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Does slack influence public and private labor market interactions?

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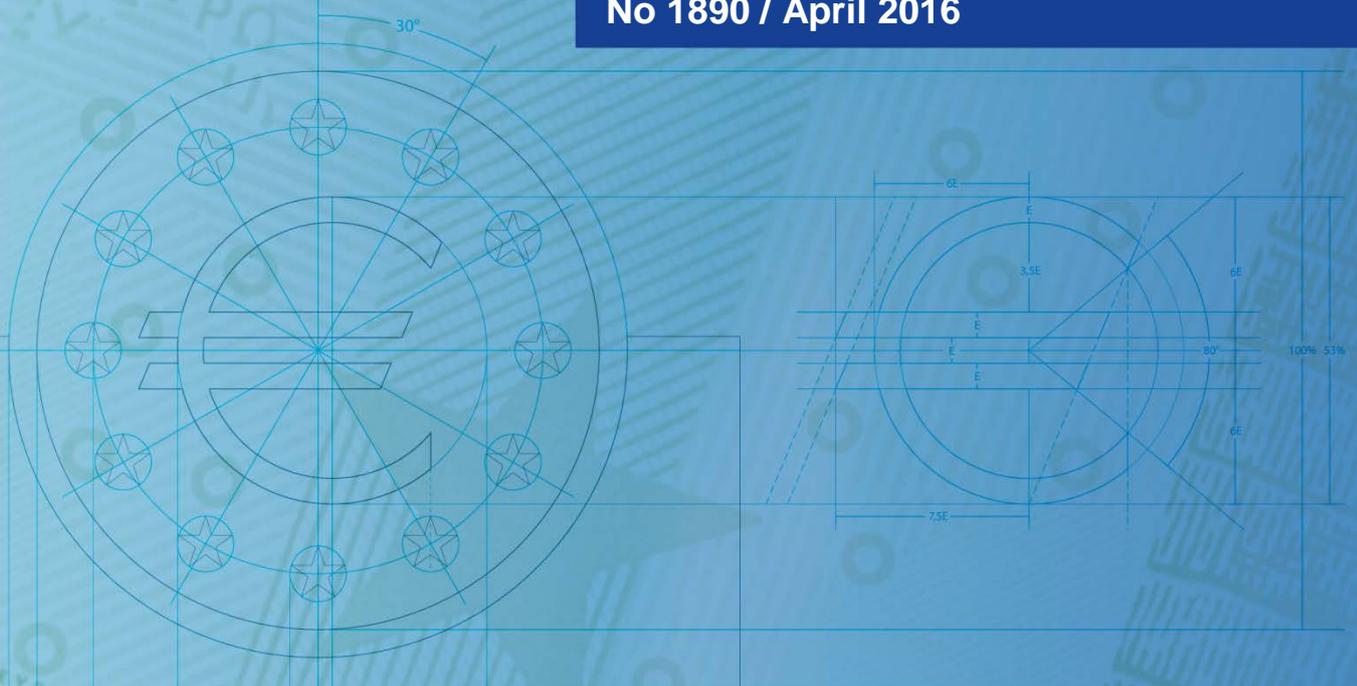
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Ana Lamo
Enrique Moral-Benito
and Javier J. Pérez

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Abstract

We empirically analyze the impact of public employment and wages' shocks on private labor market outcomes by studying if policies operate differently in periods of economic slack than in normal times. We use local projection methods and focus on the Spanish and euro area aggregate cases. We find that the degree of economic slack is key to determine: (i) if public employment crowds-out private employment, and (ii) the degree and extent of public wage influence on the private sector.

In addition, we find that the specific features of the economy also count. In the case of Spain, when fiscal consolidation is implemented at times of economic distress, the contractionary effects of public employment cuts appear more damaging for the economy than those of public wage cuts, while the opposite happens for the euro area as a whole. These differences are likely to be related to specific features of the labor markets in both cases.

JEL Classification: E62; E65; H6; C3; C82.

Keywords: Public employment; Wages; Unemployment; Fiscal policies.

Non-technical summary

In this paper we empirically analyze the impact of public employment and wages' shocks on labor market outcomes in the short and medium-term, by studying if policies operate differently in periods of economic slack than in normal times. Our research questions are the following: (i) Is the impact of a public employment shock on private employment different depending on the degree of economic slack?; (ii) Is the degree and extent of public wage influence on the private sector state-contingent?; (iii) As regards the choice of public employment and public wages as a fiscal consolidation instrument, which is the one to be preferred from the point of view of their GDP effects?

We study the cases of Spain and the euro area taken as a whole (euro area aggregate), to cover two cases with significantly different levels of unemployment and degrees of fiscal stress during the most recent crisis. To allow for non-trivial non-linearities, we set up state-dependent models using Jordà's (2005) local projection method. Our main findings are the following.

First, we find that a public employment shock crowds-out private employment in normal times, while the opposite happens in periods of high-unemployment, at least in the short-run. While the literature tends to find that an increase in public employment crowds-out private employment, at least in the medium-term, our findings provide empirical support to some recent theoretical papers (see Michaillat, 2014) that argue that crowding-out is more a "good times" issue.

Second, the role of economic slack is less pronounced in determining the effect of public wages on private wages. While the effect is positive for the euro area, in both cases (larger in periods of high unemployment), it is slightly negative, short-lived and only marginally significant for Spain. This results validates and extends the by now standard result that public wages may lead private sector wages in the euro area. We read the fact that the mechanism operates in recessions as a signal that policies of public wage restraint may set in motion a labor market adjustment that otherwise would have taken longer and would have been, consequently more costly for the economy as a whole.

Third, regarding the composition of labor-based consolidations in periods of economic

slack, the contraction effects of employment cuts appear more damaging for the economy than wage cuts, as found by Bermperoglou et al. (2013). Indeed, public wage cuts might have expansionary effects in the case of Spain.

1 Introduction

In this paper we provide empirical evidence on the impact of public employment and public wages' policies on private labor market outcomes and GDP during the recession. This is to us a relevant question given the prominent role taken by public wage bill consolidation policies during the most recent crisis.¹ More specifically our research questions are the following: (i) Is the impact of a public employment shock on private employment different depending on the degree of economic slack?; (ii) Is the degree and extent of public wage influence on the private sector state-contingent?; (iii) As regards the choice of public employment and public wages as a fiscal consolidation instrument, which is the one to be preferred from the point of view of their GDP effects?

