

Institutions, capital stock and wage setting in Spain

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Postprint / Postprint

Zeitschriftenartikel / journal article

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Empfohlene Zitierung / Suggested Citation:

Sala, H. (2009). Institutions, capital stock and wage setting in Spain. *Applied Economics*, 41(6), 779-789. <https://doi.org/10.1080/00036840601007435>

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Journal:	<i>Applied Economics</i>
Manuscript ID:	APE-06-0357.R1
Journal Selection:	Applied Economics
JEL Code:	E22 - Capital Investment (including Inventories) Capacity < E2 - Consumption, Saving, Production, Employment, and Investment < E - Macroeconomics and Monetary Economics, O40 - General < O4 - Economic Growth and Aggregate Productivity < O - Economic Development, Technological Change, and Growth, J30 - General < J3 - Wages, Compensation, and Labor Costs < J - Labor and Demographic Economics, E62 - Fiscal Policy Public Expenditures, Investment, and Finance Taxation < E6 - Macro Policy Formation, Macro Public Finance, Macro Policy, etc < E - Macroeconomics and Monetary Economics
Keywords:	Wage setting curve, Institutions, Capital stock

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1 Introduction

This paper examines to what extent labour market institutions, on one side, and the ratio of public to private capital stock, on the other side, are relevant to the wage setting curve in Spain. Following the contributions of Aschauer (1989), Barro (1990) and subsequent research, this ratio is considered a *growth driver*, a variable that enhances economic growth. Some labour-macro literature (see below) has already inspected the role of growth drivers such as capital stock, technological change or working-age population. It is along these lines that the role of this ratio is taken into account in the context of a wage setting curve comprising standard variables such as the labour market institutions. This analysis, thus, lies in the intersection of two distinct conceptions of the labour market: the Institutionalist view, with its main focus in the notion of equilibrium, and the Chain Reaction Theory (CRT) view, with its dynamic perspective.

In the institutionalist approach wage pressure factors play the central role.¹ Among them are the labour market institutions, typically classified in four categories: wage bargaining institutions, labour taxation, employment protection legislation, and unemployment protection legislation. Their impact is generally analyzed via reduced-form unemployment equations with a significant exception in Nunziata (2005), who provides an empirical analysis in terms of the labor cost.² Another standard feature is the use of five-year averages of the time series to eliminate conjunctural variations and better focus on equilibrium or long-term relationships. This procedure, claimed to be correct on the grounds that institutions hardly vary across time, gives rise to an important concern: to take five-year averages impoverishes the available information; together with the estimation of single-equation models, it undermines the role of labour market adjustments in the presence of shocks.

An alternative to the institutionalist approach is the CRT:³ it focuses on the importance of the lagged adjustment processes and outlines the central role of the *growth drivers* in explaining the unemployment trajectory. For example, Henry, Karanassou and Snower (2000) and Karanassou, Sala and Snower (2003 and 2004) find capital stock to be a crucial determinant of unemployment in the UK and the EU. The empirical methodology of the CRT involves the estimation of multi-equation systems (with a wage setting equation always considered) and yields a salient result: the influence of the *growth drivers* is found to overcome the importance of wage pressure factors in

¹See Nickell, Nunziata and Ochel (2005).

²This is important since in reduced-form unemployment equations the effect of wages is substituted by their determinants. Hence, the influence of institutions on wage setting is not explicitly considered, and only their direct impact on unemployment is analyzed. This of course, may cause an overestimation of the unemployment consequences of institutions. Nunziata (2005) investigates the impact of institutions on wage setting, but does not explain their final indirect impact on unemployment.

³See Karanassou and Snower (1997, 1998), Henry, Karanassou and Snower (2000) or Karanassou, Sala and Snower (2003 and 2004).

explaining unemployment.

To confront these two views, the Spanish wage setting curve is estimated to test: (i) to what extent the ‘usual suspects’ from the institutionalist view are relevant in a dynamic framework; and (ii) the relevance of a *growth driver* such as the ratio of public to private capital.

The empirical methodology differs from Nunziata (2005). To take five-year means would imply the need to increase the number of cross-section units to gain degrees of freedom for the estimation; this would force the consideration of a large group of countries. Instead, this paper relies on a single-country detailed time-series investigation. The implications of this analysis are many. First, if wages are sensitive to the ratio of public to private capital there is a new source of long run employment effects of public capital beyond its well-known impact via Total Factor Productivity (TFP). Second, it starts filling a gap in the empirical literature on the economic impact of public capital. This impact has traditionally been investigated leaving wages apart: treated as an exogenous variable all the wage-labour demand feedback effects have been overlooked. Third, it evaluates the direct impact of institutions on wage setting, in contrast to the conventional attention on just their unemployment consequences. Finally, this evaluation is conducted in a dynamic framework along the lines of some other work outlining the relevance of *growth drivers* in the labour market.

