the private sector. Where is it better to have them? Creating value in the public or the private sector? It is not a priori clear whether a social planner would want more high-quality workers in the public or the private sector. A definite answer would require specifying the importance of high-quality workers in private- and public-sector production and its value, for which there is little empirical evidence available. In the absence of a clear answer, we think that the government should have to have representative selection of worker. The government "should hire the right person for the job."

This view implies that the worry of the government should not be in offering wages above to private sector for particular posts to ensure that it hires the best workers, but to offer a wide enough distribution to be able to hire high-ability workers, within a skill-mix that matches that of the overall economy. This view is modeled by Geromichalos and Kospentaris (2020). They argue that the public-sector selection process in many countries, through an exam system, designed to hire the best workers for a particular positions, is worst than a system where the government hires a representative worker.

- **Insight 45.** The distribution of public wages within particular groups should match the one from the private sector

8 Other aspects of public employment

8.1 Nepotism and Non-Meritocracy

8.1.1 Some facts

One common perception regarding government hiring practice, is that, in several countries, they are sometimes based on nepotism. One dimension is the influence that politicians or civil servants use to hire friends or family members. There is vast anecdotal evidence of such practices. The anecdotal evidence is particularly widespread in Southern European or developing countries. In Spain, for example, the press recently 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. Evidence of nepotism also exists for richer countries. The current US president hired his daughter and son-in-law, and a leading French presidential candidate in the 2007 elections was convicted for embezzlement after found have put his wife, son and daughter employed on the public payroll.
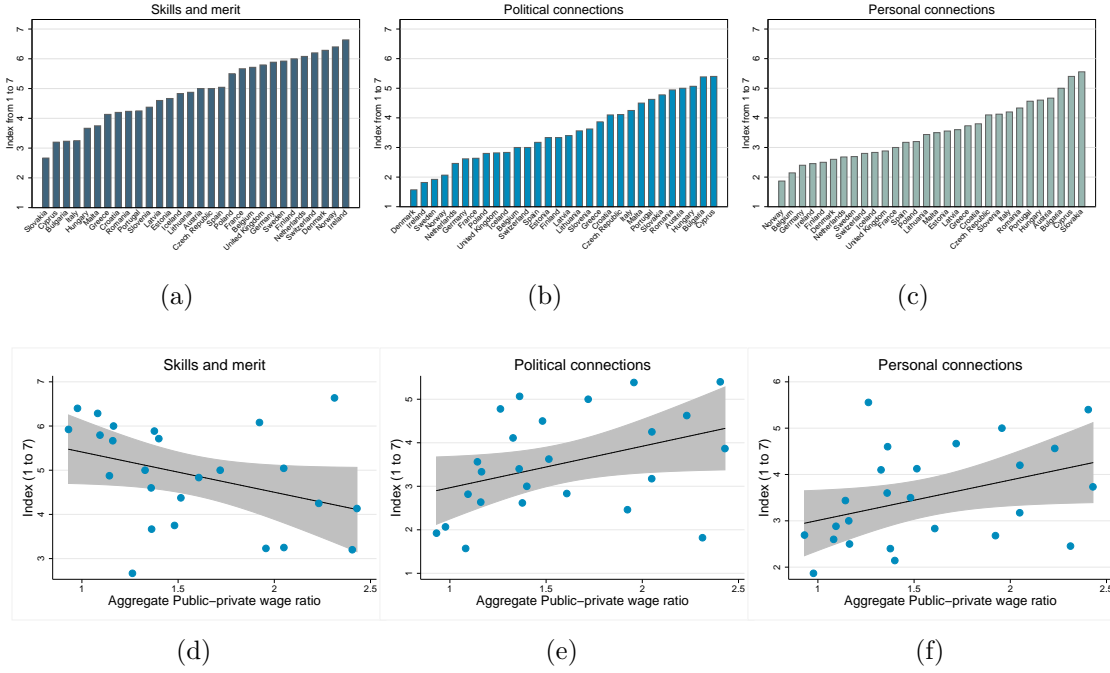
A second dimension that is common to all countries is political appointments. Whenever there is a change in government, there is a subsequent turnover of jobs. The report Government at a Glance by OECD (2019) highlights the cross-country differences in staff turnover following a change of government. 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.

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, Dahlstrom, Fazekas, and Lapuente (2017). Dta from two of such surveys: the *Quality of Government Survey* and the *European Quality of Government Index*, shows that these practices are present in the public sector, more than in the private sector, and that they vary widely across European countries.

The *Quality of Government Survey* (QoG) 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. 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 23 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"

Figure 23: Recruitment practices in European public sectors

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 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.

These differences in the role of political or personal connections are related to public-sector wages. We use aggregate data to calculate an average public-private wage ratio. Using OECD and AMECO data, we calculate the government's wage bill over the size of government employment relative to the private-sector wage bill over the size of private-sector employment. The bottom graphs in Figure 23 show the relation between the three indexes of recruitment practices and the public-private wage ratio. Higher average wages in the public sector is associated with recruitment practices less based on merit (a correlation coefficient of -0.4) and more based on political and personal connections (correlation of 0.4), both significant at 10 percent.

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

Figure 24: Non-meritocracy in the public sector relative to the private sector
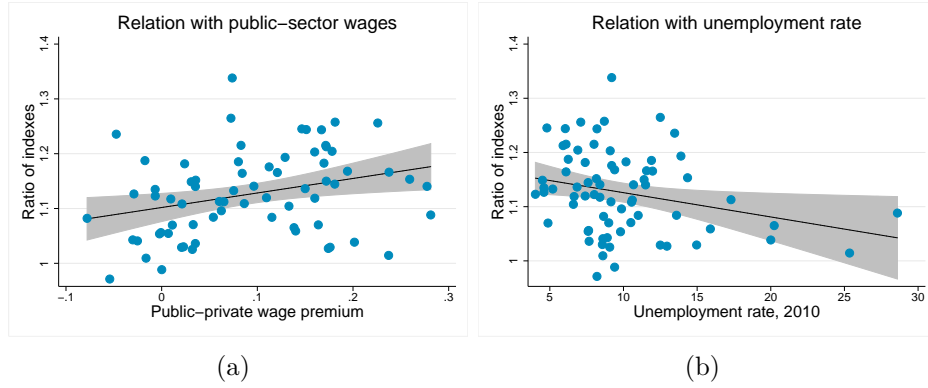
(a)   (b)

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. 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 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.

- **Fact 28.** There is *shred* of evidence of nepotism / chronism in hiring in some public sectors.

- **Fact 29.** Nepotism is larger in countries/regions with higher public-sector wage premium.

