

# Public employment

Does it increase unemployment?

## SUMMARY

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*We explore the consequences of public employment for labour market performance. Theory suggests that public employment may not only crowd out private employment, but also increase overall unemployment if, by offering attractive working conditions, it draws additional individuals into the labour force. Empirical evidence from a sample of OECD countries in the 1960–2000 period suggests that, on average, creation of 100 public jobs may have eliminated about 150 private sector jobs, slightly decreased labour market participation, and increased by about 33 the number of unemployed workers. Theoretical considerations and empirical evidence, however, suggest that the crowding out effect of public jobs on private jobs is only significant in countries where public production is highly substitutable to private activities and the public sector offers more attractive wages and/or other benefits than the private labour market.*

— Yann Algan, Pierre Cahuc and André Zylberberg



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# Public employment and labour market performance

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## 1. INTRODUCTION

Public employment accounts for an important share of total employment in many OECD countries. While there are many possible definitions of ‘public’ employment, in this paper we study its labour market implications on the basis of the rather restrictive definition for which comparable cross-country statistics are available. The OECD makes available data on jobs belonging to central and local administrations, to non-profit organizations owned or directly financed by public administrations, to army and embassies (see OECD, 1997, and Section 3.1.1 below for further discussion). On this basis, the share of public employment in total employment averages 16.6% across seventeen OECD countries over the 1960–2000 period and displays an increasing trend over time: in 2000, it averages 18.8% across the countries for which data are available (see Table 1).

These data are highly policy-relevant and amenable to empirical exploration because industrialized countries are very heterogeneous in the relevant respects. In the year 2000, the share of employment accounted for by public jobs ranged from 8.4% in Japan to 31.2% in Norway (Table 1), and country experiences are also very

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For helpful comments we thank, without implication: the managing editors, discussants, and members of the 34th *Economic Policy* Panel Meeting, Antoine d’Autume, Paul Beaudry, Pierre Granier, Stéphane Grégoir, Pierre-Yves Henin, Francis Kramarz, Guy Laroque, Etienne Lehmann, Fabien Postel-Vinay, Jean-Marc Robin, Bernard Salanié, Etienne Wasmer, and seminar participants at University Paris 1, University of Antilles-Guyane, University of Lausanne, ECARES-Free University of Brussels, Aarhus University, and CREST-INSEE.

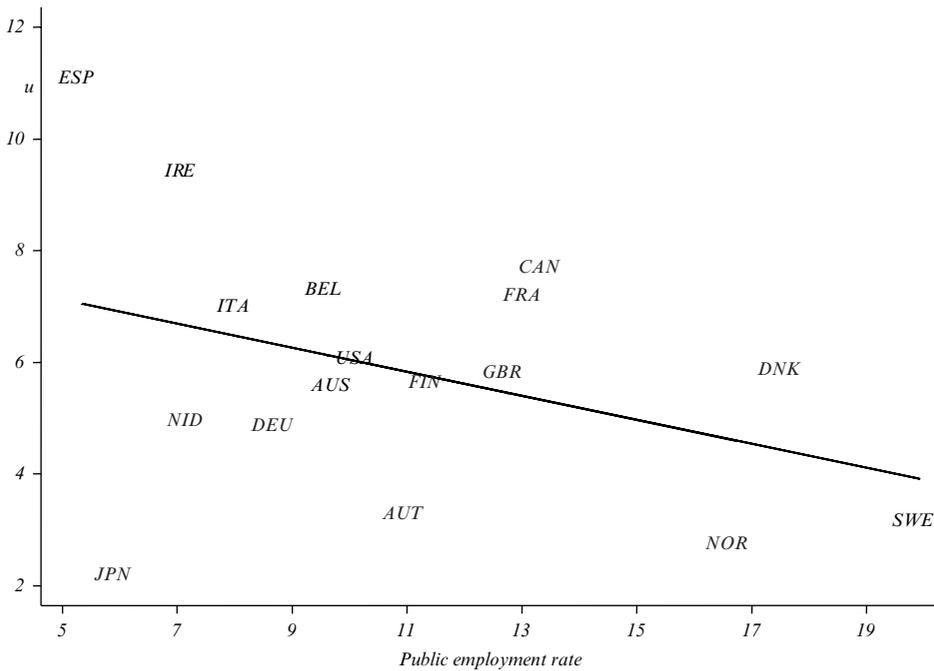
**Table 1. Public employment and unemployment in 17 OECD countries over the period 1960–2000**

	Public employment %		Std ( $u$ )	Std ( $Lg$ )	Corr ( $u, Lg$ )
	Total employment 1960–2000	Average 2000			
Australia	14.6	14.8	3.09	1.56	0.88
Austria	17.0	20.6	1.95	2.27	0.84
Belgium	16.6	18.5	4.41	1.43	0.90
Canada	20.3	19.1	2.35	1.04	0.83
Denmark	23.8	30.3	3.73	5.46	0.88
Finland	16.5	23.2	4.51	3.32	0.68
France	21.1	24.9	3.79	1.14	0.96
Germany	13.3	14.9	3.71	1.34	0.78
Ireland	12.2	11.0	4.45	0.90	0.64
Italy	14.6	17.1	3.19	1.20	0.79
Japan	8.3	8.4	0.99	0.26	0.78
Netherlands	12.9	11.4	2.60	0.25	0.21
Norway	23.9	31.4	1.48	5.00	0.78
Spain	9.9	14.6	8.00	1.75	0.90
Sweden	26.6	30.9	2.18	5.71	0.36
UK	18.2	13.4	3.49	1.93	0.16
USA	15.4	15.2	1.48	1.03	0.17

Source: OECD.

heterogeneous as regards the dynamics of public employment. In the 1960–2000 period public jobs, as a fraction of working age population, were stable in Japan and the Netherlands. They initially increased, and then started to fall in the early 1980s, in Ireland and the UK, and they increased steadily, if at different speeds, in the other countries of our sample (see the figures in Appendix 3).

Since the dynamics of employment and unemployment rates were also quite heterogeneous across the OECD in that period, it is perhaps surprising that little attention has so far been paid to the possible consequences of the public sector for private employment and unemployment (see Box 1 below for a brief literature review). Policy debates sometimes view public employment as a useful tool to counteract the scarcity of jobs in the private sector, and public employment programmes motivated by such considerations are not rare in European countries. Thus, the strong positive correlation between the unemployment rate and the size of public employment in most countries over time (Table 1, column 3) could represent the response of governments to increasing unemployment. Observing a negative correlation between public employment and unemployment across countries rather than over time (see Figure 1) could lend support to a benign view of the impact of public sector jobs on overall labour market performance. Over time, however, causation could run in the opposite direction: public employment may well increase unemployment if public job creation causes destruction of private jobs by, for example, increasing labour taxes and/or exerting competitive pressure on private producers' output and labour markets.



**Figure 1. Average public employment as a ratio of working-age population, and unemployment rates; 17 OECD countries, 1960–2000 averages**

Source: OECD.

We bring such theoretical considerations on possible motivations and labour-market effects of public sector job creation to bear on data where no clear-cut relationship is readily apparent. The negative correlation between unemployment and public employment illustrated by Figure 1 suggests that public employment may decrease unemployment, whereas inspection of Table 1, where the two variables are positively correlated, may lead to an opposite conclusion.

We first study theoretical channels for public jobs to affect private employment and aggregate unemployment. Our analysis is focused on medium and long-run effects of public job creation, disregarding nominal rigidities and demand-side effects that may play an important role in the short run. From this perspective, we argue that the size and sign of public employment's labour market effects depend on the market impact of public jobs, which in turn depends on whether the production of the public sector is substitutable to that of the private sector. Public jobs that produce pure collective good (such as justice or defence) have smaller negative (or even positive) effects on private employment than those in transport, education and health, where private production is possible. Generally, crowding out effects should be increasing with the degree of substitutability between the production of the public and the private sector. However, employment conditions in the public sector also play an important role in determining the impact of public jobs on private employment. Public jobs that pay high wages,

**Box 1. Related literature**

To the best of our knowledge, very little has been written on the macroeconomic labour market effects of public employment. A strand of literature, surveyed by Rama (1999) and focused on corruption issues, has studied the public sector's role in developing countries. But two major surveys of public sector labour markets by Ehrenberg and Schwarz (1986) and Gregory and Borland (1999) show that studies of public employment in industrialized countries has mainly focused on the internal organization of the public sector, especially the influence of trade unions, and on wage differentials between the private and the public sector. Holmlund and Linden (1993) and Calmfors and Lang (1995) study the macroeconomic effect of temporary employment programmes, arguing that temporary public jobs increase wage pressure in the private sector. These papers both conclude that wage pressure from public jobs reduces private employment. Holmlund and Linden (1993) note that it cannot be ruled out that the offsetting effect of temporary jobs is so strong that unemployment actually increases when hires into relief jobs are intensified, but this outcome is a remote possibility in their framework. Holmlund (1997) offers more insight on the relationship between the public sector and unemployment in a trade-union model. He shows that public sector expansion increases equilibrium unemployment if unions are relatively more powerful in the public sector than in the private sector.

Finn (1998) obtains more precise results in a real business cycle model applied to the US economy. Finn distinguishes between the goods purchases and employee compensation components of government spending. Then she shows that positive shocks to government goods purchases increase private output and private employment, whereas positive shocks to government employment have the opposite effects.

The empirical literature confirms the ambiguous impact of public employment on labour market performance. Some empirical evidence is provided by Demekas and Kontolemis (2000) for Greece, and by Malley and Moutos (2001) for Germany, Japan and the US. Both papers rely on time series data and suggest that public employment has a strong crowding out effect on private employment. Edin and Holmlund (1997) used pooled crossed section and annual time series data for 22 OECD countries over the period 1968–90. The basic message emerging from their exercises is that public sector employment decreases unemployment in the short run, whereas there is no significant long-run effect. Among existing contributions, Boeri *et al.* (2000) is perhaps the closest antecedent to our work. Their Table 4 includes public employment, along with labour market institutions, as an explanatory variable for the non-agricultural employment rate for 19 industrialized OECD countries over the

period 1982–95. Their estimate is about 0.7, to imply that one public job crowds out 0.3 private jobs, and significant at the 1% level. Like other existing estimates, however, this does not account for possible endogeneity of public employment.

require low effort, and offer attractive fringe benefits should attract many workers, and crowd out many private jobs.

These are the two key channels of economic interaction in our approach. We should acknowledge, of course, that many other factors are likely to be important in reality. For instance, the crowding out effect of public jobs on the private sector might be larger in countries where taxes introduce larger distortions and in more open economies, which face stronger international competitive pressure. However, we focus on the specific channels outlined above, and seek empirical support for their empirical relevance.

### 1.1. Empirical approach and results: summary

Empirical evidence is not easy to gather, because public employment responds to many of the same phenomena that cause other labour market outcomes. As mentioned, a positive correlation between public employment and unemployment may be induced by government job creation in response to poor labour market conditions, and it would be obviously incorrect to conclude from that correlation that public jobs increase unemployment. To isolate the direct effect of public employment on private jobs from other sources of correlation between these two variables (or, to address endogeneity), we can rely on our theoretical framework to identify variables influencing public employment directly as well as labour market performance. Our empirical work experiments with productivity growth, the political inclination of the government, the degree of openness, the urbanization rate and some features of the public sector in that role.

The results suggest that public employment did importantly affect labour market performance of OECD countries over the last 40 years. We find that public employment increases unemployment in these countries. Like any other econometric estimate, these numbers have to be interpreted cautiously. A large part of the empirical analysis below is devoted to assessing their robustness (additional tests are reported in the paper's Web Appendix, which can be found on <http://www.economic-policy.org>). While different estimation techniques provide different estimates, most of the results confirm the broad impression conveyed by the numbers reported above, and none of our specifications indicate that public employment significantly decreases unemployment.

Our theoretical approach predicts that the crowding out effect of public employment increases with the degree of public/private production substitutability, and that public employment should destroy more private jobs in countries where public sector employment is attractive. These features are not easy to capture empirically. However,

**Table 2. Country clustering according to the level of public rents and the degree of substitutability of public and private jobs**

	High rents in the public sector	Low rents in the public sector
High substitutability	Belgium, Japan, Spain	Denmark, Finland, Germany, Norway, Sweden, UK
Low substitutability	Austria, France, Ireland, Italy, USA	Austria, Canada, Netherlands

*Notes:* Public rent is measured by the corruption index while the substitutability of public and private jobs is based on the share of public spending in total health expenditure.

If public rent is measured by the wage premium there is a category change for Canada and Austria (data are missing for France, Belgium, Denmark and Finland).

If the degree of substitutability is measured by the share of defence, general public services and public order in total expenditure, there is a change in category for Austria, Ireland and UK (data are missing for Belgium, France and Germany).

we can measure substitutability on the basis of public expenditure shares in the health sector rather than in production of more purely public goods. And we can assess the attractiveness of public jobs on the basis of public/private wage differentials as well as on the basis of a ‘corruption index’ meant to capture benefits accruing to public employees from use of power. Table 2 groups countries on the basis of such indicators of the level of rents in the public sector (i.e. where holders of public jobs are paid more than is required to get them to work, in light of alternative employment opportunities), and of the degree of substitutability of public and private jobs (see Section 3.1.1 for more detailed discussion).

The characteristics of public employment are quite different across OECD countries. In Belgium, Japan and Spain, the public sector offers relatively large rents and its output is highly substitutable to that of the private sector. Our theoretical perspective suggests, and our empirical results confirm, that the crowding out effect of public jobs is largest for this group, and that it is only for this group that public employment significantly increases unemployment. The size of the public sector is below the median in these countries (see Table 1), so the simpler idea that crowding out effects of public employment are increasing in size cannot explain our results. At the other extreme, Australia, Canada and the Netherlands couple public rent and substitutability of private and public jobs below the median. For this group of countries, the crowding out effect of public jobs is theoretically and empirically small. Finally, effects of intermediate size should be (and are) observed in the four Scandinavian countries (Denmark, Finland, Norway and Sweden), in Germany, and the UK, which feature low rents in public administration and high substitutability between private and public jobs.

Overall, the data confirm that public employment effects appear to be important, and that their analysis needs to take into account detailed country-specific features. Our estimates show that differences in the development of the public sector across our sample countries explained a non-negligible share of the variance of the private employment rates over the last 40 years. Indeed, we find that about 12% of the private

employment rate dispersion can be explained by differences in public sector size, a share comparable to those explained by labour market institutions in previous studies.<sup>1</sup>

## 1.2. Policy implications

Our results point out that crowding out effects of public jobs on the private sector may be important, especially if public activities are substitutable to those of the private sector and if public jobs provide large rents. Needless to say, large and significant crowding out effects cast serious doubts on the efficacy of large public employment programmes as a policy tool in combating unemployment. Moreover, our analysis suggests that reforms aimed at reducing the rents of public employees may significantly improve labour market performances.

However, our results should be interpreted cautiously, and certainly do not imply that public employment should be reduced even in the countries where it appears significantly to worsen labour market performance. To determine the optimal level of public employment, policy-makers should take into account scores of other country-specific features, such as exposure to international trade, the level of education, the size of the country, the degree of urbanization, access to natural resources (see Hart *et al.*, 1997, and Rodrik, 1998). A large public sector may crowd out many private jobs, but may also offer access to good health, education and transport. It is impossible to evaluate the efficiency of the public sector without looking meticulously at its production side, and we make no attempt to do so in this paper (see Karras, 1996, 2000, for some relevant evidence). Even from our narrow labour-market perspective, public employment may well have beneficial effects (despite higher overall unemployment) for the welfare of disadvantaged individuals, if the public sector's labour markets is better able to implement equal-opportunity and anti-discrimination policies and increase labour market participation of individuals who endure discrimination.<sup>2</sup>

## 2. THEORY

### 2.1. Labour market effects of public employment

In theory, public jobs have an ambiguous impact on unemployment. If private employment and the labour force were given, an additional public job would obviously and

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<sup>1</sup> Blanchard and Wolfers (2000) find that interactions of common macroeconomic shocks with unemployment benefits, union coverage, union density, the degree of co-ordination of collective bargaining, the tax wedge, active labour market policies and employment protection explains about 32% of the private employment rate dispersion. Nickell (1997), Daveri and Tabellini (2000), Belot and van Ours (2000), and Freeman (2000) have performed similar empirical exercises. These and most other studies of aggregate labour market performance omit public employment from their empirical specifications.

<sup>2</sup> Public employment has arguably improved labour market access for disadvantaged groups of workers. For instance, the steady increase of public employment in Sweden and elsewhere during the 1960s and 70s was associated with increasing labour market participation by women (Rosen, 1995). More generally, gender and race earnings differentials are larger in the private than in the public sector in many OECD countries (Gregory and Borland, 1999).

directly reduce unemployment. However, public employment can also affect unemployment indirectly, through private employment and labour force participation.

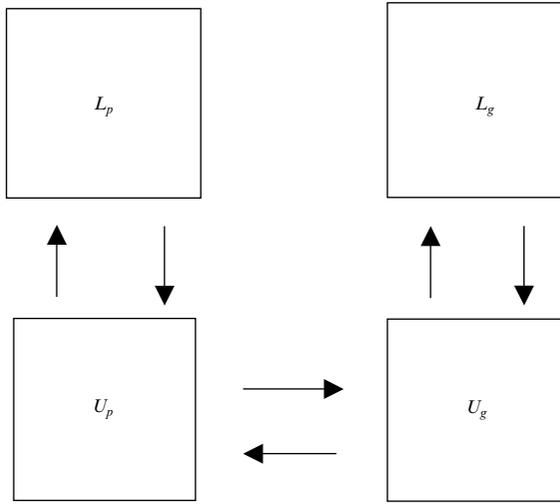
Public jobs crowd out private employment through different channels. First, goods produced by the public sector can be substitutable to those produced by the private sector. Secondly, the creation of public jobs may improve the expected gains of the unemployed workers, which increases wage pressure and decreases private employment (Holmlund and Linden, 1993, Holmlund, 1997). Thirdly, the cost of public jobs generally implies an increase in public expenditure or public expenditure switching. In the former case, it reduces the after-tax profitability of firms. In the latter case, it leads to reductions in public investment or infrastructure building. In both cases, the financing implications can be distortionary and impact negatively on the productivity of the private sector, thereby reducing labour demand in that sector.

