



INTER-AMERICAN DEVELOPMENT BANK
BANCO INTERAMERICANO DE DESARROLLO
LATIN AMERICAN RESEARCH NETWORK
RED DE CENTROS DE INVESTIGACIÓN
RESEARCH NETWORK WORKING PAPER #R-466

THE ECONOMIC EFFECTS OF UNIONS IN LATIN AMERICA: THEIR IMPACT ON WAGES AND THE ECONOMIC PERFORMANCE OF FIRMS IN URUGUAY

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SEPTEMBER 2002

**Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library**

Cassoni, Adriana.

The economic effects of unions in Latin America : their impact on wages and the economic performance of firms in Uruguay / by Adriana Cassoni, Gaston J. Labadie, Gabriela Fachola.

p. cm. (Research Network Working papers ; R-466)
Includes bibliographical references.

1. Labor unions--Uruguay--Economic aspects. 2. Business enterprises--Effect of labor unions on--Uruguay. 3. Wages--Effect of labor unions on--Uruguay. I. Labadie, Gastón J. II. Fachola, Gabriela. III. Inter-American Development Bank. Research Dept. IV. Title. V. Series.

331.88 C377--dc21

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Inter-American Development Bank
1300 New York Avenue, N.W.
Washington, DC 20577

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Abstract^{*}

This study examines the impact of unionization and the level of centralization in bargaining, at the level of the industry or the firm, on wages and on the economic performance of firms within the manufacturing sector in Uruguay, using a panel of establishments for the period 1988 to 1995. In doing so, we control for the degree of exposure to international and regional competition as well as for industry and firm characteristics.

The main findings suggest that unionization increases wages and employment and promotes investment due to firms substituting labor by capital. Unions tend to organize in those plants with highest rates of profits, but promote increases in productivity and prevent profitability increases. The mechanism at work seems to be that firms moved to more capital-intensive technologies, hence increasing the rate of growth of labor productivity and reducing that of profitability. Given the negative effect of unionization at the industry level on the rate of growth of profitability of firms, results also suggest that unions tended to organize and to be stronger in those sectors in which extra rents were higher due to monopoly power.

The evidence also suggests that firm-level negotiations take into account the interests of both parties, so that enhanced productivity and probably survival were achieved together with lower rates of substitution between labor and capital and/or lower profits.

^{*} We acknowledge the assistance of Dardo Curti in estimating the survival models here reported, as well as Alejandro Retamoso for his help in data processing.

Introduction

This paper examines the impact of unionization and the level of centralization in bargaining (the industry or the firm) on wages and on the economic performance of firms within the manufacturing industries in Uruguay.

Previous work on the impact of labor market institutions (Cassoni, Labadie and Allen, 1995) has shown the significance of unionization in understanding employment determination, labor mobility and the performance of the Uruguayan labor market. The response of wages to macroeconomic conditions was also examined, concluding that the observed compression and lower response are the consequences of the resumption of collective bargaining (Cassoni, Allen and Labadie, 1996). This same conclusion was also found when comparing the evolution of wages and employment before and after re-unionization (Cassoni, Allen and Labadie, 2000a). However, in that same study evidence was also found signaling a decrease in the wage gap generated by unions in the mid-1990s. These changes could be linked to the fact that firms and unions started bargaining at a more decentralized level and also to a change in the issues over which negotiations took place, including employment and working conditions. Evidence of reduced turnover rate among unionized industries was also found. Thus, a new study was carried out in order to further explore these effects and its conclusions showed that starting in 1992, unions have had a positive impact on employment, while decreasing their effect on wages (Cassoni and Labadie, 2001). Trade unions are also found to buffer the effects of fluctuations in product demand and of external shocks on employment. Further, the extent of firm-level bargaining has also favored the above effects. Finally, it was also shown that unions affect the distribution of employment between production and non-production workers. Given the relative wages of these categories, unions reduce the proportion of production workers. However, as they also buffer the impact of external shocks on the employment mix, the direction of the total effect depends on the degree of import penetration and the share of exports in total sales of each manufacturing industry.

From the above it is clear that unions introduced rigidities into the labor market in the 1980s, especially by raising the wage above its market clearing level. The fact that unions did not bargain over employment caused lower rates of hiring while the fear of strikes generated labor hoarding. Firms used hours of work in order to adjust their labor input to fluctuations in product demand. At the beginning of the 1990s, however, workers started worrying about job instability,

while the rules of bargaining changed, mainly by eliminating the previous mandatory extension of collective agreements. This, in turn, promoted the inclusion of work conditions as a bargaining issue and the gradual upsurge of decentralized bargaining (at the firm level).

What effects did all these phenomena have on the performance of the firm? Two different scenarios can be imagined. First, the rigidities introduced by union action in the mid-1980s, primarily high wages, could have become an incentive for firms to move toward more capital-intensive technologies. They would have thus increased the level of investment to achieve productivity gains and higher rates of profit. This should have implied a further reduction in the level of employment. It has to be noted, however, that the same output could have also been obtained under a bargaining model in which job stability was an issue, so that cooperation between unions and managers would have eased the introduction of new technology while the effects on labor demand were not necessarily negative. Another possible scenario is that unions kept bargaining over wage levels and preventing firms from adjusting the employment level, thus reducing productivity. In a context of increased competition, profitability should also be reduced. Further, underinvestment should be expected, as unions would also try to obtain extra rents from capital.

The three indicators mentioned—the investment rate, profitability and productivity—are generally seen as good indicators of firm performance. Hence, to shed light on the effects of trade unions on these variables will help to understand the real mechanisms at work. In order to do so, these effects are here estimated using data from 1988 to 1995 at the establishment level. The dataset includes not only surviving establishments but also new ones and those that closed during the period as well. The methodology makes it possible to overcome some of the problems that result from using aggregate data as discussed in the literature, as well as some of the biases resulting from mortality selection in a balanced panel (Hammermesh, 1993).

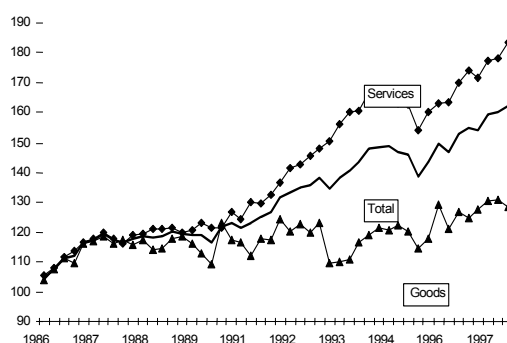
1. Stylized Facts on the Uruguayan Economy in the 1980s and 1990s¹

Uruguay started implementing a series of policies oriented towards opening its economy beginning in the mid-1970s. However, it was not until the early 1990s that the effects were actually felt at the micro level, both in terms of production and the allocation of resources of local firms. This was partly due to the starting high levels of tariffs but also to the existence of

non-tariff barriers. At the same time, the reciprocal tariff reductions with Argentina, Brazil and Paraguay brought about by the Mercosur agreements introduced strong competitive pressure into an economy that was heavily dependent on the region in terms of its exports and imports and also heavily threatened by regional competitors.

Towards 1988, Uruguay had successfully overcome the 1982-84 economic recession during which GNP declined by 15 percent, and favorable external conditions allowed the country to grow until 1990. However, the historical significance of external regional shocks was once again felt in 1991, when Argentina implemented its monetary reform (Plan de Convertibilidad), changing the relative prices of tradables and non-tradables and generating a positive impact in terms of product and employment for the service and non-tradable industries in Uruguay. Exports to Argentina increased 130 percent in 1991 and 74 percent in 1992, moving Brazil to second place among destinations of Uruguayan exports. These dynamics led to growth, but with a change in the share of tradable and non-tradable sectors (Figure 1). Uruguay's stabilization plan, in turn, although more gradual and less comprehensive than Argentina's, also started to have positive effects in 1991 and 1992; inflation, which had peaked at 129 percent in 1990, declined to 30 percent in 1996. As a consequence, imports into Uruguay increased greatly between 1990 and 1995, partly due to tariff reduction and trade preferences granted through Mercosur, but also due to an exchange rate appreciation and an increase in domestic expenses. At the same time, exports to Brazil and Argentina also increased significantly, especially in terms of their relative share.

Figure 1. Total and Sector GNP (average index 1983=100)



Source: Central Bank of Uruguay

¹ This section is largely based on de Brun and Labadie (1997).

The macro changes described above were particularly felt by firms in the manufacturing sector in Uruguay. While manufacturing represented 27 percent of GDP in 1987, it steadily declined to 18 percent in 1999. The composition of the sector changed as well. In 1985-1987, 21 percent of total sales were exports, while in 1999 that figure rose to 30 percent. There is additionally great variance within the manufacturing sector. Industries like textiles and leather, which already had export levels of around 40 percent in 1985, were exporting nearly 80 percent of their sales in 1995; industries like paper and printing, or metal products, have never exported more than 20 percent of sales. Still, all industries significantly increased their export levels during the 1990s. At the same time, exports to Mercosur increased in terms of their share, enhancing the importance of the region and the vulnerability of local industries to the regional shocks and regional competitors (Figures 2 and 3).

Figure 2. Regional Imports/Total Imports (percentage)

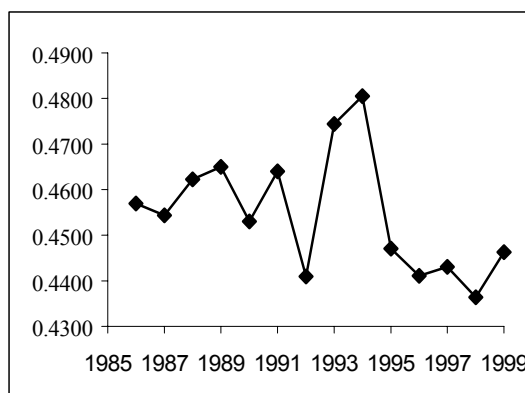
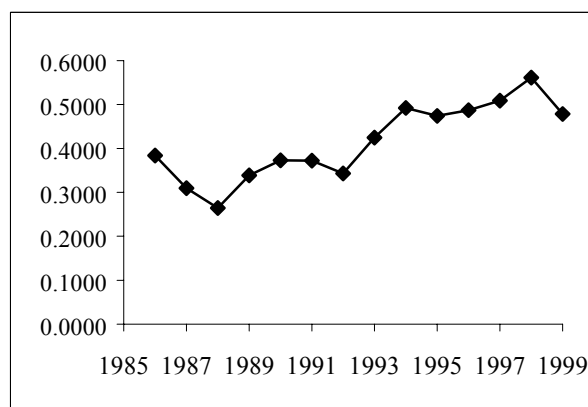


Figure 3. Regional Exports/Total Exports (percentage)

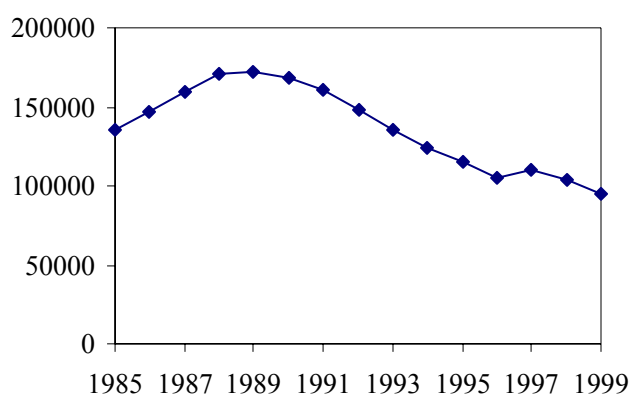


Source: Central Bank of Uruguay.