8.1.2 Evidence from the literature

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. This fact is sometimes used to correct for selection in the estimation of the public- sector wage premium (Christofides and Pashardes, 2002). Durante, Labartino, and Perotti (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, Mounu, and Teso (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, Mounu, and Teso (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.

Chassamboulli and Gomes (2020) think of nepotism as the restriction that some jobs in the public sector are reserved for a subset of workers that have political or personal connections. It is important to distinguishing two aspects of nepotism. On the one hand, 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. On the other hand, it might allow workers

of lower quality to enter the public sector. They study the interaction between public-sector policies, nepotism and unemployment, from a theoretical angle, using a search model. They assume that job seekers can pay a cost to get "connections" ex-ante. 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.

Their model has two interesting findings. First, they show that employment and wage policies influence incentives to use political and personal connections to get a job. 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. They view nepotism not as a disease, but as a symptom of high public-sector wages. This can rationalize the evidence that Southern European countries, known for having nepotistic practices, 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.

Their second finding is that nepotistic hiring has a silver lining. 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. Nepotism creates a bubble of public-sector jobs, who prevents the negative spillovers of employment and wage policies into the private sector.

Chassamboulli and Gomes (2020) they view nepotism not as a disease, but as a symptom that the value of a public-sector job is too high compared to the private sector. This mechanism goes against a general argument in the literature arguing that higher wages for civil servants are necessary to avoid corruption in the public sector (Nunberg and Nellis, 1995). Here again, public-sector wages are in a center of a difficult trade-off. If they are too low, they might generate corruption, but we should also be careful on the opposite end, as higher wages for civil servants creates an asymmetry with the private sector, which might itself create an incentive for a different type of corruption. This can explain why the empirical literature does not find robust evidence of a negative relation between public wages and corruption.

Gorodnichenko and Peter (2007), using Ukranian data for the period 1997-2003, find that the public sector worker were paid 24 to 32 percent less than the private sector. On the other hand, workers in both sectors have essentially identical level of consumer expenditures and asset holdings, which suggests the presence of non-reported compensation in

the public sector. They calculate the value of bribery to be about 1 percent of Ukraine's GDP. Rijckeghem and Weder (2001) using data on 31 developing countries and low-income OECD countries10 over the period 1982–1994, finds a negative relationship between aggregate corruption indices and relative civil service pay. However, the quasi-eradication of corruption would require average public sector wages to be two to eight times higher than average manufacturing wages. An and Kweon (2017) using a panel of 43 countries for the period between 1999 and 2008, find a negative relation between public wages and overall corruption in non-OECD countries. The effect is quantitatively very small. To reduce the level of corruption in non-OECD countries to that in OECD countries,the government wage would have to be increased seven fold. Gans-Morse, Borges, Makarin, Mannah-Blankson, Nickow, and Zhang (2018) provide a comprehensive review of the interdisciplinary state of knowledge regarding anti-corruption policies, with a particular focus on reducing corruption among civil servants. They find that adequate civil service wages seem to be a necessary but insufficient condition for control of corruption. Similar conclusion was found by Chen and Liu (2018). The paper studies the relation between public-sector wages and corruption in China, measured by the value of bribes obtained by government officials, reported in court proceedings, between 1985 and 2014. They find a systematic U-shaped relation. Corruption goes down with public-wages but after a certain point it increases. For Latin America, Panizza (2001) finds no clear correlation between the average public-private wage differential and the quality of the public sector bureaucrats.

- **Insight 46.** High wages generate long queues, so workers have incentive to "invest" in political/personal connections to jump the queue.

8.2 Public employment in developing countries

To show some of the facts on the size of public employment in the labour market and the wage bill, for a wider set of developing countries, we use data from the World Bank's Worldwide Bureaucracy Indictors (WWBI) dataset. The WWBI is a newly published dataset on public sector employment. It is intended to provide researchers and development practitioners with a better understanding of the personnel dimensions of state capability, the footprint of the public sector on the overall labour market and fiscal implications of the government wage bill. The dataset also compiled estimates of the public-sector wage premium controlling for education, age, gender and location, calculated from microdata.

Figure 25 shows the boxplot, of public-sector employment as a fraction of total employment, the public-sector wage premium and the size of the wage bill in GDP and in total

Figure 25: Basic facts in developing countries
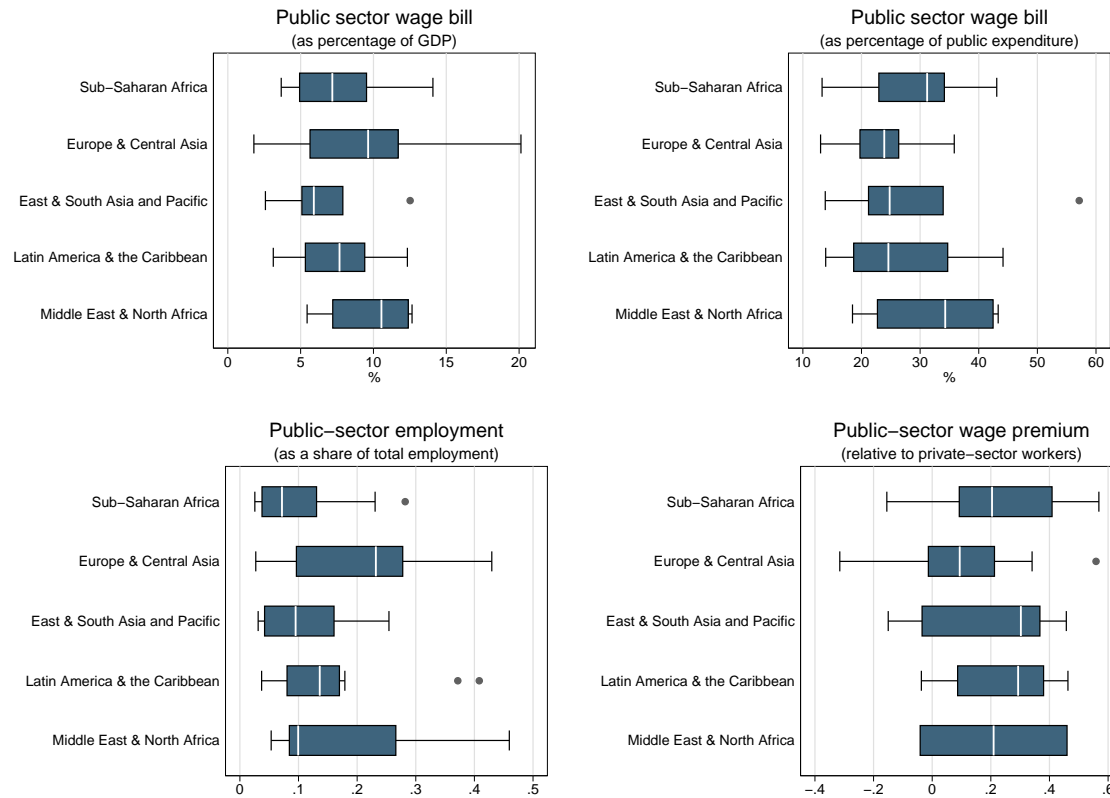
Source: Taken from World Bank's Worldwide Bureaucracy Indictors. Sample of 73 countries (18 is Sub-Saharan Africa, 27 in Europe and Central Asia, 8 in East and South Asia and Pacific, 15 in Latin America and the Caribbean, 5 in Middle East and North Africa). Boxplot shows the minimum, Q1, median, Q3, maximum and any outlier. Average for the available periods between 1999 and 2016.