Public jobs also influence labour force participation. To the extent that public job creation improves all unemployed workers' job-finding and wage outlook, it must make labour force participation more appealing, and increase unemployment. Public employment can also have negative effects on participation, however, if public-sector workers produce goods that make out-of-labour-force status more appealing for their fellow citizens. For example, supply and management of public housing, and some health programmes for the disadvantaged, can have such effects.

In summary, public jobs have a negative direct effect on unemployment and indirect effects that can be either positive or negative.<sup>3</sup> Theory, however, can also indicate how to resolve such ambiguities. We proceed to outline a simple framework of analysis where the sign and size of public jobs' unemployment effects depends on the size of the rents in the public sector, on the one hand, and on the degree of substitutability of public and private outputs on the other. Like every model, our framework yields a partial view on the consequence of public employment. In particular, we voluntarily neglect the distortionary impact of taxes in financing public jobs (see Holmlund, 1993 on this issue) in order to focus on the role of rents and the degree of substitutability of public and private employment.

**2.1.1. The size of the rents in the public sector.** In Appendix 1 we propose and study a model with public and private jobs. The private sector produces with decreasing returns to labour a private good, while the public sector produces a public good consumed by all individuals. We suppose that unemployed workers can look either for a public or for a private job, but not for both types of job at the same time. This assumption, while not essential for the qualitative results of our analysis, conveniently simplifies our reasoning and may well be realistic, since in many countries the public sector hiring process is very different from the private sector's, and civil

<sup>3</sup> Formally, let  $U$  denote unemployment, i.e., the difference between labour force ( $N$ ) and the sum of private ( $L_p$ ) and public ( $L_g$ ) employment and public employment. The effect of public employment on the unemployment rate  $u = U/N$ , from the identity  $U = N - (L_p + L_g)$ , is given by  $Ndu/dL_g = (1 - u)dN/dL_g - dL_p/dL_g - 1$ .



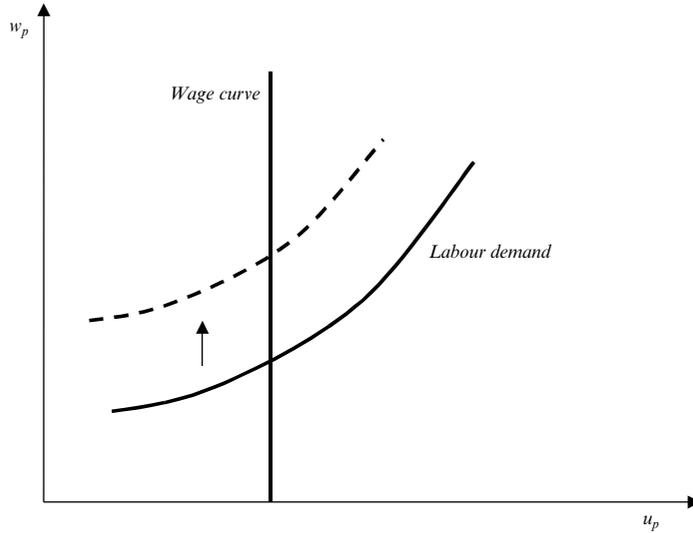
**Figure 2. Labour flows in a market with public and private employment and unemployment**

*Notes:*  $L_p$  is private employment,  $L_g$  is public (government) employment;  $U_p$  and  $U_g$  denote the unemployed who seek jobs in the public and private sector.

servants tend to follow separate training and career tracks. In France, for example, those seeking public employment must engage in national examination-based competitions. The model, however, assumes that unemployed workers can move across the two sectors at zero cost, so that expected utility of unemployed workers has to be the same in both sectors. The flows on the labour market are summarized in Figure 2.

In the private sector, wages are determined by collective bargaining. All workers who belong to the private sector are represented by a trade union that bargains wages with the representative firm. In this very standard framework, inspired by Layard *et al.* (1991), some positive level of unemployment is needed to stabilize wages. More precisely, wage bargaining implies a relationship between the wage and the unemployment rate in the private sector,  $u_p = (N_p - L_p)/N_p$  (where  $N_p = L_p + U_p$  is the number of private-sector workers), the so-called ‘wage curve’. In our model, this relationship is very simple. Any level of wage is stabilized by the same unemployment rate in the private sector, as shown by Figure 3.<sup>4</sup> Concerning employment, it is assumed that firms have the right to manage. Thus, they stand on their labour demand and the wage is equal to the marginal productivity of labour. Accordingly, the private wage,  $w_p$ , and the unemployment rate in the private sector,  $u_p$ , are determined

<sup>4</sup> This means that the wage curve is vertical in the  $(w_p, u_p)$  plane. More precisely, this property holds either for a constant replacement ratio, such that the income of unemployed workers is proportional to the wage in the private sector, or if the income of the unemployed workers amounts to zero. Assuming that unemployed workers get an income that is not proportional to the private wage would yield a decreasing wage curve and more complex mechanisms than those discussed here, but with similar predictions for our purpose.



**Figure 3. Effects on the private labour market of higher public employment**

by the intercept of a vertical wage curve and an increasing labour demand curve in the  $(w_p, u_p)$  plane, as shown by Figure 3.

In this setting, the private unemployment rate depends on the bargaining power of workers and on the features of the production function in the private sector. Moreover, as the (steady state) equilibrium private unemployment rate does not depend on the size of the labour force, it is independent of the number of workers who belong to the private sector.<sup>5</sup>

Let us now focus on the public sector. The returns to unemployment in the public sector are obviously increasing with the number of public jobs and with the public wage level. Therefore, the share of the labour force that belongs to the public sector (including public jobs and public unemployment) increases with the number of public jobs and the relative level of the public wage,  $w_g$ , with respect to the private wage,  $w_p$ . Now, public jobs creation attracts workers into the public sector at the expense of the private sector if the ratio of public to private wage rates is constant.<sup>6</sup> If the participation rate is given, this will necessarily crowd out private jobs, and the crowding out effect is more pronounced when the relative wage of the public sector is higher, and attracts more workers into the public sector. This is a very important element of our

<sup>5</sup> Since the unemployment rate in the private sector does not depend on the number of workers who belong to the private sector, denoted by  $N_p$ , private employment, which amounts to  $N_p(1 - u_p)$ , is influenced by public employment through changes in the allocation of workers across sectors, i.e. changes in  $N_p$ . The unemployment rate in the private sector does not depend on the size of the public sector in the model outlined in the Appendix, but larger public employment would increase the private unemployment if financed by distortionary taxes.

<sup>6</sup> In Appendix 1, we show that collective bargaining in the public sector can indeed imply such constancy.

argument. More generally than in the specific model we propose, and quite intuitively, the crowding out effect of public jobs increases with the *rents* provided by those jobs. ‘Good’ public jobs that provide better wages, fringe benefits, and working conditions than can be obtained in the private sector crowd out more private jobs than ‘bad’ public jobs with low wages, low fringe benefits, and bad working conditions.

Public jobs increase the wage in the private sector, for a constant relative wage, because the crowding out effect implies a reduction in private employment, which increases the marginal productivity of labour in the private sector. This effect is depicted in Figure 3. This result is important since one would expect that public jobs creation has an opposite impact on the private wage (net of taxes) if the transmission mechanism goes through an increase in taxes. Indeed, an increase in taxes, due to a public employment hike, should decrease the net wage. Our empirical findings show that a rise in public employment actually increased net wages in the private sector of OECD countries over the last 40 years. This result suggests that the mechanisms put forward in our theoretical framework are empirically relevant.

The consequence of public jobs on the unemployment rate depends on the size of the crowding out effect on the private sector. When the size of the labour force is taken as given, the creation of one public job decreases unemployment only if the crowding out effect is small enough, namely if less than one private job is destroyed. Since the crowding out effect increases with the relative level of the public wage, it can be shown that public jobs creation increases the unemployment rate if wages in the public sector are high (see Appendix 1). In other words, public jobs increase the unemployment rate if employees in the public sector get sufficiently high rents. It should be noticed that this result does not mean that large rents in the public sector are necessarily inefficient. They can be a way to attract efficient workers in the public sector, and to improve overall efficiency if public and private productions are complementary.

### **2.1.2. Substitutability of public and private outputs, and participation.**

In our framework, the role of the substitutability between private and public productions can be illustrated by taking into account the influence of public jobs on labour market participation. Up to now, the labour force has been assumed constant, but public jobs can influence participation in the labour market. By improving employment opportunities, public job creation is likely to increase the size of the labour force. This must soften the crowding out effect of public jobs on the private sector. However, it should be noticed that public jobs may influence participation in the labour market through other channels. First, it can be the case that the public good has a different value for those who participate and who do not participate in the labour market. For instance, the production of the public sector can be more valuable for individuals who participate in the labour market. Public transport in big cities is an obvious example. In that case, an increase in public sector employment fosters labour participation and induces smaller crowding out effects on private

employment. The opposite may be the case, however, for other types of public employment. In particular, the production of the public sector can influence the private sector productivity (see Appendix 1). Jobs in the judicial system, police and public transport arguably have positive effects on private productivity (and employment). Conversely, when public jobs produce goods that are substitutable to those produced by the private sector, the relative price of goods produced by the private sector must decrease, with negative effects on private employment.

## 2.2. On the determinants of public employment

Public employment is influenced by many factors. Among them, the objectives of governments and the features of private and public labour markets play a key role in our argument.

**2.2.1. The objectives of the public sector.** Of course, public and private employment are set on the basis of very different criteria. Whereas private employment is aimed at maximizing firms' profit, public employment aims at maximizing sociopolitical or bureaucratic objectives (Gregory and Borland, 1999). Hence, public employment can be used for production of collective goods (such as foreign policy, justice, defence, police) or goods that cannot be satisfactorily supplied by market mechanisms (such as unemployment benefits, health care, prison, education; see Tirole, 1994, and Hart *et al.*, 1997). But it can also be used for distributive purposes, in order to circumvent opposition to an explicit tax-transfer system (Coate and Morris, 1995, Alesina *et al.*, 1998).<sup>7</sup> Thus, public employment in principle is jointly determined by a wide variety of real-life features, including labour market performance.

**2.2.2. Public and private employment interactions.** For our purposes, interactions of public and private employment can be represented in a simple framework in which it is assumed that a benevolent government sets public employment and negotiates the wage in the public sector with a utilitarian trade union that represents the workers who belong to the public sector (see Appendix 1 for detailed formal derivations). The benevolent government aims at maximizing the difference between the social value of the public good and its cost. In this context, one can explain both the public wage and the public employment level. In equilibrium, the public-private wage ratio depends on the bargaining power of trade unions in both sectors, and on the elasticities of private and public labour demands.

Public employment is determined so as to equate its marginal benefits to the public wage. As the public wage is influenced by the private wage, public employment hinges not only on the features of the public labour market, but also on those of the

<sup>7</sup> For instance, Alesina *et al.* (2000) argue that about one-half of the public wage bill in the south of Italy can be identified as a subsidy. They stress that both the size of public employment and the level of wages are used as a redistributive device.

private labour market that influence the wage in the private sector. Accordingly, our model shows that the equilibrium size of the public sector depends on policy-makers' or society's valuation of public goods, and on the institutional features influencing private and public wages. The same type of result would obviously obtain if the public labour demand were deduced from the behaviour of a politician or a bureaucrat maximizing an ad hoc objective function implying a trade-off between public and private employment, or between public employment and taxes.

Finally, our model allows us to describe the determinants of public employment and private employment by a simple set of two relations. Private employment (or similarly the unemployment rate) depends on productivity in the private sector, labour market institutions and public employment. And public employment depends on the valuation of public goods, on productivity in both sectors, and on labour market institutions. These are the two theoretical channels we bring to bear on empirical analysis below, relying in particular on the role of other variables in those relationships.

For example, a negative private productivity shock is predicted to decrease wages and increase public jobs, since public production becomes relatively more attractive – see Equation (15) in Appendix 1. The effects on aggregate unemployment depend on the size of the rents in the public sector – see Equation (10) in Appendix 1. If public job rents are large, the increase in public employment increases unemployment, because workers are attracted into the public sector, in which the unemployment rate is the highest. The reverse result holds if public job rents are sufficiently small. Accordingly, our model can yield either a positive or a negative correlation between unemployment and public employment in response to productivity shocks. But it also suggests conditions under which it will take either sign. A positive correlation is predicted if there are large rents in the public sector, and a negative one if public jobs are not very attractive.

The model has similar implications for the consequences of an increase in the value attached to public-sector production. In our empirical work, we will try to control for this effect by such variables as the political inclination (left or right) of the government, the degree of openness of the economy, and its urban density. A higher preference for public production gives rise to an increase in public employment that can induce either a decrease (if public rents are small) or an increase (if public rents are large) in the unemployment rate. On the whole, our theoretical framework shows that unemployment and public employment can be considered to be co-determined by a set of independent variables whose variations can give rise to positive as well as negative correlations between unemployment and public jobs.

### 3. EMPIRICAL EVIDENCE

We proceed to assess the consequences of public employment from an empirical perspective. In what follows, we first describe the data before focusing on the impact

of public employment on private employment, unemployment and participation. Then we bring our theoretical framework to bear on the data, aiming to establish whether public employment has a more important crowding out effect on private employment in countries where the public sector offers high rent and produces goods that are highly substitutable to those produced by the private sector.

### 3.1. Data

We have collected data for 17 OECD countries over the period 1960–2000, the sample size being dictated by the availability of data. In order to remove the effect of cyclical fluctuations, we average the time-dependent macroeconomic variables over five-year periods. Thus the benchmark panel consists of 17 countries and 8 observations per country, except for two countries displaying no information on public employment for the first period. The sample size of the benchmark regression is consequently made up of 132 observations. However the size of this sample is subject to evolution through the econometric analysis depending on the availability of information on public employment instruments. All data sources are listed in Appendix 2.

Unemployment rates are the usual OECD standardized series, and we measure the private employment rate as the ratio of total business sector employment to working age population. The data on the incidence of public employment, drawn from the OECD database, are the ratio of general government employment on population in working age. Following Nickell (1997), we take the logarithm of unemployment rate, private employment rate and public employment rate. This allows easier comparisons with the previous literature, and has a very minor impact on the results.

According to the OECD definition, government employment consists of jobs in central and local administrations, in non-profit organizations controlled or financed by public administrations, and in military and diplomatic entities. The definition does not include firms that are ‘public’ in that the government owns them outright or owns a controlling interest, but are engaged in other activities. The OECD public employment definition is restrictive and quite consistent across countries. Besides administrative civil servants, it includes mainly workers engaged in defence, justice, health and education. Unfortunately, the OECD provides only aggregate public employment data, rather than the employment shares in each of these activities. This makes it difficult to assess the substitutability of public and private output, which plays an important role from our theoretical perspective. Hence we will need to discuss possible empirical proxies in the next section.

To understand this definition, it is helpful to consider its application to France and the US. Public jobs, as defined by the OECD, include all civil servants employed directly by national authorities by central state authorities (Federal employees in the US) and by local administrations. This definition captures interesting variations across these two countries. For example, in France most higher-education workers belong to

the public sector (but those working for, e.g., private business schools do not), while in the US most such workers are classified in the private sector (but not those working in state universities). In both countries, however, many jobs that could be considered ‘public’ are excluded by the definition. For example, neither French nor American postal service workers are counted.

We will also need to account for joint determination of public employment’s and aggregate unemployment’s evolution over time. Theory indicates that private employment (and the unemployment rate) should depend on private sector productivity, on labour market institutions, and on public employment, which in turn depends on the valuation of public goods, on productivity in both sectors, and on labour market institutions. To disentangle these intricate interactions, we use variables (selected on the basis of theoretical considerations and data availability) meant to capture fairly general features of economic, sociological and political cross-country variation. We use the urbanization rate and total factor productivity as measures of economic development, which is arguably closely related to public infrastructures, spending and employment growth on the basis of ‘Wagner’s law’ (see e.g. Musgrave, 1985). We also use an indicator of political orientation, since the political environment should foster public job creation when the Left is in power. Finally, we use exposure to international trade, a variable that is predicted by many theories to have important (if ambiguous) effects on public employment. Higher foreign exposure should reduce the size of the public sector if international tax competition is an important constraint on public policy, but a larger public sector may be observed in a risk-reducing role when economies are more significantly exposed to external shocks (see Rodrik, 1997).

Labour market institutions jointly determine public employment, private employment, and the unemployment rate. Our institutional variables are the same as those used in Nickell (1997), Blanchard and Wolfers (2000), and other previous studies. The effects of unemployment insurance are captured by the level of the replacement rate and the number of years of benefit eligibility. The employment protection index is ranked into 20 levels according to five criteria: working time, fixed-term contracts, employment protection, minimum wages and employees’ representation rights. Three features of the wage-setting framework are also included: an index of co-ordination between unions and employer (ranked from a low level of 1 to a high level of 6); union density (the share of union members among wage earners); and union coverage, i.e. a discrete indicator of the share of workers covered by collective bargaining regardless of union membership: ranks from 1 (less than 25% coverage) to 3 (over 75% coverage).