In this context there are two salient results. First, key institutional variables capturing the incidence of unemployment benefits, union power or the tax system are not relevant for the Spanish wage setting curve. On the contrary, Social Security benefits play a very significant role and, we argue, may be capturing at least partially some of the effects of the other institutional variables. This calls for further research on the channels through which labour market institutions affect unemployment (the wage channel is one of them, but there are also labour demand and labour supply channels). The second salient result is the negative and significant influence of the ratio of public to private capital stock, which is robust to different specifications of the wage setting equation.

The structure of the paper is the following. Section 2 backs the empirical analysis with several theoretical underpinnings. Section 3 provides some descriptive evidence for Spain on the relationship between real wages and some of their expected determinants. Section 4 deals with the estimation of the wage setting curve and its long run implications. Section 5 concludes.

2 Theoretical underpinnings

This section underpins the estimates of the wage setting curve by providing different theoretical arguments. The first one briefly sketches the well-known mechanism whereby

institutions are relevant to wage setting. The second and third ones justify the presence of the ratio of public to private capital relying, first, on the existence of a changing elasticity of employment with respect to wages; and, second, on the consideration of commuting costs (and, thereby, the ratio of public to private capital stock) as a relevant element of working conditions and, thus, of the wage bargaining process.

The role of institutions is the key addition to the labour market analysis in a context of imperfect competition (see Nunziata (2005) for a recent model along these lines). Imperfect competition implies the existence of monopoly rents that both firms and workers try to capture: firms fix prices as a mark-up on nominal wages (which gives rise to a price setting curve) and workers bargain nominal wages as a mark-up on prices (which yields a wage setting curve). This is frequently called the ‘battle of the mark-ups’ and characterises the wage bargaining process determining the position of the price setting and wage setting curves. These two curves replace the labour demand and labour supply curves of the competitive labour market and their intersection determines the equilibrium (the labour supply remains just to compute the equilibrium unemployment rate as the distance between this intersection and the labour supply at the equilibrium real wage). In this theoretical context, wage mark-ups are a positive function of the workers’ bargaining power which, in turn, is enhanced by institutions such as unions, taxes, unemployment benefits and the employment protection legislation. This is the reason why these institutions are expected to rise real wages and are normally called wage pressure factors. As explained below, in Spain they do not seem to be the main wage setting driving force.

From the seminal contributions of Aschauer (1989) and Barro (1990) to the recent study by Kamps (2006) a large stream of literature has comprehensively analysed the economic impact of public capital (see Flores de Frutos *et al.* (1998) for the Spanish case).⁴ A general feature of the economic growth models is the assumption of full-employment and inelastic labour supply. This leaves the labour market out of the analysis and has a far-reaching implication: wages are taken to be exogenous and there are no feedback effects with employment, capital stock, GDP or productivity growth.

Amidst these models, the one by Daveri and Tabellini (2000) is extended in Raurich, Sala and Sorolla (2001) and Raurich and Sorolla (2003) to re-evaluate the economic consequences of public capital when allowing for unemployment. The central feature of these models is a changing elasticity of employment with respect to the ratio of public to private capital stock:⁵ the higher the ratio, the larger this elasticity due to the

⁴It is well known that, due to congestion, it is not the level of public capital on its own what matters, but this level relative to a measure of economic activity like private capital stock.

⁵Public capital affects employment via TFP and real wages. The first mechanism is well-known: the fact that GDP depends on public capital is a stylized fact after Aschauer (1989); for it to hold public capital needs to be considered in the production function along the lines of Barro (1990). The second can be achieved, as shown in Raurich, Sala and Sorolla (2001) and Raurich and Sorolla (2003),

enhanced substitutability between private capital stock (which is now more efficient) and employment.⁶ The solution of these models yields a wage equation that incorporates the ratio of public to private capital stock, together with standard determinants such as unemployment, productivity and wage pressure factors. This type of equation is the one estimated below for the Spanish economy.

