Labour demand in Uruguay before and after re-unionisation

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ABSTRACT

This paper examines a unique situation in Uruguay where before-after comparisons about the impact of collective bargaining can be made. During the period under study there were three distinct regimes: (1) 1975-1984 when bargaining was banned, (2) 1985-1991 when there was tripartite bargaining, and (3) 1992-1997 when there was bargaining without government involvement. During the third regime the economy became much more open, which would presumably also have an effect on bargaining results.

Strong evidence of a change in economic behaviour after 1985 is reported. Based on this evidence, a standard labour demand model, derived from a neoclassical framework, for 1975-1984 and a right-to-manage bargaining model for 1985-1997 are estimated. The results show that the long run wage elasticity of labour demand and the employment-output elasticity fell sharply, while there was no overall change in the amount of time needed for employment to adjust to its equilibrium level. The bargaining model results indicate that unions significantly raised wages in 1985-1992. Afterwards, the change in the bargaining structure and the increased openness had a pronounced effect on bargaining outcomes. The overall impact of unions has been a much higher level of wages at the cost of a lower level of employment.

RESUMEN

Este artículo examina una situación única en Uruguay, donde es posible realizar comparaciones sobre el impacto de las negociaciones sindicales en el mercado de trabajo analizando las mismas industrias en un período en el que los sindicatos están activos y otro en el que no lo están. Durante el período bajo estudio existieron tres regímenes diferentes: (1) 1975-1984 cuando las negociaciones no existían, (2) 1985-1991 en que la negociación era tripartita, y (3) 1992-1997 cuando las negociaciones se realizaron sin intervención del gobierno. En este último subperíodo, la economía se volvió más abierta, lo que también habría tenido, presumiblemente, efectos sobre los resultados de la negociación colectiva.

Se reporta evidencia sustentando un cambio en el comportamiento económico en 1985. Con base en ello, se estima un modelo estándar de demanda de trabajo, derivado de un contexto neoclásico, para el período 1975-1984, y un modelo de negociación colectiva donde las empresas retienen el poder de decidir el nivel de empleo (*right-to-manage*) para el período 1985-1997. Los resultados obtenidos muestran que la elasticidad empleo-salarios y la elasticidad empleo-producto cayeron sustancialmente a partir de 1985, mientras que no se detecta un cambio en la velocidad con la que el empleo se ajusta a su nivel de equilibrio. Los resultados del modelo de negociación colectiva indican que los sindicatos han permitido aumentar los salarios significativamente en 1985-1992. Después de esa fecha, los cambios en la estructura de la negocicación y el aumento en el grado de apertura de la economía, tuvieron importantes efectos sobre los resultados de la negociación. El efecto global de la acción sindical ha sido un mayor nivel de salarios a costa de un menor nivel de empleo.

I. Introduction•

The subject of how unions affect employment adjustment generates strong opinions. The prevailing view among many economists and policy analysts is that unions prevent labour market forces from operating effectively. Unions take a hard line in bargaining that prevents wages from falling, no matter how high unemployment has gotten. They resist attempts by management to streamline production and introduce new technology. They stand in the way of team-based production by clinging to outdated job descriptions and occupational jurisdictions. They insist on advance notice and severance pay arrangements that make it extremely costly to reduce employment.

Au contraire shout union supporters. Centralised negotiations provide a framework for wage adjustments to take place more rapidly than they would in a world where all bargaining is one-on-one. Unions see the handwriting of technological change on the wall as clearly as management, and also see that management does not think about implementation of new technology in the workplace until installation time. Joint committees provide a framework to make changes more productive by getting full input from employees on how to redesign jobs and processes. Rules on job security admittedly make downsizings more difficult, but other parts of union agreements make labour markets more effective by encouraging long term employment relationships and investments in firm-specific skills.

In Latin America the prevailing wisdom is that the former view is closest to the truth. Even though most markets have been liberalised, the labour market has been what Edwards (1995) calls "the forgotten sector." Welfare losses come from three main sources: (1) wages set above market clearing levels, (2) lost output and wages from strikes, and (3) rent-seeking activities such as support for protectionism and state ownership of industry.

Given these very strong views, one would think that there would be a massive research literature on how unions affect employment adjustment to changes in wages and output in Latin America. There is not. In the case of Uruguay, some theoretical work has been developed by Rama (1993a, 1993b, 1994) while there is some recent empirical research (Allen, Cassoni and Labadie, 1994; 1996; Cassoni, Labadie and Allen, 1995). Although there are numerous studies making union-nonunion comparisons for particular countries at particular time periods, they have generally concentrated on wage gains and wage gaps (Blanchflower, 1984; Freeman and Medoff, 1984; Hirsch and Addison, 1986; Lewis, 1986; 1990;) while employment differentials have been somehow neglected[1]. Regarding elasticities of substitution between labour and capital and among different types of labour, research has been even less prolific. In the US, it has been found that they are much lower in union than nonunion establishments (Freeman and Medoff 1982; Allen 1986). Further, Boal and Pencavel (1994) found some evidence suggesting the underlying production function is different depending on the sector being unionised or not. In the UK, Blanchflower, Millward and Oswald (1991) analysed the impact of unionism on the path of employment growth, finding significant differences, although their result has been critised for not being robust (Machin and Wadhwani, 1991). Another line of reserach that has been followed is that related to the influence of unions on the costs of adjusting the level of employment (Burgess, 1988; 1989; Burgess and Dolado, 1989; Lockwood and Manning, 1989 are examples).

Although all the above papers do illuminate one component or another of the effects of unions on wages and/or employment, they cannot address the issue of unions influence comparing the same establishment or

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[1] An extensive survey can be found in Pencavel, 1991 and Booth, 1995.

individual with and without union status. Does employment adjustment to changes in wages and output vary when the firm is unionised and when it is not? How long does it take to complete the adjustment in these two settings?

This paper examines these issues directly, using evidence from manufacturing industries in Uruguay from 1975 through 1997. Uruguay is well suited for such a study because the same industries can be observed in two consecutive subperiods, being unions absent in the first while they re-organised in the second. A military government took over in 1973 and stayed in power through 1984. Collective bargaining was proscribed during the military regime. Labour unions regained the right to bargain collectively with the return of democracy in 1985. As part of its anti-inflation policy, the national government played a significant role in negotiations. Legal regulations of work -which constitute public-order individual rights and therefore cannot be resigned under any circumstance- can be superseded by collective agreements. They can go beyond these restrictions, increasing (but not decreasing) the benefits that workers have in the area of minimum wages, working conditions, job security, and employee benefits. Tripartite negotiations took place at the industry level through "Wage Councils", allowing wage adjustment to vary by industry. If an agreement met the government's anti-inflation targets, then it would apply to all firms – even those with nonunion work forces -- in the industry once the agreement was officially endorsed.

The government stopped participating in this system in 1991. Some bargaining is still conducted through industry-wide Wage Councils, but increasingly it is being done at the company level. As a result there are three different bargaining regimes that can be examined in this study: before 1985 when bargaining was banned, 1985-1991 when there was tripartite bargaining, and 1992 to the present when the government did not participate in bargaining.

The primary focus of the paper is on estimating labour demand parameters under different bargaining regimes. The paper begins with background on the economy, the labour market, and collective bargaining in Uruguay (Section II), followed by a brief theoretical overview on unions and labour demand (Section III) and a description of the data (Section IV). The labour demand results (Section V) indicate a structural shift in the labour demand function occurred at about the same time as the return of collective bargaining. Wages are weakly exogenous to employment through 1984, but weak exogeneity is rejected afterwards. The elasticity of employment to wages and output fell by more than 50 percent after 1984. There is no change in the amount of time needed for the market to adjust, as indicated by the coefficient of lagged employment. Results from a bargaining model show that union wage demands are highly sensitive to the openness of the economy. The concluding section summarises and assesses these findings.

II. Background on Uruguay

II.I. Macroeconomic and labour market conditions

Traditionally, the Uruguayan economy has been subjected to a series of global and regional shocks, particularly those coming from Argentina (Favaro and Sapelli, 1986) and this has continued to be so during the last 25 years. At the beginning of the sample period (1975), the Uruguayan economy was still recovering from the oil shock of 1973 and the ensuing global recession. These conditions were exacerbated by the European Community's decision in 1974 to stop importing beef. Unemployment was above 10 percent in 1976-1978 (see Figure 1).

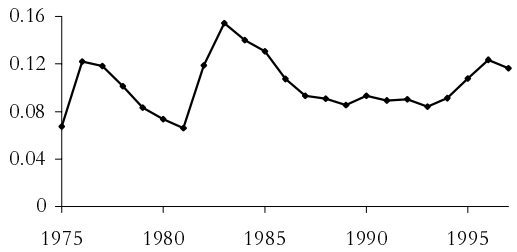
The economy recovered in the late 1970s in response to a series of steps to liberalise financial markets and promote exports. Growth accelerated when the government adopted a preannounced schedule of monthly devaluations with the rate of devaluation declining gradually over time. Global economic conditions were not kind to this schedule; by the early 1980s, the net result was a highly overvalued currency which had to be

devalued in the global recession of 1982. Unemployment had fallen to 7 percent by 1980-1981, but increased to 15 percent in 1983 and stayed above 10 percent through 1986. GDP decreased by 15.9 percent in three years.

By 1988 Uruguay had successfully recovered from this deep recession. The economy grew 8.9 percent in 1986 and 7.9 percent in 1987, supported by an increase in demand from Brazil, which was implementing a stabilisation plan (Plan Cruzado). Exports grew and the public deficit decreased to 4.2 percent of GNP in 1987. In 1989, however, the favorable regional environment changed, the public sector deficit grew to 7 percent and a stabilisation plan was implemented by the new government elected in 1990. These policies have resulted in a sustained, steady decline in inflation from 129 percent in 1991 to 15 percent in 1997.

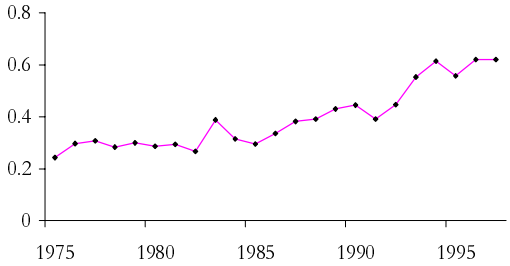
During the 1990s, together with the regional shocks, a domestic stabilisation plan and an increase in the openness of the economy had significant effects on macro and industry perfomance (as shown in Figure 2, where openness is defined as the ratio of imports plus exports to GDP). The Argentinian "Plan de Convertibilidad", imposed in April 1991, improved relative competitiveness for Uruguay, with exports to that country increasing 130 percent in 1991 and 74.3 percent in 1992. Expanded trade with Argentina, no small part of which consisted of tourism, and a deterioration of the real exchange rate meant that growth in the service sector far outstripped growth in goods production. Within the latter, the actual impact depended upon exposure to external competition.

Figure 1: Unemployment rate



Source: National Institute of Statistics (INE).

Figure 2: Openness



Source: Bank of the Republic of Uruguay (BROU); Central Bank of Uruguay (BCU).

Besides the domestic stabilisation plan, during the period 1990-1992, a series of trade policy measures consolidated the opening of the economy that had started in the mid-1970s, during the military regime, but that was discontinued in the early 1980s. In 1982, the highest tariff was 55 percent and after a temporary increase in 1985, a gradual decrease started in 1986, which ended with a maximum tariff of 40 percent in 1989. The pace of these changes accelerated in 1991-1993. By 1993 the highest tariff was 20 percent. Together with these reductions, many non-tariff barriers and sectoral privileges (like those given to the automotive industry) were removed, and export subsidies were reduced (de Brun and Labadie, 1997). These unilateral trade policy changes were accompanied by a series of regional tariff reductions as a consequence of the creation of the Southern Cone Common Market (MERCOSUR). By 1995 a great number of Uruguayan products could circulate among its members, Argentina, Brazil, Paraguay and Uruguay, without any tariff. The exceptions to the Common External Tariff are subject to a calendar that was established in December 1994. Economic conditions deteriorated since 1994, largely in response to high unemployment generated by the "tequila effect" in Argentina. Unemployment increased to 11 percent in 1995 and 12 percent in 1996-1997. Unemployment held steady around 9 percent between 1987 and 1994.

The manufacturing sector has been severely affected by all the above. Its share in total output has gone down from 25-27% at the beginning of the period to 18% in 1997. Employment in manufacturing grew until 1989,

but it has decreased significantly since then, to unprecedented levels. This decrease reflects the impact of trade liberalisation as some establishments cut back production, whereas others raised productivity to compete.

II.2. Collective bargaining[2]

When parliament was closed by the military in June 1973, the union confederation CNT launched a general strike. The government reacted by banning union activity and giving employers the right to dismiss anyone who did not return to work. Many union leaders were jailed; the others went into hiding or exile. The union movement began a political comeback in the early 1980s, with a series of demonstrations and general strikes organised by a new confederation, but there was no bargaining until the return of democracy in 1985.

In the absence of unions, employers were relatively freer to adjust wages and employment. Wage increases were limited to lagged inflation. This policy, along with high unemployment, was accompanied by a 49 percent decrease in real wages from 1973 through 1984. Employment adjustment also became more flexible. Interview evidence compiled by Handelman (1981) indicates that after the ban on unions, many employers used the opportunity to get rid of trade union officials and excess employees. Dismissals of public sector workers also were permitted by law between 1977 and 1984 (Gillespie, 1991). On the supply side, there was a surge in emigration precipitated by political repression and high unemployment. Taking into account all of these factors, it is clear that the Uruguayan labour market was exposed to strong competitive forces during the ban on unions.