It is thus seen that one of the effects of the Mercosur on Uruguayan manufacturing was promoting changes in the origin of imports and the destiny of exports. Countries in the region have become a more convenient market for Uruguayan manufacturing goods while, with a lower common external tariff, imports from the rest of the world have increased sharply, although only after 1994.

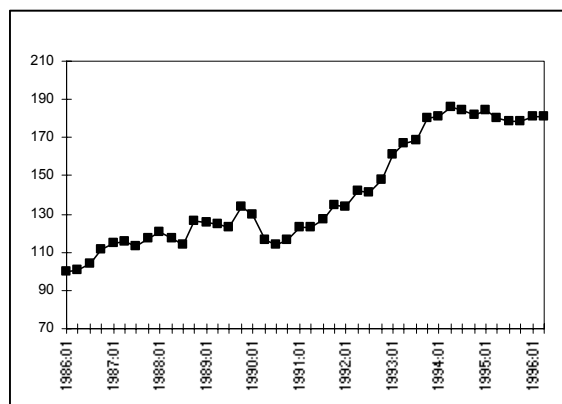
The manufacturing sector shrank in the 1990s while the level of manufacturing employment decreased even more. While in 1990 168,000 workers were employed in manufacturing, representing 15 percent of total employment, by 1999 that number had declined to 96,000, representing only 8 percent of total employment. Accordingly, wage increases started to decelerate and a decline is registered starting in 1994 (Figures 4 and 5).

Figure 4. Employment in the Manufacturing Industry (Number of workers)



Source: National Institute of Statistics.

Figure 5. Real Wage Costs in the Manufacturing Industry (1986.1=100)



Source: National Institute of Statistics, Central Bank of Uruguay.

Starting in 1993 there was a significant increase in the previously declining average productivity of the sector, due in part to the restructuring of many manufacturing firms but also to the reduction of their personnel. It seems to be the case that lowering the level of employment was the way that the manufacturing sector adapted to reduce its wage costs in the context of unfavorable relative prices and increasing competitiveness. Granted, the actual employment numbers take into account only partially the different outsourcing strategies that the sector also developed. The available information on outsourcing refers to 1994-1996 and it indicates that, in total, the manufacturing sector outsourced activities that involved 2.2 percent of its personnel.² Larger firms had lower proportions of their personnel outsourced. However, the reductions in personnel were particularly high among those exporting firms (those that export 75 percent or more of their production), while relatively lower among the sub-sample of firms that export to Mercosur. More interesting is the result that non-unionized firms outsourced areas with higher proportions of personnel in the period 1994-96 than unionized firms, thus suggesting that unions did care about this issue and bargained over employment in that period. Further, the reduction of employees *via* outsourcing was higher among those firms that had collective agreements only at the industry level than for those with firm-level agreements (5.4 percent versus 2.4 percent). It is apparent and theoretically consistent that those firms bargaining at a more decentralized level negotiated over employment more than those that were not.

2. Labor Unions and Labor Relations in Uruguay and its Manufacturing Sector

2.1. Labor Unions in Uruguay

The existence of unions in Uruguay can be traced back to the beginning of the century, but it was only in the early 1940s that they started playing an active role in wage setting, negotiations taking place in the so called Wage Councils. A distinctive characteristic of the Uruguayan wage councils was the fact that they were tripartite bargaining stances: representatives of the workers, the firms and the government negotiated at the wage councils. Their main objective was to set the minimum wage by sector and occupation. However, they also ensured that their resolutions were effectively undertaken and acted further as mediators in conflicts. Whatever was settled at

² These calculations were performed using a special purpose survey on firm performance that was carried out by the Department of Economics at the Social Sciences Faculty of the University of Uruguay.

the wage council was enforced on all firms within the sector, whether they were seated at the bargaining table or not.

In 1964 the first central union was created under the name of CNT (National Convention of Workers). Only two years after that, representatives of all workers in the economy were part of the central union. The strong summoning power showed by the central union served as a means to ratify it as an important social actor. However, with the advent of the military government in 1973, unions and all activities related to them were declared illegal so that unionization was completely banned. Only at the beginning of the eighties the government, still military, authorized the existence of associations of workers at the firm level. This smoothed the path towards re-unionization. In 1984, a year before democratic elections took place again, the union movement was informally re-organized under the name of PIT-CNT³ and wage councils were reinstated in 1985, playing a very similar role as before the military coup.

Employers' associations, and specifically some firms, actually set wages over the minimum level negotiated. Hence the most active opponent to unions' claims in the bargaining table in the 1980s was, in the end, the government that was pursuing an inflation stabilization policy. The government's main instrument in this pursuit was that governmental approval meant mandatory extension of the result of negotiations to all firms in the sector, regardless of whether they were effectively represented in the council. Given the wage, firms were free to determine the level of employment.

Although bargaining took place at the economic sector level, the central union generally succeeded in obtaining the consensus of the different unions to establish a common percentage of wage increase during 1985-1992. Bargaining could be thus considered quite synchronized during this period. However, as some firms ended up raising wages above the level set in the agreement, the positive effects of co-ordination finally vanished (Calmfors and Driffill, 1988).

In 1991 the new government publicly announced its intention to abandon the bargaining table in all sectors except for construction, health care services and some activities linked to transportation services. It effectively did so in 1992, and by 1993 all collective agreements that had been signed under the previous regime expired. The new institutional setting had two major consequences. On one hand, it acted as an incentive for both firms and workers to negotiate at more decentralized levels, particularly at the firm level. On the other hand, it meant collective

³ PIT is the Spanish acronym for the Workers' Inter-Union Plenary.

agreements no longer had mandatory extension to all firms within the sector. As a result, membership in the central union has declined dramatically since then. This, however, does not mean unionization *per se* diminished at that rate, but that the synchronization, coordination and political bargaining power of the Central Union deteriorated.

2.2. The Nature and Structure of Bargaining

In the early 1990s there were more than 300 trade unions in Uruguay. They represented workers from specific economic activities but sometimes only included those employees belonging to a single firm. These unions were further organized in federations that constituted, in turn, the central union. Negotiations were taken over by the federations or groups of unions of the same economic sector. The role of the central union, apart from its political weight, has been generally one of coordinating the claims of all unions and federations. Employers, on the other hand, organized in associations in order to bargain with unions.

A distinctive characteristic of Uruguayan trade unions is the lack of any regulation regarding their constitution, the bargaining process itself and the possible channels through which conflicts may be solved. As a consequence, no legal rules refer to any aspect of the agreements, such as length of the contracts, issues over which to negotiate, or schedules for future negotiations. However, bargaining over minimum wages by occupation has always been undertaken at the wage councils. They have generally set which practice will be followed to raise wages as well as the amount of wage increases. In the 1980s and at the beginning of the 1990s, indexation of wages to the inflation rate was done combining the past and the expected (according to the government's forecast) rate of inflation.⁴ Coordination and synchronization of the negotiations helped to keep wage differentials by economic sectors quite stable in the sub-period. Afterwards, as enforceability vanished and bargaining at the firm level began to be a common practice, negotiated wage increases followed a wide variety of rules, depending on the degree of competition firms and sectors faced and on the evolution of their relative prices, as well as on the bargaining power of the particular trade union.

The analysis of all contracts signed up to 1992 shows that other issues have also been part of the bargaining agenda (see Cassoni, Allen and Labadie, 2000b; Ermida, Cedrola, Raso et al.,

⁴ For a discussion on the type of contracts signed in the period 1985-1991 and their macroeconomic effects, see Forteza, 1992.

1998; and Rodríguez, Cozzano, Mazzuchi et al., 1998). Rules related to working conditions, such as length of the work week, paid holidays, job stability, or annual extra premia, were generally found in collective agreements. Some unions also set hourly wages for overtime work higher than the legally stipulated rates. Other clauses that were sometimes included relate to the position at the firm of union leaders and the available means of solving conflicts. All these clauses, however, do not determine directly the level of employment. Most of them may further be translated into non-wage labor costs. Moreover, although strikes have historically acted as a means of discouraging employers from firing workers, there are no collective contracts in which the parties explicitly reached an agreement on the number of jobs.

In the mid-1990s contracts began to include two new types of conditions: those regulating the introduction of new technology—essentially, how to put in practice training programs and mechanisms to reduce the workforce—and those determining premia linked to productivity gains. This sort of clauses reflected two facts: first, the new economic conditions faced by firms, in a framework of increased foreign competition that required investment in technologies more capital and skill intensive and second, the workers' renewed worry about employment stability. Simultaneously, and linked to these two facts, negotiations at the firm level are known to have included bargaining over employment (Rodríguez, Cozzano, Mazzuchi et al., 1998). Contracts signed at the firm level were many times a complement to collective agreements governing the whole sector. That is, they could either modify some clauses of the general agreement or add others, especially those related to employment stability.

2.3. Union Membership and Union Density

The affiliation rate once unions were legally re-organized in 1985 was around 26 percent for the economy as a whole, with variations by economic sector. Traditionally, public workers have always had a higher affiliation rate than private workers, and this remained so in the 1980s and 1990s. Among private activities, those related to the manufacturing and construction industries have shown the highest union density (Table 1).

The temporal evolution of the affiliation rate shows the previously mentioned decline of membership to the central union. Membership, as reported in the annual congresses, has systematically gone down, so that in the last national congress the number of central union

members was only 165,000 (around 15 percent of employment) compared to 250,000 in 1985.⁵ Although membership to the central union has diminished continuously, unionized workers have not necessarily become an extinct species. Many unions have stopped participating in the national confederation but continued to act as representatives of workers in an economic sub-sector or even at a firm.⁶

Table 1. Union Membership 1985-1997
(percentages)

Union Density	1985	1987	1990	1993	1997
Agriculture, leverage & fishing	18.3	14.3	13.7	6.4	3.9
Manufacturing	32.9	27.3	23.0	25.3	16.6
Electricity, gas & water	79.0	85.4	91.1	91.6	93.7
Construction	28.9	16.4	17.1	10.0	5.2
Commerce	6.5	6.1	4.7	3.1	2.6
Transport & communications	32.3	35.4	32.9	19.9	19.7
Banking & services to firms	26.0	32.4	28.9	20.3	20.1
Social & personal services	20.9	22.3	21.7	20.9	19.1
Private sector	19.4	16.7	14.2	10.0	7.2
Public sector	48.4	42.0	42.3	48.5	47.3
Total	25.8	22.6	20.4	17.3	14.7

Note: Membership is obtained from the National Congresses held in each of the reported years. Union density is defined as the ratio of membership to total employment in each sector.

Sources: Various newspapers, according to data reported by the Central Union (PIT-CNT); Household Surveys, National Institute of Statistics.

While the decline in union participation is substantial in the private sector, it is not so for public activities. Among the former, workers in primary sectors, as well as those in the manufacturing and construction industries have registered the highest de-unionization rates. A possible explanation for the evolution of membership in the primary and manufacturing sector is that commercial liberalization and increased competitiveness have set a limit on wage increases as employment stability has been at stake. They have further forced a huge restructuring of many firms and even of some industries as a whole. As a consequence, jobs have been lost and workers have found bargaining at a decentralized level more profitable for achieving their goals. This might also be the case for the construction industry, although in this case as the result of an increased degree of informality in the industry.

⁵ The figures reported in 1985 cannot be taken as exact measures of membership due to the fact the different unions had a number of representatives at the national congress linked to the reported number of affiliates. This fact acted as an incentive to upwardly bias the real figure.

⁶ Workers in the frozen meat industry and those belonging to the major firm producing beer are examples of these two cases, respectively.