The other rationale can be procured from the literature analyzing working conditions and their influence on wage bargaining. The effect of working conditions on the workforce has been studied in some papers, generally by considering working conditions to be bargained between workers and firms together with wages. For example, Van den Berg and Gorter (1997) consider working conditions in a matching set up, and Daniel and Sofer (1998) in a union set up. Central to this discussion is the fact that working conditions is usually taken to be a broad concept including the level of sound, light, smoke or temperature at the workplace; physical location of the firm; or commuting costs. Among all these variables, our focus is on commuting costs, which are assumed negatively related to the ratio of public to private capital stock. In particular, the higher this ratio (for example, the more dense the network of train and bus stations, the more frequent the public transport services, or the more available the highways, always relative to a given level of economic activity), the lower the costs of commuting. This argument is not new in the literature and has been recently developed by Van Ommeren and Rietveld (2005) in the equilibrium search framework. In particular, they develop a commuting model (that is, worker's commuting costs are endogenously determined) taking explicitly into account labour market imperfections and different bargaining power of workers and employers. Their main result is that, when productivity grows, average commuting costs and average wages both increase in the long run. Because commuting costs are a relevant element of working conditions and are negatively related to the ratio of public to private capital stock, it naturally follows that the lower this ratio (that is, the higher commuting costs), the higher the average wage (and vice versa).

In terms of a wage equation this argument can be intuitively pushed forward as follows. Because worse working conditions lower the morale of the workforce and, thereby, effort, it is reasonable to conceive that lower commuting costs enhance effort.⁷ In particular, we could think of an effort function, such as the one in Collard and De la

by postulating a union monopoly or an efficiency wage model with a non-constant elasticity of labor demand with respect to wages.

⁶For example, if transport activities become more efficient due to a larger provision of public infrastructures, private labour demand will become more sensitive to wage increases. The reason is that firms can, to some extent, substitute labour by their enhanced capital efficiency due to a higher provision of public capital stock (relative to private capital). This, of course, does not preclude any of the well-known positive impacts of public capital stock on the economy, it is just an additional effect.

⁷See Howitt (2002) for the link between morale and effort.

Croix (2000), where the workers chose a level of effort that keeps the disutility of work constant (and equal to zero). In this context, when commuting costs rise and worsen working conditions, agents reduce effort to keep their disutility equal to zero. As a consequence, the firms' reaction to maintain the level of effort is to increase salaries to enhance wage satisfaction and compensate workers for the rise in commuting costs. This argument is of course valid for any element of working conditions such as the level of noise, temperature, etc., and provides a plausible explanation of the positive (negative) relationship between commuting costs (the ratio of public to private capital stock) and wages.⁸

3 Empirical facts

This section provides a descriptive analysis that helps to understand the econometric results presented below. Available data, collected from different sources,⁹ allows to consider the following central institutional variables: the replacement rate,¹⁰ unemployed coverage $\left(= \frac{\text{Employees covered by U. benefits}}{\text{Total number of employees}}\right)$, Social Security benefits¹¹, union coverage $\left(= \frac{\text{Employees covered by collective agreements}}{\text{Total number of employees}}\right)$; and several fiscal variables such as direct taxes and indirect taxes, Social Security contributions and the fiscal wedge. The ratio of public to private capital stock, the unemployment rate, and labour productivity are also considered.

Following figures 1a and 1b there is no clear cut relationship between wages and the percentage of unemployed covered by unemployment benefits (the correlation coefficient of these two series both in levels and differences is 0.06). In the first half of the 1970s and second half of the 1990s this relationship seems to be negative whereas, during the fall of this coverage in the early 1980s and 1990s, wages stopped their previous rising path. The alternative way of looking at the association between wages and unemployment benefits is to consider the replacement rate (figures 1c and 1d). The picture in this case is somewhat different: the replacement rate rose in the first part of the 1980s and remained stable in the interval between the unemployment benefits' reforms of 1992 and

⁸The analytical developments of such arguments lie far beyond the scope of this paper and are left for future research.

⁹OECD, FBBVA -see Mas, Pérez and Uriel (2005)- and Spanish Ministry of Labour and Social Issues. Data provided by the FBBVA are those made available in 2005 running to 2002. Data provided by the Spanish Ministry of Labor and Social Issues are those available from the Boletín de Estadísticas Laborales.

¹⁰This is the proportion of unemployment benefits (averaged over the different types of recipients) of average earnings before tax. The series provided by the OECD are biannual. The usual procedure of filling up the gaps by taking averages of the two adjacent years is followed.

¹¹Social Security benefits are normalized by working-age population (i.e., all potential contributors to the Social Security). This measure allows us to have a sense of the generosity of the Social Security in Spain.

2002. The correlation coefficient is 0.88 for the levels, but becomes slightly negative (-0.04) for the differences: from figure 1d there seems to be a negative association.

