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THE EFFECTS OF TRADE UNIONS ON WAGES AND EMPLOYMENT IN URUGUAY

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ABSTRACT

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This research adds new insights to the analysis of the role trade unions play in the determination of wages and employment levels. It first identifies the main puzzles faced by economists in the last 40 years and those that are being addressed in the nineties. Picking up one of these issues, it is here argued that wage rigidity and the degree of employment adjustment to shocks need not be the result of a fixed reservation wage for union members, but the consequence of agents being uncertain on the future state of nature when bargaining. Sequential bargaining models are proposed as the best instrument to be used in empirical research, as they nest other specifications and allow for efficient and inefficient outcomes depending on union power and on the degree of uncertainty faced by agents at the bargaining table. The empirical research carried out for Uruguay takes advantage of the unique situation of having temporal data from 1975 to 1999 for the same economic sectors with and without unions, while during the time in which unions were active, two different bargaining structures were observed. Thus, using the Uruguayan case, it is here possible to compare the performance of the manufacturing sector under different institutional settings. The empirical results show that the re-appearance of trade unions in the eighties, when negotiations were done in a co-ordinated way at the industry level, generated inflexibility in the labour market compared to its performance in the seventies. Wages were set above their market clearing levels at the expense of lower employment, the number of jobs being unilaterally set by management. In the nineties, bargaining over employment and decentralised negotiations resulted in lower wage increases than in the previous decade and even wage cuts. Union action also promoted that management moved towards more skilled labour intensive technologies. However, they granted job stability by buffering the negative effects of external shocks and demand fluctuations both on employment levels and its composition.

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Preface

The nineties, as all other decades, was one of important economic transformations in the world. Its distinctive seal was that liberalisation and integration processes took place in almost all regions. Many aspects linked to how the different agents relate to each other were revised in the light of the new economic puzzle. One hot topic was that of the flexibility of the labour markets. Regulations, labour laws and agents involved were all suspects of being the main cause of existent rigidities. Latin America did not escape the picture, and neither did Uruguay.

Many and diverse are the sources of rigidity in labour markets. Laws related to valid causes that allow a firm to dismiss workers and bureaucratic steps to be accomplished; high costs of firing employees; excessive levels of non-wage labour costs; or strict time schedules allowed; are some of the most frequently claimed arguments. Unemployment benefits that generate incentives for not looking and/or accepting a job are also possible sources. Restrictions to labour mobility or inefficient channels of information can also qualify as generators of inflexibility. Two of the most cited sources preventing wages to adjust in the amount and as fast as necessary given demand fluctuations are the existence of minimum wages and labour institutions. A branch of the discussion in the nineties thus referred to the economic advantages or disadvantages of having legal minimum wages and on analysing if their level was too high. The other line of debate that generated strong opinions focused on the role trade unions have played in keeping wages above their market clearing levels.

In Uruguay all of the above candidates were, and still are, under analysis. However, and possibly due to their also playing a political role, trade unions have been one of the preferred topics. Uruguay underwent a period of non-democratic government in the seventies and part of the eighties. The fact that unions were one of the institutions organising social actors in the way out of the military regime gave them a strong social summoning power. Hence, once democracy was reinstated, most workers were sympathetic to become union members. Bargaining power was high, given the social support unions enjoyed in those first years. At the same time, as wages had gone down to a historically unregistered low level, unions' concern on wages at the bargaining table was regarded by members as the best strategy to be followed, while not including employment in the bargaining agenda was nothing to be surprised of. However, after a first period of harmony between unions, employers and the

government, supported by the society as a whole, the usual struggle for political and economic strength was again on the table.

From a theoretical point of view it is generally expected that unions that bargain only over wages would raise its level by shifting the labour supply curve. However, to what extent they are able to extract rents from the firm depends on many factors. Less clear is their expected influence on the performance of the labour market, as when getting higher wages they might also be enhancing productivity and the levels of effort of the firm's workforce. The literature on trade unions has focused first on the effects of trade unions on wages exclusively, inferring the effects on employment *via* the wage elasticity of labour demand. Afterwards the attention moved to the process of bargaining itself. It was then stated that the effects of trade unions depend both on which is the utility function of the parties involved and on the issues over which bargaining takes place. Different models were proposed and other aspects were also taken into account, such as the role of strikes or if membership is endogenous to the bargaining process and its outcomes. Another important characteristic that has been found relevant in analysing union effects is the structure of bargaining. That is, at what level negotiations take place - centralised; at the industry level; at the firm level - as well as if done simultaneously over all issues in the agenda or at different stages.

The theoretical analysis of the economic effects of trade unions was particularly nourished by the results obtained in the empirical research. Applied research in turn has been fed by the new insights given by theorists. Basically, empirical studies compared the performance of economies/sectors/firms with and without unions, and found dissimilar results depending on the time period and the individual analysed. However, a major handicap of this literature is the impossibility of comparing the same economy, sector or firm with and without trade unions, something that would constitute a good *proxy* for a 'natural experiment' in social sciences. The importance for applied research of having this opportunity relates mainly to its making unnecessary to build lots of variables accounting for all other differences between individuals that would, in turn, allow for the isolation of the real effects of the phenomenon of interest. Thus, most of the applied research needed to add diverse controls in order to model the different characteristics of the individuals that bargain with a union and those that do not. However, the difficulty of so doing has always been large, while many of them are generally not observable.

The case of Uruguay in this respect constitutes an incomparable gift to applied researchers, as although a 'natural' experiment is most unlikely to be performed in Economics, the Uruguayan experience allows one to get quite close to it. Given data on the economic indicators for the manufacturing sector are available since 1975, it is possible to study the performance of the manufacturing industries during a period when there were no unions - 1975 to 1984- with the performance of those same sectors when unions were again playing a role in the labour market - 1985 up to now. Despite there were many other economic changes taking place in the economy at this same time, most of them were related to the opening up of the economy and have started previous to the re-appearance of unions, so that variables accounting for them can be included while confusing union effects in 1985 with other phenomena does not appear as a problem. Regarding social and political factors, being not quantifiable, they can however be modelled using binary variables.

In the first chapter a brief summary of the main characteristics of the Uruguayan economy is sketched in order to situate the reader in the context in which the empirical analyses are afterwards done. The emphasis is put on the main feature characterising the economy in the last 25 years: the processes of trade liberalisation and economic integration it has gone through. In the second chapter, a description of the characteristics of the labour market is done, trying to identify the most likely changes associated with the opening up of the Uruguayan economy. The third chapter is devoted to summarise the history of trade unions in Uruguay, focusing on those facts that determine their objective function nowadays. The decline in membership – a phenomenon that has taken place in many societies in the last decade – is here situated in the context of changes in the institutional framework in which negotiations have taken place. These changes, in turn, have also had effects on the structure of bargaining. While in the eighties negotiations were tripartite and done at the industry level, in the nineties they became bipartite and those carried out at the firm level started being a common practice. Moreover, agreements up to 1991 were enforceable while after that date the mandatory extension of contracts was eliminated. This review is based not only on the existent literature but also on the analysis of the majority of collective agreements signed since 1985. In this sense, the aim is to directly obtain information on union objectives and the level of bargaining from the original sources, so that the assumptions implied by the empirical models afterwards proposed are closer to the temporal-spatial reality under analysis.

Once the main empirical features that are the benchmark for the applied analyses to be developed are described, a review of the main recent lines of research is done. The chapter is not meant as an extensive survey of the literature. It only tries to highlight which have been the hot topics under analysis, that in turn explain the subjects that currently attract theoretical and empirical researchers. One of the topics there identified is that of the link between the expected outcome of bargaining and the evolution of wages and employment when there is an exogenous shock to the economy. In chapter 5 a technical paper is thus developed, in which the result is linked to the uncertainty faced by agents when bargaining instead of to the assumption of fixed reservation wage.

In the following two chapters an empirical research is performed in order to shed light on the actual effects of trade unions on wages and employment in the case of Uruguay. Chapter 6 exploits the fact that there is information on the different manufacturing industries for a time in which there was a ban on unions and also for a period in which unions and firms negotiated over the wage level. During the first period wages and employment can be thought of as the result of a competitive model. The resumption of unions in 1985, on the other hand, allows one to assume wages are the result of bargaining at the industry level while afterwards employment is determined according to the firm's labour demand schedule. The effects of trade unions on wages and employment can be directly compared using both models. Further, as the same sectors can be analysed with and without unions, the main shortcoming faced by most researchers of not having observations on the same individual/sector/economy with and without trade unions is avoided. It is there proved that trade unions did introduce rigidities in the labour market, increasing wages above their market clearing value. They also prevented employment to fall as much as it would in a competitive setting. However, some evidence on changes in the estimated union effects on wages and on employment is detected in the early nineties. Given the rules of the bargaining game changed in 1991, the result was thought of as being reflecting the possible effects of changes in the structure of bargaining and in the issues players bargain over on the negotiated outputs. The observations available by the time the research was carried out, though, were not enough to properly model the changes. In Chapter 7 then, with two more years of quarterly data, a model that do not assume any specific bargaining model is estimated in order to get primary evidence on the existence of union effects on employment. The results show that unions did have an effect on wages all along the period, but their direct impact on employment is only observed after 1992. These findings were taken as evidence on the existence of two different bargaining models after 1985: a

right-to-manage model before 1992 and a recursive or efficient contracts model after that date. Further, the available collective agreements also supported the hypothesis. No clauses on employment or associated items were present in the collective agreements signed before 1992. After that date, on the contrary, they explicitly considered issues not only related to how firms could adjust their labour input in face of demand fluctuations but also on the introduction of new technology and on training programmes. So issues over which they negotiated did change in the early nineties. Secondly, decentralisation of bargaining started to be a widespread practice partly promoted by the fact that contracts were not enforceable any more. Negotiating over employment at the industry level would be a very difficult task as it involves so many different firms. Bargaining at the firm level, on the contrary, makes it a possible practice. The results of the estimated models show that once unions started bargaining also over employment and the process became decentralised, they succeeded in protecting employment against demand fluctuations but allowing firms to adjust their labour input more than before if faced to relative price increases. Hence, the new bargaining output resulted in lower wage inflation and greater relative job stability.

There is a large amount of literature on union wage effects in developed countries, and a not so large volume on union employment effects. It is not possible to state the same for Latin America, and least of all for Uruguay. Thus, the research here carried out is indeed relevant in this respect. The special characteristics of unions in Uruguay further give the opportunity of carrying on a desirable experiment, not only on the effects of unions on wages and employment but also on the effects of changes in the bargaining structure on the outcome of bargaining. What this research cannot answer is if union effects are positive or negative for the overall performance of the firm. Their impact on other indicators should be analysed. This and other shortcomings that point at future interesting lines of research are summarised in the final chapter.

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Chapter 1. The most salient features of the Uruguayan economy

The research summarised in this and the following chapters provides new insights in the understanding of the mechanisms influencing wage setting and employment determination in the Uruguayan labour market. It is thus necessary to review some of the most important economic processes that have taken place in the period under analysis, so as to have a clear benchmark in which to situate the evolution of the key variables studied. This is briefly carried out below, while the main features characterising the labour market itself are described in the next chapter.

Uruguay is a small country – with an annual GDP of around 20000 million dollars and a total population of 3 million people in 2000. Production of tradable goods has always been essential, although half of the Uruguayan GDP originates in the services sector. As a consequence, the economy has always been very dependant on external conditions. Further, being geographically located between two large and not stable economies -Argentina and Brazil - Uruguay has been traditionally subjected to a series of regional shocks, particularly those coming from Argentina (Favaro and Sapelli, 1986) and this has continued to be so during the last 25 years.

By the mid-seventies, the Uruguayan economy was still recovering from the oil shock of 1973 and the ensuing global recession. It fully recovered in the late 1970s, partly in response to the liberalisation of financial markets and the starting of commercial liberalisation as well. Growth accelerated when the government adopted a pre-announced schedule of monthly devaluations with the rate of devaluation declining gradually over time. Unemployment, that had peaked to12% in 1976, fell to 6% by 1980-1981. However, global economic conditions were not kind to this schedule and by the early 1980s the net result was a highly overvalued currency, which had to be devalued in the global recession of 1982. As a consequence, GDP decreased 16% in three years and the unemployment rate went up to 15%.

The second half of the eighties was a period of political and economic re-structuring. After 13 years of a military government, the return to democracy brought up many economic policies that aimed to answer social claims, such as the immediate recovery of wage levels or the reinsertion in their previous jobs of workers that had been fired for political reasons. Commercial agreements were also a priority, as a means of fuelling the regional economies, while tariff reductions were also implemented. By 1988 Uruguay had successfully recovered

from the deep economic recession. The economy grew 9% in 1986 and 8% in 1987, supported by an increase in demand from Brazil, which was implementing a stabilisation plan (Plan Cruzado). In 1989, however, the favourable regional environment changed, the public sector deficit grew to 7% of GDP, while the inflation rate started to increase. The new government, elected in 1990, thus implemented a stabilisation plan aimed at stopping the inflationary process, having the exchange rate as an anchor. At the same time the regional integration process started and by 1991 the legal framework giving birth to the Common Southern Market (Mercosur) was at work. These facts resulted in a sustained, steady decline in inflation from 129% in 1991 to 5% in 2000. External conditions were also favourable to this performance. The stabilisation plan imposed in Argentina in 1991 (Plan de Convertibilidad) improved relative competitiveness for Uruguay, with exports to that country increasing 130% that year. Expanded trade with Argentina, no small part of which consisted of tourism, and a deterioration of the real exchange rate meant that growth in the service sector far outstripped growth in goods production. Within the latter, the actual impact depended upon relative exposure to external competition. There were also important tariff reductions along those years, so that by 1993 the maximum was 20%. Non-tariff protection was also decreased, together with the elimination of some specific sectoral protection and some deregulation that took place in the export-import procedures. The main result of these policies was a huge increase in imports, especially of those coming from the rest of the world. Exports also increased, mainly those to the region, although at a significantly lower pace.

The above described macro changes were particularly felt by firms in the manufacturing sector. While its share in total GDP was 27% in 1987, it steadily declined to 17% in 1999. Moreover, the composition of output also changed. In 1985-1987 21% of total sales were exports, while in 1999 the figure rose to 30%. There is a great variance within the manufacturing sectors, with industries like textiles & leather that already had in 1985 levels around 40% and in 1999 were exporting nearly 80% of their sales, to industries like paper and metal products that have never surpassed a 20% of exports over sales. In spite of this, all industries significantly increased their exports levels during the nineties. At the same time, exports to Mercosur have 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. Hence, one of the major consequences of the integration process was to promote a change in the origin of manufacturing imports and the destiny of manufacturing exports.

This, in turn, did have an impact on the required technologies and on the adequate composition of the labour input, depending on firms being exporters or import competitors.

All the above changes in terms of the composition of output and the framework in which production took place had important effects on the labour market. Regarding the unemployment rate, it meant that after the economic recession of 1982-1984, it declined and stabilised around 9% in the late eighties and early nineties, an average that is higher than that prevailing in the seventies (Cassoni, Allen and Labadie, 1996). It can be argued that this is explained by the steady increase in labour supply, but the employment rate also went down. Further, there is evidence on an increase in job instability, a fact that can be linked to the services sector being the one absorbing the workforce expelled by the manufacturing sector in the nineties (Cassoni, 1999). Moreover, in the mid-nineties and after the 'Tequila shock' the unemployment rate started to increase again so that it reached 15% in 2000 and is still going up in 2001. Thus, it is apparent that the impact of negative external shocks on the overall performance of the labour market is more permanent today than in the past while the absorption of workers is also slower. The statement can be further reinforced if just looking at the average rate of growth of GDP together with the unemployment rate. In the eighties the average unemployment rate was 10.8% while GDP grew at an average annual rate of 0.2%. In the nineties, a similar figure for unemployment is registered (10.8%) but it is matched with an average yearly rate of growth of GDP of 3.5%.

Regarding wages, their evolution along the last three decades has been very unsteady. The seventies were years of real wage reduction, as private wages were allowed to increase only by government decree since 1968. However, by the mid-seventies firms started to grant wage increases over the minimum allowed, given the excess demand of labour. Increases in product demand made it necessary for firms to hire more workers while, at the existing wage, labour supply was insufficient. Still, by 1981 the accumulated loss in the real wage, in terms of the price of consumption goods, was around 40%. With the advent of the first democratic government after the military coup, wages were immediately granted an increase, but never returning to their previous levels. In any case, and also due to the re-installation of the bargaining practices and the reappearance of all actors related to wage setting – unions, employers associations and government – wages showed an upward trend until the mid-nineties. Their sectoral evolution has been, however, dissimilar. Public wages were part of the anchorage and adjusting variables for public finances and therefore had a decreasing

trend since 1982. Private wages, on the other hand, increased about 20% in real terms in the period until 1996, and stabilised afterwards. Manufacturing salaries evolved similarly than private wages in the eighties, although the average productivity of labour did not follow the same increasing path. In the late nineties, however, these processes were somehow reverted, so that manufacturing wages declined relatively more than those in other sectors while labour productivity rose significantly. Increased job instability and the competitive pressure brought up by the new commercial environment are probably at the root of the process.

All of the above shows that the Uruguayan economy has gone through various and important transformations along the last three decades, mainly related to the opening up of the economy but also to the institutional framework in which economic relations have taken place. These transformations have meant a re-structuring of the economy that has determined changes in the sectoral distribution of GDP as well as in the use of technology, at least in some sectors (Cassoni and Fachola, 1997; Croce, Macedo and Triunfo, 2000; Tansini and Triunfo, 1998a; 1998b). At the same time, high unemployment rates have been observed both in the eighties and in the nineties, in spite of the economy being growing. More disturbing yet is the fact that in the nineties if faced to adverse shocks, unemployment went up almost immediately while the reverse did not hold. One of the probable causes of persistent unemployment is related to the lack of flexibility in the labour market, due to its regulatory framework. However, other arguments that can be sustained are related to changes in the characteristics of labour demand that are not matched by those offered in the market. Thus, a first step is to analyse which are the groups that are unemployed today and how have their characteristics varied in the last decades. This will be done the following chapter.

Chapter 2. Stylised facts on the Uruguayan labour market performance[1]

Given the aim of this research is to offer an explanation on wage and employment determination in the Uruguayan labour market, in what follows the main characteristics of the labour force and its evolution in time is depicted using information from the Uruguayan Household Survey. The survey is carried out monthly, using a sample of around 20000 individuals in Montevideo, the capital city, since the early seventies. In the early eighties the National Institute of Statistics started collecting data from the urban areas in rest of the country using a sample of similar size, given the population is evenly distributed between both urban regions.

By the end of the nineties unemployment rates in Uruguay were high and increasing. Further, more than one third of the workforce was either underemployed or employed in the informal sector. Turnover was high and at the same time the length of the unemployment spell increased (Cassoni, 1999). All these features could be just temporary and linked to the economic cycle or, on the contrary, a new structural characteristic that is the result of the transformations experienced by the Uruguayan economy.

The participation rate in Montevideo[2] has steadily increased since the mid-seventies. So has the employment rate. With smaller figures, the rest of the country has behaved in the same way (Table 2.1).

Table 2.1: Labour market indicators 1970 – 1999 *(%)*

	Participation Rate	**Employment Rate**	**Unemployment Rate**
Montevideo			
1970-1980	50.6	46.2	8.8
1981-1990	58.2	52.0	10.8
1991-1999	60.6	54.3	10.3
Interior			
1981-1990	53.2	48.1	9.4
1991-1999	55.9	50.4	9.8

Source: National Institute of Statistics

Given that the unemployment rates in the last two decades are almost identical, it can be argued that the additional jobs have been created so as to just absorb the new entrants.

[1] I acknowledge comments from Judy Baker and William Maloney on part of this section.
[2] Those employed or unemployed as a percentage of people older than 13 years.

However, the overall performance of the economy has been substantially different in both sub-periods: while in the early 80s the economy underwent its worst economic crisis, the nineties were years of almost continuous growth (Table 2.2). Hence, the dynamics of job creation in the nineties were markedly slower than in the previous decade.

Table 2.2: Rate of growth of output and unemployment rate 1970 – 1999 *(%)*

Average	Unemployment Rate	GDP Growth rate
1970-1975	7.7	2.1
1976-1980	9.9	4.5
1981-1985	12.2	-2.9
1986-1990	9.4	3.3
1991-1995	9.2	3.7
1996-1999	11.5	3.0
70's	8.8	3.4
80's	10.8	0.2
90's	10.3	3.5

Note: The unemployment rate refers to Montevideo
Sources: National Institute of Statistics; Central Bank of Uruguay

It could also be argued that, given the increased labour supply, the high unemployment rate observed today is the consequence of the behaviour of the new entrants to the market, who would be more selective job seekers. However, those looking for a job for first time (FTS) have been a quite stable, and even decreasing proportion of the labour force (Table 2.3). On the contrary, by the end of the nineties, those unemployed with previous experience (UwE) have substantially increased their share in total unemployment. Thus, the upsurge of unemployment in the nineties has been mainly driven by the behaviour of those that had had a previous job.

Table 2.3: Unemployment rate by category 1982-1998 *(%)*

	Montevideo			Interior		
	Total	FTS	UwE	Total	FTS	UwE
1982-1986	12.9	3.0	9.9	11.2	nd	nd
1987-1990	9.0	2.6	6.4	8.1	2.4	5.6
1991-1994	8.9	2.5	6.4	8.8	2.4	6.4
1995-1998	11.2	2.3	9.0	10.6	2.3	8.3

Note: nd = no data available; FTS = first time job seekers;
UwE = unemployed with previous experience
Source: National Institute of Statistics

In many Latin American countries migration from rural to urban areas is one of the alleged causes of persistent urban unemployment. In the case of Uruguay, although the same process has been observed, migration has taken place at an average annual rate of 1.5% in the last forty years, so that the argument would be weak. Uruguay is, however, a country in which the capital city has always concentrated more than 40% of the population, and migration from urban areas to Montevideo has indeed occurred. The labour market in Montevideo and that of the rest of the urban country are also different, as the economic activities being developed in both areas are also distinct. Industrial production, financial services and most of the public sector are located in Montevideo, while the production of primary goods is the main source of production in the rest of the country. Being the diversity of job opportunities scarce in the rest of the country, migration to Montevideo has further pushed up the unemployment rate until recently. In the nineties the geographical differences are vanishing, so that in 1999 both unemployment rates are almost the same. This is consistent with the fact that migration to the capital city has stopped or at least significantly slowed down, partly as a consequence of the lack of job opportunities in the industrial sector and the shrinking of the public sector.

Although the above arguments point at the demand side as the responsible for the high unemployment rates, it could still be the case that the individual characteristics of labour supply explain the phenomenon. One issue that has been widely discussed in Latin America is that of the effects of the increase in female labour supply on the labour market as a whole. Women are more selective job seekers and tend to have higher rates of turnover while they are also found to face more obstacles in getting a job (Blau, 1998). Female participation rates in Uruguay have indeed risen and in fact explain all of the increase in the overall participation rate (Table 2.4).

Table 2.4: Labour market indicators by gender 1970 – 1999 *(%)*

	Participation rates		**Employment rates**		**Unemployment rates**	
Montevideo	Male	Female	Male	Female	Male	Female
1970- 1980	72.7	32.0	67.4	27.8	7.3	12.7
1981- 1990	75.3	44.7	69.1	38.3	8.3	14.2
1991- 1999	73.7	49.9	67.8	43.4	8.1	12.9
Interior						
1985- 1990	73.0	37.1	67.9	34.1	7.4	10.4
1991- 1999	71.5	42.1	66.0	37.6	7.7	12.9

Note: No data is available before 1985 for the Interior
Source: National Institute of Statistics

However, their employment rates have gone up, while their specific rate of unemployment has gone down, at least in Montevideo for which data are available. Further, differences by gender in the specific rates of unemployment have diminished, especially when considering new entrants in Montevideo (Table 2.5).

Table 2.5: Specific rates of employment and unemployment by gender 1982 - 1998 *(%)*

	Montevideo				Interior		
	1982- 86	1987- 90	1991-94	1995-98	1987-90	1991-94	1995-98
Employment							
Overall rate	50.1	54.3	54.3	54.4	50.8	50.2	50.4
Male	67.5	70.3	68.7	67.2	69.0	66.7	65.6
Female	36.4	41.3	42.7	44.1	35.8	35.7	38.5
Unemployment							
Overall rate	13.0	9.0	8.9	11.2	8.2	8.8	10.6
UwE	9.9	6.4	6.4	9.0	5.6	6.4	8.3
Male	7.9	5.1	5.1	7.2	4.7	5.3	6.7
Female	12.6	8.3	8.1	11.0	7.1	8.0	10.5
FTS	3.0	2.6	2.5	2.3	2.4	2.4	2.3
Male	2.1	1.8	1.7	1.9	1.5	1.6	1.5
Female	4.4	3.7	3.4	2.9	3.9	3.7	3.5

Note: UwE = unemployed with previous experience; FTS = first time job seekers
Source: National Institute of Statistics

Another preferred topic discussed in the applied labour economics literature is that of the performance of young individuals in the Latin American labour markets (see Diez de Medina, 2001, for a recent reappraisal). This group is generally pointed at as the one with more difficulties in getting a job, although the reasons for it may be very different. The analysis of the behaviour of employment and unemployment by age shows that the youngest group -those in the age interval (14, 19)- do have relatively more difficulties in getting their first job than other age groups but this does not hold when looking at those with previous working experience (Table 2.6). The age structure of employment and of unemployment when considering those with previous experience is quite stable in time, no matter whether unemployment is high or low. On the contrary, the share of those in the age interval (20, 29) in unemployment is structurally higher than in employment, thus pointing at a group with a higher rate of turnover. Turnover can be voluntary, especially if the individual is not head of the household, but it can also be involuntary and linked to the costs of firing[3].

[3] These costs are a function of tenure in Uruguay. For a discussion on the effects and level of non-wage costs in Uruguay, see Cassoni, Labadie and Allen (1995) and Cassoni and Ferre (1997).

Table 2.6: Distribution of employment and unemployment by age 1982-1998 *(%)*

Age interval	Montevideo				Interior		
	1982- 86	1987-90	1991-94	1995-98	1987-90	1991-94	1995-98
Employment							
Overall rate	50.1	54.3	54.3	54.4	50.8	50.2	50.4
14-19	5.2	5.6	5.7	5.1	8.0	8.0	7.2
20-29	25.4	23.5	22.7	24.0	21.4	20.9	22.0
30-39	22.2	23.7	24.7	23.7	24.7	24.3	23.2
40 & more	47.2	47.2	47.1	47.3	46.0	46.9	47.7
Unemployment							
Overall rate	13.0	9.0	8.9	11.2	8.2	8.8	10.6
UwE							
14-19	14.6	19.2	20.8	16.5	22.2	24.4	21.2
20-29	34.4	38.7	36.3	36.2	35.3	34.5	34.7
30-39	17.5	18.3	18.3	18.8	19.3	18.1	18.4
40 & more	33.5	23.7	24.6	28.6	23.3	23.1	25.8
FTS							
14-19	52.9	52.4	59.4	61.9	52.5	64.5	62.4
20-29	37.6	39.4	34.6	31.6	35.3	26.4	29.3
30-39	4.8	4.4	3.1	3.2	7.5	6.3	4.4
40 & more	4.7	3.9	3.0	3.3	4.7	2.9	4.0

Note: UwE = unemployed with previous experience; FTS = first time job seekers
Source: National Institute of Statistics

Specific unemployment rates for those with previous experience are decreasing with age, as expected (Table 2.7). However, the increase in the specific rates of unemployment by the end of the nineties has been proportionally larger the older the worker.

Table 2.7: Specific rates of unemployment 1982 - 1998 *(%)*

	Montevideo				Interior		
	1982-86	1987-90	1991-94	1995-98	1987-90	1991-94	1995-98
FTS							
14-19	21.3	17.8	18.5	19.1	12.7	15.1	15.0
20-29	4.3	4.1	3.6	2.9	3.8	2.9	2.9
30-39	0.7	0.5	0.3	0.3	0.8	0.7	0.4
40 & more	0.4	0.2	0.2	0.2	0.3	0.2	0.2
UwE							
14-19	19.0	16.2	16.8	20.0	12.8	15.0	18.2
20-29	12.8	10.0	9.8	12.8	8.8	10.1	12.4
30-39	8.2	5.2	4.9	7.4	4.6	5.0	6.9
40 & more	7.4	3.6	3.7	5.9	3.1	3.4	4.8

Note: UwE = unemployed with previous experience; FTS = first time job seekers
Source: National Institute of Statistics

The above description suggests that the Uruguayan unemployment is not the result of the change in the distribution of the labour force by gender. On the contrary, both men and women are being subject to unemployment in equal proportions. Regarding the age structure, the current increase in the unemployment rate points at those older than 40 years as the most vulnerable group instead of the youngest strata. Being the increase in unemployment driven by those with previous experience, the evidence suggests that displaced workers are the bulk of the unemployed population. A first question relates to the reasons for being unemployed. Is it voluntary or not? In Table 2.8 it is shown that the share of those that were laid-off, either individually or because their firm shut down, has more than doubled in the nineties relative to the eighties in Montevideo. Thus, when the unemployment rate went up in the nineties, those that involuntary lost their job increased their share in total unemployment in 10 percentage points.

Table 2.8: Distribution of the unemployed by reasons for leaving the job 1982 – 1998 *(%)*

	1982-86	1987-90	1991-94	1995-98
Montevideo				
Laid-off	22.9	17.4	26.9	37.5
Quit	77.1	82.6	73.1	62.5
Interior				
Laid-off	---	12.0	18.8	28.4
Quit	---	88.0	81.2	71.6

Note: FTS= first time job seekers; UwE= unemployed with previous experience
Source: National Institute of Statistics

A second issue is related to which are the economic sectors expelling workers. When looking at the temporal evolution of employment, it is seen that the share of manufacturing employment in Montevideo has gone down in 5 percentage points in the last decade while commerce has increased its share in both Montevideo and the rest of the country. In Montevideo, jobs have also been created in activities linked to offering services to firms and in social and personal services, while in the Interior it is the agricultural and leverage sector the one that has generated new jobs. Thus, people expelled from the industrial sectors have apparently found a job in those linked to non-financial services and agriculture (Table 2.9). However, after 1995, the share in total unemployment of those that have worked in construction and commerce increased significantly, explaining most of the rise in the unemployment rate.

Table 2.9: Employment and unemployment distribution by occupation and sector 1982 – 1998 *(%)*

	Montevideo				Interior		
Economic sector	**1982-86**	**1987-90**	**1991-94**	**1995-98**	**1987-90**	**1991-94**	**1995-98**
Employment							
Agricult., leverage, fishing & mining	1.7	1.5	1.5	1.8	6.7	7.7	7.7
Manufacturing	22.6	24.0	22.8	17.8	19.3	18.1	15.9
Construction	4.4	4.3	5.0	5.3	8.9	9.2	9.0
Commerce	18.0	17.5	18.5	20.5	17.1	18.4	19.7
Electricity, transport. & communications	9.1	8.6	7.5	7.8	6.9	6.7	6.4
Real estate & services to firms	6.1	6.5	7.7	8.8	3.0	3.2	3.6
Social & personal services	38.1	37.8	37.1	38.1	38.3	36.8	37.7
Unemployment							
Agricult., leverage, fishing & mining	1.1	1.3	1.2	1.1	9.1	10.4	8.0
Manufacturing	35.0	32.2	31.5	27.5	22.4	17.6	17.7
Construction	7.9	6.8	5.4	7.1	11.5	11.4	12.7
Commerce	20.4	23.2	23.9	25.8	18.1	18.7	20.7
Electricity, transport & communication	4.5	3.8	4.3	4.5	3.7	3.9	3.8
Real estate & services to firms	4.4	5.3	5.6	6.4	2.4	2.2	2.4
Social & personal services	26.5	27.5	28.1	27.7	33.1	35.7	34.8

Note: Unemployment refers only to those with previous experience
Source: National Institute of Statistics

The change in the sectoral structure of employment favouring non-financial services and commerce is such that the degree of volatility of jobs has increased while the level of schooling generally required is higher than the one needed in manufacturing and/or construction. Is it that unemployment is concentrated among those least educated? Yes and no. The overall level of education of the population has increased, so that the share of those with only primary education has gone down, both among employed and unemployed individuals (Table 2.10). However, when the unemployment rate went up in the second half of the nineties, the least skilled individuals showed the highest increase in their specific unemployment rates in Montevideo (Table 2.11). The opposite occurred in the Interior, as less educated workers are linked to primary sectors, with a more inelastic labour demand. Further, those with intermediate levels of schooling – technical or not – are the ones showing a clearest upwards trend in their share in unemployment in the nineties.

Table 2.10: Distribution of employment and unemployment by education level 1982-1998 *(%)*

	Montevideo				Interior		
Employment	**1982-86**	**1987-90**	**1991-94**	**1995-98**	**1987-90**	**1991-94**	**1995-98**
Primary School	42.5	35.9	30.4	25.1	49.9	44.9	40.6
Secondary School L1	22.7	24.5	23.8	20.9	22.1	20.4	20.5
Secondary School L2	9.9	11.3	12.4	17.5	8.2	12.4	15.2
Technical School	11.2	11.6	12.8	12.9	12.2	14.0	14.4
High education	13.8	16.8	20.6	23.7	7.6	8.4	9.3
Unemployment							
FTS							
Primary School	19.6	16.1	11.4	14.7	24.5	20.0	19.0
Secondary School L1	28.4	30.0	27.4	26.5	35.2	28.1	24.4
Secondary School L2	19.6	20.6	23.0	24.3	18.3	26.2	29.5
Technical School	14.8	10.9	13.3	14.5	15.8	16.3	19.2
High education	17.7	22.5	24.8	19.9	6.2	9.5	8.0
UwE							
Primary School	47.0	32.9	29.6	26.1	46.6	43.0	38.4
Secondary School L1	25.3	30.5	30.3	27.4	28.3	25.9	23.9
Secondary School l2	8.7	13.8	13.5	19.5	8.8	11.7	16.7
Technical School	12.1	12.3	14.5	14.2	13.4	16.0	16.7
High education	7.0	10.5	12.2	12.8	3.0	3.4	4.3

Note: FTS = first time job seekers; UwE = unemployed with previous experience. Primary School = 6 years; Secondary School L1 = level 1, 3 years; Secondary School L2 = level 2, 3 years; Technical School = up to 6 years; High education = University and others
Source: National Institute of Statistics

Table 2.11: Specific rate of unemployment by education level 1982-1998 *(%)*

	Montevideo				Interior		
	1982-86	**1987-90**	**1991-94**	**1995-98**	**1987-90**	**1991-94**	**1995-98**
FTS							
Primary School	1.4	1.2	1.0	1.3	1.2	1.1	1.1
Secondary School L1	3.7	3.1	2.8	2.9	3.7	3.3	2.7
Secondary School L2	5.9	4.6	4.5	3.1	5.2	5.0	4.4
Technical School	3.9	2.5	2.5	2.5	3.1	2.8	3.0
High education	4.1	3.6	3.0	2.0	2.0	2.9	2.1
UwE							
Primary School	11.0	6.0	6.3	9.4	5.4	6.2	8.0
Secondary School L1	10.9	7.9	8.0	11.4	7.0	7.9	9.5
Secondary School L2	8.6	7.6	6.8	9.8	5.8	5.9	8.9
Technical School	10.5	6.8	7.2	9.7	6.1	7.3	9.4
High education	5.1	4.1	3.8	5.1	2.3	2.7	4.1

Note: FTS = first time job seekers; UwE = unemployed with previous experience. Primary School = 6 years; Secondary School L1 = level 1, 3 years; Secondary School L2 = level 2, 3 years; Technical School = up to 6 years; High education = University and others
Source: National Institute of Statistics

It is thus apparent that there has been a change in the characteristics that workers are required to have, so that it is likely that displaced workers do not have the skills demanded by those economic sectors that are not shrinking.