Agreements signed at the firm or plant level have existed since 1985. However, their number was negligible until the 1990s. During the period 1985-1989, 94 percent of all contracts were signed at the industry level, while the percentage declined to 34 percent by 1997. Two percent of contracts, although signed between the trade union and the employers' association, and no longer enforceable, covered only those firms and workers effectively represented at the bargaining table. Thus, while membership went down dramatically, the new structure of bargaining meant an even larger decline in the coverage of collective agreements (Rodríguez, Cozzano, Mazzuchi et al., 1998), so that coverage in 1997 was only 23 percent compared to almost 90 percent in 1990, as is shown in Table 2.⁷ As a result membership and coverage have become very similar concepts since 1997.

Table 2. Membership and Coverage, 1990 and 1997
(percentages)

	Membership Coverage			
	1990	1997	1990	1997
Manufacturing	23	17	83	17
Commerce	5	2.5	91	6
Services	26	21	91	25
Total	20	15	88	23

Source: Rodríguez, Cozzano, Mazzuchi et al., 1998.

2.4. Unions within the Manufacturing Sector in Uruguay

Union density has always varied among the different manufacturing industries under study (Table 3). There are industries, such as textiles and leather or metal products, in which union density has gone down from very high levels in 1985 (60 percent) to less than 15 percent in 1996. On the other hand, the decline has been less severe in the paper and printing industry and especially in oil and chemicals. The latter is an exceptional case, given it includes a large publicly owned firm, and the decrease in unionization in the public sector has not been as sharp as in the private sector.

⁷ The percentages were calculated analysing contracts that were registered at the Ministry of Labor. As the parties were not obliged by law to register these contracts, the figures cannot be considered definitive.

Table 3. Union Density by Manufacturing Industry
(percentages)

	Food, Bever. & Tobacco	Textiles & Leather	Paper & Printing	Oil & Chemicals	Non-Metallic Minerals	Metal Products
1985	45.13	65.86	46.87	67.22	35.08	68.17
1986	42.71	59.54	43.25	62.45	32.59	59.69
1987	44.35	45.06	36.91	60.52	20.29	33.50
1988	42.72	43.86	34.10	57.32	17.33	26.56
1989	41.74	42.82	34.58	57.44	17.67	27.37
1990	39.70	33.08	27.36	57.36	9.01	28.77
1991	41.00	35.19	29.53	63.24	8.76	29.32
1992	44.02	39.21	29.89	68.33	8.77	31.88
1993	25.75	21.72	27.64	51.18	7.33	25.24
1994	26.26	24.93	32.08	55.98	7.94	28.37
1995	28.03	29.58	33.70	55.86	9.43	30.41
1996	21.48	13.42	24.91	50.22	7.31	9.75
1997	21.50	13.05	27.17	51.69	7.78	9.64
1998	22.06	14.09	28.28	53.41	8.18	10.17
1999	23.48	17.17	29.96	58.95	11.04	10.57

Sources: Various newspapers, according to data reported by the Central Union (PIT-CNT), Household Surveys, National Institute of Statistics.

The most significant decline started in the 1990s, when the government stopped participating in negotiations and agreements ceased to be enforceable. After the change in the rules of the game, there was an increase in the number of collective agreements signed at the plant or firm level (Table 4).

Table 4. Firm-level agreements by industry
(Number of ongoing agreements and percentage workers covered by them)

	Food, Bever. & Tobacco		Textiles & Leather		Paper & Printing		Oil & Chemicals		Non-Metallic Minerals		Metal Products	
Year	FLA	%L	FLA	%L	FLA	%L	FLA	%L	FLA	%L	FLA	%L
1985	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1986	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1987	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1988	3	0.5	0	0.0	0	0.0	1	1.4	1	0.5	0	0.0
1989	3	0.5	0	0.0	0	0.0	1	1.5	2	2.6	0	0.0
1990	3	0.5	0	0.0	0	0.0	1	1.7	2	2.6	0	0.0
1991	4	0.6	2	1.2	1	7.1	1	1.9	2	2.4	0	0.0
1992	6	0.6	3	1.3	2	14.1	1	2.0	2	2.3	0	0.0
1993	8	2.3	4	1.5	2	13.7	1	2.0	2	2.2	2	0.0
1994	15	2.4	4	1.7	2	15.0	1	1.9	2	2.5	2	0.0
1995	15	2.5	4	2.1	2	15.6	1	1.8	2	2.8	2	0.0
1996	22	6.3	6	6.2	4	19.3	2	2.2	2	2.9	4	0.4

Note: FLA is the number of firm-level agreements in the industry; %L is the percentage of workers covered by them.

Source: Database on collective agreements, Industrial Survey, National Institute of Statistics.

Consistent with the observed decline in unionization, the analysis of the data stemming from the 1996 special purpose survey indicates that half of the manufacturing firms were not bound by any collective agreement in 1996. The percentage, however, decreases with firm size, although rising again for the largest firms (more than 100 workers). That is, de-unionization has left uncovered by collective agreements mostly those workers in small firms (Table 5). The result must be linked to the fact that firm-level agreements are more often found in large than in small firms.

Table 5. Distribution of Firms by Type of Collective Agreement and Size, 1996
(percentages)

Number of workers	No agreement	Firm-level agreement	Industry-level agreement	Both levels
<10	74.1	1.7	24.1	0
10-29	61.7	10.2	25.8	2.3
30-49	56.0	13.3	24.0	6.7
50-99	35.9	17.5	38.8	7.8
100+	45.0	22.9	19.3	12.9
Total	52.4	14.7	26.2	6.7

Source: Firm Strategies and Employment Policy Survey, Department of Economics, University of Uruguay.

Small firms (with fewer than 30 workers) tend to have agreements at the industry level. This is particularly true in industries like paper and printing, non-metallic minerals and metal products. Further, it is a significant trend in firms that export between 26 percent and 60 percent of their production, but not necessarily in those that export a proportion even higher than that figure. Only 40 percent of the 40 firms that export 75 percent or more of their production report having some kind of collective agreement, while 67 percent of the 88 that export less than 25 percent report having collective agreements. This proportion is higher for those that export between 26-50 percent of their products (85.7 percent). Hence, together with the trend of having collective agreements at the industry or firm level for those that export between one fourth and two-thirds of their production, there is a trend towards not having collective agreements among those that export most of their production. With slight differences, the situation is similar when only the level of exports to Mercosur is considered.

Finally, regarding the inclusion of employment clauses, they are more frequently found among agreements signed by firms with 10-30 employees, and among those that export 25-50

percent of their production; that also being the case when only exports to Mercosur are considered.

3. Theoretical and Empirical Models

In order to model union behavior the literature has either used the monopoly union model, assuming that unions have the power to impose their preferred wage target on the firm, which then determines employment from its labor demand curve (see Pencavel, 1991), or it has used a bargaining model. The conceptual issues that bargaining models pose, are related to: a) what do the parties bargain over? (wages, employment, other issues); b) what are the union preferences and objective function?; and c) whether bargaining takes place sequentially, over wages first, and then over labor, or is there “efficient bargaining” over wages and employment at the same time.

In the case where the level of employment is set by the firm once wages have been bargained over, a right-to-manage model must be specified. This model is particularly appealing when negotiations over wages take place at the industry level, since it is rather obvious that employment cannot be bargained at that level (at least at the same time), fitting the Uruguayan case for the period until 1993. On the other hand, when bargaining takes place at the firm level, and the unions’ objective functions seem to be changing as has been described, sequential models, of which the “efficient bargaining model” is a particular case, could be more suitable.⁸ This could be the case for Uruguay by the mid-1990s, when bargaining stopped being a process involving all workers simultaneously, while employment emerged as a possible additional target of negotiations. Hence, from a theoretical point of view, one could translate the above changes into specifying two different bargaining models depending on the time period.

The dataset includes only 4 years of observations from each sub-period. Hence, and in spite of the above, it is preferable to assume that only wages are the result of bargaining, while the determination of employment, investment, productivity and profitability is afterwards done according to different models and subject to the bargained wage. However, in order not to rule out any possible direct effect of unions on these variables, proxies for union power are included in the mentioned models, following a methodology similar to that sketched in Boal and Pencavel (1994).

⁸ Efficient contracts are a particular case of sequential models, for example, when the bargaining power of unions over employment and wages are the same (Manning, 1987).

3.1 The Model for Wages and Employment

The model postulated implies that in a first stage employers and workers bargain over the wage level at the industry level. Once the wage is set, the firm/establishment decides a wage level that might differ from that bargained depending on its specific characteristics.⁹ Afterwards, the firm sets the level of employment according to its labor demand function.

The utility function of unions is derived from a median voter framework, assuming that they maximize a surplus over an alternative income w^a . Union members care about the real wage in terms of the consumption price index. The alternative income is linked to average earnings in the informal sector, average unemployment benefits and wages in other industries in the previous time period.¹⁰ Let the utility functions of the parties be as follows:

$$\text{Unions: } \Gamma(w_t, w_t^a, cp_t, cp_{t-1}, L_t) = [(w/cp)_t - (w^a/cp)_{t-1}] * L_t^\phi$$

$$\text{Employers: } \Pi(Q_t, L_t, K_t, p_t, w_t, p_{ct}) = p_t Q_t - w_t L_t - p_{ct} K_t$$

where w/cp is the real wage; w^a/cp is the alternative income in terms of the price of consumption goods; L is employment; p is the product price; Q is production; p_c is the price of capital services and K is the capital level.

Hence, the generalized Nash bargaining problem implies the maximization of the weighted product of the utility function of the players, minus their respective fallback positions. These are assumed to be zero (Binmore, Rubinstein and Wolinsky, 1986),¹¹ while the weights are given by the bargaining power of the parties. The resulting expression is as follows:

$$\text{Max}_w Y = (\Gamma - \Gamma_0)^\beta (\Pi - \Pi_0)^{1-\beta}$$

⁹ Before 1992, they were able to set a wage higher or equal to that bargained, since government compulsorily enforced the agreed wage on all firms in the sector. After that date, smaller wage increases relative to the negotiated ones were also possible.

¹⁰ The relevant measure for the alternative wage refers to the time period prior to bargaining. Thus, it has to be deflated by the consumption price index of that same period (cp_{t-1}).

¹¹ In the event of no agreement there would be a strike. Then the firm will have no operating profits and union members will have zero earnings, as there are no legal provisions assuring any income to strikers in Uruguay.

Subject to the assumption that the capital level is given, once bargaining over the wage occur, the solution to the Nash bargain yields an equation for the wage at the industry level as follows (Pencavel, 1991: 120; Booth, 1995: 154):

$$(w/pp)_{j,t} = \eta(\phi, \beta) * f[(w^a/cp)_{j,t-1}, (pp/cp)_{j,t}] \quad \text{"j" indexes the industries, "t" indexes the year}$$

where $\eta(\phi, \beta)$ is the mark-up over the alternative income and the functional form for "f" depends on the production function assumed. Since unions care about the real wage in terms of consumption goods while firms are interested in the cost of labor relative to the price of their products, the wedge between those two prices also enters the wage equation. The bargaining power of the union cannot be observed. Thus, it is here assumed that it is a function of union density (U) and the structure of bargaining (%FLB). Market conditions, on the other hand, may set a limit to union action. Hence, other variables (X) are also considered as determining union power, such as the degree of exposure to competition; the occurrence of external shocks; or the degree of international trade of the industry. The solution of the maximization problem results in a bargained wage level for each industry "j" as given by:

$$(w/pp)_{j,t} = \eta(X_{j,t}, \%FLB_{j,t}, U_{j,t}) * f[(w^a/cp)_{j,t-1}, (pp/cp)_{j,t}] \quad (1)$$

If it is further considered that each firm "i" can set a wage in each time period "t" that differs from the bargained wage level depending on its individual characteristics, its relative size or market power, and its exposure to foreign competition, the equation for wages at the establishment level can be written as:

$$(w_{i,j}/pp_j)_t = \eta(X_{j,t}, \%FLB_{j,t}, U_{j,t}) * f[(w^a/cp)_{j,t-1}, (pp/cp)_{j,t}] + d(Y_{i,j,t}, X_{j,t}, Z_t) \quad (2)$$

where $d(.,.,.)$ refers to the establishment wage differential, a function of its own specific characteristics ($Y_{i,j,t}$) as well as of industry ($X_{j,t}$) and macroeconomic (Z_t) variables. Unobservable characteristics of the establishments are taken into account using individual fixed effects.