**3.1.1. Definition of country groups.** According to the theoretical model, public employment is expected to have the strongest effect on private employment and on unemployment in countries matching two criteria. The first one is a high degree of substitutability between public and private activities. The second one is the size of rents caught by employees in the public sector in comparison to the private one. To

test for this implication, we partition countries according to different indicators expected to capture these two criteria.

The first issue is that of finding a good measure of the substitutability of public and private employment. No comparable data are available on the share of employment across the different public activities for a large set of countries. Much more information, however, is available on the decomposition of public spending across these activities. Thus, the measure of substitutability will be based on public expenditure composition, rather than on public employment data. The availability of data leads us to distinguish two measures of substitutability. The first indicator consists of the ratio of private spending relative to public spending in the health sector. This sector can be considered as one in which private and public production are among the most substitutable. From a theoretical point of view, the lower this ratio is, the higher is the share of public spending in substitutable activities, and the larger are the crowding out effects on private employment.

Table 3 reports the classification of countries according to the median of this index. Countries displaying a ratio of private spending to public spending above the median are classified under the low substitutability index as opposed to the high substitutability index. The ranking of countries leads to two homogeneous groups, except for a few cases. The relative share of public spending is rather high in the three Scandinavian countries (Denmark, Norway and Sweden) in addition to Belgium, Germany, Spain and the UK. By contrast, this share is comparably low in the Anglo-Saxon countries (Australia, Canada, the US), in Continental European countries (Austria, France, Italy, the Netherlands) and in Ireland and Finland. In this group, the US is a striking outlier, as the only country where the share of private spending is larger than the public share. Note that Finland is the closest country to the median, and including it in the high substitutability group would let it join the other Scandinavian countries. The gap between the Finnish indicator and the Scandinavian average, however, is rather large.

The second measure of substitutability is based on the share of public spending, in total public expenditure, devoted to production complementary to private activity. To this end, we define a core set of public goods made up of defence, justice and general administration and we compute the fraction of these activities in total government outlays. These public goods are truly complementary to the private production. The higher the fraction is, the lower is public investment in production substitutable to the private one. Note that fewer data are available for this indicator, excluding four countries from our analysis. Table 3 reports the classification of countries under the high and low substitutability index. Following our previous strategy, we split the two groups according to the median except for one main exception: Denmark. This country displays a value approximately equal to Sweden and Norway. But the lack of information on European countries such as France and Italy would lead to separating Denmark from the Scandinavian countries by using the median. By contrast, our classification leads to rather homogeneous groups. The share of public expenditure

**Table 3. Country clustering according to the degree of substitutability between public and private activities**

Health expenditure Private spending %		Public goods expenditure Complementary activities %	
Groups	Public spending Indicator	Groups	Total expenditure Indicator
<i>High substitutability</i>			
Belgium	13.37	Japan	7.74
Sweden	16.80	Austria	10.24
UK	18.45	Ireland	11.41
Denmark	19.06	Spain	11.75
Norway	20.05	Finland	12.72
Spain	27.46		
Germany	28.30		
<i>Low substitutability</i>			
Finland	29.95	Denmark	13.31
Netherlands	33.25	Netherlands	13.51
France	34.42	Sweden	13.86
Ireland	35.22	Norway	14.81
Austria	35.56	Canada	17.36
Italy	36.87	Australia	18.17
Canada	38.37	UK	18.84
Australia	49.46	USA	29.96
USA	128.24		
<i>Missing data</i>			
None		Belgium, France, Germany, Italy	

in complementary goods is rather high in the Scandinavian countries (Denmark, Norway, Sweden) and the Anglo-Saxon countries (Australia, Canada, UK, US). It is worth noting that this new measure of substitutability does not match the previous classification for the Scandinavian countries. They combine a high share of public spending in the health sector with a large share of complementary public goods. Yet the two measures lead to convergent conclusions as regards the other countries, especially the Anglo-Saxon group. In particular, it can be noticed that the correlation coefficient between our two measures of the substitutability of private and public production amounts to 0.80.

Consider next the size of job rents in the public sector, which our theoretical perspective associates with larger private-employment crowding out effects of public job creation. It is not easy to define and measure such rents. A first natural proxy is the wage premium indicator in the public sector compared to the private one. To that end, we use Blanchflower's (1996) indicator, based on wage regressions on micro data sets for each country. However, this indicator is not available for four countries. More importantly, wage differentials do not fully account for the relative appeal of public employment, which also depends on working conditions, power and hierarchy aspects,

**Table 4. Country clustering according to the size of rents in the public sector**

Corruption index		Wage premium	
Groups	Indicator	Groups	Indicator
<i>High rents</i>			
Italy	4.58	Japan	0.21
Spain	5.94	Spain	0.13
Austria	7.34	USA	0.09
Japan	7.52	Canada	0.09
Belgium	7.84	Ireland	0.08
France	7.93	Italy	0.07
Ireland	7.98	Germany	0.05
USA	8.08		
<i>Low rents</i>			
Germany	8.13	Sweden	0.04
UK	8.13	UK	0.04
Australia	8.30	Netherlands	0.04
Sweden	8.31	Australia	0.03
Denmark	8.44	Austria	0.01
Finland	8.51	Norway	-0.07
Canada	8.69		
Netherlands	8.72		
Norway	8.85		
<i>Missing data</i>			
None		Belgium, Denmark, Finland, France	

job security and other hard-to-measure characteristics. Accordingly, we also experiment with using the Corruption Perception Index (Lambsdorff, 2000). This indicator is based on a cross-country survey of public-sector employees, senior business people, and academic experts, who are asked to assess on the basis of various criteria the degree of transparency prevailing in public administration. All survey questions hinge on the potential misuse of public power for private benefits. This definition integrates bribing of public officials, kickbacks in public procurement, embezzlement of public funds and so on. The higher the indicator is, the less corrupted are public administrations. For our purposes, the Corruption index may serve as an indirect measure of the degree of overall control and pressure on public sector employees.

Table 4 reports the clustering of countries according to these two indicators. Generally these two measures yield similar classifications. In particular the Scandinavian countries display both low wage premium and low corruption in the public sector.

## 3.2. Econometric evidence

**3.2.1. Basic specification.** We start by estimating the additional effect of public employment in the benchmark literature linking unemployment variation to institutional variables. In line with the pioneering work of Nickell (1997), the literature

traditionally explains unemployment dispersion across countries by the underlying heterogeneity in national labour market features. Usually, blame for high unemployment is laid on factors such as unemployment benefits, the duration of unemployment benefits, the strength of unions, the tax rate and the employment protection legislation. As illustrated by Figure 1, however, the different countries also display a great deal of heterogeneity as regards their level of public employment. We test if this large cross-country variance also matters in explaining unemployment evolution.

To that end, we follow a two-step approach. We first run the same specification as Nickell (1997), linking unemployment to traditional labour market institutional variables. These variables, which have displayed small variations over the last few decades, are traditionally considered as time invariant in this literature and capture fixed-country effects. We also control for specific time-varying effects by introducing as many time dummies as periods at hand. Note that the only significant difference between Nickell's and these regressions is the sample's time span: instead of considering the 1980s and 90s only, we run the regression on the whole 1960–2000 period. We then add public employment to this standard regression and estimate the marginal impact of this variable on unemployment. For each unemployment specification, we report ordinary least square estimates as well as estimates that account for correlation of errors over time and across countries.

The results of this explorative estimation are reported in Table 5. In Nickell's specification without public employment (column 1 and column 3), institutional variables seem to do a poor job in explaining unemployment. The only factor to appear significant in all specifications is union co-ordination, which is consistently associated with lower unemployment. By contrast the positive impacts of the replacement rate, the union coverage and the union density are significant only if residual covariance is not taken into account. Note that in the original article by Nickell, these variables were still statistically significant under GLS estimations. Looking for the origin of the discrepancy between our results and Nickell's, it turns out that the period of estimation plays a key role. Specific national institutional variables are likely to matter during the 1980s and the 90s at a time of high cross-country variation in unemployment rates. But while these variables were approximately the same from the 1960s to the 90s, the unemployment heterogeneity was much less pronounced in the 60s and the 70s. Consequently, labour market factors lose significance when the period of estimation is extended to the four decades taken as a whole.

By contrast, public employment appears statistically significant at the 10% level whatever the method of estimation. The estimated coefficients are much larger than those of all other institutional factors, and public employment explains a sizeable amount of cross-country unemployment variance. This first finding suggests that the traditional literature based on the impact of institutional variables on unemployment has so far missed an additional key factor.

To further explore the channel through which public employment affects unemployment, we estimate its impact on private employment. Table 6 reports OLS and

**Table 5. Estimates of unemployment according to labour market institutions and public employment over 1960–2000**

Estimation specification	$u$ OLS institutions	$u$ OLS institutions + public employment	$u$ GLS institutions	$u$ GLS institutions + public employment
Public employment	–	0.208** (0.120)		0.374* (0.200)
Replacement rate	0.005** (0.002)	0.006** (0.002)	0.005 (0.005)	0.007 (0.006)
Benefit length	0.005 (0.039)	0.000 (0.039)	0.005 (0.091)	–0.004 (0.096)
Union density	0.005** (0.002)	0.003 (0.002)	0.005 (0.005)	0.004 (0.006)
Union coverage	0.173 (0.139)	0.183 (0.139)	0.167 (0.322)	0.002 (0.006)
Co-ordination	–0.354** (0.043)	–0.368** (0.044)	–0.356** (0.100)	–0.380 (0.106)
Tax-rate	0.009** (0.004)	0.006 (0.005)	0.009 (0.010)	0.003 (0.011)
Employment protection	0.013 (0.010)	0.021* (0.012)	0.011 (0.024)	0.029 (0.027)
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.760	0.764	0.760	0.762
Number of observations	132	132	132	132

Notes: Public employment and unemployment rates are taken in log. Period of estimation: 1960–2000.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

**Table 6. Estimates of private employment according to labour market institutions and public employment over 1960–2000**

Estimation specification	<i>u</i> OLS institutions	<i>u</i> OLS institutions + public employment	<i>u</i> GLS institutions	<i>u</i> GLS institutions + public employment
Public employment	–	–0.112** (0.026)		–0.188** (0.036)
Replacement rate	–0.000 (0.000)	0.000* (0.000)	–0.000 (0.001)	–0.001 (0.001)
Benefit length	0.012 (0.007)	0.015** (0.007)	0.013 (0.018)	0.017 (0.018)
Union density	0.000 (0.000)	0.001* (0.000)	0.000 (0.001)	0.001 (0.001)
Union coverage	–0.084** (0.028)	–0.090** (0.026)	–0.086 (0.063)	–0.096 (0.066)
Co-ordination	0.047** (0.008)	0.054** (0.008)	0.047** (0.019)	0.059** (0.020)
Tax-rate	–0.003** (0.000)	–0.001 (0.000)	–0.003 (0.002)	–0.000 (0.002)
Employment protection	–0.004** (0.002)	–0.009** (0.002)	–0.004 (0.004)	–0.011** (0.002)
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.557	0.566	0.557	0.595
Number of observations	132	132	132	132

*Notes:* Public employment and private employment are taken in log. Period of estimation: 1960–2000.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

GLS regressions of private employment. No matter the estimation method, public employment is found to significantly crowd out private employment, the coefficient estimates ranging from  $-0.18$  to  $-0.12$ . As in unemployment regressions, public employment captures the main share of private employment variance across countries. Robustness of the estimated effects across estimation methods indicates that links between public employment and labour market performance may indeed be important and realistic. However, all estimates above are in theory distorted by endogeneity bias, i.e., they fail to take into account that public employment, private employment and unemployment are jointly determined. This issue is tackled in the following section.

**3.2.2. The endogeneity of public employment.** Theory predicts that unemployment, private employment and public employment are simultaneously determined. Accordingly, our empirical work pays particular attention to the possibility of very different results when endogeneity of public employment is appropriately accounted for. We first test for the endogeneity of current public employment in unemployment and private employment regressions. Since labour market institutions are time invariant, the appropriate method of estimation is by fixed effects with country-specific intercepts as a proxy for institutions. Unobservable temporary shocks are still taken into account by introducing time dummies (one per sub-period) in line with Nickell (1997) and Blanchard and Wolfers (2000). In order to evaluate the potential endogeneity bias, we run a standard specification test.<sup>8</sup> The standard OLS regression of unemployment and private employment on the current value of public employment and the DWH tests are reported in Table 7, columns 1 and 2. The introduction of fixed effects in place of institutional variables does not alter the nature of the public employment effect. This variable significantly increases unemployment by crowding out private employment, but the specification test accepts the hypothesis of the endogeneity of current public employment, implying that OLS are not consistent.

To cope with the endogeneity bias, we first instrument current public employment by its lagged value. The lagged value is computed as the previous five-year average of public employment, introducing a significant time gap from its current value. However, the figures in Appendix 3 on public employment evolution, suggest that the adjustment process of this variable is sluggish in some countries. Thus, we also test possible endogeneity of lagged public employment by following the same previous methodology. Columns 1 and 2 of Table 7 report specification tests which reject the endogeneity of lagged public employment in both unemployment and private employment regressions. Accordingly, this instrument turns out to be consistent.<sup>9</sup> Table 7 also reports instrumental variable (IV) regressions of unemployment and

<sup>8</sup> Specifically, we use the Durbin–Wu–Hausman (DWH) test of statistical significance on the residuals of possibly endogenous variables. A small  $p$ -value indicates that the residual is statistically different from zero, implying an endogeneity bias in the regression.

<sup>9</sup> In addition to the DWH test, we also perform alternative specification to tackle the endogeneity bias by instrumenting current public employment by its second order lagged value rather than its first order one. This strategy yields very similar statistical and economic relations, reported in the Web Appendix of the paper.

**Table 7. Public employment endogeneity and serial correlation**

Estimation specification	OLS		2SLS		2GSLs	
	$u$	$L_p$	$u$	$L_p$	$Du$	$DL_p$
Public employment	0.454 (0.234)* [0.421]	-0.224 (0.041)** [0.077]**	0.838** (0.251)** [0.514]*	-0.303 (0.056)** [0.088]**		
Growth rate of public employment					1.369 (0.695)** [0.662]**	-0.271 (0.109)** [0.090]**
Growth rate of employment protection					-0.585 (0.489)	-0.031 (0.070)
Growth rate of replacement rate					-0.203** (0.088)	0.022* (0.012)
Fixed effects	Yes**	Yes**	Yes**	Yes**	No	No
Time effects	Yes**	Yes**	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.823	0.741	0.862	0.750		
Number of observations	132	132	115	115	98	98
Durban–Wu–Hausman test	$p$ -value = 0.029	$p$ -value = 0.038	$p$ -value = 0.227	$p$ -value = 0.278		
H0 : exogeneity	H0 rejected	H0 rejected	H0 accepted	H0 accepted		

Notes: Public employment, private employment and unemployment rates are taken in log. Period of estimation: 1960–2000.

2SLS: Public employment is instrumented by its five-period lagged value. Robust to spurious regression, but may introduce a moving average structure (MA(1)) in the error term.  
2GSLs: two stage least square with random effects regressions on differenced data (to account for serial correlation). Growth rate of public employment instrumented by the growth rate of its five-period lagged value.

(Standard errors) – [Standard errors robust to country clustering].

A  $p$ -value below 0.05 rejects the absence of endogeneity of public employment.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

private employment on the lagged value of public employment as an instrument for its current value (columns 3 and 4). This evidence indicates that endogeneity of public employment does matter in the unemployment equation, but is not very relevant as regards private employment determination. Comparing columns 1 and 3 indicates that the positive impact of public employment on unemployment nearly doubles (from 0.45 to 0.83) when it is treated as an endogenous variable. This result is consistent with our previous theoretical investigations. Public employment reacts positively to a surge in unemployment, which leads to a ratchet effect of the former on the latter. By contrast, there is weaker evidence of such differences as regards private employment. Treating public employment as endogenous or not yields similar estimates. This result provides empirical support to the idea that the variable of interest for governments is the unemployment rate and not the private employment rate.

Besides endogeneity, other statistical issues need to be taken into account. Public employment, unemployment and private employment have steadily risen in some countries over the last three decades (see the figures in Appendix 3), hence the results might be driven by spurious covariation (a common trend) rather than by causal channels.<sup>10</sup> We address this concern by estimating the model in first differences (i.e. as the difference of five-year average data). This eliminates country-fixed effects, and to capture some country-specific features we use time variable institutional variables based on the time series constructed by Blanchard and Wolfers (2000) for the replacement rate and the employment protection index. The former consists of the replacement rate during the first year of an unemployment spell, averaged over all categories, while the latter is an index of employment protection ranking from 0 to 6 (see Appendix 3). Unobservable shocks on the growth rate of unemployment and private employment are still accounted for by temporal dummies. In light of previous results, the growth rate of public employment is instrumented by its lagged value. For all estimation methods, the estimated coefficient of public employment on unemployment (private employment) remains consistently positive (negative) and highly significant and quite comfortably similar (additional similar results are reported in the Web Appendix).

A second potential source of spurious correlation is the very high serial correlation of public employment within countries. Hence the standard errors could be too small, leading to an overestimation of the statistical significance of public employment effects on unemployment and private employment. To take into account such effects, we compute in each regression variance estimates robust to country clustering, reported in brackets. Column 3 in Table 7 indicates that the standard-error estimates of the level of public employment almost double, but the effects of this variable on unemployment and private employment are still statistically significant, at least at the 10% level of confidence.

