The public wage channel on the post-EMU loss of competitiveness in Southern Europe

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Abstract

In this paper, I explore the effect of the robust increase in public wages following the introduction of the Euro on the overall loss of competitiveness of the economies of southern Europe during the past decade. To that end, I simulate the drop on interest rates (risk premium) that these countries experienced just before the introduction of the common currency within a DGSE model with search and matching frictions and two sectors. In this model, the fall on interest rates relaxes the budget constraint of the government, allowing for increases in the public wage. In turn, the public wage affects the bargaining of the private wage by altering the outside option of the workers. Therefore, an increase in public wages produces a pull-effect on private wages, leading to an overall loss of competitiveness in comparison with countries not affected by the interest rate shock. The paper also offers some insight on the effects of the cuts on public wages observed in some countries after 2010 in order to reduce public spending and debt.

1 Introduction

The loss of competitiveness of the southern economies of the Euro Area remains a concern of the European authorities, starting even before the onset of the current crises. The correction of these differentials on inflation, wages and productivity is proving to be a painful process. Without independent monetary policy and limited maneuvering room for fiscal policy, the governments of these

economies have engaged in costly internal devaluation to correct course and converge with the core of the Eurozone.

The aforementioned differentials caused imbalances on the real effective exchange rates (REER) within the fixed exchange rates regime of the common currency. These imbalances can be quantified thanks to the European Central Bank's data on harmonized competitiveness indicators, based on unit labour costs indexes. For every country, the indicator shows the REER calculated vis-à-vis 20 trading partners plus the other Euro Area countries. The REER of the main southern economies of the Euro Area have appreciated markedly since their adoption of the Euro until the end of 2007: a 14.2% for Spain, 12.1% for Italy and 10.0% for Portugal, thereby hurting the competitiveness of their economies. By comparison, the REER of France has appreciated at a much slower pace, a 5.0%, whereas the REER of Austria and Germany actually depreciated, a 5.9% and 14.6%, respectively.

At the same time that labour costs and wages were going up in some Euro Area countries, public wages were going up even more. The wage premium paid to workers in the public sector in Portugal, Spain and Italy went notably up. Table 1 presents data on the difference on average annual growth in wages per employee between the public and the private sectors for the pre- and post-EMU period. As can be seen in the Table, public wages in the countries with worst REER record for the post-EMU period have risen well over private wages, in comparison with the relative contention of the northern countries on the post-EMU period or of all countries in the pre-EMU period.

	1971-1998	1999-2008
Spain	-2.3	1.7
Portugal	-0.3	1.7
Italy	-0.1	1.4
Austria	-0.1	0.2
France	0.3	-0.1
Germany	-0.6	-0.1

Table 1: Annual growth of public wages minus annual growth of private wages.

The increase in public wages can have a "pull-effect" on private wages. This argument has been extensively studied on the literature, both theoretically and empirically. Theoretically, just to name a couple of examples, in Quadrini and Trigari (2007), Ardagna (2007) or Afonso and Gomes (2008) increases in public wages affect the private wage by improving the outside option of workers,

thereby affecting wage bargaining. In Fernández-de-Córdoba et al. (2012), the increase in the public wage crowds out private employment and the private wage goes up, both because private employers need to match public wages to attract workers and because workers are more productive via the increase in public good provision. Empirically, Pérez and Sánchez (2010) found evidence of a public sector leadership role in wage setting for Germany, Spain, France and Italy, albeit in conjunction with bi-directional channels in the case of Germany and Spain. Also focusing on the causal two-way relationship between public and private wage setting, Lamo et al (2012) conclude that the private sector appears to have a stronger influence but, however, the public wage setting have stronger feedback effects than the private wage setting, so that increases in public wages are likely to have strong effects on private wages.

The introduction of the EMU had the potential to relax the budget constraint of the governments, making it easier to observe wage increases not attached to increased productivity. The reason for the relaxation of the budget constraint was a reduction of borrowing costs. As can be observed in Figure 1, during the built-up to the introduction of the European common currency there was a reduction of the interest rate spread between the countries in the periphery of the Euro area and its core. This tendency reverted on 2007 with the beginning of the Great Recession.

Therefore, the goal of this project is to evaluate the importance of the "public wage channel" on the loss of competitiveness of Spain following the introduction of the EMU. The entrance of this country in the Euro had the effect of decreasing significantly its costs of financing. The subsequent relaxation of the budget constraint of the government can be modeled as a risk premium shock, leading to the observed increases in the public wage premium. Finally, the higher public wages would have feedback effects on the private wages, with the final effect being a deteriorating competitiveness with respect to the core of the Euro Area, that was not affected by the drop on interest rates.

A hypothesis similar to this one was proposed by Johnston (2011). On her paper, the author argues that the pre-EMU period was marked by the efforts of the countries to meet the Convergence criterion defined by the Maastricht Treaty. These efforts limited the bargaining power of public unions, reducing the pressure they could exert on their governments. Once in the Euro, the conditions of the Maastricht Treaty were replaced with the softer conditions of the Growth and Stability Pact. Therefore, the public unions could again pressure their governments into higher wages. On the other hand, private sector wages were

Figure 1: 10-year Government bond yield, monthly average.

constrained by the higher competitive environment resulting from the newly created monetary union. This way, the creation of the Euro led to an increase on the public wage premium: the author estimates that wage growth in EMU's public sectors, relative to wage growth in manufacturing, was on average 0.6 per cent higher per year than it was in non-EMU and non-Maastricht years on average on the whole EMU. This estimation is consistent with the data of Table 1. What the author fails to notice is that the increase was focused exclusively in the southern economies, which were the ones most affected by the reduction in their financing cost. This asymmetry would support the hypothesis that it was changes in government financing conditions what led to the increase in the public wage premium, not changes in the bargaining position of the public unions.