The above descriptive analyses do not take into account the cross effects of the different dimensions of the individual characteristics. It might be the case, e.g., that women have higher unemployment rates than men not for being discriminated but just as a consequence of them having low education levels. In order to analyse the determinants of the odds of being unemployed controlling for all characteristics simultaneously, a multivariate logit model is estimated. The specification of the model is as follows:

$$P(y = j) = \exp(\beta_j \mathbf{x}_i)/[1+\sum_k \exp(\beta_k \mathbf{x}_i)]$$

Where P(y = j) is the probability of individual 'i' choosing 'y=j' relative to a 'base' category. The available choices (j) are to not participate in the labour market; and to participate and be unemployed. The 'base' category is to participate and be employed. Variables explaining the occurrence of one outcome or other ($\mathbf{x}_i$) refer to the personal characteristics of the individual and to his/her environment. Variables to be considered in the first group are gender; age; education level; marital status; household status; and experience. Those related to the environment are the geographical area in which the individual lives and an index of his/her household poverty status[4]. The poverty index is calculated using principal factor analysis (see Harris, 1975 for an extensive treatment of the topic). This is done in order to avoid the biases that would arise if one measures poverty only according to the total income of the household. The fact that the individual is working or not, especially if he/she is the head of the household, will change the strata in which the household is classified according to the *per capita* income. Hence, the characteristics of the house the individual lives in are incorporated as relevant variables. Factors used are then the *per capita* income of the household (considering all sources of income); the number of household members *per* room;

[4] Gender is a binary variable (male=1, female=0). Age and schooling are continuous variables. Possible categories of marital status are single; married; and divorced or widower, defining a binary variable each. Household status is a binary variable accounting for the individual being head of the household or not. Experience is calculated as the individual's age minus 6 minus years of schooling, except for the FTS for which experience is equal to 0 by definition. Region equals 1 if the individual lives in Montevideo, 0 otherwise. The poverty index ranges from 1 to 5, corresponding 1 to households in the 20% poorest strata.

and the level of precariousness of the house[5]. The poverty index is also calculated excluding the *per capita* income in order to analyse if the inclusion of the labour income, when there is one, would significantly bias the estimated effect of this variable on the odds of unemployment or change other estimated coefficients.

The results of the model (Table 2.12) show that, other characteristics constant, the odds of unemployment relative to employment are higher for women than for men; for non-married than for married individuals; for single than for divorced or widowers; for those not in charge of the household than for the household head; for those living in Montevideo than for people living in the Interior.

Table 2.12: Results of the logit model for unemployment: relative odds and coefficients 1986 – 1998

	Gend	Age	Coeff. Age^2	School	Coeff. Sch^2	Exper	Coeff. Exp^2	Marr.	D/W
1998	0.63	1.86	-0.002	0.81	-0.02	0.53	0.003	0.78	0.88
	(0.031)	(0.076)	(0.000)	(0.033)	(0.002)	(0.016)	(0.000)	(0.049)	(0.089)
1997	0.67	2.02	-0.003	0.83	-0.02	0.50	0.003	0.92	1.24
	(0.030)	(0.077)	(0.000)	(0.030	(0.002)	(0.014)	(0.000)	(0.052)	(0.109)
1996	0.75	2.01	-0.003	0.85	-0.02	0.51	0.004	0.83	0.96
	(0.033)	(0.076)	(0.000)	(0.031	(0.002)	(0.014)	(0.000)	(0.046)	(0.085)
1995	0.68	1.84	-0.002	0.82	-0.02	0.53	0.003	0.76	1.03
	(0.032)	0.069)	(0.000)	0.030)	(0.002)	(0.015)	(0.000)	(0.046)	(0.096)
1994	0.68	2.28	-0.004	0.79	-0.02	0.45	0.004	0.79	1.09
	(0.035)	(0.105	(0.000)	0.033)	(0.002)	(0.015)	(0.000)	(0.053)	(0.118)
1993	0.68	2.28	-0.003	0.69	-0.02	0.45	0.004	0.74	1.13
	(0.037)	(0.106)	(0.000)	(0.030)	(0.002)	(0.015)	(0.000)	(0.052)	(0.127)
1992	0.69	2.17	-0.004	0.76	-0.02	0.48	0.004	0.78	1.06
	(0.037)	(0.093)	(0.000)	(0.029)	(0.002)	(0.015)	(0.000)	(0.052)	(0.113)
1991	0.74	2.20	-0.004	0.72	-0.02	0.46	0.005	0.89	1.02
	(0.039)	(0.099)	(0.000)	(0.029)	(0.002)	(0.015)	(0.000)	0.046	(0.090)
1990	0.79	2.07	-0.004	0.69	-0.01	0.49	0.004	0.94	1.23
	(0.043)	(0.086)	(0.000)	(0.025)	(0.001)	(0.014)	(0.000)	(0.050)	(0.109)
1989	0.70	2.41	-0.005	0.71	-0.01	0.44	0.005	0.94	1.02
	(0.039)	(0.108)	(0.000)	(0.025)	(0.001)	(0.014)	(0.000)	(0.100)	(0.011)
1988	0.65	2.11	-0.003	0.71	-0.01	0.48	0.004	0.84	1.12
	(0.034)	(0.083)	(0.000)	(0.024)	(0.001)	(0.013)	(0.000)	(0.042)	(0.094)
1987	0.67	2.30	-0.004	0.77	-0.02	0.45	0.005	1.01	0.96
	(0.035)	(0.091)	(0.000)	(0.026)	(0.001)	(0.013)	(0.000)	(0.051)	(0.088)
1986	0.82	2.09	-0.004	0.74	-0.01	0.49	0.005	1.01	0.97
	(0.042)	(0.037)	(0.000)	(0.024)	0.001)	(0.013)	(0.000)	(0.054)	(0.074)

[5] The precariousness of the house is an index taking values between 1 and 4 and accounts for the materials the house is built with, the size of the rooms and other issues related to comfort (1 is very high quality and 4 is precarious).

(Table 2.12 continued)

	Head	Reg.	Pov.1	Goodness of fit of the model			
				(1)	(2)	(3)	(4)
1998	0.52	1.28	1.29	0.16	90.82	0.000	0.78
	(0.034)	(0.054)	(0.024)				
1997	0.49	1.34	1.33	0.19	90.15	0.000	0.77
	(0.031)	(0.057)	0.023)				
1996	0.48	1.45	1.39	0.19	89.64	0.000	0.78
	(0.030)	(0.060)	0.023)				
1995	0.47	1.42	1.38	0.20	91.10	0.000	0.79
	(0.033)	(0.061)	0.024)				
1994	0.48	1.34	1.38	0.23	92.37	0.000	0.81
	(0.037)	(0.064)	0.027)				
1993	0.48	1.34	1.34	0.24	93.17	0.000	0.81
	(0.041)	(0.070)	(0.027)				
1992	0.44	1.13	1.29	0.22	92.48	0.000	0.80
	(0.035)	(0.059)	(0.024)				
1991	0.44	1.24	1.30	0.23	92.72	0.000	0.80
	(0.034)	(0.061)	(0.026)				
1990	0.48	1.68	1.50	0.24	92.92	0.000	0.81
	(0.037)	(0.085)	(0.030)				
1989	0.47	1.50	1.48	0.25	93.51	0.000	0.82
	(0.038)	(0.078)	(0.030)				
1988	0.55	1.45	1.44	0.24	93.13	0.000	0.81
	(0.040)	(0.070)	(0.027)				
1987	0.48	1.51	1.51	0.26	92.96	0.000	0.81
	(0.034)	(0.072)	(0.028)				
1986	0.48	1.85	1.54	0.24	92.24	0.000	0.80
	(0.033)	(0.088)	(0.028)				

Notes: Figures refer to relative odds unless stated. In that case 'Coeff.' (coefficient) is added to the name of the variable. Variables are: 'Gend' = gender: 1 if male, 0 if female; 'Age': continuous; 'Age^2': age squared; 'School' = years of schooling, continuous; 'Sch^2': schooling squared; 'Exper' = experience; 'Exp^2': experience squared; 'Marr' = married: 1 if married, 0 otherwise; 'D/W' = divorced or widower: 1 if divorced or widower, 0 otherwise; 'Reg' = region: 1 if Montevideo, 0 if Interior; 'Pov.1' = poverty index: 1 to 5 indicating from highest to lowest quintiles of a poverty index calculated using principal factor analysis. Factors are *per capita* income of the household; quality of the house and members of the household *per* room. Standard deviations are in parenthesis under the estimators. Goodness of fit measures are: (1) = pseudo-R^2; (2) = % correctly classified; (3) = prob.> χ^2 for the Pearson statistic; (4) = area under the receiver operating characteristic (ROC) curve.

Further, unemployment likelihood decreases with experience and increases with age at a decreasing rate. This result suggests that the higher unemployment rate of young individuals is mostly linked to their lack of experience or training. Educated individuals have lower odds of being unemployed than those less educated. The speed with which this occurs increases with schooling. Finally, when discriminating the labour force according to the above mentioned poverty index, it is seen that the unemployment odds are higher for those belonging to the poorest households. If the odds are allowed to vary *per* quintile, individuals belonging to households in the lowest 20% of the income distribution have significantly

higher odds of unemployment than the rest[6]. The results of the model are not sensitive to the use of the two different indexes built. Only the estimates related to the effects of the poverty index on the odds of unemployment change, revealing the expected upwards bias when including the *per* capita income of the household[7].

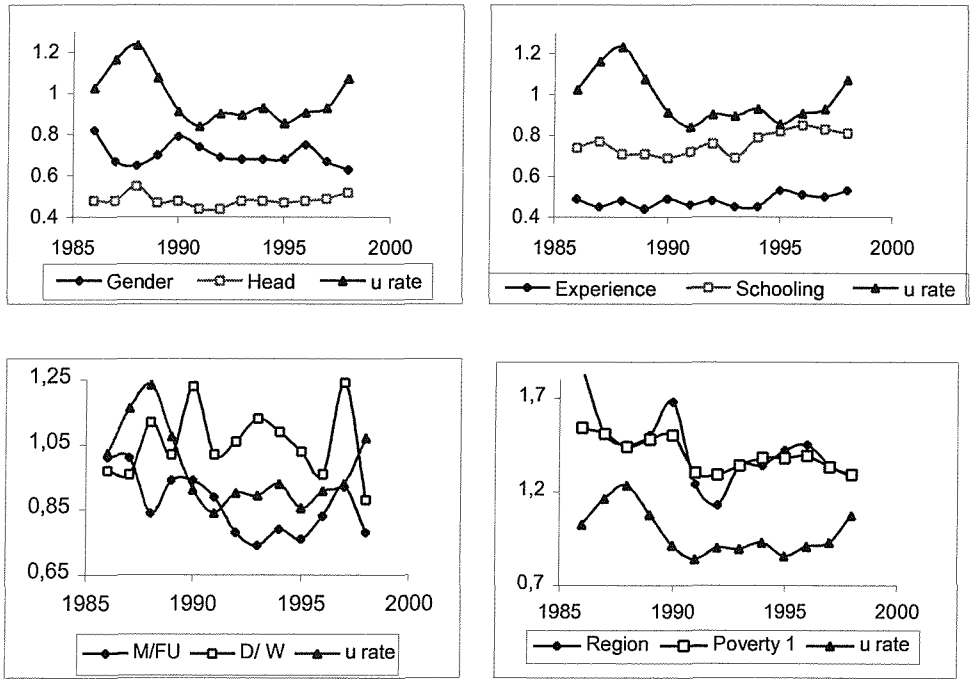
The temporal evolution of the estimated coefficients shows the different groups have evolved in a distinct way (Table 2.12, Figure 2.1). First, the relative odds of age, schooling and experience are relatively constant along the period. However, after 1994 there is some evidence of an increase in the relative risk of unemployment for young; educated; and experienced individuals. This behaviour is consistent with the increase in the unemployment rate, when relative gaps tend to disappear. Regarding differences by gender and household status, it is more apparent that the odds move with the unemployment rate. The relative risk of unemployment for women and household heads are larger when the unemployment rate is higher. Finally, the geographical area where the individual lives and the position of his/her household in the income distribution as factors differentiating the probability of being unemployed have decreased in importance in the nineties relative to the eighties. They also move with the unemployment rate, in the opposite direction.

Thus the model validates many of the findings derived from the descriptive analysis and helps identifying the real mechanisms at work. All the information displayed can be summarised in six statements. First, women, especially those that are single, not in charge of the household and not living in the capital city show relatively more difficulties in getting and keeping a job. When first time job seekers, however, the finding is consistent with a more selective job seeker, not with a discriminated individual. Second, young individuals owe their relatively poorer performance in the labour market to their lack of experience. Experience and schooling account for skill and hence decrease the odds of unemployment. Third, the evolution and characteristics of those in the age interval (20-29) reveal they are the most fragile group in terms of job stability. Although turnover can be voluntary in many cases, it is also associated to the costs of firing workers according to tenure. Fourth, individuals younger than 20 years face high unemployment rates. However, their behaviour

[6] The estimated values of the relative odds with respect to the richest quintile in 1998 are: 1.58 (0.13); 2.64 (0.22); 1.78 (0.15); 3.66 (0.32), corresponding to the second richest quintile up to the fifth (the poorest). Standard deviations are in parenthesis.
[7] The bias is such that the unemployment odds are around 20% higher.

is likely to be linked basically to their belonging to the poorest households. Fifth, less educated people have declined their share in total unemployment steadily in time. However, there are still a significantly high proportion of unemployed individuals with previous experience that have only primary school, especially in the Interior. Finally, the percentage of unemployed workers that have not quit their job has increased sharply in the nineties, pointing further to job stability problems.

Figure 2.1: Results of the multinomial logit model for unemployment
Relative odds 1986 - 1998



Note: 'D/W' is divorced or widower; u rate is the unemployment rate; head refers to the household head.

As a result, one could think of two groups the behaviour of which is the result of the economic transformations faced by Uruguay. They are not a minor proportion of workers, as together they represent more than 4 percentage points of the unemployment rate by the end of the nineties. First, individuals belonging to the age group (20-29) and living in urban areas other than Montevideo are facing greater job instability. They are 30% of the unemployed, thus 3% of the labour force. Second, unemployed workers with previous experience older than 40 years that are not qualified for the current available jobs and do need recycling. Those that have been unemployed for more than 6 months account for 12% of total unemployment and 1.2% of the labour force (Cassoni, 1999; de Brun and Labadie, 1997;

Reggio and Amarante, 2000). Finally, the data also suggest that the higher unemployment rate in the nineties is mainly due to the increase in the percentage of workers that have involuntary lost their job. The change in the economic structure is behind this phenomenon. The reduction in the size of the manufacturing sector has eliminated an important source of job creation given its multiplicative effects on other sectors. Thus, employment dynamics are slower today than in the eighties. On the other hand, job stability has also deteriorated, as employment in the non-financial services sector is a lot more volatile than that in the industrial sector.

It was here argued that some groups in the labour force do not have the characteristics demanded in the market, while the instability of jobs has increased. The effects of adverse shocks to the economy are further reinforced by a reduced manufacturing sector, so that the re-absorption of unemployed workers after a shock is slower today than in the past. It is possible to claim, however, that it is the inflexibility of the labour market the one responsible for not allowing supply to adjust to the new demand at the pace that it should. However, it is also likely that inefficiencies linked to managerial practices are playing a role too. In Uruguay there are many monopolistic and/or oligopolistic product markets, their existence being associated both to the small size of the market and to a varying but generally high level of protection. Liberalisation and integration have set a limit to it, but it can still be argued that even today regional markets are not completely competitive in many sectors.

In what follows the role of one possible source of inefficiencies linked to labour market rigidities - the existence of unions - will be analysed. The next chapter thus is devoted to describe the role these institutions have played in Uruguay, with especial emphasis on their evolution in the last 15 years.

Chapter 3. Trade unions in Uruguay: some historical features explaining their economic role

Brief historical overview

The existence of unions in Uruguay can be traced back to the beginning of the century, in 1905. Foundational members were mainly Italian and Spanish immigrants, many of them linked to the anarchist movement (Zubillaga and Balbi, 1992). These characteristics partially determined that during the first decades their role was strongly linked to the consolidation of the political and social institutions in the country. They also explain the future involvement of the union movement in the political life of the country.

In the early forties unions started playing an active role in wage setting. Discussions around the level of wages in different economic sectors took place in what was called 'Consejos de Salarios' (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 controlled that their resolutions were effectively undertaken and acted further as mediators in conflicts. Whatever was there decided was to be obeyed by all firms in 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. Some union leaders were even persecuted and incarcerated. Unionisation was completely banned. Only at the beginning of the eighties the government, still military, authorised the existence of associations of workers at the firm level. This smoothed the path towards re-unionisation. In 1984, a year before democratic elections took place again, the union movement was informally re-organised under the name of PIT-CNT[8].

[8] PIT means Workers Inter-unions Plenary.

Wage Councils were thus reinstalled in 1985, playing a very similar role as before the military coup. However, the union movement has changed in different directions since then. At the very beginning, and linked to the social and political environment, they played a major role as receivers and amplifiers of different claims of the workers, both related to the level of real wages - that have decreased around 40% in 10 years - and to the existent working conditions. They were further a strong political actor, acting as a partner of the still illegal political parties negotiating a way out of dictatorship with the military government.

In order to alleviate some of the most urgent claims of the society as a whole, the first democratic government granted an immediate increase for all wages, which meant an average rise of around 25%. By the end of 1985, nominal wages were 100% higher than in the previous year, although in real terms the recovery was of only 15%. However, there were other economic imbalances to account for by that time. Thus, the apparent partnership between the new government and unions rapidly dissolved, and negotiations over wage levels quickly acquired all the characteristics of bargaining games between parties with different power.

Moreover, firms' associations were more flexible than the government regarding wage increases, so that at the firm level they often set wages over the minimum level bargained. The most active opponent to unions' claims in the bargaining table was, in the end, the government. The goal pursued by the government representatives was to get wage increases in line with their inflation target. Their power consisted in that governmental approval meant enforceability of the output of negotiations to all firms in the sector, no matter they were effectively represented in the council or not. Thus, it was not rare that in order to get the approval of the government and hence guarantee enforceability, wage levels stipulated in the agreements were smaller than the actual ones (Forteza, 1992). In any case, firms were free to determine the level of employment. Further, in sectors in which competition was weak, wage increases could be easily transferred to the price of goods (Rama, 1994). This practice was very well known and a prior matter of concern for the economic authorities. Oligopoly power in the manufacturing sector varies by industry. However, on average, in the late eighties and early nineties, 57% of sectoral production was accounted for by the GDP of the four biggest firms in all industries (C4 index). Data needed to calculate this indicator by industry are available in 1988 and 1995. Only three industries at the 3-digits ISIC level had a figure below 50% in 1988, while in 1995 concentration increased relative to 1988 in all sectors except for

the automobile and rubber industries. Given 66% of firms in the Uruguayan manufacturing sector are small (have less than 5 employees), the degree of concentration can be considered quite high. It is not apparent that wage increases due to union action and market power go together, so that this can be thought of as generating barriers to entry, since the correlation between increases in concentration and membership is inexistent along the period 1988-1995. However, it has been stated that unions with the highest affiliation rates did appear in those sectors with the highest levels of profits, while increases in profitability and membership in the period are positively correlated (Cassoni, Fachola and Labadie, 2001). Hence, a sensible hypothesis is that union presence and their ability to increase wages were indeed favoured by a high level of market power of firms, but this was common to all industries in the manufacturing sector. Nonetheless, most powerful unions were certainly organised and likely to survive in the most profitable sectors.

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 synchronised along the period. However, as firms ended rising wages over the level set in the agreement, the positive effects of co-ordination (Calmfors and Driffill, 1988) finally vanished.

In 1991 the new government publicly announced its will 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 contracts signed under the previous regime had expired. The new institutional setting had two major consequences. Firstly, it acted as an incentive both for firms and workers to negotiate at more decentralised levels, particularly at the firm level. Secondly, it meant collective agreements would no more be enforceable. As a result, membership to the central union went down dramatically since then. This, however, does not mean unionisation *per se* diminished, but that synchronisation, co-ordination and political bargaining power deteriorated. The relationship between the government and the central union was further damaged by the fact that the political power in the nineties systematically insisted on making the labour market more 'flexible' and on establishing regulations ruling unions and bargaining. Unions historically opposed to the latter while they explicitly fought against the former idea all along the last decade.

The nature and structure of bargaining

In the early nineties there were more than 300 trade unions in Uruguay. They represented workers from specific economic activities but sometimes they only included those employees belonging to a firm. These unions were further gathered 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 co-ordinating the claims of all unions and federations. Employers, on the other hand, have organised in associations in order to bargain with unions.

Collective agreements signed within the framework of wage councils have ruled firms and workers represented by the bargaining parties since the very beginning of the union movement. However, conditions agreed upon have been considered as lower/upper bounds – depending on the issue – for employers and employees, instead of compulsory rules. If the government was further in accordance with the conditions stipulated in the collective agreements, they became enforceable to all firms in the sector until 1992, no matter they were seated at the bargaining table or not. After that, the output of negotiations has been valid only for the parties involved.

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 done 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 eighties and at the beginning of the nineties, indexation of wages to the inflation rate was done combining the past and the expected (according to the government's forecast) rate of inflation[9]. Co-ordination and synchronisation 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 were faced to and on the evolution of their relative prices, as well as on the bargaining power of the trade union.

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

The analysis of the contracts signed up to 1992 shows that other issues have also been part of the bargaining agenda (Ermida *et al.*, 1998 and Rodriguez *et al.*, 1998). Rules related to working conditions, such as length of the working week; paid holidays; job stability; or annual extra premia, are generally found in collective agreements. Some unions have also set hourly wages for overtime work higher than the legally stipulated rates. Other clauses that are sometimes included relate to the position in the firm of union leaders and the available means to solve conflicts. All these clauses, however, do not determine directly the level of employment. Most of them may further be translated into non-wage labour costs. Moreover, although strikes have historically acted as a means of hindering employers from firing workers, there are no collective contracts in which the parties explicitly reached an agreement on the number of jobs. Hence, from a theoretical point of view, the appropriate model to analyse bargaining between unions and firms up to 1992 would be the right-to-manage model, by which negotiations over the wage are accounted for but the level of employment is unilaterally set by the firm, according to its labour demand function (for a discussion on this topic see, for example, Pencavel, 1991).

In the mid-nineties a new type of conditions started to be included in the contracts: those regulating the introduction of new technology - how to put in practice training programmes and mechanisms to reduce the workforce - and those determining premia linked to productivity gains. This sort of clauses reflected two facts. Firstly, the new economic conditions faced by firms, in a framework of increased foreign competition that required investment in technologies more capital and skill intensive. Secondly, 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 (Rodriguez *et al.*, 1998). Contracts signed at the firm level were many times a complement to collective agreements ruling the whole sector. That is, they could either modify some clauses of the general agreement or add others, especially those related to employment stability. Thus, a new bargaining model is at work in the late nineties, one in which more decentralised negotiations take place over both the wage and the employment levels. It is not clear, however, if an efficient contract model is in place. Recursive models, stating that bargaining over wages and over employment takes place at different stages, are also consistent with the new structure of negotiations (for a theoretical derivation of recursive models see Manning, 1987).

Membership and union power

The return to democracy in 1985 was achieved after at least two years of generalised public demonstrations against the military regime. Unions played an important active role in them. Within that framework, the affiliation rate once unions were legally re-organised was very high. In 1985, the reported affiliation rate was 26% for the whole economy. The structure by economic sector is depicted in Table 3.1. However, the figures cannot be taken as exact measures of membership, due to the different unions having the number of representatives in the national congresses linked to the reported number of affiliates. This fact acted as an incentive to upwards bias the real figure.

Table 3.1: Union membership 1985-1997

Membership	**1985**	**1987**	**1990**	**1993**	**1997**
Agriculture, leverage & fishing	6265	6597	4976	3200	2000
Manufacturing	73148	63176	54548	43394	31050
Electricity, gas & water	13728	14303	15023	14450	13800
Construction	14908	11156	12600	8000	4000
Commerce	12600	10818	9500	6473	6000
Transport & communications	24874	25478	22150	13115	13400
Banking & services to firms	13605	15644	15476	13377	14000
Social & personal services	89688	85887	90287	86024	81200
Private sector	145713	132493	122507	87713	65500
Public sector	103103	100566	102053	100320	99950
Total	248816	233059	224560	188033	165450

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.

Traditionally, public workers have always had a higher affiliation rate than private workers. This remained so in the eighties and nineties. Among the private activities, those related to the manufacturing and construction industries have shown the highest union density.

The temporal evolution of the affiliation rate shows the previously mentioned decline of the central union. Membership, as reported in the annual congresses, has systematically gone down, so that in the last national congress the number of affiliates to the central union was only 165000 (around 15% of employment) compared to 250000 in 1985 (Table 3.1). Although membership to the central union has diminished continuously, unionised workers have not necessarily become an extinct species. Many unions have stopped participating of the national confederation but go on acting as representatives of the workers in an economic sub-sector or even at a firm[10].

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-unionisation. A possible explanation for the evolution of membership in the primary and manufacturing sector is that commercial liberalisation and increased competitiveness have set a limit to wage increases while employment stability has been at stake. Both processes have further forced a huge re-structuring of many firms and even of some industries as a whole. Jobs have been lost at an unregistered rate and hence workers have found bargaining at a decentralised level more profitable to achieve their goals. This might also be the case for the construction industry, although not because of a loyal competition but because of the increased degree of informality in the industry.

The levels of unionisation and union density vary among the different manufacturing industries under study (Table 3.2). There are industries such as textiles & leather or metal products that have lowered their union densities from very high levels in 1985 (around 60%) to less than 15% in 1996. On the other hand, the decline has been less severe in the paper industry and especially in chemicals & oil. The latter is an exceptional case, given the decrease in unionisation in the public sector has not been as sharp as in the private sector and this industry includes a big publicly owned firm. In any case, the most significant decline

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

starts in the nineties, when the government stopped participating in negotiations and agreements ceased to be enforceable.

Table 3.2 Union density by manufacturing industry *(%)*

	Food, Beverage & Tobacco	Textiles Leather	Paper & Printing	Chemicals & oil	Non-Metallic Minerals	Metal Products
1985	45.1	65.9	46.9	67.2	35.1	68.2
1987	44.3	45.1	36.9	60.5	20.3	33.5
1990	39.7	33.1	27.4	57.4	9.0	28.8
1993	25.7	21.7	27.6	51.2	7.3	25.2
1996	21.5	13.4	24.9	50.2	7.3	9.7
1999	23.5	17.2	30.0	58.9	11.0	10.6

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

Agreements signed at the firm level have always existed since 1985. However, their number was negligible until the nineties (Table 3.3). During the period 1985-1989 94% of all contracts were signed at the industry level while the percentage declined to 34% by 1997. Some of them (2%), although signed between the trade union and the employers' association, not being enforceable anymore, covered only those firms and workers effectively represented at the bargaining table. On the other hand, 15% of manufacturing companies signed contracts at the firm level in 1996 covering nearly 20% of manufacturing workers.

Table 3.3 Firm-level agreements by manufacturing industry
(Number of ongoing agreements and percentage workers covered by them)

	Food. beverage & tobacco		Textiles & leather		Paper		Chemicals & oil		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
1987	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1990	3	0.5	0	0.0	0	0.0	1	1.7	2	2.6	0	0.0
1993	8	2.3	4	1.5	2	13.7	1	2.0	2	2.2	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. %L is the percentage of workers covered by them relative to the total number of employees in the industry.
Source: Database on collective agreements; Industrial Survey, National Institute of Statistics

Finally, while membership has gone down dramatically, the new structure of bargaining has meant an even larger decline in the coverage of collective agreements (Rodriguez *et al.*,

1998). Their lack of enforceability, once the government retired from negotiations, has implied that coverage in 1997 is only 23%, compared to almost 90% in 1990, as it is shown in Table 3.4[11]. Further, it has implied that membership and coverage became very similar concepts by 1997.

Table 3.4: Membership and coverage 1990 and 1997 *(%)*

	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: Rodriguez *et al.*, 1998

In considering membership as a key determinant of union power it is being assumed that as unions control a larger share of the pool of workers, they would be more likely to prevent the firm from substituting unionised by non-unionised employees. As a consequence, unions' ability to increase wages would be enlarged. The fact that before 1992 contracts were enforceable, however, raises the free-rider problem: the number of members and the number of workers covered by collective agreements at that time were very different figures. Nonetheless, union status has also generated other benefits, as unions have always been political actors recognised by governments and the society as a whole and union leaders' political weight has been linked mostly to the number of members of the particular union. Further, the fact that the mandatory extension of agreements was obtained at the bargaining table suggests that it is membership not coverage what matters in explaining unions bargaining power in the Uruguayan case. The issue becomes irrelevant by the late nineties, once agreements only cover those workers effectively represented in the bargaining table.

The role played by trade unions and the evolution in time of membership as a measure showing how representative of Uruguayan workers the institutions have been, suggest that they have necessarily to be taken into account when analysing wages and employment

[11] The percentages were calculated analysing contracts that were registered at the Ministry of Labour. The figures cannot be considered as definite since the parties have no punishment for not registering the collective agreements as the law states.

determination. The mechanisms at work have changed along the last 15 years, so that the suitable bargaining models are different depending on the time period. It should be possible to derive the output of bargaining in the eighties assuming negotiations took place only over the wage and at a centralised level. By the mid-nineties bargaining cannot be considered as a process involving all workers simultaneously anymore, while employment has emerged as a possible additional target of negotiations. Moreover, the utility function of the parties is not similar between the different trade unions anymore, but dependent on the particular performance of the firm or economic activity. The effects of the new structure of bargaining on wages and employment relative to the previous framework are not clear-cut. Bargaining at the industry level was demonstrated to be the least favourable world in terms of its effects on the overall unemployment rate, relative to both centralised and completely decentralised negotiations[12]. However, if synchronisation and co-ordination were present, as in the Uruguayan case during the pre-1992 period, the implications on wages and employment should be similar to those of a centralised bargaining. On the other hand, the changes in the bargaining structure and in the objective function of the players involved have to be considered as well. Together with the decline in coverage and the generalisation of firm level bargaining, it is strongly suggested that recursive models are used to analyse the Uruguayan case from 1993 onwards.

The next chapter will provide a summary on how economists have dealt with the role of trade unions in the literature. It is not meant to be a survey on all the existing research but just a broad overview in order to place the emphasis on the topics that are currently under discussion.

[12] Calmfors and Driffill (1988) demonstrated so while Rama (1994) found exceptions to the result.

Chapter 4. A brief survey on the role of trade unions in labour markets

Brief historical overview

The analysis of the economic effects of trade unions on labour markets has evolved in a quite unsteady way. Empirical findings have many times posed theoretical unsolved puzzles. Theoretical analyses, on the other hand, have been scarce in some fields, such as the study of the effects of unions on the performance of firms, and amazingly prolific in others, such as the factors determining the existence of union wage differentials (Pencavel, 1991).

In the industrial relations literature many hypotheses on the incidence and structure of collective bargaining were developed a long time ago. These, along with some standard economic theory analyses, motivated quite an important amount of empirical research. At this early stage and until the late sixties, economic theorists generally considered trade unions as institutions that would shift the labour supply curve but would not influence the competitive characteristics of the labour market.

The fact that the wage level observed was different depending on the presence or absence of a union stimulated an upsurge of empirical research on the effects of unions on wage setting. Thus, this early work was devoted mainly to explaining or verifying the existence of a wage gap between unionised and non-unionised firms, industries and/or countries (see Lewis, 1986 for a survey). In doing so, researchers were faced with the dilemma of defining an adequate utility function for the union to maximise, of choosing the appropriate decision variables and, to a smaller extent, of finding a suitable way of including the characteristics of workers and firms among the determinants of unionism. However, as Johnson (1975) noted, there was still no consensus on unions' goals while theoretical foundations were still missing. Moreover, despite the many case studies which were carried out, various methodological issues were not addressed during this period, such as how critically the models relied on the exogeneity of the variables involved or whether it was possible to obtain similar results with different assumptions on the utility functions and bargaining processes. Despite these shortcomings, the analyses brought out many stylised facts that fed into the theoretical research.

One of the first aims of economic theorists was to explain the bargaining processes by which outcomes arose and to discuss the optimality or efficiency of these outcomes. However, for this to be done rigorously, the analysis of unions' preferences had to be thoroughly revised so

that the variables included in the bargaining agenda could be clearly determined. Although researchers have been discussing the issue for decades (Dunlop, 1944 and Ross, 1948 are early references), there is as yet no consensus on unions caring or not about the level of employment. Empirical evidence is inconclusive. Although observed contracts do not generally include clauses on employment, some studies have shown that employment does matter to unions (Farber, 1978; Dertouzos and Pencavel, 1981; Carruth and Oswald, 1985 are examples).