We study the cases of Spain and the euro area taken as a whole (euro area aggregate), to cover two cases with significantly different levels of unemployment and degrees of fiscal stress during the most recent crisis. To allow for non-trivial non-linearities, we set up state-dependent models using Jordà's (2005) local projection method. This method offers a straightforward solution to some problems that arise in computing impulse responses in regime-switching models, as discussed for example by Ramey and Zubairy (2013).

The potential state-contingency of public employment and wages can be illustrated with a simple, though suggestive chart. In Figure 1 we show the unconditional correlation line between public and private sector employment and wages for a number of euro area countries over the period 1970-2012.² The first row of the chart displays the scatter plots for the whole sample: in both cases (employment and wages) an overall positive correlation is observed. In the second and third rows we show separately the unconditional correlations for "good" and "bad" times, i.e. in above-the-average real GDP growth periods and below-the-average growth periods. Interestingly, while the results drawn from the whole sample scatter plot for the correlation between public and private wages are similar to those in the cases of high- and

¹See for instance Pérez et al. (2015.)

²Countries included in the scatter plot are: Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal and Finland, i.e. the original (i.e. since 1999 or 2001) euro area countries with the exception of Luxembourg (not included due to data shortages). Data are taken from European Commission's AMECO database.

low-growth periods taken separately, this is not the case, at least, for public employment. Indeed, in bad times a positive correlation is observed, while in good times this correlation turns out to be negative.

Our analysis is rooted in three related strands of the literature. First, a fast expanding group of works that explores whether estimates of government spending vary depending on whether the economy is in recession or in expansion, and that has provided abundant pieces of evidence showing that indeed this is generally the case.³ Within this literature there is very limited empirical evidence on the role of labour market channels in determining the state-contingency of public spending multipliers,⁴ while a recent theoretical literature highlights their importance.⁵ A second strand of the literature explores the optimal design of fiscal consolidations and finds that when the public wage bill is used as a policy instrument the probability of the consolidation being successful increases. The later fact is related to the particular transmission channels through which public employment and wages' policies operate, namely by affecting private wages and thus private investment and competitiveness.⁶ In this respect, the final branch of the literature related to our paper is the one on the public-private employment and wages nexus, that has stressed, on the one hand, the potential crowding-out of private employment by public employment⁷ and, on the other hand, the influence (signalling/causality effects) of public wages over private sector wages.⁸

Our main findings are the following. First, we find that a public employment shock crowds-out private employment in periods of normal economic slack, while the opposite

³See for example Auerbach and Gorodnichenko (2012), Ramey and Zubairy (2013), Hernández de Cos and Moral-Benito (2015), and the references quoted therein.

⁴Most of the empirical work on this issue estimates standard SVAR or similar models in which public and private sector labor market variables are allowed to interact (see for instance Pappa, 2009; Linnemann 2009; Lamo et al., 2012)

⁵See for instance Michailat (2014) or Betti and Coudert (2015).

⁶See for instance Alesina et al. (2002), Linneman (2009). On related grounds see Bermpoglou et al. (2013).

⁷For different theoretical channels and empirical evidence see for example Algan et al. (2002), Forni and Giordano (2003), Ardagna (2007), Pappa (2009), Fernández de Córdoba et al. (2012), Malley and Moutos (2001), Behar and Mok, (2013) or Lamo et al. (2013), and the references quoted therein.

⁸See for instance Lindquist and Vilhelmsson (2006), Pérez and Sanchez-Fuentes (2011), Lamo et al. (2012), Zeilstra and Elbourne (2013) or Afonso and Gomes (2014).

happens in periods of high-unemployment, at least in the short-run. While the literature tends to find that an increase in public employment crowds-out private employment, at least in the medium-term, our findings provide empirical support to some recent theoretical papers (see Michailat, 2014) that argue that crowding-out is more a “good times” issue.⁹ Second, the role of economic slack is less pronounced in determining the effect of public wages on private wages. While the effect is positive in both cases for the euro area (larger in periods of high unemployment), it is slightly negative, short-lived and only marginally significant for Spain. Third, regarding the composition of labor-based consolidations in periods of economic slack, the contractionary effects of employment cuts appear more damaging for the economy than wage cuts, as found by Bermperoglou et al. (2013).¹⁰ Indeed, public wage cuts might have expansionary effects in the case of Spain.

The rest of the paper is organized as follows. In Section 2 we explain the data used in the study and the methodological approach. In turn, in Section 3 we present the main results of the paper. Finally, in Section 4 we provide some conclusions.