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<sup>10</sup> To tackle this issue, it would be most appropriate to apply cointegration analysis. Im *et al.* (1995), Blinder *et al.* (2001), and other recent contributions have begun to develop tests for unit root and cointegration in heterogeneous panel. This literature, however, is still in its infancy and does not yet offer tools for analysing large panel samples.

Finally, we also investigate what would be the estimated relation between public employment and labour market performance if the variable which truly matters is the five-period lagged value of public employment rather than its current value. Such an assumption could be based on the fact that wage bargaining and worker reallocation take time and that the public employment adjustment process is rather sluggish. OLS estimation of the impact of the lagged value of public employment on unemployment yields a coefficient of 0.70, significant at the 10% level, with standard errors robust to country clustering. This result is similar to the previous ones. The full regression is reported in the Web Appendix.

The robustness of all these estimations leads us to explore further the economic and statistical relationships between public employment and labour market performances. Our theoretical model suggests a richer framework for explaining public employment evolution than its lagged value. Furthermore, it provides evidence that unemployment (or private employment) and public employment are jointly determined. We then go one step further by running simultaneous equation regressions (3SLS) and explicitly estimating the determinants of public employment.

**3.2.3. The joint determination of public and private employment.** The theoretical model lays out the interactions between unemployment (equivalently private employment) and public employment on a set of two relations. The first relation defines the unemployment rate or private employment as a function of public employment, total factor productivity, and labour market institutions – see Equations (9) and (11) in Appendix 1. The second relation links public employment to total factor productivity, labour market institutions, and valuation of public goods – see Equation (15) in Appendix 1. These two relations lead us to estimate a system of simultaneous equations between unemployment (similarly private employment) and public employment. The private employment equation and the public employment equation display only two main differences. First, while public employment enters into the unemployment equation, the reverse is not true. Secondly, public employment is determined by additional variables that relate to the weight attached to public goods in the policy-making environment: these variables do not affect the unemployment rate in our model, and can therefore be used as instruments.

The choice of specification and instruments directly derives from this theoretical framework. The level of productivity entering the two equations is proxied by the growth rate of total productivity factors (the Solow residual in the business sector) constructed by Blanchard and Wolfers (2000). The productivity term is taken in difference rather than in level, consistently with an ‘Okun’s law’ link between unemployment levels and changes in the output growth rate. Institutional variables also jointly determine unemployment and public employment evolutions. But as already stressed in the previous section, the most appropriate estimation consists of replacing institutions by country-specific effects, since institutions are time invariant. We also take into account unobservable temporal shocks in both equations by introducing time dummies.

**Table 8. 3SLS estimates of simultaneous equations public employment–private employment and public employment–unemployment**

	Unemployment	Public employment	Private employment	Public employment
Public employment	0.883 (0.451)** [0.707]		-0.314 (0.083)** [0.157]**	
Tfp	0.039 (0.024)	0.010 (0.007)	-0.003 (0.004)	0.011* (0.007)
Urbanization		0.030** (0.004)		0.030** (0.400)
Left–Right		0.009 (0.019)		0.015 (0.019)
Openness		0.094 (0.166)		0.263** (0.165)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.859	0.945	0.791	0.945
Number of observations	119	119	119	119

Notes: Public employment, private employment and unemployment rate are taken in log. Period of estimation: 1960–2000.

The sample size is reduced to 119 observations, the instrument Tfp lacking information for the first period. The standard errors reported are not computed taking country clustering into account, since the correction is not suitable for such small sub-samples.

(Standard errors) – [Standard errors robust to country clustering].

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

As regards variables measuring the weight given to public goods by policy-makers, the choices are dictated by theoretical literature and data availability, and lead us to select three instruments: the urbanization rate, the political inclination of governments, and the degree of economic openness.

Table 8 reports estimated coefficients for the two simultaneous equation systems: unemployment–public employment and private employment–public employment. We first focus on the impact of public employment on private employment (column 3) and the unemployment rate (column 1), the details of public employment determination being left to the end.

Private employment is significantly crowded out by public employment: creation of one public job destroys 1.5 private jobs on average.<sup>11</sup> This is a larger effect than that identified by Boeri *et al.* (2000), who estimate a 30% crowding out effect of public jobs on private jobs in a 1982–95 panel of observations. Unlike Boeri *et al.*, however, we account for endogeneity bias and we estimate the regression on a much longer time period, including the very sharp increases in public employment during the 1960s and 1970s shown by the figures in Appendix 3. Our estimates imply that about 12% of the private rate employment dispersion is explained by public job creation.<sup>12</sup>

<sup>11</sup> To see this, consider that estimation yields  $\log(L_p) = -0.314 \log(L_g)$ , hence  $dL_p = -0.314(L_p/L_g)dL_g$ , and that  $(L_p/L_g) \approx 4.89$  on average. The confidence interval ranks from 0.8 to 2.3.

<sup>12</sup> The adjusted R<sup>2</sup> amounts to 0.791 when public employment is included in the private employment equation. We do not report regression results for a private employment equation that only includes fixed effects, time effects and the growth rate of productivity, but the adjusted R<sup>2</sup> of that regression is 0.674.

The impact of public employment on the unemployment rate (column 1) is still significantly different from zero. The coefficient is very close to the one obtained when the current value of public employment is instrumented by its lagged value (0.883 against 0.853 respectively), highlighting the robustness of this relationship. To interpret this result, it is helpful to compute explicitly the impact of public employment on the number of unemployed workers. To this end, we ran regressions in which the dependent variable is the ratio of the number of unemployed workers on the population in working age instead of the unemployment rate (recall that public employment is the ratio of the number of public jobs on the population in working age). Such regressions, not reported here for the sake of space, yield results very similar to those displayed in Table 8, the coefficient of unemployment is 0.83 with a standard error of 0.42. Therefore, the creation of one public job adds about 0.3 unemployed workers.<sup>13</sup> The comparison of this result with those obtained on private employment suggests that public employment decreases participation in the labour market. Indeed, since the creation of one public job destroys about 1.5 private jobs and increases the number of unemployed workers by 0.3, it draws about 0.2 individuals away from the labour force. This effect, however, is not significantly different from zero.<sup>14</sup>

We now turn to the determinants of public employment. Together, the instruments fit public employment evolution very well. The most significant variable is the urbanization rate. This is quite consistent with theoretical views of urbanization as an important determinant of public employment growth. Public employment also increases with productivity, consistently with Wagner's law, but this effect is significant only at the 10% level. Similarly, the effect of international openness is positive (but not significant) on public employment, in line with Rodrik's (1997) results. The variable aimed at capturing the political orientation of governments is never statistically different from zero.

### 3.3. In which countries does public employment destroy many jobs?

The previous section provides a suitable econometric framework for evaluating the joint determination of unemployment, private employment and public employment. However, the theoretical model suggests that these interactions should differ across countries according to two main criteria: the degree of substitutability between the public production and the private one, and the size of rents in the public sector. The effects of these two criteria on the crowding out effect of public employment go through the wage channel. The higher the size of rents in the public sector, the more workers are attracted to public activities, putting upward wage pressure and thereby

<sup>13</sup> If  $U$  denotes unemployment as a fraction of working age population, we have  $dU = 0.83(U/L_g)dL_g$ , and  $(U/L_g) = 0.37$  on average. The 95% confidence interval of this effect is [0.1,0.6].

<sup>14</sup> The 95% confidence interval is [-1.0,0.3].

**Table 9. 3SLS estimates of public employment effects on private employment according to the size of public rents**

	High wage premium	Low wage premium	High corruption	Low corruption
<i>Private employment</i>				
Public employment	0.883** (0.451)	0.052 (0.121)	-1.11** (0.279)	-0.123 (0.079)
Tfp	-0.018 (0.007)	-0.002 (0.007)	-0.014 (0.009)	-0.004 (0.005)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.780	0.736	0.664	0.753
<i>Public employment</i>				
Tfp	-0.005 (0.009)	0.033 (0.017)	-0.009 (0.010)	0.024* (0.012)
Urbanization	0.034** (0.008)	0.037** (0.012)	0.012** (0.006)	0.030 (0.005)
Left-Right	0.042** (0.024)	0.064** (0.035)	0.017 (0.017)	-0.006 (0.027)
Openness	0.301** (0.147)	0.322 (0.385)	0.529** (0.129)	-0.388 (0.412)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.948	0.937	0.936	0.942
Number of observations	51	42	56	63

*Notes:* Public employment and private employment are taken in log. Period of estimation: 1960–2000.

Sub-samples size varies according to the availability of data for each clustering criteria.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

*Sources:* Wage premium: Blanchflower (1996); Corruption index: Lambsdorff (2000).

reducing employment in the private sector. The role of substitutability goes the same way around. In this section we evaluate the empirical relevance of these two criteria.

**3.3.1. The impact of public job rents.** Public employment effects on labour market performance are first decomposed according to the size of rents in the public sector. Theoretically, the larger rents are, the higher is the crowding out effect of public employment on private employment, and thereby the higher is the positive impact of public employment on the unemployment rate. We test for the implication by using two measures of rents: the wage premium and the corruption index described in the previous data section. These variables are classified so that high levels of each index correspond to large rents in the public sector.

Estimation results on country group effects are reported in Tables 9 and 10. The two measures of rents lead to similar conclusions, providing support to the relevance of the rent effect. Table 9 indicates that public employment has significant crowding out effects on private employment only in countries in which public rents are above the median. Further, these effects are much larger than the one found in the whole regression mixing up all countries. The coefficient estimates under the two criteria are close to  $-1$  (columns 1 and 3) whereas the whole data set regression yields  $-0.31$  (Table 8, column 3). This heterogeneity has direct implications as regards the impact of public employment on the unemployment rate. As indicated by Table 10, columns 1

**Table 10. 3SLS estimates of public employment effects on unemployment according to the size of public rents**

	High wage premium	Low wage premium	High corruption	Low corruption
<i>Unemployment</i>				
Public employment	2.97** (0.607)	-1.56* (0.816)	3.15** (0.929)	-0.400 (0.519)
Tfp	0.089** (0.032)	0.039 (0.048)	0.039 (0.032)	0.043 (0.038)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.888	0.847	0.872	0.875
<i>Public employment</i>				
Tfp	-0.000 (0.009)	0.039 (0.017)	-0.007 (0.010)	0.024* (0.012)
Urbanization	0.041** (0.009)	0.037** (0.012)	0.019** (0.006)	0.030** (0.005)
Left-Right	0.026 (0.028)	0.076** (0.035)	0.007 (0.022)	-0.005 (0.027)
Openness	0.008 (0.173)	0.760** (0.387)	0.391** (0.154)	-0.422 (0.413)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.951	0.939	0.937	0.942
Number of observations	51	42	56	63

Notes: Public employment and unemployment rate are taken in log. Period of estimation: 1960–2000.

Sub-samples size varies according to the availability of data for each clustering criteria.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

Sources: Wage premium: Blanchflower (1996); Corruption index: Lambsdorff (2000).

and 3, public employment effects turn out to be positive and statistically different from zero only in countries displaying large rents in the public sector. But once again, this positive impact becomes more than twice as large as the one found without distinguishing countries (Table 8, column 1).

### 3.3.2. The impact of the substitutability of public and private jobs.

We now test the second proposition: the higher the extent of substitutability between public and private production, the larger is the crowding effect of the former on the latter, inducing a higher unemployment rate. Two measures of substitutability are used to check for the relevance of this theoretical link. The first one corresponds to the fraction of public spending devoted to complementary goods (defence and general public administration) in total government outlays. The second consists of the share of public spending relative to private ones in health activities. The clustering of countries according to these two substitutability measures is that discussed in Section 3.1.1.

Tables 11 and 12 report the effects of public employment on private employment and the unemployment rate respectively, for groups of countries that have relatively similar theoretically relevant features. The two criteria lead to very similar results since they group together the same countries, with very few exceptions (see Section 3.1.1). Private employment appears to be significantly crowded out by public employment only in countries with substitutable public activities (Table 11). Consequently, the

**Table 11. 3SLS estimates of public employment effects on private employment according to the degree of substitutability of public production**

	High public expenditure substitutable goods	Low public expenditure substitutable goods	High public expenditure in health sector	Low public expenditure in health sector
<i>Private employment</i>				
Public employment	-0.344** (0.146)	-0.114 (0.107)	-0.302** (0.056)	-0.139 (0.190)
Tfp	-0.006 (0.007)	-0.012 (0.007)	-0.006 (0.004)	0.000 (0.007)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.889	0.595	0.890	0.692
<i>Public employment</i>				
Tfp	-0.001 (0.017)	0.033** (0.012)	0.027** (0.011)	0.003 (0.007)
Urbanization	0.021** (0.007)	0.067** (0.009)	0.061** (0.010)	0.016** (0.003)
Left-Right	0.063 (0.040)	0.007 (0.026)	-0.001 (0.034)	0.007 (0.017)
Openness	0.448 (0.291)	0.158 (0.338)	1.30** (0.352)	-0.231** (0.128)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.924	0.947	0.965	0.946
Number of observations	35	57	54	65

*Notes:* Public employment and private employment are taken in log. Period of estimation: 1960–2000.

Sub-samples size varies according to the availability of data for each clustering criteria.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

*Sources:* Fraction of public spending in complementary goods in total government outlays: IMF; relative share of public spending in health: World Bank.

positive impact of public employment on the unemployment rate turns out to be statistically different from zero only in those countries as indicated by Table 12.

Finally we check if these sub-sample cuts yield similar results when the regressions are run in first-differenced form, to eliminate potential spurious effects. The results (reported in the Web Appendix) are reassuring: both the size and statistical significance of public employment effects are very similar when regressions are run on first differences. Furthermore, we investigate additional sub-sample cuts, in particular by excluding countries whose public sector matches both the two criteria of high rents and a high degree of substitutability. In the Web Appendix, we show that the effects of public employment on private employment and unemployment rate are slightly smaller, but remain statistically significant.

**3.3.3. The propagation channels of public employment.** The last step of our study consists in evaluating the channel through which public employment affects labour market performance. The theoretical mechanism goes from public employment to private employment through an increase in wages pressure, leading eventually to an increase in the unemployment rate. The induced upward wage pressure is expected to heavily depend on the two main criteria regarding the size of rents in the public sector and the degree of substitutability between public output and private

**Table 12. 3SLS estimates of public employment effects on unemployment rate according to the degree of substitutability of public production**

	High public expenditure substitutable goods	Low public expenditure substitutable goods	High public expenditure in health sector	Low public expenditure in health sector
<i>Unemployment</i>				
Public employment	1.74** (0.657)	-0.182 (0.479)	0.719** (0.380)	0.826 (0.844)
Tfp	0.011 (0.035)	0.098** (0.045)	0.068** (0.032)	0.012 (0.032)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.936	0.813	0.900	0.839
<i>Public employment</i>				
Tfp	0.001 (0.011)	0.034** (0.012)	0.028** (0.011)	0.003 (0.007)
Urbanization	0.024** (0.007)	0.067** (0.009)	0.064** (0.010)	0.017** (0.003)
Left-Right	0.021 (0.045)	0.008 (0.026)	-0.003 (0.034)	0.005 (0.017)
Openness	0.308 (0.276)	-0.057 (0.385)	1.07** (0.355)	-0.158 (0.126)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.923	0.947	0.966	0.946
Number of observations	35	57	54	65

Notes: Public employment and unemployment rates are taken in log. Period of estimation: 1960–2000.

Sub-samples size varies according to the availability of data for each clustering criteria.

\*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

Sources: Fraction of public spending in complementary goods in total government outlays: IMF; relative share of public spendings in health: World Bank.

output.<sup>15</sup> The larger these indicators are, the more workers are attracted outside the private sector, putting higher pressure on private wage. We test the relevance of this channel by estimating the direct impact of public employment on the wage rate of the business sector. This variable comes from the OECD National Accounts database. To understand further the mechanisms at work, public employment effects are distinguished according to the rent and the substitutability criteria. Similarly to the previous section, we provide two different measures for each criterion. Table 13 reports the OLS estimated impact of public employment on private sector wages. We control for specific country effects and unobservable shocks by introducing both constant and time dummies. The growth rate of inflation is also included to take account of potential Phillips curve mechanisms. Since countries are split into two distinct groups; the coefficient estimates standard errors are calculated accounting for country clustering.

<sup>15</sup> In the theoretical model, the degree of substitutability may actually influence the impact of public jobs on the private sector through two opposite effects. Consider the relationship  $A(L_p) F'(L_p) = w_p$  reported after Equation (5) in Appendix 1. The  $A(L_p)$  term represents the effect of public employment on private sector productivity, and is a decreasing function of  $L_p$  if the degree of substitutability between private and public productions is high. If public job creation decreases private productivity, however, workers leave the labour force according to Equation (11) in the Appendix, and this may lead private employment to decline and its marginal productivity  $F'(L_p)$  to increase.

**Table 13. OLS estimates of public employment effects on private sector's wage rate**

	Corruption index	Wage premium	Health public expenditure	Substitutable goods public expenditure
Public employment high indicator	0.812** (0.311)	0.949** (0.295)	0.366** (0.218)	0.790** (0.207)
Public employment low indicator	0.163 (0.264)	-0.073 (0.257)	0.431 (0.280)	-0.299 (0.243)
Inflation growth rate	-0.063 (0.055)	-0.067 (0.084)	-0.049 (0.067)	-0.022 (0.062)
Fixed effects	Yes**	Yes**	Yes**	Yes**
Time effects	Yes**	Yes**	Yes**	Yes**
R <sup>2</sup>	0.955	0.948	0.952	0.963
Number of observations	121	96	121	93

*Notes:* Public employment and wage rates are taken in log. Period of estimation: 1960–2000. Sub-samples size varies according to the availability of data for each criterion and the inflation rate. \*\* denotes significant at the 5% level, \* denotes significant at the 10% level.

