Unions, Wages and Productivity. The Spanish Case, 1986-2000

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1.- Introduction

The labor market is a crucial institution in any economy. It supplies firms with one of the inputs in the production process, labor. Moreover, it allows potential employees to find a job in accord with their preferences and skills. The smooth functioning of the labor market is thus a key piece in order for economic resources to be allocated efficiently. The performance of the labor market has also implications for relevant macroeconomic variables such as productivity, the unemployment rate or inflation.

The labor market, however, differs from conventional markets. One of the main divergences between these two categories is related to the fact that each potential employee does not negotiate the price and quantity of his services alone. Rather, he delegates an important part of this negotiation in the unions. Hence, to understand the mechanisms of a particular labor market we need to ascertain in depth the behavior of the unions operating in it and the consequences of such behavior.

It has been considered traditionally that one of the main role of unions is to ensure an adequate wage for employees. Accordingly, they strive for higher wages and, if they are successful, employees will earn a wage that exceeds the equilibrium wage (the wage that would prevail under perfect competition). The outcome of the negotiation, therefore, will be a wage that is typically higher than the one clearing the market.

More recently, unions have also been considered as promoters of *social capital* in the economy. According to this last view, they represent workers' petitions, exert a pressure aimed to improve conditions at the workplace and, more generally, act as a vehicle of transmission among employers and employees (the so called *exit voice* mechanism). The basic intuition underlying this idea is that unions may act as the voice of employees, thus easing communication with the employer and helping reduce the degree of job turnover and the training cost of new workers. The enhancement of working conditions, in turn, may increase inputs' productivity. (For a full explanation of this voice mechanism see Freeman (1980),

Freeman and Medoff (1984) and Booth (1995)). Checchi and Lucifora (2002) argue that unions can provide an insurance towards unemployment to workers.

The *exit voice* mechanism may contribute to improve the atmosphere at the work place and increase labor productivity, but it could also be the case that unions introduced distortions in the organization of the firm and spur antagonism among different categories of employees. These distortions, in turn, might damage efficiency and induce lower levels of output per worker. It could also be possible that unions reduced productivity if they imposed *make work*[1] practices, entailing that the number of employees exceed the optimal. The net impact of unions on productivity is thus ambiguous.

Empirical evidence has shown that that unions exert an upward pressure on wages. However, there is not such consensus on the sign of the effect of unions on productivity, according to the available evidence.

This lack of consensus can be partly attributed to the fact that unions affect productivity through two different channels. First, they have a direct impact on the degree of efficiency of the firm, which in turn will be positive if the exit voice effect is large enough or negative if the outcome of the unions' activity is a disruption in the social climate in the firm. Second, unions exert an indirect effect on productivity through changes in wages.

The pressure induced by unions on the relative price of labor changes the quantity demanded by the firm and thus the magnitude

[1] This term refers to some procedures imposed by unions within labor deals.

of output per worker. Thus, even in the cases in which the exit voice mechanism entailed substantial rises in productivity, the sign of the total effect would still be unclear. It is not surprising that, while there is a certain accord on the sign of the impact of unions on wages[2], such a consensus is lacking when addressing the effect of unions on productivity.

A set of contributions that flourished following the seminal contribution of Brown and Medoff (1978) have studied empirically the changes in productivity favoured by unions. Examples of papers that report a positive impact of unions on productivity are Brown and Medoff (1978), Allen (1983, 1984, 1986, 1988), Clark (1980, 1984), Freeman and Medoff (1984), Benson (2000) and Green *et al.* (1996). More recently, Machin and Stewart (1996) have argued that financial performance (an indirect proxy for productivity) is lower in unionized establishments. García Serrano and Malo (2002) analyze Spanish data and find that unionization reduce gross worker flows (although an impact on job flows is not detected). Instead, other papers such as Delery *et al*. (2000) or Pencavel (2003) find little evidence in support of the voice mechanism. Paradoxically, studies of this sort for the case of the Spanish economy – where the power of unions has been historically larger - are sparser.