Even though public wage bargaining can probably be excluded as a causal mechanism, it is still an important part of the picture. In the papers considered in previous paragraphs, the public sector is usually modeled so as to follow exogenous rules, either on wages, on vacancies or both. However, as shown in Gomes (2012), if public jobs are safer, then the optimal policy for the public sector is to offer a lower salary than in the private sector, to avoid "queuing" for

4

public jobs, which would increase unemployment. Given that we do not observe that in the data, but quite the opposite, it is evident that public unions are an important player, pushing up public wages. The influence of public unions will be introduced in the rules of the public sector, with unions pushing up for higher wages when the fiscal deficit of the government goes down.

Estimating this proposed wage rule can be difficult, as the government wage bill itself is part of the evolution of the deficit. Instead, I estimate a public wage rule that reacts to changes in interest payments by the government. Such a wage rule reflects the reasoning developed during this introduction: a reduction in interest payments, due to decreasing interest rates in this case, is interpreted by the unions as a sign of a looser budget constraint and used to push wages up.

In the regression, I use data for Spain, Italy and Portugal from 1999 to 2007, representing the period where the countries had already entered the Euro and where therefore not constrained by the Maastricht criteria and before the beginning of the crisis. Data is annual and taken from the OECD Economic Outlook No. 90. Public wages (WG) are defined as *real (base 2005) compensation rate of public employees* and computed in logs and the interest payments (IP) are defined as *net government interest payments as a percentage of GDP*. The estimating equation relates the logarithm of public wages *log* PG_{ct} to the interest payments IP_{ct}, controlling for total government debt ($DEBT$, defined as *Gross public debt, Maastricht criterion, as a percentage of GDP*) and unemployment ($URATE$, defined as *unemployed workers as percentage of active population*):

$$log\ WG_{c,t} = \alpha_c + \gamma_t \quad +\rho\ log\ WG_{c,t-1} \quad +\theta_1\ IP_{c,t} \quad +\theta_2\ DEBT_{c,t} \quad +\theta_3\ URATE_{c,t} \quad +u_{c,t}$$

$$\begin{array}{cccc} 0.925^{***} & -0.166^{**} & -0.004 & 0.036 \\ (0.04) & (0.03) & (0.00) & (0.02) \end{array}$$

where α_c are country fixed effects, γ_t are year fixed effects and $u_{c,t}$ is an error term clustered at the country level. The coefficient θ estimated is -0.166, which goes in the expected direction: an increase of interest payments reduces public wages and vice versa. On the other hand, the value of the coefficient ρ of the lagged public wage is 0.925; this estimation will be used later in the calibration for the persistence of the wage rule.

2 The model

Labor market

The economy is populated by a measure one of agents and composed of two sectors: a public and private sector. At any point in time, agents are either working on the public sector, working in the private sector or unemployed:

$$1 = u_t + n_t^g + n_t^p \tag{1}$$

Through the paper, a superindex p will be used to represent a private sector variable and a superindex g to represent a public sector variable.

The evolution of employment in both sectors depends on the number of new matches m_t^g and m_t^p and on the separations that occur every period. Jobs are destroyed at a constant fraction σ^j, different across sectors. The evolution of employment on each sector is then given by:

$$n_{t+1}^g = (1 - \sigma^g)n_t^g + m_t^g \tag{2}$$

$$n_{t+1}^p = (1 - \sigma^p)n_t^p + m_t^p \tag{3}$$

On the other hand, the new matches are determined by a Cobb-Douglas matching function for each sector:

$$m_t^g = \mu^g (u_t^g)^{\eta^g} (v_t^g)^{1-\eta^g} \tag{4}$$

$$m_t^p = \mu^p (u_t^p)^{\eta^p} (v_t^p)^{1-\eta^p} \tag{5}$$

Because I am assuming directed search, u_t^j represents the number of un-employed workers looking for a job in sector j. Call s_t to the proportion of unemployed agents looking for jobs in the public sector, so that $u_t^g = s_t u_t$ and $u_t^p = (1 - s_t)u_t$. From the matching functions, I can define the probabilities of vacancies being filled q_t^j and the job-finding rates conditional on searching in a particular sector p_t^j:

$$q_t^j = \frac{m_t^j}{v_t^j}, \ p_t^j = \frac{m_t^j}{u_t^j}; \ j = g, p \tag{6}$$

6

Households

Each household is infinitely lived and derives utility from private consumption c_t and public good g_t, supplied by the government. It also derives utility from unemployment u_t, which captures leisure and home production. Following Merz (1995), I assume that all incomes in the household are pooled so as to eliminate the possibility of heterogeneity due to unemployment risk. Therefore, the problem of the household is to maximize:

$$E_t \sum_{t=0}^{\infty} \beta^t [u(c_t, g_t) + v(u_t)] \tag{7}$$

subject to laws of motion of employment (2) and (3), and the budget constraint in period t:

$$(1-\tau^c)c_t + i_t + \pi_t g_t = [r_t - \tau^k(r_t - \delta)]k_t + (1-\tau^n)(w_t^g n_t^g + w_t^p n_t^p) + bu_t + \Pi_t \tag{8}$$

where w_t^j for $j = g, p$ is the wage in the two sectors, r_t is the return to capital, b are unemployment benefits, δ is the depreciation rate, Π_t encompasses transfers from the government and (potentially) profits from the firm, τ^c, τ^n and τ^k are taxes on consumption, labor and capital (allowing for depreciation), respectively, and π_t is the relative price of public goods.

Finally, capital evolves over time according to:

$$k_{t+1} = (1-\delta)k_t + i_t - \frac{\omega}{2}\left(\frac{k_{t+1}}{k_t} - 1\right)^2 k_t \tag{9}$$

where $\frac{\omega}{2}\left(\frac{k_{t+1}}{k_t} - 1\right)^2 k_t$ are adjustment costs, paid by the household.