Table 13 shows that public employment increases private sector wages only in countries matching one of the two criteria, no matter the way these criteria are measured. The positive impact ranges from 0.366 to 0.943, depending on the indicator used for describing the size of rents or the degree of substitutability of production. The invariance of these estimations provides strong support to the wage mechanism underlying the theoretical model. Furthermore these results are quite consistent with the previous estimation of the impact of public employment on private employment and the unemployment rate.

#### 4. CONCLUDING COMMENTS

Has public employment significantly influenced labour market performances in rich OECD countries over the last 40 years? This issue has been surprisingly neglected, and our work sheds some light on it. The light is not more intense than a candle's, however, and a candle lit in a very windy corridor. Before assessing the wind's force, we summarize our three main findings:

1. Empirical evidence suggests that public employment had, on average, a strong crowding out effect on private employment in industrialized OECD countries over the period 1960–2000.
2. The impact of public employment depends importantly on the degree of substitutability with private production and on the size of job rents in the public sector. This means that reforms of the public sector that aim to change these features may have an important impact on labour market performances.
3. There is no empirical evidence that public employment decreases unemployment. Our results suggest the opposite. On average, public employment seems to increase unemployment in industrialized OECD countries over the period 1960–2000.

Importantly, confidence in these results is fostered by finding that economic and statistical relations between public employment and labour market performances are only significant in countries where public activities are highly substitutable to private ones and display a wage premium.

Of course, data limitations do not allow us to evaluate with full confidence the consequences of public jobs on private employment and unemployment. In particular, it cannot be excluded that our instrumental variable regressions lead to overestimating the crowding out effect of public jobs on private employment. Further progress, however, would require better and finely disaggregated public employment and wage data. Information on union density and internal organization of the public sector would also be very helpful. We also view our results on specific channels of interaction as less than conclusive. Tax distortions, in particular, would probably deserve more attention, but would call for a more refined general equilibrium framework of analysis.

We should also note here that dynamic relationships between public employment, private employment and unemployment are beyond the scope of this paper. We focused on the medium- to long-run impact of public jobs, but demand-side effects would imply that public employment has a more favourable impact on private employment in the short run. As far as we are aware, very little is known on this issue (see Edin and Holmlund, 1997, and Demekas and Kontolemis, 2000).

Our paper's scope is admittedly very limited in other respects, and many issues are left to further research. Our paper focuses on labour market effects, but says little as to the optimal size of the public sector. In particular, it would be misleading to deduce that the public sector is too large in countries in which it is associated with large crowding out effects. Determining the optimal size of the public sector would require extensive information on the production side of the public sector, and on the public's evaluation of public sector goods. Both data and theory, however, are not yet up to tackling such issues convincingly.

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## Discussion

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This paper addresses an important question that has received surprisingly little attention. The government plays a large role in all modern OECD economies but the size and role of governments differs quite a lot. The paper asks how employment by the government affects the labour market and makes a useful start in thinking about this problem. But it is a hard problem, and a lot more research will be needed before we have a firm idea to what degree public employment is really detrimental for private employment.

The paper provides both some theory and some empirical evidence. The theoretical channels outlined in the paper are plausible, and I have little to argue with them. But the theory cannot establish whether public employment raises or lowers private employment and unemployment. I will therefore concentrate my comments on the empirical results. The paper starts by presenting a number of interesting correlations. Across countries, bigger governments are associated with lower unemployment. It is the Scandinavian countries which have relatively large public sectors, while the southern European countries have small ones. The first surprising result for me was to see that simply adding some standard variables on labour market institutions to a cross-sectional unemployment rate regression is enough to turn the sign on public employment around.

Since the authors have assembled a panel starting in 1960, the natural next step is to add country dummies to the regression, and hence isolate the within-country variation. The within-country time series association between public employment and the unemployment rate is stronger than the association across economies. This association can be seen nicely in some of the figures provided in the Appendix to the paper.

What should we make of these results? The key question is, of course, whether any of these estimates reflect the causal effect of a larger public sector on the functioning of the private economy, and which one of the estimates we should pick. The most obvious reason why causality might run the other way is that governments might expand public employment in times of high unemployment. This would lead to a positive correlation of public employment and the unemployment rate and hence bias the coefficient upwards. I would imagine that some of the time series variation of public employment may be explained by this phenomenon. Or to put it differently, some countries might have adopted such policies of expanding public employment in the 1980s (or of not shrinking it) because unemployment was high in that period. I do not find it very believable that this explains very much of the difference between the large governments in Scandinavia and the small governments in southern Europe. This suggests that the cross-country regressions might actually be preferable to the within regressions, and the pattern of the coefficients is consistent with the expected bias.

But it is not just reverse causality that is an issue. Other factors, which are not controlled for, might affect both the size of the public sector and the level of unemployment. Think of the United Kingdom. The Conservative Government in the 1980s started to liberalize the labour market, probably leading to some wage moderation, which eventually brought down unemployment. It was also keen on privatization of government services, and the share of public employment declined quite precipitously. A similar story can be told for the Netherlands: unemployment came down, but probably because of the wage moderation due to the Wassenaar agreement, and not due to the shrinking government. This will generate the positive correlation seen in the within regressions. The stories I told are again for a particular country over time, rather than for the cross-country variation. Hence the cross-sectional variation might

**Table 14. The effect of public employment on various outcomes**

Dependent variable	Unemployment rate		Private sector employment rate		Private sector wage	
Public employment	0.45 (0.23) [0.42]	-0.10 (0.45) [1.08]	-0.22 (0.04) [0.08]	-0.03 (0.07) [0.12]	0.54 (0.23) [0.63]	-0.33 (0.20) [0.43]
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country specific trends	No	Yes	No	Yes	No	Yes
Number of observations	132	132	132	132	113	113

*Notes:* Conventional standard errors in parentheses. Standard errors adjusted for arbitrary serial correlation within countries in square brackets. Regressions for the private sector wage also include the inflation growth rate as a regressor.

again be preferable to the within variation. Since public employment is the only country-specific time varying variable in the specifications based on the within country variation in the paper's Table 7, by necessity it will have to pick up any country-specific trends over time.<sup>16</sup>

One way to address the issue would be to find variables which control for the other – omitted – factors in the regressions, which rely purely on the variation within countries over time. The simplest such variable to add to the regressions is a linear, country-specific time trend. The authors were kind enough to let me use their data, and I have run the regressions with the country-specific trends included. In all cases, the coefficient on the public employment variable either drops to zero, or changes sign, and it always becomes statistically insignificant. The results are displayed in Table 14.

Is this evidence enough to dismiss the estimates in the paper? Of course, one may dismiss the estimates that control for country-specific trends because they 'throw out the baby with the bath water'. Clearly, by adding more regressors of this type, any variable will eventually lose significance. In the end, by trying to eliminate uncontrolled factors, we will end up learning nothing, because there is simply not enough variation in the data to give us any meaningful answers on any question. I have some sympathy with this concern, but I think it would be the wrong reaction in this case for at least two reasons.

As the table reveals, it is true that the precision of the estimates generally declines when we allow for country-specific trends, as is reflected in the larger standard errors. Nevertheless, not just the precision of the estimates changes, but in all cases the estimate

<sup>16</sup> The paper tries to address these issues by presenting Durbin-Wu-Hausman tests to assess the endogeneity problem. Based on the test results, the authors suggest that the fixed effects regressions in Table 7 are preferable to the cross-country regressions in Tables 5 and 6. But the Durbin-Wu-Hausman test can never establish which estimates make more sense. It is a purely statistical tool: it can say that the estimates in Tables 5 and 6 are different enough from those in Table 7, and that these differences are very unlikely to be due to the inevitable random element induced by the use of a small sample of countries and time periods. Choosing which estimates to believe has to rely on economic reasoning. As I tried to argue above, the case for the cross-sectional estimates is much stronger.

itself changes quite dramatically as well. The new results would be insignificant even given the original standard errors. This is the first reason to pay attention to these results.

The second reason is that in this case it is simply not true that no variable for labour market institutions is significant in these regressions. A recent paper by Nickel *et al.* (2001) tries to explain the evolution of OECD unemployment using time-varying labour market institutions. These authors find nine significant institution variables and interactions of these variables, even after including country-specific trends. The Nickel *et al.* regression is based on annual data, not five-year averages, and hence uses much more variation than the regressions in this paper.

I therefore re-estimated the Nickel *et al.* models using five-year averages for the period 1960–94 (the Nickel *et al.* data do not cover the later years), and I included the public employment variable used by the authors in this regression.<sup>17</sup> Out of the ten institutional variables used by Nickell *et al.*, six are still significant at the 5% level while public employment is insignificant.<sup>18</sup> In fairness to the authors it should be mentioned that public employment's effect remains positive after controlling for time-varying institutions (but not for country-specific trends), and that the Nickell *et al.* specification uses many interactions. The authors also stress the importance of interactions of the size of the public sector with its structure. But including interactions of public employment with the indicators for substitutability of public expenditures and rents of public sector workers does not alter the picture.

I do not want to defend the Nickell *et al.* specification here. The point is merely that the specification including country-specific trends cannot simply be dismissed as unable to reveal anything about economic variables. Hence it is difficult to escape the conclusion that there is no relationship between the evolution of unemployment and the public employment rates in OECD countries.

At the end of the day, we would like some truly exogenous variation in the size of the public sector to address the issue of reverse causality and other omitted factors. The authors make a laudable attempt at coming up with instruments for public employment. Unfortunately, I am not very convinced by their choices.

Their first attempt is to use lagged public employment in the fixed effects regressions as an instrument for current public employment. Lagged public employment turns out to be more strongly associated with the unemployment rate than current public employment. Clearly, reverse causality is much less likely in this case. But third factors could still be driving both variables. Take the British and Dutch examples again. Privatizing public services can be done more quickly than bringing down unemployment through labour market reform. This might well explain some of the

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<sup>17</sup> Nickell *et al.* (2001) include the lagged unemployment rate to capture short-run dynamics, but this variable plays less of a role for the longer-run averages and is omitted here.

<sup>18</sup> When arbitrary serial correlation is allowed for in estimating the covariance matrix (reflected in the standard errors in square brackets in the paper), four of the Nickell *et al.* (2001) variables are still significant.

stronger correlation between the lagged variable and unemployment. More generally, because the size of the public sector moves rather slowly over time, lagging the variable is unlikely to resolve the causality issue.

The authors take another approach, trying to find other instruments for the size of the public sector. They use urbanization, the ideological position of the government, the degree of centralization of public spending, and the degree of openness of the country. I have to admit that I find none of these instruments particularly compelling. A good instrument has to predict the endogenous regressor, i.e. public employment, and it should affect the outcome variable, e.g. unemployment, only through its effect on public employment but not through any other channel. I do not think either of the instruments satisfies the second condition.

Take urbanization. It is certainly plausible that countries may get bigger governments as they become more urbanized. But if governments create more public jobs, these jobs may also disproportionately be located in cities, and hence induce more workers to migrate there. Hence causality could run the other way, and this would invalidate the instrument. Urbanization is also likely related directly to unemployment for reasons that have nothing to do with public employment. For example, a simple search and matching model predicts that unemployment is higher in a thinner rural market. This also renders the instrument invalid. The fact that the instruments are motivated by the model does not add to their validity. The model is highly stylized and excludes many features, which may well be important in reality. The simple model is useful to organize our thinking about the labour market effects of public employment, but not for the choice of suitable instruments.

Similar arguments can be made for the other instrumental variables. But at least in the unemployment equation, urbanization is the only instrument that predicts public employment at all. These worries about the instruments get confounded by the fact that I would have expected the OLS bias to be positive, as discussed before. Hence the instrumental variable results should be smaller. Instead, they have much larger coefficients.

The final part of the paper links the empirical work with the theoretical channels the authors have discussed in the first part of the paper. The size of the public sector should matter more in countries where the public goods produced are more substitutable to private goods, and where the rents from working in the public sector are higher. Hence they split the sample according to indicators for substitutability and rents. This works surprisingly well in any of their specifications and seems rather robust to the specifics of how countries are classified. Unfortunately, here the results are also much less clear-cut once the regressions include country-specific trends. In this case, there is no evidence anymore of a stronger relationship between the size of the public sector and unemployment in countries where the public sector produces more substitutable goods. It works better for the splits according to rents. In the high rent group the coefficient remains positive and sizeable (although not statistically significant), while it is negative (and similarly insignificant) for the low rent group.

These results are in principle consistent with the story told by the paper, but offer rather limited statistical support to it.

In conclusion, what do I take away from the paper? I think the basic story of the authors is quite believable. Public sector employment may crowd out private employment through a variety of channels. The effect could potentially be important, so this is certainly something economists should pay more attention to, even though the authors' preferred results do not hold up to scrutiny. The only defensible estimates, in my opinion, are those based on cross-sectional variation in the paper's Tables 5 and 6. Hence, if I was asked to put a bet on any specific numbers at this stage, I would say the effect of public employment on private sector employment and unemployment is close to zero.

## Thierry Verdier

DELTA, Paris

This paper by Algan, Cahuc and Zylberberg is welcome and very timely. It deals with a hotly debated and interesting issue for policy-making in OECD countries: the role of public employment in labour market performances. In many of these countries, public employment is actually a crucial dimension of the functioning of labour markets and, certainly, a highly contentious political issue. It is therefore important to have a clear-cut analysis of the impact of public job programmes on unemployment and labour market outcomes.

More precisely, the paper studies the impact of public employment on labour market performances in 17 OECD countries over the period 1960–2000. The main issue is to see if public employment has a crowding out effect on private employment and whether it has a positive or a negative effect on the unemployment rate. After a quick overview of the evolution of public employment in OECD countries, the authors start by sketching a simple theoretical framework (more expanded in the Appendix) which presents various channels through which public employment can affect labour market performances. Beyond the direct negative impact of public employment on unemployment rates, one may expect public jobs to have indirect positive impacts on unemployment because of crowding out of private sector jobs (through increased wage pressures or taxes) or because of an induced rise in labour force participation. An important implication of the framework is the idea that the crowding out effect on private employment and the positive impact on unemployment is stronger the larger the substitutability between public production with private output and the larger the rents allocated to the public sector.

The paper then naturally proceeds to an empirical analysis of the impact of public employment on private employment and unemployment. They rightly point out the issue of endogeneity of public employment programmes to unemployment and control for this by using a 3SLS procedure, instrumenting public employment by variables like political preferences, degree of centralization of public expenditure, international openness, GDP per capita and urbanization. In order to test the predictions

of the theoretical framework, the degree of substitutability between public and private production is proxied by the relative importance of public expenditures in the health sector while the importance of rents in the public sector is proxied by a corruption/transparency index or the public wage premium in the country.

The main results of this analysis are quite startling. First, public employment has a crowding out effect on private employment and increases unemployment rates. Secondly, the effects are stronger for countries where public production is more substitutable to private production (as measured by the relative level of public expenditure in the health sector) and when there are larger rents in the public sector (as measured by the corruption index or the public–private wage gap). Those conclusions are quite provocative. Given their sensitive political implications for labour market policy, I am sure that they will not remain uncontroversial and will feed on the debate between ‘free market oriented’ and ‘interventionists’ on the role of the public sector in the functioning of labour markets and in the economy more generally.

I will organize my discussion in three parts. The first one considers the theoretical framework expanded by the authors. The second deals with some empirical aspects of the paper and the last part concludes with policy implications and what can be learned in the end from this paper.

The theory side first. The model, though a bit restrictive, is simple and quite illustrative of some of the channels through which public employment can affect labour market performances. Still, one may wonder why the authors do not put more emphasis on the distortionary impact of taxes in financing public jobs. The authors just allude to this aspect in the theory part and then go on with lump sum taxation to finance public wages in the rest of the paper. It seems to me that a potentially important indirect effect of public jobs exactly goes through this channel. If there are limits to public deficits, more public jobs imply ‘public expenditure switching’ or tax increases. In the first case, it leads to reductions in public investment or infrastructure building. In the second case, it reduces the after tax profitability of firms. In both cases, the financing impact can be distortionary and impact negatively on the productivity of the private sector, thereby reducing labour demand in that sector.

In passing, let us mention one technical aspect. In the theoretical appendix, quite conveniently the authors use a specification which makes the private sector unemployment *rate* just a function of a constant wage mark up. Because of that, employment in the private sector becomes only influenced by public employment through changes in the allocation of workers between the two sectors. Clearly this is related to the use of a Cobb–Douglas production function for the private sector. Without such an assumption, the wage mark up need not remain constant and the private sector unemployment rate may also indirectly depend on public production and employment.

Another aspect of the theoretical framework is to emphasize the fact that the larger the level of rents in the public sector, the larger the crowding out effect of that sector on private sector’s jobs. This may not always be the case if there are reasons for

efficiency wages in the public sector and output in the public sector is complementary to that in the private sector. As a matter of fact, one may have to pay enough rents to public sectors' workers to ensure that they provide reliable inputs (justice, property right enforcement, police, infrastructures etc.) to the private sector. In that case, at least for low enough rents, one may have a positive relationship between rents in the public sector and employment in the private sector. Also, this discussion suggests that the crowding out effect of public employment on private employment should be less sensitive to higher public sector rents in countries where public output is more complementary to private output.