The Spanish labor market has some specific and interesting features. One of the most significant is perhaps the principle of *general efficiency* of agreements or mandatory extension of collective contracts that entails that collective bargaining has a large impact on

[2] See, for example, Blanchflower and Bryson (2002).

the whole economy. Moreover, and since in practical grounds this principle makes the services of unions tantamount to public goods, this principles renders irrelevant the distinction between members and non members of the unions when trying to measure the true influence of unions. This kind of arrangement is common in Europe, whereas in the US workers can chose between unionized and non unionized workplaces[3]. Another characteristic of the Spanish labor market is the large degree of wage inertia it presents, despite the high level of unemployment (the unemployment rate exceed 20% in the 80s and the early 90s). This inertia has been especially acute in the 80s although has decreased in the last decade.

Furthermore, the behavior of Spanish unions over time has not been uniform. This fact is consistent with some reforms that affected the Spanish labor market in the 90s and tried to reduce some of its rigidities. In the early 90s the government implemented a package of measures intended to increase flexibility in the labor market. In particular, temporary agreements were encouraged. This policy, however, entailed a heavy segmentation of the labor market. The main goal of the social agents was not so much to get increases in wages but to improve the degree of stability in the job. As a result of this performance, the 90s have envisaged a considerable effort in the reduction of labor costs, tacitly accepted by unions[4]. Whereas in the second half of the 80s the average increase in labor costs was 6%, in the 90s this figure did not reach 3%. Increases in wages agreed by

[3] For an interesting description of the features of European unionization, see Checchi and Lucifora (2002).

collective bargaining have been even negative in 1994, 1995 and 2000.

This paper pursues an empirical analysis of the connection between unionization, wage increases and productivity changes for the Spanish economy over the period 1986-2000.

The structure of the paper is as follows: Section 2 designs a model that distinguishes two channels through which unions may affect productivity and provides a theoretical background for the empirical analysis. Section 3 describes the data and main results of the estimations pursued. Section 4 offers some concluding remarks.

2.- Theoretical Background

As it was said above, the influence of unions on the firm may be decomposed in two main sorts of effects:

A direct impact on productivity, particularly through mechanisms of the exit-voice sort.

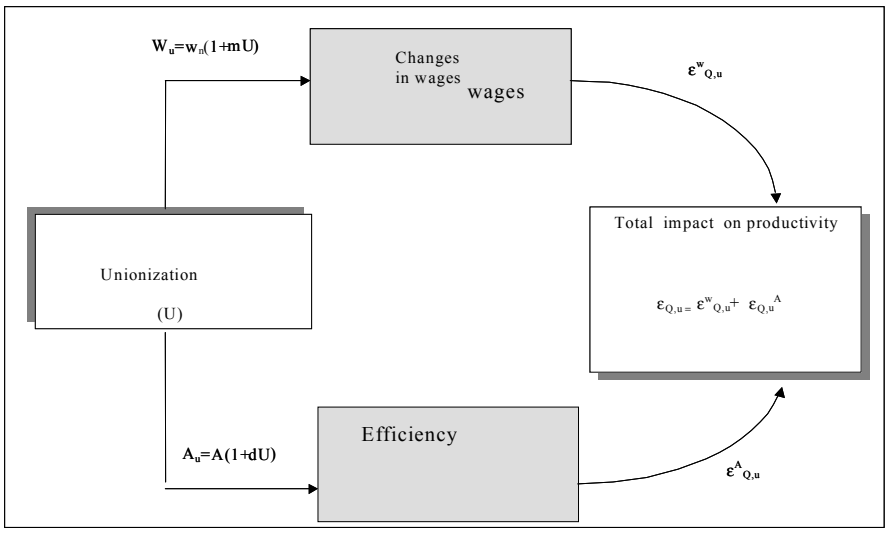
A pressure in wages, that indirectly alters the quantity of labor hired by the firm, and ultimately brings about changes in productivity.

To pin down the impact of unions on productivity is a complex task since the total effect will be the result of several partial influences. A natural way to ascertain whether unions increase or decrease productivity is to estimate both the direct and indirect effects

[4] Blanchflower and Bryson (2002) also document a reduction in the wage premium induced by unions in the US and UK economies from 1994 onwards.

mentioned above (direct impact on productivity and indirect effect through changes in wages) separately and add up the results[5].
This section presents a model, inspired in Clark (1984), that tries to disentangle the two effects mentioned above by means of using elasticities.