Therefore, denoting the Lagrange multipliers of the budget constraint and the laws of motion of public and private employment as λ_t^c, λ_t^{ng} and λ_t^{np}, respectively, the FOCs of the households' problem are:

$$(c_t) \quad \lambda_t^c(1-\tau^c) = U_{c,t} \tag{10}$$

$$(g_t) \quad \lambda_t^c \pi_t = U_{g,t} \tag{11}$$

$$(s_t) \quad \lambda_t^{ng} p_t^g = \lambda_t^{np} p_t^p \tag{12}$$

$$(n_{t+1}^g) \quad \lambda_t^{ng} = \beta \Big\{ U_{u,t+1} +$$
$$E_t \left[\lambda_{t+1}^c [(1 - \tau^n) w_{t+1}^g - b] + \lambda_{t+1}^{ng}(1 - \sigma^g - p_{t+1}^g) \right] \Big\} \quad (13)$$

$$(n_{t+1}^p) \quad \lambda_t^{np} = \beta \Big\{ U_{u,t+1} +$$
$$E_t \left[\lambda_{t+1}^c [(1 - \tau^n) w_{t+1}^p - b] + \lambda_{t+1}^{np}(1 - \sigma^p - p_{t+1}^p) \right] \Big\} \quad (14)$$

$$(k_{t+1}) \quad \lambda_t^c \left[1 + \omega \left(\frac{k_{t+1}}{k_t} - 1 \right) \right] =$$
$$\beta E_t \lambda_{t+1}^c \left\{ 1 - \delta + [r_{t+1} - \tau_k(r_{t+1} - \delta)] + \frac{\omega}{2} \left[\left(\frac{k_{t+2}}{k_{t+1}} \right)^2 - 1 \right] \right\} \quad (15)$$

Private good production

Private good firms produce the consumption good with labor, private capital and public capital,

$$y_t = a_t \left[(n_t^p)^{(1 - \varphi_p)} (k_t^p)^{\varphi_p} \right]^{1 - \varphi_{pg}} (k_t^g)^{\varphi_{pg}} \quad (16)$$

where a_t is an aggregate technology shock that follows an AR(1) process with persistence ρ_a and standard deviation σ_a. The price of the good is normalized to one. Firms use working capital as in Neumeyer and Perri (2005) or Mendoza (2010): they take intra-period loans at the international rate R_t to finance a fraction θ of their wage bill. Finally, since current hires give future value, the optimization problem is dynamic and firms maximize the discounted value of future profits. The problem becomes:

$$Q^p(n_t^p, k_t^p) = \max_{k_t, v_t^p} \{ y_t - [1 + \theta R_t] w_t^p n_t^p - r_t k_t - \kappa^p v_t^p + E_t[\Lambda_{t,t+1} Q^p(n_{t+1}^p, k_{t+1})] \} \quad (17)$$

where κ^p is the cost of posting vacancies on the private sector and $\Lambda_{t,t+1} = \beta \frac{U_{c_{t+1}}}{U_{c_t}}$ is the stochastic discount factor. The firms maximize with respect to the private employment transition equation (3). The FOCs of their problem are:

$$(k_t^p) \quad r_t = \varphi^p \frac{y_t}{k_t^p} \quad (18)$$

$$(v_t^p) \quad \frac{\kappa^p}{q_t^p} = E_t \Lambda_{t,t+1} \left[(1 - \varphi^p) \frac{y_{t+1}}{n_{t+1}^p} - (1 + \theta R_t) w_{t+1}^p + (1 - \sigma^p) \frac{\kappa^p}{q_{t+1}^p} \right] \quad (19)$$

Private wage determination

The private wage is determined as the result of Nash bargaining between workers and firms. The problem is to maximize the weighted sum of the surpluses:

$$\max_{w_t^p} \left\{ (1 - \vartheta) \ln V_{n_t^p}^H + \vartheta \ln V_{n_t^p}^F \right\} \quad (20)$$

where $V_{n_t^p}^F$ is the expected value of the marginal job for the firm, given by:

$$V_{n_t^p}^F = (1 - \varphi^p) \frac{y_t^p}{n_t^p} - (1 + \theta R_t) w_t^p + (1 - \sigma^p) \frac{\kappa}{q_t^p} \quad (21)$$

and $V_{n_t^p}^H$ is the expected marginal value for the household of having an additional member employed in the private sector:

$$V_{n_t^p}^H = \lambda_t^c (1 - \tau^n) w_t^p - U_{u,t} + \lambda_t^{np} (1 - \sigma^p - p_t^p) \quad (22)$$

The solution to the maximization gives an expression for the private wage

$$w_t^p = \frac{(1 - \vartheta)}{\Gamma} \left[(1 - \varphi^p) \frac{y_t^p}{n_t^p} + (1 - \sigma^p) \frac{\kappa}{q_t^p} \right] + \frac{\vartheta}{\Gamma \lambda_t^c (1 - \tau^n)} [U_{u,t} - \lambda_t^{np} (1 - \sigma^p - p_t^p)] \quad (23)$$

where $\Gamma = \vartheta + (1 - \vartheta)(1 + \theta R_t)$.

Government

The public good is produced with labor. The cost of vacancies is subtracted from production as in Gomes (2012),

$$g_t = (n_t^g)^{1 - \varphi_g} - \kappa v_t^g \quad (24)$$

Public capital evolves over time according to:

$$k_{t+1}^g = (1 - \delta) k_t^g + i_t^g \quad (25)$$

and public investment i_t^g follows a simple autoregressive rule

$$i_t^g = \bar{i}_g + \rho_{i_g} (i_t^g - \bar{i}_g) + \epsilon_t^{ig} \quad (26)$$

9

where $\bar{i}_g$ is the steady state value of public investment. Government income consists on the revenue from the taxes levied to the households. It is assumed that the tax rates are fixed. The government uses an internationally traded bond b_t with return R_t. The return R_t is determined exogenously as

$$R_t = \bar{R} * \epsilon_t^R \tag{27}$$

where ϵ_t^R follows an AR(1) process with persistence ρ_R and standard deviation σ_R. Government spending includes the public wage bill, the unemployment benefits and the lump-sum transfers to the households T_t. The government budget constraint is:

$$w_t^g n_t^g + b u_t + T_t = \tau^c c_t + \tau^n (w_t^g n_t^g + w_t^p n_t^p) + \tau^k (r_t - \delta) k_t + def_t \tag{28}$$

where def_t is the government deficit,

$$def_t = (1 + R_t) B_{t+1} - B_t \tag{29}$$

To ensure determinacy of equilibrium and a non-explosive path of debt, I assume a debt-targeting rule of the form:

$$T_t = \bar{T} \exp\{\nu (B_t - \bar{B})\} \tag{30}$$

where $\bar{B}$ is the steady state value of debt.