Establishments are assumed to use a technology with two inputs, capital and labor. Maximization of profits thus yields a two-equation system of derived demands, given the price of inputs. Employment at the firm level is thus determined according to a standard labor demand

equation, so that it is a function of the wage set, the level of capital and market conditions. Also included in the equation, however, are variables accounting for union density and the structure of bargaining, in order to allow for the possibility that negotiations on employment may also take place. The inclusion of these variables is tested for only in the last three years, when the bargaining regime changed. The estimated model is thus:

$$L_{i,j,t} = f[w_{i,j,t}/pp_{j,t}, K_{i,j,t}, \%FLB_{j,t}, U_{j,t}, Y_{i,j,t}, X_{j,t}, Z_t] \quad (3)$$

3.2. *The Model for Investment*

It is assumed that firms make their investment decisions prior to setting the wage and the employment level, this being done by negotiating with the union or not. Therefore, the firm has to consider that the union will try to capture quasi-rents from capital as well, depending on its bargaining power. This has been generally seen as an effective increase in the price of capital, as if unions were able to tax investment. The known result of under-investment stemming from the fact that a cooperative bargaining output is unlikely, given the length of contracts in relation to the life of capital (Grout, 1984; Dow, 1993), is not, however, the only possible one (Hirsch and Prasad, 1995). Actually, the factor mix in a unionized firm may be identical to that in a non-union setting, as both labor and capital prices can be distorted. As in the case of labor, no definite empirical proof can be performed to decide on the correct bargaining model, as both sequential and efficient models are compatible with the same results. Given this, only union variables are included in the specification and the statistical significance of their estimated coefficients is tested for. In order to obtain a simple estimable model for the investment level, a Cobb-Douglas production function is assumed. Given the model for wages and employment determination and assuming there are adjustment costs,¹² it is possible to specify a model for the level of investment as in Machin and Wadhwani (1991) of the form:

$$I_{i,j,t} = f(dq_{i,j,t}, \%FLB_{j,t}, U_{j,t}, p_{c,j,t}/w_{i,j,t}, Y_{i,j,t}, X_{j,t}, Z_t) \quad (4)$$

where for year “t”, $I_{i,j,t}$ is the level of investment of the firm; $dq_{i,j,t}$ denotes product growth at the firm level; $\%FLB_{j,t}$ refers to the extent of firm-level bargaining in the industry; $U_{j,t}$ is a measure of union power at the industry level; and $p_{c,j,t}/w_{i,j,t}$ is the price of capital services relative to the

¹² Adjustment costs are a function of unionization, investment and specific characteristics of the establishment.

firm's labor costs. $Y_{i,j,t}$ refers to variables accounting for firm-specific characteristics; $X_{j,t}$ denotes industry-specific variables; and Z_t is a vector of macroeconomic variables.

As the level of investment is generally related to absolute size of the plant and/or the existence of capital, the same equation is also estimated, but instead using the rate of investment as dependent variable:

$$I_{i,j,t}/K_{i,t-1} = f(dq_{i,j,t}, \%FLB_{j,t}, U_{j,t}, p_{c,j,t}/w_{i,j,t}, Y_{i,j,t}, X_{j,t}, Z_t) \quad (4')$$

3.3. The Model for Productivity

The role of unions is generally sketched as that of a rent-seeking agent. However, the firm may be willing to accept sharing extraordinary profits in exchange for increasing productivity. In this sense, unions can have another face, that of productivity-enhancing agents. This can be derived from assuming that the advent of unionism forces management to increase efficiency, or from the notion that unions promote higher morale and cooperation among the working teams (Freeman and Medoff, 1979). These opposite views make the empirical analysis of the effects of unions on productivity even more necessary. Other possible effects are related to the decrease in the turnover rate and hence in its associated costs for the firm and also to all productivity gains derived from increased effort at the workplace.

In order to study how unions affect productivity, an equation of productivity determination is derived from the production function. Assuming a Cobb-Douglas methodology:

$$\ln(Q_{i,j,t}/L_{i,j,t}) = c_{ij} + \alpha \ln(K_{i,j,t}/L_{i,j,t}) + \beta \ln(M_{i,j,t}/L_{i,j,t}) + \delta Y_{i,j,t} + \gamma X_{j,t} + \lambda Z_t \quad (5)$$

where c_{ij} are firm-specific effects; $K_{i,j,t}$ refers to the capital stock; $L_{i,j,t}$ is employment; and $M_{i,j,t}$ are raw materials. Variables in $Y_{i,j,t}$ refer to firm-specific characteristics; those in $X_{j,t}$ account for industry-specific characteristics, including union density and the structure of bargaining; and those in Z_t capture macroeconomic performance affecting productivity.

Several econometric problems are associated with this model.¹³ First, omission of other unobservable variables that affect labor productivity, and that are in turn correlated with the union variable, would bias the estimated effect of unions. This could be avoided by estimating the effects of unions on productivity growth. Unobservable individual characteristics would be

¹³ Booth (1995) provides a list.

considered but they would disappear in the dynamic version of equation (5). Another strategy is to estimate the model in levels but transforming all variables to deviations from the sample mean. Second, endogeneity bias could arise from the fact that unions might tend to organize in those establishments where monopoly power is greater and hence extra profits are more likely to be obtained. To account for this effect, variables reflecting monopoly power and international exposure of the industries are included. Finally, estimates might be subject to simultaneity bias if bargained wages alter the level of inputs in the right hand side of the equation. This issue can be addressed by estimating the productivity equation as a system including wage and employment equations. Alternatively, variables can be properly instrumented, which is the strategy followed here.

Also estimated are the possible effects of union density on the rate of productivity growth, using an equation analogous to that of the productivity level. If unions originally concentrate in sectors or establishments with the highest rate of profits, which in turn can be the consequence of being the most productive ones, then it might be the case that they are positively correlated with the level of productivity but negatively correlated with its rate of growth. The model analogous to equation (5) is (5'):

$$\begin{aligned} \ln(Q_{i,j,t}/L_{i,j,t}) - \ln(Q_{i,j,t-1}/L_{i,j,t-1}) = & c_{ij} + \alpha[\ln(K_{i,j,t}/L_{i,j,t}) - \ln(K_{i,j,t-1}/L_{i,j,t-1})] + \\ & + \beta[\ln(M_{i,j,t}/L_{i,j,t}) - \ln(M_{i,j,t-1}/L_{i,j,t-1})] + \delta Y_{i,j,t} + \gamma X_{j,t} + \lambda Z_t \quad (5') \end{aligned}$$

3.4. The Model for Profitability

Unions are expected to reduce the profitability of firms given their rent-seeking activity. However, the structure of the product market in which firms operate is the main determinant of the existence of any profit. When there is bargaining, whatever the level of supernormal rents, the extent to which owners of the firm or the union can appropriate these rents will depend on their bargaining power. A further determinant of the existence of extra surplus is related to the amount of innovation. Although it is sometimes argued that this surplus is just a normal return to investment in R&D, unions need not share this view. Some authors also argue that unions' share in innovation is captured by higher wages (Van Reenen, 1995), so that it is necessary to estimate the wage equation together with the model for profits. On the other hand, if the effects of unions on productivity are positive, then they might be increasing profitability. The proposed analysis of the above issues is done by estimating the direct effect of unions on some indicator of profits,

taking into account the structure of the market the firm operates in; the extent to which the firm is subject to binding foreign competition; union density; and the degree of decentralization of bargaining. Adequate instruments for the wage are also included in order to avoid simultaneity biases, since wages and profits are jointly determined. The estimable equation is:

$$\text{Profit}_{i,j,t} = g(w_{i,j,t}/p_{j,t}, \%FLB_{j,t}, U_{j,t}, Y_{i,j,t}, X_{j,t}, Z_t) \quad (6)$$

As was mentioned in the case of productivity, sectors with the highest union density might be found in those establishments or sectors with the highest level of profits. Following the same strategy as before, also estimated is an equation for the rate of growth of profitability, that is specified analogously to equation (6):

$$\text{Profit}_{i,j,t} - \text{Profit}_{i,j,t-1} = g[(w_{i,j,t}/p_{j,t}) - (w_{i,j,t-1}/p_{j,t-1}), \%FLB_{j,t}, U_{j,t}, Y_{i,j,t}, X_{j,t}, Z_t] \quad (6')$$

4. Description of the Sample, Variables Used and Models Specified

4.1 The Sample

The units of observation are the manufacturing establishments surveyed by the National Institute of Statistics on an annual basis during the period 1988 to 1995. There were 842 establishments in 1988, the base year. Many of them closed for good along those years, while others, after remaining closed for a year or two re-opened with another owner. There were also births along the period, although many of these establishments did not survive. As a consequence, the total number of establishments surveyed in 1995 equals 646. Table 6 describes the distribution of the establishments in the sample according to their status. Annex 1 reports descriptive statistics for the whole sample, yearly and according to this classification. Establishments that survived without any change in ownership during the period under analysis are only 50 percent of the sample. Unsuccessful establishments, that is, those that ended closing regardless of their original status, account for 27 percent of the sample.

Table 6. Distribution of Establishments According to Survival Status, 1988 -1995

	<i>Number of Observations</i>	<i>Number of Establishments</i>	<i>Percentage</i>
Alive during the whole period	3,832	479	50.0
Born in the period and surviving	216	49	5.1
Born in the period and dead	11	5	0.5
Dead in the period	1,058	234	24.4
Alive, dead, rebirth and surviving	700	169	17.6
Alive, dead, rebirth and dead	60	22	2.3
Total	5877	958	100.0

Source: Industrial Survey, National Institute of Statistics.

Establishments in the sample belong to 37 different industries at the 3 ISIC digit level, except for food, beverage and tobacco, which is dealt with at the 4-digit level due to the heterogeneity of its sub-markets. The observations are not expanded, so that the results obtained with the dataset cannot be taken as representative for all establishments in the industry. However, all establishments with more than 50 employees are included in the sample, so that the results must be viewed with particular caution in regard to small establishments.

4.2 The Variables

Data on all variables referring to establishment characteristics stem from the Annual Industrial Survey, performed by the National Institute of Statistics. These are: value added, gross output, value of sales, employment, wages, taxes, exports, value of raw materials, investment, depreciation, and profits. Variables are measured in pesos and are therefore deflated by the appropriate price index when necessary. Product prices, capital prices and export prices are not reported at the establishment level, so that industry-level prices are used instead.

Wages paid are not the relevant variable for firm decision making, as there are other costs linked to the labor input that are also considered. Hence, a cost of labor variable is used instead of wages adding all non-wage costs to the wage. These costs refer to social security and health insurance contributions, payroll taxes and annual extra payments. The legal cost of labor is further multiplied by a bargained non-wage costs index, stemming from the manufacturing collective agreements signed between 1988 and 1995 following the methodology described in Cassoni, Allen and Labadie (2000).