In any case, the first models developed assumed that bargaining took place only over the wage level, thus implying that management determined employment unilaterally according to the labour demand curve. Two models became quite popular, depending on the role assigned to management in the negotiations: if it was to take the wage as given -set by the union- then the monopoly union model (the origin of which is attributed to Dunlop, 1944) was proposed, while if it was assumed to bargain with the union to determine the wage level the right-to-manage model was considered as an appropriate description (Nickell, 1982). The models yielded similar predictions, although in the latter the resulting wage level was lower than in the former, as firms would have some bargaining power. However, both implied that the outcome was Pareto non-efficient, that is, that the wage-employment pair observed would generally be worse, for at least one party, than other possible outcomes. This gave rise, once again, to the debate on the inclusion/exclusion of the employment level as a union goal, although this time for theoretical instead of empirical reasons.

The above argument led to the formulation of the efficient contracts model (MacDonald and Solow, 1981), in which unions and management were assumed to bargain simultaneously over both wages and employment, so that Pareto optimality was guaranteed. The wage-employment outcomes predicted would lay on the contract curve, to the right of the labour demand. However, the model would still be inconsistent with the observed fact that negotiations do not generally include employment explicitly in the bargaining agenda (see Oswald, 1993 for a recent extensive survey).

Many empirical studies were carried out during this period trying to assess the reliability of the different formulations in explaining real phenomena. Moreover, some researchers tried to select among them testing their validity for specific data sets (Brown and Ashenfelter, 1986; Card, 1986; among others). However, the procedures used have been recently criticised

because of not being robust to changes in the underlying assumptions (Pencavel, 1991; Manning, 1994). Hence, the adequacy of the models should be seen as a major empirical research topic, as the implications of the alternative formulations are very different. Firstly, the efficiency or inefficiency of the outcome is important in terms of the behaviour of agents. To assume that the parties ignore a potential gain, as is the case in the right-to-manage and monopoly union models, could cast doubts on the adequacy of the bargaining process proposed. Secondly, small wage increases and/or low wage levels could be attributed to the union caring about employment or to the firm rejecting the union's proposed wage and succeeding. Again, the above implies different objective functions and bargaining frameworks. Finally, the efficient contracts model predicts a higher level of employment over the cycle than that resulting from the right-to-manage and the monopoly union formulations, in which employment is, further, unaffected by union 'bargaining power' over this variable.

During the second half of the seventies and the early eighties, the debate on union preferences and goals as well as on which of the two formulations was more suitable -both theoretically and empirically- was still widespread. One approach to reconcile the assumption of efficiency with the unobserved bargaining over employment was developed in the implicit contracts theory. According to this view, uncertainty on the economic environment to be faced and the assumption that workers need to have an insurance against 'bad' states of nature, would promote the design of contracts contingent on the future economic performance, unknown *ex-ante* but observed by both parties *ex-post* (Baily, 1974; Azariadis, 1975). Thus, the risk aversion of the parties would justify that they accepted a contract in which they would share the risk. Further developments proposed employment contingent contracts (Calvo and Phelps, 1977). Assuming that the firms would possess better information than workers about the state of nature and that workers would never observe the value of certain variables, the authors proposed that the only way to prevent the firm from cheating once the wage was set would be to link the wage to the employment level. Alternative formulations based on private information further added some insight to the approach (see Oswald, 1986b). Despite the resulting contracts were optimum, the approach was criticised mainly because real contracts are generally very simple while contingent contracts would be not only complex to design but very difficult to monitor (Oswald, 1986a). Further, as wages are generally settled for a fixed period of time while employment is not, there would always exist an incentive for the firm to default. Some authors argued, however,

that the existence of a union itself as well as the repeated nature of union-management relationships could be enforcing the contract (Malcomson, 1983).

A second line of research restated the union's preferences. Two main arguments were put forward. First, if the implicit rule for firing workers was 'first in, last out', then seniority would be an important variable to be taken into account in specifying union's preferences. Under the new scheme it was shown that it was possible to obtain the efficient outcome at the point in which the marginal revenue of labour equals the wage (Grossman, 1983; Oswald, 1985; Oswald, 1993). An analogous result was obtained if the utility function of the union was specified differently depending on employment being smaller or greater than membership. Once it was considered that the union's concern over employment would disappear when all members got a job, the union's indifference curves would become horizontal and, again, it would be possible that the tangency between isoprofit contours and indifference curves would be lying on the labour demand curve (Oswald, 1985; Carruth and Oswald, 1987).

Another proposed way to overcome the obstacle of imposing *a priori* restrictions on the structure of bargaining was to include other variables in the agenda that would be negotiated separately from the wage. Thus, although actual contracts do not include any statement on employment, it could be thought that indirect agreements on this matter - such as the assignment of workers to machines - would be negotiated in further stages, or that wage bargaining might be done at a centralised level while employment and/or other issues would be negotiated at the industry or firm level. At each stage the parties might have different bargaining power, due to the union having an unequal interest on the variables or an unbalanced capacity of summoning members. Models with these characteristics could be labelled multistage or sequential bargaining models (Manning, 1987; Card, 1990; Johnson, 1990). Their main implication is that if the wage is set in a first stage and employment in a second one, the model would nest the three previous formulations and empirical tests on the significance of the parameters could be used as a means of identifying the bargaining procedure that is relevant for a specific data set. The outcome predicted by the multistage model would be somewhere between the labour demand curve result and the contract curve outcome depending on the relative bargaining power of the parties. Thus, from a theoretical point of view, efficiency would be possible but is neither imposed nor subject to a specific utility function. Still, the possibility of agents cooperating to obtain a non-optimum

employment-wage outcome under certain circumstances would remain. However, since the difference in union power at various stages is the origin of inefficiency, the model might suggest a distinct direction of analysis related to the determinants of union's strength.

Finally, an alternative approach was to view the bargaining process as a repeated instead of a one shot game (Espinoza and Rhee, 1989). The repeated interaction among the parties would allow for reputation effects as well as for the possibility of their being punished in the future when deviating from previous agreements. As a consequence, incentive compatibility would be guaranteed and it would be possible to observe an efficient outcome without bargaining over employment. The right-to-manage and the efficient contracts models would be especial cases of this general formulation, depending on the time preferences of the parties and the discount rates they use.

In the second half of the eighties, attention was also drawn to other aspects of the economics of trade unions. The aim was basically to analyse how the predictions of the by then standard models would be affected by the relaxation of some of their simplifying assumptions. Among them, the hypothesis of fixed membership was revised in different ways. One example is Sampson (1988) in which membership is endogenous and where uncertainty is also incorporated, by allowing for a stochastic labour demand schedule. Other researchers addressed topics such as the effects of the size of union membership; the free-rider problem -enjoy the benefits without incurring the costs- as well as the implications of heterogeneous members (Booth, 1985; Naylor, 1989; Booth and Ulph, 1990). Further, for the empirical research to better approximate real world processes, it was necessary to modify some aspects such as, for example, the static nature of the models. The inclusion of dynamics was justified in terms of the existence of employment adjustment costs relative to negotiations themselves; coordination; adjustment to shocks; etc. (Lockwood and Manning, 1989 is an example); and also on the endogenisation of membership (Kidd and Oswald, 1987; Lockwood and Manning, 1987).

Lastly, more attention started to be paid to the role played by unions in wage formation at a macroeconomic level. Thus, the analyses tried to shed some light on the way that unions' reaction to fiscal policies would influence their formulation as well as on how the policies themselves would restrict unions' claims. Bargaining over wages was hence analysed as a game between a centralised union and the government, the result of which would be

considered as an explanation for the evolution of the unemployment rate in previous decades. At the same time, decentralised bargaining was also studied, trying to evaluate the consequences of this different structure on the macroeconomic regularities observed (Calmfors, 1985). The issue of how the above two different settings would influence the macroeconomic performance was afterwards addressed by Calmfors and Driffill (1988).

The state of the art

Theoretical research on the economics of trade unions is quite profuse nowadays despite the apparent decline of these institutions all around the world. One of the main reasons for this is the renewed interest on how their presence and strength, as well as their structure and coverage, can affect the expected results of economic policies. In a world where deregulation, liberalisation and integration are being largely discussed and implemented with very different results, the role of the diverse institutional settings arises as a main issue.

In the nineties the concern of theorists were divided in two broad categories. Firstly, there is a considerable amount of papers that continue and deepen the analysis of some of the topics brought up by the previous literature. Secondly, a renewed interest on the critical analysis of bargaining models and their implications on the outcomes is being addressed.

Regarding the first class of work, five main topics can be identified. Firstly, centralised *versus* decentralised bargaining. The issue was addressed in some papers during the second half of the eighties (such as McCallum, 1983; or Bean, Layard and Nickell, 1985). However, it was the 1988 paper by Calmfors and Driffill that gave rise to a huge amount of empirical and theoretical research on how the structure of negotiations affects the outcomes. This proved to be a neglected area of analysis and to have important consequences for the theoretical and empirical research that, up to that moment, had relied on the assumption of centralised or decentralised bargaining (see Calmfors, 1993 for a survey). The topic has been related to coordination and synchronisation issues as well as to multi- unionism (Naylor, 1995) and multi-level bargaining (Calmfors, 1993 and references therein). Further, a lot of attention is being paid to how different structures might influence the expected results of macroeconomic policies such as rising the degree of openness (Driffill and van der Ploeg, 1993; Rama, 1993a, 1993b, 1994), deregulating the labour market (Heylen, 1993) or implementing tax reforms (Altenburg and Straub, 2001).

A second field is that of private information and the role of strikes. This stream of research is the natural extension of some of the work carried out in the eighties in which strikes were considered a form of signal that would enhance credibility in bargaining when there are informational imperfections and sequential bargaining (Chatterjee and Samuelson, 1987; Hart, 1989 are examples). Some of the recent analyses develop various sophistications, such as time-varying threats (Cramton and Tracy, 1994); the effectiveness of threats linked to union density (Corneo and Lucifora, 1997); the consequences of centralised and decentralised bargaining with respect to strike frequency and duration (Goerke, 1994); the relationship between the length of strikes and their costs (Card and Olson, 1995) as well as the magnitude of wage increases (Jimenez-Martin, 1999); or the effects of signalling and the incentive structure on the outcome of standard models (Vetter, 1995) and specifically on the frequency of strikes (Kuhn and Gu, 1998).

Thirdly, considerable attention is being devoted to models in which membership is an endogenous variable. This issue had been mentioned since the very beginning because many results depended critically on this assumption. An early theoretical example is the equivalence of the utilitarian and the expected utility functions only if membership is fixed (Oswald, 1985). Regarding empirical work, simultaneity and exogeneity biases may arise if the hypothesis of given membership does not hold. As was mentioned in the previous section, in the eighties there were some attempts to include membership dynamics and to analyse its implications for the models. The main ideas developed have been related either to the existence of an inter-temporal objective function that links actual employment to future membership (Jones and McKenna, 1994) or to the simultaneous determination of membership and wages (Booth and Chatterji, 1993 and 1995). Currently, the effects of the endogenisation of membership on the estimated union wage premium are also under analysis, interestingly differentiating between membership and coverage (Budd and Na, 2000).

The fourth branch of research relates to the effects of unions on some specific variables accounting for firm performance, such as productivity, innovation and hours of work. Further, concern on these same issues at the macro level has gained such a renewed attention in the late nineties that it motivated a textbook surveying the main findings (Palokangas, 2000).

Regarding productivity, it is argued that opposed to the monopoly 'face' of unions, they possess a productivity-enhancing facet. This is related to higher morale; the availability of public services, such as better job conditions or improvement in information channels; the involvement of workers in the performance of the firm; the existence of a link between workers and management without the fear of retaliating against those who complain; among others (Rosen, 1989; Wadhawani, 1990; Moreton, 1993).

The main question posed with respect to innovation is if because of the fear of lower employment, unions would be opposed to R&D activities and the introduction of new technology (Ulph and Ulph, 1988; 1994; 1998; van Reenen, 1995 are examples). Again, the analyses show that the structure of bargaining, the issues over which bargaining takes place and the length of contracts will have a decisive effect on the final result. The topic is also related to the effects of unions on investment. On the one side, the existence of unions *per se* could motivate firms to move to more capital intensive technologies, thus generating a positive correlation between the level of investment and unionisation (Hirsch and Prasad, 1995). On the other hand, the most supported view is that unions will try to capture quasi-rents from capital too, depending on its bargaining power. This has been generally seen as an effective rise of the price of capital, as if unions were able to tax investment (Dow, 1993).

Regarding hours of work, the existence of fixed costs -and different adjustment costs in the context of a dynamic analysis- implies that the firm should treat distinctly hours and employment. Further, unions have probably different preferences among various combinations of number of jobs and hours worked by employees. Hence, the inclusion of hours in the objective function of the union might have interesting consequences for standard models (Earle and Pencavel, 1990; Oswald and Walker, 1994). The analysis of adjustment costs as a possible explanation of the occurrence of different outcomes has also been studied recently (Modesto and Thomas, 2001) as well as the implications of considering heterogeneous workers on the outcomes of bargaining. An early paper dealing with the subject as linked to multi-unionism was Horn and Wolinsky (1988). The authors found that the best strategy for workers regarding separate or joint bargaining depends on them being substitutes or complements. The result motivated other research, both empirical (Machin, Stewart and Van Reenan, 1993) and theoretical (Naylor, 1995) as well as the development of other lines of analysis, such as the effects of unionism on the choice by the firm of different types of workers according to skill or occupation (Myles and Naylor, 1995) or on the effects

of inefficiencies arising from bargaining on the number of categories of workers that firms are willing to hire (Strand, 2000).

Empirical research has also been done recently, making use of establishment-level data. The availability of disaggregated information in time as well as new methods and software to perform the econometric analyses, invited researchers to work on case studies. Although results could not be generalised to other realities, it helped to solve many of the shortcomings faced by aggregated analyses. The chosen topics are diverse and mainly related to firm performance, as the following examples illustrate. The effects of unions on R&D investment were analysed for Britain concluding that there exists a positive relation unless union power is high and bargaining takes place only over wages (Menezes-Filho, Ulph and van Reenen, 1998); the impact of unionisation on job dissatisfaction for UK using household survey data was found to be real and similar to that of non-union members although different from free-riders (Clark, 2001); the effects of unions on the level of many unobserved characteristics, such as management success, was recently analysed being the conclusions diverse depending on the variable studied (Black and Lynch, 1997).

Lastly, the observed processes of integration around the world and the increased liberalisation of trade, has led to a renewed interest on the role trade unions can play and on how their effects on labour market variables can be altered. Both theoretical and empirical studies have been recently carried out. An interesting line is that linking the trade regime with the strategy unions may follow regarding wage increases (Naylor, 1998; 1999), concluding that the effects are dependant on the level of trade costs. In a further extension (Naylor, 2000), however, the trade regime is endogenised and it is thus showed that the relationship between openness and wages cannot be signed *a priori*, thus explaining the variety of results of empirical work.

The second main branch of current research analyses the weakness, or lack of robustness, of standard models when faced with changes in the underlying assumptions, such as those related to the variables used as an indirect means of bargaining over employment or to the production function (Clark, 1990; Johnson, 1990; Layard and Nickell, 1990; Manning, 1994; Benassy, 1995). However, there have also been remarkable advances by modelling the union-management bargaining process as a repeated game - an early example is Driffill (1985) - so that the current behaviour of the parties would build a reputation and, if it is the

case, would imply agents will be subject to punishment in the future (Haltiwanger and Harrington, 1991; Kandori, 1991; Rotemberg and Woodford, 1992). The existence of punishment for those who deviate from equilibrium strategies could make contracts incentive compatible, and thus equilibrium may depend, for example, on the discount rates of the agents (Espinoza and Rhee, 1989). This, in turn, may be use to understand the behaviour of employment and wages in the business cycle (Schultz, 1994). Uncertainty enters naturally in this set-up, as expectations on the future economic performance might have a crucial role in determining their willingness to cheat, the credibility of their threats and the plausibility of their offers. Other extensions relate to the possibility of endogenising the issues in the bargaining agenda, so that different models would arise depending on union density (Petrakis and Vlassis, 2000) or different degrees of inefficiency would be observed depending on the issues included and the delay of negotiations (Conlin and Furusawa, 2000).

There are still many caveats where the economics of trade unions can help understanding the effects of this particular institutional setting on the performance of labour markets. Theoretical models need to be developed trying to include the empirical regularities that have already been stated. On the other hand, empirical research must be systematised and more work needs to be done in order to shed light on the adequacy of the theoretical assumptions. The knowledge of the actual union agenda and the way bargaining takes place in each case must be considered when empirical models are specified if policy recommendations are to be meaningful, as results have shown to be sensitive to these assumptions.

The following chapter was motivated by two issues raised in the previous review of the literature that are, at the same time, relevant in the Uruguayan case. Firstly, the adequacy of the theoretical models has been shown to be a quite important matter in that it may distort the results obtained or at least confound the conclusions at which one arrives when doing empirical research. Multi-stage models appear in this context as a good strategy in order not to impose some unnecessary restrictions on the way negotiations are carried out. Secondly, uncertainty is commonly observed in all situations in which a conflict between negotiating parties may arise. As a consequence, it seems natural to include it in a model of bargaining and ask which would be the theoretically expected outcomes in a two-stage bargaining model. One of the predictions obtained in models under certainty is that wages would be sticky while employment would fluctuate when there are fluctuations in demand, which is

also an observed stylised fact. However, not all labour markets have worked in this way, so that proposing a model in which the result would be observed under certain circumstances shows up as appealing.

The use of multi-stage models is attractive for the Uruguayan case. In the eighties, bargaining was done at the industry level in a co-ordinated way and negotiations took place only over wages. In the nineties, the structure of bargaining changed towards a decentralised one, while employment negotiations were also observed. Thus, a theoretical model that nests different proposals is attractive in order to analyse the behaviour of wages and employment under the two different settings. Further, uncertainty is a constant for the Uruguayan agents, as the economy has always been very sensitive to external shocks while globalisation and openness have further deepened the effect. Finally, wages in Uruguay along the nineties have not been as rigid as standard models predict, so that looking for alternative explanations in the framework of the bargaining theory for the observed evolution of these variables is indeed a relevant subject also in this particular case.

Chapter 5. A bargaining model with uncertainty and varying outside opportunities[13]

Introduction

The aim of this section is to propose an alternative explanation of wages and employment fluctuations within the framework of the bargaining process between unions and management[14]. In many economies, it is often observed that employment bears most of the adjustment to shocks while wages are relatively rigid. The result is justified in terms of the insider-outsider approach, as due to the bargaining power unionised workers have. However, its validity relies on both the elasticity of demand and the reservation wage being constant. The issue addressed in the paper is how to recover the observed stylised fact once the latter assumption is removed, although the former is kept. The proposed answer is linked to agents facing uncertainty on the future evolution of the economy when bargaining over the wage. Hence, expectations would be in the root of different possible patterns characterising the evolution of wages and employment.

The bargaining models proposed in the literature postulate that unions maximise the utility of their members. The individual utility function depends on the bargained wage for those that remain employed and on the alternative income that the worker would receive if fired for those that lose their job (what the individual can earn working at another firm and/or the unemployment benefit). This alternative wage is assumed fixed or given. The assumption, although simplifying, is not very reliable if the economy is subject to external shocks. If shocks have an impact on the whole economy, no matter how centralised/decentralised bargaining is, the hypothesis is not sustainable. The probability of finding a job will change with the observed state of nature and so will the expected pay. If negotiations are at the industry level, it is still an implausible assumption, as even sectoral shocks would have externalities that spill over to the whole economy. Only if bargaining takes place at a very decentralised level, say the firm, and the shock is specific to one or few sectors, might the hypothesis of fixed reservation wage be reliable.

The consequences of the assumption are not negligible when analysing the reaction of bargained wages and employment to shocks. Once it is removed, the widely studied pattern of constant wage and employment that bears all the adjustment to shocks (Blanchard and

[13] I gratefully acknowledge comments from Alvaro Forteza, Andrew Oswald and Marcel Vaillant.
[14] The other two standard approaches are the efficiency wages and the implicit contracts theories.

Fischer, 1993) no longer holds. Instead, wages would vary with shocks, as they are a mark-up over the now variable reservation wage while employment would be more or less flat.

The role of uncertainty has been discussed mainly in the framework of the implicit contracts theory. Stable wages along the economic cycle are the result of workers being risk averse, so that they would prefer lower wages in good states of nature but higher levels of pay in downturns. However, even if the need of insurance were absent from the union's objective function, there could be other explanations for the inclusion of uncertainty in the bargaining process. Assuming negotiations over wages have a fixed deadline and that unions care about employment, the possibility of a changing economic environment during the period in which the wage is fixed would induce uncertainty. Unless there is an explicit agreement on how will employment vary, the firm may unilaterally change its level when a shock takes place. Hence, agents would want to make use of any available information on the future state of nature when setting the wage. In order to do so, they must assign a probability to the occurrence of 'good' and 'bad' states, thus allowing their beliefs to alter the outcome of bargaining. Negotiations would not be contingent on future economic performance or employment but the probability distribution of shocks would play a role in wage bargaining.

The above mechanism could be thought of in the framework of multi-level bargaining. Wage negotiations would be done first, taking into account possible effects on employment. In a second stage, after the shock is observed, bargaining could take place over employment, possibly at a different level (such as the firm).

How would expectations influence the outcome of bargaining under the above hypotheses? When agents are optimistic, the expected rents to be shared are large and the probability of losing a job is small. Further, outside opportunities should be large and/or the income one could get should be high. Then it is quite possible that the union pushes up the wage more than if it had to worry about its members keeping their jobs. On the contrary, when a 'bad' shock is likely, moderate wage demands should be expected. Hence, the magnitude of wage variations will depend on the distribution of shocks, although not on their realisation.

Little work has been done along this line but there are some notable exceptions. Oswald (1982) proved that including uncertainty in a monopoly union model does not change its qualitative predictions, no matter which is the variable in the objective function agents are

uncertain about. However, changes in the degree of uncertainty do modify the optimum wage. Another paper is Naish's (1988) in which the union is uncertain as to what price level will prevail when setting the wage in a monopoly union model. It is shown that the choice of the wage is linked to the shape of the utility function of the union and to the distribution of the price level. Hence, the degree of confidence on the price forecast would play a role in determining wages.

Before developing the model itself, it is worth to summarise two particular points that have been extensively discussed in the literature and that will be used in this paper. Firstly, it is quite generally agreed that the specification of the utility function maximised by the union with a kink at full employment of members, as proposed by Carruth and Oswald (1987) is adequate[15]. The assumption of flat indifference curves when all members are employed would explain why some unions are not concerned about employment at some point. Further, it emphasises the importance of the determination of membership for modelling purposes while it is a suitable benchmark to understand why sometimes, but not always, the outcome of bargaining is on the labour demand curve.

Secondly, an extensively discussed issue is that of the efficiency of the wage-employment optimum pair[16]. While early models assuming the firm has the right-to-manage imply that the outcome is not Pareto-optimal, efficient contracts models impose efficiency but on the assumption that employment and wages are negotiated simultaneously. However, the empirical evidence renders the inclusion of employment in the bargaining agenda quite implausible, at least when bargaining is not fully decentralised. Further, if it were included it is rarely considered as an issue to be negotiated over at the same time or with the same weight than over wages. Some authors have proposed different ways of avoiding the theoretical dilemma of inefficiency. The specification of bargaining as a repeated game (Espinoza and Rhee, 1989) is one alternative. Efficiency, according to this formulation, would depend on the discount rate agents use to calculate the present value of their expected utility. Another possibility is to postulate that although there is no explicit bargaining over employment, unions do negotiate indirectly by establishing manning practices (Johnson, 1990). Other authors have proposed a similar hypothesis, based on the idea that being

[15] See textbooks as Booth (1995) or Pencavel (1991).
[16] The topic has been included in textbooks as the ones cited in the previous footnote. See also Layard, Nickell and Jackman (1991).

bargaining a repeated interaction, it could be implicitly agreed that the outcome has to be efficient and that to prevent agents to cheat it is just needed that the punishment for future negotiations is hard enough (Schultz, 1994). A final option is that of multistage models (Manning, 1987), in which it is assumed that wages are set in a first stage with a given bargaining power while in a second stage employment is determined. This could be thought of as a relatively simple proposal, nesting other formulations without restricting their outcome to be efficient or inefficient. The issue is thus left as a hypothesis to be verified empirically. However, sometimes their analytical complexity renders them intractable at a general level, so that very simplifying assumptions on the technology and/or the union's utility function have to be made to draw conclusions.

In what follows a model incorporating the elements discussed above will be proposed. Its main implication is that the stylised fact of flat wages and fluctuating employment can be recovered, once the assumption of constant reservation wage is removed, by incorporating uncertainty in bargaining. It will be shown that the pattern is not the only possible one to observe and that it is not the consequence of union power itself, as in Manning (1987), but of the impossibility of fully anticipate the state of nature that will prevail.

The model is developed incorporating uncertainty at the outset. However, the analogous result in the case of fully anticipated shocks (no uncertainty) is also derived. After describing the assumptions involved and the outcomes of bargaining obtained, the implications on wage rigidity are discussed. Finally, the efficiency of the outcomes and how the model nests other formulations are presented.

A model with uncertainty and varying outside opportunities

Bargaining is assumed to take place between one union and one employer or association of employers. The union represents a given percentage of the total workforce. Negotiations are carried out in two stages. In the first stage wages are determined, while in the second the employment level is set. The structure of bargaining is such that at each stage a sequence of offers and counteroffers occurs until an agreement is reached depending on the relative bargaining powers of the parties, so that the generalised Nash bargaining solution applies (Binmore, Rubinstein and Wolinsky, 1986). Union and management maximise utility functions defined over wages and employment. It is assumed that the objective function of the union has a 'kink' point at employment equal to membership as proposed by Carruth and

Oswald (1987). Management maximises profits that do not include adjustment costs of employment and the production function is concave. A demand shock to the economy takes place before negotiations over employment. It is assumed that the shock can be of one of two types, 'good' (θ_g) or 'bad' (θ_b). The shock alters the revenue product and the reservation wage. Prices are normalised to unity.

The optimisation problem in the first stage is solved conditionally on its effects over the second stage of bargaining. The problem can be expressed in the following way:

$$\text{Stage 1:} \quad \underset{w}{\text{Max}}\ \Phi_1 = E_\theta[(\Gamma - \Gamma_0)]^{\alpha} E_\theta[(\Pi - \Pi_0)]^{1-\alpha}$$

$$\text{Stage 2:} \quad \underset{L}{\text{Max}}\ \Phi_2 = (\Gamma - \Gamma_0)^{\beta}(\Pi - \Pi_0)^{1-\beta}$$

Where E_θ is the expected value operator; θ is the shock; $\Gamma(w,L,M,r)$ is the union's utility function; w is the wage; L is the employment level; $r = r(\theta)$ is the reservation wage; M is membership; $\Gamma_0 = Mu(r)$ is the fall-back position of the union; $u(\cdot)$ is the utility function of the individual member; $\Pi(w,L,\theta)$ is the value of profits for the firm and Π_0 its fall-back position that will be assumed to be zero (no production and no operating costs); while α and β are the bargaining powers of the union in the first and second stage of negotiations, respectively. Two cases can be distinguished. First, when the shock is fully anticipated by the parties, so that the expected utilities are equal to their actual values[17]. Second, when it is common knowledge to the parties that the shock will occur but there is no full anticipation of its value. The assumption to be used is that both parties assign the same probability to the two possible realisations - 'good' or 'bad'. The probability of observing a 'good' shock is p and, as there are only two states of nature, agents assign a probability of $(1-p)$ to the event of a 'bad' shock. In this case the optimisation problem in the first stage takes place in an *a priori* unknown state of nature. Note that the case in which the shock is fully anticipated by the parties is the result of p being equal to 1 or to 0.

The specification of the utility functions is such that:

[17] This is equivalent to postulating that the shock takes place before bargaining over the wage level.

$\Gamma_i(w,L_i,M,r_i) = L_i[u(w) - u(r_i)] + Mu(r_i)$ if $L_i < M$

$\Gamma_i(w,L_i,M,r_i) = Mu(w)$ if $L_i \geq M$

$\Pi_i(w,L_i,\theta_i) = \theta_i f(L_i) - wL_i$ $\forall L_i$

With: $\partial u/\partial w = u'_w \geq 0$ $r_i = r(\theta_i)$ $\partial r/\partial\theta_i = r_i' \geq 0$ and $i = g, b$

The utility function of an employed union member is $u(w)$ while $u(r_i)$ is that of an unemployed union member. The reservation wage - r - is assumed to be a linear non-decreasing function of the shock. If the shock is to the economy, what is being postulated is that good states of nature would increase -or keep constant- the expected income to be obtained in other activities. Sectoral shocks might have the opposite effect, though.

The expected utility functions are:

$E_\theta(\Gamma - \Gamma_0) = pL_g[u(w) - u(r_g)] + (1-p)L_b[u(w) - u(r_b)]$ if $L_i < M$

$E_\theta(\Gamma - \Gamma_0) = pM[u(w) - u(r_g)] + (1-p)M[u(w) - u(r_b)]$ if $L_i \geq M$

$E_\theta(\Pi - \Pi_0) = p[\theta_g f(L_g) - wL_g] + (1-p)[\theta_b f(L_b) - wL_b]$ $\forall L_i$

$r_g = r(\theta_g)$ $r_b = r(\theta_b)$

The outcome of the two-stage bargaining is obtained by backwards induction: first the level of employment - $L_i^*(w^*, \beta, \theta_i)$ for $i = g, b$ - is obtained in the second stage. The resulting expression is substituted into the utility functions in order to solve for the optimum wage level - $w^*(\alpha, p, \theta_i, r_i)$ - in the first stage.

The first order condition (f.o.c.) for the second stage problem - generally known as the rent division curve (RDC) - is:

$$\beta\Pi/(\Gamma - \Gamma_0) = -(1-\beta)\Pi_L/(\Gamma-\Gamma_0)_L$$

The conditional solution for the first stage maximisation problem is given by:

$$\beta(1-\alpha)E_\theta[\Pi_w]/E_\theta[(\Gamma-\Gamma_0)_w] = \alpha(1-\beta)E_\theta[(\Gamma-\Gamma_0)\Pi_L/(\Gamma-\Gamma_0)_L]/E_\theta(\Gamma-\Gamma_0)$$

The second order condition for a maximum in the second stage optimisation problem holds. That for the first stage problem holds for risk-neutral and risk-averse players. If workers are risk loving, on the other hand, some additional restrictions ought to be satisfied.

Given the definition of the utility function of the union, two cases have to be distinguished. Firstly, that in which shocks and bargaining are such that the resulting changes in employment maintain its level below membership ($L_i^* < M$) no matter the shock is 'good' or 'bad'. Secondly, the case in which the optimum level of employment bargained is equal to or greater than the number of members ($L_i^* \geq M$).

Case I: $L^* < M \quad \forall\theta$

The f.o.c. for the second and first stage optimisation problems can be respectively re-written given the assumed utility functions as:

$$w^* = \beta\theta_i f(L_i)/L_i + (1-\beta)\theta_i f_L(L_i) \qquad i = g,b \qquad (2.1)$$

$$w^* = \frac{\alpha(1-\beta)E_\theta(\theta f_L L)\{E_\theta[Lu_w] + E_\theta[(u(w) - u(r))L_w]\}}{\alpha(1-\beta)E_\theta(L)\{E_\theta[Lu_w]+E_\theta[(u(w)-u(r))L_w]\}-\beta(1-\alpha)E_\theta\{[u(w)-u(r)]L\}E_\theta(L_w)} -$$

$$- \frac{\beta(1-\alpha)E_\theta\{[u(w)-u(r)]L\}E_\theta[\theta L_w f_L - L]}{\alpha(1-\beta)E_\theta(L)\{E_\theta[Lu_w]+E_\theta[(u(w)-u(r))L_w]\}-\beta(1-\alpha)E_\theta\{[u(w)-u(r)]L\}E_\theta(L_w)} \qquad (2.2)$$

Case II: $L^* \geq M \quad \forall\theta$

If $\Gamma = Mu(w) \quad \Rightarrow \quad \Gamma - \Gamma_0 = M[u(w) - u(r)]$ and $\partial(\Gamma - \Gamma_0)/\partial L = 0$

Hence the f.o.c. for the second stage problem is just $\Pi_L = 0$ and β has no influence on the employment level. Being all union members employed, unions should not care about the employment level. The results in this case, following the same steps as before, are:

$$w^* = \theta_i f_L(L_i) \qquad i = g,b \qquad (2.3)$$

$$w^* = E_\theta[\theta f(L)]/E_\theta(L) - [(1-\alpha)/\alpha]E_\theta[u(w)-u(r)]/u_w \qquad (2.4)$$

Comparing equations (2.1) and (2.3) it is seen that for a given wage level, rule I determines a higher level of employment than that stemming from the use of rule II. The result is the expected one if there are unemployed members and unions care about and bargain over employment.