2 Data and empirical methodology

2.1 The data

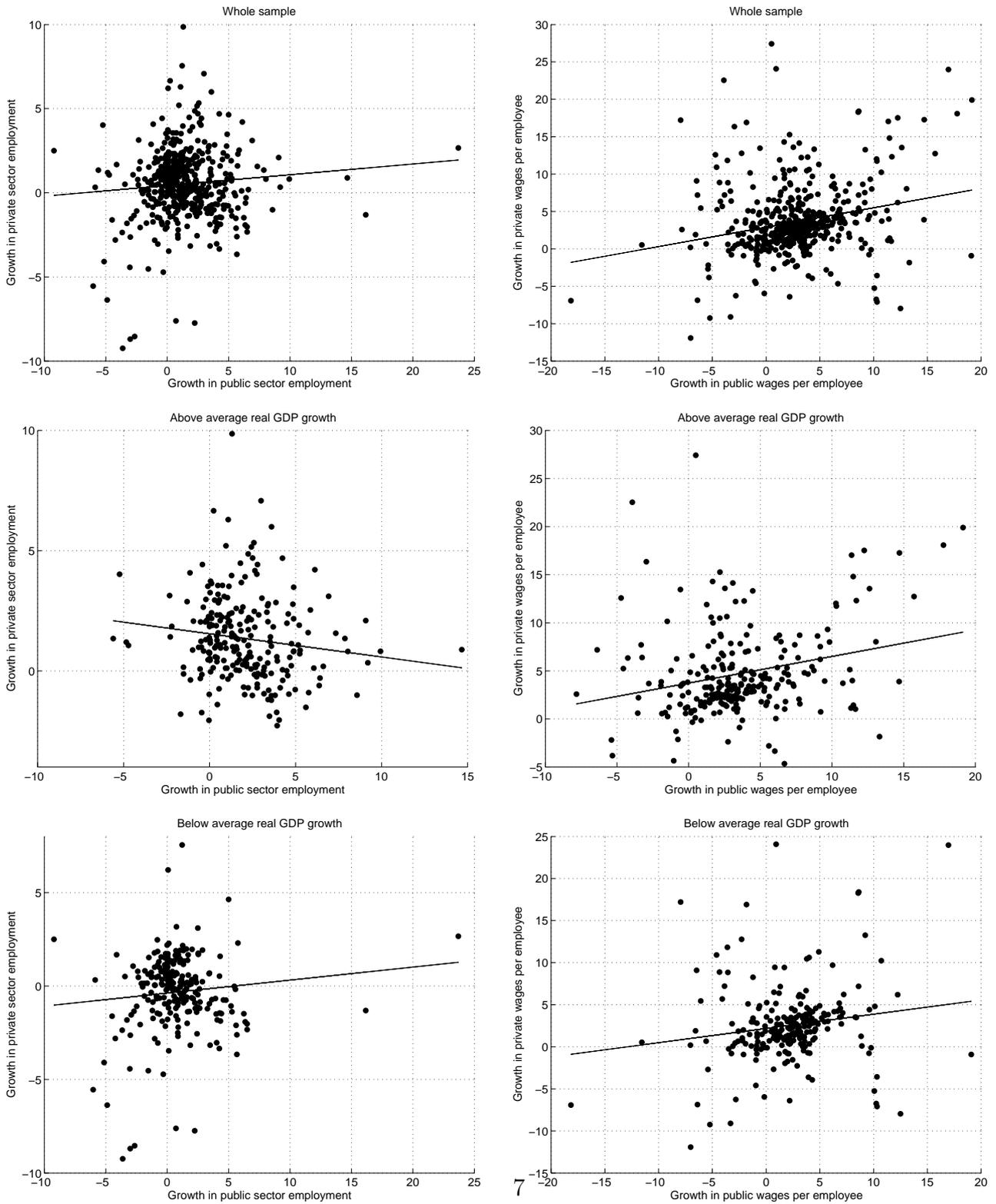
We take the euro area aggregate figures for the period 1980Q1-2012Q4 from ECB’s Area Wide Model Database.¹¹ The fiscal block of the latter database is described in Paredes et al. (2014). In the case of Spain, we take the time series for macroeconomic aggregates from

⁹In this type of papers increasing public employment stimulates labor demand, which in turn increases tightness and therefore crowds-out private employment, while when labor demand is depressed and unemployment is high, the increase in tightness and resulting crowding-out are small.

¹⁰Within the fiscal multipliers literature, Bermperoglou et al. (2013) find in a SVAR framework that cuts in the wage bill component identified as government vacancy cuts generate the largest output losses and achieve the smallest deficit reductions, regardless of the sample and the country (US, Canada, Japan, the UK), and significant unemployment losses in the US and the UK, while wage cuts have, if anything, insignificant expansionary effects to achieve the largest deficit reductions.

¹¹See Fagan et al. (2005) and Gumiel (2012). This database is disseminated regularly through the official AWM site with the Euro Area Business Cycle Network ([www.eabcn.org\data\awm\index.htm](http://www.eabcn.org/data/awm/index.htm)).

Figure 1: Private versus public employment and wages in the euro area (1970-2012).



Bank of Spain’s MTBE database, and fiscal data from de Castro et al. (2014). In this case our dataset covers the period 1986Q1 to 2012Q4.

We compute compensation per employee using employee compensation and employment data. Compensation of private sector employees is defined as total economy employee compensation minus the compensation of government employees. Compensation per private employee is defined as private employee compensation divided by the number of private sector employees (i.e. total employment minus government employment minus self-employment). Compensation per employee, deflated by the private consumption deflator, will be our concept of “wage per employee”. This is the standard approach of the literature analyzing aggregate public and private wages.¹²

2.2 Methodology

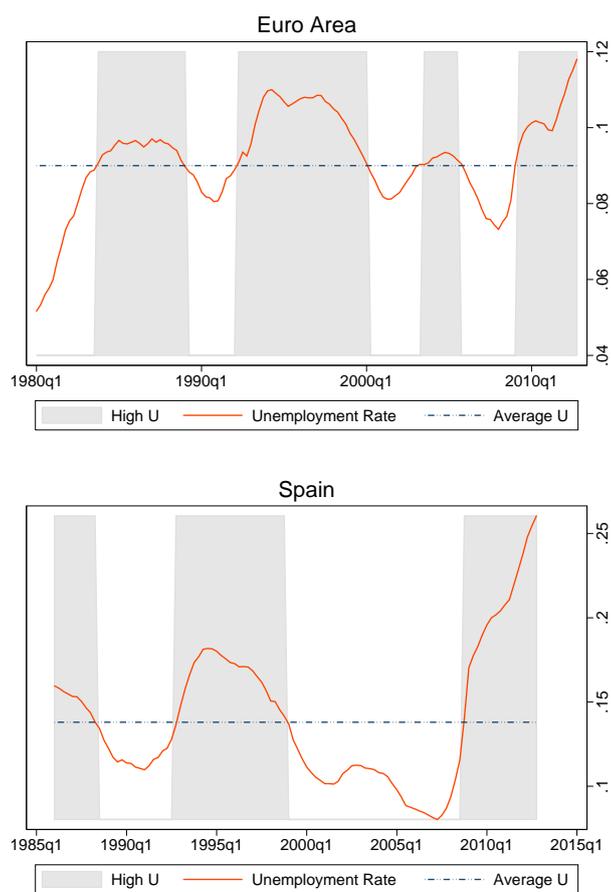
The main motivation of the Local projections (LPs) approach (Jordá, 2005) was to develop a method to reduce the dependence of the IRF estimates on the specification of the data generating process, that is, LPs are more robust to model misspecification than other alternative methods, in particular, Smooth Transition Vector Autoregression models (STVAR henceforth). Moreover, LPs are easy to implement, and they can be easily adapted to non-linear specifications. In fact, LPs are becoming very popular in the literature for these reasons.¹³ Intuitively, LPs are based on a sequence of linear projections of the variable of interest on the current information set. The slope parameters of such projections combined with any estimate of the structural impact multiplier matrix (e.g. the Cholesky decomposition) directly produce the IRFs of interest. Provided the data generating process is stationary and linear, IRFs based on LPs are asymptotically equivalent to those based on the standard VAR alternative. However, in contrast to standard VARs, LPs do not require any non-linear transformation of the slope parameters and their estimation involves much less parameters, which prove specially useful in non-linear settings.¹⁴

¹²See for instance Lamo et al. (2012) and the references quoted therein.

¹³See for instance Ramey and Zubairy (2013), that consider this approach to estimate state-dependent multipliers of government spending.