government spending, for five groups of countries: Sub-Saharan Africa, Europe and Central Asia, East and South Asia and Pacific, Latin America and the Caribbean and Middle East and North Africa. We can see that the variation across countries that existed in the sample of OECD countries is even more notorious in developing countries. Most of the facts documented in this report occur also in developing countries, often to a much greater extent.

The traditional explanations for the determinants of public employment also apply to developing countries. Given that their institutions are worse, the explanations based on rent-seeking behaviour and corruption are more prominent. Along these line, Jaimovich and Rud (2014) propose an explanation based on the quality of bureaucrats. In a model of occupational choice of agents who differ in their skill level and degree of public-mindedness. When the public sector attracts bureaucrats with low degree of public service motivation, they will use their position to rent seek by employing an excessive number of unskilled workers. The motive this mechanism by showing a negative association across countries between the share of public sector workers in clerks, service workers, machine operators occupations, and the corruption perception index.

But other explanations, more specific to the macroeconomic conditions of developing

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countries have also been proposed. Rodrik (2000) was one of the first papers that extended the focus of public employment, from OECD countries into developing countries. To explain the variation across countries in the level of public employment, instead of the usual explanations based on rent-seeking, he argued that government jobs represent partial insurance against undiversifiable external risk. He shows partial correlations between a measure of external risk and the size of employment. Recent cross-country evidence by Gözgör, Bilgin, and Zimmermann (2019), using the WWBI data, has shown that these correlations no longer hold. In fact, more globalization is associated with less public employment.

Other papers have focus on the labour market impacts of public employment, having in mind that the labour markets in developing countries have different features from developed countries. In particular, they have a very large informal sector. From a theorectical angle, Yassin and Langot (2018) set up an equilibrium matching model for developing countries' labor markets where the public, formal private and informal private sectors interact. In their model, the gains from reforms aiming at liberalizing formal labor markets can be annulled by shifts in the public sector employment and wage policies. Because the public sector affects the outside option for all workers, it acts as an additional tax for the formal private firms. Using data on workers' flows from Egypt, they show that the gains in terms of job creation after a labour market liberalization, were offset by the increase of the offered wages in the public sector observed at the same time. From an empirical angle, Ranzani and Tuccio (2016) use census data for Ghana, Mali, and Mozambique, to study the long-term impact of public sector employment on local labor markets. We find that the public sector crowds out private employment and induces skilled workers to queue for a public job, thus increasing their unemployment rate.

Finally, Baerlocher (2020) shows that there is an inverted U-shaped relationship between public employment and economic growth. He sets up a model where government allocates workers to the production of public goods, which reduces operational costs, increasing the number of firms in the market, and creating incentives to innovate. This positive effect of government employment, is offset by the negative labour market crowding out effects, reducing the number of firms and the incentives to innovate. The model replicates the inverted U-shaped relationship between public employment and economic growth found in the data.

8.3 Unionism in the public sector

Table 8 shows the union density in the public and private sectors in 1980s and 2010s for several countries. We observe two key facts. The first is that the union density in the public sector is higher than in the private. In early 2010s, the average union density was 24.3 in the private sector and 48.5 in the public, about double the rate. The second is the well-documented decline in overall union density. On average, across these countries, the

Table 8: Evolution of union density in public and private sector

Country	1980s			2010s		
	Year	Private	Public	Year	Private	Public
Australia	1982	39.0	73.0	2013	12.0	41.7
Belgium	1980	49.3	81.2	2013	53.0	56.0
Canada	1984	25.9	71.8	2013	15.9	72.0
Denmark	1980	69.3	69.2	2013	62.0	78.0
France	1981	9.5	24.0	2013	8.7	19.8
Germany	1980	32.5	52.6	2015	14.7	26.7
Greece	1977	41.2	77.2	2012	17.3	47.1
Italy	1980	42.8	59.6	2008	24.4	50.0
Japan	1979	24.7	74.5	2015	16.3	28.0
Netherlands	1980	26.2	59.7	2013	16.0	23.5
Norway	1980	46.8	74.3	2013	37.0	79.0
Portugal	1989	37.0	45.0	2013	11.0	59.0
Sweden	1980	78.0	81.1	2013	65.0	83.0
Switzerland	1980	23.8	70.7	2013	15.0	22.0
United Kingdom	1979	45.6	81.5	2013	14.4	55.5
United States	1983	16.5	36.7	2013	6.7	35.3

Note: Data taken from the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts Dataset, 1960-2017 (ICTWSS).

union density fell by 13.7 percentage points in the private and by 16.0 percentage points in the public.

The importance of public-sector unions was one of the key aspects of the literature on public employment in the 1980s. Reder (1975) argued that they were the most likely explanation for the public-private wage differentials. Freeman (1986), in a classic paper, was the first to point out that, because of their effects on the costs of government services and taxes, public-sector unions involve different welfare calculations than the typical private-sector unionism. Freeman (1986) documents the rise in unionization rates in the public sector, and also emphasizes their effects on public-sector wages. The theory suggests that public-sector unions are able to bargain for more resources, and expand the demand, either through more public employees or higher wages. The evidence of this hypothesis is mixed. O'Brien (1994), using city level data, found that increased union activity led to greater municipal expenditures or revenues, in particular through higher employment but not through higher compensation. (Lewis, 1990) reports a union wage effect that is positive but smaller in the public sector than in the private sector. Valletta (1993), using a sample of police, fire, sanitation, streets and highways, and finance and control departments in approximately 900 U.S. cities during 1977-80, found that cross section estimates supported the hypothesis, but when using longitudinal estimates that controlled for omitted variables, there was no longer evidence that higher unionization would led to higher public employment or wages. More recently papers, for instance Blanchflower and Bryson (2010), found that the union membership wage premium is twice higher in the public sector than in the private sector.