Public vacancies and wages evolve according to rules. Public vacancies follow a simple autoregressive rule

$$v_t^g = \bar{v}_g + \rho_{v_g} (v_t^g - \bar{v}_g) + \epsilon_t^{vg} \tag{31}$$

where $\bar{v}_g$ is the steady state value of public vacancies. Public wages also follow an autoregressive rule, but are in turn affected by the government deficit. This extra term reflects the pressures of public unions, which are able to extract higher wages when they perceive that the government budget constraint is looser, that is, when deficit goes down

$$w_t^g = \bar{w}_g + \rho_{w_g} (w_t^g - \bar{w}_g) - \rho_{def} (def_t - \bar{def}) \tag{32}$$

where variables with bars represent steady state values.

Labour market	σ_g	σ_p	η_g	η_p	μ_g	μ_p	κ
	0.0329	0.0659	0.2	0.5	0.1482	0.4683	0.0995
Production and capital	φ_g	φ_p	φ_{pg}	δ	ω	a	θ
	0.1318	0.36	0.033	0.025	5.5	1	0.3144
Steady state values	u	n_g	n_p	R	w_g/w_p	g/y	B/y
	0.14	0.13	0.63	0.06	1.17	0.3	0.626
Other parameters	β	γ	ζ	χ	ν	ϑ	b/w_p
	0.99	1	0.1	0.46	2	0.0442	0.35
	τ_c	τ_k	τ_n	ρ_a	σ_a	ρ_R	σ_R
	0.151	0.293	0.305	0.9	0.08	0.9	0.1

Table 2: Parameters and stady state values.

Closing the model

The aggregate resources constraint is given by

$$y_t = c_t + i_t + \kappa_p v_t^p \tag{33}$$

The model features two exogenous disturbances: the shocks to productivity a_t and to the return to the internationally traded bond R_t. The shock to R_t would be calibrated to replicate the decrease of the risk premium faced by the southern economies of the Euro Area described on the introductory section.

3   Calibration

The model is calibrated so its steady state matches some key statistics from the second half of the 1990s in the Spanish economy. This period represent an intermediate state between the period of economic crisis of the beginning of the decade and the introduction of the common currency in 1999. The calibration is summarized in Table 2

Time is in years. The steady state value of unemployment (u) and of public employment out of total employment (n_g) are set to match observed values. The total separation rate (σ) is taken from Hobijn and Sahin (2007) and then computed for each sector. The matching elasticities (η_g and η_p) are taken from Gomes (2012).

For the tax rates (τ_c, τ_k and τ_n) I use the average implicit tax rate computed by Eurostat. The depreciation rate (δ), the discount factor (β), the capital share in the production function (φ_p) and the adjustment cost of capital (ω) are taken

from the literature. The exponent of the public good in the production function (φ_{pg}) is calibrated from the average public investment to output ratio, as in Baxter and King (1993). The productivity shock (a) is normalized to 1. The vacancy cost per filled job (κ/w_p) is taken from Galí (2011). This ratio is used together with the private wage obtained from the firm's FOC for private vacancies to isolate κ.

The public wage premium (w_g/w_p), the public spending ratio (g/y), the debt-to-GDP ratio (b/y), the debt interest rate (R), the replacement rate (b/w_p) and the working capital-to-GDP ratio are set to match observed values, and used to obtain the public wage (w_g), public good production (g), public debt (B), unemployment benefits (b) and the proportion of private wages paid in advance (θ). Then, the labor elasticity in the public production function (φ_g) can be obtained from the public good production function. Finally, the workers' bargaining power (ϑ) can be extracted from the private wage determination function.

4   Main results

In this section I present the effects on the model economy of the decrease in financing costs occurred during the process of adoption of the Euro in Spain. This decrease is simulated with a shock to the interest rate paid by the government and used by the firms to finance their working capital.

For reference, Figure 2 presents the impulse responses of the economy to a productivity shock. Figure 3 presents the impulse responses to a negative international interest rate shock.