¹⁴The LPs method is not without drawbacks, however. It might present higher variances (efficiency losses) if the data generating process is well approximated by a VAR.

Figure 2: Regime indicators: weights on the high unemployment regime.



To begin with, we review how to introduce LPs in a linear specification for the sake of simplicity, and then we move to the description of the LP method to a nonlinear framework. We start from a baseline linear VAR specification similar to the one traditionally used in the literature on this topic. Regarding employment, this baseline VAR contains five variables, namely, public employment (N^g), private employment (N^{pr}), real GDP (GDP), the real interest rate (R), and real total government revenues (T). Macroeconomic fluctuations are accounted for by the inclusion of output and real interest rate; for instance, aggregate shocks other than fiscal shocks might simultaneously affect private and public employment so these two variables aim to control for this potential source of endogeneity. In addition, the variable on government revenues is included to account for the indirect effect that private activity (e.g. employment) might have on public employment through increases in the amount of funds available to the government. Formally, the reduced-form VAR is:

$$X_t = B_1 X_{t-1} + \dots + B_p X_{t-p} + \epsilon_t \quad (1)$$

where $X_t = (N_t^g, N_t^{pr}, GDP_t, R_t, T_t)'$, B_1, \dots, B_p are coefficient matrices and ϵ_t is a 5-dimensional i.i.d. white noise; $E(\epsilon_t) = 0$, $E(\epsilon_t \epsilon_t') = \Sigma_\epsilon$ with Σ_ϵ being a non-singular and positive definite matrix.¹⁵ In the case of wages, the vector X_t includes public wages (W^g), private wages (W^{pr}), productivity ($PROD$), the real interest rate (R), and real total government revenues (T). The rationale for this specification is essentially the same as that of the employment VAR. Moreover, one can write in structural form the reduced-form VAR in equation (1) as:

$$A_0 X_t = A_1 X_t + \dots + A_p X_{t-p} + \eta_t \quad (2)$$

where η_t are the structural shocks and $E(\eta_t \eta_t') = \Sigma_\eta = I_5$ without loss of generality. Following Linnemann (2009), we include all variables in logarithms of their levels, except the real interest rate, which is entered as the logarithm of one plus the real rate. Then, we formally consider a sequence of H forward projections for $h = 1, \dots, H$ as follows:

$$N_{t+h}^{Pr} = \alpha^h + \beta_1^h X_t + \dots + \beta_p^h X_{t-p+1} + u_{t+h} \quad (3)$$

¹⁵For expository purposes, we abstract from deterministic regressors and lags of endogenous variables, although we allow for them throughout all the estimations in the paper.

where the 5×1 vector X_t is defined above.¹⁶ By construction, β_1^h can be interpreted as the response of N_{t+h}^{Pr} to a reduced-form disturbance in t :

$$\beta_1^h = E(N_{t+h}^{Pr} | \epsilon_t = 1; X_t, \dots, X_{t-p}) - E(N_{t+h}^{Pr} | \epsilon_t = 0; X_t, \dots, X_{t-p}) \quad (4)$$

where ϵ_t is the reduced form shock in (1). Therefore, it is easy to estimate the structural response at horizon h of private employment (wages) to a public employment (wages) shock as follows:

$$\Theta_h = \beta_1^h d_{Ng} \quad (5)$$

where d_{Ng} is the first column of the impact matrix A_0^{-1} defined in (2). Analogously, we could construct IRFs based on local projections (i.e. LPIRFs henceforth) for shocks in other variables by simply considering alternative columns of the impact matrix.

In practice, we simply need to obtain the \hat{A}_0^{-1} matrix by using standard VAR methods. We rely on a Cholesky identification strategy with the public employment/wage variable ordered first, which is standard in the linear literature.¹⁷ The remaining variables enter in the same order as they are listed in the vector X_t above.¹⁸ In practice, this identification strategy implies that A_0^{-1} is a lower triangular matrix satisfying $A_0^{-1}(A_0^{-1})' = \Sigma_\epsilon$.¹⁹ It is based on the assumption that fiscal policy actions are independent of economic activity (e.g. private employment/wages, output) within the current quarter. As long as fiscal authorities require some planning and preparations to conduct policy, it seems reasonable to assume that public employment/wages do not react to either private employment/wages or GDP within the current quarter.

¹⁶Moreover, p is the lag length of each projection. In practical terms, note that one cannot forecast further than the sample size available for estimation, which is reduced as p and H increase.

¹⁷This identification strategy is also standard in the multipliers literature (see e.g. Blanchard and Perotti, 2002; Gali et al., 2007) and in the public employment literature. Malley and Moutos (1996) assume that public employment is weakly exogenous in a VEC-ECM model including public employment, private employment and the stock of capital. Algan et al. (2002) consider a panel approach and instrument public employment with its own lags assuming lack of contemporaneous correlation between public employment and shocks to private employment. Finally, Linnemann (2009) considers a linear VAR model adopting the same ordering as the one we adopt here.

¹⁸ In the estimation we allow for up to 8 lags of each endogenous variable and include linear and nonlinear trends and a constant.

¹⁹Note that $\epsilon_t = A_0^{-1}\eta_t$ so that $E(\epsilon_t\epsilon_t') = \Sigma_\epsilon = A_0^{-1}\Sigma_\eta(A_0^{-1})'$.

We estimate a sequence of least-squares regressions in (3) for each horizon h . Turning to inference, we use the Newey-West correction for our standard errors to account for the serial correlation in the error terms induced by the successive leading of the dependent variable; Jordá (2009) and Kilian and Kim (2009) provide an in-depth analysis of confidence intervals in the LPs framework.

It is straightforward to extend the LPs method to a nonlinear framework. Let us define a dummy variable I_t that indicates the state of the economy at period t taking the value 1 if the slack is high (high unemployment) and 0 when the slack is low (low unemployment). Armed with the I_t indicator of the state of the economy, we can simply estimate a set of regressions for each horizon h :²⁰

$$N_{t+h}^{Pr} = I_t \left\{ \alpha^{h,HS} + \beta_1^{h,HS} X_t + \dots + \beta_p^{h,HS} X_{t-p+1} \right\} + (1 - I_t) \left\{ \alpha^{h,LS} + \beta_1^{h,LS} X_t + \dots + \beta_p^{h,LS} X_{t-p+1} \right\} + u_{t+h} \quad (6)$$

Importantly, we allow the slope coefficients to vary according to whether the slack of the economy is high (HS) or when the slack is low (LS) as defined by the I_t indicator. Thus, we are able to construct a LPIRF for recessions as a sequence of $\Theta_h^{HS} = \beta_1^{h,HS} d_{Ng}$, and a different LPIRF for expansions by computing Θ_h^{LS} . Analogously, we can also estimate LPs and the corresponding LPIRFs to a public employment (or wages) shock for any variable of interest by simply substituting the dependent variable in equation (6). In addition to private employment (N_{t+h}^{Pr}), we also explore the responses of public employment and wages, private wages, GDP, productivity, interest rates, and tax revenues.