We define the elasticity of labor productivity to unions as the changes in productivity induced by the presence of unions (measured in percentage points). This elasticity, in turn, can be decomposed in two terms: the impact of unionization on labor productivity through changes in wages (elasticity-wages), that we denote by $\varepsilon^{W}_{Q,U}$ and the impact of unionization on labor productivity through modifications in efficiency, $\varepsilon^{A}_{Q,U}$ (elasticity-efficiency). These ideas are summed up graphically in Fig. 1.



[5] Most papers that deal with the connection unions-productivity focus in the first of these two effects. They do not consider, however, the indirect effect that unions may exert on productivity by their impact on wages.

Fig. 1. Impact of unions on productivity

Next we proceed to derive and obtain an analytical expression for these elasticities. This expression depends on: a) the technology of production, b) the wage-settings process, and c) the structure of markets.

a) The technology of production is Cobb Douglas of the form

$$Q = A K^{\beta} L^{\alpha}$$
$$\alpha + \beta = 1$$

where Q is output, L is labor, K is capital and A is Total Factor Productivity (TFP). α and β are technological parameters.

b) The wage-setting process is conditioned by trade unions. Trade unions press through collective bargaining in order to bring about wage increases for workers. Following Lewis (1963), we assume that the wage that comes out from the negotiation W_u is related to the competitive wage W_n (the one that would prevail in absence of unions) through eq. (1):

$$w_u = (1 + mU)w_n \qquad m > 0 \tag{1}$$

where mU represent the margin of union presence, and U captures the degree of unionization, as measured, for example, by the number of workers affiliated to the union, by the number of workers affected by collective bargaining or, alternatively, by different indicators that capture union presence.

c) The structure of the labor's market is assumed to be imperfect competition, because the level of wages is influenced by unions. We also assume that the industry is in a long run equilibrium position and therefore in the long run the profits of the firm are cero.

2.1 Elasticity of Output with Respect to Unions through Wages

The firm in this model is profit-maximizing. The profit function can be written as:

$$\pi = pAK^{\beta}L^{1-\beta} - wL - rK \tag{2}$$

where r is the rental price of capital and w is the wages. From the first-order conditions for the maximization problem gives

$$p(1-\beta)A\left(\frac{K}{L}\right)^{\beta} - w = 0 \tag{3}$$

then

$$pA\left(\frac{K}{L}\right)^{\beta} = \frac{w}{1-\beta} \qquad (4)$$

substituting this expression in the profit function the capital-labor ratio can be written as

$$\frac{K}{L} = \left(\frac{(1+mU)w_n}{r}\right)\frac{\beta}{\alpha} \qquad (5)$$

and labor productivity is

$$\frac{Q}{L} = A\left(\frac{K}{K}\right)^{\beta} = \frac{A}{\left(\frac{\alpha}{\beta}\right)^{\beta} w_n{}^{-\beta} r^{\beta}} \qquad (6)$$

From eq. (6) we can compute the elasticity of productivity with respect to wages (eq. (7))

$$\varepsilon_{Q/L,w} = \left(\frac{\delta Q/L}{\delta w}\right)\left(\frac{w}{Q/L}\right) = \beta \qquad (7)$$

Using assumption (1) above and substituting w_n by w_u yields:

$$\frac{Q}{L} = \frac{A}{\left(\frac{\alpha}{\beta}\right)^{\beta} \left[w_n(1+mU)\right]^{-\beta} r^{\beta}} \qquad (8)$$

and the elasticity of productivity with respect to unions via wages $\varepsilon_{Q/L,u}{}^{w}$ can be computed as:

$$\varepsilon^{w}_{Q/L,U} = \left(\frac{\delta Q/L}{\delta U} \right) \left(\frac{U}{Q/L} \right) = \beta \left[\frac{mU}{1+mU} \right] \quad (9)$$

Eq. (9) is increasing in U: higher presence of unions will induce larger values of this elasticity. $\varepsilon_{Q/L,U}{}^{w}$ will be positive as long as the margin m is positive.