On the empirical side now. I know that it is notoriously difficult to have a good measure of rents in the public sector. Still, I am a bit dissatisfied by one of the proxies (index of corruption) used by the authors. First of all, it is not a *true* measure of corruption or rents but rather a measure as *perceived* by businessmen and experts. While this may be perfectly correct to use this measure for questions like how is foreign direct investment affected by the *perception* of corruption, I am not sure that it is really appropriate in the present context. Recall that the basic story is the idea that these rents are supposed to reflect higher benefits to public jobs, attracting more workers to that sector and thereby putting wage pressures and reducing employment in the private sector. So it is the amount of rents as perceived by local workers which is going to matter and this may be quite at variance with the perception of experts and foreign investors. In particular, workers (at least in OECD countries) will be more attracted to public jobs not so much because of the amount of bribes or kick-backs that they anticipate but more because of concerns about job security, pension benefits, parameters which will not be captured by this index. Clearly, the other proxy for public rents, the public wage premium, is more satisfactory, though it may not capture precisely all the benefits that public jobs offer and can be subject to measurement errors.

This last aspect makes me think that the larger crowding out effect of public sector employment on private sector employment for countries with a large corruption index may actually illustrate a mechanism quite different from the one argued by the authors. Rather than going through a supply-side effect in the labour market with a reallocation of workers to the public sector, it could simply reflect that more corrupt countries have less efficient public sectors and that less efficient public sectors are more penalizing at the margin for private firms' productivity, penalizing through a direct labour demand side effect private employment.

This point leads me to a general comment about the empirical analysis which is that one does not really have a sense of the precise mechanism (demand side versus supply side) by which public employment crowds out private employment and increases unemployment.

Finally, let me turn to the last part of my comment: policy implications. What have we learned from this exercise? First, public employment is bad for employment and secondly, public sector reforms by reducing public rents is good for labour market

performances. Can we draw important normative implications from this? Strictly speaking, no. As rightly pointed out by the authors, there is no efficiency analysis of the public sector here, nor is there a discussion of a well-defined objective function through which social and redistributive outcomes can be evaluated. One should therefore be very careful not to draw too quickly normative implications from the conclusions of the paper. Still, on the political side, it seems to me that two implications appear to emerge naturally from the analysis. First, one cannot justify public employment policies as a way to reduce unemployment. Conversely, however, reducing unemployment may be used as an argument to justify public sector reforms. Whether this in turn will convince voters of the merits of good public sector reforms, however, remains to be seen.

## Panel discussion

In reply to Thierry Verdier, Pierre Cahuc agreed that distortionary taxes should be relevant. However, he noted that the last table in the paper offers intriguing evidence that public employment does exert some influence on private-sector wages, as implied by the paper's theoretical perspective.

Patrick Honohan found the distinction into high and low substitutability somewhat arbitrary, and asked whether omitting Spain would yield similar results. Charles Goodhart found the political message of the paper very provocative, but he was not completely convinced by the paper's econometric techniques. The authors agreed to perform extensive specification testing, now reported in the paper and in the Web Appendix.

Paolo Mauro suggested that similar insight might be applicable to developing economies, and he thought that GDP per capita could be a better instrument (in light of Wagner's law) than total factor productivity. Jan van Ours thought that time-varying market institutional variables should be more extensively included in empirical regressions, even though standard cross-sectional estimates do ease comparison with earlier work. He also pointed out that the estimated 1.5 crowding out effect is not significantly different from a more intuitively appealing unitary level.

## APPENDIX 1. A FORMAL MODEL

Consider a labour market with private and public jobs. Population in working age is normalized to one, and  $N \leq 1$  denotes labour market participation. In the private sector, a representative firm produces output (the numeraire) using labour as the only factor in the production function  $AF(L_p) = AL_p^\alpha / \alpha$ ,  $\alpha \in ]0, 1[$ , where  $A > 0$  indexes productivity and  $L_p$  denotes private employment. There are  $L_g$  jobs in the public sector, each producing a unit of a public good. All individuals have the same preferences, and an individual whose income is  $w$  enjoys utility

$w + H(L_g)$ , with  $H'(\bullet) > 0$ ,  $H''(\bullet) < 0$ . Unemployed workers have no income, and only derive utility from the public good. There is no job-to-job mobility. The  $U = \mathcal{N} - L_p - L_g$  unemployed workers can search either for a public job or for a private job. In equilibrium, they must be indifferent between the two choices on the basis of rational expectations as to wages and employment prospects in the two sectors.

### Private-sector labour market

A trade union aims at maximizing the total utility of the  $\mathcal{N}_p$  workers who belong to the private sector. If  $z_p$  is the expected utility of an unemployed worker in the private sector,

$$z_p = u_p H(L_g) + (1 - u_p)[w_p + H(L_g)] = H(L_g) + (1 - u_p)w_p \quad (1)$$

where  $w_p$  and  $u_p = (\mathcal{N}_p - L_p)/\mathcal{N}_p$  are the wage and the unemployment rate in the private sector. The objective of the trade union is

$$V_p = L_p[w_p + H(L_g)] + \text{Max}(\mathcal{N}_p - L_p, 0)z_p. \quad (2)$$

The implications of this simple model are qualitatively similar to those of a model with explicit flows between employment and unemployment (see for instance, Layard *et al.*, 1991). A standard right-to-manage Nash (1950) bargaining program with  $\pi \in [0, 1]$  bargaining power of workers and disagreement payoffs  $\mathcal{N}_p z_p$  for the union and zero for the firm,

$$\text{Max}_{w_p} L_p^\pi [w_p + H(L_g) - z_p]^\pi [F(L_p) - w_p L_p]^{1-\pi} \quad \text{s.t. } AF'(L_p) = w_p, \quad (3)$$

yields the condition

$$AF'(L_p) = w_p = \mu_p [z_p - H(L_g)], \quad \mu_p = \frac{\alpha + \pi(1 - \alpha)}{\alpha} \geq 1 \quad (4)$$

for an interior solution with  $L_p < \mathcal{N}_p$  (an efficient bargaining model as in MacDonald and Solow, 1981 would have the same qualitative implications). The Cobb–Douglas technology implies that the unemployment rate is independent of the labour force size, and only depends on the wage mark-up  $\mu_p$  in the private sector: substituting (4) in (1) we have

$$\mu_p = \frac{\mu_p - 1}{\mu_p}. \quad (5)$$

Thus, private-sector unemployment is not directly influenced by public employment, which however can affect aggregate unemployment by altering the allocation of  $\mathcal{N}_g$  and  $\mathcal{N}_p$  workers to the two sectors. Hence, the private wage,  $w_p = AF'[\mathcal{N}_p(1 - u_p)]$ , is also influenced by the size of the public sector through changes in  $\mathcal{N}_p$ .

### Public sector labour market (relative wages given)

In the public sector, the job-finding probability is  $L_g/\mathcal{N}_g$ . Thus, the expected utility of a worker who looks for a job in the public sector is:

$$z_g = H(L_g) + \frac{L_g w_g}{\mathcal{N}_g} \quad (6)$$

where  $w_g$  denotes the wage in the public sector. For simplicity, let the wage in the public sector be proportional to the private wage:  $w_g = \lambda w_p$ , where  $\lambda > 0$  indexing the relative wage of public and private sector workers. It will be shown later that such proportionality can be rationalized by an explicit model of collective bargaining in the public sector.

### Equilibrium labour market effects of public employment

In equilibrium, unemployed workers must have the same expected utility in the private and the public sector,

$$z_p = z_g \equiv z, \quad (7)$$

and (1), (5), (6) and (7) yield

$$N_g = \lambda \mu_p L_g, \quad \text{where } \lambda = w_g/w_p. \quad (8)$$

Hence, the number of workers in the public sector increases with the number of public jobs, and does so more strongly when  $\lambda$  is large (public wages are high relative to private wages). Using (5), (8) and the identity  $u_g N_g = N_g - L_g$  yields

$$\lambda(1 - u_g) = 1 - u_p$$

Thus, the unemployment rate is higher in the public sector than in the private sector if and only if  $\lambda > 1$ , i.e., if wages are higher in the public sector (Holmlund, 1997, obtains the same result in a related model).

From equations (5) and (8) and the identity  $N = N_p + N_g$ ,

$$L_p = (N/\mu_p) - \lambda L_g; \quad (9)$$

private jobs are necessarily crowded out by public jobs, and the effect is stronger when  $w_g/w_p = \lambda$  is larger.

The identity  $U + L_p + L_g = N$ , together with (5) and (9), yields an expression for the aggregate unemployment rate:

$$u = \frac{U}{N} = \frac{L_g}{N}(\lambda - 1) + \frac{\mu_p - 1}{\mu_p} \quad (10)$$

Public sector expansion decreases the unemployment rate if and only if  $\lambda = w_g/w_p < 1$ .

### Public jobs and labour market participation

The results above took the participation rate as given. It is not difficult, however, to study the effects of public employment on participation. To this end, let individuals enjoy different utility levels  $\bar{z}$  when out of the labour market. The distribution of utility levels is denoted  $\Phi(\bar{z})$ . Labour market participation is only attractive for individuals whose  $\bar{z}$  is such that utility out of the labour force,  $\bar{z} + H(L_g)$ , is lower than the  $z$  level of utility defined in (7) above. We have  $z = H(L_g) + (w_p/\mu_p)$  from equations (6) and (8). Since  $w_p = AF'(L_p) = AF'[(N/\mu_p) - \lambda L_g]$ , the participation rate  $\Phi[z - H(L_g)]$  of the unitary population can be written

$$N = \Phi[AF'[(N/\mu_p) - \lambda L_g]/\mu_p]. \quad (11)$$

This equation implies that the participation rate increases with public employment, which crowds out private jobs, increases marginal productivity and wages in the private sector, and therefore attracts workers into the labour market. By equation (9), there are  $(N/\mu_p) - \lambda L_g$  private jobs: hence, higher participation increases private employment, and reduces the crowding out effect of public jobs on the private sector.

Accordingly, our basic model suggests that the response of participation to public employment tends to soften the crowding out effect of the public sector. Public jobs, however, may influence participation through several other channels. They can affect the out-of-labour market welfare  $\bar{z}$  by producing goods that are valuable in that state, and they can also influence productivity in the private sector. In order to illustrate such an effect, let us assume that the productivity parameter  $A$  of the private sector's production function depends on public employment:  $A = f(L_g)$ . The function  $f(\bullet)$  may be increasing or decreasing, depending on the type of public sector activity. If it is increasing, higher private productivity from public job creation increases private wages, and strengthens public employment's impact on the participation rate. However, if public jobs produce goods that are substitutable to those produced by the private sector, the relative price of goods produced by the private sector must decrease. In the model, this can be represented by  $f'(L_g) < 0$ , in which case public jobs lead to a reduction in private sector wages and participation.

As argued in the main text of the paper, the model implies that public jobs can influence the size of the labour force through different channels, and that the total effect of public employment on participation is ambiguous.

## Determinants of public employment

Consider first the case where its level is chosen by a benevolent government so as to maximize the difference between public good's social value,  $H(L_g)$ , and its cost,  $w_g L_g$ . For simplicity, suppose that public employment is financed on a lump-sum basis. Then, public labour demand is given by the condition  $H'(L_g) = w_g$ . Also for simplicity, let participation be exogenous ( $N = 1$ ), and suppose public wages are bargained by a representative trade-union and the government (Holmlund, 1993, makes similar assumptions in a model focused on distortionary taxation effects). Then, the objective function  $V_g$  of the public-sector trade union is similar to the private-sector one above,

$$V_g = L_g[w_g + H(L_g)] + \text{Max}(N_g - L_g, 0)z_g, \quad (12)$$

and with  $\gamma \in [0, 1]$  the relative bargaining power of public-sector workers wages are set by the Nash program

$$\text{Max}_{w_g} L_g[w_g + H(L_g) - z_g]^\gamma [H(L_g) - w_g L_g]^{1-\gamma} \quad \text{s.t. } H'(L_g) = w_g,$$

whose interior solution satisfies

$$H'(L_g) = w_g = \mu_g[z_g - H(L_g)], \quad \mu_g = \frac{\beta + \gamma(1 - \beta)}{\beta} \geq 1 \quad (13)$$

where  $\beta = L_g H'(L_g)/H(L_g)$ . Equation (13), together with equation (4) and the arbitrage condition (7) implies:

$$w_g = \lambda w_p, \quad \text{with} \quad \lambda = \mu_g / \mu_p. \quad (14)$$

Thus, relative wages in the two sectors are determined by wage mark-ups, which in turn depend on labour demand elasticities and bargaining power parameters. According to Ehrenberg and Schwarz (1986), labour demand elasticities are empirically similar for public and private jobs. Trade union density, however, is usually higher in the public sector. Thus, employees may enjoy higher rents in the public than in the private sector.

Since the public wage is equal to the marginal productivity in the private sector, (9), (13) and (14) yield:

$$H'(L_g) = \lambda AF'[(1/\mu_p) - \lambda L_g] \quad (15)$$

This equation shows that the government creates public jobs up to the point where the marginal utility of the public good  $H'(L_g)$  is equal to its marginal social cost,  $\lambda AF'(L_g)$ . As the marginal cost of the public good increases with the ratio  $\lambda = w_g/w_p$ , a high wage in the public sector induces the government to create less public jobs.

The model can illustrate the consequences of an increase in public employment due, for instance, to a more pressing concern for the public good. For concreteness, suppose that  $H(L_g) = BL^\beta$ ,  $\beta \in ]0, 1[$ ,  $B > 0$ . A higher value of  $B$  represents a more socially valuable public good. This increases public employment, according to equation (15), without any change in the wage differential between the public and the private sector, as shown by equation (14). Accordingly, as noted in the main text, relative wages can be meaningfully kept constant when analysing the consequences of an increase in public employment due to a rise in the valuation of the public good.

Assuming that public employment is determined by the maximization of personal objectives of politicians or bureaucrats would yield similar results. For instance, it can be assumed that politicians face a trade-off between public and private employment. In that case, their objective can be represented by the minimization of a loss function with the following form:

$$W(L_g, L_p) = \frac{1}{2}(L_g - \bar{L}_g)^2 + \frac{1}{2}(L_p - \bar{L}_p)^2,$$

where  $\bar{L}_g$  and  $\bar{L}_p$  are two exogenous parameters. The minimization of  $W$  with respect to  $L_g$ , subject to equation (9) yields the same qualitative results as those obtained in (15).

## APPENDIX 2. LIST OF VARIABLES, SYMBOLS, DEFINITIONS AND SOURCES

$u$  = global unemployment rate as the ratio of the number of unemployed workers  $U$  on the size of the labour force  $\mathcal{N}$ . Source: OECD National Accounts.

$L_p$  = private employment rate.  $L_p$  is computed as the ratio of total employees in the business sector on population in working age. Source: OECD National Accounts.

$L_g$  = public employment rate.  $L_g$  is computed as the ratio of total employees in the public sector on population in working age. The public sector consists of all government activities excluding public firms ownership. Source: OECD National Accounts.

$w_p$  = wage rate in the business sector. Source: OECD National Accounts.

**Tfp** = growth rate of total factor productivity in the private sector. Source: Blanchard and Wolfers (2000).

**Employment protection** = index ranked into 20 levels according to five criteria: working time, fixed term contract, firing costs, minimum wages and employee's representation right. Source: Blanchard and Wolfers (2000).

**Replacement rate** = level of the replacement rate of unemployment benefits. Time-invariant variable. Source: Blanchard and Wolfers (2000).

**Benefit** = duration of the unemployment benefits in number of years. The variable ranges from 0 to 4. Time-invariant variable. Source: Blanchard and Wolfers (2000).

**Union density** = share in percentage of union members among wage earners. Time invariant variable. Source: Blanchard and Wolfers (2000).

**Union coverage** = share of workers covered by collective bargaining. The variable ranges from a low value 1 to a high value 3. Time invariant variable. Source: Blanchard and Wolfers (2000).

**Union co-ordination** = extent of co-ordination among employees and entrepreneurs. The variable ranges theoretically from a low value 1 to a high value 6. Time invariant variable. Source: Blanchard and Wolfers (2000).

**RG** = political colour of governments, classified as left-wing or right-wing orientation. Source: Alesina *et al.* (1997).

**Openness** = degree of external exposure computed as the total share of international trade (exports plus imports) in output. Source: Penn World Table data set.