Temporal data on capital are not available. However, the 1988 Industrial Census did request information on capital stock. There have been various unsuccessful attempts to calculate a time series using the 1988 stock together with annual depreciation, investment and assets sold. The reasons behind this fact are probably linked to the accounting policy of firms. Overestimation of the amount of depreciation is avoided by calculating an average depreciation rate by type of asset—building, machinery and others—by industrial sector and by year. The resulting depreciation rate is then used for all firms within each sector yearly. Further excluded is the value of assets sold in the measure of capital, assuming assets have been totally depreciated when sold.¹⁴ The equation for estimating the capital stock in 1988-1995 is thus:

$$K_{i,j,t}^c = K_{i,j,t-1}^c + I_{i,j,t}^c - \delta_{j,t}^c * K_{i,j,t-1}^c \quad \text{for } c = \text{machinery, buildings, other assets}$$

i indexes the firm; j the industrial sector, t the year

$$\delta_{j,t}^c = \sum_i D_{i,j,t}^c / \sum_i K_{i,j,t-1}^c$$

where K is the capital stock; I refers to the amount of investment; δ is the depreciation rate; and D is the amount of depreciation.

Union density is defined as the affiliation rate of the industry at the 3 ISIC digit level. The time series is built using data on membership reported by the central union in each congress and dividing this figure by total employment. It is important to note that, given the data available, measured here are the effects of unionization at the industry level on the performance of the establishments that operate in that industry. Nevertheless, since wage bargaining was done at the industry level during most of the period the use of union density at this same level is adequate. Its effects on the performance of establishments, however, must not be thought of as relative to non-union establishments but as relative to establishments in non-union industries.

The bargaining models to be used assume that unions negotiate a mark-up over an alternative wage. This alternative wage can also be thought of as the opportunity cost of working or reservation wage, if no bargaining model is assumed. The alternative income for a worker in industry “j” is defined as the weighted average of what he/she would earn if hired by a firm in the manufacturing sector; the income the worker would receive if he/she becomes unemployed and collects unemployment benefits (50 percent of his/her last wage received); and the average income

¹⁴ This methodology is close to that used in Black and Lynch (1997).

of self-employed individuals, under the assumption that if the worker cannot find a job in the formal sector, he/she would prefer to undertake an informal job instead of remaining unemployed. At the establishment level, however, the exact calculation is not possible. Thus included are the variables defining the reservation wage directly. The weights are a function of the unemployment rate and the average duration of the unemployment spell. Thus, the variables that have to be included are the income in the informal sector and its product with the unemployment rate and by duration of unemployment. The relevant measure to be considered when bargaining takes place is not the current alternative income, which is not known at the time of negotiation, but that prevailing in the previous time period.

Using the variables defined above, other indicators are built:

1. Investment rate: level of investment in year “t” divided by capital at the beginning of the year.
2. Productivity: gross output divided by number of workers
3. Profitability: profits divided by sales
4. Export share in total sales
5. Capital *per* worker: capital in machinery divided by number of workers
6. Relative size of the establishment: gross product of the establishment divided by the industry gross product. The indicator can also be taken as a measure of relative monopoly power of the plant.

Market conditions are also considered. First, the degree of concentration of the industry (C4), calculated as the ratio of total sales of the 4 biggest establishments to total sales of the industry. Second, measures of the relative exposure of the industry to foreign competition, both locally and internationally. Thus five time series are built so as to account for trade liberalization:

1. The ratio of imports to total consumption (GDP - exports + imports) in 1988 prices, as an index of import penetration at the industry level, which accounts for sectoral external shocks.
2. The share of exports in total sales in 1988 prices at the industry level, also to proxy sectoral shocks.

3. The share of regional exports in total exports and the share of regional imports over total imports in order to account for the relative importance in trade of those countries in the region.
4. Relative prices, defined as the local relative price for each sector (PPI of the industry divided by the price index for non-tradables) divided by international prices.

Finally, the degree of openness of the economy as a whole, which should be a fundamental factor affecting firm performance in the Uruguayan case, is also considered. Openness has been proxied in the literature using various indicators. In general, these can be classified in two groups: those accounting for the results of trade liberalization on the amount of production subject to trade; and those reflecting the level of price distortion. Among the former group, one criticism that must be overcome is that related to not measuring quantities in constant prices, as the variations in the relative price of tradables/non-tradables would distort the real index (Low, Olarreaga and Suárez, 1999). Second, the relative size of the tradable sector will also generate biases. Among the indicators of degree of openness based on price distortions the real exchange rate is one of the most popular. However, its use has been extensively criticized as it reflects other phenomena at the same time (see Rodrik and Rodríguez, 1999). Berlinski (1999) proposed an alternative measure based on relative prices between export and import substitutive sectors in an economy. These in turn depend on the international price and the exchange rate, as well as on local trade policy. Hence, all sources of distortions are included in the indicator. Vaillant (2001) has calculated the time series for Uruguay and shown that its evolution is very similar to the analogous time series based on quantities.¹⁵

4.3 Model Specification and Estimation Methods

All the models described in this section are specified allowing for dynamics, using only one lag of the dependent variable. Given the nature of the dataset used, individual effects (establishment-specific) are also included. In order to avoid the possibility of them being correlated with the

¹⁵ Since relative prices in “t” (rp_t) are defined as $(p^T/p^{NT})_t/(p^{*T}/p^{*NT})_t$, that is local tradable to non-tradables prices divided by international relative prices, and this in turn equals the tariff in the base year (τ_0) divided by the tariff in “t,” the “equivalent” tariff τ_t is equal to $[(1+\tau_0)/rp_t] - 1$.

predetermined variables, the models are estimated in orthogonal deviations instead of in levels, so that these effects are eliminated from the equations.^{16,17}

Many of the predetermined variables included in the models cannot be considered strictly exogenous. Thus, instrumental variables methods have to be used to avoid endogeneity bias. Further, given that there are 8 time periods in the panel and lagged endogenous variables, it is also necessary to estimate taking into account the specific form of the variance-covariance matrix. Hence, in order to achieve consistency and asymptotic efficiency, the estimation method used is the Generalized Method of Moments (GMM), which has been shown to be a method that provides the optimum set of instruments (see, for example, Arellano and Bover, 1990 or Arellano and Bond, 1991). The software to be used is the DPD (Arellano and Bond, 1998).

In spite of the fact that endogeneity bias can be considerable, also reported is the output of estimation by Generalized Least Squares (GLS), with fixed effects by industry and a time trend. The exercise is intended to further validate the output of the GMM estimation, since it is known that the results when using instrumental variables methods are quite sensitive to the set of instruments chosen. Instruments for the wage are nevertheless retained in those equations where it appears as an independent variable, in order to be consistent with the theoretical models proposed. The estimated effect of unions on the different indicators of firm performance is of the same sign when estimating the models in levels, except for the employment equation. Statistical significance, however, is not always found. Regarding the estimation in orthogonal deviations, effects go in the same direction for the models explaining wages, productivity, productivity growth, and profitability. The opposite is found in the models for investment, employment and profitability growth but in no case are statistically significant coefficients obtained. The conclusion is thus that the results obtained using the GMM methodology are robust enough. The output of the GLS regressions is reported in Annex 2.

Since the estimation period is 1988-1995, different bargaining models were not estimated for the sub-periods resulting from the change in the institutional framework that took place in 1992, as temporal observations in the dataset are not enough. However, dummy variables were

¹⁶ The correlation between individual effects and predetermined variables is expected. As an example, consider the implausibility of having independence between management skills and relative size of the establishment, or export share.

¹⁷ Orthogonal deviations of x_{it} are proposed in Arellano (1988) as deviations from average future observations, according to:

$$x_{it}^* = [x_{it} - (1/T-t)(x_{it+1} + \dots + x_{iT})] / [(T-t)/(T-t-1)]^{1/2} \text{ for } t=1, \dots, T-1$$

included allowing for a change in the impact of union density and coverage of firm-level agreements on the different dependent variables from 1993 onwards.¹⁸ Recent work at the aggregate level has shown the existence of different effects of unions on diverse variables in the eighties and in the nineties, pointing at 1993 as the year in which the institutional changes had an observable effect (Cassoni and Labadie, 2001).

Apart from the variables entering each equation, observable establishment-specific and industry-specific characteristics were included in the equations for wages, employment, investment, productivity and profitability. The establishment-level variables used are the share of exports in total sales (xsales); and the relative size of the establishment (size). Industry-specific variables include export share (xsalesI); import penetration (maconsI); the share of regional exports in total exports (%regxI); the share of regional imports in total imports (%regmI); a concentration index (C4); the union affiliation rate (%unionI); and the percentage of workers in the industry that are covered by firm/establishment agreements (%flbI). Finally, the previously defined price indicator of the overall degree of openness in the economy is also included (etariff).

The set of instruments used for the control variables at the economy, industry or establishment level is the same for all equations. These are the ratio of domestic to international sectoral prices (xpriceI), serving as instrument for establishment and industry export share, as well as for industry import penetration. The equivalent tariff is considered exogenous and thus included as an instrument. Instruments used for the relative size of the establishment, for the degree of concentration of the market, union density, and the extent of coverage of firm-level agreements are all possible lags of the same variables. When the model includes the lagged dependent variable, all lags starting with the second lag are included as instruments as well. Regarding the variables that are specific to each model, they are all considered endogenous, so that all lags starting with the first are used as instruments in each equation.

5. Results

Estimated results are summarized in Table 7. Regarding the **wage** equation, the effects of the average income in the informal sector and its product with the duration of the unemployment

¹⁸ Cassoni, Allen and Labadie (2000) have shown that the data signals at 1993 as the period in which the institutional change is reflected in the evolution of wages and employment.

spell and the unemployment rate have the expected signs, that is, positive for the former and negative for the latter two. The wage elasticity of the wedge between production and consumption prices is -0.63 , reflecting that product wages go down whenever this wedge increases as unions bargain over real wages in terms of consumption goods. Bigger establishments pay higher wages relative to the rest. Workers in establishments of exporting industries and in those that operate in more concentrated markets also receive higher pay than others, while the reverse holds in import-substituting industries. However, if imports come from the region, the negative effect on wages vanishes. Interestingly, the more open the economy (the lower the equivalent tariff) the higher the wage level. This result has also been found in other research (see Cassoni and Labadie, 2001) and is linked to the fact that growth in the Uruguayan case is highly dependent on the evolution of exports, so that overall growth and openness are almost synonymous nowadays. On the other hand, the level of establishment exports and the share of regional exports in total sales at the industry level have no impact on wages. Finally, union density is positively correlated with wages, so that full unionization in the period would have meant an additional real wage increase of 4.8 percent *ceteris paribus*, evaluated at the mean value of union density (0.365). The extent of coverage of firm-level agreements has no statistically significant effect. Neither did the variables accounting for the institutional changes in the 1990s. However, the estimated coefficients have the expected signs: positive in the case of firm-level coverage and negative in the case of those multiplying union density and firm-level coverage since 1993. That is, before 1993, if unions further bargained at the firm level, they could only increase what was agreed at the Wage Council. After that date, the effect of unions on wages diminished (to half its previous estimated effect) while firm-level bargaining, possibly due to the inclusion of employment in negotiations, further reduced wage increases.