Figures 1e and 1f display the relationship of wages with a principal wage bargaining institution, union coverage. Both from the levels and differences it is difficult to identify a clear pattern in their comovement (the correlation coefficient attains 0.88 in levels, and just 0.12 in differences). When considering the main labor taxation institution, the fiscal wedge, the analysis is similar: as shown in figure 1f, both series display a growing course in levels (with a correlation coefficient of 0.96), while different and frequently opposite paths in their variation can be observed in figure 1h (with a resulting very low correlation of 0.04).

The first variable considered in figure 2 is a global measure of benefits, including unemployment benefits and other transfers by Social Security. The expected positive relationship with wages is apparent, both from figures 2a and 2b, with correlation coefficients of 0.99 in levels and 0.38 in differences (the latter significant at a 2% critical value). Wages and the ratio of public to private capital stock have a rising path (figure 2c) but according to figure 2d they seem to have a negative relationship in differences (the correlation coefficient is -0.10). This is a first empirical indication of the negative relationship postulated in our model. As we will see in Section 4, the coefficient of this ratio is quite robust to different specifications of the estimated equation. Following the theory, the comovement of wages and unemployment should reflect an unanimous clear positive relationship (the correlation coefficient is 0.88). From figures 2e and 2f, though, this is not as clear-cut. Up to 1975, real wages rose without much variation in unemployment, whereas in the 1980s they stopped rising and unemployment increased substantially in the first half of that decade and decreased afterwards. Since the second half of the 1990s wages remained stable while unemployment went down sharply. Finally, figures 2g and 2h show the expected clear positive association between wages and productivity, with a correlation coefficient of 0.99 in levels and 0.59 in differences (significant at a 1% critical value).

4 The Spanish wage setting curve

The estimation of the wage setting curve for the Spanish economy is carried out following the Autoregressive Distributed Lagged (ARDL) methodology developed in Pesaran (1997), Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001). The ARDL approach yields consistent estimates both in the short and long run, and is an alternative procedure to the standard cointegration techniques (see below for details). First we present the estimates of the wage setting equation, and then show their consistency with the ones that would be obtained from the Johansen framework.

4.1 Estimates

One of the main results of the econometric analysis is the failure of most institutional variables to account for the Spanish average real wage trajectory in the last decades. Recall that, in contrast to the standard literature, this analysis is dynamic, for a single country and focuses on the wage setting curve rather than a reduced-form unemployment equation. We do not show all the unsuccessful results, but it is important to stress that, in addition to the variables used in the specifications reported below, all the institutional variables plotted in figure 1 were also taken into account. To summarize the results obtained from these attempts, we shall mention that unemployment coverage displayed the expected positive sign, but was clearly non-significant, as well as union coverage (that attained a higher t-statistic, but still far from significant at standard critical values); the replacement rate was found to have an unexpected negative effect on wages, non-significant, but nevertheless with a t-statistic above 1. A similar surprising result was found when including the fiscal wedge, which displayed a negative and still more significant influence on wages.

These results are striking according to the institutionalist view. The fact that we were unsuccessful in generating significant results for most of the institutional variables (with the exception of Social Security benefits) calls into question the crucial role that they are generally assigned from this view.¹² We have seen that the percentage of unemployed covered by unemployment benefits has hardly any relationship with wages. As for the rest, a plausible explanation of this outcome is the high correlation displayed by benefits with the replacement rate (0.89), union coverage (0.88) and the fiscal wedge (0.98). The positive correlation of the benefits' growth rate with the differences in the unemployed coverage (0.36 significant at a 4% critical value) and the differences in the fiscal wedge (0.30 significant at a 7% critical value) is also noteworthy. From this perspective, Social Security benefits should be interpreted as a global proxy of the labour market institutions. These findings and this interpretation, however, raise the question of what are the main mechanisms whereby labor market institutions affect unemployment. This issue is central and deserves further attention: Do these institutions provoke real wage stickiness? To what extent? Do some of them directly affect the labour demand and the labour supply? These questions need to be answered, but the conventional estimation of reduced-form unemployment equations hinders the response.

Table 1 displays a selection of the estimated specifications of the wage setting curve. The starting point is the simplest equation, $E1$, where wages (w) are regressed on a constant (c), their first lag, and the ratio of public to private capital stock (g) as a

¹²Ayala, Martínez and Ruiz-Huerta (2002) provide a detailed analysis of the labour market institutions in the OECD countries. The institutional components of the labour market are found to have a greater impact on earnings inequality than on unemployment.

central variable in this analysis.¹³ The latter coefficient has the correct sign, but it is not significant. From this base-run specification other relevant variables are sequentially added in the following order: productivity (θ) in $E2$, unemployment rate (u) in $E3$, Δu in $E4$, Social Security benefits (b) in $E5$, and Δg in $E6$. All of them are significant at standard critical values (b_t in $E5$ and Δg_t in $E6$ at 15%). Along this process, the wage inertia coefficient decreases progressively, the standard errors of the equation are reduced and the log-likelihood increased. Because this reflects just partially the full analysis undertaken, it is important to mention that the selection was made according to the Akaike Information Criterion and the Schwarz Bayesian Criterion (for example, Δg_t was also included in equations $E1 - E5$, but the resulting specifications were inferior to the ones presented)¹⁴.