Looking at the aggregate data also challenges the importance of public-sector unions in

driving public-sector wage premium. The premium is lower in Nordic countries, that have high unionization rates, and is highest in South European countries that have lower unionization rate. If we are skeptical that unionization rates are still main drivers of employment and average wages in the public sector, they still matter for other aspects of policies, in particular the wage compression across education groups. Strom (1995), using data on Norwegian local government finds that low-skilled local government employees respond not to wages in the external labour market, but to wages of higher skilled and higher paid workers inside the local government.

From a theoretical perspective, while most of the literature has moved to incorporate search and matching friction, there is still some papers with a DSGE model with public sector unions Vasilev (2015).

8.4 State-Owned Firms

Employment in state-owned firms is different from the rest of the public sector. Although the management is not public, they produce well-defined good with a market price, so the firm has revenues from sales and profits or losses. According to the OECD, state-owned enterprises (SOEs) in the member countries are valued at over 2 trillion USD and employ over 6 million people – about 2.5% of national employment on average. , SOEs are highly concentrated in strategic sectors on which large parts of the private economy depend.

The tradition justification for public enterprises is that they overcome market failures. Public enterprises are controlled by governments maximizing social welfare, and improve on the decisions of private enterprises when monopoly power or externalities introduce divergence between private and social objectives. Half of SOEs by value operate in the network industries such as telecoms, electricity and gas, transportation and postal services.

On the other hand, many economists argue that public enterprises are highly inefficient, and their inefficiency is the result of political pressures. Shleifer and Vishny (1994) argues that subsidies to public enterprises and bribes from managers to politicians emerge naturally in state-owned companies. State-owned companies are also more responsive to unemployment making them more labour intensive that under primate ownership (Borger, 1995). With a wave of privatization since the 1980s in OECD economies, the review of the evidence on their effects by Megginson and Netter (2001) supported the proposition that privately owned firms are more efficient and more profitable than otherwise-comparable state-owned firms. More recently, the focus has been on China. Cooper, Gong, and Yan (2015) analyse private and public-sector manufacturing plants in China, using data from 2005–2007. They find that public plants, like the private plants, maximize discounted expected value of profits. They find that they have lower discount factor, face higher adjustment costs of labour and operate without a strong budget constraint.

In macro search models, two papers focus of state-owned companies. Hörner, Ngai, and

Olivetti (2007) study the effect of turbulence on unemployment when wages in the public sector are insulated. They conclude that an increase in turbulence induces the more risk-averse unemployed to search for jobs in public companies, resulting in higher aggregate unemployment than if the companies were managed privately. Feng and Guo (2019) document some facts about the Chinese labour market worker gross flows and set up a search and matching model with state-owned enterprizes, that are different from private sector firms in terms of productivity, bargaining power and firing restrictions.

The question about the effects of privatization of state-owned firms is related to the question of whether some public-sector services, like health or education, themselves should be outsourced. The problems are slightly different, because the services are financed primarily by taxation. The potential benefits of outsourcing include higher productivity or lower costs, more consumer choice and more innovation. On the other hand, there might induce lower quality of services because of problems in monitoring, segregation, and job loss of public employees. One key aspect is how the procurement takes place and how prices are determined (Jordahl, 2019). A recent volume on public sector outsourcing from CESifo Economic Studies, overview the recent empirical literature (Andersson, Jordahl, and Josephson, 2019) and provides many case studies in the health (Wübker and Wuckel, 2019), education (Kortelainen and Manninen, 2019) and sanitation Meriläinen and Tukiainen (2019), together with more macroeconomic evidence from OECD countries (Potrafke, 2018).

Part C

Public Employment: A Perspective from Italy

9   The Evidence for Italy

The Italian basic labor force survey does not make available in the main release to the public the specific information regarding public employment. This makes it difficult to fully compare the evidence provided in the previous sections. The evidence on Italy is thus based on alternative source, based on a Bank of Italy Survey created originally for measuring wealth and savings.

9.1   The Survey on Household Income and Wealth and The Measurement of Public Employment

The Survey on Household Income and Wealth (SHIW) begun in the 1960s to gather data on incomes and savings of Italian households. Over the years, the survey has grown in scope and now includes wealth and other aspects of households' economic and financial behaviour, including, for instance, the payment methods employed. The sample used in the most recent surveys comprises about 8,000 households (20,000 individuals), distributed over about 300 Italian municipalities. The survey results are published regularly in the Bank of Italy's Statistic series - Survey on Household Income and Wealth. The data on households is freely available, in anonymous form, for further processing and research. The SHIW data base is a rotating panel, with 50 percent of households present in two or more waves. For our purposes, the different waves are treated as a repeated cross sections.

The final dataset we use has information on age gender and education, on type of jobs and on the wages between 1993 and 2016. We restrict age between 16 and 64 to account for standard labor force participation range. The total number of observations drops to 297,403.

There are two questions that allow us to identify public employment. The first is being an income earner recieving a salary. The second one is the branch of activity. The latter is available from 1993 onwards (12 years up to 2016 wave), and this is the time range we use for the analysis. We thus create a dummy variable for public or private employment. It takes value 1 whenever the individual is in public employment and working for a salary[7] . Note that we disregard all observations for which info on branch of activity (*settp11*) was not available. This amounts to 212,563 (48.37% of the original sample). Tales of wage distribution have been discarded too. Final dataset is made of 72,637 observations. As there is not enough information on different industries, unlike CPS data, it is not possible to further

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[7]*settp11==9* and the person is actually working and perceiving a salary (*perl==1*)

divide public employment into sub-sectors. We observe household member characteristics, payroll employment income and self-employment income (members of the professions, the self-employed, sole proprietors and entrepreneurs, active shareholder/partner and family businesses). The wage variable is built as the sum of either payroll employment income (*yl*) or self-employment income (*ym*). Income from properties and financial assets has been discarded. To compute hourly wage, yearly income has been divided by the number of hours worked (*hoursworked*). When looking at the branch of activity (*settp11*) over the whole sample the second most frequent category (after public employment) is manufacturing (23.44% of total employed, while wholesale and retail accounts for about 17%). Education is first measured in 6 levels. Similarly to what we do for the rest of the paper, we simplified into a college dummy that takes value 1 if education level is either 5 (bachelor's degree) or 6 (post-graduate qualification).

9.2   Basic Statistics on Public Employment

Employment income earners represents 54.72 of the standard labor force sample. In Table 9 we focus on 5 key facts for Italy. First, we look at the total size of public employees in the sample. Individuals who self report being employed in government or any public service are 20,837, 24.56% of total workers on average.[8] Number of workers in public employment ranges from 2,245 in 1993 (27.9% of total employed) to 1,172 in 2016 (22,74% of total employed).

The second fact concerns education. The share of public employment with a college degree is 3 times larger in the private sector, with a share that is (31.41%, against a 9.28% in the private sector has 9.28%. The education differences is also remarkably present when we divde the education group into 5 categories, goring from no education until post graduate qualification. While the public sector hires only 10 percent of people with elementary school, it hires more than 60 percent of the individuals with a post graduate qualification. The third fact concern gender. Among female workers in the sample, 54 of them work in the public sector while 36 percent work in the private sector.