**Urbanization** = percentage of population living in urbanized areas. Source: World Bank World Tables.

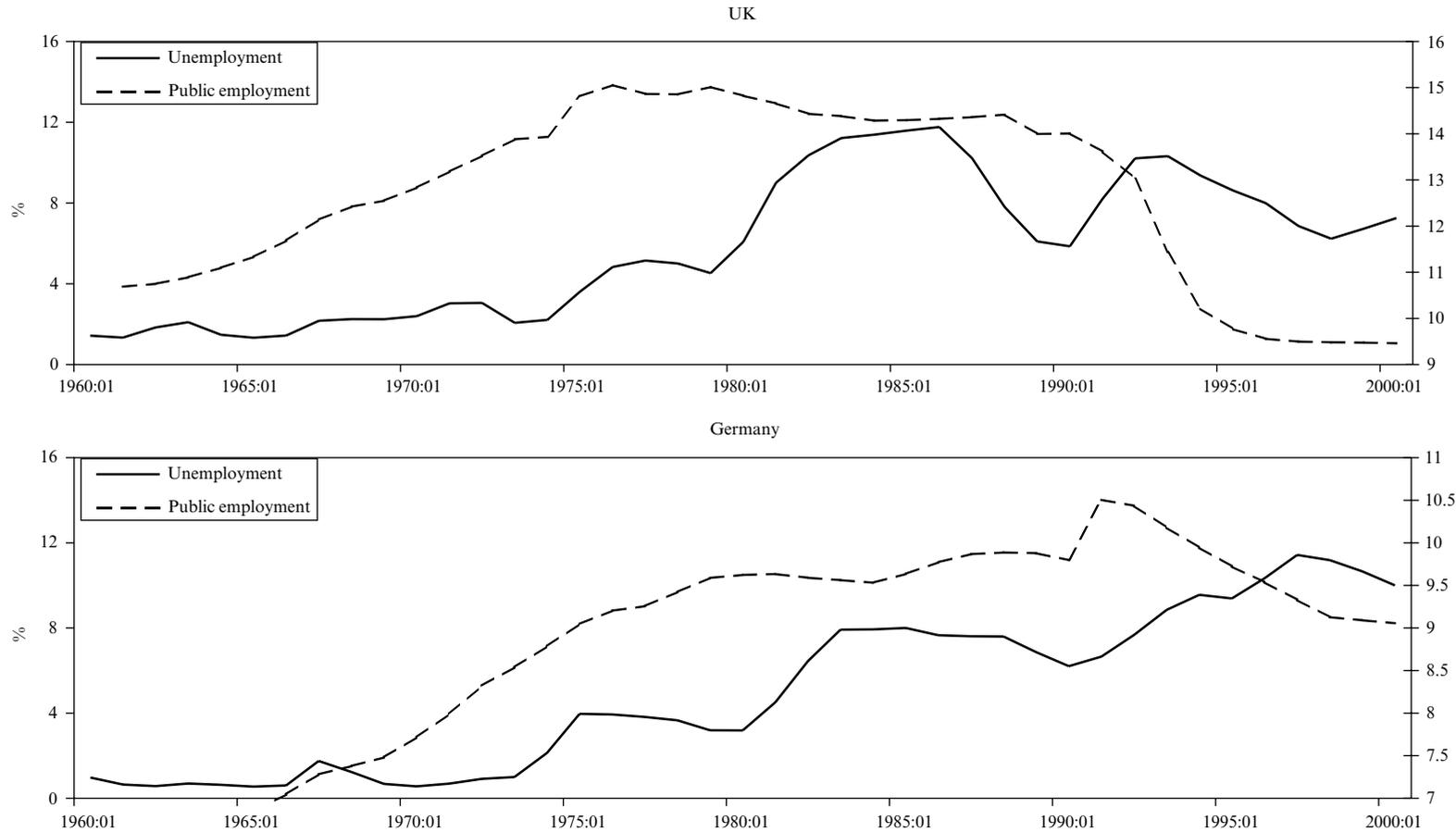
**Corruption Perception Index** = degree of misuse of public power for private benefits. Range between 0 (highest corruption) and 10 (lowest corruption). Source: Lambsdorff (2000).

**Wage premium** = percentage gap between public wages and private ones. Source: Blanchflower (1996).

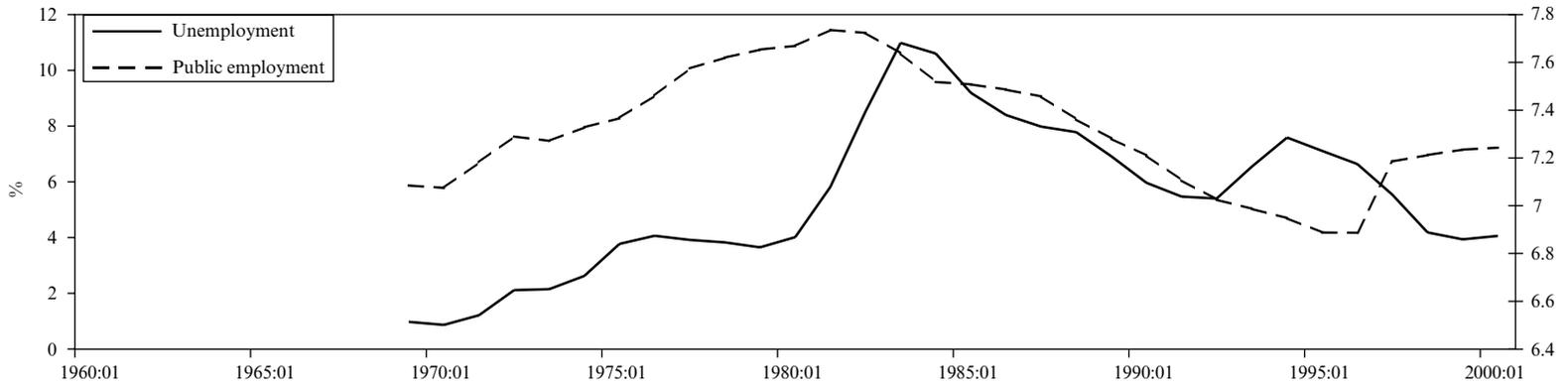
**Health** = share of public expenditure in total health expenditure. Source: World Bank World Tables.

**Complementary public goods** = share of public spending in defence, general public services and public order in total government outlays. Source: IMF.

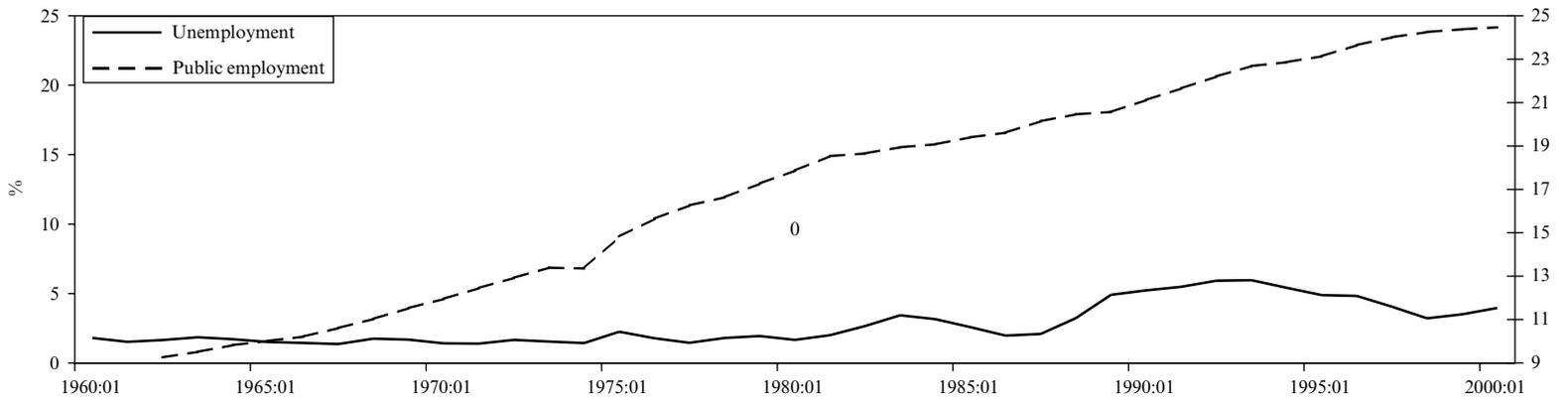
### APPENDIX 3. UNEMPLOYMENT (LEFT SCALE) AND PUBLIC EMPLOYMENT (RIGHT SCALE) RATES IN 17 OECD COUNTRIES OVER THE PERIOD 1960–2000

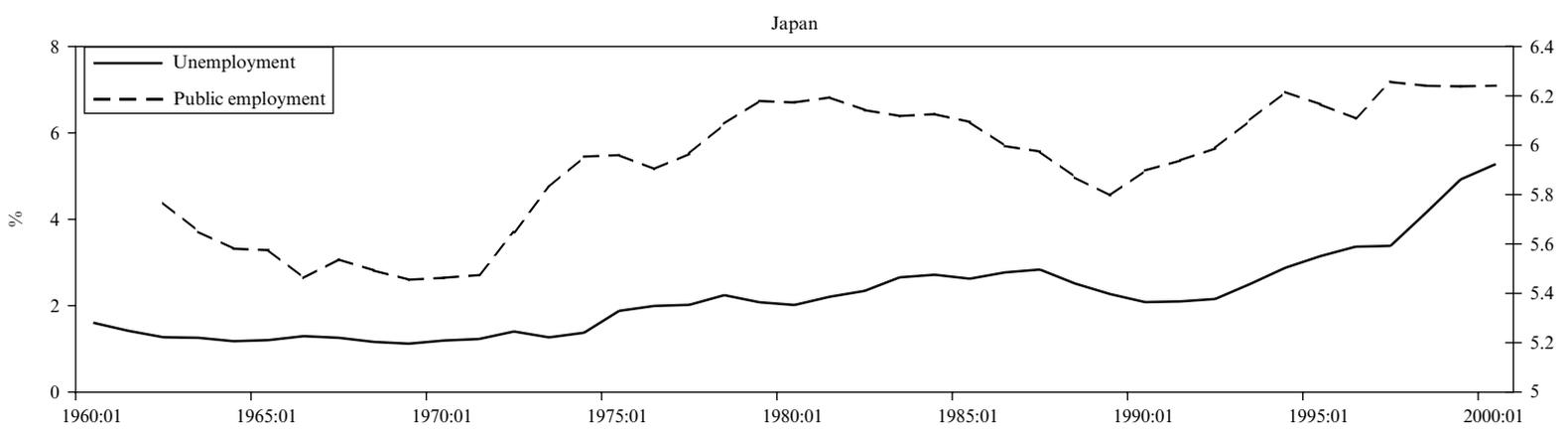
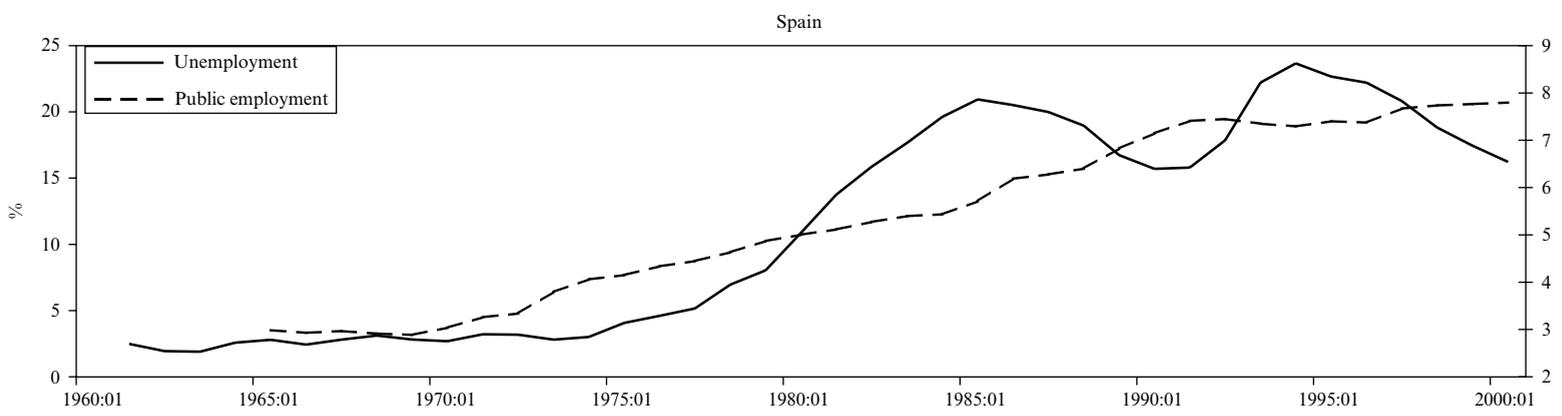


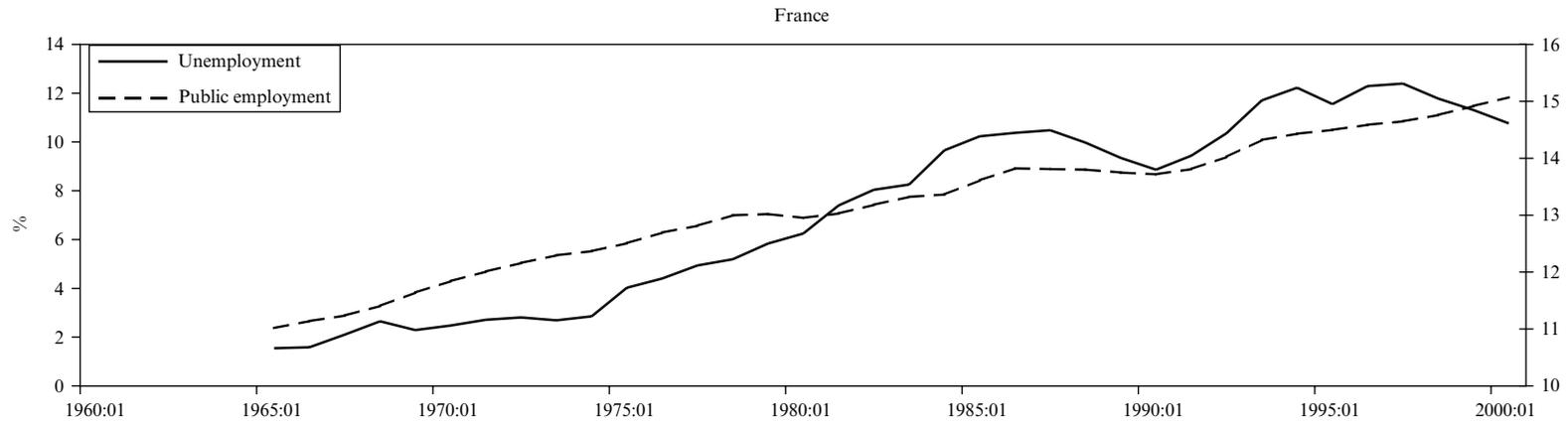
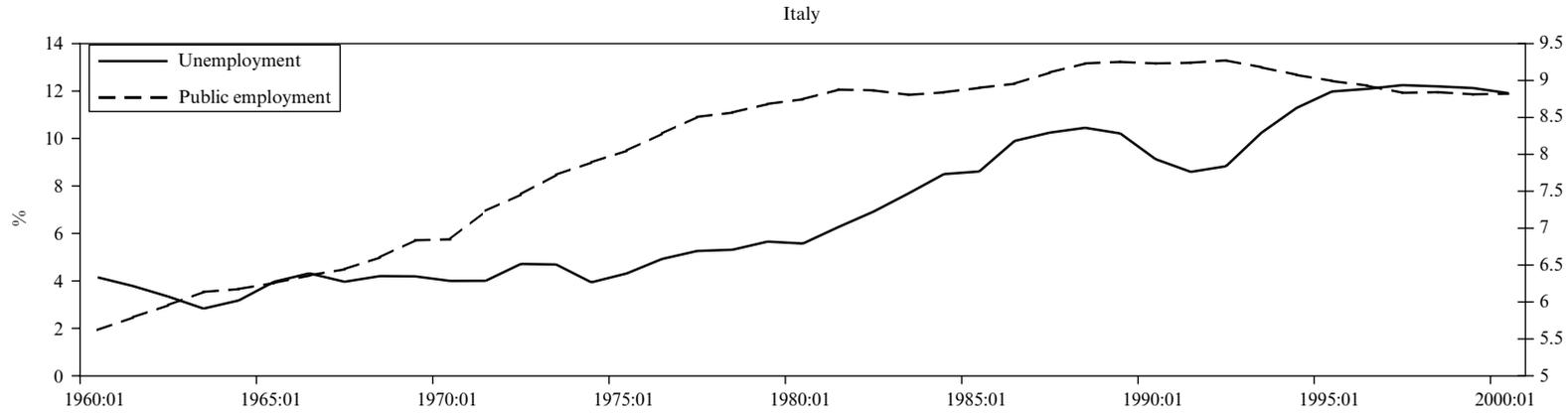
Netherlands