Starting in 1985, Uruguay's unique system of wage councils was reinstituted. Collective bargaining in the private sector in Uruguay had traditionally operated mainly through a system of trilateral wage councils that set minimum wages by industry and labour category. Wage levels were adjusted three times a year through 1990; since then, accumulated inflation since the last adjustment had to pass a specific threshold for wages to be adjusted. Often the Wage Councils agreed to a formula that will be in effect for 16 to 24 months, allowing adjustment to take place without a formal meeting. If the government delegates gave their consent to the wage agreement, it applied to the entire sector, not just to the firms and unions involved in the bargaining. Government approval usually required keeping wage increases in line with official inflation targets. Direct negotiation between the union and the firm was also practiced, especially in manufacturing.

In 1991 there was a significant change in the structure of negotiations. The government stopped participating in bargaining. The terms of the contract bind only those firms and unions that are actually represented in the negotiation. Wage Councils only meet in a few sectors and the result, to be shown below, has been a sharp drop in union density in the private sector.

Much bargaining now takes place at the company level. Membership is not compulsory and union dues are voluntary in most cases. In 1988, only three years after unions were legal again, the single National Central Union reported a total of 188,000 members and five years later, in 1993, 177,000 members, belonging to 17 federations and 359 unions. In 1996, there were 164,000 in the National Central, but some unions are not members of it. By 1993, 54 percent of the membership belonged to the public sector, which has had the smallest drop in its number of affiliates.

The role that collective agreements play in introducing rigidities could be very significant, varying in degree depending on union density and the specific clauses of the contracts, that include wage adjustments, minimum wages by job categories, length of work day, holidays, job rotation and stability, recognition of union officers, "peace clauses" that preclude strikes under certain circumstances, and other related working conditions. Although there are no explicit clauses regarding severance pay nor restrictions to hiring new workers, unions have generally imposed extra costs to employment adjustment. In some sectors non-written

[2] For a general description of labour market institutions in Uruguay, see Cassoni *et al.*, 1995.

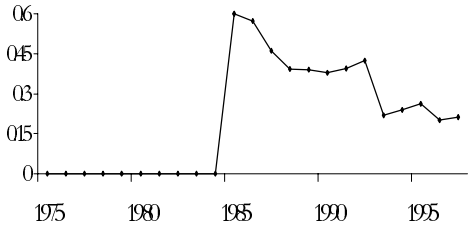
extra compensations have been a common practice, while in others strikes have worked as a means of getting additional severance pay. Government intervention in collective bargaining is only provided in the case of Wage Councils, and there is no other regulation of the bargaining process, not even in the case of conflict and strikes (for a more detailed description, see Cassoni *et al.*, 1995: 167-70).

No database up to this date has actually evaluated the impact of the contents of collective agreements. Recently, Ermida *et al.* (1997) and Cedrola, Raso and Perez Tabó (1998) have examined qualitatively the contents of collective agreements for the period 1985-1995. For this study, a data base that covers all collective agreements registered at the Ministry of Labour between 1985 and 1997 has been developed and the contents of its clauses have been quantified to determine the actual nonwage costs resulting from the bargaining process at the industry level.

Using these data it is possible to analyse quantitatively a period in which union behaviour was absent (up to 1984); a period in which union density of each sector is known but also the amount of nonwage costs imposed to all firms in an industry, due to the endorsement by decree that the State did (1985-1991); and a more recent period in which union density is known, but the collective agreements are exclusively binding for those firms and those workers that participated in the negotiation and signed the agreement. The completeness of data for this final period is less clear, since many of these agreements did not have to be registered at the Ministry of Labour (precisely because they did not have to be endorsed by the public authority in order to be binding among the contracting parties).

This study focuses on manufacturing, where there are pronounced changes in union density during the last decade, with no small amount of variation across individual industries. Upon the return of unions in 1985, 60 percent of production workers were covered by collective bargaining agreements (see Figure 3). This initial level probably reflects political support for the role unions played in the return to democracy. Union sustainability hinges on both worker support for collective, as opposed to individual agreements, and on the ability of unionised employers to survive economically. Union density gradually dropped to 40 percent by 1988 and stayed near that level through 1992. By this point the contracts signed under the old Wage Council system had expired and the impact of trade liberalisation was beginning to be felt. The openness ratio jumped from 44% in 1992 to 55% in 1993 and was above 60% for most of 1994-1997. Union density dropped from 42% in 1992 to 22% in 1993 and has stayed at about that level since. The pattern of union growth and decline has varied considerably across industries, as shown in Table 1.

Figure 3: Percentage union



Sources: National Union Federation (PIT-CNT);
National Institute of Statistics (INE).

Table 1. Percentage union and openness ratio, by year and industry

Industry	Union 1985	Union 1988	Union 1992	Union 1997	Open 1985	Open 1992	Open 1997
Food products	59	54	55	27	24	24	28
Textiles & apparel	77	54	46	16	49	54	83
Paper	70	52	44	39	19	19	45
Chemicals	100	87	100	94	16	44	60
Nonmetallic	48	21	11	10	12	22	36
Metal products	100	43	43	19	76	146	350

Sources: National Union Federation (PIT-CNT); National Institute of Statistics (INE); Central Bank of Uruguay (BCU); Bank of the Republic of Uruguay (BROU).

Union strength remained near 100 percent throughout the sample period in chemical and oil, which not coincidentally consists largely of state-owned enterprises. In fact union density dropped in all industries after 1992 except in chemicals and oil products. The most dramatic decline took place in metal products and nonmetallic minerals, where union coverage in the period dropped to 20% of its original level. At the same time, and particularly in the former industry, imports plus exports increased sharply. There was also a considerable drop in union coverage in textiles and apparel and, to a lesser extent, in the paper industry. With the exception of food products, all industries experienced an important increase in openness after 1992.

III. Theoretical framework

This section describes the framework used to analyse possible changes in both elasticities of labour demand and labour dynamics, due to the institutional changes that took place in 1985, that is, the re-appearance of trade unions as "players" in the labour market. In order to do so, the estimable models will be specified so as to measure labour demand elasticities for production workers and the speed of adjustment of labour to its equilibrium level in both regimes.

Through 1984, a competitive model seems suitable to describe the behaviour of the labour market. Wage increases were set by the Government from 1968 up to 1979, although from 1977 onwards there were extra shifts in some sectors. In any case, they were exogenous to the firm. Further, labour supply to each industry can be considered perfectly elastic. Since 1985, it might be possible to approximate the observed employment and wage pairs using the same model, but the institutional framework actually changed. Since that date, the wage level has been the result of a bargaining process that has itself evolved all along the decade. Before 1992, bargaining was a synchronised process, taking place at the industrial sector level through Wage Councils. After that date, it became more heterogeneous as negotiations at the firm level have become quite common, while synchronisation has deteriorated.

Given the above institutional changes, the research strategy developed was the following: first a model of labour demand derived from a pure neoclassical static framework was estimated. The wage variable is a cost

of labour proxy, including the wage plus nonwage costs - such as health insurance and payroll taxes - as well as other benefits bargained between firms and unions from 1985 onwards.

As will be shown in more detail below, the model was estimated for the whole period and the stability of the parameters was tested. The econometric analysis supported the specification of a different model for the post-1984 period. This model was derived from a bargaining framework. A first implication is that wages are not exogenous as in the previous specification, as they are determined jointly by unions and firms through a bargaining process, where firms attempt to maximise profits and unions maximise their members´ utility function. Secondly, other variables could enter the model, as alternative wages or fall-back positions of the parties.

III.1. Labour demand: theoretical framework

The starting point is a standard specification for a labour demand equation in a static framework. Assuming a generalised CES production function with three inputs (capital and labour divided in production and non-production workers), maximisation of profits would yield a 3-equations system of derived demands for inputs. The equation describing the demand for production workers would be:

$$\ln N_t = \alpha_0 + \alpha_1 \ln(w/p)_t + \alpha_2 \ln Q_t \qquad (1.1)$$

where N=employment of production workers, w=wage, p=product price, and Q=output

Hence, the elasticity of substitution between capital and employment is equal to $-\alpha_1$, while the wage elasticity of labour demand is $-\alpha_1*(1 - s_L)$, with s_L denoting labour share in value added.

In order to estimate the model, some methodological issues have to be solved. If variables are not stationary, a possible strategy is to estimate the model in differences. A second approach would be to test if the variables involved are cointegrated and if so, the estimation can be carried out in levels. However, as in finite samples the estimators in equation (1.1) are biased, it might be preferable to estimate a dynamic version of the model based on Engle and Granger's representation theorem (Engle and Granger , 1987):

$$\alpha(L)(1-L)\mathbf{Z}_t = -\gamma\beta\mathbf{Z}_{1-1} + d(L)\varepsilon_t \qquad (1.2)$$

where $\alpha(L)$ is a polynomial matrix in the lag operator; **Z** denotes the vector of variables involved (N, w/p, Q); d(L) is a polynomial; and ε_t is a stationary process.

The model can be linearly transformed as an autoregressive-distributed lag model:

$$\alpha_1(L) y_t = \alpha_2(L)\,\mathbf{X}_t + \varepsilon_t \qquad (1.3)$$

where $\alpha_1(L) = 1 - \sum_{i=1}^{m} \alpha_{1i} L^i$; $\alpha_2(L) = \sum_{i=0}^{m} \alpha_{2i} L^i$ and $(y,\mathbf{X}) = \mathbf{Z}$

The econometric analysis of the model will determine its final dynamic structure. It has been shown that the lag structure of each variable need not be the same (for an extensive discussion of all the above methodological issues, see Banerjee *et al*, 1993).

The fact that variables are non-stationary means that at least some shocks have permanent effects on them. In particular, shocks related to productivity and accumulated knowledge have been generally found to be non transitory, so that they have long lasting effects on output and employment (Blanchard and Quah, 1989; Aghion and Saint-Paul, 1993; and references there in). Thus, variables would have a stochastic trend but, if

cointegrated, the equilibrium relationship among them would still be stationary and hence stable. The dynamics are the result of agents not being able to adjust instantaneously to equilibrium because of factors such as adjustment costs, price rigidities, etc. Adjustment costs have been extensively discussed in the literature (Hamermesh, 1993, 1995; Hamermesh and Pfann, 1996) as the source of the observed lags in adjusting employment. They would explain why actual employment (N) differs from its equilibrium level (N^e). If firms maximise expected profits, expectations are static and costs are quadratic, the optimum path of employment would be:

$$N_t = g(N^e - N_t) \quad (1.4)$$

yielding a demand for labour equation like:

$$N_t = \lambda N_{t-1} + \beta \mathbf{X}_t \quad (1.5)$$

with $\mathbf{X}_t$ being a vector of variables determining long run labour demand and λ a parameter measuring the speed of adjustment to equilibrium, which is thus assumed to be constant.

III.2. Bargaining models

Since 1985 unions started playing a role in the determination of wages, working conditions and employment. Their role has varied over time, as well as the issues they bargained over. After analysing all the collective agreements that have been signed since then, it is clear that there have always been negotiations over wages but rarely over employment. Agreements have covered a wide range of other benefits, increasing the annual wage a worker receives; linking the wage to different variables, such as productivity or tenure; and increasing fringe benefits. Working conditions have also been in the bargaining agenda, as well as the length of the working week and year. Although at first sight negotiations looked as if done in stages, this turned out to be false. The procedure followed has generally been one by which at some point unions and firms have bargained over the wage, other benefits and working conditions. Regarding every issue but the wage, agreements have worked as long-term contracts (one year minimum, three years on average). Regarding the wage, however, they were quite short, covering a time period of three or four months, so that most of the contracts were agreements only over the wage.

The above suggests that the most suitable benchmark to analyse the Uruguayan bargaining process is that of a right-to-manage model (see Pencavel, 1991 for a discussion on this topic). The model will be considered as a maintained hypothesis, based on the analysis of all collective agreements. No tests against an efficient contract model will be carried out as it has been extensively proven by now that those tests cannot support one specification against the other (Booth, 1995; Pencavel, 1991)[3]. Thus, the following specification is used:

First Stage: unions and firms bargain over the cost of labour.

$\Gamma(w, w^a, N)$ is the union´s utility function, where w is the real wage, w^a is the alternative income, and N is employment. It is assumed that membership status is lost if unemployed; that all members of the union are equally considered by union leaders; and that members care about the real wage surplus over the alternative income they would earn working elsewhere or being unemployed (de Menil, 1971). A standard specification is then:

[3] For example, the alternative income would enter the employment equation only in the efficient contract model. However, some utility functions can yield a solution to the efficient bargain that excludes the alternative income from the specification. Further, the empirical distinction between both models is not straightforward, as the contract curve may lie on the labour demand curve (Carruth and Oswald, 1987).

$$\Gamma(w, w^a, N, M) = (w - w^a)N^{\phi}$$

where ϕ is a parameter denoting how much weight the union gives to employment in its utility function. If ϕ equals 1, then the model is the rent maximisation model (Pencavel, 1991).

$\Pi(p, Q, K, N, p_c, w)$ is the firm´s profit function, where K=capital and p_c=price of K. It is assumed that managers maximise revenue minus costs, so that:

$$\Pi(p, Q, K, N, p_c, w) = pQ - wN - p_cK$$

A well known solution to the bargaining problem is given by the maximisation over the wage of the generalised Nash bargain, subject to the optimum labour demand that will be set in a second stage:

$$\begin{aligned} &\underset{w}{\text{Max}}\ Y = (\Gamma - \Gamma_0)^{\beta}(\Pi - \Pi_0)^{1-\beta} \\ &\text{s. t.} \qquad\qquad (2.1) \\ &\qquad N = N^* \end{aligned}$$

Γ_0 and Π_0 are the fall-back positions of each player. They refer to what the union and the firm would get in the event of no agreement (Binmore, Rubinstein and Wolinski, 1986). If we assume that under this circumstance there will be a strike, then the firm will have zero operating profits and union members will have zero earnings[4].