Crucially, note that we estimate our LPIRFs by means of single OLS regressions, thus, the number of parameters to be estimated to obtain each LPIRF is drastically reduced. This is in sharp contrast with the STVAR approach, where one needs to estimate the full set of parameters in the highly parametrized nonlinear VAR. Moreover, as pointed out by Koop et al. (1996), estimation of IRFs in nonlinear models poses a challenge. In contrast to linear models, the response may depend on the magnitude of the shock as well as on the history of previous shocks. By means of the LP method, we estimate separate regressions

²⁰ When estimating equation (6) we allow for 2 lags of each endogenous variable in the case of Spain and 4 lags in the case of the euro area equation, and include linear and nonlinear trends and a constant.

for each horizon h ; thus, the estimated parameters $(\beta_1^{h,HS}, \beta_1^{h,LS})$ and the resulting LPIRFs depend on the average behavior of the economy in the historical sample between t and $t+h$. Intuitively, the parameter estimates on the right-hand-side variables in (6) take into account the average tendency of the economy to evolve between states (e.g. low slack vs. high slack).

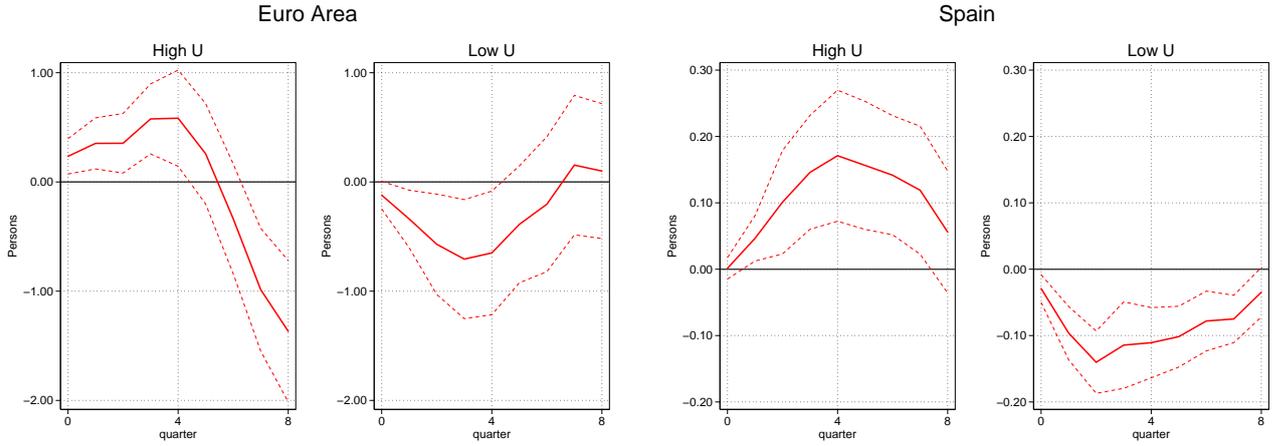
2.3 Definition of the economic slack state

We focus on the high unemployment and low unemployment states as the periods of high and low slack of the economy, respectively. This is guided by the prescriptions of the theory, as discussed above. Labor market channels are expected to operate differently when the unemployment rate is high than when it is low, and this is likely to provide more insights than the standard recession/expansion distinction. Nevertheless, for the sake of robustness, we have run our empirical applications with a more standard measure of slack, namely real GDP, and the results are qualitatively similar to the ones we will report based on the measure of high/low unemployment, that is closer to the theoretical literature of reference.²¹

As to the particular way of computing the different states, we define an economy to be in a slack state ($I = 1$) when the unemployment rate is above its sample average, namely, 13.8% in the case of Spain, and 9% in the case of the euro area. This is a simple, transparent and standard approach. Shaded regions in Figure 2 correspond to the periods of slack (i.e., $I_t = 1$) identified for Spain and the euro area following this rule. In any case, to check for the potential influence of our choice for the subsequent empirical results, we have also estimated threshold values in the framework of STVAR models. The key intuition of the STVAR methodology is to define a set of probabilities for each state of the economy (e.g. low slack versus high slack) and then estimate state-specific VAR coefficients and variance-covariance matrices in order to estimate IRFs and multipliers that depend on the state of the economy. We run the models to identify the states of the economy. Nevertheless, in addition, we use this methodology as a sensitivity test for our benchmark Local Projections approach. As regards the first issue, estimated states are identical to the ones identified with sample averages. As regards the second issue, qualitative results are in line with the one we

²¹The results are available from the authors upon request.

Figure 3: Response of private employment to a public employment shock.



will show later.²²

Formally, the STVAR model is:

$$\begin{aligned}
 X_t^\dagger &= C + (1 - F(z_{t-1}))\Phi_{S_1}X_{t-1}^\dagger + F(z_{t-1})\Phi_{S_2}X_{t-1}^\dagger + e_t & (7) \\
 e_t &\sim iid(0, \Omega_t) \\
 \Omega_t &= \Omega_{S_1}(1 - F(z_{t-1})) + \Omega_{S_2}F(z_{t-1}) \\
 F(z_t) &= \frac{\exp(-\gamma z_t)}{(1 + \exp(-\gamma z_t))}, \quad \gamma > 0
 \end{aligned}$$

where the sub-indices S_1 and S_2 refer to the states of the economy. The vector X_t^\dagger contains the variables included in the STVAR, which is only a subset of those included in the original vector X_t in equation (1). The number of variables to be included in X_t^\dagger is restricted because the sample size available for estimation does not yield enough degrees of freedom to robustly estimate the high number of coefficients of the model (this is a crucial concern of the STVAR approach, not only restricted to our particular empirical application). In particular, our exercise is based on $X_t^\dagger = (N_t^g, N_t^{pr}, GDP_t)'$. Matrices Φ_{S_1} , Φ_{S_2} , Ω_{S_1} , and Ω_{S_2} contain the coefficients of the lag polynomials and the variance-covariance matrices of the shocks in the different regimes.²³ Finally, z_t is an indicator of the state of the economy in quarter t , normalized to have zero mean and unit variance. The weights assigned to

²²Results are available from the authors upon request.