The fourth fact concerns regional difference. The percentage difference between public employees is larger in the South, but not dramaticaly so. Whereas in the North 20 percent of the people are employed in the public sector, in the South the percentage grows to 31 percent. Table 10 looks at the distribution across regions. With respect to the macro region distribution, the only exception is Basilicata, where public employee account for 22 percent of the workers.

The wage premium is estimated in Table 11. Controlling for age, gender, year region and part time dummy, Italy features a positive wage premium for workers with no college and

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[8]Employed income earners are those individuals for which (*perl==1*). Those who are employed in government are (*settp11==9*)

Table 9: Public Employment in Italy: Summary Statistics

	Public Employment	Private Employment
Age		
up to 30 years	12.82	87.18
from 31 to 40 years	23.39	76.61
from 41 to 50 years	28.37	71.63
from 51 to 65 years	32.03	67.97
Gender		
Female	53.91	35.35
Education		
College	31.41	9.28
None	12.07	87.93
Elementary school	10.56	89.44
Middle school	16.48	83.52
High school	31.75	68.25
Bachelor's degree	57.21	42.79
Post-graduate qualification	60.95	39.05
Area		
North	20.57	79.43
Centre	25.98	74.02
South and Islands	31.04	68.96
Wage		
College	19967.08	20516.97
	(10778.49)	(12470.79)
No college	14995.85	13797.29
	(5393.48)	(7390.21)
Average	24.55	75.45

Note: If only one category displayed, expressed as share of total employment.
Standard errors in parenthesis

a negative premium for college workers. There is thus clear evidence of wage compression across the education. In the next section, we move to a more systematic analysis on the link between public sector and education in Italy.

Table 10: Public Employment in Italy By Region

Region	Public Employment	Private Employment
Piemonte	19.32	80.68
Valle D'Aosta	24.36	75.64
Lombardia	21.68	78.32
Trentino A. A.	26.46	73.54
Veneto	16.16	83.84
Friuli V.G	26.07	73.93
Liguria	25.19	74.81
Emilia Romagna	18.64	81.36
Toscana	22.35	77.65
Umbria	19.01	80.99
Marche	23.10	76.90
Lazio	30.59	69.41
Abruzzi	26.98	73.02
Molise	34.72	65.28
Campania	30.36	69.64
Puglie	32.22	67.78
Basilicata	22.30	77.70
Calabria	35.76	64.24
Sicilia	34.22	65.78
Sardegna	26.71	73.2

Note: Note: Government employment as a fraction of total employment for different educational level using SHIW data. Data come from the Bank of Italy SHIW survey for the years 1993-2016

9.3   Further Look into the The Education Gap for Italy

Figure 27 reports the basic statistics on public employment in Italy, using the same educational categories initially proposed for the other countries. The share of employment in the public sector increases smoothly as the educational group increases, raising from less than 10 percent for workers with elementary schools until almost 60 percent for people with post graduate education. In this respect, Italy fits perfectly into the standard picture we described in the previous sections.

Figure 27 shows also the public sector wage premium in Italy for different education groups. Italy shows higher shares of post graduates employed in public-sector. Wage premium seems to be small and negative for bachelors, yet it becomes positive and greater in size for post graduates workers. Wage premium has been estimated similarly to Garibaldi, Gomes, and Sopraseuth (2019) by regressing the log of hourly wage on a dummy for public sector employment, controlling for gender, age, year and part time dummy (detailed info on occupation is not available in SHIW data) for workers with different education levels

Table 11: Public Sector Wage Premium in Italy

|	No college	College
Public sector	0.175***	-0.0286**
	(0.005)	(0.011)
Age	0.0107***	0.0220***
	(0.0002)	(0.0005)
Gender	-0.277***	-0.281***
	(0.004)	(0.009)
Region	-0.0174***	-0.0116***
	(0.0003)	(0.0009)
Year	0.0191***	0.0129***
	(0.0003)	(0.0007)
Part-time	-0.396***	-0.438***
	(0.006)	(0.018)
Constant	-28.71***	-16.39***
	(0.544)	(1.390)
Observations	61848	10857
R^2	0.280	0.301

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

separately. It covers information from 1993 to 2016.

As a way to compare the statistics and the findings for Italy with those of other countries, in Figure 29 we construct the public sector employment share in using the ratio of public employment share (r_g). The top-right graph shows the ratio of public employment shares (r_g). The latter appears above 2 for both male and female workers. The bottom left graph shows the public employment share for college and non college workers at different age groups. The bottom-right graph shows the ratio of public employment shares for the same statistics. While the ratio of public employment share are larger than 2 across all age groups, they are close to 3 for young workers.

Figure 30 reports the public employment share by education across Italian regions and over time. The top left graph shows the public employment shares, the fraction of public-sector employment out of total employment for college and not college graduates for different Italian regions. The top-right graph shows the ratio of public employment shares (r_g) across regions. While they are all largely above one, the share is definitely larger in Northern regions than in Southerns regions. The bottom left graph shows the public employment share for college and non college workers between 1993 and 2016. The bottom-right graph shows the ratio of public employment shares between 1993 and 2016. The ratio of public employment share has been constantly growing, suggesting that the Italian public sector has been hiring more and more graduates over time.

## Figure 26: Public Employment in Italy by Education, Gender and Age
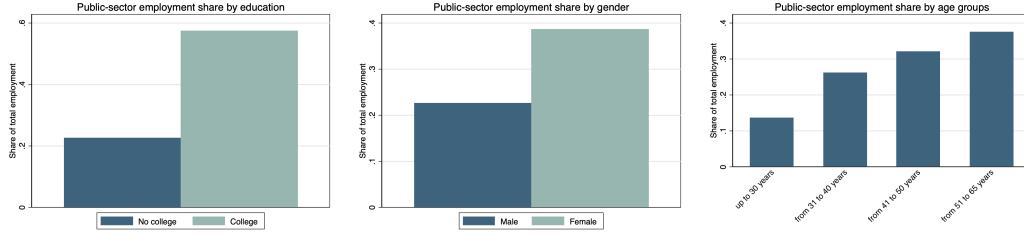
Note: The graph shows government employment as a fraction of total employment for different educational level using SHIW data. Data come from the Bank of Italy SHIW survey for the years 1993-2016