Second Stage: firms maximise profits.

$$\underset{N, K}{\text{Max}}\ \Pi = pQ - wN - p_cK \quad (2.2)$$

Subject to some quite restrictive assumptions, the solution to (2.1) and (2.2) is:

$$\begin{aligned} &N^* = N(w/p; Q) \\ &\qquad\qquad (2.3) \\ &w^* = \eta\, w^a \end{aligned}$$

The solution can be derived under quite restrictive assumptions. The first equation is just the result of profit maximisation by firms, under a CES production function, for example. However, to get the equation for the wage level, it has to be assumed that when bargaining, firms take capital as given, that is, they have already made decisions on the capital level. Thus, the profit function depends just on employment.

The parameter η is the mark-up over the alternative income. It can be considered a function of some characteristics of the sector firms operate in, such as the degree of competitiveness and the affiliation rate (Layard, Nickell and Jackman, 1991).

Finally, the alternative income workers consider as a comparison wage is a weighted average of what they would earn if they got a job in any manufacturing industry; what they would get if they decided to become self-employed; and of what they would receive as unemployment benefits in the event of losing their job. Weights are given by the probability of being in each of the mentioned states, calculated as the annual frequency of each category.

[4] There are no legal provisions assuring any income to strikers in Uruguay. They generally ask people for contributions but this cannot be measured.

The estimable model proposed is a multivariate model, in which wages are not exogenous but they are set subject to the determination of the level of employment.

III.3. Union impact

In a static framework, unions have an incentive to take whatever steps they can to reduce the wage elasticity of labour demand so that they can bargain for increased wages with less severe consequences for employment. Unions can make product demand less elastic by making fewer options available to consumers through various rent-seeking activities. One way of doing this is to create entry barriers, such as state ownership or regulated entry into markets where establishments are unionised. Tariffs, quotas, and other barriers to free trade also can be used to reduce consumer choice. The elasticity of substitution between union labour and other inputs can be reduced through collective bargaining. Contracts with unions often spell out the conditions under which work is to be performed, including dictates on minimum crew sizes, limitations on substituting nonunion personnel for work that "belongs" to the union, and limits on technologies that reduce labour hours.

Empirically, it is well known that unions should try to organise the sectors of the economy with the most inelastic demand. In this study, however, the same sectors of manufacturing are looked at before and after re-unionisation, so this self-selection into rent-seeking opportunities is controlled for. Thus, it will be possible to establish in a before-and-after framework whether unions are actually able to reduce labour demand elasticities.

The impact of unions on adjustment lags and the elasticity of labour demand to output hinge on a variety of factors. Ignoring adjustment costs for the moment, firms can adjust labour hours to a change in output by changing employment or by changing hours per person. The impact of unions on this tradeoff is not clear *ex ante* (Oswald and Walker, 1994 addressed this issue for UK). Unions often negotiate for premium rates for overtime that are well above those required by labour legislation, which would by itself lead unionised firms to increase employment more for a given increase in output. However, unions also negotiate for employee benefits that make increasing employment expensive relative to increasing hours. Lower turnover in unionised establishments encourages greater investments in employee training, which in turn increase the cost of hiring an additional person. In a frictionless world, the effect of unions on the employment-hours balance would be an empirical question that would hinge on whether the marginal cost of an extra hour per person is the overtime rate dictated by labour laws or the super-overtime rates from the union contract. If it is the standard overtime rate, then the dominating effect of unions would be through increased costs of hiring an extra person and we would expect a smaller elasticity of employment to output.

A final channel for union influence is the speed at which labour adjustments are made. Unions have numerous methods at their disposal to change the cost of making changes in employment. This can be done with formal contract provisions dictating advance notice or severance pay in case of layoffs or through informal threats of slowdowns or strikes. Another factor leading to slower adjustment of employment to output in unionised establishments is the low rate of voluntary turnover. When attrition is sufficiently high, employment can adjust very quickly through a simple hiring freeze.

IV. Data

Before describing the actual definition of variables, some aggregation issues are worth stating. First, the units of observation considered will be manufacturing industries at the two-digit level of aggregation. Six of them can be observed during the period 1975 to 1997: food, beverage & tobacco; textiles and apparel; paper; chemicals and oil products; nonmetallic minerals; and metallic products. It is well known that the optimum unit of observation is the establishment as adding up technologies never guarantees that the parameters obtained for the aggregate are what they are sought to be. However, working with industries is not the worst of the alternatives. In a small country like Uruguay, most of the year-to-year variation in industry data is driven by a small number of firms, hence problems related to aggregate data should be fewer than in a large country. Nevertheless, it should be taken into account that this might bias the estimates (Hamermesh, 1993). Second, temporal aggregation does not seem a problem here as quarterly data will be used, so that the lag structure should not understate the true lag structure.

Cost of labour: W

The measure to be used in the model has to approximate the total cost of labour for the firm, so that it has to include not only the wage but also nonwage costs. The latter account for labour taxes; social security contributions; and bargained costs since 1985. All costs related to hiring and firing workers are being omitted. In order to account for these costs, the labour demand function should be specified contingent on different states of nature, that would imply firing or hiring workers, and a distribution of these states should be also proposed. It can be shown that not specifying a state contingent labour demand might bias downwardly the estimates of the elasticities due to the omission of relevant variables [5]. This issue will not be addressed empirically as data needed to calculate marginal firing and hiring costs are not available[6].

Data on wages are obtained from the Quarterly and Annual Industrial Surveys carried out by the National Institute of Statistics (INE) [7]. Annual data for production workers is available from 1975 up to 1997. Quarterly data however, is not published (nor processed by the INE) after 1991. Hence, for 1992-1997 the within year evolution of wages was assumed to follow the same pattern as that stemming from the Wage Survey (INE)[8] for manufacturing workers.

Data on nonwage costs were taken from Picardo, Daude and Ferre (1997) and from Cassoni and Ferre (1997). All costs related to health insurance and social security as well as payroll taxes were used to build a factor by which to increase wages for each 2-digit industrial sector. Social security and health insurance contributions are a fixed percentage of wages that has varied over time. On the other side, payroll taxes, first imposed in 1982, have generally varied depending on the level of earnings. Hence, information from the Household Survey (INE)

[5] I am grateful to Prof. J.Heckman for pointing out this particular issue.

[6] The law relative to severance pay has not changed in the sample period and the compensation a worker is entitled to is the same for all industries and depends on his/her tenure (none if tenure is less than three months; one wage per year for those working for more than three months and up to a maximum of six). Average tenure for those employed in 1991-1997 (the only years for which the data is available) is between seven and ten years, not varying much between industries. Hence, the expected average severance pay does not change, being between 3.7 and 4.2 wages depending on the industry. As it is not possible (due to the number of observations) to calculate the probability of a worker being laid off for each tenure, this should be calculated as the overall frequency of layoffs and will thus be negatively correlated with employment by definition. Finally, even if a tentative measure of average severance pay based on tenure of employees instead of on that of laid off workers is included, it would be introducing biases which need not be of the same sign along the period. They would depend on the prevailing rules of firing workers and these have been probably different during 1975-1997. During the period in which unions were active, the most likely rule in place should have been one of last in-first out. However, during periods of restructuring, as were the late seventies and the early nineties, firms might have got rid of more senior workers, with higher wages and not easily retrainable. Given all these issues, these costs will be omitted from the analysis, although they might be reflected in the estimated effect of unions on the labour demand model.

[7] These surveys are carried out using a sample of firms employing 5 workers and more, that stems from the previous Industrial Census. Data collected refer to many variables related to production, employment, and inputs. The Quarterly Survey reports indexes while the Annual Survey publications report values.

[8] The Wage Survey is carried out on a monthly basis to establishments belonging to all economic sectors.

was used to calculate the distribution of workers in the different relevant segments, yearly, for each manufacturing sector. Apart from these factors increasing wages, employers face an annual extra payment of one monthly salary plus 20 days that must be paid before the worker starts his/her annual holidays before the end of the year. Both were also included in the cost of labour.

There are several issues over which unions have bargained since 1985. Among them, supplemental end-of-year bonuses, either related to tenure, productivity, or simply on a general basis; shorter length of the working day; and extra holidays. These negotiations took place at the industrial 2-digit level, so that they vary by industry. Annual premia applying to all workers was directly used to increase the factor built upon the legal rates. Information on extra holidays was used to calculate the percentage increase in costs due to non-working days. If paid vacations were 12 days more per year over the legal standard, the actual monthly wage would be 25/24 times w, instead of w. Where agreements were reached shortening the legal length of the working day or week, the cost of labour was increased by the proportion of legal to bargained hours in the same way as paid vacations.

All the information above described stemming from the manufacturing collective agreements signed between 1985 and 1997 was used to build an index increasing the legal cost of labour. This index varied in time and among industries, with an average value for the whole manufacturing sector of 12 percent. Industries with the lowest extraordinary bargaining costs were paper; metallic products and nonmetallic minerals, for which the increase was around 1 percent on average. Sectors related to food, beverage and tobacco and chemicals have negotiated increases of 12 percent over the legal costs, while those related to textiles and apparel have an average percentage premia of 21 percent during the period.

Given all the above, the cost of labour variable was defined as:

Cost of Labour = CL = Wage*(1 + legal nonwage costs + bargained nonwage costs)

Employment: N - Production: Q - Product prices: p

Employment refers to total number of production workers obtained from the Quarterly and Annual Industrial Surveys, at the 2-digit level. An index of production is available on a quarterly basis (INE). The index was then transformed to monetary values using the 1988 Industrial Census and the Annual Industrial Survey (INE). Data on product prices refer to the PPI at the 2-digit level (INE). All data refer to monthly values calculated as an average on a quarterly basis.

Some corrections to the official data

In Uruguay, industrial census are performed every 10 years. Each time a census is done, annual and quarterly surveys update their samples based on the new information. In 1988, the last national industrial census was performed and its results showed that the samples that were being used in the industrial surveys – stemming from the 1978 census – were severely misrepresenting the different sectors. Annual surveys started including the new information in 1989 while quarterly surveys did so in 1993. However, no correction to the data was done before those dates. The differences in the samples meant that the estimated levels of employment and output for the whole manufacturing sector differred in around 25% depending on the sample used. At the 2-digit level there were even broader differences. It was thus decided to correct the offical data, discussing and taking advice from those in charge of the surveys at the National Institute of Statistics. Given that the 1982-1983 economic recession had had major and different effects depending on the industrial sector, the assumption used to calculate the new data was that the lack of representativeness of the 1978 sample went back to 1984. As other sources showed that the evolution of the variables stemming from the surveys along the post-1984 period was quite correct, the differences in the levels according to both samples were geometrically distributed along those years (1984-1988 for the annual survey; 1984-1993 for the quarterly survey).

Degree of openness: OPEN

The index was calculated as total exports plus total imports divided by value added, per manufacturing industry. Data came from the Republic Bank of Uruguay (BROU), that was the authority in charge of registering all foreign exchange activities. Since 1995, the Customs Office has been responsible of collecting the data.

Alternative wages: AW

They were calculated using the information of wages in manufacturing as described in IV.1; and that of average income of self-employed individuals according to the Household Survey. The alternative income for a worker in industry "j" was defined as the weighted average of the wage in the rest of the manufacturing industries; the income the worker would receive if he/she becomes unemployed and collects unemployment benefits (50% of his/her current wage); and the average income of self-employed individuals. Weights were defined as the annual frequency of each category as stemming from the Household Survey.

Union density: UNION

Union density was calculated using annual number of production workers as stemming from the Industrial Surveys and total membership reported by the National Union Federation after each congress. These congresses took place in 1985, 1987, 1990, 1993 and 1996-97.

Descriptive statistics for the above variables are summarised below in Table 2, differentiating between the pre and post re-unionisation subperiods (1975-1984 and 1985-1997). Data for the entire manufacturing sector are reported to indicate overall trends; data for manufacturing industries indicate the diversity of conditions across different markets. Note that with the return of collective bargaining, the market trends are toward greater production, reduced employment, higher wages, and increased openness.

Table 2. Descriptive Statistics

a) *Manufacturing sector*

	1975.1 – 1984.4 Number of observations: 40				1985.1 – 1997.4 Number of observations: 52			
Variable	Mean	S.D.	Max	Min	Mean	S.D.	Max	Min
W	82.02	13.97	103.6	56.81	90.02	21.64	133.3	52.38
LNWC	1.336	0.071	1.426	1.243	1.332	0.031	1.375	1.290
BNWC	1.000	0.000	1.000	1.000	1.123	0.038	1.156	1.000
TLC	109.7	18.6	143.54	72.56	136.2	36.34	203.7	67.79
AW	0.000	0.000	0.000	0.000	42.95	11.67	62.59	24.87
UNION	0.000	0.000	0.000	0.000	0.365	0.129	0.601	0.200
OPEN	0.298	0.036	0.388	0.242	0.468	0.109	0.620	0.295
Q	57.00	6.740	70.00	44.60	60.16	5.097	71.04	49.16
N	108143	14496	129491	86010	104782	19727	129995	71735

b) Manufacturing industries

	1975.1 - 1984.4 Number of observations: 240				1985.1 - 1997.4 Number of observations: 312			
Variable	Mean	S.D.	Max	Min	Mean	S.D.	Max	Min
W	86.93	28.84	202.9	41.90	104.8	40.96	246.3	41.25
LNWC	1.337	0.071	1.433	1.238	1.328	0.038	1.383	1.232
BNWC	1.000	0.000	1.000	1.000	1.076	0.096	1.265	1.000
TLC	115.3	35.31	255.6	58.65	151.4	68.23	405.8	53.23
AW	0.000	0.000	0.000	0.000	69.88	21.27	136.7	30.79
UNION	0.000	0.000	0.000	0.000	0.507	0.285	1.000	0.083
OPEN	0.338	0.257	1.149	0.096	0.575	0.657	3.500	0.102
Q	9.431	6.971	27.42	1.598	9.804	6.784	26.69	1.296
N	17661	12763	49715	4167	16543	12292	42150	3897

Notes: W is monthly real wage per production worker in 1988 pesos; LNWC is 1 + percentage increase in wages due to legal nonwage costs; BNWC is 1 + percentage increase in wages due to bargained nonwage costs;TLC are monthly total real labour costs in 1988 pesos; AW is the monthly real alternative wage in 1988 pesos; UNION is percentage union; OPEN is degree of openness; Q is production in 1988 million pesos; and N is number of production workers.