It could be the case that the above two rules do not cover all possible situations. One could imagine that the shock is such that $L^* > M$ if rule I is used and $L^* < M$ if rule II is used. If this were the case, it would be sensible to assume that the union would bargain conditional on full employment of its members ($L^* = M$), so that rule II should be used. This yields the following optima:

Case III: $L^* = M \quad \forall\theta$

$$L_i^* = M \qquad (2.5)$$

$$w^* = E_\theta(\theta)f(M)/M - (1-\alpha)/\alpha E_\theta(r) \qquad (2.6)$$

Equations (2.1) to (2.6) show that bargained wages depend on the distribution of shocks, while the negotiated employment level depends also on the realisation of the shock, except for *Case III*, in which employment is fixed at membership. Thus, wages would be rigid and employment would bear most of the adjustment to shocks. But this is so due to the shock not being fully anticipated and not because of a fixed reservation wage. As agents are uncertain as to what state of nature they will face, wage claims will be somewhere in between the levels that would be accepted if the 'bad'/'good' character of the shock were known. The point is illustrated in Figure 5.1 comparing the results with those stemming from both an efficient contract and a two-stage bargaining model with no uncertainty when employment is below membership. The additional assumptions used are that union members are risk-neutral; the utility function of the union is utilitarian; and the production function of the firm is quasi Cobb-Douglas. The expressions for $i = g,b$ are thus:

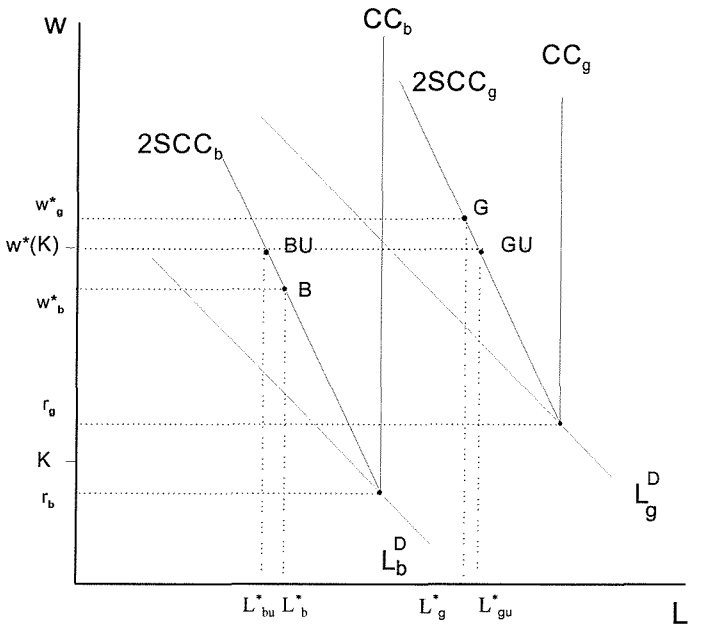
$$u(w_i) = w_i \;\; ; \;\; \Gamma_i(w_i,L_i,M,r_i) - \Gamma_0 = L_i(w_i - r_i) \;\; ; \;\; f(L_i) = L_i^{\gamma} \;\; ; \;\; \Pi_i(w_i,L_i,\theta_i) = \theta_i L_i^{\gamma} - w_i L_i$$

$$L_i^* = \{[(\alpha+\gamma(1-\alpha))/\gamma(\beta+\gamma(1-\beta))][E_\theta(Lr)/\theta_i E_\theta(L)]\}^{1/(\gamma-1)}$$

$$w^* = \{[\alpha+\gamma(1-\alpha)]/\gamma\}[E_\theta(Lr)/E_\theta(L)]$$

With $E_\theta(r) = pr_g + (1-p)r_b$ and $E_\theta(Lr) = pL_g r_g + (1-p)L_b r_b$

Figure 5.1 The outcome of bargaining under different models



K is the ratio $E_\theta(Lr)/E_\theta(L)$, so that $w^*(K)$ is the optimum wage under uncertainty in *Case I*. L_b^D, L_g^D are the labour demand curves after a 'bad' and a 'good' shock, respectively. CC_b, CC_g are the corresponding contract curves, while $2SCC_b$, $2SCC_g$ are possible two-stage contract curves in the event of 'bad' and 'good' shocks, respectively. Points B and G are the employment-wage optimum pairs that would result after a 'bad'/'good' shock with no uncertainty (p=0/p=1), while BU and GU would be the outcomes of a model with uncertainty (0<p<1). Results are unchanged if *Case II* is used instead. The 2SCC collapses to the labour demand function and points BU and GU will be to the left of those here drawn[18].

Being the wage set at a value in between those expected under certainty, employment will vary more than it would if the shock were fully anticipated. The result is thus analogous to that obtained if assuming a fixed reservation wage, the reasons behind it being however very different.

[18] The optimum wage according to rule II is always higher than that resulting from rule I under the assumption of mean independence of L and r: $w_I^* = \{[\alpha+\gamma(1-\alpha)]/\gamma\}E_\theta(r) \leq [\gamma(1-\alpha)/(\gamma-\alpha)]E_\theta(r) = w_{II}^*$.

How much would employment adjust to shocks? It would depend -given the above- on the distribution of shocks, that is, on the ability agents have in foreseeing the future state of nature. When the distributional variance is small, agents are quite certain they will face a 'good'/'bad' state of nature ($p \rightarrow 1$/ $p \rightarrow 0$). If their beliefs turn out to be 'correct', the effect on the employment level could not be stated *a priori*, as the positive/negative effect of the shock could be offset by the increase/decrease in the wage level. However, if the shock turns out to be of the opposite sign to that expected by agents (θ_b/θ_g), all the adjustment would be born by the employment level. On the other hand, when uncertainty is at its maximum (p=1/2), employment will bear most of the adjustment no matter the sign of the observed shock.

The above can be summarised in the following proposition:

Proposition

In a two-stage bargaining model where shocks take place after negotiating wages, the elasticity of demand is constant and the reservation wage is a non-decreasing function of the state of nature, the extent up to which employment adjusts to shocks will be determined by agents' expectations, the realised state of nature and its effect on the reservation wage.

How will changes in the distribution of shocks and in the reservation wage affect the outcome of bargaining? Although it is not possible to derive unconditionally the effects of changes in every parameter, some results can be stated. Table 5.1 shows the sign of the relevant derivatives, their explicit expressions being included in the appendix for the example that is being considered.

Being a mark-up over the reservation wage, the optimum wage bargained rises and the employment level falls whenever there is an exogenous increase in the alternative income. Further, changes in the value of 'good' and 'bad' shocks would in turn influence the value of the reservation wage, thus reinforcing their direct effect.

If there are unemployed members and agents become more optimistic (increases in p) or if the possible states of nature improve (increases in θ_g and/or θ_b), the optimum wage will be set at a higher level, although in the latter case this will depend on the relative magnitude of the alternative wage under both states of nature. Thus, a distribution of shocks with a bigger

mean (more to the right) will generate increases in the wage bargained, no matter what the change in the distributional variance is[19]. Unfortunately, the effects of changes in the variance, for a fixed distributional mean, on the outcome cannot be derived analytically. Some preliminary simulations were carried out but the results obtained were not conclusive. While increases in the variance due to a rise in p from 0 to 0.5 with fixed ε have a positive effect on the optimum wage, when p decreases from 1 to 0.5 the result will depend on the value of the parameters defining the utility function of agents. Thus, further work needs to be done in this area.

Table 5.1 Changes in the optimum wage and employment levels

Derivative	*Case I*	*Case II*	*Case III*
$\partial w^*/\partial r_i$	+	+	+
$\partial w^*/\partial p$	+	+	+
$\partial w^*/\partial \theta_g$	+	+	+
$\partial w^*/\partial \theta_b$	?	+	+
$\partial L_i^*/\partial r_i$	-	-	0
$\partial L_i^*/\partial r_j$	-	-	0
$\partial L_i^*/\partial p$	-	-	0
$\partial L_i^*/\partial \theta_i$	- iff C_1	- iff C_1	0
$\partial L_g^*/\partial \theta_b$	- iff C_2	-	0
$\partial L_b^*/\partial \theta_g$	-	-	0

Condition C_1 is: $(\partial w^*/\partial \theta_i)(\theta_i/w^*) > 1$
Condition C_2 is: $\partial w^*/\partial \theta_b \geq 0$

The level of employment bargained at the second stage will depend also on the realisation of the shock. Given a 'good' state of nature, employment will fall with increases in the probability assigned by agents to 'good' shocks. A rise in the value of θ_g, on the other hand, may result in a decrease or an increase in employment, depending on the change of the optimum wage relative to that of the shock (more or less than proportional). The same results are derived for realisations of 'bad' sates of nature. However, a rise in θ_g implies a

[19]The mean value and the variance of the distribution are: $\theta_m = p\theta_g + (1-p)\theta_b$;
$V(\theta) = p(1-p)\varepsilon^2$ with $\varepsilon = (\theta_g - \theta_b)$

decrease in employment if the observed shock turns out to be 'bad', while a rise in θ_b generates a decline in employment when the actual shock is 'good' only if it raises the wage.

Whether there are unemployed members or not will not change the direction of the above variations but their magnitude. As employment is not an argument in the objective function of the union when all members have a job, the wage level set and its rate of change will be always higher in this case than otherwise.

The model do invite for further developments, especially those related to its dynamic aspects. A first possible way of introducing dynamics would be to assume shocks are specific stochastic processes. If a sequence of periods is considered and bargaining with the timing proposed is assumed to take place in each period, states of nature that are not time-homogenous would result in wages being time dependent. If the stochastic process has 'memory' (shocks are not independent) there is also scope for persistent effects on employment. The model can be expressed, oversimplifying, as:

$$w_t^* = a_0 + a_1 E_{t-1}(r_t) \qquad L_t^* = b_0 + b_1\theta_t - b_2 w_t^*$$

If $E_{t-1}(\theta_t) = \theta_{m,t}$ and $E_{t-1}(r_t) = r_{m,t}$, then w^* would not be constant anymore when agents are assumed to take into account all the past relevant information. Wages are not responsive to the realisation of the shock, but as states of nature have a different distributional mean, employment adjustment might be smoother than otherwise. Moreover, if states were autocorrelated, the past history would influence directly the outcome:

$$\theta_t = \lambda\theta_{t-1} + \varepsilon_t \quad E_{t-1}(\theta_t) = \lambda\theta_{t-1} \quad \text{and} \quad E_{t-1}(r_t) = \eta r_{t-1}$$

$$\Rightarrow \quad w_t^* = a_0 + a_1\eta r_{t-1} \qquad L_t^* = b_0 + b_1\lambda\theta_{t-1} - b_2 w_t^* + b_1\varepsilon_t$$

$$\Rightarrow \quad b_1\lambda\theta_{t-1} = \lambda L_{t-1}^* - \lambda b_0 + b_2\lambda w_{t-1}^* \quad \Rightarrow \quad L_t^* = b_0(1-\lambda) - b_2\lambda w_t^* + b_2\lambda w_{t-1}^* + \lambda L_{t-1}^* + b_1\varepsilon_t$$

Further extensions could be analysed under different assumptions. If the distribution of shocks is not known but should be forecasted instead, the behaviour of the variables used to predict the parameters and/or past realisations of shocks would influence the outcome. A Bayesian approach could also be considered in a multi-period framework, so that agents

would update their subjective beliefs using all the available information and thus generate dynamics.

Fully anticipated shocks

If there were no uncertainty and outside opportunities depended on the realisation of the shock, the set of outcomes (2.2), (2.4) and (2.6) would be the following:

$$w_i^* = \theta_i f_L(L_i) + \frac{\beta(1-\alpha)L_i[u(w_i) - u(r_i)]}{\alpha(1-\beta)u'(w_i)L_i + (\alpha-\beta)[u(w_i) - u(r_i)]L_w} \qquad i = g,b \qquad (2.2)'$$

$$w_i^* = \theta_i f(L_i)/(L_i) - [(1-\alpha)/\alpha][u(w_i)-u(r_i)]/u_w \qquad i = g,b \qquad (2.4)'$$

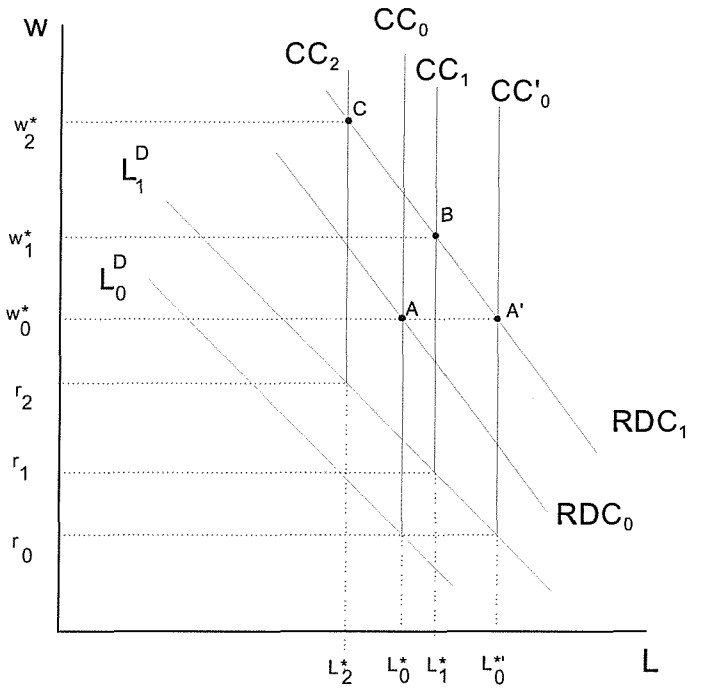
$$w_i^* = \alpha\theta_i f(M)/M + (1-\alpha)r_i \qquad i = g,b \qquad (2.6)'$$

Equation (2.2)' is the two-stages contract curve (2SCC) as derived in Manning (1987). The bargaining outcomes in this case clearly show that wage stickiness will not be observed, being the magnitude of its adjustment dependant on how the alternative income is affected by shocks. Employment might then fluctuate less, as the positive/negative impact of shocks will be partially offset by the relative increase/decrease in the wage level. This could mean that, in the event of a 'good' shock for example, the employment level could remain unaltered or even decrease, depending on the ratio r_g/θ_g. The shock shifts the RDC curve and the 2SCC to the right. An increase in the reservation wage, on the other hand, does not move the RDC but causes the 2SCC to shift in. Hence, with shocks altering the reservation wage the final result on the 2SCC cannot be asserted *a priori.* The result is depicted in Figure 5.2 using the same simple example as before.

The figure is drawn assuming $\alpha=\beta$ (so that the two-stage model is equivalent to the efficient contracts formulation). Point A describes the initial wage-employment optimum pair, with reservation wage r_0, labour demand curve L_0^D, rent division curve RDC_0 and contract curve CC_0. Point A' shows the optimum pair after the occurrence of a 'good' shock θ that shifts the labour demand curve to L_1^D and the rent division curve to RDC_1 but does not affect the reservation wage. Point B is the optimum pair that would result if the shock affects the

reservation wage, so that its new level is r_1. Point C is the optimum pair that would result if the impact of the shock on the reservation wage were such that its new level was r_2.

Figure 5.2 The effects of shocks on the outcome of bargaining



The behaviour of wages and employment in the different cases analysed - $L^* \geq M$, $L^* < M$ - is almost analogous to the one resulting from a 2-stages model with constant reservation wage, as in Manning (1987), that is, higher mark-up of w over r and smaller employment level for each wage when bargaining takes place according to the rule prevailing for $L^* \geq M$ than when $L^* < M$. With constant r, wages will always be higher when there is full employment of members than when there are members unemployed. Although the result is what one would expect, it is often observed in some economies that although unemployment is high, wage increases do not slow down. The model proposed here would give an explanation that is quite plausible around the point at which $L^* = M$. 'Good' shocks when there are unemployed members might generate a higher wage level compared to the one got in a 'bad' state of nature with full employment of members, provided the difference between the reservation wages in both states is big enough:

$$w_b^*(L \geq M) \leq w_g^*(L < M) \quad \text{iff} \quad 1 - r_b / r_g \geq \alpha^2(1-\gamma)/\gamma^2(1-\alpha)$$

Higher wages with a lower employment level in 'good' states relative to the values observed in a 'bad' state could be possible, given the above, as a consequence of the bargaining process. The odds of observing such result increase with the reaction of the reservation wage to shocks.

The above situation links the character of the shock with the preferences of the union in a way such that it can explain why unions seem to react differently when employment is to be increased than when it is to be lowered. In 'good' states wages will rise more than in 'bad' states, thus allowing that employment could even remain unchanged in the former situation while in the latter the decrease in the number of jobs could be less significant. Economies and/or sectors in which most employees are unionised could be thought of as being well described by this case, since increases in the employment level would always mean hiring non-members while decreases in the number of workers would be linked to firing members. Hence, 'good' shocks would always generate relative wage inflation and employment stagnation while 'bad' shocks would be accompanied by moderate wage increases and a relatively smaller employment adjustment.

Finally, it is interesting to note that the three cases that have been defined along the paper - depending on employment being less than, equal to, or greater than membership- can be re-stated for the example used in terms of the relative magnitude of θ and $r(\theta)$[20]:

Case I: $\theta_i/r_i \leq [\alpha + \gamma(1-\alpha)]M^{(1-\gamma)}/\gamma[\beta + \gamma(1-\beta)]$

Case II: $\theta_i/r_i > (1-\alpha)/(\gamma-\alpha)]M^{(1-\gamma)}$

Case III: $[\alpha + \gamma(1-\alpha)]M^{(1-\gamma)}/\gamma[\beta+ \gamma(1-\beta)] \leq \theta_i/r_i < (1-\alpha)/(\gamma-\alpha)]M^{(1-\gamma)}$

Rephrasing the problem in this way what is being defined are two thresholds for θ that would determine employment being smaller or greater than membership. This allows one to think of an asymmetric behaviour of unions depending on the magnitude of exogenous shocks. There is a zone in between both values, however, that is not determined. There is thus an economic environment in which unions would bargain subject to all members having a job (*Case III*).

[20] Alvaro Forteza kindly suggested this point to me.

Efficiency of the outcomes

The proposed formulation allows for different results depending not only on the bargaining power of the parties at the two stages of negotiations but also on the evolution of the reservation wage after the shock.

The outcome of bargaining would be efficient whenever the isoprofit and the indifference curves are tangent, that is, when the following equality holds:

$$\theta_i f_L(L_i^*) - w^* = -[u(w^*)-u(r)]/u'(w^*)$$

With the assumed utility function of the individual member the above equation becomes: $\theta_i f_L(L_i^*) = r_i$. Assuming a quasi-Cobb-Douglas production function and a utilitarian objective function for the union, the conditions under which an efficient outcome is obtained can be stated for *Cases I* and *II*. In *Case III* the outcome will not be efficient by construction.

Case I: $L^* < M \quad \forall\theta$

(w^*, L^*) is efficient iff $\{[\alpha+\gamma(1-\alpha)]/[\beta+\gamma(1-\beta)]\}[E_\theta(Lr)/E_\theta(L)] = r_i \quad i = g,b$

If the reservation wage is an increasing function of the shock -an assumption that would not necessarily hold if decentralised bargaining is considered or if shocks are sector specific- then:

$$r_b \leq E_\theta(Lr)/E_\theta(L) \leq r_g$$

This implies a different necessary condition depending on the nature of the actual shock:

If $\theta = \theta_g$: $\{[\alpha+\gamma(1-\alpha)]/\gamma[\beta+\gamma(1-\beta)]\}[E_\theta(Lr)/E_\theta(L)] = r_g$

$$\Rightarrow [\alpha+\gamma(1-\alpha)]/\gamma[\beta+\gamma(1-\beta)] \geq 1 \quad \Leftrightarrow \quad \alpha \geq \beta$$

If $\theta = \theta_b$: $\{[\alpha+\gamma(1-\alpha)]/\gamma[\beta+\gamma(1-\beta)]\}[E_\theta(Lr)/E_\theta(L)] = r_b$

$$\Rightarrow [\alpha+\gamma(1-\alpha)]/\gamma[\beta+\gamma(1-\beta)] \leq 1 \quad \Leftrightarrow \quad \alpha \leq \beta$$

Hence, if there are unemployed members but still the bargaining power of the union over wages is greater than over employment, efficient outcomes can only be observed in 'good' states. If the opposite holds, efficiency can be attained only in 'bad' states, while if bargaining

powers are equal in the two rounds of negotiations the outcome can be efficient when shocks are both 'good' and 'bad'. Since the expected reservation wage is always greater than that observed in a fully anticipated 'bad' state of nature, and the mark-up over it is greater than 1 if bargaining power over wages is higher than over employment and there are members unemployed, the union/firm could have always been better off, without negatively affecting the other party, bargaining a smaller wage and getting a higher employment level in the second stage if a 'bad' shocks takes place. However, if the shock turns out to be 'good', there is still the chance that the output is efficient, given the combined effect of shocks and wage level on the level of employment and hence on the level of benefits. The analogous reasoning applies to the case in which bargaining power over employment is greater than over wages.

The result is different from that obtained in Manning's (1987) two-stage model. While there the sufficient condition for efficiency is $\alpha=\beta$, in the present formulation it is not the only one, because of agents bargaining over wages subject to the expected shock and its effects on the reservation wage. Further, the same argument allows for Pareto optimality also when $\alpha\neq\beta$, so that inefficiencies would arise not only because of different bargaining powers as in the cited paper but also depending on the state of nature in which employment negotiations take place and on how 'correctly' agents are able to predict it.

Finally, underemployment is observed when the marginal labour product exceeds the competitive wage and if this difference is negative there is overemployment. Assuming that the alternative income is a good approximation to the above competitive wage, one can draw some conclusions by analysing the model's optima. When union power in negotiating wages is greater than or equal to that when bargaining over employment ($\alpha>\beta$) and a 'bad' shock takes place ($\theta=\theta_b$) overemployment is not possible, while if $\alpha\leq\beta$ and $\theta=\theta_g$ underemployment cannot be observed. However, for the combination of $\alpha>\beta$ and $\theta=\theta_g$ and for $\alpha\leq\beta$ and $\theta=\theta_b$ both results are possible. The latter conclusion differs from the one arising from a two-stage model with no uncertainty in which underemployment will necessarily occur when $\alpha>\beta$ and overemployment only in the opposite situation.

Case II: $L^* \geq M \quad \forall\theta$

When employment exceeds membership, the efficiency condition becomes:

(w^*, L^*) is efficient iff $[\gamma(1-\alpha)/(\gamma-\alpha)]E_\theta(r) = r_i \qquad i = b,g$

Given that $[\gamma(1-\alpha)/(\gamma-\alpha)] \geq 1 \ \forall\alpha$ - the mark-up over the reservation wage is always greater than 1 - efficiency could only be attained in 'good' states if $r_b \leq r_g$ holds. Moreover, in 'bad' states there will always be underemployment. This result is the consequence of the union not caring about employment when all members have a job. However, it should be assumed that firms faced with a 'bad' shock are laying off non-union members first. On the contrary, in 'good' states it is possible to observe both over and underemployment, depending on the probabilities assigned to each state of nature, the bargaining power over wages and the elasticity of output with respect to employment.

Summarising, the main results on efficiency relate to the possibility of obtaining Pareto optimality of the outcome without imposing that the union's bargaining power over wages and employment should be equal. The conditions under which efficiency is possible depend, however, on the nature of the shock, the existence or not of unemployed union members and on the accuracy of agents' predictions.

Nesting existing models

For different combinations of the values of the parameters of the proposed model, various standard formulations are derived. Firstly, if the probability of occurrence of a 'good' shock is set equal to 1 or 0, the formulation becomes the two-stage model with varying outside opportunities sketched previously. That is, the case in which the shock is fully anticipated.

If it is further assumed that the reservation wage is independent of shocks, the standard two-stage model results. Note, however, that this same model can be obtained if keeping uncertainty but with a constant reservation wage and a production function with constant elasticity.

Adding the assumption that bargaining powers are equal in both stages determines that the model collapses to the efficient contracts formulation while if β is set equal to 0 the right-to-manage model is obtained. Finally, imposing the restrictions that $\beta=0$ and $\alpha=1$, the model becomes the monopoly union.

As stated in Manning (1987), the advantages of having a general formulation are obvious. In encompassing different possible bargaining structures, it allows for testing, instead of imposing, the restrictions that would yield a simpler model. However, it must be noted that there might exist identification problems that would severely reduce the practical viability of the testing procedures.

Concluding remarks

The bargaining model proposed in this paper is intended to analyse how standard results would be affected by the inclusion of agents' beliefs and varying outside opportunities. This is thought to be relevant not only because of being a better approximation of real world but also because of its consequences on the expected behaviour of wages and employment.

The results obtained show that once the alternative income is allowed to vary with shocks, wages are not sticky anymore and the employment level fluctuates less than according to standard models. If uncertainty is included, however, wage rigidity is recovered while the extent of employment fluctuations will depend on the distribution of shocks, their realisation and the evolution of the reservation wage. If uncertainty is high and/or if the state of nature turns out to be of the opposite sign of the most expected one by agents, the employment adjustment is maximum. Observed shocks of the same sign than those expected by agents and/or scarce uncertainty generate small employment adjustment to shocks. Moreover, the relative responsiveness of wages and employment will depend on the existence or not of unemployed members.

According to the proposed model, there is not a unique prediction regarding the Pareto optimality of the outcome of bargaining. In contrast to other formulations, it allows for both efficient and inefficient wage-employment pairs, depending not only on union strength but also on agents' beliefs and the observed state of nature. Even if unions were not concerned about employment, as many authors claim to be the case, it would be possible to attain efficient outcomes when faced to 'good' states of nature in this framework. Thus, the model provides a way of overcoming one of the points confronting right-to-manage and efficient contracts models.

Further theoretical work must be done, however, analysing how sensitive the results are to hypotheses such as the risk neutrality of agents. Given that it is not possible to derive analytically the outcome of bargaining when individuals are risk averse, simulations should be carried out in order to shed some light on this issue.

Moreover, it would be interesting to compare the results derived with those that would be obtained in a setting with decentralised bargaining, especially because the relevant reservation wage could evolve differently depending on the shock being sectoral or economy-wide.

Finally, given that the predictions of the model regarding employment adjustment depend on the responsiveness of the reservation wage to shocks, an interesting extension would be to endogenise the alternative income in a general equilibrium model of the labour market. Considerations relative to the behaviour of the unemployed individuals - such as effectiveness of their job search; duration of unemployment; or availability of information on vacancies- would be thus included.

In the following chapter the effects of unions on wages and employment are analysed, comparing the behaviour of the same economic sectors with and without unions in time. Bargaining is modelled using a right-to-mange scheme. The negotiated mark-up over wages is specified as a function of membership but also of the degree of competitive pressure faced by firms. This is a very simple way of indirectly introducing the effect of shocks on the outcome of bargaining. However, it can also be thought of as a means of partially including one of the main sources of uncertainty for Uruguayan agents. In this sense, the alternative income can be proxied by an exogenous variable but the probability of being unemployed/employed would be dependant on the distribution of shocks. This, in turn, can be assumed as dependant on the degree of exposure of the local economy to external conditions, among other factors.

Chapter 6. Labour demand in Uruguay before and after re-unionisation[21]

Introduction

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

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

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

Given these very strong views, one would think that there would be a massive research literature on how unions affect employment adjustment to changes in wages and output in Latin America. There is not. As for Uruguay, some theoretical and empirical work has been recently developed (Rama, 1993a, 1993b, 1994; Allen, Cassoni and Labadie, 1994; Cassoni

[21] I acknowledge comments from Steve Allen, James Heckman, Daniel Hamermesh, Gastón Labadie, Fernando Lorenzo, William Maloney and Carmen Pagés-Serra.

et al., 1995, 1996), taking advantage of its being a good *proxy* for a natural experiment in Economics, since manufacturing industries can be observed both during a period when no unions participated in the labour market and during a period in which unions were active.

Although there are numerous studies making union/non-union comparisons for particular countries at particular time periods, they have generally concentrated on wage gains and wage gaps (Blanchflower, 1984; Freeman and Medoff, 1984; Hirsch and Addison, 1986; Lewis, 1986; 1990;) while employment differentials have been somehow neglected[22]. Regarding elasticities of substitution between labour and capital and among different types of labour, research has been even less prolific. In the US, it has been found that they are much lower in union than non-union establishments (Freeman and Medoff 1982; Allen 1986). Further, Boal and Pencavel (1994) found some evidence suggesting the underlying production function is different depending on the sector being unionised or not. In the UK, Blanchflower, Millward and Oswald (1991) analysed the impact of unionism on the path of employment growth, finding significant differences, although their result has been criticised for not being robust (Machin and Wadhwani, 1991). Another line of research that has been followed is that related to the influence of unions on the costs of adjusting the level of employment (Burgess, 1988; 1989; Burgess and Dolado, 1989; Lockwood and Manning, 1989 are examples).

Although all the above papers do illuminate one component or another of the effects of unions on wages and/or employment, they cannot address the issue of unions influence comparing the same establishment, individual or economic sector with and without union status. Does employment adjustment to changes in wages and output vary when the firm is unionised and when it is not? How long does it take to complete the adjustment in these two settings?

This paper examines these issues directly, using evidence from manufacturing industries in Uruguay from 1975 through 1997. Uruguay is well suited for such a study because the same industries can be observed in two consecutive sub-periods, being unions absent in the first while they re-organised in the second. A military government took over in 1973 and stayed in power through 1984. Collective bargaining was proscribed during the military regime. Labour unions

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

regained the right to bargain collectively with the return of democracy in 1985. As part of its anti-inflation policy, the national government played a significant role in negotiations. Legal regulations of work -which constitute public-order individual rights and therefore cannot be resigned under any circumstance- can be superseded by collective agreements. They can go beyond these restrictions, increasing (but not decreasing) the benefits that workers have in the area of minimum wages, working conditions, job security, and employee benefits. Tripartite negotiations took place at the industry level through 'Wage Councils', allowing wage adjustment to vary by industry. If an agreement met the government's anti-inflation targets, then it would apply to all firms – even those with non-union work forces - in the industry once the agreement was officially endorsed.

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

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

Collective bargaining in Uruguay[23]

When parliament was closed by the military in June 1973, the union confederation CNT launched a general strike. The government reacted by banning union activity and giving

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

employers the right to dismiss anyone who did not return to work. Many union leaders were jailed; the others went into hiding or exile. The union movement began a political comeback in the early 1980s, with a series of demonstrations and general strikes organised by a new confederation, but there was no bargaining until the return of democracy in 1985.

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

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

In 1991 there was a significant change in the structure of negotiations. The government stopped participating in bargaining. The terms of the contract bind only those firms and unions that were actually represented in the negotiation. Wage councils only met in a few sectors and the result has been a sharp drop in union density in the private sector.

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

The role that collective agreements play in introducing rigidities could be very significant, varying in degree depending on union density and the specific clauses of the contracts, that include wage adjustments, minimum wages by job categories, length of work day, holidays, recognition of union officers, 'peace clauses' that preclude strikes under certain circumstances, and other related working conditions. Although there are no explicit clauses regarding severance pay, nor restrictions to hiring new workers, unions have generally imposed extra costs to employment adjustment. In some sectors non-written extra compensations have been a common practice, while in others strikes have worked as a means of getting additional severance pay. Government intervention in collective bargaining is only provided in the case of wage councils, and there is no other regulation of the bargaining process, not even in the case of conflict and strikes (for a more detailed description, see Cassoni *et al.*, 1995: 167-70).

No database up to this date has actually evaluated the impact of the contents of collective agreements. Recently, Ermida *et al.* (1998) and Cedrola, Raso and Perez Tabó (1998) have examined qualitatively the contents of collective agreements for the period 1985-95. For this study, a database covering all collective agreements registered at the Ministry of Labour between 1985 and 1997 was developed and the contents of its clauses quantified to determine the actual non-wage costs resulting from the bargaining process at the industry level.

Using these data it is possible to analyse quantitatively a period in which union behaviour was absent (up to 1984); a period in which union density of each sector is known but also the amount of non-wage costs imposed to all firms in an industry, due to the endorsement by decree that the State did (1985-1991); and a more recent period in which union density is known, but the collective agreements are exclusively binding for those firms and those workers that participated in the negotiation and signed the agreement. The completeness of

data for this final period is less clear, since many of these agreements were not registered at the Ministry of Labour (precisely because they did not have to be endorsed by the public authority in order to be binding among the contracting parties).

This study focuses on manufacturing, where there are pronounced changes in union density during the last decade, with no small amount of variation across individual industries. The initial level of union density calculated over total number of blue-collar workers (60%) probably reflects political support for the role unions played in the return to democracy. Union sustainability hinges on both workers support for collective as opposed to individual agreements, and on the ability of unionised employers to survive economically. Membership gradually dropped to 40% by 1988 and stayed near that level through 1992. By this point the contracts signed under the old Wage Council system had expired and the impact of trade liberalisation was beginning to be felt. The openness ratio (exports plus imports over GDP) jumped from 44% in 1992 to 55% in 1993 and was above 60% for most of 1994-1997. Union density dropped from 42% in 1992 to 22% in 1993 and has stayed at about that level since. The pattern of union growth and decline has varied considerably across industries, as shown in Table 6.1.

Table 6.1. Percentage union and openness ratio, by year and industry

	Union density				Openness		
Industry	**1985**	**1988**	**1992**	**1997**	**1985**	**1992**	**1997**
Food, beverage & tobacco	59	54	55	27	24	24	28
Textiles & apparel	77	54	46	16	49	54	83
Paper	70	52	44	39	19	19	45
Chemicals & oil	100	87	100	94	16	44	60
Non-metallic minerals	48	21	11	10	12	22	36
Metal products	100	43	43	19	76	146	350

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

Union strength remained near 100 percent throughout the sample period in chemicals & oil, which not coincidentally consists largely of state-owned enterprises. In fact union density dropped in all industries after 1992 except in chemicals & oil products. The most dramatic decline took place in metal products and non-metallic minerals, where union coverage in the period dropped to 20% of its original level. At the same time, and particularly in the former industry, imports plus exports increased sharply. There was also a considerable drop in union

coverage in textiles & apparel and, to a lesser extent, in the paper industry. Except for food, beverage & tobacco, all industries experienced an important increase in openness after 1992.

Theoretical framework

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

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

Given the above institutional changes, the research strategy developed was the following: first a model of labour demand derived from a pure neoclassical static framework was estimated. The wage variable is a cost of labour proxy, including the wage plus non-wage costs - such as health insurance and payroll taxes - as well as other benefits bargained between firms and unions from 1985 onwards.

As will be shown in more detail below, the model was estimated for the whole period and the stability of the parameters was tested for. The econometric analysis supported the specification of a different model for the post-1984 period that was derived from a bargaining framework. A first implication is that wages are not exogenous as in the previous specification but determined jointly by unions and firms through a bargaining process, instead. Firms attempt to maximise profits and unions maximise their members' utility

function. Secondly, other variables could enter the model, as alternative wages or fallback positions of the parties.