2.2 Elasticity of Productivity to Unions through Changes in Efficiency

So far we have considered the changes that can be induced in output through variations in wages. Unions, however, not only can affect wages but also may exert some impact on the organization of the firm. In effect, as argued above, unions may lead to gains in productivity through improvements in the climate of social relations within the firm and in the motivation of workers.

The influence of unions on production through this last channel can be also computed from a Cobb-Douglas production function such as eq. (10):

$$Q = A\,(U)\,K^{\beta}L^{\alpha} \quad (10)$$

where *A(U)* is a function of the degree of unionization of the form:

$$A(U) = A\,(1+dU) \quad (11)$$

To grasp the intuition behind eq. (11), we can think of A as the level of total factor productivity (TFP) that would be achieved in absence of unions whereas A(U) is TFP considering the presence of unions.

U captures the degree of unionization in that particular sector. d measures the magnitude and sign of the impact of unions on the organization of the firm. If this impact is positive (negative) d will also be larger than (smaller than) zero. The rest of the assumptions are the same as in the first case.

The elasticity of productivity to unions via improvements in efficiency can be computed following a similar procedure as above. For an industry under perfect competition and constant returns to scale, labor productivity and elasticity are given by eq. (12) and (13) respectively:

$$\frac{Q}{L} = \frac{A_n(1+dU)}{\left(\frac{\alpha}{\beta}\right)^{\beta} w^{-\beta} r^{\beta}} \tag{12}$$

$$\varepsilon_{Q,U}{}^{A} = \left(\frac{\delta(Q/L)}{\delta U}\right)\left(\frac{U}{(Q/L)}\right) = \left[\frac{dU}{1+dU}\right] \tag{13}$$

2.3 Total Elasticity of Productivity to Unions

Now it is straightforward to compute the total sensibility of the ratio Q/L to unionization, which will be given by the sum of eq. (9) and (13):

$$\varepsilon_{Q/L,U} = \left(\frac{\delta(Q/L)}{\delta U}\right)\left(\frac{U}{(Q/L)}\right) = \left[\frac{\beta m U}{1+mU} + \frac{dU}{1+dU}\right] \tag{14}$$

The first term in the right hand side of eq. (14) captures the sensibility of productivity to unions as far as wage negotiations are concerned. If m is positive, then the presence of unions is positively correlated with productivity. The second term captures the sensibility of productivity to unions via changes in the organization of the firm. The sign of this term depends crucially on d. If $d<0$, then unionization ends up in lower levels of productivity. If $d>0$, the sign of the total effect of unions on productivity depends on the relative magnitude of the individual effects. If both effects are equal in magnitude, then unions will not affect productivity.

3.- Empirical Analysis

This section will pursue an empirical exercise that estimates the impact of unions on productivity. We proceed in two steps. First, we estimate the wedge m that unions impose on wages. Second, we estimate the influence of unions on efficiency by means of estimating d.

As a first step we need to define three categories of wages. W_{ni} is the equilibrium wage in the i^{th} industry in absence of unions. It captures idiosyncratic features of the sector such as productivity or unemployment. W_{ei} is defined as the wages in presence of unions. They are affected by unionization and by the nature of collective bargaining. The links between the two categories of wages can be described as:

$$W_{ei} = W_{ni} (1 + m_1) \qquad (15)$$

where m_1 is the wage premiums achieved by unions.

Eq. (15) means that wages established under collective bargaining, can be computed as the wages that would be fixed in absence of negotiation plus a margin due to unionization and bargaining.