²³Note that equation (7) contains one single lag to avoid notational clutter; however, we estimate the model considering a maximum of three lags

each regime vary between 0 and 1 according to the weighting function $F(\cdot)$. Note also that the index z is dated at $t - 1$ to avoid contemporaneous feedbacks from policy actions to the state of the economy. Intuitively, $F(z_t)$ can be interpreted as the probability of being in a high unemployment state when z_t is the unemployment rate. The estimated weights (probabilities) for the high-unemployment regimes, for the cases Spain and the euro area aggregate, respectively, unveil the same episodes characterized in Figure 2.

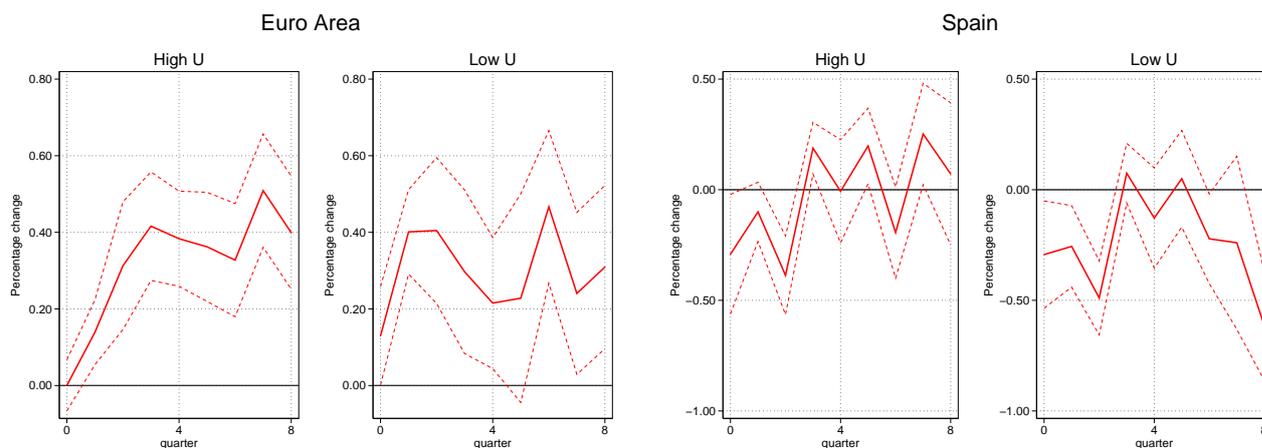
3 Results

3.1 Main results

We discuss in this Section simulations to provide answers to the three questions posed in the Introduction: (i) Is the impact of a public employment shock on private employment different depending on the degree of economic slack?; (ii) Is the degree and extent of public wage influence on the private sector state-contingent?; (iii) As regards the choice of public employment and public wages as a fiscal consolidation instrument, which is the one to be preferred from the point of view of their GDP effects?

As regards the first question, in Figure 3 we show the response of private employment to a public employment shock (an unexpected increase in public employment). The following findings can be highlighted. First, we find crowding-out of private employment by public employment in times of low unemployment, both in cases of the euro area aggregate and Spain. When unemployment is low the estimated response of private employment are statistically significant and negative even after eight quarters in the case of Spain: a 1 person increase in public employment leads after eight quarters to a fall of private employment of 0.75 persons over that period (see Panel B of Table 1). In the case of the euro area aggregate, in turn, the cumulative (negative) effect is larger in magnitude but shorter-lived, as it loses statistical significance after four quarters, with a cumulative reduction of 1.74 workers after four quarters (see Panel A of Table 1). By contrast, when unemployment is high (high slack in the economy) we find evidence in support of crowding-in of public employment over private employment both in the case of Spain and the euro area aggregate. Indeed, for the

Figure 4: Response of private sector wages to a public wage shock.



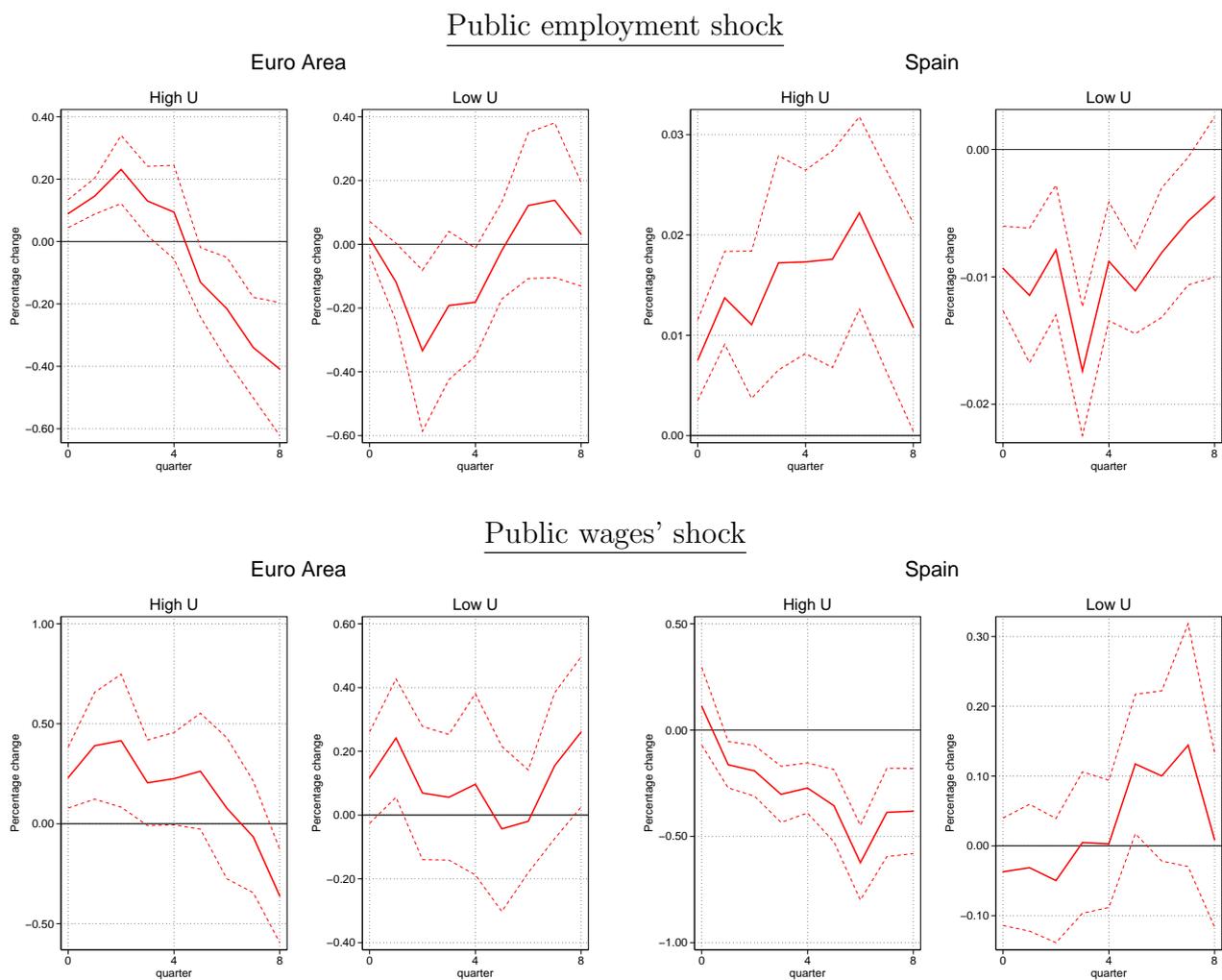
euro area aggregate, a 1 person increase in public employment, when unemployment is high, leads after four quarters to an increase of private employment of 1.52 persons, while in the case of Spain it leads to an increase of 0.30 persons after four quarters and 0.88 persons after eight quarters. Interestingly, for the euro area after the first year the response of private employment turns into negative territory, i.e. the crowding-in result is short-lived and turns into crowding-out as of the second year. These results reinforce the most recent theoretical literature that highlights the crucial role of economic slack to determine the crowding-out/-in of public employment over private sector employment. As discussed above, our empirical results can be rationalized by models like the one in Michailat (2014). In the later model, the crowding-out effect is based on a lower pool of unemployed searching for a job in the private sector following the rise in public vacancies. When the pool of searchers is high at the steady-state, this crowding-out effect is then lower.