V. Labour demand: empirical results

V.1.Specifying a model for the whole period

To determine whether and how much elasticities and adjustment lags of labour demand in the manufacturing sector changed after the return of collective bargaining, the appropriate specification of the empirical model must be first established. The quarterly data on the six manufacturing industries described in previous sections was used. To estimate equation (1.1) as it stands, the stationarity of the variables has to be analysed, which was done by estimating the order of integration of employment, labour costs, and output for each manufacturing industry in the 1975-1997 period. All variables are nonstationary but their first differences are stationary, so that they are integrated of first order -I(1). The unit root tests used to perform the analyses were those proposed by Fuller (1976), known as Augmented Dickey-Fuller tests (ADF). The models over which the tests were performed were different depending on the variable and industry, including only a constant and lags of the dependent variable in some cases while in others they also incorporated seasonals and a time trend (for details, see Table 1 in the annex). These results are somehow expected. Regarding employment,

output and real wages, accumulated knowledge and productivity shocks have been found to generate stochastic trends in these variables as it was mentioned in section III. The non stationarity of the degree of openness could be interpreted in similar terms, being external shocks and trade policies in the root of the result. Finally, the most likely explanation for the stochastic trend found in the union density variable should be linked to membership dynamics and insider-outsider arguments (Blanchard and Summers, 1986).

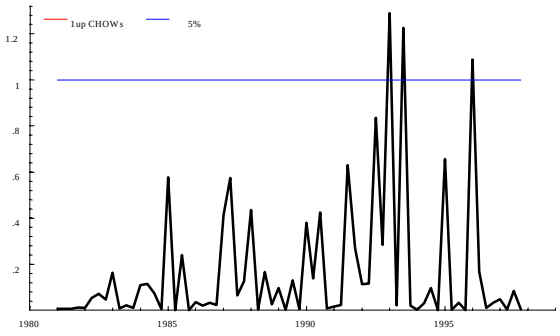
Given the statistical properties of the data, one possible strategy is to estimate the model in differences.

The institutional framework depicted in previous sections suggests, as a second step, the analysis of the stability of the parameters in time. The model in differences was thus estimated industry by industry, using recursive least squares (RLS) and assuming wages and output are exogenous. The results, depicted in Figure 4, show there are structural breaks in the labour demand equation in all industries except nonmetallic minerals. The timing of the breaks is not identical in each industry, but breaks can be identified at some point in the early 1980s as well as at another point around 1991-1993. These dates can be clearly related to the major economic crisis in 1982-1984; the end of the military regime in 1985; and the end of all contracts that had been signed in the tripartite Wage Councils.

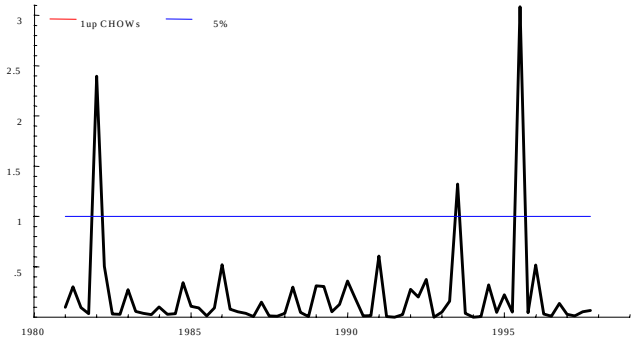
A third stage of the analysis involved using the pooled cross section-time series data set. Given the nonstationarity of the variables and the instability of the parameters, the model was specified in differences with the parameters shifting in various combinations of 1983, 1985 and 1993 and estimated by ordinary least squares (OLS). Elasticities were imposed to be the same for all six industries while wages and output were taken as exogenous variables. These results are reported in Table 3.

The first three columns test for a single break in 1983, 1985, and 1993. The null hypothesis of no shifts cannot be rejected for 1983 and 1993, but is rejected for 1985. The output coefficient falls from 0.141 in 1975-1984 to 0.073 in 1985-1997. The wage coefficient becomes smaller in absolute value terms, going from –0.103 to –0.047. The sum of the two lagged employment coefficients falls from 0.196 to 0.022. The models in the last two columns test for multiple break points. Having established a shift in the early eighties, these results examine whether there was an additional shift in 1993. In the fourth column breaks in 1983 and 1993 are included while in the fifth the shifts take place in 1985 and 1993. The joint null of no breaks is rejected in both cases.

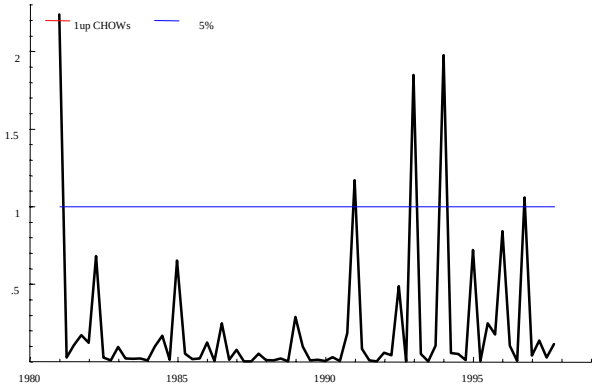
Figure 4: Recursive residuals, by industry



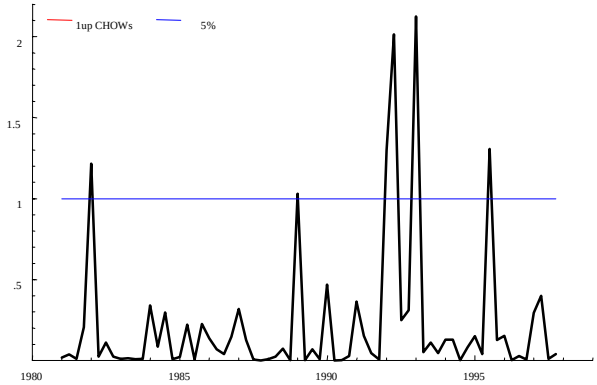
Food, beverage & tobacco: breaks in 1992-93



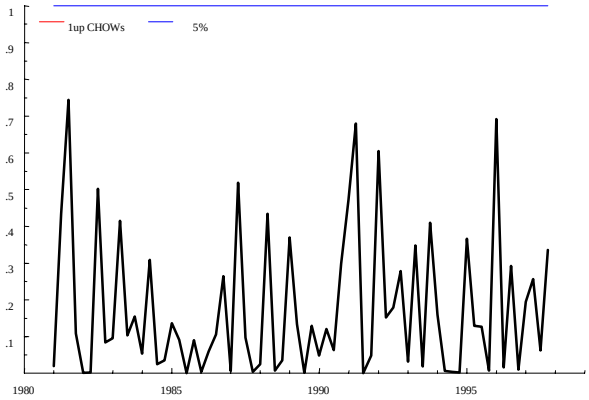
Textiles & apparel: breaks in 1982, 1995



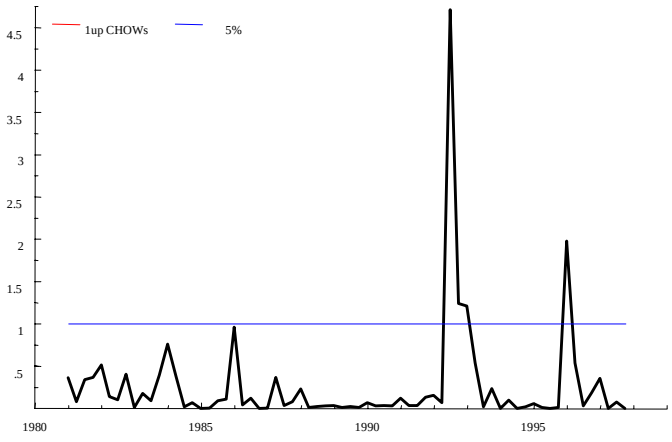
Paper products: breaks in 1991- 92



Chemicals: breaks in 1982, 1993



Nonmetallic minerals: no breaks



Metal products: break in 1992

Table 3: Estimation in differences, manufacturing industries, 1975-1997

Dependent variable: $\Delta N_t = N_t - N_{t-1}$
Sample: 1975 – 1997
Number of Observations: 534

Structural Breaks	**1983**	**1985**	**1993**	**1983&1993**	**1985&1993**
Variables					
ΔN_{t-1}	0.01256	0.04312	0.02399	0.01316	0.03833
	(0.0604)	(0.0564)	(0.0468)	(0.0593)	(0.0557)
ΔN_{t-2}	0.16010	0.15278	0.09722	0.16832	0.15082
	(0.0605)	(0.0564)	(0.0469)	(0.0594)	(0.0559)
ΔQ_t	0.15244	0.14078	0.12545	0.15180	0.14259
	(0.0306)	(0.0263)	(0.0203)	(0.0300)	(0.0260)
ΔW_t	-0.08480	-0.10309	-0.09007	-0.08364	-0.10675
	(0.0296)	(0.0234)	(0.0224)	(0.0291)	(0.0264)
$\Delta NdY1_{t-1}$	-0.01144	-0.07197	-0.08663	0.01955	-0.06430
	(0.0833)	(0.0835)	(0.1043)	(0.0943)	(0.0995)
$\Delta NdY1_{t-2}$	-0.11730	-0.10185	0.03228	-0.21630	-0.20982
	(0.0837)	(0.0839)	(0.1051)	(0.0950)	(0.1002)
$\Delta QdY1_t$	-0.05929	-0.0679	-0.05994	-0.04599	-0.04991
	(0.0374)	(0.0349)	(0.0388)	(0.0410)	(0.0430)
$\Delta WdY1_t$	0.01234	0.05570	0.09638	-0.01371	0.04344
	(0.0424)	(0.0244)	(0.0704)	(0.0449)	(0.0507)
$\Delta NdY2_{t-1}$				-0.24582	-0.18643
				(0.1233)	(0.1293)
$\Delta NdY2_{t-2}$				0.03721	0.04908
				(0.1213)	(0.1273)
$\Delta QdY2_t$				-0.03598	-0.02352
				(0.0430)	(0.0473)
$\Delta WdY2_t$				0.13014	0.09706
				(0.0747)	(0.0793)
R^2	0.0930	0.1028	0.0922	0.1398	0.1344

Note: $\Delta X = X_t - X_{t-1}$. N is number of production workers; W is the real labour cost of a production worker; Q is production. $\Delta XdY1$ is ΔX multiplied by a dummy variable that is equal to 1 in the subperiod starting in Y1 (Y1= 1983; 1985 or 1993 according to the column). $\Delta XdY2$ is ΔX multiplied by a dummy variable that is equal to 1 in the subperiod starting in 1993. Standard errors are in parenthesis below each estimated coefficient.

Finally, cointegration techniques were also applied . When variables are nonstationary the estimation of the model in levels has been proven to be misleading, unless the variables are jointly stationary, that is, they are cointegrated. Hence, cointegration (CI) tests were then done to see if an equilibrium relationship could be sustained for the whole period. Both Engle and Granger (EGM) and Johansen (JM) methods were used,

specifying various models that differ in the number of lags included, as well as in the inclusion of seasonal dummies or a constant. Cointegration between employment, production and labour costs was rejected for all industries according to at least some of the tests performed (Table 2 in the annex). In those cases in which CI cannot be rejected, the graph of the CI relation shows it is not stationary, so that it is probably spurious, as it is the existence of a structural break in the relation that makes the statistics significant (see Graphs 1 to 4 in the annex).

In summary, all the above analyses suggest 1985 stands out on both institutional and statistical grounds as the date at which a structural change in labour demand behaviour took place. There is also some evidence of a further shift in the nineties. These break points will be used in the remainder of the paper.

V.2. Specifying a model for each subperiod

First, the analysis of order of integration and cointegration of variables for each subsample and each industry was repeated. For 1975-1984 and 1985-1997, every variable is I(1) within each subperiod. Details are reported in Table 3 in the annex. Second, for 1975-1984, the tests using EGM and/or JM report a CI relation for at least one model (see Table 4 in the annex)[9]. For 1985-1997 no CI among employment, labour costs and production can be found in any industry, for any model using EGM. However, CI is not rejected in any industry once variables that would reflect a bargaining framework -- alternative wages, bargained costs, degree of openness and union density -- are included. The existence of an equilibrium relation between the variables –according to the non rejection of CI- would state that shocks, having a long lasting effect on each of the individual variables, alter equlibrium only in a transitory way. In the first subperiod, the result is consistent with a standard neoclassical labour demand framework. In 1985-1997, however, the need to include other variables to achieve CI suggests that the framework in which labour demand has been determined actually changed. One possibility is to link the existence of a stochastic trend in the residuals to not having modelled technical change. One might argue that this is partially captured when adding the degree of openness: increases in openness would force the different industries to invest in new technology once they are faced to greater competitive pressures; and/or firms with older technologies closed so that on average technical progress would be observed. However, as not only openness but variables accounting for bargaining are included in the CI relation, there is also evidence supporting that a bargaining framework is in place to analyse the labour demand schedule in 1985-1997.