Dividing (15) through L (the number of employees) and taking logs we get:

$$\ln (W_{ei}/L) = \ln (W_{ni}/L) + \ln (1 + m_1) \quad (16)$$

The next step consists in assuming that the wage in each sector can be computed as a geometric average of the following terms: wages fixed under bargaining and wages fixed in absence of bargaining. Thus wages in sector i^{th} can be computed as (17):

$$W_{ui} = W_{ei}^{Pe} W_{ni}^{Pn} \quad (17)$$

where P_e, and P_n are the percentage of employees affected by unions and not affected by unions respectively. Dividing through by L and taking logs we have:

$$\ln (W_{ui}/L) = P_e \ln (W_{ei}/L) + P_n \ln (W_{ni}/L) \quad (18)$$

Plugging in (16) in (18) yields:

$$\ln (W_{ui}/L) = P_e \ln (W_{ni}/L) + P_e \ln (1 + m_1) + P_n \ln (W_{ni}/L) \quad (19)$$

Employing the approximation $\ln(1+m_1) = m_1$, and rearranging terms we get:

$$\ln (W_{ui}/L) = P_e m_1 + (P_e + P_n) \ln (W_{ni}/L) \quad (20)$$

$$\ln (W_{ui}/L) = P_e m_1 + \ln (W_{ni}/L) \quad (21)$$

According to (21) the average salary in sector i^{th} is a function of the proportion of employees affected by margins imposed by unions. Generally speaking, the exact value of W_{ni} will be unknown. However, it can be estimated assuming that wages depend on a set of variables according to a function of the form:

$$\ln(W_{ni}/L) = f(X_i) + \varepsilon_{i1} \quad [6]$$

The variables that encompass the X vector will be detailed below. Plugging this expression in (21) yields:

$$\ln (W_{ui}/L) = P_e\, m_1 + f\,(X_i) + \varepsilon_{i1} \qquad (22)$$

From the estimation of (22) we can recover the coefficients m_1.

4.- Data and Variables

The empirical analysis pursued has been divided in two subperiods: 1986-1992 and 1993-2000. The reason for this division is related to the data. In 1992 the methodology employed by the National Institute of Statistics changed and the series constructed before and after this year are not homogeneous.

For the subperiod 1986-92 we have used a data panel of 88 activities obtained from the Industrial Survey of Firms. The dependent variable is wage per worker, measured in real terms. The deflator employed is the index of industrial products. The regressors,

[6] Alternatively, we could assume that Wni is fixed within a insider-outsider model, along the lines of Layard *et al*. (1991).

following Fernández and Montuenga (1997), include two sets of variables. The first one considers the aspects that determine the wage internally, while the second set refers to conditions in the labor market. Among the first we have included output per worker, the average size of the firm, a proxy of human capital and hours worked per employee. In the second group we have included the first lag of the wage in that particular sector and unemployment (both at the aggregate and the sector's level)[7].

The degree of unionization has been captured by several indicators which are combined to form an index of unions' presence (U). A single indicator of unions' presence may not account for the whole effect. Here, we consider simultaneously five variables that incorporate information on unions' impact: the number of employees affected by agreements at the firm level (Le), the number of the employees covered by agreements of higher scope (Lo), the average rise of wages attained by agreements at the firm level (We), and of higher scope (Wo), and finally the number of wasted days on strikes (H). This index is constructed by principal component analysis as a linear combination of these variables[8]:

$$U = \alpha_1 Le + \alpha_2 Lo + \alpha_3 We + \alpha_4 Wo + \alpha_5 H \qquad (23)$$

[7] The variable average hours worked per employee has been included to control for the fact that collective bargaining may affect not only wages but also the number of hours that encompass the working day.

[8] This index is similar to the one used by Machin (1990).

The main problem now is how to assign the appropriate weight to each of the component of the index. We solve this by estimating the first principal component (Fc) and using the correspondent coefficients as the weights of the index. It is interesting to note that four weights are positive (Le, Wo, We, and H) and one is negative (Lo). Hence the value of the index will be higher in those industries in which the number of employees affected by agreements at the firm level is greater, the rises of wages entailed by agreements at the firm level and at a higher level are more pronounced (We and Wo), the number of wasted days on strikes is larger (H) and the number of employees covered by agreements of wider scope is reduced (Po).

In the subperiod 1993-2000 we have used data from 100 branches, from the *Encuesta Industrial de Empresas* (Industrial Survey of Firms). The variables included in the analysis are the same as in the first subperiod.