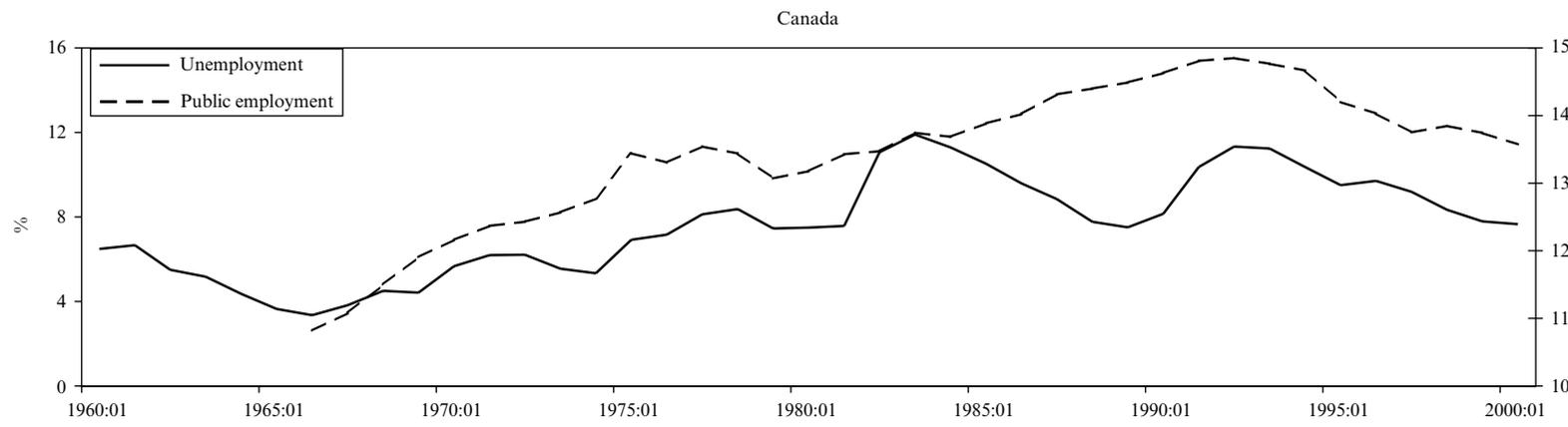
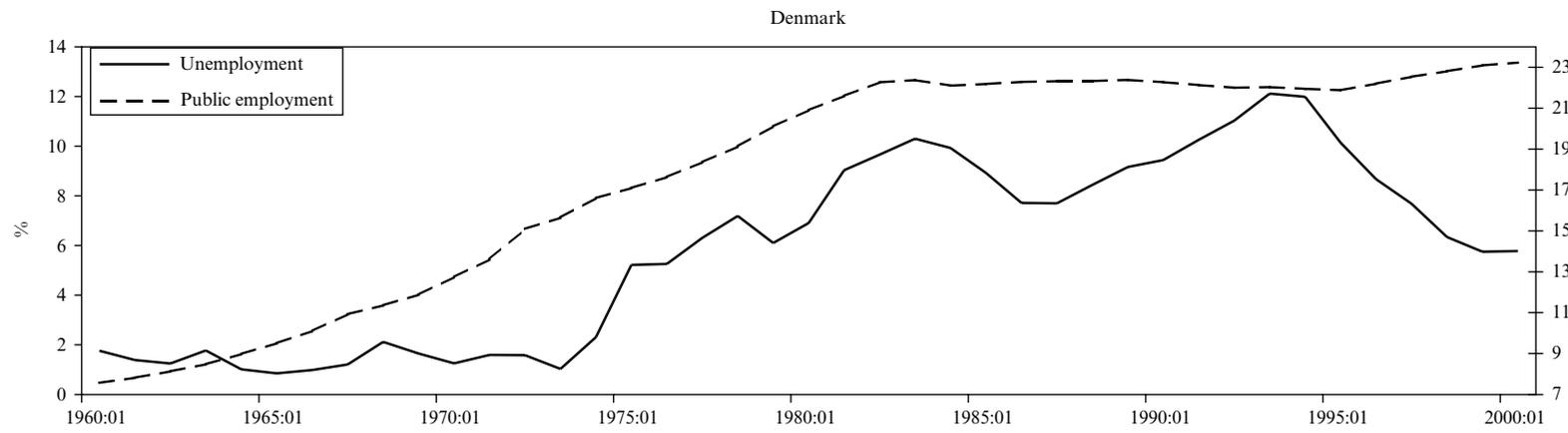


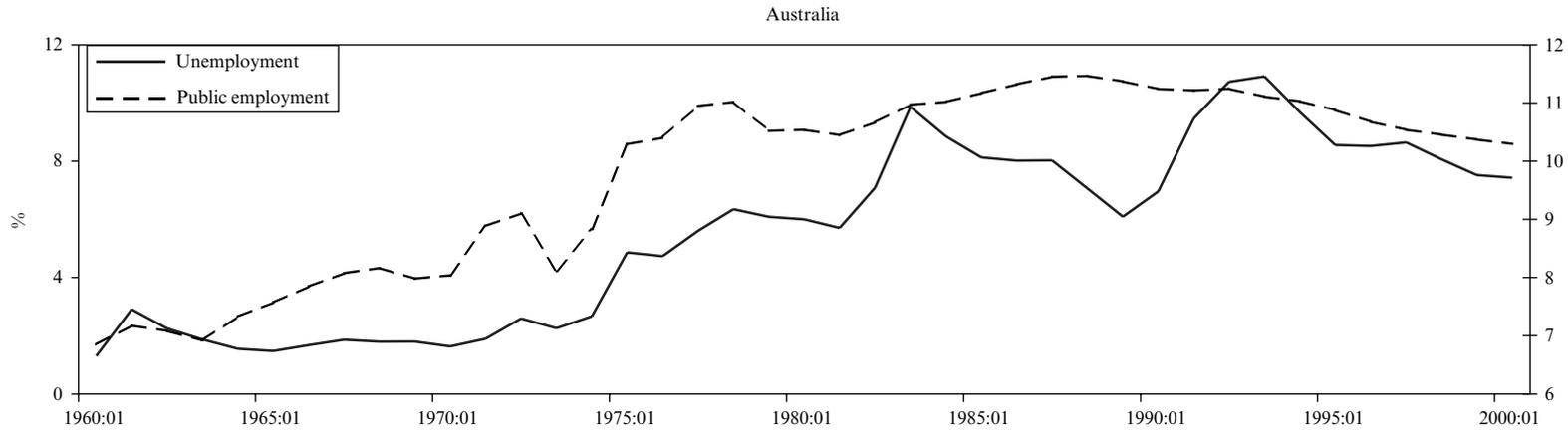
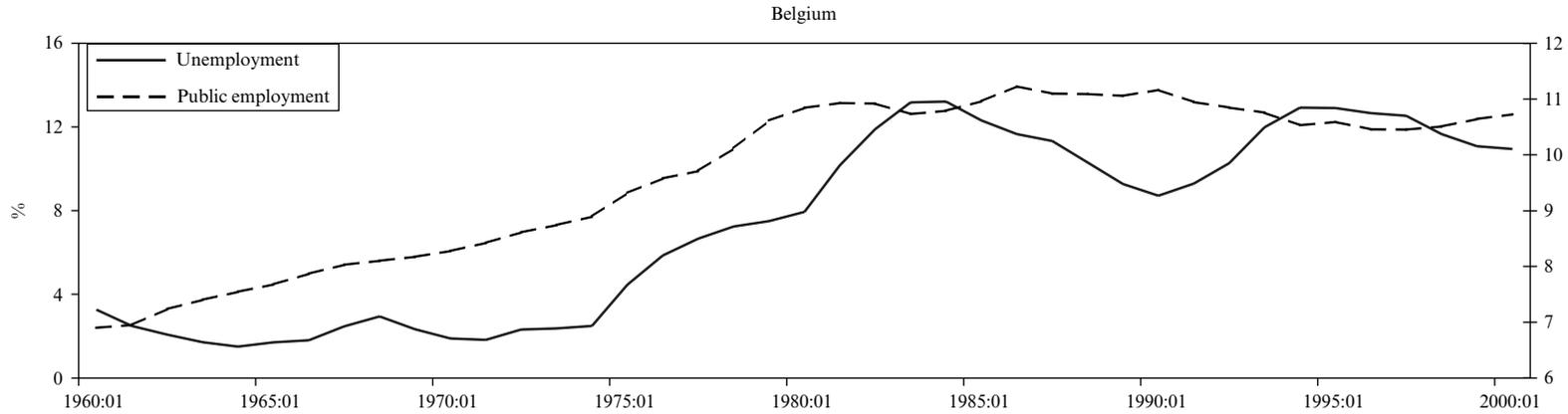
Norway

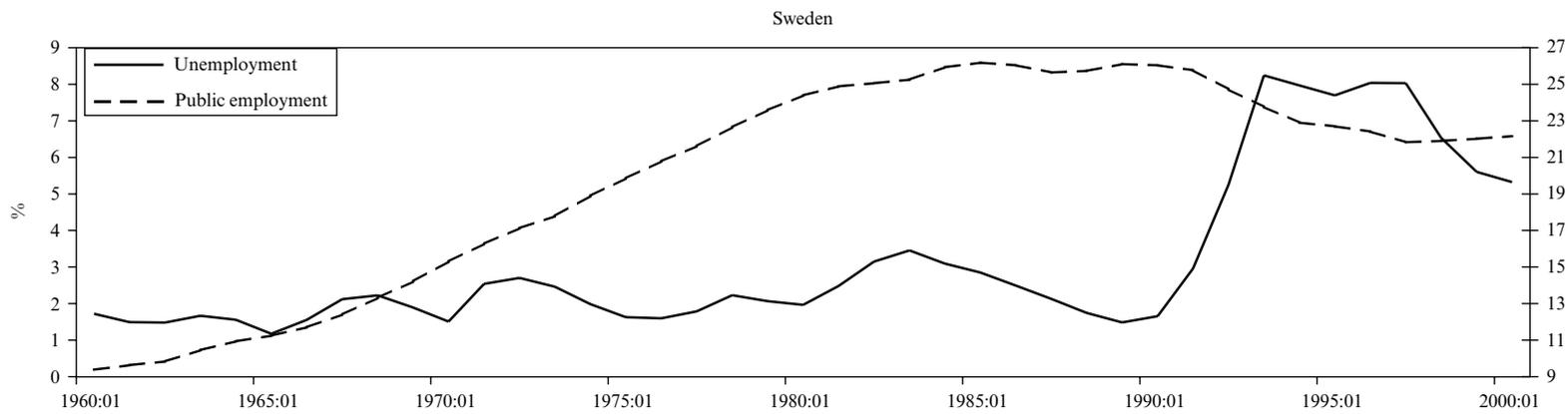
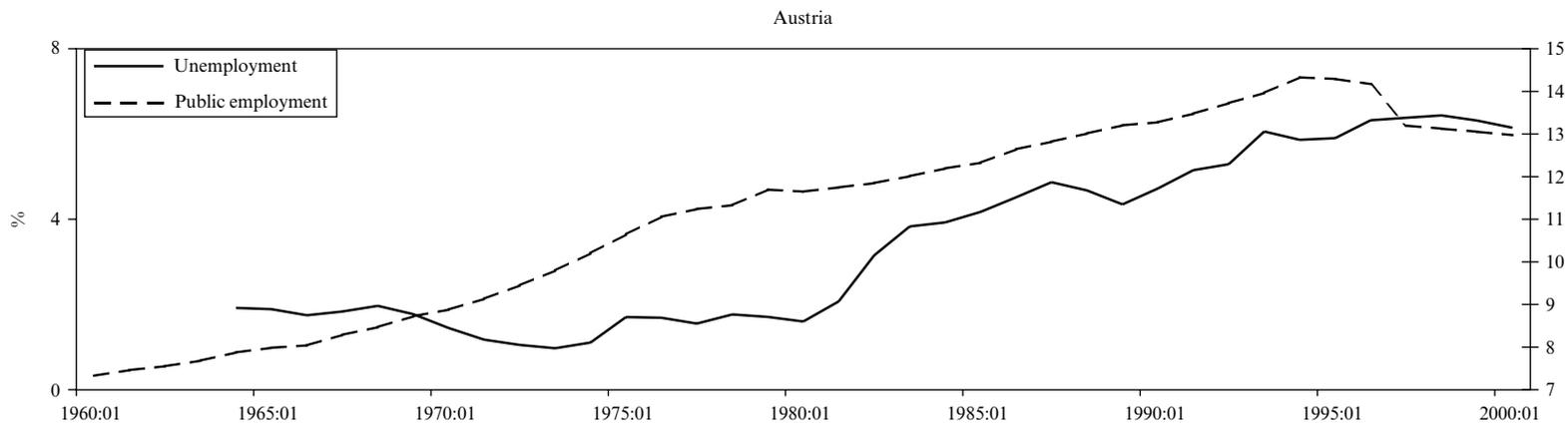


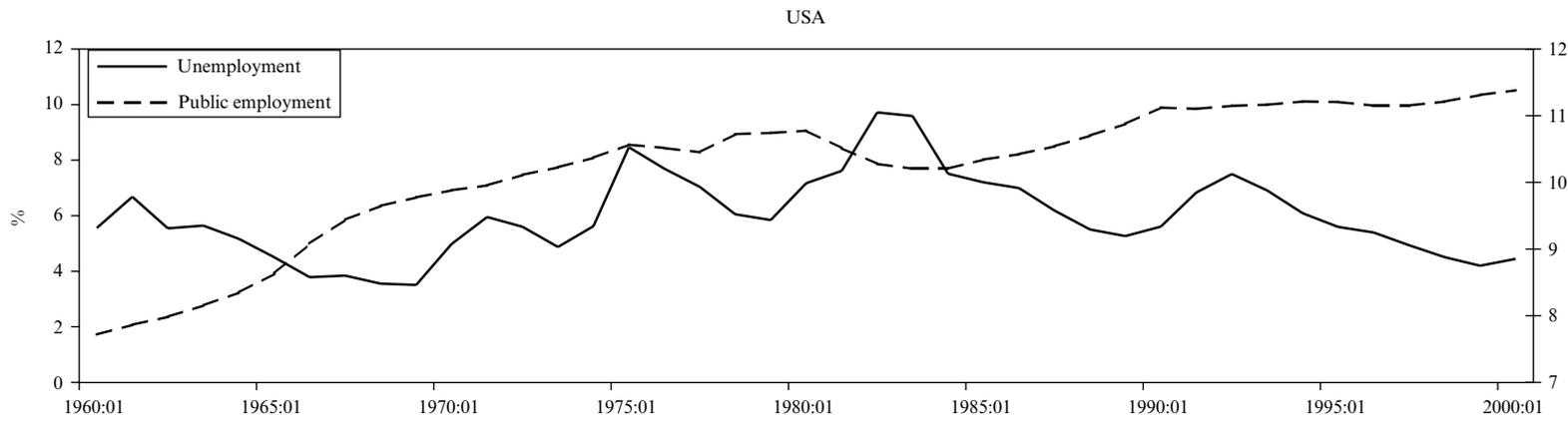
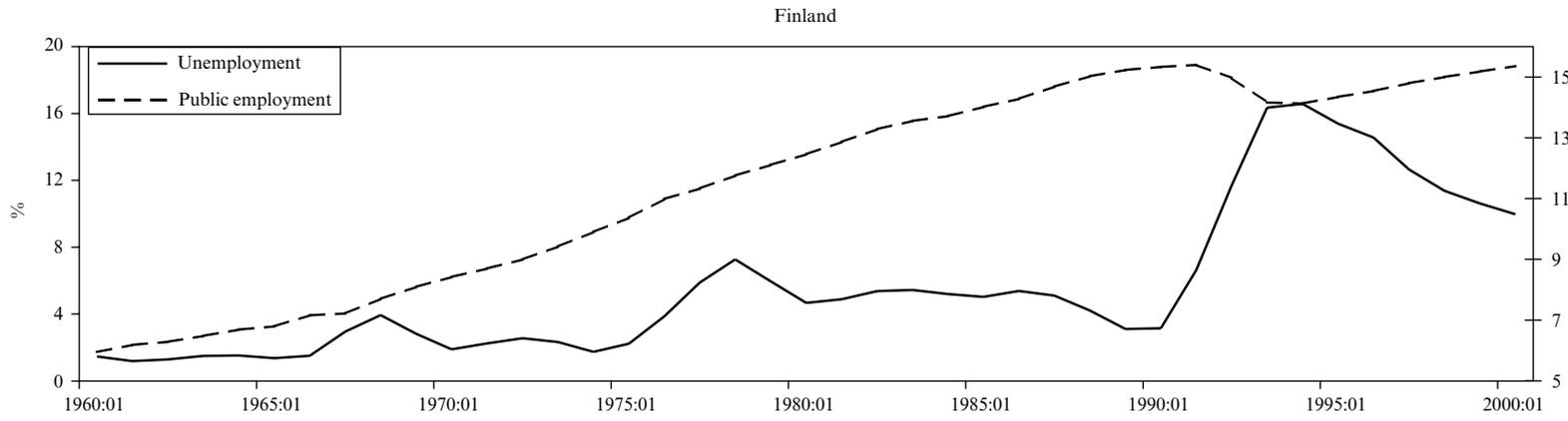


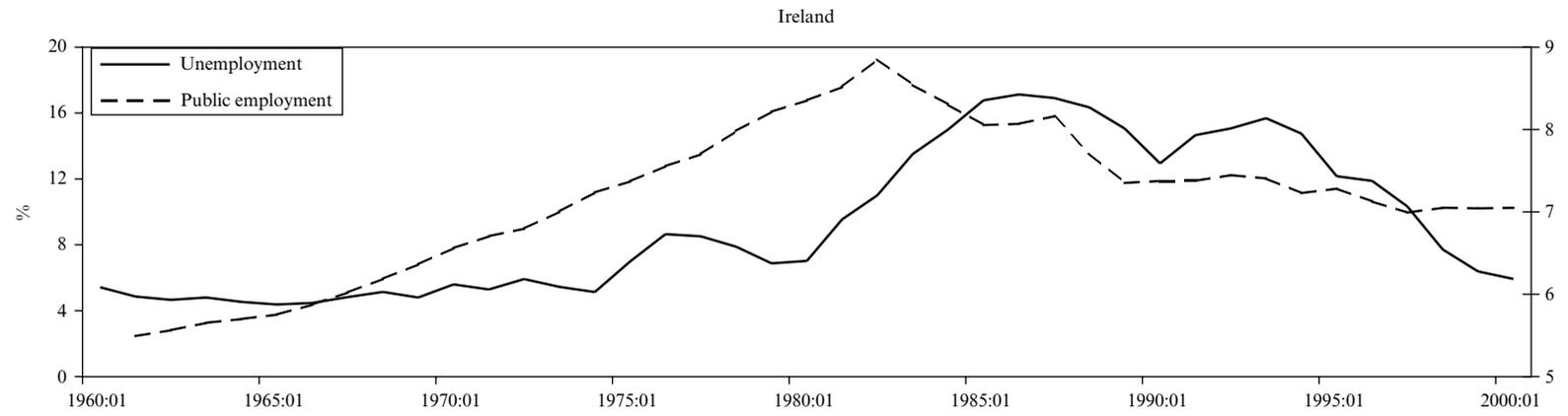












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