To further establish whether the return of collective bargaining was a likely cause of the observed change in parameters, exogeneity tests on wages were then performed. In the competitive model wages are assumed to be exogenous (as supply is assumed to be perfectly elastic), while in the bargaining model they are not. In the latter case they would be set either simultaneously or subject to the determination of employment. Using a Hausman test (1978) in which the OLS estimate of the wage parameter is compared to a Seemingly Unrelated Regressions estimate (SUR), weak exogeneity of wages cannot be rejected in the first subperiod while it is rejected in the second[10]. The SUR estimator is calculated using lags of the wage as instruments in both subperiods. For 1985-1997, however, the test was also performed including bargaining variables (degree of openness and union density). Further, given the evidence on the existence of instability in the nineties, the statistics were also calculated including a dummy variable in the equations, which takes the value 0 before 1993 and of 1 after that date. The values of the statistics for the different models are reported

[9] EGM was preferred due to the number of observations available. JM was used for paper and chemicals to check if a CI relation could be found.

[10] The Hausman statistic is: $T(b_{OLS} - b_{SUR})^2 Var(b_{OLS} - b_{SUR})^{-1}$ where b is the estimator, by OLS or SUR, and T is the number of observations. It is distributed as a $\chi 2$ with 1 degree of freedom.

in Table 4. The results provide further support for estimating a standard neoclassical labour demand model for 1975-1984 and a bargaining model for 1985-1997.

Table 4: Weak exogeneity tests for the wage 1975-1984 and 1985-1997

	1975-1984	1985-1997
Model 1	3.02	5.9
Model 2	-----	90.4
Model 3	-----	294.2
Model 4	-----	226.6
Hausman Statistic 95% confidence	3.84	

Note: Each model contains 5 industry dummies and a constant. In models 1 and 2 labour demand is specified as a function of wages and output, using 4 lags of every variable. In models 3 and 4 a dummy variable for 1993 is also included in both the labour demand and the wage equations. In models 1 and 3, instruments used for the wage are just its lags while in models 2 and 4 instruments for the wage include bargaining variables.

Given all the above results, the estimated models are as follows:

1975-1984: $\ln N_t = \alpha_0 + \alpha_1(L)\ln(w/p)_t + \alpha_2(L)\ln Q_t + \alpha_3(L)\ln N_{t-1}$

1985-1997: $\ln N_t = \beta_0 + \beta_1(L)\ln(w/p)_t + \beta_2(L)\ln Q_t + \beta_3(L)\ln N_{t-1}$

$\ln(w/p)_t = \gamma_0 + \gamma_1(L)\text{union} + \gamma_2(L)\text{open} + \gamma_3(L)\ln(w^a) + \gamma_4(L)\ln(w/p)_{t-1}$

where N refers to number of production workers; w/p are real labour costs (which after 1985 include bargained costs); Q is production; union is union density; open is degree of openness; and w^a is the alternative wage. The order of the polynomials in the lag operator will be tested empirically, starting with polynomials of order 4. The bargaining model is a recursive, two-equation model, so gains in efficiency can be achieved through simultaneous estimation. To avoid possible endogeneity bias due to the non modelling of output, lag values of Q (up to two lags), seasonals and industry dummies were used as instruments for this variable in the estimation for both subperiods. Hence, estimation was done using Instrumental Variables (IVE) in the first subsample and three stages least squares (3SLS) in the second, using PCGive and PCFiml 9.0 software (1996). The dataset is the pooled cross section – time series one described above. Fixed effects per industry are always allowed for. Elasticities are imposed to be equal for all industries, so that the estimates reflect the average elasticities for the whole manufacturing sector.

V.3. Main results

For both subperiods Table 5 reports three simple versions of the labour demand model. Starting with a model including up to four lags for every variable, sequential reductions were performed. Further, the different coefficients were allowed to vary in 1993 in order to check for possible shifts. Only the last two steps are reported including the shifts that were significant as well as two lags of employment in column (1) and just the previous' quarter employment in column (2). Column (3) includes the variable OPEN in the labour demand equation, so as to test if increased openness was affecting the estimates. The wage equation for the bargaining model allows the wage bargain to vary by industry after 1993. This was done to test whether the change in the bargaining structure has had an overall impact on wage demands and whether the effect varies by industry. Residuals are not autocorrelated but they are heteroscedastic. Thus, standard errors were

calculated according to White (1980). Although normality is rejected, hypothesis testing results should be robust to non-normality given the sample size (Spanos, 1986; Ch.21.2).

As can be seen by comparing columns 1 and 2 of the labour demand results within each subperiod, employment from one quarter ago has an effect on employment in the current quarter but employment from two quarters ago has no impact. Further, the degree of openness is not only statistically non significant but does not alter the estimates of the relevant elasticities. Accordingly, the focus will be on the results for column 2. These show three major results:

1. The output coefficient falls from 0.093 in 1975-1984 to 0.040 in 1985-1997.
2. The wage coefficient falls (in absolute value) from –0.102 in 1975-1984 to –0.039 in 1985-1997.
3. There is no significant change in the impact of lagged employment between these two periods.

The wage equation results show that the effect of union density on wages decreased significantly after 1992, although the extent of this change varies per industry. A key finding in the wage equation results is that bargained wages fall with increased openness. The effect is rather small, however, a 50 point change in openness being associated with a 1.5 percent change in the bargained wage.

Because of the different approaches taken to estimating the IVE labour demand and the 3SLS bargaining model, one might wonder if these findings are sensitive to the choice of estimation method or to the inclusion/exclusion of variables in the model. To put the two subperiods on an equal footing, both models were nested in a 2-equation system and estimated using 3SLS. In order to do so, each variable was multiplied by two binary variables - one for 1975-1984, another for 1985-1997 - so that X75 equals X in 1975-1984 and 0 after that date and X85 is equal to X in 1985-1997 and 0 before that date. Tests of significance of coefficients and tests of coefficients being equal before and after 1985 were performed and they all re-inforce the previous results (see Table 5 in the annex).

In Tables 6 and 7, labour demand elasticities and results for other relevant parameters are summarised, using models (2) of the previous table. Confidence intervals are also reported. These results show that the wage elasticity of labour demand dropped from 0.69 in 1975-1984 to 0.22 in 1985-1997. The employment-output elasticity fell by more than 50 percent, from 0.83 to 0.31. The estimated speed of adjustment is the same in both periods, about 5 quarters, so that there is no evidence that the return of bargaining lengthened the amount of time needed for employment to adjust, which is contrary to what one might generally expect[11].

Although the estimates might be downwards biased due to the omision of hiring and firing costs, the evidence of a decline between both subperiods is quite robust. The smaller responses of employment to changes in output and wages are consistent with collective bargaining restricting the options available to employers. Once unions reappeared and started playing a role in wage setting, the rules of the game changed. Costs of hiring and firing workers were at least expected to increase by union resistance. Employment would not adjust to changing output demand as before because of increased uncertainty on the reaction of unions. Hence, there might have been more labour hoarding during slowdowns and increased use of overtime work during upswings than when unions were not active.

[11] An exception is the paper by Lockwood and Manning (1989), in which the opposite result is found.

Table 5. Estimates of labour demand and wage equations - manufacturing industries

Labour demand equation: dependent variable: N_t

	Sample: 1975 – 1984			Sample: 1985 – 1997		
Model	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Variables						
Constant	1.4969	1.3840	1.5638	1.3403	1.3630	1.3526
	(0.2980)	(0.3012)	(0.3338)	(0.2333)	(0.2187)	(0.2186)
N_{t-1}	0.90382	0.88844	0.87473	0.79468	0.86921	0.87186
	(0.1299)	(0.0315)	(0.0330)	(0.0625)	(0.0218)	(0.0202)
N_{t-2}	-0.01477	-----	-----	0.07809	-----	-----
	(0.1181)	-----	-----	(0.0588)	-----	-----
Q_t	0.09074	0.09304	0.09092	0.03912	0.04024	0.03309
	(0.0261)	(0.0244)	(0.0239)	(0.0244)	(0.0245)	(0.0173)
W_t	-0.10000	-0.10180	-0.09865	-0.04098	-0.03886	-0.03882
	(0.0227)	(0.0182)	(0.0174)	(0.0178)	(0.0184)	(0.0172)
DUMMY93	-----	-----	-----	-0.03957	-0.04019	-0.0393
	-----	-----	-----	(0.0123)	(0.0126)	(0.0122)
IND.31	-0.04217	-0.04499	-0.07533	0.08076	0.08336	0.08755
	(0.0285)	(0.0271)	(0.0357)	(0.0287)	(0.0287)	(0.0250)
IND.32	0.03857	0.03757	0.02439	0.08019	0.08335	0.08357
	(0.0247)	(0.0267)	(0.0296)	(0.0206)	(0.0206)	(0.0202)
IND.34	0.02271	0.02498	-0.03521	-0.05909	-0.06096	-0.06533
	(0.0276)	(0.0273)	(0.0442)	(0.0209)	(0.0214)	(0.0238)
IND.35	-0.10358	-0.10557	-0.15528	-0.04310	-0.04563	-0.04006
	(0.0242)	(0.0221)	(0.0409)	(0.0246)	(0.0249)	(0.0201)
IND36	-0.04382	-0.04285	-0.10538	-0.07504	-0.07684	-0.08307
	(0.0243)	(0.0233)	(0.0460)	(0.0279)	(0.0283)	(0.0279)
Qr.1	-0.01536	-0.01524	-0.01451	0.00098	-0.00019	-0.00111
	(0.0127)	(0.0127)	(0.0127)	(0.0081)	(0.0080)	(0.0080)
Qr.2	0.00815	0.00783	0.00846	0.01122	0.01031	0.00996
	(0.0079)	(0.0082)	(0.0082)	(0.0059)	(0.0058)	(0.0053)
Qr.3	-0.01340	-0.01323	-0.01286	-0.01589	-0.01778	-0.01793
	(0.0069)	(0.0067)	(0.0068)	(0.0072)	(0.0069)	(0.0067)
OPEN	-----	-----	-0.07185	-----	-----	-0.00090
	-----	-----	(0.0532)	-----	-----	(0.0092)
Number of Observations:	228	228	228	300	300	300
R^2	0.9946	0.9947	0.9947	0.9967	0.9967	0.9967
AR 1-4	3.3058	3.5757	3.9374	1.2294	1.7403	1.7430
	[0.5080]	[0.4665]	[0.4145]	[0.8732]	[0.7834]	[0.7829]
Normality	143.0	138.0	131.7	60.4	56.6	56.7
	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**	[0.0000]**
Xi^2	2.9151	2.272	2.309	1.5052	1.7656	1.5585
	[0.0002]**	[0.0067]**	[0.0039]**	[0.0353]*	[0.0074]**	[0.0247]**

Wage equation: dependent variable: W_t

Sample: 1985 – 1997 **Model**	**(1)**	**(2)**	**(3)**
Variables			
Constant	-0.29674	-0.27408	-0.27471
	(0.1068)	(0.1041)	(0.1041)
W_{t-1}	0.36874	0.43003	0.43033
	(0.0563)	(0.0401)	(0.0402)
W_{t-2}	0.07493	-----	-----
	(0.0433)	-----	-----
Aw_t	0.71198	0.72145	0.72126
	(0.0523)	(0.0540)	(0.0540)
$OPEN_t$	-0.02471	-0.02426	-0.02424
	(0.0107)	(0.0107)	(0.0107)
$UNION_t$	0.15515	0.15477	0.15470
	(0.0227)	(0.0229)	(0.0229)
$UNION93_t$	-0.23953	-0.23432	-0.23437
	(0.0693)	(0.0703)	(0.0703)
$UNION93_t$ *Ind.31	0.05711	0.06146	0.06161
	(0.0846)	(0.0862)	(0.0862)
$UNION93_t$ *Ind.32	-0.14993	-0.14841	-0.14815
	(0.0784)	(0.0809)	(0.0809)
$UNION93_t$ *Ind.34	-0.04242	-0.03842	-0.03838
	(0.0745)	(0.0763)	(0.0762)
$UNION93_t$ *Ind.35	0.17082	0.17512	0.17504
	(0.0616)	(0.0627)	(0.0626)
$UNION93_t$ *Ind.36	-0.89888	-0.89890	-0.89809
	(0.2909)	(0.2934)	(0.2935)
DUMMY93	0.10029	0.10001	0.09997
	(0.0332)	(0.0331)	(0.0331)
Qr.1	-0.04555	-0.04357	-0.04358
	(0.0107)	(0.0109)	(0.0109)
Qr.2	0.01220	0.02054	0.02056
	(0.0091)	(0.0086)	(0.0086)
Qr.3	0.01208	0.00984	0.00985
	(0.0085)	(0.0083)	(0.0083)
Number of Observations:	300	300	300
R^2	0.9780	0.9782	0.9782
AR 1-4	1.9425	1.6430	1.6429
	[0.7530]	[0.7928]	[0.7927]
Normality	7.74	7.85	7.85
	[0.0209]*	[0.0198]*	[0.0198]**
Xi^2	1.9445	2.0968	1.9892
	[0.0014]**	[0.0006]**	[0.0010]**

Notes: N is number of production workers; W is the real labour cost of a production worker; Q is production; Aw is the alternative wage; UNION is union density; OPEN is the degree of openness; Qr"j" is a dummy variable for quarter "j"; Ind."i" is a dummy variable for industry "i"; DUMMY93 is a dummy variable equal to 1 in 1993-1997; UNION93 is UNION multiplied by DUMMY93. Industries are: food, beverage & tobacco (31); textiles and apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38). Models (1) and (2) differ in that the former includes 2 lags of the dependent variable, while the latter only includes 1. Model 3 includes the variable OPEN in the labour demand equation. Variables are in logs, except for UNION; OPEN and binary variables. Corrected (according to White, 1980) standard errors are in parenthesis below each estimated coefficient. AR 1-4 is test of autocorrelation of order 4 in the residuals; Normality is Jarque-Bera's test; Xi^2 is a test for hereoscedasticity of the residuals, using all variables and their squared value in the model for the variance.