5.- Main Empirical Results

a) Wages

We have pursued the estimation of the wage equation by means of the Generalized Method of Moments (GMM). The estimation includes a lag of the wage cost in order to capture wage inertia.
We have also considered the possibility of treating productivity (Va) as endogenous variables. Accordingly, we have used as instruments the first lag of this variable. Other regressors are: hours worked (Hr), the number of establishments per worker (T), the index of union presence and the stock of human capital, (H) measured by the

percentage of employees that enjoy a certain level of studies (primary studies).

Results are displayed in table 1 (unionization is captured by Fc). The main messages of the estimation can be summarized as follows:

1. The point estimate of the first lag of the wage exhibits a rather high value. It is close to 0.8 in the subperiod 1986-92. In the second subperiod, however, the coefficient is around 0.5. A preliminary interpretation of this result is that wage inertia has been acute in the 80s but has decreased over time. This is consistent with the larger degree of flexibility that the Spanish labor market has acquired in the 90s when compared to the 80s.

Results suggest that unions might have imposed a premium to wages in collective bargaining over the subperiod 1986-92, since the coefficients associated to Fc are positive (but not significant at conventional levels, column 1 and 2). This is not the case, though, in 1993-2000, since the signs of both coefficients (column 3 and 4) are negative. This result is in accord with the idea that unions pursued a strategy of moderation in bargaining from 1994 onwards (Fina *et al*. (2001a, 2001b)).

The link between industry unemployment and labor costs over the subperiod 1993-2000 is found to be positive. In other words, the decrease in unemployment has been accompanied by a reduction in wages. This can be attributed, in turn, to the greater social commitment of agents, and in particular of unions, that arose in the 90s. This attitude entailed a moderation in wage demands when negotiating, despite the fact that unemployment was also decreasing.

Finally, the coefficients associated to productivity and hours per employee are positive and significant in both subperiods[9].

Table 1: Wage cost estimation (unionization captured by Fc)

	(1) GMM1 1986-92	(2) GMM1 1986-92	(3) GMM1 1993-2000	(4) GMM1 1993-2000
W_{-1}	0,78 (9,8)	0,85(9,6)	0,46(4,9)	0,26(2)
Va	0,36 (6,3)	0,22(2,73)	0,32(4,5)	0,5(5,7)
Us	-0,002(-	-0,002(-0,5)	0,01(1,1)	0,03(2,5)
H	0,5)	----	0,004(1,5)	0,004(1,3)
Hr	-0,03(-	0,33(1,53)	0,31(2,6)	0,25(1,6)
T	1,1)	-0,09(-2,3)	-0,03(-1,3)	-0,04(-1,7)
Fc	0,29(1,5)	0,018(1,6)	-0,02(-1,8)	-0,004(-0,2)
	-0,08(-			
	1,7)			
	0,01(1,5)			
Instruments	W(3)	W(3) Va(3)	W(3)	W(3) Va(3)
Range	1988-92	1988-92	1995-2000	1995-2000
Sargan test	11,13	32	33,2	40,44
Degr. Of freedom	(11)	(22)	(14)	(28)

[9] Fernández and Montuenga (1997) suggest that wages are influenced by productivity only in laggard sectors, whereas in more dynamic sectors this link can not be detected.

M1	-3,4	-3,5	-4,9	-4,5
M2	-1,1	-1,3	0,9	-0,5

Notes: Dependent variable is wage cost.

a) T statistics in parenthesis.

b) Autocorrelation of first and second order has been tested by the statistics M1 and M2, respectively. These tests are follow a N(0,1). In estimation in first differences correlation appears by construction. The null hypothesis is the absence of correlation. The number in parentheses are the p-values.

c) The test for the validity of instruments is the Sargan test. Under the null of valid instruments this statistic is distributed as a χ^2_n, where n is the number of overidentifying restrictions.

The theoretical model presented above, together with the results got from the estimation, allows to compute the sensibility of productivity to the presence of unions $\varepsilon_{Q/L,u}^{w}$, by using eq. (24):

$$\varepsilon_{Q/L,u}^{w} = \beta \times [mU/(1+mU)] \qquad (24)$$

where U captures the degree of unionization and has been considered to be the point estimate of the index value in the estimations pursued above. Since this variable has not been significant in the estimations, we assume that d is equal to zero and the elasticity is also zero.