When the interest rate shock hits, the first direct effect is the reduction in interest payments, which therefore reduces the fiscal deficit. Unions take advantage of this reduction to push for higher public wages, as can be seen in Equation 32. Then, the rise of public wages affect private wages through three different mechanisms. First, a higher public wages affects the outside option of the private worker during wage bargaining. The value of unemployment rises for the unemployed worker, because they discount the possibility of obtaining a (now more lucrative) public job in the future, so firms must increase private wages. Second, as we will see below, an interest rate shock decreases capital accumulation on impact. With less capital in the economy, the workers are less productive and the firms reduce the private wage. Finally, higher public
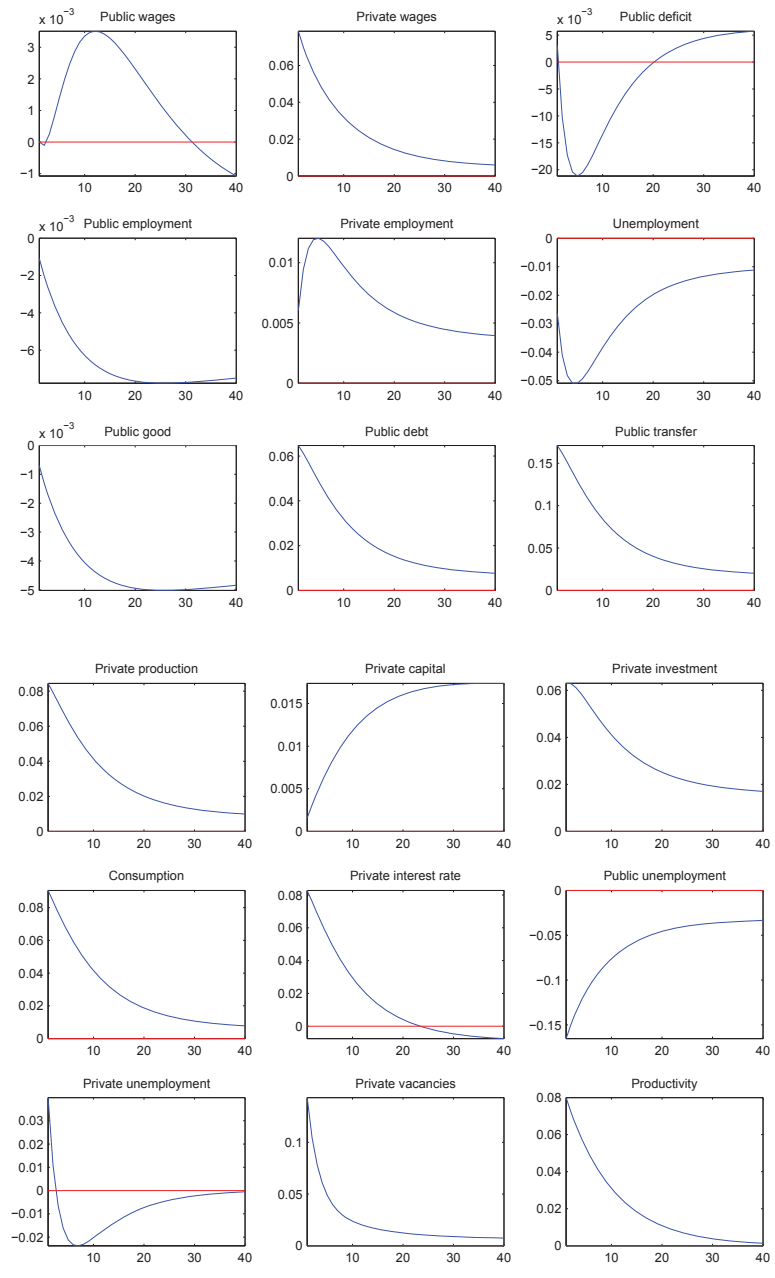
12

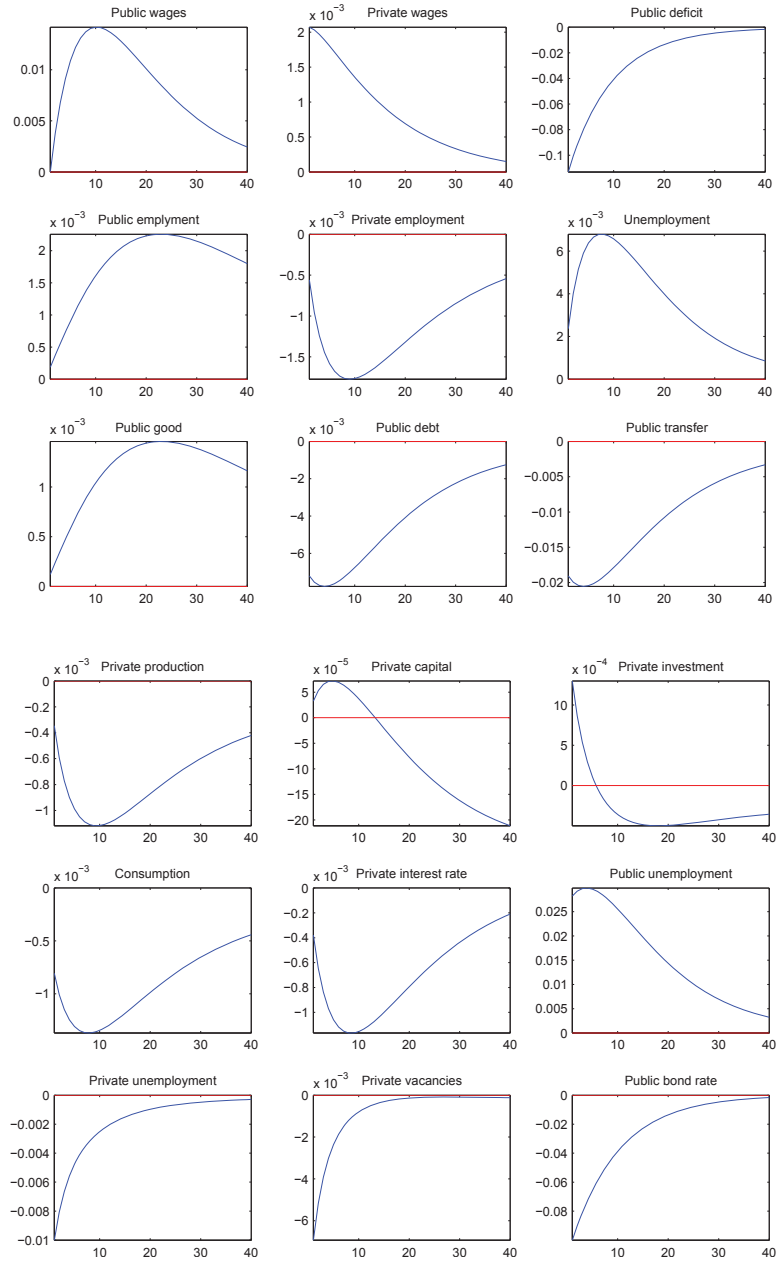Figure 2: Impulse responses to a productivity shock

13

Figure 3: Impulse responses to an interest rate shock

14

wages lure more people into looking for jobs in the public sector, producing more matches and more employment in the private sector and so increasing the production of public good. As the public good increases the productivity of the firm, each worker is now more valuable for the firm and private wages go up. The net effect of these three effects, two positive and one negative, is an increase of private wages following the interest rate shock.

On the other hand, the presence of working capital creates and additional mechanism of transmission from interest rates to private wages. When the interest shock hits, firms can finance their intra-period loan more cheaply, reducing the cost of their wage bill and, as can be seen in Equation 21, the value of a job for the firms rises, therefore increasing private wages. Therefore, to study the public wage channel is necessary to shut down this mechanism, simply by setting $\theta = 0$, so that no intra-period loans are taken.