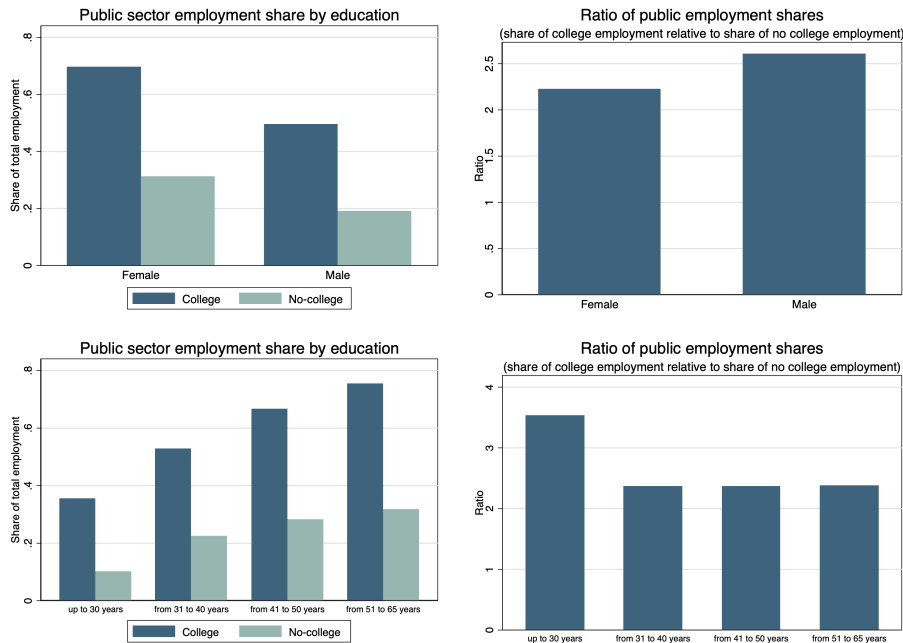## Figure 27: Public-Sector Employment Share by Educational Levels
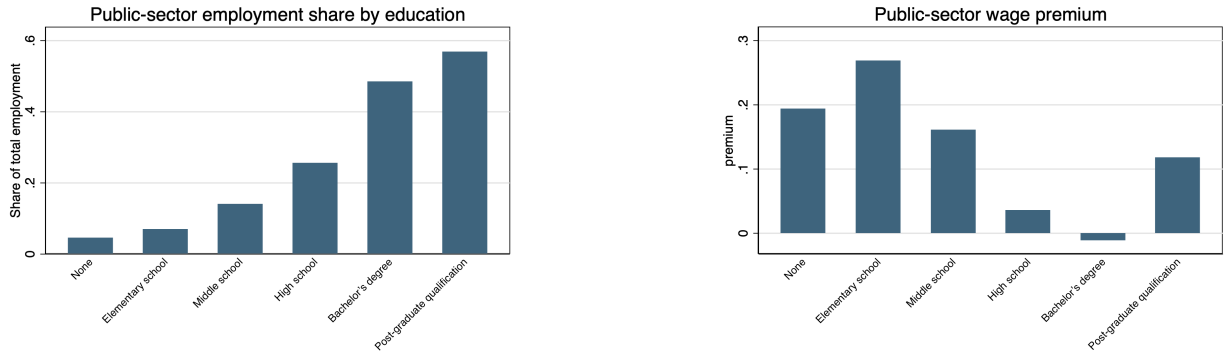
Note: The left-graph shows government employment as a fraction of total employment for different educational level using SHIW data. The graph on the right shows estimates of the public-sector wage premium. Wage premium has been estimated as in Garibaldi Gomez and Sopraseuth (2020) by regressing the log of hourly wage on a dummy for public sector employment, controlling for gender, age, year and part time dummy (detailed info on occupation is not availabe in SHIW data) for workers with different education levels separately. Data come from the Bank of Italy SHIW survey for the years 1993-2016

Figure 28: Public-Sector Education Bias
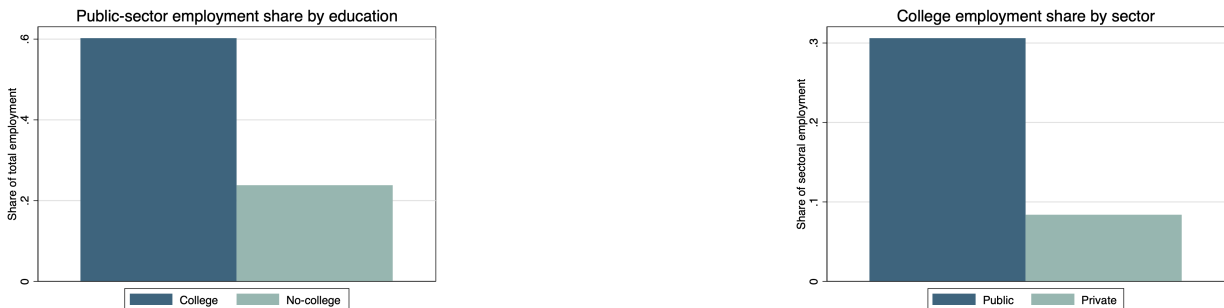
Note: The left graph shows the public employment shares, the fraction of public-sector employment out of total employment for college and not college graduates. The bottom-left graph shows the ratio of public employment shares (r_g). The right graph shows the education intensity by sector, the share of public- private workers that have a college degree. The bottom-right graph shows the education intensity ratio (e_{ig}). Data come from the Bank of Italy SHIW survey for the years 1993-2016

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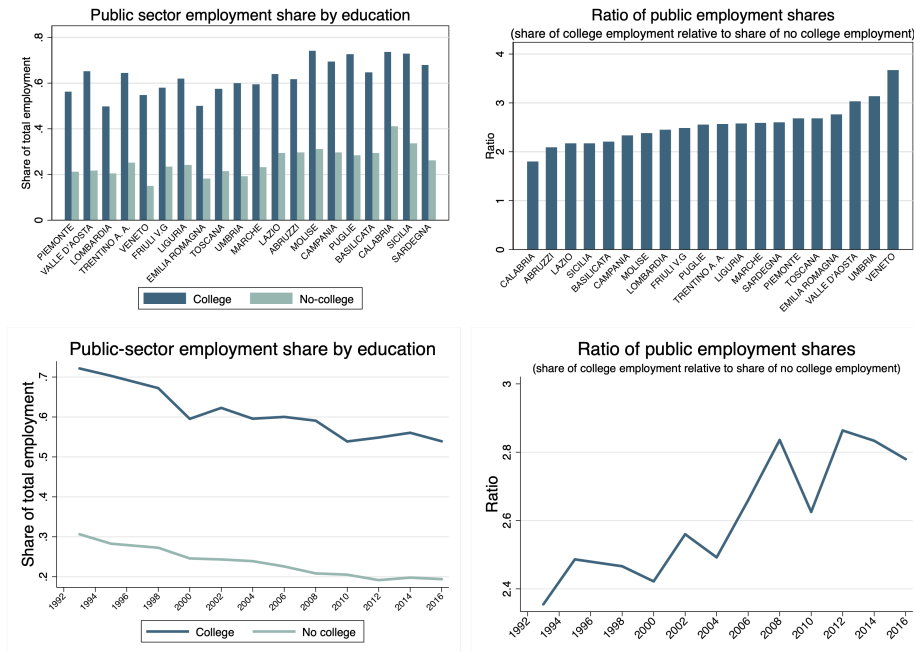Figure 29: Public-Sector Employment Share by Education and Age