Labor demand depends on the price of labor relative to the product price and on the level of capital in machinery and equipment. Wage and capital elasticities are -0.85 and 0.10 , respectively. A more open economy favors employment *via* growth, while external sectoral shocks, as measured by export share and import penetration are not statistically significant. Regional exports as a share of total exports are found to have a negative impact on employment levels while those establishments that increase their share of exports in total sales also increase employment. Bigger establishments, as well as those operating in more competitive markets, hire more workers than others. As in the case of wages, the extent of firm-level bargaining has no

effect on employment, while no statistically significant change in the estimated coefficients in 1993 is found. The direct effect of unions on labor demand is to increase employment (by 0.1 percent for each 1 percent increase in union density). Given the indirect effect *via* wages, full unionization in the period would have meant a 14 percent increase in employment.

Investment is modeled according to equation (4) and (4') and taking into account the total amount of investment, that is, investment in machinery and equipment, in buildings and in other assets. The price of capital relative to the wage has the expected negative coefficient in both models while that of output growth is positive (the output elasticity is 0.2 in both models and the price elasticity is -0.9 in the model in levels and -0.7 in that for the rate of investment). While establishments with a bigger relative size invest less than the rest, when analyzing its impact in terms of the rate of investment, the effect vanishes. Establishments operating in markets that are more competitive have a higher rate and level of investment. However, increases in export share and in import penetration generate a decline in both the level and rate of investment. This could mean that foreign competition is faced using more labor-intensive technologies. The effect is quite expected in the case of imports, as they came mainly from the region until 1994, so that imported goods were intensive in unskilled labor. The destination of exports, on the other hand, changed at the beginning of the 1990s, from the rest of the world to the region, so that it might be the case that those firms already had a high level of capital and thus needed to invest less than the rest in relative terms. If exporting to the region, the effect is thus smoother. No statistically significant effect of the overall degree of openness is found.

Table 7. Estimated Coefficients for the Different Models Estimated

Establishment Variables	Wage	Employment	Investment Level	Investment Rate	Productivity Level	Productivity Growth	Profitability Rate Level	Profitability Rate Growth
Wedge	-0.523 (0.056)							
Wage informal sector	0.349 (0.060)							
Wage informal sector * Unemployment duration	-0.125 (0.015)							
Wage informal sector * Unemployment rate	-0.094 (0.015)							
Wage		-0.264 (0.038)					-0.123 (0.054)	
Capital		0.032 (0.017)						
Price of capital / wage			-0.692 (0.425)	-0.515 (0.164)				

Table 7., continued

Establishment Variables	Wage	Employment	Investment Level Rate		Productivity Level Growth		Profitability Rate Level Growth	
Output rate of growth			0.141 (0.029)	0.186 (0.034)				
Capital / employment					0.237 (0.027)			
Raw materials / employment					0.650 (0.035)			
Capital / employment rate of growth						0.113 (0.041)		
Raw materials / employment rate of growth						0.515 (0.050)		
Price of capital							-0.169 (0.087)	
Wage rate of growth								-0.083 (0.047)
Price of capital rate of growth								-0.227 (0.138)
Lagged dependent variable	0.174 (0.032)	0.695 (0.045)	0.222 (0.024)	0.227 (0.020)	0.022 (0.010)	-----	-----	-----
Exports/sales	0.030 (0.187)	0.704 (0.271)	0.038 (1.848)	1.486 (1.687)	-0.005 (0.245)	0.244 (0.290)	0.071 (0.292)	-0.675 (0.583)
Size	0.833 (0.275)	2.202 (0.641)	-6.504 (3.971)	-2.586 (3.641)	5.020 (0.966)	1.579 (0.818)	-0.568 (0.608)	1.793 (1.269)
Industry Variables								
Union density	0.062 (0.024)	0.089 (0.036)	0.596 (0.349)	0.743 (0.365)	0.057 (0.042)	0.147 (0.043)	0.091 (0.045)	-0.090 (0.063)
Union density *dummy93	-0.031 (0.027)	0.044 (0.037)	0.122 (0.336)	-0.033 (0.331)	-0.013 (0.056)	-0.019 (0.043)	0.109 (0.041)	0.062 (0.065)
%Workers covered by firm-level agreements	0.268 (0.221)	0.133 (0.311)	-5.566 (2.775)	-4.929 (2.814)	1.727 (0.505)	-0.581 (0.431)	1.034 (0.479)	0.304 (0.656)
%Workers covered by firm-level agreements*dummy93	-0.153 (0.131)	-0.006 (0.166)	1.182 (1.545)	1.050 (1.699)	0.032 (0.279)	0.138 (0.199)	-0.500 (0.229)	-1.319 (0.744)
C4	0.295 (0.103)	-0.324 (0.159)	-3.464 (1.434)	-4.786 (1.429)	-0.036 (0.167)	-0.286 (0.112)	0.279 (0.205)	0.299 (0.365)
Exports/sales	0.169 (0.109)	-0.222 (0.162)	-4.881 1.298	-4.398 (1.341)	0.232 (0.172)	0.506 (0.207)	-0.302 (0.167)	0.170 (0.295)
%Regional Exports	0.010 (0.035)	-0.129 (0.053)	0.860 (0.509)	0.810 (0.510)	0.016 (0.071)	-0.034 (0.073)	0.043 (0.063)	0.223 (0.118)
Imports/Consumption	-0.053 (0.025)	-0.015 (0.031)	-0.423 (0.282)	-0.450 (0.291)	0.007 (0.046)	-0.053 (0.059)	-0.029 (0.036)	-0.033 (0.057)
%Regional Imports	0.091 (0.048)	-0.031 (0.068)	0.463 (0.641)	0.502 (0.650)	0.014 (0.085)	0.110 (0.086)	-0.119 (0.076)	0.204 (0.162)
Equivalent tariff (refers to the whole economy)	-0.166 (0.029)	-0.126 (0.034)	0.416 (0.366)	0.451 (0.366)	-0.135 (0.037)	-0.155 (0.054)	0.082 (0.071)	0.176 (0.086)
Sargan test	0.044	0.015	0.014	0.023	0.017	0.318	0.320	0.629
1st order autocorrelation	0.000	0.000	0.000	0.000	0.001	0.001	0.228	0.191
2nd order autocorrelation	0.207	0.731	0.169	0.183	0.589	0.012	0.640	0.229
N° of observations	4849	4849	4849	4849	4849	3073	4849	3073

Notes: Sargan test is that of over-identifying restrictions. Figures reported for all tests are p-values.

Variables accounting for union effects are found to be statistically significant in both models—for the level and for the rate of investment—although no change in the estimated coefficients is found in 1993. Establishments in industries with higher union density and fewer

workers covered by collective agreements signed at the firm level are found to invest more than those in other industries. The estimated elasticities are 0.3 and -0.1, respectively, being the total effect of unions further increased if also considering the positive indirect effect *via* wages (Table 8). That is, since unions increase wages and this promotes substitution between capital and labor, the positive direct effect of unions on investment at the establishment level is reinforced. If bargaining at the firm level, however, the effect is smaller. The result is consistent with the structure of bargaining described in previous sections. Previous work (Cassoni and Labadie, 2001) has shown that one of the observed effects of unions has been to promote substitution between blue and white-collar workers. Hence, the positive effect of unions on the level and rate of investment can be thought of as the result of firms moving to more capital-intensive technologies in order to avoid possible extra costs of union action. If negotiating at the firm level, however, bargaining over employment is also observed, and so it is likely that the parties would agree to slow down this process.

The estimated equations for **productivity** and **productivity growth** also suggest there are positive direct effects of unionization at the industry level. No change in the estimated parameter is found in 1993. The statistical significance of the union variable in the levels equation is weak, while firm level bargaining is highly significant. The positive direct effect of unionism on productivity becomes negative when adding the estimated indirect effects *via* employment (Table 8). Regarding productivity growth, the estimated impact of unionism is such that a 10 percent increase in membership, evaluated at the mean value of union density, implies a 0.6 percent rise in the rate of growth of labor productivity. Full unionization, thus, would have meant an increase of 9 percent in the rate of growth. However, if including the indirect impact *via* employment, the total effect is nil.

There are many theoretical explanations for a positive link between unionism and productivity related to increased co-operation and higher morale, as discussed in Section 3. Some authors have also tried to measure the typical unobservable characteristics by using special surveys (Black and Lynch, 1997 is an example). In the Uruguayan case, however, the result could also be linked to the decrease in turnover that takes place in unionized sectors (Cassoni, Allen and Labadie, 2000). Further, if unions induce substitution of labor by capital and new technologies are more efficient than the previous one, then labor productivity can be increased. Regarding the effect of firm-level bargaining, the positive direct effect further supports the

previous argument: if bargaining over employment takes place, one should expect that an increased stability of jobs would raise productivity in exchange for lower turnover.

Other variables explain the performance of firms regarding productivity. The relative size of the establishment and the degree of openness of the economy are variables that have a positive effect both on the level and the rate of growth of labor productivity. Belonging to industries facing more competitive pressure *via* import penetration lowers productivity, while competing in foreign markets *via* exports raises productivity growth. The result, again, can be understood if the origin of imports and the destiny of exports are taken into account. During most of this period imported goods came mainly from countries in Mercosur. Given the common external tariff established by regional agreements, and considering the type of goods imported, it could well be that the regional agreements operated as a subsidy within the region. Hence, products coming from neighbor countries belonged to industries that were not competitive with the rest of the world but that were competitive with local industries at least until 1994 (see Section 1). At the same time those firms that imported the most actually transformed a great deal of their production into distribution, precisely because they were not competitive. Exporting industries, instead, were forced to increase their levels of productivity so as to actually export to the region. The effect was further reinforced if they were exporting to the rest of the world. Finally, as expected, the more concentrated the market in which the establishment operates, the lower the rate of growth of productivity, while no significant effect is found on the level of labor productivity.

The final equations describing the determinants of the **rate of profits** and **profit growth** are econometrically unsatisfactory,¹⁹ and further work needs to be done in this area. Nonetheless, two results are worth discussing. Plants in industries with higher union density and a larger percentage of workers covered by firm-level agreements have higher rates of profits, holding wages constant (direct effect) and also once the indirect effects *via* wages are considered. However, the direct effect of unionization on the rate of growth of profitability is negative, and firm level bargaining has no impact on this indicator of firm performance, while the indirect effects *via* wages are negligible (Table 8). This could signal that unions organize in those sectors

¹⁹ The set of instruments is not good enough while first order autocorrelation is not present as would be expected given the transformation done.

in which there are more rents to be shared while, once there, they prevent further increases in profitability.

The second result worth mentioning is that starting in 1993, the union direct effect on the level of profitability increases, while that of firm level bargaining goes down. The explanation for the results can again be linked to the changes in the structure of bargaining. Surviving unions are still in sectors with the highest level of supernormal rents. However, if workers worry and negotiate over employment at the firm level, then job stability might be gained and wage inflation and profitability sacrificed in order to face the new economic framework in the 1990s. As a consequence, the negative effect of unions on the rate of growth of profitability remains negative while firm level bargaining reduces it.

In Table 8 the direct and indirect effects that unions have on the different dimensions of firms performance are summarized. It must be stressed that here analyzed are the effects of unionization at the industry level on the performance of the firm. Thus gaps between unionized and non-unionized firms are not being calculated, but rather the effects that the extent and structure of bargaining have on the indicators of firm performance. The results should then be read as: firms in unionized sectors pay relatively higher wages/employ more workers/ invest more/are relatively more productive/get higher profits but at a lower rate than those in less unionized industries.