With working capital, the relative accumulated response of private wages to public wages for the first five periods, that is, the ratio between the accumulated response of public and private wages, is of 0.3193. This result implies that for every 1% increase in public wages, private wages go up a 0.3193%. Without working capital, just setting $\theta = 0$ the elasticity falls to 0.0817, implying that around a quarter of the total effect registered on the benchmark economy is due to the public wage channel.

Using the same data of Table 1, I can therefore compute the effect of the increase of public wages on private wages. During the 1999-2007 period, public wages increased at an annual rate of a 4.4%, which would produce an increase in private wages of a 0.363%. As private wages increased during that same period at an annual rate of a 2.7%, then the model estimates that a 13.32% of the total increase was a consequence of the lower interest rates.

As a counter factual, according to the simulation, if public wages had increased at the same annual rate than private wages, the annual increase of private wages would have been a 2.477%, due to the reduced pull effect of public wages. If public wages would have been frozen during the period, then the increase of private wages would have been just a 2.337%, a reduction of almost 0.4 percentage points. For comparison, the annual growth rate of private wages from 2008 to 2013 was a 2.55%, even with the country involved in a process of internal devaluation.

As commented before, we can also observe that the negative shock to the interest rates is pro cyclical: as the interest rate goes down, so does consumption and production, whereas unemployment goes up. In the standard literature,

interest rates shocks are countercyclical, as the lower interest rates make investment cheaper and allow for increased capital accumulation. The difference is that in this model only the government holds bonds, to isolate the public wage channel. Then, the decrease in the interest rate pushes up public wages, as we have seen, which move unemployed works to search with more intensity in the public sector. The proportion of people looking for jobs in the public sector goes up and, correspondingly, the proportion of people looking for jobs in the private sector goes down. With less unemployed workers looking for jobs, the private sector reduces the number of vacancies it offers, decreasing the probability of a given vacancy being filled. These two effects push unemployment up: more people queuing for public jobs and less total vacancies in the economy, because public vacancies do not move. The lower number of private vacancies reduces private employment, which in turn slows production and consumption.

5   Sensitivity

As I discussed on the previous Section, the rise on public wages affect private wages through three channels: first, altering the outside option of workers while bargaining for wages; second, producing a resources redistribution that decreases capital and production that pushes private wages down; and, finally, making public employment go up and increasing the production of public good. More public good means more productivity per private worker, so that the expected value of an extra job for the firm goes up and private wages rise.

In the benchmark calibration I have assumed a value for the output elasticity of the public good of 0.0333. By setting $\varphi_{pg} = 0$, the public good becomes unproductive and we can observe the importance of the third channel. With $\varphi_{pg} = 0$, the ratio between the accumulated response of public and private wages decreases to 0.2569, so this channel accounts for about 19.56% of the total effect. In this version of the model, the simulation estimates that a 41.86% of the total increase in private wages from 1999-2007 was a consequence of the public wage channel.

Similarly, the presence of adjustment costs in capital helps enhance the effect of public wages on private wages by affecting the second channel, the decrease of capital. With adjustment costs, the decrease in capital is smaller than with no adjustment costs and, therefore, the productivity of the private worker does not fall as much, helping keep their wages up. If I set $\omega = 0$, so as to eliminate

adjustment costs, the ratio between the accumulated response of public and private wages decreases to 0.3152; a reduction of about a 1.30% in the total effect. Without adjustment costs, the proportion of private wage increase consequence of the increase on public wages falls to a 51.36 per cent.

Another element of the model affects the outside option of the unemployed workers and hence the first channel: unemployment benefits. Reducing unemployment benefits by half, so that the replacement rate is around that of the United States, makes the accumulated response of public and private wages fall to 0.2752, a reduction of 13.82% of the benchmark. The simulation with reduced unemployment benefits estimates that 44.84% of the total increase in private wages during the 99-07 period was consequence of the public wage channel.

Finally, the size of the interest rate shock, that is, changes to ϵ_t^R, have no effect on the ratio between the accumulated response of public and private wages. Whereas a the size of the shock affect the size of the response of public wages, the change on private wages is proportional to that of public wages, so the ratio stays the same.

6   The effect of the post-crisis public wage cuts

As we have seen in previous sections, public wages played a significant role in the loss of competitiveness experienced by some Eurozone countries prior to the crisis. In the aftermath of the crisis, public wages have kept a central role, as European authorities raced to cut spending, reduce debt and improve competitiveness.

These efforts translated in pay cuts or freezes for public employees all around Europe, but specially in the countries affected the most by the crisis or under austerity programs. For example, the Spanish government introduced a 5% cut in civil servants' wages in 2010 and a freeze of their pay in 2011 as part of the program to reduce expenditure by 15,000€ million during those two years. Similarly, the emergency package introduced by the Italian government during the spring of 2010 included a three year public sector wage freeze and cuts of 5% and 10% for those with annual incomes over 90,000€ and 150,000€, respectively. In Portugal, the government announced in 2010 a freeze of the wages of civil servants and employees in public companies as part of the effort to save up to 3,000€ million. Finally, the case of Greece was particularly intense, after receiving a loan from the IMF and the EU. The government introduced a cut

in public sector wages, a 30% cut in special bonuses, a reduction in overtime pay and the suspension of recruitment of new workers. It is estimated that cuts in wages and bonuses will result in a de facto loss of income for public sector workers of 12 to 20%[1].

What are the effects of a public wage cut? In the model developed in previous sections, this event can be modeled as a shock to $\bar{w}_g$ in Equation 32. The effects of such a shock can be seen in Figure 4. For a better comparability, the model is simulated without the working capital constraint, to focus on the effects coming solely from the public sector.

In this simulation, the ratio between the accumulated response of public and private wages, is of 0.0612, implying that for every 1% increase in public wages, private wages go up a 0.0612%. In the benchmark model without working capital constraints this ratio was of 0.0826. Therefore, the pull-effect of public wages is stronger as a result of the loosening of the budget constraint of the government than directly inducing the movement on public wages, because the reduced interest rates creates and additional feedback effect through the movement of the deficit. So, inducing a decrease on public wages of the same size as the increase observed after the introduction of the Euro would not be enough to return private wages to their pre-Euro levels.