Labour demand

The starting point is a standard specification for a labour demand equation in a static framework. Assuming a generalised CES production function with three inputs (capital and labour divided in production and non-production workers), maximisation of profits would yield a 3-equations system of derived demands for inputs[24]. The CES production function was chosen in order not to impose a unit elasticity of substitution between labour and capital. In so doing, the possibility of unions opposing to the introduction of new technology, or favouring the use of certain technologies can be analysed comparing the relative size of this parameter in the different sub-periods. The equation describing the demand for production workers would be:

$$\ln N_t = \alpha_0 + \alpha_1 \ln(w/p)_t + \alpha_2 \ln Q_t \qquad (1)$$

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

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

In order to estimate the model, some methodological issues have to be solved. If variables are not stationary, a possible strategy is to estimate the model in differences. A second approach would be to test if the variables involved are co-integrated and if so, the estimation can be carried out in levels. However, as in finite samples the estimators in equation (1) are biased, it might be preferable to estimate a dynamic version of the model based on Engle and Granger's representation theorem (Engle and Granger, 1987):

$$\alpha(L)(1-L)\mathbf{Z}_t = -\gamma\beta\mathbf{Z}_{t-1} + d(L)\varepsilon_t \qquad (2)$$

Where $\alpha(L)$ is a polynomial matrix in the lag operator; **Z** denotes the vector of variables involved (N, w/p, Q); d(L) is a polynomial; and ε_t is a stationary process. The model can be linearly transformed as an autoregressive-distributed lag model:

[24] The problem is not stated in terms of minimisation of costs since the data needed for the empirical analysis that follows are not available.

$$\alpha_1 (L) y_t = \alpha_2 (L) \mathbf{X}_t + \varepsilon_t \qquad (3)$$

Where $\alpha_1 (L) = 1 - \sum^m_{i=1} \alpha_{1i} L^i$; $\alpha_2 (L) = \sum^m_{i=0} \alpha_{2i} L^i$; $(y,\mathbf{X}) = \mathbf{Z}$; $y = N$; $\mathbf{X} = (w/p, Q)$

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

The non-stationarity of variables would mean that shocks have permanent effects on them. In particular, shocks related to productivity and accumulated knowledge have been generally found to be non transitory, so that they have long lasting effects on output and employment (Blanchard and Quah, 1989; Aghion and Saint-Paul, 1993; and references there in). In that case, variables would have a stochastic trend but, if co-integrated, the equilibrium relationship among them would still be stationary and hence stable. The dynamics are the result of agents not being able to adjust instantaneously to equilibrium because of factors such as adjustment costs, price rigidities, etc. Adjustment costs have been extensively discussed in the literature (Hamermesh, 1993, 1995; Hamermesh and Pfann, 1996) as the source of the observed lags in adjusting employment. They would explain why actual employment (N) differs from its equilibrium level (N^e). If firms maximise expected profits, expectations are static and costs are quadratic, the optimum path of employment would be:

$\Delta N_t = g(N^e - N_t)$ (4) yielding a demand for labour equation like:

$N_t = \lambda N_{t-1} + \beta \mathbf{X}_t$ (5) with $\mathbf{X}_t$ being a vector of variables determining long run labour demand and λ a parameter measuring the speed of adjustment to equilibrium, which is thus assumed to be constant.

Bargaining models

Since 1985 unions started playing a role in the determination of wages, working conditions and employment. Their role has varied over time, as well as the issues they bargained over. After analysing all the collective agreements that have been signed since then, it is clear that there have always been negotiations over wages but rarely over employment. Agreements have covered a wide range of other benefits, increasing the annual wage a worker receives; linking the wage to different variables, such as productivity or tenure; and increasing fringe benefits.

Working conditions have also been in the bargaining agenda, as well as the length of the working week and year. Although at first sight negotiations looked as if done in stages, this turned out to be false until the mid-nineties. The procedure followed has generally been one by which at some point unions and firms have bargained over the wage, other benefits and working conditions, signing contracts that were to be valid until a new one was signed explicitly revoking the previous settlement. In practice, regarding every issue but the wage, the agreements have worked as medium-term contracts (one year minimum, three years on average). Since the inflation rate was high and remained so until the late nineties, new contracts were generally signed every three or four months stating a new wage level but ratifying previous negotiations over the other issues.

The above suggests that the most suitable benchmark to analyse the Uruguayan bargaining process is that of a right-to-manage model (see Pencavel, 1991 for a discussion on this topic). Although some previous research suggested efficient contracting might be a good approximation to the Uruguayan case (Cassoni *et al.*, 1996), this model is discarded by the analysis of the contracts signed during the period. The model will be considered as a maintained hypothesis, based on the analysis of all collective agreements. No tests against an efficient contract model will be carried out as it has been extensively proven by now that those tests cannot support one specification against the other (Booth, 1995; Pencavel, 1991)[25]. Thus, in the specification used it is assumed that firms bargain over the cost of labour and afterwards the firm sets employment unilaterally.

$\Gamma(w, w^a, N)$ is the utility function of the union, where w is the real wage, w^a is the alternative income, and N is employment. It is assumed that membership status is lost if unemployed; that all members of the union are equally considered by union leaders; and that members care about the real wage surplus over the alternative income they would earn working elsewhere or being unemployed (de Menil, 1971). A standard specification is then: $\Gamma(w, w^a, N, M) = (w- w^a)N^{\phi}$, where ϕ is a parameter denoting how much weight the union gives to employment in its objective function. If ϕ equals 1 the model is the rent maximisation model (Pencavel, 1991).

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

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

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

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

$$\begin{aligned} &\text{Max } Y = (\Gamma-\Gamma_0)^{\beta}(\Pi-\Pi_0)^{1-\beta} \\ &w \\ &\text{s. t.} \quad N = N^* \end{aligned} \qquad (6)$$

Γ_0 and Π_0 are the fallback positions of each player. They refer to what the union and the firm would get in the event of no agreement (Binmore *et al.*, 1986). If it is assumed that under this circumstance there would be a strike, then the firm will have zero operating profits and union members will have zero earnings[26]. In a second stage firms maximise profits according to:

$$\begin{aligned} &\text{Max } \Pi = pQ - wN - p_cK \\ &N, K \end{aligned} \qquad (7)$$

The solution to (6) and (7) is:

$$N^* = N(w/p; Q) \qquad w^* = \eta^* w^a \qquad (8)$$

The solution can be derived under quite restrictive assumptions. The first equation is just the result of profit maximisation by firms, under a CES production function, for example. However, to get the equation for the wage level, it has to be assumed that when bargaining, firms take capital as given, that is, they have already made decisions on the capital level. Thus, the profit function depends just on employment. The parameter η is the mark-up over the alternative income. It can be considered a function of some characteristics of the sector firms operate in, such as the degree of competitiveness and the affiliation rate (Layard *et al.*, 1991). Finally, the alternative income workers consider as a comparison wage is a weighted

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

average of what they would earn if they got a job in any manufacturing industry; what they would get if they decided to become self-employed; and of what they would receive as unemployment benefits in the event of losing their job. Weights are given by the probability of being in each of the mentioned states. The estimable model proposed is a multivariate model, in which wages are not exogenous but they are set subject to the determination of the level of employment.

Union impact

In a static framework, unions have an incentive to take whatever steps they can to reduce the wage elasticity of labour demand so that they can bargain for increased wages with less severe consequences for employment. Unions can make product demand less elastic by making fewer options available to consumers through various rent-seeking activities. One way of doing this is to create entry barriers, such as state ownership or regulated entry into markets where establishments are unionised. Tariffs, quotas, and other barriers to free trade also can be used to reduce consumer choice. The elasticity of substitution between union labour and other inputs can be reduced through collective bargaining. Contracts with unions often spell out the conditions under which work is to be performed, including dictates on minimum crew sizes, limitations on substituting non-union personnel for work that 'belongs' to the union, and limits on technologies that reduce labour hours. Empirically, it is well known that unions should try to organise the sectors of the economy with the most inelastic demand. In this study, however, the same sectors of manufacturing are looked at before and after re-unionisation, so this self-selection into rent-seeking opportunities is controlled for. Thus, it will be possible to establish in a before-and-after framework whether unions are actually able to reduce labour demand elasticities.

The impact of unions on adjustment lags and the elasticity of labour demand to output hinge on a variety of factors. Ignoring adjustment costs for the moment, firms can adjust labour hours to a change in output by changing employment or by changing hours *per* person. The impact of unions on this trade-off is not clear *ex ante* (Oswald and Walker, 1994 addressed this issue for UK). Unions often negotiate for premium rates for overtime that are well above those required by labour legislation, which would by itself lead unionised firms to increase employment more for a given increase in output. However, unions also negotiate for employee benefits that make increasing employment expensive relative to increasing hours.

Lower turnover in unionised establishments encourages greater investments in employee training, which in turn increase the cost of hiring an additional person. In a frictionless world, the effect of unions on the employment-hours balance would be an empirical question that would hinge on whether the marginal cost of an extra hour *per* person is the overtime rate dictated by labour laws or the super-overtime rates from the union contract. If it is the standard overtime rate, then the dominating effect of unions would be through increased costs of hiring an extra person and a smaller elasticity of employment to output should be expected.

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

The data

Before describing the actual definition of variables, some aggregation issues are worth stating. First, the units of observation considered are the manufacturing industries at the two-digit level of aggregation. Six of them, out of eight, can be observed during the period 1975 to 1997: food, beverage & tobacco; textiles & apparel; paper; chemicals & oil products; non-metallic minerals; and metal products. The remaining two industries – wood and basic metals - are not substantive in terms of production and employment.

It is well known that the optimum unit of observation for statistical analysis is the establishment, as adding up technologies never guarantees that the parameters obtained for the aggregate are what they are sought to be. However, working with industries is not the worst of the alternatives, especially in a small country like Uruguay, in which most of the year-to-year variation in industry data is driven by a small number of firms. Hence, problems related to aggregate data should be fewer, although not negligible, than in a large country. Nevertheless, it should be taken into account that this might bias the estimates (Hamermesh, 1993). Second, temporal aggregation does not seem a problem in this case, as quarterly data will be used, so that the lag structure should not understate the true lag structure.

Descriptive statistics for the variables as described below are summarised in Table 6.2, differentiating between the pre and post re-unionisation sub-periods (1975-1984 and 1985-1997). Data for the entire manufacturing sector are reported to indicate overall trends; data for manufacturing industries indicate the diversity of conditions across different markets. Note that with the return of collective bargaining, the market trends are towards greater production, reduced employment, higher wages, and increased openness.

Table 6.2 Descriptive statistics

	Manufacturing sector							
	1975.1 – 1984.4				**1985.1 – 1997.4**			
Variable	Mean	S.D.	Max	Min	Mean	S.D.	Max	Min
W	82.02	13.97	103.6	56.81	90.02	21.64	133.3	52.38
LNWC	1.336	0.071	1.426	1.243	1.332	0.031	1.375	1.290
BNWC	1.000	0.000	1.000	1.000	1.123	0.038	1.156	1.000
TLC	109.7	18.6	143.54	72.56	136.2	36.34	203.7	67.79
AW	0.000	0.000	0.000	0.000	42.95	11.67	62.59	24.87
UNION	0.000	0.000	0.000	0.000	0.365	0.129	0.601	0.200
OPEN	0.298	0.036	0.388	0.242	0.468	0.109	0.620	0.295
Q	57.00	6.740	70.00	44.60	60.16	5.097	71.04	49.16
N	108143	14496	129491	8601	104782	19727	129995	71735
N° observations	40				52			
	Manufacturing industries							
	1975.1 - 1984.4				**1985.1 - 1997.4**			
Variable	Mean	S.D.	Max	Min	Mean	S.D.	Max	Min
W	86.93	28.84	202.9	41.90	104.8	40.96	246.3	41.25
LNWC	1.337	0.071	1.433	1.238	1.328	0.038	1.383	1.232
BNWC	1.000	0.000	1.000	1.000	1.076	0.096	1.265	1.000
TLC	115.3	35.31	255.6	58.65	151.4	68.23	405.8	53.23
AW	0.000	0.000	0.000	0.000	69.88	21.27	136.7	30.79
UNION	0.000	0.000	0.000	0.000	0.507	0.285	1.000	0.083
OPEN	0.338	0.257	1.149	0.096	0.575	0.657	3.500	0.102
Q	9.431	6.971	27.42	1.598	9.804	6.784	26.69	1.296
N	17661	12763	49715	4167	16543	12292	42150	3897
N° observations	240				312			

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

Cost of labour: W

The measure to be used in the model has to approximate the total cost of labour for the firm, so that it has to include not only the wage but also non-wage costs. The latter accounts for labour

taxes; social security contributions; and bargained costs since 1985. All costs related to hiring and firing workers are being omitted. In order to account for these costs, the labour demand function should be specified contingent on different states of nature, that would imply firing or hiring workers, and a distribution of these states should be also proposed. It can be shown that not specifying a state contingent labour demand might bias downwardly the estimates of the elasticities due to the omission of relevant variables[27]. This issue will not be addressed empirically as data needed to calculate marginal firing and hiring costs are not available[28].

Data on wages are obtained from the Quarterly and Annual Industrial Surveys carried out by the National Institute of Statistics (INE)[29]. Annual data for production workers is available from 1975 up to 1997. Quarterly data however, is not published (nor processed by the INE) after 1991. Hence, for 1992-1997 the within year evolution of wages was assumed to follow the same pattern as that stemming from the Wage Survey (INE)[30] for manufacturing workers. Data on non-wage costs were taken from Picardo, Daude and Ferre (1997) and from Cassoni and Ferre (1997). Costs related to health insurance, social security and payroll taxes, as well as annual premia and paid holidays, were considered in building a factor that increases wages for each 2-digit industrial sector. Social security and health insurance contributions are a fixed percentage of wages that has varied over time. On the other side, payroll taxes, first imposed in 1982, have

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[27] I am grateful to Prof. James Heckman for pointing out this particular issue.

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

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

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

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

There are several issues over which unions have bargained since 1985. Among them, supplemental end-of-year bonuses, either related to tenure, productivity, or simply on a general basis; shorter length of the working day; and extra holidays. These negotiations took place at the industry level, so that they vary by industry. Annual premia applying to all workers was directly used to increase the factor built upon the legal rates. Information on extra holidays was used to calculate the percentage increase in costs due to non-working days. If paid vacations were 12 days more *per* year over the legal standard, the actual monthly wage would be 25/24 times w, instead of w. Where agreements were reached shortening the legal length of the working day or week, the cost of labour was increased by the proportion of legal to bargained hours in the same way as paid vacations. All the information above described stemming from the manufacturing collective agreements signed between 1985 and 1997 was used to build an index increasing the legal cost of labour. This index varied in time and among industries, with an average value for the whole manufacturing sector of 12 percent. Industries with the lowest extraordinary bargaining costs were paper; metal products; and non-metallic minerals, for which the increase was around 1% on average. Sectors related to food, beverage & tobacco and chemicals & oil have negotiated increases of 12% over the legal costs, while those related to textiles & apparel have an average percentage premia of 21% during the period. Given all the above, the cost of labour variable was defined as:

$$\text{Cost of Labour} = \text{Wage}*(1 + \text{legal non-wage costs} + \text{bargained non-wage costs})$$

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

Employment refers to total number of production workers obtained from the Quarterly and Annual Industrial Surveys, at the 2-digit level. An index of production is available on a quarterly basis (INE). The index was then transformed to monetary values using the 1988 Industrial

Census and the Annual Industrial Survey (INE). Data on product prices refer to the PPI at the 2-digit level (INE). All data are monthly values calculated as an average on a quarterly basis.

Some corrections to the official data

Industrial censuses in Uruguay are performed every 10 years. Each time a census is done, annual and quarterly surveys update their samples based on the new information. The last national industrial census was performed in 1988 and its results showed that the samples that were being used in the industrial surveys – stemming from the 1978 census – were severely misrepresenting the different sectors. Annual surveys started including the new information in 1989 while quarterly surveys did so in 1993. However, no correction to the data was done before those dates. The differences in the samples meant that the estimated levels of employment and output for the whole manufacturing sector differed in around 25% depending on the sample used. At the 2-digit level there were even broader differences. It was thus decided to correct the official data, discussing and taking advice from those in charge of the surveys at the National Institute of Statistics. Given that the 1982-1983 economic recession had had major and different effects depending on the industrial sector, the assumption used to calculate the new data was that the 1978 sample stopped being representative in 1984. As other sources showed that the evolution of the variables stemming from the surveys along the post-1984 period was quite correct, the differences in the levels according to both samples were geometrically distributed along those years (1984-88 for the annual survey; 1984-93 for the quarterly survey).

Degree of openness: OPEN

The index was calculated as total exports plus total imports divided by value added, *per* manufacturing industry. Data came from the Republic Bank of Uruguay (BROU), the authority in charge of registering all foreign exchange activities up to 1995. Since that date, the Customs Office has been responsible of collecting the data[31].

Alternative wages: AW

The alternative income for a worker in industry 'j' was defined as the weighted average of the wage in the rest of the manufacturing industries, assuming he/she is hired by a firm in the rest of the manufacturing industry; the income the worker would receive if he/she becomes

[31] The indicator is the simplest one available. Other measures of openness could have been built in order to differentiate diverse effects depending, for example, in competitive pressure taking place in the domestic market, *via* import penetration, or abroad where exporting industries sell their products. They were not used, however, in trying not to add further sources of variation by industry.

unemployed and collects unemployment benefits (50% of his/her current wage); and the average income of self-employed individuals as an individual alternative to formal employment. Weights were defined as the annual frequency of each category as stemming from the Household Survey. All variables are lagged 1 period, as it is here assumed that when bargaining the union does not know the alternative wage that will prevail in the current period. The definition used implies that reservation wages for workers in high wage industries will always be lower than for those hired in low wage industries. The argument is true and reflects what workers are faced to when bargaining at the industry level: the alternative opportunity for all workers taken together if negotiations fail is, in fact, to change industry, if one assumes they will not move to other economic sector than manufacturing, for which they do not have the required skills. Hence, the unions will try to maximise a mark-up of the industry wage over a reference level of earnings in case all members have to change *sector*.

Union density: UNION

Union density was calculated using the annual number of production workers as stemming from the Industrial Surveys and total membership reported by the National Union Federation after each congress. These congresses took place in 1985, 1987, 1990, 1993 and 1996-97. As a consequence, only five points in time could be calculated based on actual data. However, it is sensible to think that union bargaining power can be linked to the revealed membership instead of the actual one, and this figure is only public after each congress. Further, in between congresses the measure was calculated using actual employment in the denominator, under the assumption that non-union members are fired first.

Labour demand: empirical results

Specifying a model for the whole period

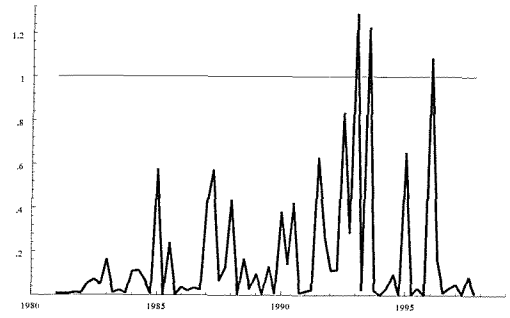
To determine whether and how much elasticities and adjustment lags of labour demand in the manufacturing sector changed after the return of collective bargaining, the appropriate specification of the empirical model must be first established. The quarterly data on the six manufacturing industries described in previous sections was used. To estimate equation (1) as it stands, the stationarity of the variables has to be analysed, which was done by estimating the order of integration of employment, labour costs, and output for each manufacturing industry in the period 1975-1997. All variables are non-stationary but their first differences are stationary, so that they are integrated of first order - I(1). The unit root tests used to

perform the analyses were those proposed by Fuller (1976), known as Augmented Dickey-Fuller tests (ADF). The models over which the tests were performed were different depending on the variable and industry, including only a constant and lags of the dependent variable in some cases while in others they also incorporated seasonals and a time trend (for details, see Table A6.1 in the appendix). These results are somehow expected. Regarding employment, output and real wages, accumulated knowledge and productivity shocks have been found to generate stochastic trends in these variables as it was mentioned previously. The non-stationarity of the degree of openness could be interpreted in similar terms, being external shocks and trade policies in the root of the result. Finally, the most likely explanation for the stochastic trend found in the union density variable should be linked to membership dynamics and insider-outsider arguments (Blanchard and Summers, 1986). Given the statistical properties of the data, one possible strategy is to estimate the model in first differences.

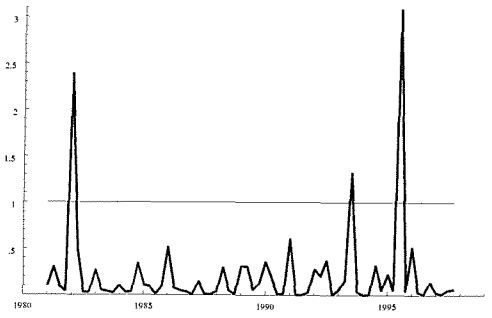
The institutional framework depicted in previous sections suggests, as a second step, the analysis of the stability of the parameters in time. The model in differences was thus estimated industry by industry, using recursive least squares (RLS) and assuming wages and output are exogenous. The results, depicted in Figure 6.1, show there are structural breaks in the labour demand equation in all industries except for non-metallic minerals. The timing of the breaks is not identical in each industry, but they can be identified at some point in the early 1980s as well as around 1991-1993. These dates could be related to the end of the military regime in 1985 and the re-appearance of unions as actors in the labour market; and the expiration of all contracts that had been signed under the tripartite wage councils.

Recursive methods need long time series previous to the first break in order to yield robust results. Thus, to link the break in the eighties with the institutional changes does not seem too arbitrary, especially when noting that the graph of most industries shows at least a peak in 1985. However, 1983 is also a candidate for structural breaks, given the huge economic crisis that took place at the end of 1982 and up to 1984. Hence, a third stage of the analysis involved using the pooled cross section-time series data set. Given the non-stationarity of the variables and the instability of the parameters, the model was specified in differences with the parameters shifting in various combinations of 1983, 1985 and 1993 and estimated by ordinary least squares (OLS). Elasticities were imposed to be the same for all six industries while wages and output were taken as exogenous variables. Results are reported in Table 6.3.

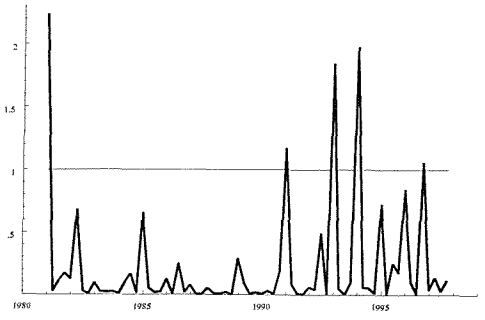
Figure 6.1: Recursive residuals, by industry



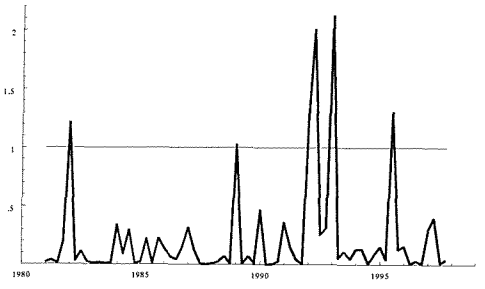
Food, beverage & tobacco: breaks in 1992-93



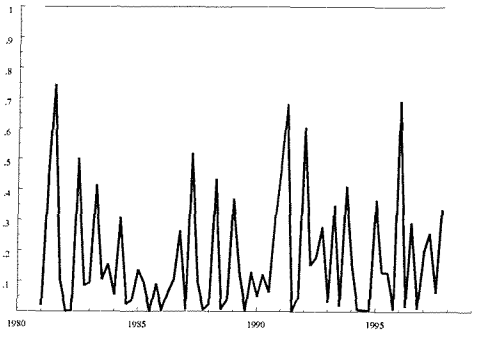
Textiles & apparel: breaks in 1982, 1995



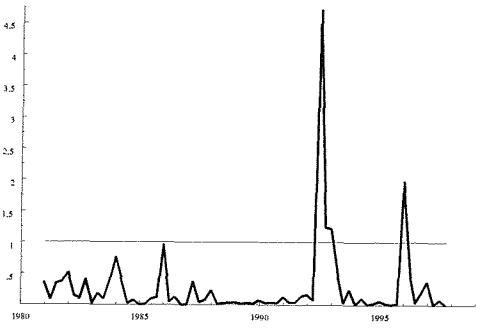
Paper products: breaks in 1991- 92



Chemicals: breaks in 1982, 1993



Non-metallic minerals: no breaks



Metal products: break in 1992

Note: The straight line in each graph corresponds to the 95% confidence interval.

Table 6.3 Estimation in differences, manufacturing industries, 1975-1997

Dependent variable: $\Delta N_t = N_t - N_{t-1}$ Sample: 1975 – 1997 Number of Observations: 534					
	Structural Breaks				
Variables	**1983**	**1985**	**1993**	**1983&1993**	**1985&1993**
ΔN_{t-1}	0.01256	0.04312	0.02399	0.01316	0.03833
	(0.0604)	(0.0564)	(0.0468)	(0.0593)	(0.0557)
ΔN_{t-2}	0.16010	0.15278	0.09722	0.16832	0.15082
	(0.0605)	(0.0564)	(0.0469)	(0.0594)	(0.0559)
ΔQ_t	0.15244	0.14078	0.12545	0.15180	0.14259
	(0.0306)	(0.0263)	(0.0203)	(0.0300)	(0.0260)
ΔW_t	-0.08480	-0.10309	-0.09007	-0.08364	-0.10675
	(0.0296)	(0.0234)	(0.0224)	(0.0291)	(0.0264)
$\Delta NdY1_{t-1}$	-0.01144	-0.07197	-0.08663	0.01955	-0.06430
	(0.0833)	(0.0835)	(0.1043)	(0.0943)	(0.0995)
$\Delta NdY1_{t-2}$	-0.11730	-0.10185	0.03228	-0.21630	-0.20982
	(0.0837)	(0.0839)	(0.1051)	(0.0950)	(0.1002)
$\Delta QdY1_t$	-0.05929	-0.0679	-0.05994	-0.04599	-0.04991
	(0.0374)	(0.0349)	(0.0388)	(0.0410)	(0.0430)
$\Delta WdY1_t$	0.01234	0.05570	0.09638	-0.01371	0.04344
	(0.0424)	(0.0244)	(0.0704)	(0.0449)	(0.0507)
$\Delta NdY2_{t-1}$				-0.24582	-0.18643
				(0.1233)	(0.1293)
$\Delta NdY2_{t-2}$				0.03721	0.04908
				(0.1213)	(0.1273)
$\Delta QdY2_t$				-0.03598	-0.02352
				(0.0430)	(0.0473)
$\Delta WdY2_t$				0.13014	0.09706
				(0.0747)	(0.0793)
R^2	0.0930	0.1028	0.0922	0.1398	0.1344

Note: $\Delta X = X_t - X_{t-1}$. N is number of production workers; W is the real labour cost of a production worker; Q is production. ΔXdY1 is ΔX multiplied by a dummy variable that is equal to 1 in the sub-period starting in Y1 (Y1= 1983; 1985 or 1993 according to the column). ΔXdY2 is ΔX multiplied by a dummy variable that is equal to 1 in the sub-period starting in 1993. Standard errors are in parenthesis below each estimated coefficient.

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

Finally, co-integration techniques were also used. When variables are non-stationary the estimation of the model in levels has been proven to be misleading, unless the variables are jointly stationary, that is, they are co-integrated. Hence, co-integration (CI) tests were then done to see if an equilibrium relationship could be sustained for the whole period. Both Engle and Granger (EGM) and Johansen (JM) methods were used, specifying various models that differ in the number of lags included, as well as in the inclusion of seasonal dummies or a constant. Co-integration between employment, production and labour costs was rejected for all industries according to at least some of the tests performed (Table A6.2 in the appendix). In those cases in which CI cannot be rejected, the graph of the CI relation shows it is not stationary, so that it is probably spurious, as it is the existence of a structural break in the relation that makes the statistics significant (see Figures A6.1 to A6.4 in the appendix).

In summary, all the above analyses suggest 1985 stands out on both institutional and statistical grounds as the date at which a structural change in the behaviour of labour demand took place. There is also some evidence of a further shift in the nineties. These break points will be used in the remainder of the paper, relating them directly to the institutional changes in the labour market associated to trade unions. It could be argued that other factors might be at the origin of the estimated structural breaks. In 1985 the economy was just recovering from a deep economic recession with major effects on manufacturing production. In 1993 the Mercosur has already stabilised as a new economic reality. However, the statistical instruments used in the following sub-section provide further evidence on the former hypothesis being the most likely one.

Specifying a model for each sub-period

First, the analysis of order of integration and co-integration of variables for each sub-sample and each industry was repeated. For 1975-1984 and 1985-1997, every variable is I(1) within each sub-period. Details are reported in Table A6.3 in the appendix. Second, for 1975-1984, the tests using EGM and/or JM report a CI relation for at least one model (see Table A6.4 in the appendix)[32]. For 1985-1997 no CI among employment, labour costs and production can be found in any industry, for any model using EGM. However, CI is not rejected in any industry once variables that would reflect a bargaining framework - alternative wages,

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

bargained costs, the degree of openness and union density - are included. The existence of an equilibrium relation between the variables –according to the non-rejection of CI- would state that shocks, having a long lasting effect on each of the individual variables, alter equilibrium only in a transitory way. In the first sub-period, the result is consistent with a standard neoclassical labour demand framework. In 1985-1997, however, the need to include other variables to achieve CI suggests that the framework in which labour demand has been determined actually changed. One possibility is to link the existence of a stochastic trend in the residuals to not having modelled technical change. One might argue that this is partially captured when adding the degree of openness: increases in openness would force the different industries to invest in new technology once they are faced to greater competitive pressures; and/or firms with older technologies closed so that on average technical progress would be observed. However, as not only openness but also variables accounting for bargaining are included in the CI relation, there is also evidence supporting that a bargaining framework is in place to analyse the labour demand schedule in 1985-1997.

To further establish whether the return of collective bargaining was a likely cause of the observed change in parameters, exogeneity tests on wages were then performed. In the competitive model wages are assumed to be exogenous (as supply is assumed to be perfectly elastic), while in the bargaining model they are not. In the latter case they would be set either simultaneously or subject to the determination of employment. Using a Hausman test (1978) in which the OLS estimate of the wage parameter is compared to a Seemingly Unrelated Regressions estimate (SUR, Zellner, 1962), weak exogeneity of wages cannot be rejected in the first sub-period while it is rejected in the second[33]. The SUR estimator is calculated using lags of the wage as instruments in both sub-periods. For 1985-1997, however, the test was also performed including bargaining variables (alternative wages, degree of openness and union density). Further, given the evidence on the existence of instability in the nineties, the statistics were also calculated including a dummy variable in the equations, which takes the value 0 before 1993 and of 1 after that date (values of the statistics for the different models are reported in Table 6.4). The results provide further support for estimating a standard neoclassical labour demand model for 1975-1984 and a bargaining model for 1985-1997.

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

Table 6.4 Weak exogeneity tests for the wage 1975-1984 and 1985-1997

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

Note: Each model contains 5 industry dummies and a constant. The models include 4 lags of every variable (wages, output, employment). Models 3 and 4 also include a dummy variable for 1993. Instruments in Models 1 and 3 for the wage are its own lags. In Models 2 and 4 bargaining variables are also included.

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

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

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

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

Where N refers to number of production workers; w/p are real labour costs (which after 1985 include bargained costs); Q is production; UNION is union density; OPEN is degree of openness; and w^a is the alternative wage. The order of the polynomials in the lag operator will be tested empirically, starting with polynomials of order 4. The bargaining model is a recursive, two-equation model, so gains in efficiency can be achieved through simultaneous estimation. To avoid possible endogeneity bias due to the not modelling of output, lag values of Q (up to two lags), seasonals and industry dummies are used as instruments for this variable in the estimation for both sub-periods. Hence, estimation is done using Instrumental Variables (IVE) in the first sub-sample and three stages least squares (3SLS) in the second, using PCGive and PCFiml 9.0 software (1998). The dataset is the pooled cross section – time series one previously described. Fixed effects by industry are always allowed for. Elasticities are imposed to be equal for all industries, so that the estimates reflect the average elasticities for the whole manufacturing sector. Finally, union density, as a key determinant of union power, was here included in the simplest way, that is, linearly and without interacting with other variables[34]. Other research has shown that there are cases in which union effects are significant only for

[34] Interactions between UNION and other variables were in fact included in preliminary specifications, but they were not statistically significant. Since there are so many sources of variation in the estimated equations, it was finally preferred to exclude them from the current analysis.

certain levels of unionisation (Metcalf and Stewart, 1992 is an example), so that allowing for different coefficients depending on the affiliation rate should not be disregarded. At this stage, however, the issue will not be addressed for the sake of simplicity.

Main results

For both sub-periods Table 6.5 reports three simple versions of the labour demand model.

Table 6.5 Estimates of labour demand and wage equations - manufacturing industries

Labour demand equation: dependent variable: N_t

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

Wage equation: dependent variable: W_t **Sample: 1985 – 1997**

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

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

Starting with a model including up to four lags for every variable, sequential reductions were performed. Further, the different coefficients were allowed to vary in 1993 in order to check for possible shifts. Only the last two steps are reported including the shifts that were significant as well as two lags of employment in column (1) and just the previous' quarter employment in column (2). Column (3) includes the variable OPEN in the labour demand equation, so as to test if increased openness was affecting the estimates.

The wage equation for the bargaining model allows the wage to vary by industry after 1993. This was done to test whether the change in the bargaining structure has had an overall impact on wage demands and whether the effect varies by industry. Residuals are not autocorrelated but they are heteroskedastic. Thus, standard errors were calculated according to White (1980). Although normality is rejected, inference should be robust to non-normality given the sample size (Spanos, 1986; Ch.21.2).

As can be seen by comparing columns 1 and 2 of the labour demand results within each sub-period, employment from one quarter ago has an effect on employment in the current quarter but employment from two quarters ago has no impact. Further, the degree of openness is not only statistically non-significant but does not alter the estimates of the relevant elasticities. Accordingly, the focus will be on the results for column 2. The three major results (Table 6.6) are:

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

The wage equation results show that the effect of union density on wages decreased significantly after 1992, although the extent of this change varies *per* industry. A key finding in the wage equation results is that bargained wages fall with increased openness. The effect is rather small, however, a 50% change in openness being associated with a 1.5 percent change in the bargained wage[35].

[35] A 50% increase in openness implies going from a degree of openness of around 60% (actual average) to almost 90%.

Because of the different approaches taken to estimating the IVE labour demand and the 3SLS bargaining model, one might wonder if these findings are sensitive to the choice of estimation method or to the inclusion/exclusion of variables in the model. To put the two sub-periods on an equal footing, both models were nested in a 2-equation system and estimated using 3SLS. In order to do so, each variable was multiplied by two binary variables - one for 1975-1984, another for 1985-1997 - so that X75 equals X in 1975-1984 and 0 after that date and X85 is equal to X in 1985-1997 and 0 before that date. Tests of significance of coefficients and tests of coefficients being equal before and after 1985 were performed and they all re-enforce the previous results (see Table A6.5 in the appendix).

In Tables 6.6 and 6.7, labour demand elasticities and results for other relevant parameters are summarised, using models (2) of the previous table. Confidence intervals are also reported.