As regards the issue of the influence of public wages on private sector wages, we present in Figure 4 the state-contingent response of private wages to a public wages' shock (an unexpected increase in government wages). Looking first at the euro area aggregate, when the unemployment rate is high an increase in public sector wages leads to an increase in private sector wages; in cumulative terms, the effect of a 1% positive shock increases private wages by 0.87% after four quarters, and by 2.45% in cumulative terms after eight quarters. In times of low unemployment, the positive impact is also present and similar in magnitude.

This evidence for the euro area sample is in line with the prescription of extant theories. Wages in the public and private sectors move in the same direction, with changes depending on the state of the economy being just a matter of the size of the impact of the public wage shock. Turning now to the Spanish case, an economy that has presented historically a significant degree of downward real wage rigidity, the response of private wages is not statistically significant, or mildly, short-lived negative, during periods of high unemployment, i.e. when public wage cuts are more likely due to the simultaneous occurrence of high slack and fiscal stress episodes. In good times (low unemployment rate), an unexpected increase in public wages presents the potential of pushing down private sector wages, probably as a result of its negative impact on output, as we discuss below. The theoretical literature provide less guidance as regards the operation of the wage channel in periods of low/high economic slack. For example, in the paper mentioned above by Michailat (2014), the real wage law of motion is assumed as exogenous. In more standard models without this distinction (see e.g. Afonso and Gomes, 2014) a positive reaction of private wages to a public wage shock can be rationalized at least by the operation of two channels. First, the public wage shock increases the value to be unemployed. Second, a rise in the marginal productivity of labour creates upward pressures on private real wages. Nevertheless, Betti and Coudert (2015) show in a similar framework that a rise in private wages following a rise in public wages depends strongly on the assumptions made about how the “shock” is financed. In particular, in case of a debt-based public wage expansion, their model produces a clear decrease in private wages.

Finally, regarding the role of public employment versus public wages as a fiscal consolidation instruments, in Figure 5 we show the response of real GDP to shocks (unexpected increases) in these two fiscal instruments, conditional on the selected variables of control. We present these estimates in order to better link our work to the literature on the macroeconomic impact of fiscal shocks, that has mainly focused on the real GDP impact of such shocks. In periods of high unemployment, an increase in public employment (first row of charts of the Figure) leads to an increase in GDP for both the euro area aggregate and Spain, with multipliers after four quarters of 0.6 and a mild 0.1, respectively (see next Section for detailed numbers). After eight quarters the multiplier for Spain remains broadly at 0,1,

Figure 5: Response of real GDP to public employment and wages' shocks.



while for the euro area taken as a whole the positive impact is shorter-lived, as it loses significance, reflecting some negative effect on GDP of the shock during the second year. After 12 quarters, in fact, the cumulative multiplier turns negative to reach -1.6. These results are in line with the cumulative and dynamic responses discussed above for private employment. These results reflect the relevance of implementing public employment policies as a reaction to adverse economic conditions, and not merely as a counter-cyclical tool. With respect to output multipliers in times of low unemployment, the crowding-out of private employment by public employment has a parallel in the response of GDP in both samples, with a larger but less significant reaction in the euro area case. Indeed, in the latter case, the cumulative multiplier after four quarters is -0.6, to reach -1.1 after 12 quarters. For Spain the responses are estimated with more precision, being significant at the 1% level, but are quantitatively weaker (-0.1 after four quarters, staying at a similar level in cumulative terms after 12 quarters). In the case of wages, the impact of a (positive) public wages' shock on GDP (second row of charts of the Figure) in times of high unemployment is positive for the euro area aggregate but negative for Spain, i.e. in this latter case, an unexpected increase in public wages cause a fall in output and private wages. As regards the impact of the public wages shock during good times, the response of GDP is not significant for both Spain and the euro area.

3.2 Additional results

Table 1 reports additional results on the impact of public employment shocks for the euro area aggregate and Spain. We show cumulative multipliers on impact, and after 4, 8, and 12 quarters. We present the responses of public and private employment, real GDP, unemployment and public and private sector wages, in all cases using the local projections methodology, as described above.

Results for the euro area are displayed in Panel A of Table 1. In the high-unemployment case a public employment (positive) shock only has a limited effect on subsequent public employment dynamics (first panel of the Table), with no on-impact effect, but that turns to 0.3% after 8 quarters. The impact on private employment (second panel of the Table), as described above, is positive and significant up to 4 quarters, with the multiplier reaching 1.5,

Table 1: Responses to a public employment shock.