This result should be taken with caution. It is perhaps too risky to say that unionization has not had any influence in the wages of firms over the period considered through variations in productivity.

Nonetheless, the tentative conclusion we may derive from this exercise is that the measures of unionization employed here do not suggest a relevant impact of unions on wages via changes in productivity.

b) Elasticity of productivity to unions through gains in efficiency

So far we have computed the response of productivity to unions through changes in wages. Next we shall analysis that answer via changes in efficiency. The impact of unionization in this regard can be measured by two different ways: considering that unions increase labor efficiency, along the lines of the model of Brown and Medoff (1978), or assuming that unions increase the efficiency of all inputs. We have chosen this second option.

In accord with the analysis stated above, now we shall capture the presence of unions through the parameter A in the production function[10]. In particular:

$$Q_i = A_n (1+dU_i) K_i^{\beta} L_i^{\alpha} \qquad (25)$$

dividing through by L_{it} and taking logs yields:

$$\ln (Q_{it}/L_{it}) = \ln A_n + dU_{it} + \beta \ln (K_{it}/L_{it}) + (\alpha + \beta - 1) \ln L_{it} \qquad (26)$$

where $\alpha + \beta$ represent the (constant) returns to scale, i indexes sectors and t time.

[10] Following Serrano (1996) we could introduce as an additional input in the production function the stock of human capital. Thus the production function would be:
$Q = A K\alpha H\beta L(1-\alpha-\beta)$
Under constant returns to scale, dividing by the number of employees yields:
$Ln (Q/L) = \ln A + \alpha \ln (K/L) + \beta \ln (H/L)$

The dependent variable is measured as added value per worker, deflated by the index of industrial prices. The regressors are: capital stock (K), the number of employees (L), the number of establishments per worker (T), some proxies for the degree of unionization –as above, an index of the union presence- and the stock of human capital, (H) measured by the percentage of employees that enjoy a certain level of studies (primary studies).
It could be the case that capital and labor were not strictly exogenous variables and thus the prerequisites for a valid within estimator would not be fulfilled. To overcome this possibility we have employed an instrumental variables estimator. (column 2 and 4). The method of estimation chosen is the Generalized Method of Moments (GMM) (Arellano and Bover (1990)). Table 2 displays the main results obtained from the estimations pursued when capital and labor are instrumented by three of their own lags. We show the results got from One Step GMM (GMM1) and Two Steps GMM (GMM2). Results from GMM1 seem more plausible. The comparison of the results obtained from GMM1 and GMM2 suggests that GMM2 estimates may be less precise due to a downward finite sample bias[11].
The point estimates of K and L display values in accord with the literature and are significant at conventional levels. Human capital and size of firms are also positively and significantly correlated with productivity. Proxies of unionization display negative signs and are significant in the GMM1 and GMM2 specifications.

[11] A similar result is documented in Arellano and Bond (1991)

Analogous estimations have been made for the subperiod 1993-2000. The main conclusions obtained for the first subperiod carry over to the second. Again, the coefficients associated to proxies of unionization are significant. The size of firms displays a negative sign, which can be attributed to some kind of agglomeration effect whereby in larger establishments it is easier to achieve a higher level of productivity.

Table 2: GMM Estimations of the production function, Fc.

	(1) first differences 1986-1992	(2) GMM1 1986-1992	(3) first differences 1993-2000	(4) GMM1 1993-2000
L	0,12(0,7)	----	-0,17(-1,3)	----
H	0,03(0,8)	0,16(2,4)	0,005(1,2)	0,018(2,8)
K	0,07(2,4)	0,39(5)	0,007(0,5)	0,16(6)
T	----	0,04(0,3)	-0,07(-1,5)	-0,11(-1,7)
Fc	-0,03(-3,2)	-0,05(-2,2)	-0,07(-4)	-0,12(-5,1)
Range	1987-92	1987-92	1994-2000	1994-2000
Sargan	----	24	----	44,5
Deg. Of freedom		14		17
M1	-0,9	-2,5	-1,7	-3

M2	0,5	0,7	0,6	-0,7

Note: t statistic in parenthesis.