Table 6.6 Labour demand estimates - manufacturing industries 1975 - 1997

Short run estimates				
		1975-1984		**1985-1997**
Variable	**Estimate**	**Confidence interval**	**Estimate**	**Confidence interval**
Production	0.09304	(0.045, 0.141)	0.040243	(0.007, 0.087)
Labour Costs	-0.10180	(-0.137, -0.066)	-0.03886	(-0.075, -0.003)
Lagged empl.	0.88844	(0.827, 0.950)	0.86921	(0.826, 0.912)
Long run estimates				
		1975-1984		**1985-1997**
Variable	**Estimate**	**Confidence interval**	**Estimate**	**Confidence interval**
Production	0.8339	(0.525, 1.143)	0.3077	(0.080, 0.536)
Labour Costs	-0.9125	(-1.368, -0.457)	-0.2971	(-0.534, -0.060)
Labour share (s_L)		0.248		0.257
Wage elasticity of labour demand		0.69		0.22

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

The results show that the wage elasticity of labour demand dropped from 0.69 in 1975-1984 to 0.22 in 1985-1997. The employment-output elasticity fell by more than 50 percent, from 0.83 to 0.31. The estimated speed of adjustment is the same in both periods, about 5 quarters, so that there is no evidence that the return of bargaining lengthened the amount of time needed for employment to adjust, which is contrary to what one might generally expect[36].

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

Table 6.7 Impact of key variables on real labour costs in manufacturing 1985-1997

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

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

Although the estimates might be downwards biased due to the omission of hiring and firing costs, the evidence of a decline between both sub-periods is quite robust. The smaller responses of employment to changes in output and wages are consistent with collective bargaining restricting the options available to employers. Once unions reappeared and started playing a role in wage setting, the rules of the game changed. Costs of hiring and firing workers were at least expected to increase by union resistance. Employment would not adjust to changing output demand as before because of increased uncertainty on the reaction of unions. The change found in the estimated parameters implies the underlying production function changed with the advent of unionism. The result can be linked to a reorganisation of working rules and procedures. It might also be the case that technical change and productivity gins were also on the root of the statistical result, but there is no evidence of these processes taking place until the beginning of the nineties. Although empirical studies have generally found union effects on employment growth, through labour hoarding and increased used of overtime work, there is some research pointing to changes in the level of employment and hence in the parameters defining the production function[37].

After 1992 the structure of bargaining changed, so that firm level negotiations became quite widespread in some industries. The effect of this institutional change is captured in both the labour demand and the wage equations, but in different ways. In 1993 the labour demand equation has shifted in, while the other estimated coefficients are stable. Regarding the wage,

[37] Boal (1985) and Freeman and Medoff (1982) are examples. Pencavel (1991) and Booth (1995) argue that the result of some other papers could be interpreted in the same direction too, as is the case of Blanchflower *et al.*, (1991).

the estimated effect is an overall increase in wages but along with a reduction of the impact of union power on the mark-up that is different by industry. Industries that have experienced a greater reduction of this positive effect are those in which firm level negotiations have become more common. Hence, while no significant change is detected in chemicals & oil (35) - a concentrated industry in which public firms are present – in non-metallic minerals (36) union power has become less effective in increasing the mark-up over alternative income. Taking each industry individually, the decrease in the effect of unions vanishes in three of them (food, beverage & tobacco; paper; and metal products), while it even becomes negative in textiles and in non-metallic minerals. Given the small number of observations involved, however, the individual effect must not be taken literally. In any case, they imply a reduction in the estimated long run effect of unions on wages. While in 1985-1992 each 10 percent increase in coverage implied, on average, a 1.5 percent increase in wages, in 1992-1997 the average effect is almost zero[3839]. The indirect effect of unions over employment *via* wages is such that an increase in coverage of 10 percentage points is associated with a 0.8 percent decline in labour demand before 1993.

As almost every parameter changed, a simulation was done using both models in order to capture all possible effects. The aim of this exercise is just to visualise the path of wages and employment under the two different regimes, assuming everything else is held at the observed levels. Hence, it is not expected to reflect the true wage and employment gaps. In particular, prices, output and the behaviour of all other economic sectors are not modified in performing the simulations. Thus, the questions to be answered are:

1. What would have been the wage level in manufacturing under a bargaining regime in 1975-1984, if outside opportunities had remained the same? What would have been its level in 1985-1997 if they continued being exogenous to the firm?

2. What would have been the level of employment if parameters in the labour demand equation had remained the same in both periods?

3. What would have been the combined effect on the level of employment of changes in both the way wages were determined and the labour demand parameters, if all other variables were assumed to be unaffected?

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

First, the wage was calculated for the period 1985-1997 using an ARIMA(4,1,0) model estimated using data for 1975-1984. Comparing the average value of the estimated wage with the actual average value, the result is that wages were 46% higher than what they would have been had no changes occurred in 1985. For 1975-1984, the same exercise shows that actual wages in the period were 18% lower than what they would have been if there had been bargaining over wages and a union density equal to its average value in 1985-1997 (see Figures 6.2 and 6.3). The magnitude of the wage gap in the first sub-period is similar to that found in the USA (14%), for example (Pencavel, 1991). Regarding that of the second sub-period, it might be overestimated due to the not inclusion of the 1993 shift in the auto-regression. This shift should be included if it is not entirely linked to unions, but to other structural reforms and productivity gains brought by increased openness.

Figure 6.2
Labour costs 1975-1984
assuming the existence of unions

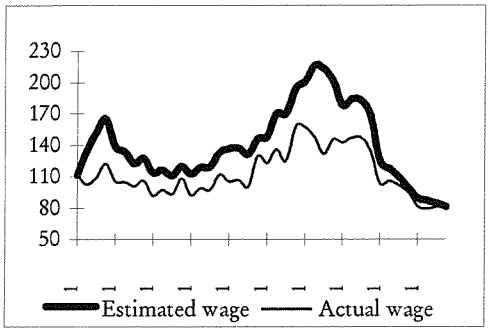
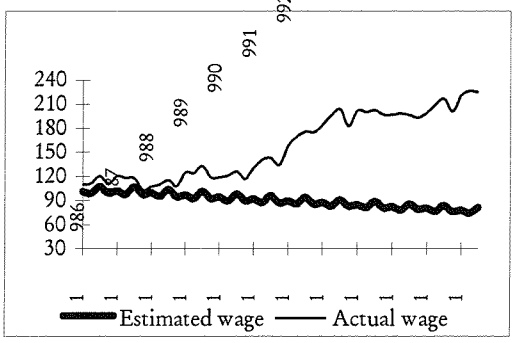


Figure 6.3
Labour costs 1986-1997
assuming there were no unions



Second, using actual wages and the two specifications of the labour demand equation, the estimated effect of the different regimes on labour demand is that the employment level in 1985-1997 was 9% higher than what it would have been according to the 1975-1984 model. This is the combined effect of the decrease in the output and wage parameters. Accordingly, in 1975-1984, employment would have been 5% higher than its observed level if elasticities had been those stemming from the bargaining model (see Figures 6.4 and 6.5). Here again the exclusion of the 1993 dummy variable might be underestimating the employment gap in 1985-1997. Estimates are within the range of studies done both in USA and UK, as surveyed in Pencavel (1991).

Figure 6.4
Employment 1975-1984
assuming the existence of unions
but using actual wages

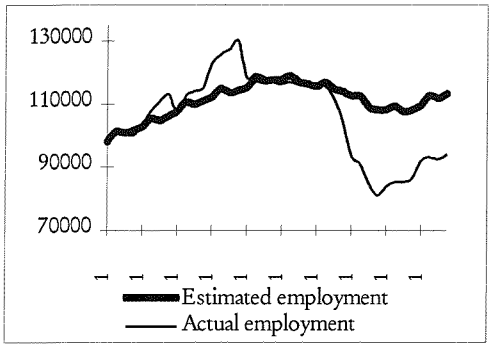
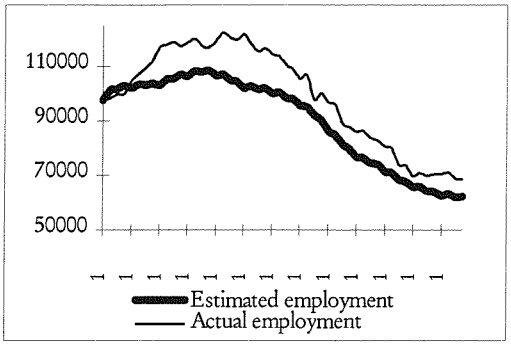


Figure 6.5
Employment 1986-1997
assuming there were no unions
but using actual wages



Finally, considering both the estimated wage level and the change in elasticities, the employment level in 1985-1997 was 24 percent lower than what it would have been if wages had followed the 1975-1984 ARIMA(4,1,0) model and elasticities had been those according to the 1975-1984 labour demand equation. In 1975-1984, on the contrary, if wages had been those predicted by the bargaining model and elasticities had had the values estimated with this same model, then the employment level would have been 1% lower than what it actually was (see Figures 6.6 and 6.7). In summary, unions could have prevented wages to fall as much as they did before 1985 at the cost of a 1% employment loss; while if unions had not been reinstated, employment would have been 24% higher but at the cost of a much lower level of earnings.

Figure 6.6
Employment 1975-1984
assuming the existence of unions

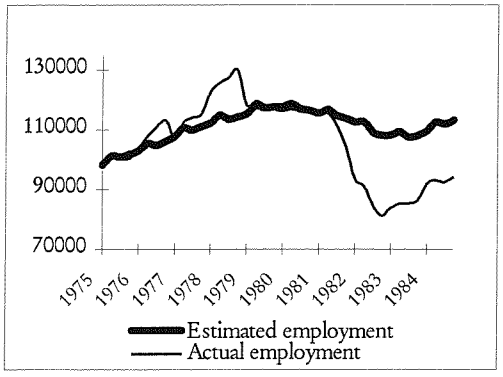
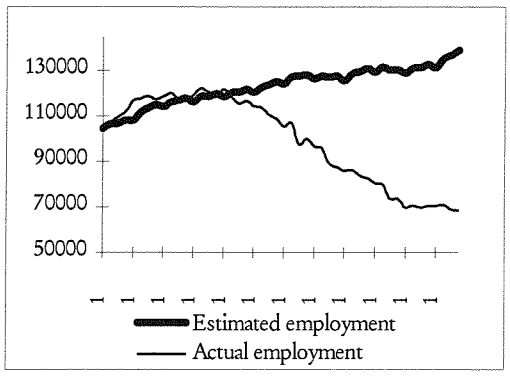


Figure 6.7
Employment 1986-1997
assuming there were no unions



The above figures should be considered only as rough indicators, not only because of the above mentioned assumptions but also because both the ARIMA(4,1,0) model for wages and the model for employment do not take into account the 1993 estimated shifts. Its effect on the simulated paths in 1985-1997 would be to overestimate wages and underestimate employment when using the 1975-1984 model (simulated wage gains and employment losses would be smaller than stated).

All the results discussed above stem from a model for the whole manufacturing sector using industry data, and in which output and wage elasticities of labour demand were assumed to be the same for all industries. A natural question is if this last assumption holds and, if not, if it is biasing the results significantly. To address the issue, all the coefficients were allowed to vary by industry in both sub-periods and the restriction imposed was tested for. In 1975-1984, the hypothesis of common elasticities and speed of adjustment was not rejected. For 1985-1997 the wage elasticity and the lagged employment coefficient were statistically equal among industries, while a unique output elasticity was rejected. Paper and chemicals & oil have significantly smaller elasticities. However, the average elasticity for the manufacturing sector estimated using this model is only slightly higher while the wage elasticity and the parameter accounting for the speed of adjustment do not show important biases[40]. Although such similarity between industries is not expected to hold *a priori*, the statistical result supports the estimation procedure followed using the pooled cross section – time series dataset. Further, the decline in the elasticities holds, no matter the amount in which they decreased might be overstated.

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

[40] Results are available upon request.

contracts, this effect has vanished in some industries while in others it has even become negative. Increased openness also has tempered wage demands by unions.

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

Conclusions

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

Strong evidence of a change in the economic behaviour after 1985 has been reported. Recursive residuals show structural shifts in five of six industries with the shifts coming at about the same time as the regime changes. These breaks are also significant in a model specified in differences using pooled cross section – time series data. Co-integration of employment, output, and labour costs is rejected for the whole period for each industry. Wages are exogenous to employment before 1985, but not afterwards. Based on this evidence, a standard labour demand model for 1975-1984 and a right-to-manage bargaining model for 1985-1997 were estimated. The results showed that the long run wage elasticity of labour demand and the employment-output elasticity fell sharply, while there was no overall change in the amount of time needed for employment to adjust to its equilibrium level.

The bargaining model results indicate that unions significantly raised wages in 1985-1992. Afterwards the change in bargaining structure and increased openness had a pronounced effect on bargaining outcomes. Labour demand shifted to the left from 1993 onwards. The

union wage differential vanished in 1993 in five industries where there were sharp increases in openness and sharp declines in percentage union. Wages in the chemicals & oil industry were not very much affected. Although that industry became more open, it has remained heavily unionised, which is no doubt a consequence of state ownership.

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

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

In the 1990s the end of tripartite bargaining, trade liberalisation, and the recession in Argentina forced unions to make compromises at the bargaining table. Faced with an adverse shift in labour demand, unions reduced their wage demands to preserve jobs. Percentage union declined to 25 percent as many unionised establishments were no longer economically competitive and others were forced to increase productivity to survive.

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

overtime rates. A model including the determination of hours of work could be thus used to analyse the issue thoroughly.

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

It could also be the case that the composition of labour changed in the nineties. The adoption of new technologies forced by increased openness may have generated changes in the ratio of production to non-production workers - or unskilled to skilled labour. This has been thought of as the result of greater ease for substituting domestic labour by foreign labour *via* imported goods (Rodrik, 1997). Greater substitutability of labour, in turn, would weaken trade unions and influence the whole bargaining framework.

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

A first approach to the last issue is carried out in the following chapter. In analysing the collective agreements signed all along the period, evidence was found on unions and firms explicitly including clauses related to job stability in the contracts. In that case the proper models to describe the new setting should include bargaining over employment. Thus, instead of estimating one model allowing for changes in the parameters, two different bargaining models are postulated depending on the time period: a right-to-manage bargaining model for the eighties and a two-stage bargaining model for the nineties. Further, labour is assumed to be heterogeneous, differentiating production from non-production workers in the models and allowing for union effects on the employment mix.

Chapter 7. The outcome of different bargaining models: the effects on wages, employment and the employment mix[41]

Introduction

Previous work on the impact of labour market institutions has shown the significance of unionisation relative to other institutional constraints in order to understand the relevant sources of rigidities in employment, mobility and performance of the Uruguayan labour markets (Cassoni *et al.*, 1995). The response of wages to macroeconomic conditions has also been examined at the macro level concluding that the observed compression and lower response are the consequences of the resumption of collective bargaining (Cassoni *et al.*, 1996).

The analysis for the period 1975-1997 has shown the impact of different institutional and labour relations settings on wages and employment, in a period where unions were banned (1973-84), when they were legalised and there was tripartite bargaining at the industry level with mandatory extension to all firms within the sector (1985-1991), and finally when there was an increased decentralisation and firm-specific bargaining with no enforceability of contracts (starting institutionally in 1992, but observed in 1993). The effects on wages and labour demand were examined for these different periods and the main findings indicate:

- Unions were able to successfully negotiate higher wages for blue-collar workers in the period 1985-1991, with an elasticity of 0.15, calculated at the mean value of union density. As a result, while employment fell, unions were able to protect against job loss by reducing wage elasticities from 0.69 (1973-84) to 0.22 (1985-97). This is concluded after characterising the bargaining framework as a 'right-to-manage' model (Nickell, 1982), which implies that there is no bargaining over employment
- The employment-output elasticity fell by more than 50 percent, from 0.83 to 0.31
- Significantly, no evidence was found indicating that the return of bargaining lengthened the amount of time needed for employment to adjust

[41] I gratefully acknowledge comments from my supervisor John Driffill, as well as from Peter Kuhn, Gastón Labadie and Gustavo Marquez. I want to especially mention Inés Terra, whose advice in all matters linked to the effects of the Mercosur on the different Uruguayan industries was most helpful.

Starting in 1992, there was a change in the bargaining system, with the Government abandoning the tripartite negotiation and relaxing the enforcement of collective agreements at the industry level. At the same time, lower tariffs became actually binding constraints around 1993-94, increasing the exposure of firms to international and regional competition in the Mercosur. As a result, it was observed that many collective agreements explicitly considered employment as part of the negotiations, suggesting that there was a change in the union objective function and the bargaining model to be considered. Using the same 'right-to-manage' model for the whole period, the main results found for blue-collar workers were:

- The union wage differential for blue-collar workers vanished in 1993 in some industries
- Labour demand shifted to the left
- Openness at the industry level has an impact on the wage differential, reducing it

The number of temporal observations when that research was done was scarce to compare the different bargaining regimes. If bargaining over employment started being a common practice after 1993, it might be the case that the impossibility of correctly modelling the new setting stemmed from having observations for only 4 years. Further, no data on non-production workers were available before 1983, so that the models before and after 1985 could only be estimated for production workers. Finally, external shocks and their effects on the bargaining outcome were introduced in a very simple form without differentiating the export and the import substitutive sectors.

Thus, the research summarised in this chapter tries to deepen the previous analysis taking into account the shortcomings above mentioned. A first aim relates to finding statistical evidence supporting what the reading of all collective agreements points at, that is, that bargaining over employment started to be a generalised practice in the Uruguayan manufacturing sector, so that direct union effects on employment should be found in the estimated labour demand function. It is not here intended to test for competing theories on bargaining, as no statistical experiment can provide definite proofs against or in favour of any theory. Further, various statistical proofs could be consistent with different theoretical models, as it was previously discussed in Chapter 6. Direct evidence from the parties bargaining should be seen as the best way to decide which is the suitable theoretical model. In that sense, the collective agreements available can be considered as a good indicator. However, in order to have a more robust argument, based on econometric methods, an

empirical model is specified as a second means of justifying the theoretical models afterwards proposed in order to correctly study the impact of unions on wages and employment, that is, a right-to-manage before 1992 and a recursive or efficient contracts model after that date.

A second aim of the research is to analyse the effects of unions on the relative demand for non-production workers. The change in the competitive pressure faced by manufacturing firms in the nineties as well as in the labour composition of traded goods, might have induced a change in the employment mix used in manufacturing.

Finally, it is here intended to model the effects of openness depending on its being changing import or export shares in the industry, since the nineties was a period of substantial variation in the external conditions with non-negligible effects in the different manufacturing sectors.

Theoretical and empirical models

Union behaviour has been modelled either using the monopoly union model, assuming that unions have the power to impose their preferred wage policy on the firm, which then determines employment from its labour demand curve (see references in Pencavel, 1991) or using a bargaining model. The conceptual issues that bargaining models pose are related to:

1. What do the parties bargain over - wages, employment, other issues?
2. What are the union preferences or objective function?
3. Is bargaining a sequential process -taking place over wages first and then over labour- or is it done over wages and employment at the same time?

The right-to-manage model must be specified whenever the level of employment is unilaterally decided at the firm after wages have been bargained over. This model is particularly appealing when negotiations over wages take place at the industry level, since it is difficult that the level of employment can 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 employment stability is explicitly included in the bargaining agenda, a recursive or efficient contracts model is more adequate. Thus, from a theoretical point of view one should analyse the Uruguayan experience specifying two different bargaining models depending on the time period.

The analysis of the contents of a high proportion of the collective agreements signed along 1985-1999 also supports the hypothesis. If there was any negotiation on employment in the first sub-period, this was likely to have taken place at the firm level, after bargaining over the wage. However, these arrangements, if they existed, were not subject to observation. In the nineties, on the other hand, many contracts did include job stability clauses, mechanisms to rotate in the unemployment insurance system; agreed ways of introducing new technologies. Further, a especial purpose survey carried out in 1996 also reveals workers in many firms were covered by firm-level agreements and that employment clauses were included in them[42]. While 52% of firms did not have any sort of collective agreements, workers in 7% of them were covered by both firm and industry level contracts. On the other hand, 15% of firms had only signed firm-level agreements with their workers, the percentage increasing to 23% if large firms only are considered. Clauses related to employment are found in 15% of those firms with firm-level collective agreements.

In spite of all of the above supporting the use of different bargaining models, indirect empirical evidence on the appropriateness of them is also here analysed. Following the strategy proposed by Boal and Pencavel (1994), a model for the whole period is firstly estimated, avoiding the specification of a bargaining model and just including union effects on both the wage and the labour demand equations.

The model for the whole period: 1985-1999

The main assumption used by Boal and Pencavel (1994) is that both union and non-union firms define employment and wages using the same functional form, but possibly with different parameters. In order to do so, they specify a wage and a labour demand equation including a binary variable that is equal to 1 if workers in the firm are unionised and zero otherwise, that in turn interacts with all the parameters. Statistical significance of the interactions is taken as evidence of direct influence of unions on wages and employment. On the other hand, if the coefficients were statistically equal to zero in the model for employment and different from zero in those for the wage, then unions would have an impact on

[42] The Survey 'Strategies and employment policy of manufacturing firms' was carried out by the Department of Economics at the Social Sciences Faculty of the University of Uruguay. The sample used was very similar to that used by those generating official statistics, so that its results are consistent with the data here analysed.

employment only indirectly, *via* the wage elasticity of labour demand. Wage and employment gaps are afterwards calculated using the estimated parameters of the model.

It has been widely demonstrated by now that these statistical tests cannot be conclusive. Thus the exercise only attempts to find further support for the specification of two different bargaining models in the Uruguayan case. The inclusion/exclusion of variables such as the alternative wage or union density in the employment equation need not be incompatible with a right-to-manage model (see for example the discussions done on the subject by Pencavel, 1991; or Booth, 1995). Further, Carruth and Oswald (1987) and Oswald (1993) have demonstrated that the contract curve may lie on the labour demand curve under certain circumstances.

Let L be total employment, which in turn is divided in production and non-production workers (L_p and L_{np}, respectively). A standard labour demand function would have employment dependant on output (q) and the price of labour (w) relative to the product price (pp), while the distribution of jobs among production and non-production workers will depend on their relative wages (w_p - w_{np}), which can be expressed in natural logs as:

$$L = \beta_0 + \beta_1(w\text{-}pp) + \beta_2 q \qquad (1)$$

$$L_{np} - L_p = \beta_3 + \beta_4(w_{np} - w_p) \qquad (2)$$

Labour supply, on the other hand, depends on the wage level relative to the price of consumption goods (cp) and on the reservation wage (w^r):

$$L = \alpha_0 + \alpha_1(w\text{-}cp) + \alpha_2(w^r\text{-}cp) \qquad (3)$$

Solving for the wage using equations (1) and (3) the wage equation in logs is:

$$w\text{-}pp = \gamma_0 + \gamma_1(pp\text{-}cp) + \gamma_2(w^r\text{-}cp) \qquad (4)$$

The parameters defining the above equations however could be different depending on the extent of unionisation; the structure of bargaining; and/or union bargaining power. Further, the equations themselves may include other variables that would account for market

conditions and observable characteristics of the industrial sectors (vector **X**). Hence, the system can be restated as:

$$L = (b_{00} + b_{01}U) + (b_{10} + b_{11}U)(w\text{-}pp) + (b_{20} + b_{21}U)q + (\mathbf{b}_{30} + \mathbf{b}_{31}U)\mathbf{X} \quad (5)$$

$$L_{np} - L_p = (b_{40} + b_{41}U) + (b_{50} + b_{51}U)(w_{np} - w_p) + (\mathbf{b}_{60} + \mathbf{b}_{61}U)\mathbf{X} \quad (6)$$

$$w\text{-}pp = (b_{70}+b_{71}U) + (b_{80}+b_{81}U)(pp\text{-}cp) + (b_{90}+b_{91}U)(w^r\text{-}cp)+(\mathbf{b}_{100} + \mathbf{b}_{101}U)\mathbf{X} \quad (7)$$

U reflects union effects, so that statistically insignificant coefficients for the union variables in equations (5) and (6) would imply they have no direct effect on employment and/or the employment composition.

Given the institutional changes that took place at the beginning of the nineties, interactions with temporal binary variables will also be included in order to study the existence of changes in the underlying bargaining models in the early nineties.

There are not non-union industries in Uruguay since 1985. However, the extent of unionisation does vary by industry and in time. Hence, wage gaps can be easily calculated following Boal and Pencavel's methodology with slight modifications. First, the different gaps (employment, employment composition, and wage) have to be calculated at the mean value of union (U_M) for each industry. Second, it has to be assumed that there are no differences in all variables, except for the wage and the employment mix, between union and non-union sectors[43]. The gaps are defined according to:

$$\Delta L = b_{01}U_M + b_{11}U_M\,(w\text{-}pp)_{NU} + (b_{10} + b_{11}U_M)\Delta(w\text{-}pp) + b_{21}U_M q + \mathbf{b}_{31}U_M\mathbf{X}$$

$$\Delta L_{np/p} = b_{41}U_M + b_{51}U_M\,(w_{np}\text{-}w_p) + \mathbf{b}_{61}U_M\mathbf{X}$$

$$\Delta w = b_{71}U_M + b_{81}U_M\,(pp\text{-}cp) + b_{91}U_M\,(w^r\text{-}cp) + \mathbf{b}_{101}U_M\mathbf{X}$$

[43] Non-union wages are union wages minus the estimated wage gap: $(w\text{-}pp)_{NU} = (w\text{-}pp)_U - \Delta w$. The composition of the labour input for non-union sectors is calculated analogously.

The model for the first sub-period: 1985-1991

The model postulated for the first sub-period implies that in a first stage employers and workers bargain over the wage level. Once the wage is set, the firm decides the level of employment according to its labour demand function. Firms are assumed to use a technology with two inputs, capital and labour. Maximisation of profits thus yields a two-equations system of derived demands, given the price of inputs and other observable characteristics of the industries and the markets they operate in. Labour is not homogeneous and can be classified in two categories: according to the worker being directly involved in production or not (production and non-production workers). Hence, given total employment, the adequate mix between blue and white-collar workers is decided depending on the relative wage of both categories. In bargaining, unions do not differentiate among production and non-production workers but negotiate a common wage increase for all workers. However, relative wages may change, as managers may prefer to increase them above the minimum set at the negotiation table. Further, they might also substitute one type of worker by the other depending on the characteristics of the market the firm operates in or the external shocks that take place. These effects are included in the relative demand for production and non-production workers. Therefore, the estimable model, with variables measured in natural logs, is:

$$K = \alpha_0 + \alpha_1(p_c\text{-}pp) + \alpha_2 q + \alpha_3 \mathbf{X} \qquad (8)$$

$$L = \beta_0 + \beta_1(w\text{-}pp) + \beta_2 q + \beta_3 \mathbf{X} \qquad (9)$$

$$L_{np} - L_p = \beta_4 + \beta_5(w_{np} - w_p) + \beta_6 \mathbf{X} \qquad (10)$$

Where K accounts for capital services; q is value added; L is total employment; L_{np} refers to non-production workers; L_p refers to production workers; **X** is a vector of variables accounting for market conditions; while $(p_c\text{-}pp)$, $(w\text{-}pp)$, $(w_{np}\text{-}pp)$ and $(w_p\text{-}pp)$ are the prices of capital services, labour, non-production and production workers, respectively, relative to the product price, pp.

The utility function of unions is derived form a median voter framework, assuming that they maximise 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. The utility function of unions is, thus:

$$\Gamma(w, w^a, cp, cp_{-1}, L) = [(w/cp) - (w^a/cp)_{-1})]L^{\phi}$$

Where cp is the consumption price and ϕ is a parameter reflecting the weight given to employment in the union utility function[44]. The generalized Nash bargaining can be stated as:

$$\underset{w}{\text{Max}}\ Y = (\Gamma-\Gamma_0)^{\alpha}(\Pi-\Pi_0)^{1-\alpha}$$
$$\text{s. to} \quad L = L^*$$

Where Γ and Π are the utility functions of unions and employers, respectively; L^* is the optimum level of employment as determined by equation (9); Γ_0 and Π_0 are the fall-back positions of each player, which are assumed to be zero; and α is the bargaining power of unions.

Subject to the assumption that the capital level is given, once bargaining over the wage and labour demand occur, the solution to the Nash bargain yields an equation for the average wage level as follows:

$$(w/pp)^* = \eta(\mathbf{X},\mathbf{U}, \phi)f[(w^a/cp)_{-1}, pp/cp)] \qquad (11)$$

Where $\eta(\mathbf{X},\mathbf{U},\phi)$, the mark-up over the alternative income, is a function of the bargaining power of the union, which in turn depends on market conditions (**X**) such as the exposure of firms to competition or the occurrence of external shocks; the union's affiliation rate and the extent of firm-level bargaining as measures of union strength (**U**). It also depends on the weight given to employment in the union objective function (ϕ). The assumed changes in the mark-up when these variables and parameters vary are:

$$\partial\eta/\partial\alpha > 0 \quad \partial\alpha/\partial\mathbf{U} > 0 \quad \partial\alpha/\partial\mathbf{X} \leq 0 \qquad \text{so that:}$$
$$\partial\eta/\partial\mathbf{U} > 0 \quad \partial\eta/\partial\mathbf{X} \leq 0 \quad \partial\eta/\partial\phi \leq 0$$

Given unions care about the real wage in terms of consumption goods while firms are interested in the cost of labour relative to the price of their products, the wedge between those

[44]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_{-1}).

two prices will also enter the wage equation. No data on capital services are available. Thus, the model to be estimated over the 1985-1991 sub-period is the 3-equations system (9) to (11). The exclusion of equation (8), however, will generate simultaneity bias of unknown size[45].

The model for the second sub-period: 1992-1999

The evidence stemming from the collective agreements signed in the 1992-1999 sub-period shows bargaining also took place over employment. One specification that takes this fact into account is the recursive contracts model. The generalized Nash bargain is stated as:

$$\underset{w}{\text{Max}}\ Y = (\Gamma-\Gamma_0)^{\alpha}(\Pi-\Pi_0)^{1-\alpha}$$

$$\text{s.to}\ \ L = L^{*}$$

Where L^{*} is determined according to:

$$\underset{L}{\text{Max}}\ Z = (\Gamma-\Gamma_0)^{\beta}(\Pi-\Pi_0)^{1-\beta}$$

The parameters α and β reflect the bargaining power of the union in wage and employment negotiations respectively. They are here assumed to be a function of union density and the structure of bargaining (the extent of coverage of firm-level agreements).

Solving the maximisation problem yields the following system of equations:

$$L = f[(w-pp), (w^{a}-cp)_{-1}, (pp-cp), q, \mathbf{X}, \mathbf{U}, \phi] \qquad (12)$$

$$w-pp = g(\mathbf{X}, \mathbf{U}, \phi, (w^{a}-cp)_{-1}, (pp-cp)] \qquad (13)$$

$$L_{np} - L_{p} = h[\mathbf{X}, \mathbf{U}, (w_{np}-w_{p})] \qquad (14)$$

The employment level will be on the contract curve whenever the bargaining power of unions when negotiating wages and employment is the same, if no uncertainty on the future state of nature is assumed. It will be nearest to its value according to the labour demand function the lowest the union bargaining power over employment (β). The effect of union density on

[45] Since a variable accounting for the difference between product and consumption prices is included, and product prices partially incorporate the price of capital, the biases are expected to be small.

bargaining power in both stages is positive and that of external conditions negative as before. However, increases in α and β will not necessarily generate increases in wages and employment (Manning, 1987). It all depends on the differences between them and also on the weight given to employment in the union objective function. On the other hand, the more the concern of unions about job stability, the lower the wage level and the higher the employment level bargained.

Special care has to be taken regarding some specific issues in estimating the above models. First, endogeneity of output has already been proved in previous research for the Uruguayan manufacturing sector, so the variable has to be properly instrumented. Some of the variables that model external shocks for each industry might be endogenous too, as is the case of import penetration or export share. Second, the models specified impose that parameters are the same for the six manufacturing industries and in time. The restrictions are strong and thus should be thoroughly tested for.

The data

The units of observation are the 2-digit manufacturing industries along 1985-1999, on a quarterly basis. Only six out of eight are used, due to data availability in the period 1985-1999: food, beverage & tobacco; textiles & leather; paper; chemicals & oil products; non-metallic minerals; and metal products. Descriptive statistics of the variables involved are shown in Table 7.1 below.

The estimated models use data on output, number of workers –production and non-production workers- and wages that stem from the Quarterly and Annual Industrial Surveys (National Institute of Statistics-INE). The Quarterly Survey publishes indexes while yearly the Annual Survey reports values. Both sources are used to build quarterly time series of values for the above variables, referring to monthly values calculated as an average on a quarterly basis. Data on product prices refer to the PPI at the 2-digit level (INE).

A cost of labour variable is used instead of wages. It is built adding all non-wage costs – legal and bargained - to the wage. Data on non-wage costs were taken from Picardo *et al.* (1997) and from Cassoni and Ferre (1997). Information on bargained non-wage costs stem from the manufacturing collective agreements signed between 1985 and 1999.

Table 7.1 Descriptive statistics of selected variables by industry 1985 – 1999

Industry	Union density	%workers covered by firm-level bargaining	Exports/ Sales	Imports/ Consum.	Relative prices Uruguay-R of W	Exports + Imports/ GDP Economy	Equival. tariff
Total Manufacturing	0.3322	0.0534	0.2450	0.3957	0.9321	0.6530	0.8100
	(0.171)	(0.093)	(0.034)	(0.126)	(0.244)	(0.142)	(0.188)
Food, Beverage & Tobacco	0.3401	0.0482	0.2564	0.0934	0.9066	0.6530	0.8100
	(0.096)	(0.070)	(0.038)	(0.050)	(0.238)	(0.142)	(0.188)
Textiles & Leather	0.3314	0.0403	0.567)	0.3615	0.9540	0.6530	0.8100
	(0.160)	(0.060)	(0.095)	(0.217)	(0.303)	(0.142)	(0.188)
Paper	0.3230	0.1069	0.0991	0.2685	0.8870	0.6530	0.8100
	(0.059)	(0.100)	(0.035)	(0.097)	(0.171)	(0.142)	(0.188)
Chemicals & oil	0.5772	0.0265	0.1216	0.4082	0.9781	0.6530	0.8100
	(0.055)	(0.027)	(0.061)	(0.115)	(0.259)	(0.142)	(0.188)
Non-metallic minerals	0.1377	0.0937	0.1340	0.2775	0.8342	0.6530	0.8100
	(0.088)	(0.159)	(0.035)	(0.124)	(0.281)	(0.142)	(0.188)
Metal products	0.2837	0.0048	0.0854	0.7443	1.0328	0.6530	0.8100
	(0.164)	(0.011)	(0.054)	(0.166)	(0.114)	(0.142)	(0.188)

	Employ-ment	Blue/white collars	Wage level	Relative wage blue/white -collars	Alternat. wage	Price wedge	GDP
Total Manufacturing	4.2010	0.4820	2.2334	-0.2132	1.8199	-0.0974	1.3432
	(0.313)	(0.158)	(0.157)	(0.057)	(0.040)	(0103)	(0.353)
Food, Beverage & Tobacco	4.6404	0.4901	2.1623	-0.2125	1.8101	-0.0561	1.8040
	(0.064)	(0.048)	(0.099)	(0.021)	(0.029)	(0.059)	(0.056)
Textiles & Leather	4.4987	0.7308	2.1353	-0.2899	1.7878	-0.1232	1.4748
	(0.153)	(0.042)	(0.113)	(0.034)	(0.031)	(0.121)	(0.088)
Paper	3.9317	0.3262	2.300	-0.1396	1.8312	-0.1208	1.0033
	(0.081)	(0.044)	(0.141)	(0.033)	(0.034)	(0.084)	(0.053)
Chemicals & oil	4.1610	0.2829	2.413	-0.2026	1.8691	-0.1051	1.6645
	(0.095)	(0.040)	(0.768)	(0.022)	(0.034)	(0.116)	(0.088)
Non-metallic minerals	3.7905	0.5691	2.1708	-0.2420	1.8130	-0.0596	0.8391
	(0.091)	(0.082)	(0.109)	(0.037)	(0.026)	(0.094)	(0.071)
Metal products	4.1875	0.4929	2.2181	-0.1927	1.8079	-0.1200	1.2734
	(0.107)	(0.040)	(0.111)	(0.049)	(0.029)	(0.110)	(0.113)

Notes: Mean values are reported, with standard deviation in brackets below. Variables in logs are employment, wages, relative wages blue/white-collar workers, alternative wage, price wedge (production/consumption price indexes) and GDP. All other variables are percentages.
Sources: National Institute of Statistics; Central Bank of Uruguay; Customs Office.