Not all these equations pass the standard misspecification tests, which are reported in the second part of table 1: serial correlation (SC), linearity (LIN), normality (NOR), heteroskedasticity (HET) and conditional heteroskedasticity (ARCH). Observe that, at a 5% critical value, $E1$ fails to pass the tests on linearity and normality, as well as $E2$ which in addition reveals slight serial correlation problems (normality, though, is not rejected at a 10% critical value). In turn, in $E3$ and $E4$ the null that the residuals are normally distributed tends to be rejected. Only in $E5$ all the tests hold, because when Δg_t is added (in $E6$) there are difficulties in rejecting the null of heteroskedasticity. With respect to the structural stability tests (Cusum and CusumQ), $E1$ fails stability whereas the estimated coefficients in $E2 - E6$ are structurally stable. To test for potential endogeneity of the regressors, the Hausman test was performed on the exogenous variables of the selected equation $E5$: g_t , u_t , b_t and θ_t . According to the results, endogeneity problems are not a concern and we can safely conclude that the estimates are consistent.

The short and long run elasticities of wages with respect to the ratio of public to private capital stock (ε_{w-g}^{sr} , ε_{w-g}^{lr}) are displayed in table 2. Two results are worth mentioning. First, ε_{w-g}^{sr} is very much robust to the inclusion of additional variables (equations $E2 - E6$). Second, ε_{w-g}^{lr} jumps from values close to -0.30 in equations $E1 - E3$, to values around -0.16 in equations $E4 - E6$. Given the former have different sources of misspecification problems, ε_{w-g}^{lr} can be safely placed at -0.16 (the implications of this value are outlined below).

¹³The same regression as $E1$ was run with each institutional variable instead of g_t . Unemployment coverage and union coverage displayed the expected positive sign, but the second one was not significant. The replacement rate and the fiscal wedge displayed a surprising negative sign, which was clearly significant in the first case. Other variables related to labor taxation (the direct tax rate or the fiscal pressure) were tried, but yielded equally unsuccessful results.

¹⁴The inclusion of the change of a particular variable, like Δg , on top of the level is just a reparametrisation of the current and first lag of the level of that variable.

4.2 Long run cointegrating vectors

Next we show that the ARDL based long run estimated coefficients in $E5$ are valid and fully consistent with those that arise from the cointegrating vectors obtained via the Johansen's procedure -see Johansen (1998 and 1991)-.

The econometric analysis of long run relations within trend stationary variables is generally undertaken using Johansen's maximum likelihood method or the Phillips-Hansen procedure. Given that the ARDL is, in words of Pesaran and Shin (1999), "directly comparable to the semi-parametric, fully-modified OLS approach of Phillips and Hansen (1990) to estimation of cointegrating relations", when comparing both approaches Pesaran and Shin (1999) find that the Phillips and Hansen's estimator is outperformed by the ARDL-based estimator, especially in case of having a relatively small sample period of analysis. In particular these authors show that, using the delta method or the Bewley's approach, valid standard errors can be computed for the long run coefficients estimated by OLS. To see to what extent the long run coefficients of the selected equation are significant, we use this method to estimate the error correction representation of $E5^{15}$:

$$\Delta w_t = \underset{(-2.43)}{-0.08} \Delta g_t + \underset{(1.03)}{0.21} \Delta u_t + \underset{(1.51)}{0.09} \Delta b_t + \underset{(5.20)}{5.02} \Delta c + \underset{(2.87)}{0.41} \Delta \theta_t - \underset{(-5.36)}{0.52} ecm_{t-1}, \quad (1)$$

where the Error Correction Model (ECM) is,

$$ecm_{t-1} = w_t + \underset{(2.69)}{0.16} g_t + \underset{(3.02)}{0.59} u_t - \underset{(-1.60)}{0.18} b_t - \underset{(-24.0)}{9.75} c - \underset{(-3.27)}{0.80} \theta_t. \quad (2)$$

All the variables in the ECM (the long run elasticities) are significant at standard critical values (5% in most cases, 10% the benefits). Beyond the already known long run elasticity with respect to g_t (-0.16), it is interesting to see that the long run elasticity of wages with respect to labor productivity is clearly significant and attains 0.80. The fact that it is below 1 implies that not all increases in labor productivity are translated into wage rises and thus enhance employment. Finally, the ECM coefficient (-0.52) reveals that, when facing a shock, the Spanish wage setting curve has an immediate adjustment of 52% of this shock.