Table 8. Estimated Effects of Unions on Firm Performance

	Wage	Employ-	Investment	Productivity	Profitability					
	ment	ment	Level	Rate	Level	Growth	Before 1993	After 1992		
							Level	Growth	Level	Growth
<i>Coefficients (LR)</i>										
Union variable	0.075	0.292	0.766	0.961	0.058	0.147	0.091	-0.090	0.200	-0.090
Other variables										
Wages		-0.865	0.889	0.666			-0.123	-0.083	-0.123	-0.083
Employment					-0.907	-0.628				
<i>Effects</i>										
Direct	0.027	0.107	0.280	0.351	0.021	0.054	0.033	-0.033	0.073	-0.033
Indirect		-0.024	0.024	0.018	-0.075	-0.052	-0.003	-0.002	-0.003	-0.002
Total	0.027	0.083	0.304	0.369	-0.054	0.002	0.029	-0.035	0.070	-0.035

Note: "LR" means long run.

Given the theoretically feasible, but somewhat surprising, positive direct effects of unions on the variables studied, except for profitability growth, and since these results are robust across

different estimation techniques, further explored are possible biases in the estimation procedure. These biases could be the result of unobserved variables (such as management quality and practices), the result of some exogenous processes taking place that could account for union organization, or even sample biases not properly modeled. In order to shed light on the possible existence of biases we explored whether unions had organized in sectors with particularly high productivity, for example, and studied the rank correlations for 1984, the year when unions re-organized after the military regime. Unfortunately no data on investments, concentration or profits is available for that year. With respect to wages, employment and productivity, no significant high rank correlation was found (the highest Spearman was 0.33).²⁰ Also used were the 1988 rankings for investments and concentration as proxies for those in 1984, assuming that neither the levels of investment nor of concentration could drastically change between those years. Again, no significant rank correlation could be found using the 37 industries under study. Cross-tabulations for the levels of unionization were also performed, and some relationship was found among concentration, effective rates of protection, and union density in 1985 (based on data from Sapelli, 1986). However the relation is not systematic across the different categories defined.²¹ These results suggest that these sectors could have been more profitable, and that unions could have organized better in them, eventually preventing further increases in profitability in those industries that, nonetheless, were the most exposed to competition by trade liberalization policies.

An alternative source of biases in the results could be due to the fact that in the unbalanced panel under study there are firms that survive, die, and are born and unions could have an effect on their survival and mortality odds. That is, if unions actually hindered firm performance, they would increase the mortality rate in the industry. In that scenario, those firms that would actually survive “despite” high union levels in their industry would be those that excelled on some other unobservable dimension (such as high quality management) but not precisely due to the effect of union behavior. In order to explore the issue we estimated a proportional hazard model was estimated calculated Kaplan-Meier hazard estimates were calculated (the results are presented in Annex 3). These models analyze the relative probability

²⁰ Basically, industries are rank-ordered along the different variables, and the cancellation between these variables and unionization is calculated.

²¹ For example, although the most concentrated industries are also the most unionized, the relationship cannot be extended to all the other strata, defined according to the degree of concentration.

of survival for a firm controlling for the relevant variables (the same used in the models described earlier in this study). The difference between both techniques refers to the former assuming a particular density function for the odds of surviving (Cox) while no distribution is assumed in the latter case. The variables used to explain the survival rates included the degree of unionization of the industry the firm belonged to and the structure of bargaining in that sector. The results indicate that there is no effect of unions on firm mortality while firm-level bargaining has a positive significant effect on firm survival, as expected. Therefore, it is concluded that there is no significant bias in the sample indirectly related to unionization.

As to unobservable variables like the quality of management or actual management practices, the survival analysis does not make it possible to control for them, as is the case with all other models. It is certainly possible that those firms belonging to industries with higher levels of unionization could have better quality of management, particularly given the bias towards large firms in the panel. Despite this fact, it is clear that given the variables included in the models, the results are not biased, except for the apparent capability of unions to organize in industries with higher levels of profits, in more concentrated and relatively more protected sectors.

6. Conclusions

This paper has analyzed the effects of unions on wages and the performance of firms during the period 1988-1995. The main findings suggest that unions increase both wages and employment; promote investment due to the firms substituting labor by capital; organize in those plants with higher rate of profits, but promote increases in productivity and prevent profitability increases. The mechanism at work seems to be that, given that the result of union action is wage inflation and labor hoarding, firms have moved to more capital-intensive technologies, hence increasing the rate of growth of labor productivity and reducing that of profitability. The hypothesis is consistent with unions reducing the share of non-production workers in total employment, as found in Cassoni and Labadie (2001).

Negotiating at the firm level meant different things in different periods. Before 1993, given the mandatory extension of collective agreements, it is possible that bargaining at the firm level further reinforced the previous effects on wages and hence the indirect effects on the other

variables. However, no statistically significant effects are found. The change in the structure of bargaining at the beginning of the 1990s, however, introduced another effect of unions that is linked to bargaining at a decentralized level. If unions started caring more about job instability than in the past, then they would be willing to negotiate over employment at the cost of lower wage inflation. This is in fact what happened in many cases in Uruguay, given this paper's interpretation of collective agreements registered at the Ministry of Labor in the period. Although statistically significant coefficients cannot be found with the dataset used, the signs are the expected ones and other research points in the same direction (Cassoni and Labadie, 2001).²² Nonetheless, it is found that firm-level bargaining reduces levels and rates of investment, increases productivity and profitability, and has no effect on the rate of growth of profits. Moreover, after 1993, the more workers covered by decentralized bargaining, the lower the increase in profitability. The evidence points at negotiations taking into account the interests of both parties, so that enhanced productivity and probably survival are achieved together with lower rates of substitution of labor by capital and/or lower profits.

Union action is associated with increases in the level of investment. The result can be linked to the decline in the relative price of capital that unions generate when increasing the wages of those workers in unionized firms. It should also be related to firms' interest in overcoming rigidities and transaction costs introduced by union action. As firm-level bargaining becomes more frequent, the positive effect is reduced. No doubt it is easier to bargain over the introduction of new technology at the establishment level, so that union resistance diminishes and at the same time union-management cooperation becomes more feasible.

Unions increase productivity and productivity growth, while increased coverage of firm-level agreements further reinforces the effect. This may support arguments derived from the industrial relations literature, such as that unions promote cooperation and high morale among groups of workers. However, given the Uruguayan general economic framework, especially at the beginning of the 1990s, the fact that unions decrease labor turnover may also have been a cause.

The above results are consistent with unions generating higher rates of profits. If they promoted investment in new technology, they generated increased productivity and productivity

²² This might be the consequence of the scarce number of years included in the analysis, particularly for the second period.

growth. So, in spite of rising wage levels, they could consistently allow the firm to obtain higher profits. However, given their negative effect on the rate of growth of profitability, the result is also reflecting the fact that unions tended to organize and to be stronger in those sectors in which extra rents were higher due to monopoly power.

As a final comment, the results here summarized should be seen in light of the de-unionization process that has been taking place in the country. First, there is no doubt that the affiliation rate diminished in the 1990s, mostly due to the non-enforceability of collective agreements. However, the decline reported in the aggregate statistics overestimates the real magnitude, as it refers to the evolution of membership in industry-level unions that, in turn, belong to the central union. Hence, workers organized in unions at the firm and establishment levels are not included. Second, the results suggest that bargaining at the firm level has promoted easier ways of introducing new technology, increases in productivity, higher job stability, more moderate wage inflation and lower increases of profitability. Thus, it is sensible to think that cooperation between workers and managers acted as a means of facing the new economic environment. If this is so, then policymakers should evaluate the benefits of supporting bargaining so that the smallest firms can also enjoy the positive effects of unions. The policy, however, need to be well balanced, as while setting general rules to protect the parties is necessary, special care has to be taken in order not to introduce rigidities that prevent the process from incorporating the specific characteristics of each unit.

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Annex 1. Descriptive Statistics
Table A1. Mean Value of Selected Variables by Industry, 1985-1999
(Industry data)

1985 – 1992									
Industry	Firm-level coverage	Union	Imports/Consumption manufacturing	Exports/sales manufacturing	Exports + imports/ GDP economy	Wedge	GDP	Employment	Ave. wage
Total Mfg.	0.010	0.40	0.28	0.23	0.53	-0.01	1.35	4.28	2.13
Food, beverage & tobacco	0.005	0.43	0.28	0.23	0.53	-0.01	1.78	4.69	2.08
Textiles & leather	0.003	0.45	0.28	0.23	0.53	-0.02	1.53	4.63	2.04
Paper	0.027	0.35	0.28	0.23	0.53	-0.05	0.98	3.99	2.18
Oil & chemicals	0.011	0.61	0.28	0.23	0.53	-0.01	1.68	4.24	2.27
Non-metallic minerals	0.013	0.18	0.28	0.23	0.53	0.02	0.82	3.84	2.08
Metallic products	0.000	0.38	0.28	0.23	0.53	-0.02	1.31	4.26	2.13
1993 – 1999									
Industry	Firm-level coverage	Union	Imports/Consumption manufacturing	Exports/sales manufacturing	Exports + imports/ GDP economy	Wedge	GDP	Employment	Average wage
Total Manufacturing	0.103	0.25	0.52	0.27	0.79	-0.19	1.34	4.12	2.35
Food, beverage & tobacco	0.098	0.24	0.52	0.27	0.79	-0.11	1.84	4.58	2.26
Textiles & leather	0.083	0.19	0.52	0.27	0.79	-0.24	1.41	4.35	2.24
Paper	0.199	0.29	0.52	0.27	0.79	-0.20	1.03	3.86	2.44
Oil & chemicals	0.045	0.54	0.52	0.27	0.79	-0.22	1.65	4.07	2.57
Non-metallic minerals	0.186	0.08	0.52	0.27	0.79	-0.15	0.86	3.73	2.27
Metallic products	0.010	0.18	0.52	0.27	0.79	-0.23	1.23	4.10	2.32

Source: National Institute of Statistics.

Table A2. Mean Value of Selected Variables by Surviving Status, 1988 - 1995
(Establishment level data)

	Size	Exports/ Sales	%Imported raw materials	%Non- production workers	Productiv- ity	Profitability
Alive during the whole period	0.06	0.14	0.09	0.73	183.59	0.37
Born in the period and surviving	0.05	0.14	0.10	0.73	1,300.43	0.05
Born in the period and dead	0.06	0.00	0.09	0.67	87.24	0.34
Dead in the period	0.03	0.16	0.09	0.70	152.12	0.29
Alive, dead, rebirth and surviving	0.03	0.15	0.09	0.73	140.62	0.27
Alive, dead, rebirth and dead	0.01	0.06	0.02	0.69	145.41	0.34
Total	0.05	0.14	0.09	0.72	213.32	0.33
	Union density	Firm-level Coverage	Average wage	Employment t	Capital/ Investment t	employment t
Alive during the whole period	0.37	0.02	42.41	123.22	7,2359.79	1,718.45
Born in the period and surviving	0.26	0.03	46.80	74.34	3,4605.31	516.41
Born in the period and dead	0.40	0.02	41.56	33.73	2,2700.67	56.21
Dead in the period	0.38	0.01	35.09	90.01	2,0948.56	2,961.59
Alive, dead, rebirth and surviving	0.35	0.02	34.85	70.49	2,4635.29	755.96
Alive, dead, rebirth and dead	0.36	0.02	29.19	33.07	3,969.44	797.32
Total	0.36	0.01	40.23	108.11	55,302.62	1,769.43

Source: Authors' calculations based on micro data from the Industrial Survey, National Institute of Statistics, Uruguay.