Table 6: Labour demand - manufacturing industries 1975 - 1997

Short run estimates

	1975-1984		1985-1997	
Variable	**Estimate**	**Confidence Interval**	**Estimate**	**Confidence Interval**
Production	0.09304	(0.045, 0.141)	0.040243	(0.007, 0.087)
Labour Costs	-0.10180	(-0.137, -0.066)	-0.03886	(-0.075, -0.003)
Lagged empl.	0.88844	(0.827, 0.950)	0.86921	(0.826, 0.912)

Long run estimates

	1975-1984		1985-1997	
Variable	**Estimate**	**Confidence Interval**	**Estimate**	**Confidence Interval**
Production	0.8339	(0.525, 1.143)	0.3077	(0.080, 0.536)
Labour Costs	-0.9125	(-1.368, -0.457)	-0.2971	(-0.534, -0.060)
Labour share (s_L)	0.248		0.257	
Wage elasticity of labour demand	0.69		0.22	

Note: s_L is equal to the wage bill (all wage and nonwage costs included) divided by value added. The wage elasticity of labour demand is equal to $-(1-s_L)*\sigma$, where σ is the elasticity of substitution between capital and labour and is given by the estimated coefficient of the wage in the labour demand equation.

After 1992 the structure of bargaining changed, so that firm level negotiations became quite common in some industries. The effect of this institutional change is captured in both the labour demand and the wage equations, but in different ways. In 1993 the labour demand equation has shifted in, while the other estimated coefficients are stable. Regarding the wage, the estimated effect is an overall increase in wages but along with a reduction of the impact of union power on the mark-up that is different per industry. Industries that have experienced a greater reduction of this positive effect are those in which firm level negotiations have become more common. Hence, while no significant change is detected in chemicals (35) - a concentrated industry in which public firms are present – in nonmetallic minerals (36) union power has become less effective in increasing the mark-up over alternative income. The estimated long run effect of unions is to increase wages by 1.5 percent per each 10 percent increase in coverage in 1985-1992. Given the changes that took place in the nineties, the average effect is almost null for the whole period[12]. The indirect effect of unions over employment *via* wages is such that an increase in coverage of 10 percentage points is associated with a 0.8 percent decline in labour demand before 1993.

[12] These effects are calculated at the mean value of UNION

Table 7: Impact of key variables on real labour costs - manufacturing industries 1985 - 1997

	Short run		Long run	
Variable	**Estimate**	**Confidence Interval**	**Estimate**	**Confidence Interval**
Openness	-0.02426	(-0.045, -0.003)	-0.04256	(-0.075, -0.010)
Alt.Wage	0.72145	(0.616, 0.827)	1.26580	(1.175, 1.356)
Lagged Wage	0.43003	(0.351, 0.509)		
Union 1985/92	0.15477	(0.110, 0.200)	0.27154	(0.215, 0.328)
Union 1993/97				
Ind.31	-0.01809	(-0.176, 0.140)	-0.03174	(-0.328, 0.265)
Ind.32	-0.22796	(-0.384, -0.072)	-0.39995	(-0.722, -0.078)
Ind.34	-0.11797	(-0.246, 0.010)	-0.20698	(-0.451, 0.037)
Ind.35	0.09557	(0.031, 0.159)	0.16767	(0.062, 0.273)
Ind.36	-0.97846	(-1.585, -0.372)	-1.71670	(-2.756, -0.677)
Ind.38	-0.07955	(-0.215, 0.056)	-0.13957	(-0.387, 0.108)

Note: Industries are: food, beverage & tobacco (31); textiles and apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38).

As almost every parameter changed, a simulation was done using both models in order to capture all possible effects. First, the wage was calculated for the period 1985-1997 using an ARIMA(4,1,0) model estimated using data for 1975-1984. Comparing the average value of the estimated wage with the actual average value, the result is that wages were 46% higher than what they would have been had no changes occurred. For 1975-1984, the same exercise shows that actual wages in the period were 18% lower than what they would have been if there had been bargaining over wages and a union density equal to its average value in 1985-1997 (see Figures 5 and 6).

Second, using actual wages and the two specifications of the labour demand equation, the estimated effect of the different regimes on labour demand is that the employment level in 1985-1997 was 9 percent higher than what it would have been according to the 1975-1984 model. This is the combined effect of the decrease in the output and wage parameters. Accordingly, in 1975-1984, employment would have been 5% higher than its observed level if elasticities had been those stemming from the bargaining model (see Figures 7 and 8).

Finally, considering both the estimated wage level and the change in elasticities, the employment level in 1985-1997 was 24 percent lower than what it would have been if wages had followed the 1975-1984 ARIMA(4,1,0) model and elasticities had been those according to the 1975-1984 labour demand equation. In 1975-1984, on the contrary, if wages had been those predicted by the bargaining model and elasticities had had the values estimated with this same model, then the employment level would have been 1% lower than what it actually was (see Figures 9 and 10).

In summary, unions could have prevented wages to fall as much as they did before 1985 at the cost of a 1% employment loss; while if unions had not been reinstated, employment would have been 24% higher but at the cost of a much lower level of earnings.

Figure 5
Labour costs 1975-1984
assuming the existence of unions

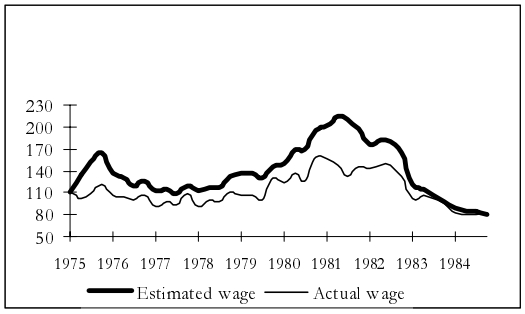


Figure 6
Labour costs 1986-1997
assuming there were no unions

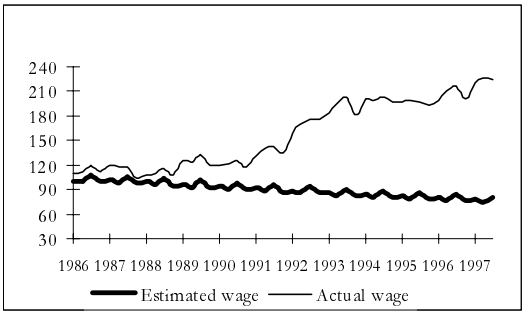


Figure 7
Employment 1975-1984
assuming the existence of unions
but using actual wages

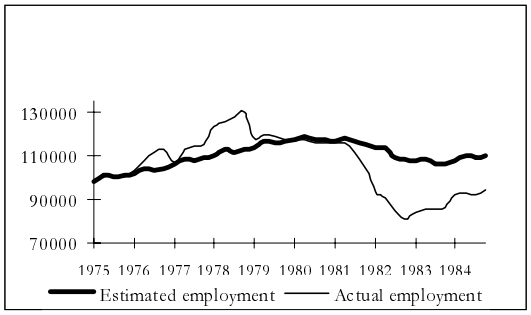


Figure 8
Employment 1986-1997
assuming there were no unions
but using actual wages

Figure 9
Employment 1975-1984
assuming the existence of unions

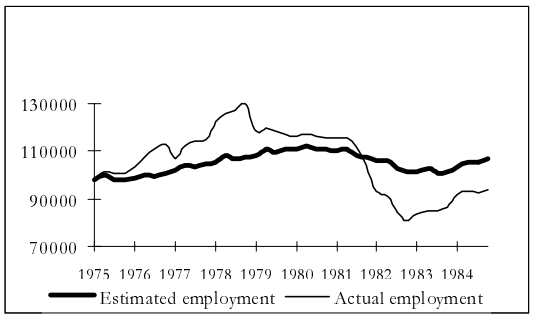
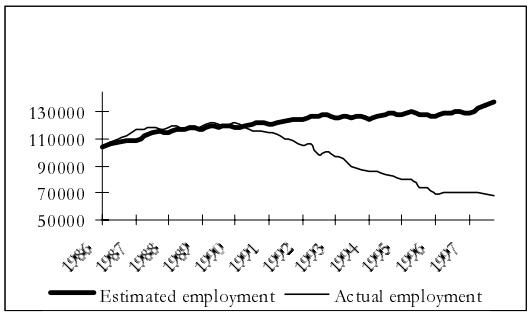


Figure 10
Employment 1986-1997
assuming there were no unions



All the results discussed above stem from a model for the whole manufacturing sector using industry data, and in which output and wage elasticities of labour demand were assumed to be the same for all industries. A natural question is if this last assumption holds and, if not, if it is biasing the results significantly. To address the issue, all the coefficients were allowed to vary per industry in both subperiods and the restriction imposed was tested. In 1975-1984, the hypothesis of common elasticities and speed of adjustment was not rejected. For 1985-1997 the wage elasticity and the lagged employment coefficient were statistically equal among industries while a unique output elasticity was rejected. Paper and chemicals have a significantly smaller elasticity. However, the average elasticity for the manufacturing sector estimated using this model is only slightly higher while the wage elasticity and the parameter accounting for the speed of adjustment do not show important biases[13]. Although such similarity between industries is not expected to hold *a priori*, the statistical result supports the estimation procedure followed using the pooled cross section – time series dataset. Further, the decline in the elasticities holds, no matter the amount in which they decreased might be overstated.

Even though no direct bargaining over employment has been observed, all these findings suggest that unions have had an effect on employment adjustment. This has taken place through two mechanisms. First, re-unionisation changed the way wages were set. Bargaining over wage levels has been done taking into account the likely effects on the labour demand schedule and outside opportunities for those that would eventually be unemployed. Industries that have been most exposed to competition have registered lower mark-ups than the rest. Union membership, which has declined systematically all along the period, raised the mark-up during the eighties. At the beginning of the nineties, and probably as a consequence of the progressive decentralisation of bargaining and non-enforcement of contracts, this effect has vanished in some industries while in others it has even become negative. Increased openness also has tempered wage demands by unions.

Second, unions have effectively altered the labour demand choice set for employers. Output and wage elasticities have gone down and union resistance is one of the probable causes. As unions forced wages up and more limits were posed to pass that increase onto prices, firms have been forced to adjust employment to cyclical variations of demand less than before. Further, expected union resistance has been probably in the root of a smaller adjustment of employment to wage increases. As a result of all these changes, wages are higher and employment is lower today than what they would have been if no institutional changes had taken place.

VI. Conclusions

This study has examined a unique situation in Uruguay where before-after comparisons about the impact of collective bargaining can be made. During the period under study there were three distinct regimes: (1) 1975-1984 when bargaining was banned, (2) 1985-1991 when there was tripartite bargaining, and (3) 1992-1997 when there was bargaining without government involvement. During the third regime the economy became much more open, which would presumably also have an effect on bargaining results.

Strong evidence of a change in economic behaviour after 1985 has been reported. Recursive residuals show structural shifts in five of six industries with the shifts coming at about the same time as the regime changes. These breaks are also significant in a model specified in differences using pooled cross section – time series data. Cointegration of employment, output, and labour costs is rejected for the whole period for each industry. Wages are exogenous to employment before 1985, but not afterwards.

[13] Results are available upon request.

Based on this evidence, a standard IVE labour demand model for 1975-1984 and a right-to-manage bargaining model for 1985-1997 were estimated. The results showed that the long run wage elasticity of labour demand and the employment-output elasticity fell sharply, while there was no overall change in the amount of time needed for employment to adjust to its equilibrium level.

The bargaining model results indicated that unions significantly raised wages in 1985-1992. Afterwards the change in bargaining structure and increased openness had a pronounced effect on bargaining outcomes. Labour demand shifted to the left from 1993 onwards. The union wage differential vanished in 1993 in four industries where there were sharp increases in openness and sharp declines in percentage union. Wages in the chemical and oil industry were not affected very much. Although that industry became more open, it has remained heavily unionised, which is no doubt a consequence of state ownership.

What would have happened to wages and employment had the ban on unions been maintained? To build a counterfactual, an ARIMA(4,1,0) model of wages was estimated for 1975-1984 and used to project a wage path through 1997. Actual wages have been significantly higher than the simulated "nonunion" wage, based on average values for 1985-1997. Taking into account the higher wage level and the reduced elasticities, employment in 1985-1997 was much lower than it would have been if unions had not returned.

The following picture emerges from these results. Unions returned on the scene as a political and economic force in 1985 and for two years more than half of Uruguay's workers were union members. Union density settled down to about 40 percent in 1987-1992 and unions were able to successfully negotiate higher wages and were able to protect against job loss by reducing employment elasticities. It would be useful to know the precise mechanisms through which unions reduced employment adjustment. It is doubtful that unions had much effect on consumer choices, since no steps were made to expand state ownership or de-liberalise trade when unions returned. The most likely channels through which unions had an impact were restrictive work practices and the threat of strikes or slowdowns in situations where layoffs were thought possible.

In the 1990s the end of tripartite bargaining, trade liberalisation, and the recession in Argentina forced unions to make compromises at the bargaining table. Faced with an adverse shift in labour demand, unions reduced their wage demands to preserve jobs. Percentage union declined to 20 percent as many unionised establishments were no longer economically competitive and others were forced to increase productivity to survive. When a few more years of data become available, it would be fruitful to determine if elasticities had returned to their 1975-1984 values.

This paper has focused on the wage and employment effects of unions. To get a more complete view of the overall impact of unions, a study of the hours/employment trade-off should be carried out. There is some evidence that in the eighties firms adjusted hours of work when output was rising. There is also data stemming from the collective contracts that may be useful to build a measure of bargained overtime rates.