Once the parameter d is estimated, we could compute the elasticity of productivity to unionization using eq. (27):

$$\varepsilon^{A}_{Q/L,u} = [dU/(1+dU)] \quad (27)$$

where U is the measure of unionization.

The elasticity may be computed for each sector and year. Since we are interested in the differences across sectors, however, we shall not compute the elasticity on a yearly basis. Rather, we take the average of the measure of unionization over the period considered.

Table 3: Elasticity of output to unionization through productivity, 1986-2000.

	$\varepsilon_{Q/L,u}^{A}$*(1986-92)*	$\varepsilon_{Q/L,u}^{A}$*(1993-2000)*
1.- Coal extraction	-2,5	-3,8
2.- Petrol and radioactive minerals extraction	-1,8	-0,8
3.- Electricity and water	-1,4	-2,3
4.- Metallurgy	-1,4	-1,5
5.- Non metallic mineral	-1,3	-2,0

extraction		
6.-Chemistry	-1,2	-1,7
7.- Elaboration of metallic products	-1,3	-1,8
8.- Machinery and electrical material	-1,4	-0,8
9.- Transport	-1,4	-1,7
10.- Precision tools	-1,1	-1,7
11.- Food	-1,3	-2,0
12.- Textile	-1,2	-1,7
13.- Leather, footwear	-1,2	-1,2
14.- Wood, cork and furniture	-1,0	-2,0
15.- Paper sheet	-1,2	-1,3

Notes: Column 2 and 3: the values employed for d are –0,05 and –0,12 (i.e. the coefficients associated to Fc in estimation number 2 and 4, Table 2).

The elasticity measured varies between -0,8 and –3,8. The largest value of the elasticity corresponds to those sectors where the number of wasted days on strikes has been very high and the coverage of firm agreements exceeds the 50% of the employees.

In order to combine both effects, via wages and via the productive process, we use eq. (14) above:

$$\varepsilon_{Q/L,\,u} = \beta\, mU/(1+mU) + dU/(1+dU) \qquad (28)$$

Since the elasticity to unionization via wages is zero, total elasticity is tantamount to the response of productivity to unions via productivity (already displayed in table 3).
These results suggest that in the 80s and 90s Spanish unions have had a negative influence in the productivity of labor, especially via decreases in productivity. The impact of unions on productivity via productive process is larger in 1993-2000 than in 1986-92.

6.- Concluding Remarks

Unions may affect output through two channels: first, unions exert pressures on wages, and this alters the demand of labor by the employer and hence the productivity of labor. Second, unions may affect the level of efficiency in the firm and thus have impact on labor productivity.
This paper has described a procedure that allows to disentangle and measure these two effects. The main originality of the models rests on the decomposition of elasticity in two components (the elasticity of productivity to unions through changes in wages and the elasticity of productivity to unions via changes in the productive process) that can, in turn, be added up.
Next we have pursued an empirical exercise using data from the Spanish economy. The data cover two subperiods: 1986-92 and 1993-2000.

Since Spanish employees do not need to belong to a union in order to profit from the outcomes of collective bargaining, data of union affiliation are not very representative. We have used instead an index of union presence as a proxy for unionization.

The main messages of the estimations are the following:

a) Unions seems to have brought about positive margins on wages in the 80s, but they are statistically insignificant. This margin is not observed, however, in the 90s. This result is in accord with the recent economic history of Spain whereby the 90s have envisaged a considerable effort of reduction of labor costs.

b) Wage inertia, understood as an sluggish adjustment of labor costs, is rather high in the 80s but smaller in the 90s.

c) Unionization, as captured by an index, is positively correlated with wage increases in the 80s but not in the 90s, and its influence over the productivity has been negative in the last twenty years. Hence, the data available for the Spanish economy do not confirm the conclusions of the exit voice models, according to which unions may improve communication between employers and employees, thus improving motivation and the atmosphere at the work place.

d) The sensibility of labor costs to changes in employment is small. This is consistent with the high degree of rigidity in the Spanish labor market.

Finally, these results should be considered with caution since the scope of conclusions are limited by the availability of data, in particular those that capture the degree of unionization.

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