A. Euro Area					B. Spain				

1. RESPONSE OF PUBLIC EMPLOYMENT									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	0.01	0.12 *	0.26 ***	0.01	High U	0.00	0.01	0.02 **	0.03 ***
Low U	-0.01	0.03	0.09	-0.12	Low U	0.00	0.00	-0.01	-0.02

2. RESPONSE OF PRIVATE SECTOR EMPLOYMENT									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	0.24	1.52 ***	1.04	-3.99 **	High U	0.00	0.30 **	0.88 ***	0.78 ***
Low U	-0.12	-1.74 **	-2.83 **	-3.40 *	Low U	-0.03	-0.38 ***	-0.75 ***	-0.66 ***

3. RESPONSE OF REAL GDP									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	0.09 **	0.60 ***	0.01	-1.56 ***	High U	0.01 **	0.05 ***	0.12 ***	0.13 ***
Low U	0.02	-0.63 *	-0.57	-1.08 *	Low U	-0.01 ***	-0.05 ***	-0.08 ***	-0.06 **

4. RESPONSE OF THE UNEMPLOYMENT RATE									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	-0.35 *	-1.42 **	-0.52	6.18 ***	High U	-0.01	-0.18 **	-0.11	0.63 **
Low U	-0.09	1.06	0.50	1.49	Low U	0.02	0.14 ***	0.12 *	-0.41 **

5. RESPONSE OF PUBLIC SECTOR WAGES									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	0.03	0.83 ***	1.26 ***	1.48 ***	High U	0.00	0.02	0.11 ***	0.30 ***
Low U	-0.15 **	-0.96 ***	-2.19 ***	-3.34 ***	Low U	0.01 *	-0.01	-0.03	-0.03

6. RESPONSE OF PRIVATE SECTOR WAGES									
<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>	<u>Regime</u>	<u>Impact</u>	<u>4q</u>	<u>8q</u>	<u>12q</u>
High U	-0.14 ***	-0.56 ***	-0.99 ***	-2.22 ***	High U	0.00	0.03 **	0.08 ***	0.18 ***
Low U	0.02	0.33	0.68 *	0.73 *	Low U	0.01	-0.01	-0.02	-0.03

^a Standard errors in parentheses. Statistical significance: ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

before turning to the negative territory (-4 after three years). The public-private employment dynamics are consistent with the effects on the unemployment rate (fourth panel) that gets reduced in the first year (by 1.4% as a reaction to the 1% shock in public employment), but that turns out to increase after 12 quarters (6% cumulative increase). The employment behaviour presents a parallel behaviour to that of GDP, that presents a 0.6 multiplier after 4 quarters, that turns into -1.6 after 12 quarters. As regards wages, the public employment shock in “bad times” leads to an increase in public wages and a reduction in private sector wages.

In turn, in the low unemployment state, the public employment expansion increases unemployment. Nevertheless, the response is not statistically significant, despite the strong decrease in private employment caused by the public employment expansion (the crowding-out effect described in the previous Section) and the null additional increase in public employment in response to the shock. In this case, the effect on real GDP is negative, while the sign of the effect on wages is the opposite as in the high-unemployment case: public wages get reduced (-0.15 on impact, -3.3 after 12 quarters), while private wages increase mildly after the second year. In good times, a Ricardian behaviour of consumers is more likely to be observed. Accordingly, the public employment shock causes a negative wealth effect that in standard models (see Finn, 1996; Cavallo, 2005) increases private wages and reduces hours worked in the private sector. Under the bargaining channel,²⁴ an increase in public employment makes it marginally more attractive (or less unattractive) to become unemployed, since unemployed people stand the chance to obtain a government job. Through this channel, an increase in public employment puts upward pressure on private wages and downward pressure on private employment, explaining crowding out.

Turning to the case of Spain (Panel B of Table 1), most of the conclusions for the euro area discussed above remain true in the Spanish case. However, it is worth highlighting that the multipliers are generally smaller than in the EU case. For instance, while the eight-quarter multiplier of public wages is 1.26 in the euro area, it is only 0.11 in the case of Spain. Finally, the reaction of private wages differs with respect to the euro area: the Ricardian increase of private wages takes place in periods of high unemployment, when uncertainty is

²⁴See for instance Caponi and Reicher (2015), Afonso and Gomes (2014).

higher.

4 Conclusions

Some policy lessons can be drawn from this study, that includes descriptive evidence, a deep description of the relevant theoretical and empirical literature, and some empirical exercises.

First, we find evidence that in expansions public employment may crowd-out private employment. In recessions, though, an unexpected increase in public employment leads to higher private employment, even though the positive effect is relatively short-lived, turning negative after 4-6 quarters. From a policy point of view, and in the framework of the “economic growth-vs-fiscal consolidation” debate, these results would advise against aggressive policies of public employees’ firing in the the midst of a recession and/or when unemployment is high, at least from a short- to medium-run perspective. At the same time, our results would also advise against policies of public labor force increase in expansions.

Second, on the wage side, we validate and extend the by now standard result that public wages may lead private sector wages in the euro area; indeed, we read the fact that the mechanism operates in recessions as a signal that policies of public wage restraint may set in motion a labor market adjustment that otherwise would have taken longer and would have been, consequently more costly for the economy as a whole. When fiscal and competitiveness problems exist, public wage restraint could help correcting both fiscal imbalances and – through the inter-linkage with private wages – competitiveness problems.

Third, along these lines, also in order to assess the response of GDP to public employment and wages’ shocks we have learnt that it is necessary to take on board the state of the economy. Our results help to understand and qualify some evidence presented in the literature. For example Bermperoglou, Pappa and Vella (2013) find that cuts in the wage bill component identified as government employment cuts generate output losses regardless of the sample and the country analyzed, while wage cuts in contrast have, if anything, insignificant expansionary effects and achieve the largest public deficit reductions according to these authors. As regards public employment, the latter results are broadly valid in our two case studies (Spain and the euro area as a whole) in “bad times” (high unemployment,

economic recession), while in times of low unemployment an increase in public employment would reduce GDP. As regards public wages, our results are not that clear-cut. Nevertheless, in this case the relevant distinction does not seem to be the good times vs bad times one, but rather the specific features of the Spanish economy versus the euro area economy as a whole. In the former case public wage cuts do have expansionary effects, while in the latter the opposite happens. Differences would have to be traced most likely to specific features of labor markets in both cases.

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