Union density is defined as the affiliation rate, by industry. The time series is built using data on membership reported by the central union (PIT-CNT) in each congress and of total

employment (production and non-production workers) yearly. These congresses took place in 1985, 1987, 1990, 1993 and 1996-97. No data on membership are available by occupational category. Thus, it is not possible to calculate union density for production and non-production workers separately.

A variable accounting for the extent of firm-level bargaining is also built. It is calculated as the ratio of number of workers in firms that signed firm-level contracts each year (according to the collective agreements analysed) over total workers in the industry. This was done using data on employment of individual establishments as stemming from the Annual Industrial Survey in the nineties.

External shocks are measured as the relative exposure of the industry to foreign competition both locally and internationally. Two types are here considered trying to differentiate overall external shocks from those specific to each 2-digit industry. Overall openness has been proxied in the literature using various indicators. There are two broad categories that refer either to the economic results or to the direct incidence of trade policy. Among the former group there is still another classification: measures accounting for the results of trade liberalisation on the amount of production subject to trade; and those reflecting the level of price distortion. A known criticism that has to be overcome if indicators based on quantities are used 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. Secondly, the relative size of the tradable sector will also generate biases (Low, Olarreaga and Suarez, 1999). One of the most popular indicators for degree of openness based on price distortions is the ratio of the local price of tradables relative to the international price (Dollar index). However, its use has been extensively criticised as it reflects at the same time other phenomena related to the trade policy being export or import oriented (Rodrik and Rodriguez, 1999). Berlinski (2000) proposed an alternative measure based on the 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 the local trade policy. The trade policy measure includes both taxes and other protection barriers, so that all sources of distortions are included in the indicator. Vaillant (2000) has calculated the time series of the implicit 'equivalent tariff' for

Uruguay and shown that its evolution is very similar to the indicators of openness based on quantities following the methodology as proposed by Low *et al.* (1999)[46].

Regarding industry-specific external shocks the indicator based on quantities is defined as the ratio of imports plus exports over gross production in constant prices. Alternatively, one could try to measure separately the impact of increases in exports and in imports on the performance of the different manufacturing sectors. Two variables can be built: the share of exports in total sales and the share of imports in total consumption, generally known as import penetration. Consumption of goods should include both national and foreign goods, so that it is defined as GDP minus exports plus imports. An indicator based on relative prices is also built. It is defined as the ratio of local relative prices times the exchange rate to international relative prices. Relative prices are the production price of goods (PPI) of each sector divided by an implicit deflator of non-tradables goods (goods from all sectors except manufacturing, fishing, agriculture and leverage).

The bargaining models to be used assume that unions negotiate to get the highest possible 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 is defined as the weighted average of what the worker would earn if hired in the manufacturing sector in order to account for his/her specific skills (which is proxied by the average wage in manufacturing excluding that of the specific sector); the income the worker would receive if he/she becomes unemployed and collects unemployment benefits (50% of his/her last wage received); and the average income 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. The latter is calculated using information from the Household Survey, as well as the weights, that are being defined as the annual frequency of each category. The relevant measure to be considered when bargaining takes place is not the current alternative income, which is further not known, but that prevailing in the previous time period.

[46] 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' (τ_t), the 'equivalent' tariff τ_t is equal to $[(1+\tau_0)/rp_t]-1$.

Results for the whole period

Equations (5) to (7) were estimated by the method of Instrumental Variables using PcGive (1998). Given that the structure of bargaining changed in 1992, temporal stability of the parameters was tested for and resulted statistically significant in many cases. Differences by industry were also found in the parameter measuring direct union effects. Fixed effects by industry were included. Further, fixed effects were found to vary at the beginning of the nineties in the equation describing employment composition, so they were accounted for using dummy variables.

Regarding the variables included to model specific characteristics of the industries, the indicators of overall and sectoral degree of openness based on prices above described were used for the sake of simplicity, given the aim of this exercise. The strategy implies that no difference is here analysed between the effects of competitive pressure in local and international markets. The wage equation includes the employment mix as a predetermined variable so as to account for possible differences in the average wage due to labour composition (white-collars earn generally more than twice the wage of blue-collars).

The models were initially estimated allowing for 4 lags of each variable and were afterwards reduced sequentially. Table A7.1 in the appendix summarises the results of estimation for the three equations while Table 7.2 displays the results relative to the existence of union effects.

No union direct effects are found on employment or on the composition of employment up to 1993. Further, coefficients for all variables interacting with union density are statistically zero. However, after 1993 some of them are found to be statistically significant. Further, there is evidence of unions having an indirect effect on employment *via* reducing the elasticity of substitution between capital and labour since 1993. Regarding the wage equation union effects, both direct and indirect, are found to be present all along the period, but changes are also found at the beginning of the nineties.

Using the estimated coefficients, the effects of unions on the different variables of interest can be calculated comparing their estimated value if unionisation had been zero with that resulting from union density being the observed mean value of the variable 'Union'. Thus, the estimators of all parameters multiplying the union density variable and its interactions

with all others are used, when statistically significant, to calculate the diverse gaps, as derived earlier in the paper.

Table 7.2 Estimated union effects 1985 - 1999

	Employment Composition	*Wage Level*	*Employment Level*
Union density	-0.0265 (0.170)	7.2961 (3.248)	-0.4293 (0.319)
Industry 31 * Union	-0.4749 (0.285)	0.1733 (0.138)	_____
Industry 32 * Union	0.0178 (0.078)	1.2924 (0.566)	_____
Industry 34 * Union	-0.0166 (0.113)	-1.4731 (0.583)	_____
Industry 35 * Union	-0.0973 (0.143)	-0.7833 (0.417)	_____
Industry 36 * Union	-0.1289 (0.102)	0.4738 (0.225)	_____
Relative wage blue-white * Union	-0.5802 (0.409)	_____	_____
Wedge * Union	_____	-0.0615 (0.556)	_____
Wedge 4 lags * Union	_____	-0.5609 (0.352)	_____
Alternative wage * Union	_____	-2.2747 (1.141)	_____
Employment composition * Union	_____	-5.2711 (2.273)	_____
Product demand * Union	_____	_____	-0.0400 (0.055)
Wage level * Union	_____	_____	0.1483 (0.128)
Rel. prices Uruguay/Rest World * Union	-0.0097 (0.101)	0.0206 (0.211)	0.0614 (0.042)
Equivalent tariff * Union	-0.1430 (0.113)	-0.4840 (0.238)	0.0397 (0.066)
Dependent variable 1 lag * Union	-0.1159 (0.108)	0.0468 (0.039)	0.0010 (0.010)
Dependent variable 2 lags * Union	0.0822 (0.110)	_____	0.0022 (0.009)
Dependent variable 3 lags * Union	0.1258 (0.081)	_____	0.0069 (0.007)
Dummy 1993 * Union	0.0061 (0.256)	-2.7160 (1.458)	-0.2094 (0.225)
Industry 31* Union * Dummy 1993	0.5619 (0.345)	_____	0.0190 (0.059)
Industry 32* Union * Dummy 1993	-0.1119 (0.156)	_____	-0.1820 (0.053)
Industry 34* Union * Dummy 1993	0.3970 (0.220)	_____	0.0580 (0.060)
Industry 35* Union * Dummy 1993	0.1940 (0.243)	_____	0.1199 (0.051)
Industry 36* Union * Dummy 1993	-2.8014 (0.426)	_____	-0.2880 (0.110)
Rel.wage blue-white * Union*Dummy 1993	0.2839 (0.497)	_____	_____
Wedge * Union * Dummy 1993	_____	2.9352 (1.155)	_____
Wedge 4 lags * Union * Dummy 1993	_____	0.4494 (0.363)	_____
Alternative wage * Union * Dummy 1993	_____	2.0044 (0.856)	_____
Employment composition * Union	_____	0.1544 (0.289)	_____
Product demand * Union * Dummy 1993	_____	_____	-0.0569 (0.097)
Wage level * Union* Dummy 1993	_____	_____	0.4718 (0.162)
Rel.prices Uru/R of W*Union*Dummy 1993	-0.0186 (0.183)	-0.9085 (0.378)	0.0442 (0.100)
Equivalent tariff * Union * Dummy 1993	0.1316 (0.124)	0.0563 (0.202)	0.0081 (0.072)
Dependent var. 1 lag*Union*Dummy 1993	0.0368 (0.106)	0.0435 (0.148)	0.0017 (0.007)
Dependent var. 2 lags*Union*Dummy 1993	-0.0670 (0.108)	_____	-0.0007 (0.007)
Dependent var. 3 lags*Union*Dummy 1993	0.0487 (0.086)	_____	-0.0005 (0.005)

Note: Industries are: food, beverage & tobacco (31); textiles & leather (32); paper (34); chemicals & oil (35); non-metallic minerals (36); metal products (38). Heteroskedasticity consistent standard errors (White, 1980) are in parenthesis besides each estimated coefficient.

Since union differentials are calculated at the mean value of membership, their value varies by industry when the estimated coefficients are found to be statistically different in the cross section. These, in turn, are used to calculate the average gap for the whole manufacturing

sector, as reported in Table 7.3. In the eighties, on average, the union/non-union wage differential is 21%. That is, de-unionisation in manufacturing would have implied that wages were 21% lower than what they actually were (implying an elasticity of 0.04). Since no effects of union on labour demand were found, the employment differential is –0.22 (that is, the wage effect times the wage elasticity of labour demand). Regarding the employment mix, union action was also found to be inexistent.

Table 7.3 Estimated gaps

	1985 - 1992	1993 - 1999
Employment mix	0	-3%
Wage level	21%	6%
Employment level	-22%	362%

Source: Table A7.1 in the appendix

In the nineties, on the other hand, union effects are found on the three variables under analysis. The estimated gap for the employment mix is –3%. In reducing the ratio of blue to white-collar workers, unions also increase the average wage (given the variable is statistically significant in the wage equation). However, other indirect effects and unions' direct effects on the wage level determine that the wage differential in the nineties is lower than before (6%). Regarding the employment gap, its estimated magnitude is too large, however signalling at positive union effects on employment. This is possibly due to the fact that there are too many sources of variation that are not properly accounted for in this simple model.

These results do support the existence of union effects in the Uruguayan case that varied in the early nineties. They could just be taken as revealing a change in union impact on the labour market outcomes along the period. However, the reading of the collective agreements showed that the items included in the bargaining agenda also changed in the nineties, including employment as a bargaining issue. This, together with the econometric results here described, is considered to strongly suggest that the specification of two different bargaining models - one for the eighties and one for the nineties – is in place. Further, the generalisation of decentralised bargaining also indicates that the proposed models for the nineties should be specified taking this fact into account. As a first approach, however, this will be done in a very simple way, by including a variable reflecting the extent of firm-level bargaining as measured by the percentage of workers covered by them in each industry.

Results for the right-to-manage model: 1985-1992

The specification of the model follows equations (9) to (11). The estimation method used is Instrumental Variables for each equation. Variables accounting for external shocks are the indicators measured in quantities as described above. The ratio of imports and exports over GDP for the whole economy is used to measure overall external shocks while import penetration and exports share by industry are included to model competitive pressure on firms at the sectoral level. The latter two variables are possibly endogenous to the model. Hence the relative price Uruguay - Rest of the world is used as an instrument for both variables, following the proposal in Abowd and Allain (1996). The equivalent tariff is used as an instrument for the overall degree of openness, in spite of endogeneity of an economy wide measure being more dubious than that of the other two variables. The methodology followed consisted in specifying first an econometrically correct dynamic version of the models with fixed effects by industry and an adequate set of instruments, starting with 4 lags for all variables except those that are used as additional controls (unionisation, external shocks). All control variables are included in the initial specification. In a second stage, the dynamics were reduced and afterwards differences by industry in the estimated parameters were tested for and included in the model when statistically significant. The fourth step consisted in eliminating the control variables that were not significant so as to avoid possible collinearity, especially among those related to competitive pressure. The final specifications are summarized in Table 7.4[47]. The results are consistent with those stemming from equations (5) to (7) in the previous sub-section, in terms of the direction of the union effect, although the magnitude of the gap is smaller.

The models show stability in the cross-section and in time. The homogeneity of the effect of unions on wages among industries reflects the fact that bargaining was quite synchronised and co-ordinated in the period. The estimated impact of union action on the average wage level is such that complete unionisation in the period would have generated a 7% increase in wages, evaluated at the mean value of union density (40%). This figure is smaller than that found for blue-collar workers (22%) implying that one of the consequences of union action was to increase the relative price of blue-collar workers with respect to the less unionised white-collar workers. The result is consistent with unions reducing wage differentials and inducing higher levels of substitution than would have taken place otherwise. Finally, the

[47] The output of the initial estimated equations is included in Table A7.2 in the appendix.

estimated effect of union action on employment, *via* the wage elasticity of labour demand, was to lower employment in –0.5% *per* each 10 percentage points increase in membership. Given the mean value of union density in the period, full unionisation would have meant a 3% decrease in labour demand[48].

Table 7.4 Estimated models 1985 - 1992

(long-run coefficients)

	Employment Composition	**Wage Level**	**Employment Level**
Imports/Consumption	-0.4715 (0.302)	0	0
Export share (industry)	0	0	0
Openness (economy)	0.6105 (0.288)	0.4269 (0.115)	0
Union density	____	0.1085 (0.044)	____
Relative wage blue/white-collars	-1.4393 (0.266)	____	____
Blue/white-collars	____	-0.2447 (0.077)	____
Wedge	____	-0.7655 (0.170)	____
Alternative wage	____	0.4037 (0.169)	____
GDP	____	____	0.4677 (0.245)
Wage	____	____	-0.4245 (0.134)
Number of observations (T)	174	162	162
Sample	1985.4-1992.4	1986.2-1992.4	1986.2-1992.4
Sargan test of over-identifying restrictions $\chi 2$(n°over-id.instruments)	1.41e-006 [0.9991]	7.5074 [0.0234]*	19.483 [0.0214]*
Normality test (Jarque-Bera) $\chi 2$ (2)	58.205 [0.0000]**	1.2738 [0.5289]	18.395 [0.0001]**
Heteroskedasticity F[m, T-m] m = n° restrictions	1.7027 [0.0453]*	1.4413 [0.1025]	2.4004 [0.0050]**
Autocorrelation order 2 $\chi 2$ (2)	2.2196 [0.3296]	3.1614 [0.2058]	0.1973 [0.9061]
Testing all coefficients = 0 $\chi 2$ (k) k = n° predetermined vars.	5430.1 [0.000]**	3364.8 [0.000]**	67046 [0.000]**
Instruments used	Relative price Uruguay- Rest of the world Equivalent tariff	Employment mix lagged; Relative wage blue/white-collars; Equivalent tariff	Employment mix lagged; Relative wage blue/white-collars; Union; Alternative wage; Wage lagged; Wedge; GDP lagged

Note: The equations include binary variables by industry and *per* quarter. Standard errors are in parenthesis besides the estimates (heteroskedastic consistent standard errors in the employment equation). Tests statistics are reported with p-values in parenthesis below. A '*' means the hypothesis is rejected at 95% confidence while if '**' it is so at 99% confidence.

[48] Given the estimated elasticity, de-unionisation in the period would have meant a wage gap of 4.5% that, in turn, would have generated an employment gap of around -2%.

Bargaining at the firm level was not a generalised practice in the period (only 1% of workers were covered by these contracts on average). However, the variable was included and no statistically significant effect was detected by the data.

External shocks had an effect only on the wage level and the employment mix. The overall increased openness of the economy promoted wage inflation, as it allowed the economy to grow based on exports of primary and manufacturing goods to a protected regional market (under regional agreements as CAUCE and PEC), in which wage increases could still be passed on to consumer prices. The effect is however reduced since it also promoted a more intensive use of non-production workers. Increases in sectoral import penetration, on the other hand, generated the opposite, thus also pushing up average wages *via* the labour composition effect.

Consistent with previous findings, the elasticity of substitution between capital and labour is below 1, and so is the output elasticity of labour demand. The partial elasticity of substitution between blue and white-collar workers is large (-1.43, statistically equal to 1 at the 95% confidence), indicating that firms were able to adjust their labour mix to changes in relative pay without much resistance from trade unions. The result is not unexpected if trade unions are not concerned about employment.

Results using a recursive contracts model: 1992-1999

The model for this sub-period is that stated in equations (12) to (14). The Instrumental Variables method was used and the methodology followed was analogous to that stated in the previous section. Results for the initial models are listed in the appendix (Table A7.3) while the estimated parameters of the final equations are summarised in Table 7.5.

The estimated equations are not stable anymore in the cross-section. Union direct effects vary by industry in all models. Further, in the model describing the composition of employment the impact of import penetration is also different depending on the manufacturing sector. The result can be associated to two phenomena. Firstly, bargaining stopped being a co-ordinated process, with trade unions becoming a lot more independent from each other and less linked to the central union. Secondly, increased openness and especially import penetration meant different challenges for the diverse manufacturing activities.

Table 7.5 Estimated models 1992 - 1999

(long-run coefficients)

	Employment Composition	Wage Level	Employment Level
Imports/Consumption (industry)	___	0	-1.109 (0.392)
Imports/Consumption*Ind.31	-2.914 (4.476)	___	___
Imports/Consumption*Ind.32	-1.639 (0.797)	___	___
Imports/Consumption*Ind.34	-10.656 (4.192)	___	___
Imports/Consumption*Ind.35	1.007 (3.608)	___	___
Imports/Consumption*Ind.36	1.554 (1.285)	___	___
Imports/Consumption*Ind.38	-14.34 (4.056)	___	___
Imp./Cons*Union density	___	0	1.787 (0.787)
Imp./Cons*Union density*Ind.31	9.745 (18.74)	___	___
Imp./Cons*Union density*Ind.32	6.525 (4.050)	___	___
Imp./Cons*Union density*Ind.34	38.81 (14.77)	___	___
Imp./Cons*Union density*Ind.35	-1.610 (6.494)	___	___
Imp./Cons*Union density*Ind.36	-27.01 (15.69)	___	___
Imp./Cons*Union density*Ind.38	65.52 (19.12)	___	___
Export share (industry)	0	-1.371 (0.576)	0
Export share * Union density	0	4.488 (1.986)	0
Union density*Ind.31	-1.450 (2.428)	-4.028 (2.045)	1.0446 (0.829)
Union density*Ind.32	-3.760 (2.136)	-6.435 (3.546)	0.3916 (0.899)
Union density*Ind.34	-12.88 (5.149)	-2.472 (1.396)	-0.1934 (0.660)
Union density*Ind.35	0.6763 (3.239)	-2.808 (1.532)	0.5266 (0.941)
Union density*Ind.36	8.990 (6.942)	-3.104 (2.713)	-1.7884 (0.955)
Union density*Ind.38	-60.05 (17.49)	-2.830 (1.722)	-0.6964 (1.116)
Relative wage blue/white-collars	-1.462 (0.302)	___	___
Blue/white-collars	___	-0.694 (0.617)	___
Blue/white-collars*Union density	___	5.234 (3.280)	___
Wedge	___	-1.880 (0.433)	0
Alternative wage	___	0.980(0.243)	0.3402 (0.156)
GDP	___	___	0.3147 (0.174)
GDP*Union density	___	___	-0.6866 (0.431)
Wage	___	___	-0.3885 (0.157)
%Workers covered by firm-level agree.	-0.0671 (0.080)	___	___
%Workers covered by fla * Ind.31	___	-0.213 (0.125)	-0.124 (0.130)
%Workers covered by fla * Ind.32	___	0.013 (0.100)	1.031 (0.461)
%Workers covered by fla * Ind.34	___	0.013 (0.100)	-0.5539 (0.153)
%Workers covered by fla * Ind.35	___	0.013 (0.100)	-0.7485 (0.301)
%Workers covered by fla * Ind.36	___	0.013 (0.100)	-0.0524 (0.058)
%Workers covered by fla * Ind.38	___	-1.415 (0.764)	-2.555 (1.101)
Number of observations (T)	168	168	180
Sample	1993.1-1999.4	1993.1-1999.4	1992.3-1999.4
Sargan test of over-identifying restrictions $\chi 2$(n° over-iden.instruments)	0.2279 [0.6331]	3.1053 [0.3757]	12.822 [0.0251]*
Normality test (Jarque-Bera) $\chi 2$ (2)	24.302 [0.0000]**	1.4036 [0.4957]	4.3655 [0.1127]

(Table 7.5 continued)			
Heteroskedasticity F[m, T-m] m = n° restrictions	1.5622 [0.0368]*	0.85343 [0.7084]	1.8104 [0.0066]**
Autocorrelation order 2 $\chi 2$ (2)	3.819 [0.1482]	1.2458 [0.5364]	1.8674 [0.3931]
Testing all coefficients = 0 $\chi 2$ (k) k = n° predetermined vars.	6521.6 [0.000]**	4381.2 [0.000]**	56761 [0.000]**
Instruments used	Relative price Uruguay- Rest of the world Imports/Consumption lagged	Relative price Uruguay- Rest of the world; Employment mix lagged; Relative wage blue/white-collars lagged; Export share lagged	Employment mix; Wage lagged; Wedge lagged; GDP lagged; GDP*Union lagged; Relative price Uruguay- Rest of the world

Notes: Industries are: food, beverage & tobacco (31); textiles & leather (32); paper (34); chemicals & oil (35); non-metallic minerals (36); metal products (38). The equations include binary variables by industry and *per* quarter. Standard errors are in parenthesis besides the estimates (heteroskedastic consistent standard errors in the employment equation). Tests statistics are reported with p-values in parenthesis below. A '*' means the hypothesis is rejected at 95% confidence while if '**' it is so at 99% confidence; 'fla' means firm-level agreements.

Unions decrease the proportion of production workers in all industries except for chemicals & oil [49]. One possible explanation for the result is that unions resist technical change towards more skilled labour-intensive technologies. The estimated effect of import penetration is in the same direction and a lot higher than in the previous period, thus further promoting changes in the employment mix in order to compete with products that in the nineties were originated mainly from the rest of the world instead of coming from regional markets. However, interactions between union density and import penetration were also statistically significant, so that unions managed to buffer the negative effects of imports on the composition of employment. The overall effect on the employment mix is negative for all industries, except for chemicals & oil (Table 7.6).

Regarding union impact on wages, the direct estimated effect is negative for all industries. However, competitive pressure as measured by export share has also a negative effect on

[49] A large public enterprise dominates this industry, so that a different result is not surprising, given it has different rules than the private sector to hire and fire workers while workers are organised in a quite strong union.

wages that is buffered by union action. Further, unions were able to smooth the effects of changes in the employment mix on wages, so that the total effect of unions on wages is negative only for exporting industries (food, beverage & tobacco; and textiles & leather) while it is nil for non-metallic minerals.

Table 7.6 Union effects on employment composition, wages and employment by industry 1992 - 1999

Employment Composition	**Direct Effect**	**Indirect Effect** *via* Import Penetration	**Total Effect**	**Mean value of variables**			
				UD	**IP**	**ES**	**EC**
Total manufacturing	-2,19	2,16	-0,03	0.25	0.48	0.24	0.46
Food, beverage & tobacco	-0,35	0,32	-0,03	0,24	0,14	0,25	0,44
Textiles & leather	-0,72	0,70	-0,02	0,19	0,56	0,65	0,71
Paper	-1,86	2,04	0,17	0,15	0,36	0,12	0,31
Chemicals & oil	0,36	-0,44	-0,08	0,53	0,52	0,16	0,28
Non-metallic minerals	0,76	-0,91	-0,16	0,08	0,40	0,15	0,54
Metal products	-11,31	11,24	-0,07	0,19	0,91	0,14	0,48

Wage Level	**Direct Effect**	**Indirect Effect** *via*		**Total Effect**
		Export share	Employment composition	
Total manufacturing	-0,81	0,25	0,53	-0,02
Food, beverage & tobacco	-0,96	0,26	0,56	-0,14
Textiles & leather	-1,23	0,21	0,45	-0,57
Paper	-0,36	0,16	0,41	0,21
Chemicals & oil	-1,50	0,59	1,18	0,27
Non-metallic minerals	-0,26	0,09	0,17	0,00
Metal products	-0,53	0,21	0,42	0,10

Employment Level	**Direct Effect**	**Indirect Effect** *via*			**Total Effect**
		Import Penetration	GDP	Wage	
Total manufacturing	0,05	0,20	-0,16	0,01	0,10
Food, beverage & tobacco	0,25	0,21	-0,16	0,05	0,35
Textiles & leather	0,07	0,17	-0,13	0,22	0,33
Paper	-0,03	0,13	-0,10	-0,08	-0,08
Chemicals & oil	0,28	0,47	-0,37	-0,11	0,28
Non-metallic minerals	-0,15	0,07	-0,06	0,00	-0,13
Metal products	-0,13	0,17	-0,13	-0,04	-0,13

Note: Union effects are calculated at the mean value of variables not in logs for each industry. Means are reported under the heading of UD (union density), IP (import penetration), ES (export share) and EC (employment composition).
Source: Table 7.5

Unions have direct and indirect effects on the employment level *via* reducing the output elasticity of labour demand as well as the negative impact of import penetration. The overall effect, including that brought forth by the wage, is positive only for the exporting industries and for chemicals & oil.

Given all the estimated effects, full unionisation (starting from 25%) would have meant, on average, a decrease in the ratio of blue to white-collar workers and the wage of around 9% and 6%, respectively, while increasing employment in 30%.

The extent of firm level bargaining has no significant impact on the composition of labour (although the sign is negative) but there are statistically significant effects on the wage and employment levels for some industries. With respect to the wage equation, bargaining at the firm level would reduce the real wage in food, beverage and tobacco; and in metal products, while no effect is found for the rest of the manufacturing sector. Regarding the employment equation, no direct effects are found for food, beverage and tobacco; and non-metallic minerals; they are positive for textiles; and negative for other industries (Table 7.7). The result for the exporting industries (food, beverage and tobacco; and textiles) supports the idea that in bargaining at the firm level, unions have accepted real wage reductions in exchange of less job instability. The reported effects for the rest of the manufacturing industries, however small, point at unions bargaining at the firm level accepting wage and employment reductions, which might be thought of as the only strategy available if the firm is to survive, but this hypothesis needs a lot of further analysis once more data are available.

Table 7.7 Effects of the extent of coverage of firm-level agreements on employment composition, wages and employment by industry 1992 – 1999

	Mean Value	Employment Composition	Wage Level			Employment Level		
		Direct	Direct	Indirect	Total	Direct	Indirect	Total
	FLA EC	Effect	Effect	Effect	Effect	Effect	Effect	Effect
Total manufacturing	0,10 0.46	-0.007	-0.005	-0.017	-0.022	-0.015	0.009	-0.006
Food, bev. & tobacco	0,10 0,44	-0.007	-0.021	-0.016	-0.037	0.000	0.014	0.014
Textiles & leather	0,08 0,71	-0.006	0.001	-0.013	-0.012	0.085	0.005	0.090
Paper	0,20 0,31	-0.013	0.003	-0.032	-0.030	-0.110	0.011	-0.099
Chemicals & oil	0,04 0,28	-0.003	0.001	-0.007	-0.007	-0.033	0.003	-0.031
Non-metallic minerals	0,19 0,54	-0.012	0.002	-0.030	-0.028	0.000	0.011	0.011
Metal products	0,01 0,48	-0.001	-0.017	-0.002	-0.019	-0.030	0.007	-0.023

Note: The effects are calculated at the mean value of variables not in logs for each industry, which are FLA (extent of coverage of firm-level agreements) and EC (employment composition).
Source: Table 7.5

Taking together the results relative to union action and the extent of coverage of firm-level agreements, it can be asserted that there are different mechanisms at work in the various Uruguayan manufacturing industries. The results of the models show that in the traditionally exporting industries – food, beverage & tobacco; and textiles & leather – the effects of unions in the nineties were to decrease the proportion of non-production workers and the average wage level while increasing employment. Further, increases in the proportion of workers covered by contracts signed at the firm level strengthen the union effects on employment (and on wages in the former case). This behaviour would be expected if unions care and bargain over employment in a context of re-structuring of firms that are in need to introduce new technology and lower their costs. Hence, what is probably taking place in these sectors is that unions' concern about job stability increased in the period and so did unions bargaining power over employment.

Something similar takes place in non-metallic minerals. The total union effect on wages is inexistent while the overall effect on employment is negative. However, wages would go down and employment up as firm level bargaining turns into a more common practice[50].

The case of chemicals & oil is different from all others since a public company dominates the evolution of the statistics of the sector and workers cannot be fired except in very specific cases regulated by law. Union effects on the employment mix are negative but they still manage to significantly increase both wages and employment. However, if workers are covered by agreements signed at the firm level, then the positive effects on employment are reduced. This behaviour is consistent with that of a strong union that need not care much about employment. It is also consistent with a union having similar bargaining power over employment and wages.

Finally, the estimated effects of unions for the paper industry and for metal products, the latter being a traditional import substitutive sector, are to increase wages and decrease employment levels. The sign of the effect of firm level bargaining indicates that decentralised negotiations would revert the effects on wages. Their behaviour is thus that of unionised sectors in which centralised negotiations are carried out with higher bargaining

[50] Non-metallic minerals and paper are the manufacturing industries with a higher percentage of workers covered by firm-level agreements by the end of the nineties (51% and 26%, respectively).

power over wages and low concern on job stability, while decentralised bargaining would be a mechanism that tries to adequate the centralised agreements to the firm's specific situation.

Conclusions

Enough evidence was shown in this paper supporting the idea that two different bargaining models are needed to well describe the behaviour of the Uruguayan manufacturing firms after 1985. The contents of the collective agreements signed as well as the econometric models estimated point at a right-to-manage model as the adequate instrument for the eighties and at a recursive bargaining model for the nineties. Unions have changed their objective function, augmenting their concern about job stability. Unions and firms have changed also the mechanisms through which wages and employment are set. While firms decided the level of employment in the eighties unilaterally, they became involved in negotiations with trade unions in the nineties. It is not possible to determine if bargaining over both items took place simultaneously or sequentially, but there is no doubt that union effects on employment were present in the second sub-period. They are, however, different by industry, thus showing that the synchronised and co-ordinated action of unions that predominated in the eighties no longer holds in the nineties.

As a consequence, this research suggests that the channels through which unions act are different in both time periods. In the late eighties, strong unions that bargained at the industry level only over the wage managed to get a higher proportion of the extra rents. In the nineties, when no protection was possible anymore and with a declining membership in a context of increased unemployment, unions started bargaining at a more decentralised level and negotiations also included employment and work conditions. Unions were able to guarantee job stability up to some extent using different mechanisms in some industries. First, by moderating their wage demands or even allowing wages to fall. Second, by buffering the negative impact of increased openness - especially that reflected in a larger amount of imported goods - and that of changes in the composition of employment. Third, by smoothing the effect of demand fluctuations on employment.

Import penetration has been substantial all along the period under analysis but especially in the nineties. The common external rate for the countries in the Mercosur meant that imports from the rest of the world increased sharply while Uruguayan exports to the region also rose. Manufacturing firms were forced to move towards more skilled-labour/capital intensive

technologies and to reduce costs. This phenomenon is reflected in the models as increases in imports generate reductions in the ratio of production to non-production workers, in the level of employment and indirectly in wage levels, while stronger competitive pressure *via* exports also decreases wage levels.

Decentralised bargaining started being a common practice in the late nineties. This has apparently had an impact on employment, employment mix and wages reinforcing or smoothing the previous effects of union action.

Finally, while a model for all industries is adequate to describe bargaining in the eighties, the empirical evidence shows that the various manufacturing industries have experienced different processes in the nineties, so that instability in the cross section has been a constant in the empirical models estimated for the latter time period. Interestingly enough exporting industries and the sector dominated by a publicly owned firm have quite clear-cut behaviours. Unions in exporting industries are concerned about employment more than the rest, so that they are willing to accept lower relative wage increases. The industry to which a large publicly owned firm belongs got both wages and employment increases due to union action, resembling the behaviour predicted by an efficient contracts model.

More work need to be done to properly take into account all the various phenomena that have taken place in the last decade. Research for each sector is in place given the heterogeneity found while the use of micro data would help to eliminate possible biases in the estimates. Further, as in other areas of Labour Economics as surveyed by Hamermesh (1993), the comparison of wage gaps, for example, estimated using aggregate and micro data for USA and for Britain, does support the existence of biases, sometimes of a significant magnitude[51]. It must be emphasized, however, that the models to be used must be derived from the a theoretical bargaining model, a fact that could explain why some estimates based on data from surveys to individuals are different from those derived from surveys to establishments (see chapter 6 in Booth, 1995 for a brief discussion on the topic). More important still would be to analyse the effects of union action on other indicators of firm performance, such as profitability, investment rates or productivity, so as to have a broader picture of the impact of unions on labour markets.