Another topic that might be analysed in more depth is that related to the dynamic patterns of employment. Although the speed of adjustment of employment to its equilibrium level was not found to vary, this could be the result of the changes in the bargaining regime that took place at the beginning of the nineties. Hence, a constant speed of adjustment in 1985-1997 might be hiding a lower adjustment in the eighties together with faster adjustment in the nineties.

Finally, this study has not discussed the benefits that result from successful union-management cooperation. Future work should carefully examine this matter. Not only because of a need to focus as carefully as possible on labour demand and bargaining, but because the structure of the system of labour relations has become increasingly decentralised in Uruguay, and unions are apparently changing their utility function when they bargain at the firm level under competitive pressures.

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ANNEX

Table 1: Tests of order of integration 1975 - 1997 per manufacturing industry

Employment: level (N)

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.1390	-0.76966	-0.76308	-0.90884	-1.2061	-1.1304
1	-1.3592	-0.37021	-0.62265	-0.44888	-1.1309	-1.0459
0	-1.4418	0.065646	-0.41783	-0.61987	-1.5025	-0.71382

Employment: first differences (ΔN)

Unit-root tests 1976 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-6.2857**	-3.9358**	-4.5668**	-4.6456**	-5.3364**	-3.9579**
1	-7.9173**	-4.8130**	-5.9609**	-5.1060**	-6.8421**	-5.8053**
0	-9.8103**	-7.5615**	-8.5221**	-10.638**	-11.078**	-7.9268**

Production: level (Q)

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values Model 1: 5%=-3.46 1%=-4.064; Constant and Trend and Seasonals included
Critical values Model 2: 5%=-2.894 1%=-3.505; Constant included

Model	1	1	2	1	1	1
Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.3540	-2.5796	-1.9669	-2.5885	-2.1739	-2.5012
1	-2.1006	-2.6076	-2.1029	-2.7678	-2.0751	-2.2671
0	-3.3231	-2.5531	-2.4932	-3.4557	-2.5633	-2.2659

Production: first differences (ΔQ)

Unit-root tests 1976 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-12.875**	-9.3050**	-6.6666 **	-5.6461**	-6.9455**	-7.3525**
1	-9.9075**	-9.3008**	-8.4027**	-8.7462**	-8.6921**	-8.2238**
0	-15.957**	-11.736**	-11.903**	-11.808**	-11.269**	-11.540**

Real labour costs: level (W)

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.6274	-1.4101	-1.1787	-0.66944	-1.6212	-0.80691
1	-1.0999	-1.4270	-1.5029	-0.77055	-1.6527	-1.4528
0	-1.5100	-2.1114	-1.5233	-1.1714	-1.9015	-2.0100

Real labour costs: first differences (ΔW)

Unit-root tests 1976 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-6.3493**	-7.1240**	-7.2240**	-7.2307**	-6.4613**	-9.2235**
1	-5.7181**	-7.6787**	-7.7919**	-7.6088**	-7.1191**	-10.307**
0	-11.331**	-12.536**	-9.5372**	-11.935**	-10.601**	-12.048**

Note: Industries reported are: food, beverage & tobacco (31); textiles and apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38).

Table 2: CI tests 1975-1997 per manufacturing industry

Industry 31: Food, beverage & tobacco

Johansen's Method

	M1 Statistic		M2 Statistic		M3 Statistic		M4 Statistic		M5 Statistic		M6 Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	26.5**	37.0**	19.8	29.1	19.3*	22.7	12.4	21.2	17.6	29.3	21.0*	26*
P<=1	7.2	9.6	7.3	9.3	3.5	3.5	8.3	8.9	10.5	11.7	5.1	5.3
P<=2	2.2	2.2	2.0	2.0	0.0	0.0	0.6	0.6	1.3	1.2	0.1	0.1

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES31	-2.3634	0.86425	0.052712	2	0.40579	0.6859	
RES31	-2.3397	0.86806	0.052456	1	-1.9782	0.0511	0.6859
RES31	-2.8569	0.84108	0.053326	0			0.1390

Industry 32: Textiles and apparel

Johansen's Method

	M1 Statistic		M2 Statistic		M3 Statistic		M4 Statistic		M5 Statistic		M6 Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	29.4**	46.1**	15.2	26.5	29.3*	37.3**	20.6	28.5	14.7	22.3	16.6	21.9
P<=1	15.1	15.6	11.2	11.3	7.1	8.0	7.7	7.9	7.6	7.6	4.5	5.3
P<=2	0.0	0.0	0.1	0.1	0.9	0.9	0.2	0.2	0.0	0.0	0.8	0.8

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES32	-1.5819	0.90187	0.081372	2	-3.9343	0.0002	
RES32	-2.8267	0.82114	0.087956	1	0.78533	0.4344	0.0002
RES32	-2.7237	0.83683	0.087762	0			0.0006

Industry 34: Paper

Johansen's Method

	M1 Statistic		M2 Statistic		M3 Statistic		M4 Statistic		M5 Statistic		M6 Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	17.0	26.0	16.3	24.8	9.5	18.6	10.5	15.9	10.9	16.0	6.7	13.3
P<=1	7.8	8.4	6.9	7.7	7.8	9.0	5.0	5.3	4.8	5.1	4.9	6.5
P<=2	0.6	3.8	0.8	0.8	1.2	1.2	0.3	0.3	0.3	0.3	1.6	1.6

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES34	-1.3420	0.93107	0.052093	2	0.34664	0.7297	
RES34	-1.3032	0.93579	0.051826	1	-0.34372	0.7319	0.7297
RES34	-1.4554	0.93126	0.051563	0			0.8884

Industry 35: Chemicals

Johansen's Method

	M1		M2		M3		M4		M5		M6	
	Statistic		Statistic		Statistic		Statistic		Statistic		Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	17.1	25.7	17.0	24.0	17.2	24.2	18.2	27.3	16.5	27.0	18.6*	27*
P<=1	8.6	8.6	6.9	6.9	5.3	7.0	9.1	9.1	10.5	10.5	7.0	8.2
P<=2	0.0	0.0	0.0	0.0	1.7	1.7	0.0	0.0	0.0	0.0	1.1	1.1

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES35	-1.9601	0.91697	0.052822	2	2.7837	0.0066	
RES35	-1.4932	0.93509	0.054856	1	-1.6864	0.0954	0.0066
RES35	-1.8562	0.92017	0.055434	0			0.0062

Industry 36: Nonmetallic minerals

Johansen's Method

	M1		M2		M3		M4		M5		M6	
	Statistic		Statistic		Statistic		Statistic		Statistic		Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	25.0*	34.7*	24.4*	32.6*	9.3	15.7	16.9	26.0	16.9	25.2	7.6	15.5
P<=1	6.7	9.6	5.1	8.2	5.6	6.4	6.8	9.1	5.8	8.6	6.6	7.8
P<=2	2.9	2.9	3.0	3.0	0.8	0.8	2.3	2.3	2.4	2.4	1.2	1.2

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES36	-2.4155	0.75575	0.078311	2	-0.51098	0.6107	
RES36	-2.7520	0.73861	0.077974	1	-2.5504	0.0125	0.6107
RES36	-4.2689**	0.62802	0.080403	0			0.0396

Industry 38: Metallic products

Johansen's Method

	M1		M2		M3		M4		M5		M6	
	Statistic		Statistic		Statistic		Statistic		Statistic		Statistic	
H_0:rank=p	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace	λ-max	trace
P==0	32.1**	52.0**	22.6*	37.8**	23.8**	31.7**	23.1*	34.6*	18.8	29.2	12.3	16.5
P<=1	17.8*	20.0**	12.4	15.2	7.1	7.9	9.7	11.5	9.1	10.4	3.5	4.2
P<=2	2.2	2.2	2.8	2.8	0.8	0.8	1.8	1.8	1.3	1.3	0.7	0.7

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.894 1%=-3.505; Constant included

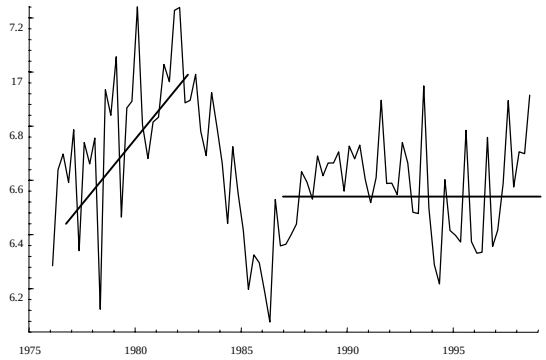
	t-adf	beta Y_1	\sigma	lag	t-DY_lag	t-prob	F-prob
RES38	-2.4862	0.75854	0.09377	2	-2.4574	0.0160	
RES38	-3.6267**	0.66597	0.09648	1	-0.0800	0.9364	0.0160
RES38	-4.1070**	0.66271	0.09593	0			0.0539

Notes: The values reported of the λ-max and trace statistics are those for small samples. M1 to M6 refer to different models: M1 is a model with one lag and a constant; M2 includes seasonals; M3 excludes constant and seasonals. M4 to M6 are the same as M1 to M3 but with 2 lags.

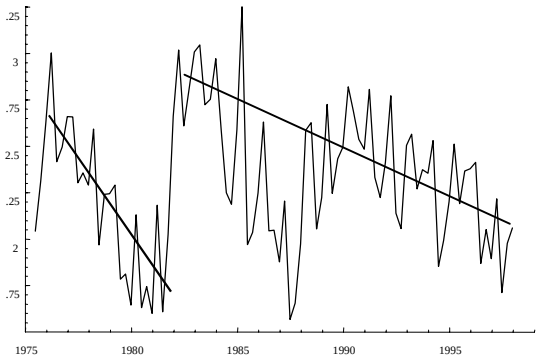
* means the statistic is significant at 99% and ** at 95% .Critical values for M1; M2; M4 and M5 for the λ-max statistic are: 21.0; 14.1; 3.8 for p==0;<=1 and <=2 respectively. Those for the trace statistic are: 29.7; 15.4 and 3.8. The figures for M3 and M6 are:17.9; 11.4; 3.8; 24.3; 12.5 and 3.8.

RES(j) are the residuals of the static regression of the log of employment on the log of real labour costs and output.

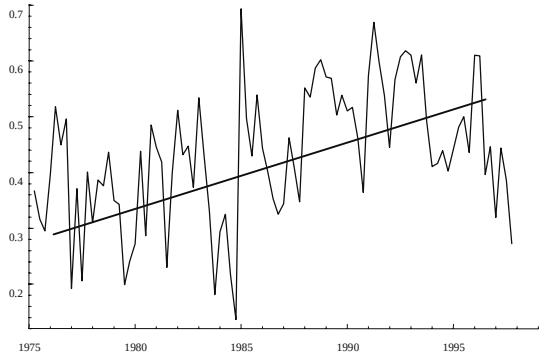
Graph 1: CI relation 1975-1997
Food, beverage & tobacco



Graph 2: CI relation 1975-1997
Textiles & apparel



Graph 3: CI relation 1975-1997
Nonmetallic minerals



Graph 4: CI relation 1975-1997
Metal products

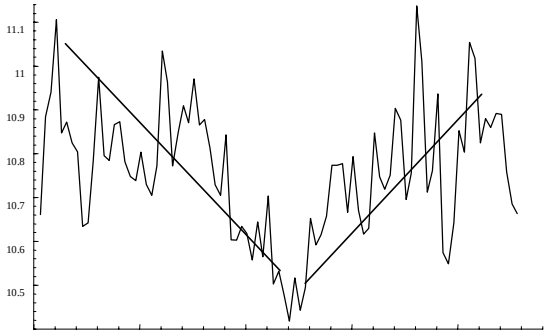


Table 3: Tests of order of integration 1975-1984 and 1985-1997 per manufacturing industry

a) 1975 - 1984

Employment: level (N)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-2.5950	-1.6086	-1.2078	-1.2582	-0.83448	-1.2016
1	-2.7889	-1.3369	-1.1917	-1.1657	-0.85303	-1.0131
0	-2.7786	-0.87525	-1.2005	-1.1396	-1.2904	-0.40892

Employment: first differences (ΔN)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-3.5006*	-2.3858	-3.1008*	-2.7929	-3.3449*	-2.2757
1	-4.7977**	-2.7784	-4.0736**	-3.3230*	-4.7078**	-2.9124
0	-5.9422**	-3.9935**	-5.9520**	-5.3326**	-7.8115**	-3.8907**

Production: level (Q)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.3551	-1.5597	-1.0378	-1.5105	-1.2428	-1.3483
1	-1.5006	-1.7065	-1.0796	-1.9170	-1.1518	-1.1211
0	-3.5859*	-1.8756	-1.3054	-2.1261	-1.3826	-1.4192

Production: first differences (ΔQ)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-7.0006**	-4.5957**	-3.1842*	-3.6610**	-4.1848**	-3.8934**
1	-5.8296**	-4.8931**	-4.4946**	-5.3628**	-4.1581**	-3.9342**
0	-11.328**	-6.5990**	-6.8692**	-6.5669**	-6.7829**	-7.2999**

Real labour costs: level (W)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.9026	-1.5492	-1.2954	-1.2465	-1.6269	-1.2547
1	-1.4888	-1.0608	-1.6641	-1.2532	-1.3242	-1.5461
0	-1.7139	-1.7121	-1.5443	-1.7968	-1.4835	-1.8132

Real labour costs: first differences (ΔW)