The analysis of a public wage cut so far has assumed that privates wages can move freely. However, private wages in the southern economies of the Euro have shown a strong nominal downward rigidity since the beginning of the crisis, despite the sharp contraction in aggregate demand and the withdrawal of external credit[2]. Taking into account this phenomenon is key to analyze the effects on output and public finances, given that debt reduction was the main motivation for the public wage cuts.

To replicate this rigidity, I introduce an additional constraint into the model, from Schmitt-Grohé and Uribe (2012):

$$w_t^p \geq \Gamma w_{t-1}^p, \ \Gamma > 0 \tag{34}$$

This setup nests the cases of absolute downward rigidity, when $\Gamma \geq 1$, and full wage flexibility, the benchmark case, when $\Gamma = 0$.

With this additional constraint, I can more accurately replicate the impact of the public wage cuts described before. The results of simulating a 5% public

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[1]Source: European Federation of Public Service Unions.

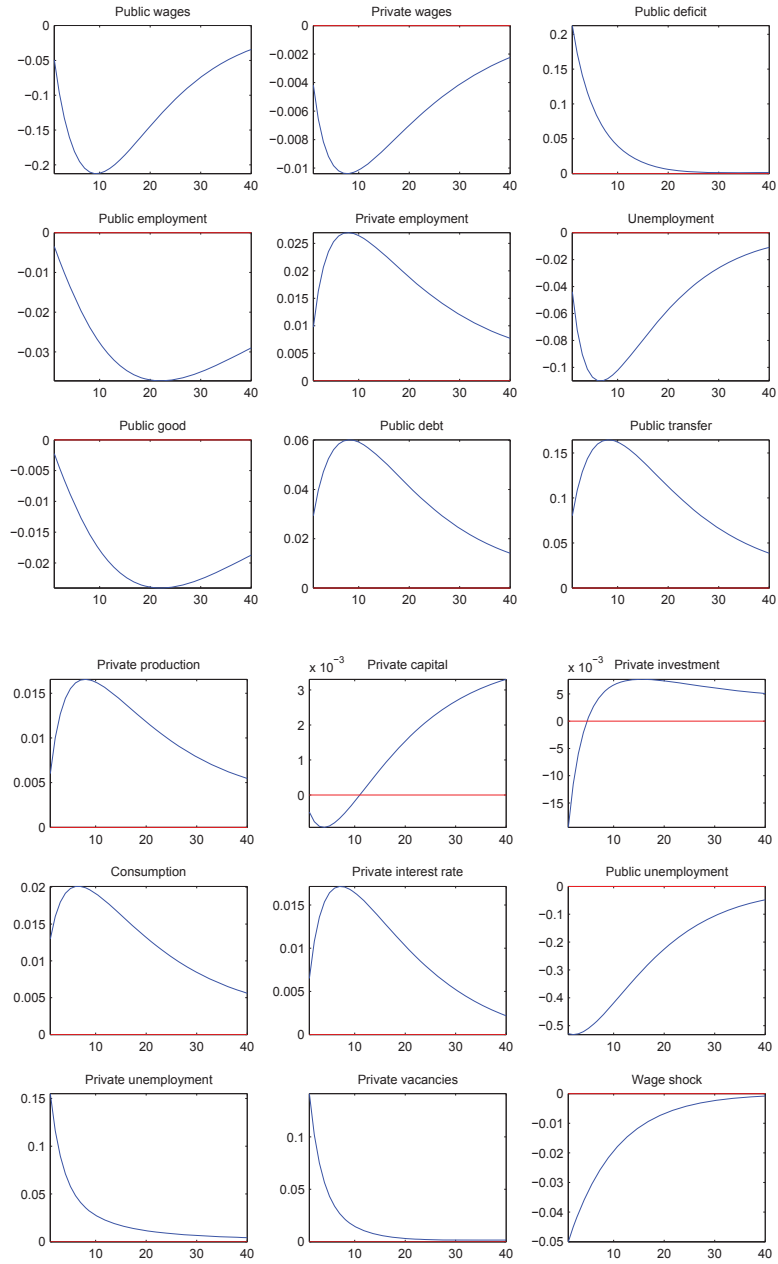[2]See, for example, Schmitt-Grohé and Uribe (2013).

Figure 4: Impulse responses to a 5% public wage cut

wage cut in this model economy can be checked in Figure 5

In comparison with the case with a fully flexible private wage, the main difference is the behavior of private vacancies. The fully flexible private wage goes down with the public wage cut, increasing the value of a match for the firms and leading to a robust increase in vacancies. Furthermore, more unemployed people are now looking for jobs in the private sector, so private employment goes up, more than enough to compensate for the loss public jobs, resulting on a fall on total unemployment. With downward wage rigidity, however, private vacancies decrease. In this case, the value of a match goes down because the loss of public jobs reduce public good production, making private workers less productive. Public employment still goes up, because of the extra unemployed workers looking for jobs in the private sector, but this increase no longer compensates the loss of jobs in the public sector, so total unemployment goes slightly up. The behavior of unemployment in the model matches perfectly the evolution of the countries involved in public wage cuts, which have had great difficulties on trying to reduce their unemployment levels.

Looking at public finances, the simulation implies that a 1% reduction in public wages leads to a 0.71% reduction in public spending but also a decrease of a 0.18% in tax income. The fall in public spending results from the reduced public wage bill, as the other component of government spending, unemployment benefits, only registers a very small increment. On the other hand, tax income goes down mainly because of the decrease on labor taxes. The tax base of this tax is hurt both because of the lower level of employment and of public wages.

To put these numbers in context, let's apply them to the situation of Spain in 2010. When the Spanish government decided to introduce public wage cuts, the public deficit was at 9.62% of GDP. With the elasticities computed in the previous paragraph, a 5% cut in public wages would have reduced public spending a 3.55% (equivalent to 14,000€ million, close to the goal of the government) and tax income a 0.88%, leaving the public deficit at 8.29% of GDP.