Note: The left graph shows the public employment shares, the fraction of public-sector employment out of total employment for college and not college graduates. The top-right graph shows the ratio of public employment shares (r_g). The bottom left graph shows the public employment share for college and non college workers at different age groups. The bottom-right graph shows the ratio of public employment shares for the same statistics. Data come from the Bank of Italy SHIW survey for the years 1993-2016

Figure 30: Public-Sector Employment Share by Region and Over Time

Note: The top left graph shows the public employment shares, the fraction of public-sector employment out of total employment for college and not college graduates for different Italian regions. The top-right graph shows the ratio of public employment shares (r_g) across regions. The bottom left graph shows the public employment share for college and non college workers between 1993 and 2016. The bottom-right graph shows the ratio of public employment shares between 1993 and 2016. Data come from the Bank of Italy SHIW survey for the years 1993-2016

9.4 A Quick Glance into Temporary Employment in the Public Sector

While the public sector is traditionally seen as a sector with long term employment contract, there is anedoctal evidence of the increase in temporary employment in the public sector. Every year, a large share of the hiring of teachers in the public sector is taking place via temporary contracts. Over and beyond the type of sector, the SHIV data base has some information on the length of the contract of the individuals. We distinguish between open ended contract and fixed term contract, where the latter includes also interim workers. Information is limited to the waves 2002-2016. Table 12 reports the basic information on the average employment in the public sector.

The main finding of Table 12 and 13 is that fixed term contract is a widespread phenomenon also in the public sector. Within the sample considered in this section, public employment refers to 27 percent of the workforce, slightly larger than the estimate obtained for the entire waves. The share of fixed term jobs in the private sector is 15.6 percent, an estimate coherent with the national statistics compiled by Istat and the OECD. The same statistic for the public sector is 10.2 percent. This implies that - conditional on being in a given sector - a fixed term job is still more likely in the private sector. The difference in the share is not as large as one would likely expect. Finally, Table 13 shows that 20 percent of the total stock of temporary jobs are held in the public sector and 80 percent in the private. Since the private sector employs 72 percent of workers in the sample, there is still an extra use of temporary contracts in the private sector.

Table **??** reports the share of temporary jobs in the private and the public sector by regions. The differences are not remarkable and they appear fairly uniform across the nation. Table focuses on the gender difference. The female share of temporary jobs appears much larger for female workers. This result is likely due to the sectoral composition and the proportion of female workers in the educational sector, where many teaching jobs are temporary.

Table 12: Temporary and Permanent Contract by Sector

	Public	Private	Total
Open Ended	13427	33292	46720
Fixed Term	1536	6172	7708

Table 13: Basic Statistics on Temporary Workers

Employment Share [a]	27.4	72.5
Share of Fixed Term Jobs in Employment by sector [b]	10.26	15.6
Share of Temporary Jobs in Ea [c]	19.92	80.07

[a] Share of Employment by sector

[b] Share of Fixed term job in each sector

[c] Share of Fixed term across sectors

Table 14: Type of contracts by macro region and sector

	North		Centre		South & Islands	
	Public	Private	Public	Private	Public	Private
Permanent	.247	.752	.274	.725	.372	.627
Fixed Term	.190	.809	.232	.767	.211	.788
Interim	.125	.874	.135	.864	.122	.877
N		26649		11663		16116

Table 15: Type of contracts by gender and by sector

	Male		Female	
	Public	Private	Public	Private
Permanent	.217	.783	.385	.614
Fixed Term	.146	.853	.289	.710
Interim	.091	.909	.176	.823
N		31549		22879

Part D

Public Employment and Wages: Policy Implications

10 Principles Guiding a Reform

10.1 Quantities are policy variables, wages should not

In principle, the government in its day by day operation has discretion on the number of public employees (quantities), as well as their wages (prices). Our reading of the existing evidence and the economic analysis suggests – as a general rule – that the government should have flexibility in choosing the level of employment, but the setting of wages should be left out of the policy space. In practice, we believe that the government would benefit by partly "tying" its own hands.

The idea of delegating instrument to a third institutions, works well in the case of monetary authorities. The parallel with monetary authorities is limited. With respect to a central bank, which mainly uses the interest rate as a means of economic influence, the government controls several instruments. On the expenditure side, it has large control on public investments, purchases of goods and services, employment levels, wages and public transfers (such as pensions). We obviously do not think that all these variables are necessarily suitable to being determined by a rule. Public investment, and the purchases of goods and services and employment involve a political choice vis -à- vis society's preferences on the supply of public goods. These choices should not be delegated, and it does not make sense to define a rule that covers the variety of public spending. Transfers - such as income support and the redistributive part of social security- reflect the extent to which society wants to protect its weakest members. Public sector wages have different characteristics. They do not directly affect the supply of government services and they are both a payment to a factor of production and transfer from society to a specific group of citizens. As such, they can be a candidate for being delegated outside the direct control of the government.

The literature on the determinants of public wages shows that, more than a payment factor of production, public wages are often perceived by policymakers and politicians as a transfer, since they can be drawn from the revenue side of the budget and given directly to the public workers. As such, they are vulnerable to manipulation for electoral reasons, to benefit interest groups or to other objectives. The heterogeneity of wage policies in OECD countries, where the estimated public-sector wage premium varies between -10 and 25 percent, supports this view. Any reform must help society to view public wages only as a payment to a factor of production. In keeping with this spirit, the government should keep the value of working in the public sector close to that of the private. This means that governments should use private sector wages as their benchmark when deciding public

sector pay. In addition, they should correct it downwards, to compensate for other public-sector job characteristics that represent additional benefits, such as job security, lower hours and better work-life balance, better pensions or health care plans. Crucially, this principle should apply both across workers and over time.

10.2 Implementing a public wage reform: balance across sectors

In the evidence reviewed in the report, public wages are compressed both within and across education, as well as by age, vis-a-vis the private sector. Additionally, in many countries there are large regional differences in the relative pay in the two sectors. Our policy prescription point to a better alignment with the private sector. How should government implement this in practice?