Unit-root tests 1976 (1) to 1984 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.945 1%=-3.623; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-4.1317**	-4.5866**	-5.2300**	-4.6311**	-3.4348*	-5.0862**
1	-3.7696**	-4.3153**	-5.0854**	-4.8072**	-3.6439**	-5.5376**
0	-6.6798**	-8.0047**	-5.5840**	-8.1063**	-6.5290**	-7.1038**

b) 1985 – 1997

Employment: level (N)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	0.46044	0.52536	0.52631	0.23815	-0.85312	-0.19819
1	0.071919	0.73045	0.47858	0.84976	-0.72559	-0.35062
0	-0.15768	0.56007	0.90892	0.26647	-0.68648	0.43073

Employment: first differences (ΔN)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-5.4181**	-3.1749*	-3.1094*	-3.4679*	-3.8123**	-3.3249*
1	-6.4158**	-4.3344**	-4.2772**	-3.8352**	-4.2025**	-5.3928**
0	-7.8121**	-7.3548**	-5.5190**	-9.3899**	-6.6537**	-7.1566**

Production: level (Q)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values Model 1: 5%=-2.923 1%=-3.571; Constant included
Critical values Model 2: 5%=-2.923 1%=-3.571; Constant and Seasonals included
Critical values Model 3: 5%=-3.504 1%=-4.158; Constant and Trend and Seasonals included

Model	1	2	3	3	3	2
Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-0.75192	-1.2447	-2.9285	-1.9864	-4.2071**	-2.1404
1	-1.5892	-1.5003	-2.6061	-1.9425	-3.9310*	-2.1935
0	-2.6469	-1.6600	-3.3922	-2.6681	-4.1709**	-2.3594

Production: first differences (ΔQ)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values Model 1: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.38
2	-13.804**	-8.5948**	-5.3499**	-3.9875**	-5.6954**
1	-8.6737**	-7.4293**	-6.0758**	-6.3471**	-7.0047**
0	-10.568**	-9.2444**	-8.7901**	-8.9858**	-8.4481**

Real labour costs: level (W)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-0.91189	-0.79368	-0.28570	-1.2903	-0.39377	-0.16091
1	-1.0367	-0.87610	-0.27960	-1.3079	-0.75799	-0.63152
0	-1.1111	-1.1709	-0.37651	-1.3448	-1.0553	-1.2518

Real labour costs: first differences (ΔW)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-4.8027**	-5.8573**	-3.5825**	-4.7689**	-6.4608**	-9.4354**
1	-4.5204**	-6.6026**	-5.0680**	-5.3096**	-6.8041**	-9.1931**
0	-11.318**	-9.6385**	-7.2193**	-7.5302**	-8.0805**	-9.8846**

Alternative income: level (AW)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.0622	-0.26599	-0.68071	-1.5105	-1.2264	-0.31812
1	-1.0977	-0.27479	-0.70182	-1.5243	-1.2636	-0.50304
0	-1.3744	-0.53359	-0.58792	-1.5418	-1.3169	-0.75351

Alternative income: first differences (ΔAW)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-5.3632**	-5.0075**	-3.6446**	-4.2448**	-5.0124**	-6.1520**
1	-5.1457**	-5.5917**	-4.6648**	-4.8143**	-5.3230**	-6.6413**
0	-11.588**	-8.8841**	-6.2868**	-6.7643**	-7.3100**	-8.3432**

Open: level (OPEN)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-1.9511	-0.71192	-0.40513	-2.6096	-0.83810	0.037784
1	-1.8791	-0.75411	-0.42541	-2.6449	-0.90096	-0.074127
0	-1.8177	-0.79349	-0.44497	-2.6798	-0.95574	-0.16839

Open: first differences (ΔOPEN)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-3.8378**	-4.0946**	-3.9638**	-4.0242**	-4.6335**	-4.5125**
1	-4.7509**	-4.9832**	-4.8664**	-4.9206**	-5.4326**	-5.3361**
0	-6.7895**	-7.0051**	-6.8980**	-6.9481**	-7.3932**	-7.3130**

Union: level (UNION)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-0.40374	-1.6373	-2.8522	-2.1880	-2.9658*	-2.7446
1	-1.0067	-1.8707	-2.8877	-2.2243	-3.0142*	-2.7748
0	-0.87189	-1.9477	-2.9067	-2.1657	-3.2859*	-2.7978

Union: first differences (ΔUNION)

Unit-root tests 1986 (1) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)
Critical values: 5%=-2.923 1%=-3.571; Constant included

Lag	Ind.31	Ind.32	Ind.34	Ind.35	Ind.36	Ind.38
2	-4.6465**	-4.3718**	-4.2272**	-3.3584*	-3.6973**	-3.3502*
1	-6.4368**	-6.2137**	-4.7436**	-5.0175**	-3.9382**	-4.7011**
0	-6.3998**	-7.2938**	-6.5521**	-6.8383**	-5.2671**	-7.1536**

Note: Industries reported are: food, beverage & tobacco (31); textiles & apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38).

Table 4: CI tests 1975-1984 and 1985-1997 per manufacturing industry

Industry 31: Food, beverage & tobacco

1975-1984

Unit-root tests 1975 (4) to 1984 (4)
Critical values: 5%=-2.942 1%=-3.617; Constant included

	t-adf
RES31	-2.6059
RES31	-2.6875
RES31	-3.0998*

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES31	-2.2252	-2.7936	-2.2839
RES31	-2.2789	-2.8361	-2.2479
RES31	-2.6317	-3.1671	-2.2749

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)
Critical values: 5%=-2.923 1%=-3.571; Constant included

	t-adf
RES31	-2.8864
RES31	-4.2126**
RES31	-3.6730**

Industry 32: Textiles & apparel

1975-1984

Unit-root tests 1975 (4) to 1984 (4)
Critical values: 5%=-3.535 1%=-4.224; Constant and Trend included

	t-adf
RES32	-3.8745*
RES32	-4.4456**
RES32	-4.9328**

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES32	-3.1211*	-3.2543	-3.0265
RES32	-2.8752	-3.1210	-2.7955
RES32	-2.9059	-3.1968	-2.8656

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)
Critical values: 5%=-2.923 1%=-3.571; Constant included

	t-adf
RES32	-2.3054**
RES32	-3.0523*
RES32	-3.5752**

Industry 34: Paper

1975-1984

Ho:rank=p	λ-max	95%	trace	95%
p == 0	23.1*	21.0	26.22	29.7
p <= 1	3.11	14.1	3.113	15.4
p <= 2	0.003218	3.8	0.00321	3.8

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES34	-1.3382	-1.4095	-1.3407
RES34	-1.7062	-1.6750	-1.7311
RES34	-1.5440	-1.4807	-1.6605

1985-1997: bargaining variables added

Ho:rank=p	λ-max	95%	trace	95%
p == 0	73.1**	21.0	95.88	29.7
p <= 1	13.95	14.1	22.78**	15.4
p <= 2	.828	3.8	8.828	3.8

Industry 35: Chemicals

1975-1984

Ho:rank=p	λ-max	95%	trace	95%
p == 0	21.45*	21.0	25.64	29.7
p <= 1	7.315	14.1	8.189	15.4
p <= 2	0.8738	3.8	0.8738	3.8

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES35	-1.9685	-3.1844	-3.1820
RES35	-1.8963	-3.2570	-3.2627
RES35	-2.2876	-3.4259	-3.2335

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)
Critical values: 5%=-2.923 1%=-3.571; Constant included

	t-adf
RES35	-3.1295*
RES35	-2.9980*
RES35	-2.9394*

Industry 36: Nonmetallic minerals

1975-1984

Unit-root tests 1975 (4) to 1984 (4)
Critical values: 5%=-2.942 1%=-3.617; Constant included

	t-adf
RES36	-2.7816
RES36	-2.6459
RES36	-4.7583**

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES36	-2.1903	-2.1938	-1.8111
RES36	-2.6522	-2.5122	-2.2906
RES36	-3.1145*	-2.9676	-2.7709

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)
Critical values: 5%=-2.923 1%=-3.568; Constant included

	t-adf
RES36	-2.6123
RES36	-2.6298
RES36	-3.2504*

Industry 38: Metal products

1975-1984

Unit-root tests 1975 (4) to 1984 (4)

Critical values: 5%=-2.942 1%=-3.617; Constant included

	t-adf
RES38	-2.2774
RES38	-2.8069
RES38	-3.2082*

1985-1997

	M1	M2	M3
	t-adf	t-adf	t-adf
RES38	-1.7686	-1.4230	-1.6327
RES38	-2.7850	-2.6151	-2.3922
RES38	-3.0954*	-2.9954	-2.6557

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)

Critical values: 5%=-2.923 1%=-3.571; Constant included

	t-adf
RES38	-2.7060
RES38	-3.3316*
RES38	-4.4244**

Notes:RES(j) are the residuals of the static regression of employment on output and real labour costs for industry "j". Industries reported are: food, beverage & tobacco (31); textiles & apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38). In 1975-84 and 1985-1997, the regression was done by OLS. When bargaining variables are added, the residual refers to the same model but real labour costs include bargained costs and the method of estimation is 3SLS, so that wages and output are endogenous. Variables explaining the wages are real alternative income, union density and degree of openness. For industries 31 and 35, a dummy variable with value 1 after 1992 is also included. Instruments for output are own lags and seasonals. For industry 34, results using Johansen method are reported. M1 refers to a model with constant; M2 includes also a trend; and M3 further includes seasonal variables. Critical values at 5% are –2.921 for M1; -3-502 for M2 and M3.

Table 5: Nesting the models - Manufacturing industries 1975 – 1997

Estimating the model by 3SLS The present sample is: 7 to 552
Equation 1 for LBLUES

Variable	Coefficient	Std.Error	t-value	t-prob
DUMMY75	1.5171	0.16578	9.151	0.0000
DUMMY85	1.2348	0.18315	6.742	0.0000
DUMMY93	-0.042049	0.011321	-3.714	0.0002
Ind3175	-0.051645	0.023671	-2.182	0.0296
Ind3275	0.043068	0.018266	2.358	0.0188
Ind3475	0.029696	0.020280	1.464	0.1437
Ind3575	-0.11854	0.017924	-6.613	0.0000
Ind3675	-0.044275	0.017602	-2.515	0.0122
Ind3185	0.058061	0.024076	2.412	0.0162
Ind3285	0.070982	0.017312	4.100	0.0000
Ind3485	-0.042266	0.016816	-2.513	0.0123
Ind3585	-0.064253	0.020555	-3.126	0.0019
Ind3685	-0.051673	0.021734	-2.378	0.0178
Qr175	-0.014015	0.0092678	-1.512	0.1311
Qr275	0.0078926	0.0089734	0.880	0.3795
Qr375	-0.013270	0.0090311	-1.469	0.1423
Qr185	0.0028249	0.0085712	0.330	0.7418
Qr285	0.0093799	0.008029	1.168	0.2433
Qr385	-0.017306	0.007874	-2.198	0.0284
Q75	0.10918	0.017011	6.418	0.0000
Q85	0.061004	0.017210	3.545	0.0004
W5	-0.10453	0.015246	-6.856	0.0000
W85	-0.029461	0.017607	-1.673	0.0949
N75_1	0.87269	0.017045	51.198	0.0000
N85_1	0.87360	0.016696	52.323	0.0000

\sigma = 0.0490045

Equation 2 for W5

Variable	Coefficient	Std.Error	t-value	t-prob
DUMMY85	-0.25003	0.090993	-2.748	0.0062
DUMMY93	0.17669	0.029745	5.940	0.0000
Qr185	-0.0016989	0.0088961	-0.191	0.8486
Qr285	-0.0053882	0.0085706	-0.629	0.5298
Qr385	0.0015368	0.0084766	0.181	0.8562
AW85	1.1983	0.025099	47.742	0.0000
UNION	0.23724	0.014423	16.449	0.0000
UNION93	-0.37267	0.070938	-5.253	0.0000
UN3193	0.11571	0.074984	1.543	0.1234
UN3293	-0.25977	0.075826	-3.426	0.0007
UN3493	-0.033919	0.067072	-0.506	0.6133
UN3593	0.33136	0.058549	5.659	0.0000
UN3693	-1.6041	0.25859	-6.203	0.0000
OPEN85	-0.044855	0.0089277	-5.024	0.0000
W85_1	0.0088766	0.0053193	1.669	0.0958

\sigma = 0.0528143

loglik = 3274.5936 log|\Omega| = -11.9948 |\Omega| = 6.17595e-006 T = 546
LR test of over-identifying restrictions: Chi^2(28) = 249.677 [0.0000] **

Note: N is number of production workers; W is the real labour cost of a production worker; Q is production; Aw is the alternative wage; UNION is union density; OPEN is the degree of openness; Qr"j" is a dummy variable for quarter "j"; Ind."i" is a dummy

variable for industry "i". Industries included are: food, beverage & tobacco (31); textiles & apparel (32); paper (34); chemicals (35); nonmetallic minerals (36); and metal products (38). "-1" attached to a variable indicates the variable is lagged one period. Variables with "75" have the actual values from 1975 up to 1984 and zero elsewhere. Those ending in "85" have a value of zero in 1975-1984 and the actual value from that date on. DUMMY75 is a dummy variable equal to 1 in 1975-1984; DUMMY85 is a dummy variable equal to 1 in 1985-1997; DUMMY93 is a dummy variable equal to 1 in 1993-1997. UNION93 is UNION multiplied by DUMMY93; UN"j" 93 is UNION93 multiplied by Ind."j".

Tests of hypothesis

1. Q75 = Q85

&19-&20=0;
Wald test for general restrictions
GenRes Chi^2(1) = 4.6104 [0.0318] *

2. W75 = W85

&21-&22=0;
Wald test for general restrictions
GenRes Chi^2(1) = 10.469 [0.0012] **

3. LAGGED N75 = LAGGED N85

&23-&24=0;
Wald test for general restrictions
GenRes Chi^2(1) = 0.15229 [0.6964]