A further feature of the ARDL approach is, in words of Pesaran and Shin (1999), "that the ARDL-based estimation procedure based on the Δ -method developed in the paper can be reliably used in small samples to estimate and test hypothesis on the long run coefficients in both cases where the underlying regressors are $I(1)$ or $I(0)$. This is an important finding since the ARDL approach can avoid the pretesting problem implicitly involved in the cointegration analysis of the long run relationships". Despite

¹⁵T-statistics in parentheses.

this advantage, it is important to show that the long run estimates of $E5$ are consistent with the ones that would be obtained in the form of cointegrating vectors using Johansen's procedure.

For this to be checked, the following step is to conduct unit root tests of the variables involved in the analysis.¹⁶ These tests lead to the conclusion that w_t , g_t , θ_t and b_t are $I(1)$, whereas u_t is $I(0)$. Next stage is to test for the existence of cointegrating vectors among the set of non-stationary variables: that is, the existence of a stationary linear combination between w_t , g_t , b_t and θ_t . Thus, we apply the Johansen's procedure and find that these variables cointegrate with the following two normalized cointegrating vectors:¹⁷ $\begin{pmatrix} 1 & 0.15 & -0.33 & -0.52 \end{pmatrix}$ and $\begin{pmatrix} 1 & 0.19 & -0.68 & 0.51 \end{pmatrix}$.

These have to be compared with the cointegrating vector implied by the ECM corresponding to $E5$. In particular, given that u_t is $I(0)$, the cointegrating vector obtained from expression (2) is $\begin{pmatrix} 1 & 0.16 & -0.18 & -0.80 \end{pmatrix}$. To test if it conforms with the first of the cointegrating vectors found using Johansen's method we conduct a likelihood ratio test which results in a value of 2.26. This needs to be compared with a $\chi^2_{5\%}(4) = 9.49$ and yields the conclusion that we cannot reject the null hypothesis that the ARDL long run coefficients conform with the cointegration analysis performed using the Johansen's method.

Even if a rise of 1 percentage points in g translates into a long run fall of 0.16 percent in wages, the final impact of public capital on employment remains uncertain. It depends on the effects via TFP, on possible direct effects of g on employment and on the elasticity of the labour demand with respect to wages.¹⁸ The effect on unemployment is still more uncertain, because the labour force also plays a role and, since it also depends on wages, a new source of interactions and feedback effects would have to be considered.¹⁹

5 Summary and concluding remarks

Two distinct perspectives of the labour market have been confronted: the institutionalist view and the Chain Reaction Theory. The former outlines the role of labour market institutions. The latter characterises the growth drivers as main determinants of employment and the labour force. The ratio of public to private capital stock is a

¹⁶For the sake of brevity we do not add an extra table to show the results of these tests. They are, nevertheless, readily available upon request.

¹⁷This choice is done by using the LR tests based on the Trace of the stochastic matrix. We conduct this cointegration analysis selecting unrestricted intercepts and no trend in the underlying VAR.

¹⁸For an empirical appraisal of all these effects in the private sector see Raurich, Sala and Sorolla (2001).

¹⁹This is, in fact, one of the salient features of the Chain Reaction Theory: the key role of the network of interactions that can only be appraised with the estimation of multi-equation models.

growth driver whose economic consequences have been profusely analysed in the economic growth literature. This paper has brought it to the labour-macro analysis to examine to what extent it is also a relevant determinant of wage setting in Spain.

From a theoretical point of view, two arguments support this relationship. The first one is a changing elasticity of labour demand with respect to wages in response to public capital availability (relative to private capital). This elasticity is likely to be larger, the higher this ratio, for a simple reason. When private capital becomes more efficient and, thus, some workers dispensable, firms become more sensitive to wage increases. Raurich, Sala and Sorolla (2001) and Raurich and Sorolla (2003) provide analytical developments of this argument. The second argument is based on an effort function depending on the ratio of public to private capital stock. This relationship is plausible because effort depends on working conditions, commuting costs is an important working condition, and the ratio of public to private capital is the main determinant of commuting costs. It is well-known that effort is a relevant argument of the wage level (for example, from the efficiency wage literature) implying that effort determinants play a role in wage setting. Beyond some literature analysing the effects of working-conditions on wage setting -Van den Berg and Gorter (1997); Daniel and Sofer (1998)-, in Rietveld and Van Ommeren (2005) the link between average commuting costs and average wages is shown to be positive when productivity grows.