The first step of wage policy reform is to review the pay schedule and progression structure of public sector workers by occupation, region, education and experience. Many European governments have obsolete pay structures. For each occupation and level of education, the offered wage should have the private sector wage as a benchmark, with a similar tenure profile. An evaluation scheme should be in place to reward unobservable skills and avoid wage compression.

On the one had, wages can be adjusted downwards to compensate for job security or if the government offers other significant perks and benefits (i.e. medical care, pensions, work life balance). On the other hand, an efficiency wage premium can be offered for sensitive types of jobs, such as those involving national security or prone to be targets of corruption, should be incorporated in the wage schedule. Unlike what happens now where the highest premium exist at the bottom, this calls for a reversion and less compressed wage schedule. Occupations with main incidence of public sector employment (for instance, judges, armed forces) should be comparable to occupations in the private sector with similar career trajectories and education. Such occupations offer some scope for political choices. Regarding regional differences, the public wages should be levelled with the poorest regions, and top-up should be added in richers regions (similar to London-Allowance) with the objective to level the regional public-sector wage premia.

Regarding gender differential there is a subtle byproduct. Although there are different public sector wage premia for men and women, we do not think that the latter is a dimension to be targeted by the reform. Let us be explicit. We certainly think that the public sector should pursue an "equal pay policy", which in presence of private sector gender wage gap will ex-post imply an asymmetric public sector wage premia by gender. On this dimension, the public wage will not mimic the private and thus, ex-post, we should expect a positive public-sector wage differential for women and a negative one for men. These differences will tend to diminish if policies to reduce gender wage gaps in the private sector are successful.

One crucial statistic to monitor the pay of public-sector workers is the number of suitable

applicants for a given job. Hundreds or thousands of suitable applicants for a given position suggest that the public sector jobs are being rationed, and that its value is larger than the private sector, should encourage an adjustment of relative pay.

10.3 Political considerations for the reforms

Given the size of public employment, one cannot implement this reform overnight. First, we think that direct wage cuts are not politically feasible nor desirable from a social perspective. Second, one has to have a longer implementation horizon, not by cutting wages but by changing the expectation of the whole wage schedule profile for all layers, over several years. One could start by freezing the pay structure, creating more brackets to enlarge the wage distribution. Some occupations, or for some educations levels, that have large negative premia in the public-sector could be unfreeze. During the adjustment, the wage increases could come through regional top-ups. This means that the wage profiles should be levelled with the poorest regions, and the top-ups, of variable magnitude that would depend of the relative private-sector wages across regions. During the implementation period, careful monitoring of the relative pay would be essential. It is very important that this top-up be labeled as "allowance", in the spirit of what takes place in the U.K. for the London area.

To facilitate the implementability, the government should try to use two hands and accompany such reform with an announcement of "quantity increase". To understand the quantity increase implied by the reform, we go back to the theoretical and empirical literature reviewed. Various theoretical papers by Gomes (2018) or Garibaldi, Gomes, and Sopraseuth (2019), and an older empirical literature on the demand of public employees, i.e. Ehrenberg (1973), suggest that changes in the wage schedule lead to a re-composition of public employment. Empirically, the forgotten literature in the 80's estimated wage elasticity for public employment in different government branches (Handbook chapters of 80's and 90's). These estimates were always negative and significant, with an average estimate around [-0.3]. In as much as different government departments are cost minimizing agents, lower relative wages for some types of workers, naturally lead to a higher demand for those workers. These expected endogenous response, should be used and announced in the political implementation. This increase in hiring, will be endogenous, and will be stronger exactly for the categories that have currently the highest premia, namely young and non-college workers in the poorest regions.

This expected re-balancing of public employment can be a political argument. The wage reform, can be justified, if it allows for an increase in hiring of public-sector workers over a given horizon without increasing spending and improving the quality of public services.

One element that is not addressed with a reform of public wages, is whether part of public employment itself is inefficient, and exists for rent-seeking or electoral reasons. This question is much harder to address, and related more with the microeconomics of the inner

workings in the public sector and their organization. One important aspect to realize, is that a reduction of public-private wage differentials, in particular to reach negative values, would reduce the incentives to use employment as a rent-seeking tool, because it would eliminate the rents. This will eliminate the bubble of public sector jobs.

10.4   How to set the annual wage increases

The second step in the reform, after the adjustment across workers has been achieved, is to delegate the decision of general wage increases. It would be necessary to set up an institution, a "Public Wage commission", in charge of setting the overall annual growth rate of public wages, inspired by the working of Low Pay Commission of the UK, with almost 20 years experience. Potentially, this task could also be done within existing Fiscal Councils created by EU member countries over the last ten years.

The delegation of the annual increase public-sector wages is vital to avoid the political manipulation of the wages. The commission should be mandated with a simple rule. One possibility is to set the growth rate of public sector wages to maintain the target ratio for the public wage bill relative to its employment and the one in the private sector. This is the aggregate public-private wage differential. The different departments - given the aggregate constraints - should hire alongside the pay structure reviewed during the first step. To avoid changes in composition of public employment from driving aggregate ratios, the pay structure of public sector workers can be re-evaluated every 10 years to adjust targets for composition.

Although the implementation of the reform would certainly face opponents, there are reasons to be optimistic. First, this reform resembles the policy followed by Nordic countries, which can serve as example for its implementation.

11 Conclusion - Public Employment and Wages in a Post-Pandemic World

This report was written in the midst of the Covid-19 Pandemic. In the short-term, economies faced a very negative demand shock, that propelled unemployment rates to levels never seen since the Great Depression. This led to an emergency response of fiscal and monetary policy, to avoid even more job losses. These responses were fundamental, but left both the governments and central banks with little ammunition for the future. Interest rates will stay at the zero-lower bound for the foreseeable future, and no matter how inventive central bankers are, we should not expect monetary policy to get us to full employment. Similarly, with the remarkable fiscal packages, have pushed government debts, that were already high before the crises, to levels very close to unsustainable. If unemployment rates do not recover naturally over the next year, than economies will face very difficult times.

The long-term effects of the pandemic are difficult to predict, but it is clear that western societies and economies are going to change profoundly. Whatever these changes may be, it seems obvious that the government is going to be at the center. It is very likely that societies will demand a bigger role of the government, most notably on health care and other key services. This will come, at a time where budgetary pressures will be unforgiven.

This combination of high unemployment, high government debt and increasing demand for government services, is a problem that is hard, but not impossible to square. The research presented in this report offers the solution for this problem. For a long time, governments have not paid attention to their employment and wage policies, and neither have economists. A reform, that simultaneous reduces the public-private wage differentials, over time, without direct wage cuts, brought together with a plan to increase the number of public employees and improve government services, is the best way to squaring the circle. The increase in employment will self-finance, absorb part of the unemployed, in particular the ones that have faced lower job prospects: the young workers, with lower education and in poorer regions.

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