Table 3. Distribution of the Sample According to Different Variables, 1988-1995
(percentages)

Establishment Variables	0% - 25%	25% - 50%	50% - 75%	75% - 100%
%Blues	3.4	10.6	32.2	53.8
Exports/Sales	81.5	5.3	4.4	8.8
Size	95.7	2.9	0.6	0.8
Industry Variables				
Union density	29.3	49.3	12.5	8.9
%Regional Exports	29.4	10.6	12.8	47.2
%Regional Imports	12.6	52.7	23.9	10.8
Exports/Sales	60.6	23.4	14.4	1.6
Imports/Consumption	44.8	26.4	14.4	14.4
C4	3.8	40.7	31.4	24.2

Source: Authors' calculations based on micro data from the Industrial Survey, National Institute of Statistics, Uruguay

Annex 2. Feasible Generalized Least Squares Estimates of the Models

Establishment Variables	Employment		Wages		Investment level		Investment rate	
	Levels	Deviations	Levels	Deviations	Levels	Deviations	Levels	Deviations
Wage	0.051 (0.026)	0.034 (0.397)						
Capital	0.007 (0.004)	0.014 (0.010)						
Wedge			-0.204 (0.044)	-0.762 (0.076)				
Wage informal sector			0.543 (0.130)	0.107 (0.157)				
Wage informal sector * unemployment duration			-0.174 (0.030)	-0.009 (0.063)				
Wage informal sector * unemployment rate			-0.103 (0.027)	0.018 (0.062)				
Price of capital / wage					-1.129 (0.111)	-2.149 (0.715)	-0.271 (0.113)	-1.578 (0.762)
Output rate of growth					-0.059 (0.054)	0.107 (0.046)	-0.018 (0.061)	0.122 (0.048)
Lagged dependent variable	0.945 (0.010)	0.533 (0.136)	0.884 (0.018)	0.259 (0.043)	0.583 (0.017)	0.083 (0.020)	0.497 (0.019)	0.062 (0.019)
Exports/sales	0.056 (0.030)	0.233 (0.129)	-0.012 (0.018)	0.125 (0.079)	0.743 (0.220)	0.792 (0.650)	0.147 (0.230)	0.650 (0.658)
Size	0.178 (0.293)	2.173 (0.462)	0.240 (0.079)	0.707 (0.222)	6.019 (1.369)	8.129 (2.174)	3.830 (1.405)	8.435 (2.196)
Industry Variables								
Union density	-0.146 (0.071)	-0.260 (0.129)	0.139 (0.036)	0.003 (0.034)	0.450 (0.461)	-0.238 (0.451)	0.631 (0.487)	-0.493 (0.480)
Union density *dummy93	-0.166 (0.165)	-0.940 (0.422)	-0.062 (0.037)	-0.160 (0.061)	0.330 (0.385)	0.066 (0.581)	0.545 (0.404)	-0.155 (0.596)
%Workers covered by firm-level agreements	-2.296 (1.454)	-4.220 (3.473)	0.800 (0.159)	0.257 (0.211)	5.838 (2.995)	1.203 (3.491)	7.137 (3.216)	0.831 (3.610)
%Workers covered by firm-level agreements*dummy93	3.016 (1.777)	9.843 (8.006)	-0.381 (0.195)	-0.119 (0.221)	-2.624 (3.015)	-0.227 (2.708)	-2.453 (3.269)	0.189 (2.773)
C4	-0.887 (0.901)	-0.361 (0.272)	0.063 (0.113)	0.250 (0.140)	-1.087 (3.930)	-2.747 (1.267)	-1.071 (4.194)	-2.940 (1.333)
Exports/sales	0.186 (0.237)	0.378 (0.179)	0.196 (0.071)	0.082 (0.090)	-1.117 (1.303)	-0.384 (0.918)	-0.763 (1.392)	-0.091 (0.947)
%Regional Exports	-0.105 (0.118)	0.009 (0.078)	-0.059 (0.050)	-0.020 (0.037)	0.732 (0.544)	0.856 (0.450)	0.583 (0.585)	0.610 (0.478)
Imports/Consumption	-0.032 (0.027)	-0.029 (0.042)	-0.042 (0.017)	-0.048 (0.017)	0.219 (0.183)	0.176 (0.178)	0.122 (0.197)	0.162 (0.186)
%Regional Imports	-0.157 (0.123)	0.015 (0.217)	0.019 (0.044)	0.003 (0.045)	0.107 (0.591)	-0.637 (0.494)	-0.077 (0.653)	-0.630 (0.547)
Economy variables								
Equivalent tariff	-0.078 (0.149)	-0.057 (0.123)	-0.231 (0.061)	-0.208 (0.048)	0.559 (0.464)	0.792 (0.489)	-0.236 (0.517)	0.073 (0.536)
Trend	-0.014 (0.017)	0.033 (0.043)	-0.044 (0.007)	0.033 (0.020)	-0.123 (0.059)	-0.099 (0.088)	-0.123 (0.064)	-0.160 (0.096)
Sargan test	0.994	0.842			0.000	0.010	0.000	0.006
1st order autocorrelation	0.644	0.000	0.003	0.000	0.000	0.000	0.000	0.000
2nd order autocorrelation	0.753	0.125	0.298	0.375	0.000	0.728	0.000	0.421
N° of observations	4849	4849	4849	4849	4849	4849	4849	4849

Establishment Variables	Productivity level Levels	Productivity level Deviations	Productivity growth Levels	Productivity growth Deviations	Profitability level Levels	Profitability level Deviations	Profitability growth Levels	Profitability growth Deviations
Capital / employment	0.034 (0.007)	0.056 (0.015)						
Raw materials / employment	0.423 (0.026)	0.524 (0.029)						
Capital / employment rate of growth			0.072 (0.021)	0.075 (0.025)				
Raw materials / employment rate of growth			0.541 (0.028)	0.507 (0.026)				
Wage					-0.075 (0.083)	-0.246 (0.130)		
Price of capital					-0.122 (0.109)	0.361 (0.282)		
Wage rate of growth							-0.139 (0.189)	-0.145 (0.087)
Price of capital rate of growth							0.232 (0.291)	0.222 (0.491)
Exports/sales	-0.070 (0.037)	0.042 (0.092)	0.001 (0.015)	0.099 (0.087)	0.287 (0.072)	0.416 (0.132)	0.007 (0.046)	0.182 (0.283)
Size	0.645 (0.138)	2.291 (0.412)	0.234 (0.055)	2.242 (0.427)	0.231 (0.484)	2.383 (1.170)	0.001 (0.362)	4.139 (1.689)
Lagged dependent variable	0.304 (0.025)	0.012 (0.015)	-0.160 (0.031)	-0.207 (0.034)	-----	-----	-----	-----
Industry variables								
Union density	0.237 (0.042)	0.029 (0.040)	0.095 (0.041)	0.087 (0.054)	0.081 (0.134)	0.138 (0.139)	-0.104 (0.138)	0.061 (0.218)
Union density *dummy93	0.0320 (0.041)	-0.003 (0.055)	-0.094 (0.043)	-0.168 (0.066)	-0.008 (0.092)	0.011 (0.144)	0.083 (0.126)	0.201 (0.296)
%Workers covered by firm-level agreements	0.284 (0.212)	-0.145 (0.230)	-0.005 (0.221)	-0.064 (0.275)	-0.295 (1.352)	2.431 (1.645)	-3.098 (3.366)	4.619 (5.399)
%Workers covered by firm-level agreements*dummy93	-0.165 (0.267)	-0.091 (0.248)	-0.079 (0.210)	-0.134 (0.257)	0.656 (0.965)	1.041 (1.238)	2.013 (2.409)	-1.993 (3.077)
C4	-0.210 (0.142)	-0.135 (0.168)	-0.146 (0.151)	-0.033 (0.211)	0.335 (0.943)	-0.417 (0.453)	0.219 (1.201)	0.541 (0.820)
Exports/sales	0.146 (0.103)	0.053 (0.111)	0.001 (0.107)	-0.061 (0.158)	-0.187 (0.406)	-0.213 (0.246)	-0.102 (0.444)	-0.088 (0.355)
%Regional Exports	-0.014 (0.050)	0.045 (0.042)	0.166 (0.073)	0.301 (0.107)	-0.111 (0.191)	-0.141 (0.166)	0.054 (0.199)	0.156 (0.248)
Imports/Consumption	-0.008 (0.021)	-0.036 (0.018)	-0.034 (0.024)	-0.062 (0.025)	-0.060 (0.083)	0.005 (0.039)	-0.038 (0.085)	-0.025 (0.062)
%Regional Imports	-0.048 (0.060)	-0.018 (0.054)	-0.101 (0.088)	-0.142 (0.124)	0.107 (0.146)	-0.031 (0.133)	0.018 (0.211)	0.036 (0.215)
Economy variables								
Equivalent tariff	0.066 (0.053)	-0.171 (0.047)	-0.471 (0.099)	-0.653 (0.197)	0.235 (0.110)	0.339 (0.148)	0.309 (0.218)	0.436 (0.304)
Trend	0.059 (0.005)	0.040 (0.008)	0.001 (0.008)	-0.018 (0.031)				
Sargan test					0.319	0.741	0.406	0.791
1st order autocorrelation	0.000	0.000	0.000	0.000	0.581	0.178	0.174	0.192
2nd order autocorrelation	0.000	0.814	0.047	0.066	0.056	0.687	0.681	0.2633
N° of observations	4849	4849	3073	3073	4849	4849	3073	3073

Instruments used for the wage are its own first lag; the income of the informal sector; the income of the informal sector times the unemployment rate; and the income of the informal sector times the average duration of the unemployment spell.

Annex 3. Mortality Proportional Hazards Model

Variables	Hazard Ratio	Std. Error	z	P> z	95% Confidence Interval	
Establishment level						
Exports/Sales	0.89415	0.173049	-0.578	0.563	.6118932	1.306619
Capital/Employment	0.99570	0.002010	-2.719	0.007	.9926091	.9987978
Size	0.00191	0.002799	-4.267	0.000	.0001074	.0338591
Industry level						
%Regional Imports	0.49103	0.252471	-1.383	0.167	.1792484	1.345141
%Regional Exports	1.10452	0.475619	0.231	0.817	.4749409	2.568689
Exports/Sales	2.17809	1.726752	0.982	0.326	.4605328	10.30133
Imports/Consumption	0.86491	0.126502	-0.992	0.321	.6493408	1.15204
C4	0.05141	0.062026	-2.460	0.014	.0048325	.5469857
Union Density	0.82736	0.413290	-0.379	0.704	.3108086	2.202389
Union Density*dummy1993	1.63094	1.042497	0.765	0.444	.4659636	5.708551
%workers covered by firm level agreements	0.00519	0.016848	-1.622	0.105	9.00e-06	2.997378
%workers covered by firm level agreements *dummy93	21.15768	69.370140	0.931	0.352	.0342464	13071.36
Economy level						
Equivalent Tariff	0.000014	0.000043	-3.564	0.000	2.95e-08	.0064996

Note: The specification includes industry dummies that are not reported. Robust standard errors are reported.

The results indicate that the capital/labor ratio is neutral with respect to the mortality of firms (significant but not different than 1); the size of the firm has a positive effect (lower than 1 and significant), market concentration (C4) increases the probability of survival (lower than 1 and significant), and tariff protection also has a positive effect in the odds of surviving (that is, higher implicit tariff—lower degree of openness—increases the probability of survival for the establishment).

Among the union variables, union density at the industry level has a positive effect, but it is not statistically significant, so that there are no union effects on survival odds. The change that took place in 1993—here modeled including a dummy variable multiplying union density—has no significant effect using this dataset covering just up to 1995. If it were to be considered, however, it would lower the probability of survival relative to the previous period but the overall effect (adding the coefficients of union density and union density times dummy1993) would still be lower than 1, the result thus being that unionization increases the probability of survival. The only significant result is that of firm-level bargaining, which increases the probability of survival even more than does size, for example.