In studying the empirical relevance of this relationship, we have also considered to what extent several institutional variables play a role in the Spanish wage setting curve. The main findings are the following. First, the coefficient of the ratio of public to private capital stock is negative, significant and relatively robust to different specifications of the wage setting equation. Second, the long run elasticity of wages with respect to this ratio can be placed at -0.16. These results have a far-reaching implication: there is a *wage channel* whereby employment is permanently affected by increases in public capital. This joins the other well-known channels through which public investment boosts economic growth. Third, with the exception of Social Security benefits, the rest of the standard institutional variables do not play any relevant role in explaining the trajectory of wages. The strong correlation of Social Security benefits with the replacement rate, union coverage and the fiscal wedge indicates that the effects of the latter three seem to be captured by the former. Therefore, these institutional variables are not dismissed as potential determinants of unemployment: beyond their impact on wage setting, a careful investigation of their effects through labour demand and labour supply decisions is necessary; the estimation of reduce-form unemployment equations does not allow this careful appraisal.

This analysis contributes to the existing literature in several respects. First, to the identification of the *wage channel*. The conventional treatment of wages as exogenous

(in the economic growth literature) prevents this channel from operating. Second, our results call into question the crucial role that the institutional variables are generally assigned from the institutionalist view. These variables are found to be central when static reduced-form unemployment equations are estimated, therefore the question of what are the main mechanisms whereby labor market institutions affect unemployment acquires further importance. Finally, this study reinforces the need to consider the growth drivers, which seem to be crucial to analyze the dynamic trajectory of wages and, thereby, of labour demand and labour supply.

Acknowledgments

This paper has benefited from the comments and suggestions made by an anonymous referee. I am grateful to the Spanish Ministry of Education for financial support through grant SEC2003-7928.

References

- [1] Aschauer, D. (1989) Is public expenditure productive?, *Journal of Monetary Economics*, **23**, 177-200.
- [2] Ayala, L., Martínez, R. and Ruiz-Huerta, J. (2002) Institutional determinants of the unemployment-earnings inequality trade-off, *Applied Economics*, **34**, 179-195.
- [3] Barro, R. (1990) Government spending in a simple model of endogenous growth, *Journal of Political Economy*, **98**, 103-125.
- [4] Collard, F. and de la Croix, D. (2000) Gift exchange and the business cycle: The fair wage strikes back, *Review of Economic Dynamics*, **3**, 166-193.
- [5] Daniel, C. and Sofer, C. (1998) Bargaining, compensating wage differentials and dualism of the labor market: Theory and evidence for France, *Journal of Labor Economics*, **16**, 546-575.
- [6] Daveri, F. and Tabellini, G. (2000) Unemployment, growth and taxation in industrial countries, *Economic Policy*, **15**, 47-88.
- [7] Flores de Frutos, R., Gracia-Díez, M. and Pérez-Amaral, T. (1998) Public capital stock and economic growth: an analysis of the Spanish economy, *Applied Economics*, **30**, 985-994.
- [8] Henry, S.G.B., Karanassou, M. and Snower, D.J. (2000) Adjustment dynamics and the natural rate, *Oxford Economic Papers*, **52**, 178-203.
- [9] Howitt, P. (2002) Looking inside the labor market: A review article, *Journal of Economic Literature*, **30**, 125-138.
- [10] Johansen, S. (1988) Statistical analysis of cointegrating vectors, *Journal of Economic Dynamics and Control*, **12**, 231-254