In conclusion, public wage cuts, even in a situation when private wages are downward sticky, are an effective way of reducing public spending. However, public wage cuts also hurt tax income by reducing the tax base of labor taxes. Therefore, the cost-effectiveness of public wage cuts to improve the fiscal position of a country is limited. Furthermore, public wage cuts produce small increases on unemployment, which can be very taxing on countries with already high levels of unemployment. The evidence presented here on public wage cuts
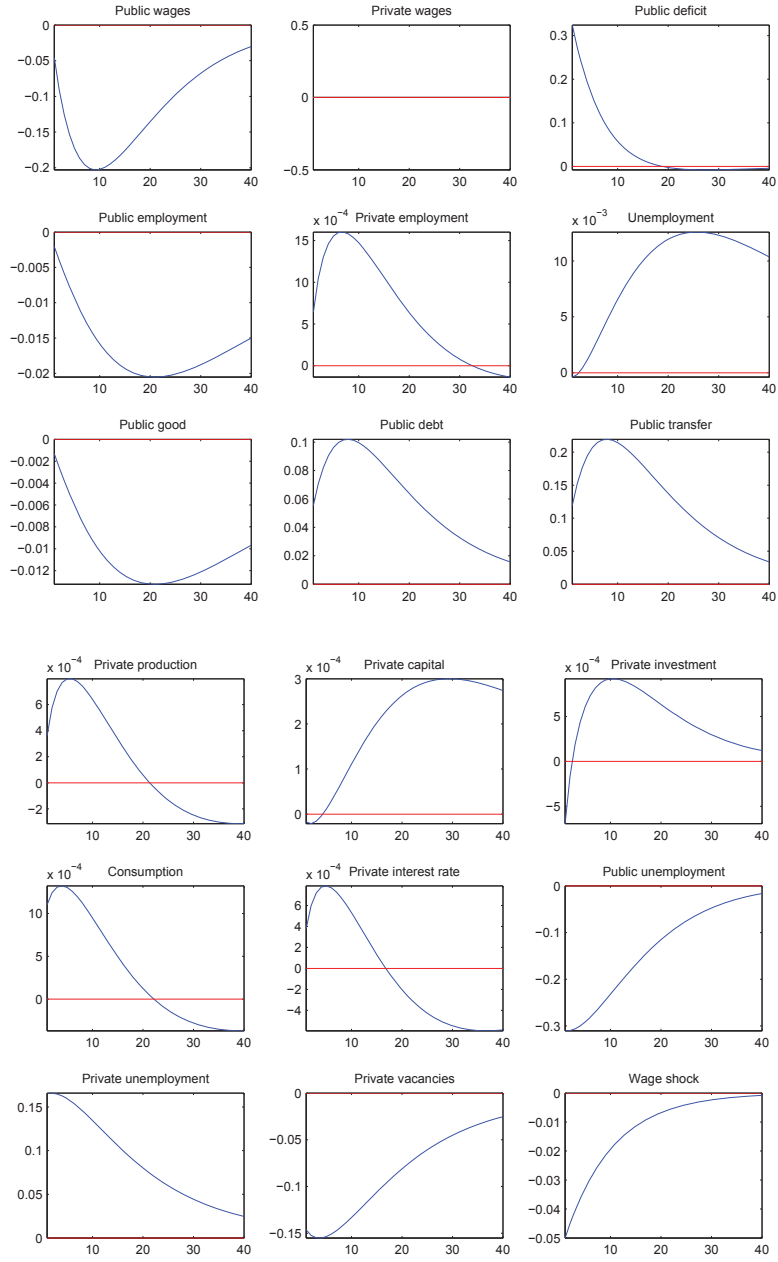
Figure 5: Impulse responses to a 5% public wage cut, with downward rigidity
on w_p

make them, at least, a risky proposition for countries with problems beyond their fiscal position and should only be undertaken if reducing public spending is the top priority of the government.

7   Conclusions

This paper provided an estimation of the effects of increases in public wages on private wages. More specifically, this question was studied in the context of the Spanish economy following the introduction of the common currency. The introduction of the Euro produced a decrease in the cost of financing, through a reduction of the interest rate premium, that relaxed the budget constraint of the government. This slack translated into strong increases on public wages that in turn pushed private wages up.

For this simulation exercise, I used a DGSE model with search and matching frictions, two sectors and a modified public wage rule to account for union pressures. When the interest rate shock hits, interest payments and therefore fiscal deficit goes down. Unions take advantage of this reduction to push for higher public wages, which also pushes the value of being unemployed up, because a public job works as an outside option when bargaining the private wage and that outside option is now more valuable. Furthermore, the increase in private wages produces a resources redistribution that decreases capital and production that pushes private wages down. Also, higher public wages make public employment go up and increase the production of public good. More public good means more productivity per private worker, so that the expected value of an extra job for the firm goes up and private wages rise. The net effect is an increase in private wages.

These results offer an important policy lesson for the countries that either joined the EMU in recent years or are planning on doing so, and also for non-core members moving forward. As we have seen, the decrease on interest rates associated with the introduction of the Euro can put an upward pressure on wages, creating a differential with the countries on the core of the Eurozone. These differentials are very difficult to correct within a monetary union from the periphery, as demonstrated by the current austerity programs ongoing in Southern Europe, without the possibility of using monetary policy and with limitations in fiscal policy. These countries are therefore advised to contain the growth of public wages in order to avoid or mitigate future problems.

As an additional exercise, I also studied the effect of the public wage cuts observed in various countries during the current Eurozone crisis. I incorporated an additional constraint in private wages to induce downward wage rigidity in the model, so as to replicate the conditions of the southern economies of the Eurozone during this particular time. When a public wage cut is simulated in this economy, public spending is effectively reduced. However, labor tax income also falls, limiting the impact of the measure on the fiscal position of the country. Furthermore, unemployment rises, as the increase in private employment cannot compensate the fall in public employment. Therefore, governments engaged in stabilization programs should approach public wage cuts with caution, given the potential of worsening the conditions of their already battered labor markets.

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