- [11] Johansen, S. (1991) Estimation and hypothesis testing of cointegrating vectors in Gaussian vector autoregressive models, *Econometrica*, **59**, 1551-1580
- [12] Kamps, S. (2006) New estimates of government net capital stocks for 22 OECD countries, 1960–2001, *IMF Staff Papers*, **53**, 120-150.
- [13] Karanassou, M. and Snower, D.J. (1997) Is the natural rate a reference point?, *European Economic Review*, **41**, 559-569.
- [14] Karanassou, M. and Snower, D.J. (1998) How labor market flexibility affects unemployment: Long-term implications of the Chain Reaction Theory, *The Economic Journal*, **108**, 832-849.
- [15] Karanassou, M., Sala, H. and Snower, D.J. (2003) Unemployment in the European Union: A dynamic reappraisal, *Economic Modelling*, **20**, 237-273.
- [16] Karanassou, M., Sala, H. and Snower, D.J. (2004) Unemployment in the European Union: Institutions, prices and growth, *CESifo Working Paper Series*, 1247, Munich.
- [17] Mas, M., Pérez, F. and Uriel, E. (2005) *El Stock de capital en España y su distribución territorial (1964-2002)*, Fundación BBVA, Bilbao.
- [18] Nickell, S., Nunziata, L. and Ochel, W. (2005) Unemployment in the OECD since the 1960s: What do we know?, *The Economic Journal*, **115**, 1-27.
- [19] Nunziata, L. (2005) Institutions and wage determination: A multi-country approach, *Oxford Bulletin of Economics and Statistics*, **67**, 435-460.
- [20] Pesaran, M.H. (1997) The role of economic theory in modelling the long-run, *The Economic Journal*, **107**, 178-191.
- [21] Pesaran, M.H. and Shin, Y. (1999) An autoregressive distributed-lag modelling approach to cointegration analysis in *Econometrics and Economic Theory in the Twentieth Century: The Ragnar Frisch Centennial Symposium*, edited by Strom, S., Cambridge University Press, 371-413.
- [22] Pesaran, M.H., Shin, Y. and Smith, R.J. (2001) Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, **16**, 289-326.
- [23] Raurich, X., Sala, H. and Sorolla, V. (2001) Growth, employment and public capital in Spain, *Documento de trabajo, 2001-21*, FEDEA, Madrid.
- [24] Raurich, X. and Sorolla, V. (2003) Growth, unemployment and public capital, *Spanish Economic Review*, **5**, 49-61.
- [25] Van den Berg, G.J. and Gorter, C. (1997) Job search and commuting time, *Journal of Business and Economic Statistics*, **15**, 269-281.
- [26] Van Ommeren, J. and Rietveld, P. (2005) The commuting time paradox, *Journal of Urban Economics*, **58**, 437-454.

Tables

Table 1: Wage equation. Spain. 1965-2002.										
Dependent variable: w_t . Method: OLS.										
	c_t	w_{t-1}	g_t	θ_t	u_t	Δu_t	b_t	Δg_t	$s.e.$	LL
[E1]	0.24 (1.46)	0.95 (44.1)	-0.01 (-0.40)						0.021	94.3
[E2]	2.66 (2.64)	0.68 (6.05)	-0.08 (-1.92)	0.33 (2.44)					0.019	97.3
[E3]	3.32 (3.62)	0.64 (6.27)	-0.10 (-2.60)	0.44 (3.55)	-0.29 (-3.18)				0.017	102.4
[E4]	4.26 (5.09)	0.53 (5.80)	-0.08 (-2.33)	0.55 (4.92)	-0.35 (-4.40)	0.68 (3.50)			0.015	108.6
[E5]	5.02 (5.20)	0.48 (5.04)	-0.08 (-2.43)	0.41 (2.87)	-0.30 (-3.55)	0.51 (2.31)	0.09 (1.51)		0.015	109.9
[E6]	5.55 (5.47)	0.43 (4.20)	-0.09 (-2.62)	0.43 (3.04)	-0.25 (-2.68)	0.52 (2.37)	0.11 (1.78)	-0.27 (-1.46)	0.015	111.2
Misspecification tests										
	$SC[\chi^2(1)]$	$LIN[\chi^2(1)]$	$NOR[\chi^2(2)]$	$HET[\chi^2(1)]$	$ARCH[\chi^2(1)]$					
[E1]	0.46 [0.500]	11.2 [0.001]	9.09 [0.011]	2.81 [0.93]	0.26 [0.609]					
[E2]	4.63 [0.031]	8.86 [0.003]	4.72 [0.094]	0.66 [0.417]	0.06 [0.801]					
[E3]	2.26 [0.133]	1.05 [0.306]	11.93 [0.003]	0.20 [0.658]	0.02 [0.880]					
[E4]	0.96 [0.326]	0.03 [0.857]	7.36 [0.025]	0.86 [0.354]	0.37 [0.545]					
[E5]	0.65 [0.421]	0.011 [0.918]	5.90 [0.052]	1.29 [0.257]	0.64 [0.422]					
[E6]	0.19 [0.666]	0.16 [0.690]	1.94 [0.379]	4.48 [0.034]	1.20 [0.274]					
Notes: t-statistics in parentheses; s.e.=standard errors; LL=Log likelihood. Probabilities in brackets; 5% critical values: $\chi^2(1) = 3.84$; $\chi^2(2) = 5.99$										

Table 2: Short and long-run elasticities with respect to g						
	[E1]	[E2]	[E3]	[E4]	[E5]	[E6]
ε_{w-g}^{sr}	-0.014	-0.083	-0.101	-0.080	-0.082	-0.087
ε_{w-g}^{lr}	-0.297	-0.263	-0.278	-0.171	-0.159	-0.152