[51] Lewis (1986) made a comparison of results using establishment, individual and aggregate data for the USA, while Booth (1995) surveys the results got for Britain and the USA.

Chapter 8. Conclusions and final remarks

The aim of this research has been to add new insights to the understanding of how the Uruguayan labour market works. In particular, it intends to explain the mechanisms of wage and employment determination for the manufacturing sector. The relevance of this sector, that is currently responsible for less than one fifth of the Uruguayan production, lies on its multiplying effects over the rest of the economy.

One issue that has been widely discussed in Uruguay relates to the existence of many sources of inflexibility that would be responsible for the observed high levels of unemployment. Previous work has analysed the existent regulations and concluded that they are not to blame for generating rigidities, except for the fact that non-wage labour costs have been too high. On the other hand, the institutional framework in which labour relations have taken place since the mid-eighties appears as a most likely source of rigidities. The most important and discussed topic in this context has been the role played by trade unions. Uruguay appears within this framework as a dream come true for researchers. Data are available to analyse the same economic sectors with and without unions, given they were prohibited during the 12 years of military government. As a consequence, the shortcoming stemming from comparing different sectors or firms with and without unions is overcome. Further, although when doing applied research there are always many unobservable factors that cannot be accounted for, it does not seem likely in this case that they are being erroneously interpreted as union effects.

The literature has analysed the possible effects of unions on labour markets for long now. No unique outcome can be expected. It all depends on several features of bargaining, such as who are the parties involved; the targets to accomplish for each of the parties; the issues they bargain over; and the structure of bargaining. The Uruguayan case is again suitable to analyse some of these issues. The structure of bargaining was different in the eighties and in the nineties, changing from industry level agreements enforceable to all firms in the sector to industry and firm level negotiations the outcomes of which become enforceable only to the parties involved. Further, there is evidence showing that the objective function of unions also changed while bargaining over employment levels has also been observed in the nineties.

This research has shown that uncertainty in bargaining is another topic that has to be included when analysing the role of trade unions. Since it is always possible to adjust the number of jobs once a wage level has been agreed upon, the expectations of agents when bargaining

over the wage on the future state of nature to be faced can prevent or promote large employment fluctuations. The theoretical result was attained using a two-stages bargaining model with uncertainty and allowing for an alternative wage for union members that is variable with shocks. In doing so it is observed that the standard result of wage rigidity and large employment variations when product demand fluctuates can be here obtained without imposing that the reservation wage is fixed, but as a consequence of uncertainty. The model also allows for both efficient and inefficient outcomes, depending on the state of nature and on all union members being employed or not, thus justifying why it may be the case that inefficient outcomes result from bargaining.

Uruguay, being a small open economy, has always been subject to external shocks. Uncertainty is a constant, especially for manufacturing firms in a framework of increased trade liberalisation and economic integration. Further, the fact that there are no legal provisions ruling unions or bargaining processes is another source of uncertainty that can help to the better understanding of the outcomes of bargaining. Hence, the theoretical proposal developed in Chapter 5 might be of relevance when studying union effects in Uruguay. However, the empirical research carried out in Chapters 6 and 7 does not incorporate uncertainty, being one of the shortcomings of this study, justified only by the fact there were so many other phenomena of interest taking place that, for the sake of simplicity, uncertainty was left aside. Modelling shocks as specific stochastic processes would probably help to understand the mechanisms at work in the Uruguayan case and is a most recommended line for future research.

The econometric analysis was performed using quarterly data on 6 out of 8 manufacturing industries, during 1975 and up to 1999. The level of aggregation of the data might be introducing some biases on the estimates, as it has been widely demonstrated by now in the literature. However, as a first approach for the Uruguayan case, the results stemming from the estimated models are considered of relevance. The methodology used consisted on estimating models for the determination of employment and wages recursively. The theoretical models proposed are the consequence of the reading of all collective agreements signed and registered at the Ministry of Labour between 1985 and 1999. However, empirical evidence was also provided without imposing a theoretical structure so as to bring further support to the maintained hypothesis. In Chapter 6, using data for 1975 – 1997, structural breaks in the equilibrium relation between wages, employment and output were spotted. Co-

integration techniques were used too and the results of the statistical analyses also pointed at the need of specifying a bargaining model for the post-1985 period. The exogeneity of wages before 1985 and their endogeneity after that date gave further support to the specification of different models for each period. The path of wages and employment in the eighties and nineties was thus modelled using a right-to-manage bargaining model. The results of the research also suggested that things might have changed in the nineties, given there was evidence on some instability of the parameters in the mid-nineties, that was not possible to model with data up to 1997 (available at the time the econometric analysis was carried out). Chapter 7 is thus devoted to analyse the possibility of different bargaining models for the eighties and nineties, on the basis of both the theoretical and econometric evidence. Using a recursive model, equations for labour demand and wages were again specified but in this case, given data availability, an equation for the determination of the employment composition between production and non-production workers was also added and the sample extended to 1999.

The empirical work developed has shown that unions have indeed introduced rigidities in the labour market in the eighties. They pushed up wages thus promoting job loss although at a lower pace than when unions were prohibited. However, it has been here demonstrated that it is not necessarily the existence of unions *per se* that originated this result but the fact that unions did not care about employment neither they bargained over it.

Things changed in the nineties. Job stability started being a major concern for workers in a setting of increased unemployment and remarkable deepening of trade liberalisation. De-unionisation was extreme and sectoral trade unions started to break their historically strong links with the central union. Synchronisation and co-ordination disappeared in a large extent while the summoning power of the central union was severely damaged. Bargaining at the firm, taking into account the specificities of workers and companies, started being a widespread practice. By 1999, 15% of workers were covered by firm level bargaining while membership to unions still gathered in the central union went down to 20%. Unions started bargaining over employment; working conditions; training; mechanisms for rotating in the unemployment insurance system; and introduction of new technology, while they moderated their wage demands. Positive union effects on employment can thus be found in some industries while union wage effects have significantly decreased. Their previously 'negative'

face regarding labour market flexibility turned into 'positive' in some sectors, promoting that both workers and firms became better off.

The composition of employment has also changed in the nineties. Competitive pressure has forced firms to move towards more skill-intensive technologies. This is also reflected in the composition of unemployment in the late nineties. Unskilled middle-aged displaced workers are one the main groups of unemployed individuals. The effect of unions is to further favour the process, probably because the strategy was also a means for firms to avoid workers resistance to lower labour costs. However, bargaining over employment and related issues is also reflected in unions being able to buffer the effects of openness and demand fluctuations on employment and its composition.

Finally, while explaining the evolution of wages and employment in the eighties can be properly done analysing all manufacturing industries together, this is no longer the best strategy for the nineties, as revealed by the econometric analysis on the stability of parameters in the cross section and in time. The heterogeneity of the processes underwent by the different sectors claims for individual analyses. Moreover, the use of micro data appears as unavoidable in this framework and this will become possible soon. It will also provide the means for analysing the effects of unions on other indicators of firm performance, such as productivity, investment or profitability, which, in turn, will help in the understanding of all the mechanisms at work that serve as basis to policy recommendations.

Appendices

Appendix to Chapter 5: Derivatives Table 5.1

Case I: $L^* < M \;\forall\theta$

$\partial w^*/\partial r_g = \{[\alpha+\gamma(1-\alpha)]/\gamma A^2\} p\theta_g^{1/(\gamma-1)} \geq 0$ with $A = p\theta_g^{1/(\gamma-1)} + (1-p)\theta_b^{1/(\gamma-1)}$

$\partial w^*/\partial r_b = \{[\alpha+\gamma(1-\alpha)]/\gamma A^2\}(1-p)\theta_b^{1/(\gamma-1)} \geq 0$

$\partial w^*/\partial p = \{[\alpha+\gamma(1-\alpha)]/\gamma A^2\}(r_g - r_b)(\theta_g\theta_b)^{1/(\gamma-1)} \geq 0$

$\partial w^*/\partial \theta_g = \{[\alpha+\gamma(1-\alpha)]/(1-\gamma)\gamma A^2\} p\theta_g^{\gamma/(\gamma-1)}[(1-\gamma)A\theta_g \partial r_g/\partial\theta_g + (1-p)(r_g-r_b)\theta_b^{1/(\gamma-1)}] \geq 0$

$\partial w^*/\partial \theta_b = \{[\alpha+\gamma(1-\alpha)]/(1-\gamma)\gamma A^2\}(1-p)\theta_b^{\gamma/(\gamma-1)}[(1-\gamma)A\theta_b \partial r_b/\partial\theta_b + p(r_b-r_g)\theta_g^{1/(\gamma-1)}] \;?\; 0$

$\partial L_i^*/\partial r_i = [\partial w^*/\partial r_i](\theta_i\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i = g,b$

$\partial L_i^*/\partial r_j = [\partial w^*/\partial r_j](\theta_i\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i,j = g,b \quad i \neq j$

$\partial L_i^*/\partial p = [\partial w^*/\partial p](\theta_i\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i,j = g,b$

$\partial L_i^*/\partial \theta_i = [(\partial w^*/\partial\theta_i)\theta_i - w^*](\theta_i\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1)\theta_i \;?\; 0$ for $i = g,b$

$\partial L_g^*/\partial \theta_b = [\partial w^*/\partial\theta_b](\theta_b\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \;?\; 0$

$\partial L_b^*/\partial \theta_g = [\partial w^*/\partial\theta_g](\theta_g\mu)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$

Case II: $L^* \geq M \quad \forall\theta$

$\partial w^*/\partial r_g = p\gamma(1-\alpha)/(\gamma-\alpha) \geq 0$ $\qquad$ $\partial w^*/\partial r_b = (1-p)\gamma(1-\alpha)/(\gamma-\alpha) \geq 0$

$\partial w^*/\partial p = (r_g - r_b)\gamma(1-\alpha)/(\gamma-\alpha) \geq 0$

$\partial w^*/\partial \theta_g = (\partial r_g/\partial\theta_g)p\gamma(1-\alpha)/(\gamma-\alpha) \geq 0$ $\qquad$ $\partial w^*/\partial \theta_b = (\partial r_b/\partial\theta_b)(1-p)\gamma(1-\alpha)/(\gamma-\alpha) \geq 0$

$\partial L_i^*/\partial r_i = [\partial w^*/\partial r_i](\theta_i\gamma)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i = g,b$

$\partial L_i^*/\partial r_j = [\partial w^*/\partial r_j](\theta_i\gamma)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i,j = g,b \quad i \neq j$

$\partial L_i^*/\partial p = [\partial w^*/\partial p](\theta_i\gamma)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1) \leq 0$ for $i,j = g,b$

$\partial L_i^*/\partial \theta_i = [(\partial w^*/\partial\theta_i)\theta_i - w^*](\theta_i\gamma)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1)\theta_i \;?\; 0$ for $i = g,b$

$\partial L_i^*/\partial \theta_j = (\partial w^*/\partial\theta_j)(\theta_j\gamma)^{1/(\gamma-1)} w^{*(2-\gamma)/(\gamma-1)}/(\gamma-1)\theta_i \leq 0$ for $i = g,b \quad i \neq j$

Case III: $L^* = M \quad \forall\theta$

$\partial w^*/\partial r_g = p(1-\alpha) \geq 0$ $\qquad$ $\partial w^*/\partial r_b = (1-p)(1-\alpha) \geq 0$

$\partial w^*/\partial p = (r_g - r_b)(1-\alpha) + (\theta_g - \theta_b)\alpha p M^{(\gamma-1)} \geq 0$ $\qquad$ $\partial w^*/\partial \theta_g = (\partial r_g/\partial\theta_g)p(1-\alpha) + pM^{(\gamma-1)} \geq 0$

$\partial w^*/\partial \theta_b = (\partial r_b/\partial\theta_b)(1-p)(1-\alpha) + (1-p)M^{(\gamma-1)} \geq 0$

$\partial L_i^*/\partial x = 0$ for $x = r_g, r_b, p, \theta_g, \theta_b$

Appendix to Chapter 6

Table A6.1 Tests of order of integration 1975 - 1997 *per* manufacturing industry

Employment: level (N)

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

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

Employment: first differences (ΔN)

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

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

Production: level (Q)

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

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

Production: first differences (ΔQ)

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

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

Real labour costs: level (W)

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

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

Real labour costs: first differences (ΔW)

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

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

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

Table A6.2 CI tests 1975-1997 *per* manufacturing industry

Industry 31: Food, beverage & tobacco

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1	M2	M3	
	t-adf	t-adf	t-adf	lags
RES31	-2.1779	-2.1751	-2.0309	2
RES31	-2.1871	-2.1854	-2.0687	1
RES31	-2.3820	-2.3785	-2.2958	0

Industry 32: Textiles & apparel

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1	M2	M3	
	t-adf	t-adf	t-adf	lags
RES32	-1.9567	-1.9295	-2.6358	2
RES32	-2.3410	-2.3203	-3.0386	1
RES32	-2.3637	-2.3465	-3.0312	0

Industry 34: Paper

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1	M2	M3	
	t-adf	t-adf	t-adf	lags
RES34	-1.3609	-1.3237	-1.5525	2
RES34	-1.3018	-1.2717	-1.5288	1
RES34	-1.4300	-1.4074	-1.6776	0

Industry 35: Chemicals & oil

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1 t-adf	M2 t-adf	M3 t-adf	lags
RES35	-1.8758	-1.8606	-1.9074	2
RES35	-1.6329	-1.6319	-1.6689	1
RES35	-1.6289	-1.6394	-1.6776	0

Industry 36: Non-metallic minerals

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1 t-adf	M2 t-adf	M3 t-adf	lags
RES36	-2.4334	-2.4082	-2.2781	2
RES36	-2.6824	-2.6593	-2.5473	1
RES36	-4.2368*	-4.2085**	-4.1497*	0

Industry 38: Metal products

Johansen's Method

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

Engle & Granger's Method

Unit-root tests 1975 (4) to 1997 (4) Augmented Dickey-Fuller statistic (t-adf)

	M1 t-adf	M2 t-adf	M3 t-adf	lags
RES38	-2.5534	-2.5223	-2.9496	2
RES38	-3.4210*	-3.3962	-3.8846	1
RES38	-3.7270*	-3.7062*	-4.0312*	0

Notes: The values reported of the λ-max and trace statistics are those for small samples. M1 to M6 when using Johansen's method refer to the following models: M1 includes one lag and a constant; M2

also includes seasonals; M3 excludes constant and seasonals. M4 to M6 are the same as M1 to M3 but with 2 lags. A '**' means the statistic is significant at 99% and if '*' at 95%. Critical values for M1; M2; M4 and M5 for the λ-max statistic are: 21.0; 14.1; 3.8 for p==0; <=1 and <=2 respectively. Those for the trace statistic are: 29.7; 15.4 and 3.8. The figures for M3 and M6 are: 17.9; 11.4; 3.8; 24.3; 12.5 and 3.8. In using Engle and Granger's method, RES(j) are the residuals of the static regression of the log of employment on the log of real labour costs and output plus seasonal variables for industry 'j'. M1 refers to a model with no constant and no trend; M2 has a constant; and M3 includes constant and trend. Critical values according to response surfaces for 89 observations, 2 exogenous variables and 95% confidence (McKinnon, 1991) are: –3.40 and –3.89, for models M2 and M3, respectively. For M1, the critical value is -3.38, according to Engle and Yoo (1987).

Figure A6.1: CI relation 1975-1997
Food, beverage & tobacco

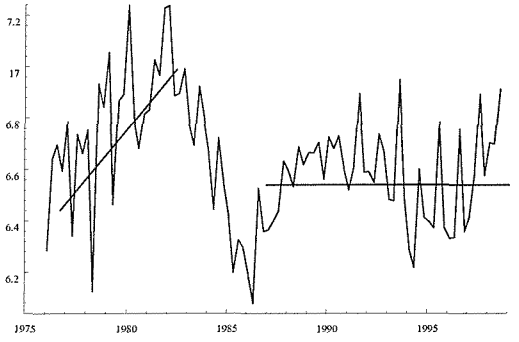


Figure A6.2: CI relation 1975-1997
Textiles & apparel

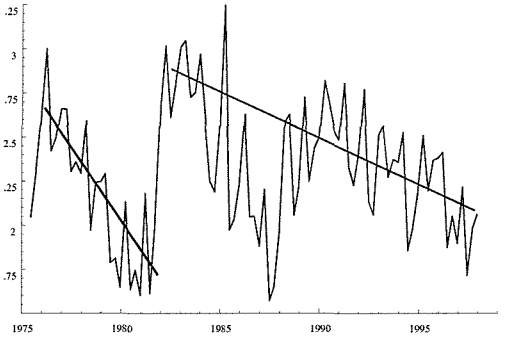


Figure A6.3: CI relation 1975-1997
Non-metallic minerals

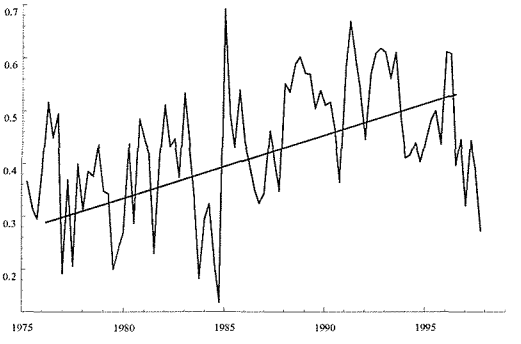


Figure A6.4: CI relation 1975-1997
Metal products

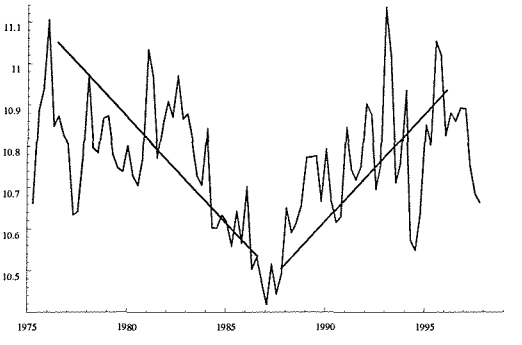


Table A6.3 Tests of order of integration 1975-1984 and 1985-1997 *per* manufacturing industry

a) 1975 - 1984

Employment: level (N)

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

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

Employment: first differences (ΔN)

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

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

Production: level (Q)

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

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

Production: first differences (ΔQ)

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

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

Real labour costs: level (W)

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

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

Real labour costs: first differences (ΔW)

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

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

b) 1985 – 1997

Employment: level (N)

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

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

Employment: first differences (ΔN)

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

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

Production: level (Q)

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

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

Production: first differences (ΔQ)

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

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

Real labour costs: level (W)

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

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

Real labour costs: first differences (ΔW)

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

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

Alternative income: level (AW)

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

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

Alternative income: first differences (ΔAW)

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

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

Open: level (OPEN)

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

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

Open: first differences (ΔOPEN)

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

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

Union: level (UNION)

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

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

Union: first differences (ΔUNION)

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

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

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

Table A6.4 CI tests 1975-1984 and 1985-1997 *per* manufacturing industry

Industry 31: Food, beverage & tobacco

1975-1984

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

	M1	M2	M3
RES31	-2.5781	-2.6059	-2.3303
RES31	-2.6416	-2.6875	-2.4316
RES31	-3.0496*	-3.0998*	-2.9301

1985-1997

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

	M1	M2	M3
RES31	-2.1390	-2.1789	-2.9737
RES31	-2.2380	-2.2627	-2.8907
RES31	-2.2342	-3.2645	-2.9461

1985-1997: bargaining variables added

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

	M2
RES31	-2.8864
RES31	-4.2126***
RES31	-3.6730**

Industry 32: Textiles & apparel

1975-1984

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

	M1	M2	M3
RES32	-1.5568	-1.5268	-3.8745*
RES32	-2.0879	-2.0581	-4.4456**
RES32	-2.5959	-2.5608	-4.9328***

1985-1997

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

	M1	M2	M3
RES32	-2.4918	-2.5476	-2.9758
RES32	-2.4311	-2.5268	-3.1125
RES32	-2.5283	-2.6209	-3.1581

1985-1997: bargaining variables added

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

	M2
RES32	-2.3054
RES32	-3.0523
RES32	-3.5752**

Industry 34: Paper

1975-1984

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

	M1	M2	M3
RES34	-1.2114	-1.1879	-2.4414
RES34	-1.3014	-1.2788	-2.5443
RES34	-1.2763	-1.2556	-2.4919

Industry 34: Paper

Johansen method

Ho:rank=p	λ-max	95%	trace	95%
p == 0	23.1**	21.0	26.22*	29.7
p <= 1	3.11	14.1	3.113	15.4
p <= 2	.003218	3.8	.00321	3.8

1985-1997

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

	M1	M2	M3
RES34	-1.5690	-1.5197	-1.5328
RES34	-1.6863	-1.6351	-1.7657
RES34	-1.5972	-1.5484	-1.7788

1985-1997: bargaining variables added

Johansen method

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

Industry 35: Chemicals & oil

1975-1984

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

	M1	M2	M3
RES35	-1.4663	-1.4505	-2.8429
RES35	-1.1495	-1.2020	-2.0465
RES35	-1.0798	-1.1821	-1.8522

Johansen method

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

1985-1997

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

	M1	M2	M3
RES35	-2.4482	-2.4769	-3.8018
RES35	-2.3147	-2.3694	-3.8712
RES35	-2.3220	-2.3797	-3.8577

1985-1997: bargaining variables added

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

	M2
RES35	-3.1295*
RES35	-2.9980
RES35	-2.9394

Industry 36: Non-metallic minerals

1975-1984

Unit-root tests 1975 (4) to 1984 (4)	M1	M2	M3	t-adf
RES36	-2.8523	-2.7816	-4.7312**	
RES36	-2.6893	-2.6459	-3.8371*	
RES36	-4.8069**	-4.7583*	-6.0524***	

1985-1997

Unit-root tests 1986 (1) to 1997 (4)	M1	M2	M3	t-adf
RES36	-2.1444	-2.1044	-1.9342	
RES36	-2.4147	-2.3712	-2.2448	
RES36	-2.8957	-2.8476	-2.7636	

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)	M2	t-adf
RES36	-2.6123	
RES36	-2.6298	
RES36	-3.2504*	

Industry 38: Metal products

1975-1984

Unit-root tests 1975 (4) to 1984 (4)	M1	M2	M3	t-adf
RES38	-2.3649	-2.2774	-2.9206	
RES38	-2.8628	-2.8069	-2.9374	
RES38	-3.2584*	-3.2082*	-2.8747	

1985-1997

Unit-root tests 1986 (1) to 1997 (4)	M1	M2	M3	t-adf
RES38	-1.8924	-1.8743	-1.6430	
RES38	-2.7655	-2.7404	-2.6231	
RES38	-3.0085	-2.9810	-2.9125	

1985-1997: bargaining variables added

Unit-root tests 1986 (1) to 1997 (4)	M2	t-adf
RES38	-2.7060	
RES38	-3.3316*	
RES38	-4.4244***	

Notes: RES(j) are the residuals of the static regression of employment on output and real labour costs for industry 'j'. Industries reported are: food, beverage & tobacco (31); textiles & apparel (32); paper (34); chemicals & oil (35); non-metallic minerals (36); and metal products (38). In 1975-84 and 1985-1997, the regression was done by OLS. When bargaining variables are added, the residual refers to the same model but real labour costs include bargained costs and the method of estimation is 3SLS, so that wages and output are endogenous. Variables explaining the wages are: real alternative income, union density and degree of openness. For industries 31 and 35, a dummy variable with value 1 after 1992 is also included. Instruments for output are own lags and seasonals. For industries 34 and 35, results using Johansen method are reported. A '***' means the statistic is significant at 99%; a '**' at 95%; and a '*' at 90%. M1 refers to a model with no constant nor trend; M2 includes a constant; M3 further includes trend. Critical values, according to McKinnon (1991) at 5% with 37 observations and 2 exogenous variables, are: –3.51 and –4.05, for M2 and M3, respectively. For M1, the 5% critical value is -3.43, according to Engle and Yoo (1987). The first file refers to ADF-test with 2 lags; the second with 1 lag and the third to DF tests.

Table A6.5 Nesting the models - manufacturing industries 1975 – 1997

Estimating the model by 3SLS The present sample is: 7 to 552

Equation 1 for Employment

Variable	Coefficient	Std.Error	t-value	t-prob
DUMMY75	1.5171	0.16578	9.151	0.0000
DUMMY85	1.2348	0.18315	6.742	0.0000
DUMMY93	-0.0420	0.01132	-3.714	0.0002
Ind3175	-0.0516	0.02367	-2.182	0.0296
Ind3275	0.0431	0.01827	2.358	0.0188
Ind3475	0.0297	0.02028	1.464	0.1437
Ind3575	-0.1185	0.01792	-6.613	0.0000
Ind3675	-0.0443	0.01760	-2.515	0.0122
Ind3185	0.0581	0.02408	2.412	0.0162
Ind3285	0.0710	0.01731	4.100	0.0000
Ind3485	-0.0422	0.01682	-2.513	0.0123
Ind3585	-0.0642	0.02055	-3.126	0.0019
Ind3685	-0.0517	0.02173	-2.378	0.0178
Qr175	-0.0140	0.00927	-1.512	0.1311
Qr275	0.0079	0.00897	0.880	0.3795
Qr375	-0.0133	0.00903	-1.469	0.1423
Qr185	0.0028	0.00857	0.330	0.7418
Qr285	0.0094	0.00803	1.168	0.2433
Qr385	-0.0173	0.00787	-2.198	0.0284
Q75	0.1092	0.01701	6.418	0.0000
Q85	0.0610	0.01721	3.545	0.0004
W5	-0.1045	0.01525	-6.856	0.0000
W85	-0.0295	0.01761	-1.673	0.0949
N75_1	0.8727	0.01704	51.198	0.0000
N85_1	0.8736	0.01670	52.323	0.0000

sigma = 0.0490045

Equation 2 for Wages

Variable	Coefficient	Std.Error	t-value	t-prob
DUMMY85	-0.2500	0.09099	-2.748	0.0062
DUMMY93	0.1767	0.02974	5.940	0.0000
Qr185	-0.0017	0.00889	-0.191	0.8486
Qr285	-0.0054	0.00857	-0.629	0.5298
Qr385	0.0015	0.00847	0.181	0.8562
AW85	1.1983	0.02510	47.742	0.0000
UNION	0.2372	0.01442	16.449	0.0000
UNION93	-0.3727	0.07094	-5.253	0.0000
UN3193	0.1157	0.07498	1.543	0.1234
UN3293	-0.2598	0.07583	-3.426	0.0007
UN3493	-0.0339	0.06707	-0.506	0.6133
UN3593	0.3314	0.05855	5.659	0.0000
UN3693	-1.6041	0.25859	-6.203	0.0000
OPEN85	-0.0449	0.00893	-5.024	0.0000
W85_1	0.0089	0.00532	1.669	0.0958

\sigma = 0.0528143

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

Notes to Table A6.5: N is the number of production workers; W is the real labour cost of a production worker; Q is production; AW is the alternative wage; UNION is union density; OPEN is the degree of openness; Qr'j' is a dummy variable for quarter 'j'; Ind.'i' is a dummy variable for industry 'i'. Industries included are: food, beverage & tobacco (31); textiles & apparel (32); paper (34); chemicals & oil (35); non-metallic minerals (36); and metal products (38). '-1' attached to a variable indicates the variable is lagged one period. Variables with '75' have the actual values from 1975 up to 1984 and zero elsewhere. Those ending in '85' have a value of zero in 1975-1984 and the actual value from that date on. DUMMY75 is a dummy variable equal to 1 in 1975-1984; DUMMY85 is a dummy variable equal to 1 in 1985-1997; DUMMY93 is a dummy variable equal to 1 in 1993-1997. UNION93 is UNION multiplied by DUMMY93; UN'j' 93 is UNION93 multiplied by Ind.'j'.

Tests of hypothesis on coefficients being equal in 1975-84 and 1985-97

1.Equal estimated product elasticity of labour demand: Q75 = Q85
&19-&20=0;
Wald test for general restrictions
GenRes Chi^2(1) = 4.6104 [0.0318] *

2. Equal estimated elasticity of substitution capital - labour: W75 = W85
&21-&22=0;
Wald test for general restrictions
GenRes Chi^2(1) = 10.469 [0.0012] **

3.Equal speed of adjustment of employment: LAGGED N75 = LAGGED N85
&23-&24=0;
Wald test for general restrictions
GenRes Chi^2(1) = 0.15229 [0.6964]

Appendix to Chapter 7

Table A7.1 Estimated coefficients 1985 - 1999

Variable	Employment Composition	Wage Level	Employment Level
Constant	0.1367 (0.070)	-0.6459 (0.859)	0.5652 (0.210)
Quarter 1	-0.0134 (0.004)	-0.0308 (0.007)	-0.0005 (0.003)
Quarter 2	-0.0010 (0.004)	-0.0043 (0.007)	0.0014 (0.003)
Quarter 3	0.0009 (0.004)	-0.0046 (0.007)	-0.0067 (0.002)
Industry 31	0.2109 (0.121)	-0.0715 (0.049)	0.0087 (0.016)
Industry 32	0.0368 (0.031)	-0.3507 (0.153)	0.0135 (0.009)
Industry 34	-0.0205 (0.038)	0.3773 (0.152)	-0.0005 (0.011)
Industry 35	0.0007 (0.086)	0.1180 (0.119)	-0.0262 (0.016)
Industry 36	0.0629 (0.025)	-0.0597 (0.045)	-0.0018 (0.019)
Dummy 1993	-0.0103 (0.025)	_____	_____
Industry 31* Dummy1993	-0.2619 (0.128)	_____	_____
Industry 32* Dummy1993	0.3719 (0.043)	_____	_____
Industry 34* Dummy1993	-0.1492 (0.065)	_____	_____
Industry 35* Dummy1993	-0.1617 (0.131)	_____	_____
Industry 36* Dummy1993	0.1849 (0.045)	_____	_____
Relative wage blue-white collars	-0.2503 (0.130)	_____	_____
Wedge	_____	-0.9134 (0.269)	_____
Wedge 4 lags	_____	-0.1445 (0.226)	_____
Alternative wage	_____	0.5795 (0.337)	_____
Employment composition	_____	1.1193 (0.569)	_____
Product demand	_____	_____	0.0809 (0.038)
Wage level	_____	_____	-0.1003 (0.055)
Relative prices Uruguay/Rest World	0.0133 (0.047)	0.0614 (0.097)	-0.0188 (0.017)
Equivalent tariff	0.0107 (0.037)	0.0675 (0.072)	-0.0046 (0.023)
Dependent variable 1 lag	0.5105 (0.064)	0.4519 (0.110)	0.7461 (0.059)
Dependent variable 2 lags	-0.0326 (0.072)	_____	-0.0124 (0.071)
Dependent variable 3 lags	0.1099 (0.061)	_____	0.1633 (0.056)
Union density	-0.0265 (0.170)	7.2961 (3.248)	-0.4293 (0.319)
Industry 31 * Union	-0.4749 (0.285)	0.1733 (0.138)	_____
Industry 32 * Union	0.0178 (0.078)	1.2924 (0.566)	_____
Industry 34 * Union	-0.0166 (0.113)	-1.4731 (0.583)	_____
Industry 35 * Union	-0.0973 (0.143)	-0.7833 (0.417)	_____
Industry 36 * Union	-0.1289 (0.102)	0.4738 (0.225)	_____
Relative wage blue-white * Union	-0.5802 (0.409)	_____	_____
Wedge * Union	_____	-0.0615 (0.556)	_____
Wedge 4 lags * Union	_____	-0.5609 (0.352)	_____
Alternative wage * Union	_____	-2.2747 (1.141)	_____
Employment composition * Union	_____	-5.2711 (2.273)	_____
Product demand * Union	_____	_____	-0.0400 (0.055)
Wage level * Union	_____	_____	0.1483 (0.128)
Rel. prices Uru/R of W * Union	-0.0097 (0.101)	0.0206 (0.211)	0.0614 (0.042)
Equivalent tariff * Union	-0.1430 (0.113)	-0.4840 (0.238)	0.0397 (0.066)
Dependent variable 1 lag * Union	-0.1159 (0.108)	0.0468 (0.039)	0.0010 (0.010)
Dependent variable 2 lags * Union	0.0822 (0.110)	_____	0.0022 (0.009)
Dependent variable 3 lags * Union	0.1258 (0.081)	_____	0.0069 (0.007)

(Table A7.1 continued)			
Dummy 1993 * Union	0.0061 (0.256)	-2.7160 (1.458)	-0.2094 (0.225)
Industry 31* Union * Dummy 1993	0.5619 (0.345)	_____	0.0190 (0.059)
Industry 32* Union * Dummy 1993	-0.1119 (0.156)	_____	-0.1820 (0.053)
Industry 34* Union * Dummy 1993	0.3970 (0.220)	_____	0.0580 (0.060)
Industry 35* Union * Dummy 1993	0.1940 (0.243)	_____	0.1199 (0.051)
Industry 36* Union * Dummy 1993	-2.8014 (0.426)	_____	-0.2880 (0.110)
Rel.wage blue-white*Union*Dummy1993	0.2839 (0.497)	_____	_____
Wedge * Union * Dummy 1993	_____	2.9352 (1.155)	_____
Wedge 4 lags * Union * Dummy 1993	_____	0.4494 (0.363)	_____
Alternative wage * Union * Dummy 1993	_____	2.0044 (0.856)	_____
Employment Comp.*Union*Dummy 1993	_____	0.1544 (0.289)	_____
Product demand * Union * Dummy 1993	_____	_____	-0.0569 (0.097)
Wage level * Union* Dummy 1993	_____	_____	0.4718 (0.162)
Rel.prices Uru/RofW*Union*Dummy 1993	-0.0186 (0.183)	-0.9085 (0.378)	0.0442 (0.100)
Equivalent tariff * Union * Dummy 1993	0.1316 (0.124)	0.0563 (0.202)	0.0081 (0.072)
Dependent var. 1 lag*Union*Dummy1993	0.0368 (0.106)	0.0435 (0.148)	0.0017 (0.007)
Dependent var. 2 lags*Union*Dummy1993	-0.0670 (0.108)	_____	-0.0007 (0.007)
Dependent var. 3 lags*Union*Dummy1993	0.0487 (0.086)	_____	-0.0005 (0.005)
Number of observations (T)	342	336	342
Sample	1985.4-1999.4	1986.1-1999.4	1985.4-1999.4
Sargan test of over-identifying restrictions	_____	3.6744 [0.159]	19.178
$\chi 2$(n° of over-identifying restrictions)			[0.014]*
Normality test (Jarque-Bera)	68.036	179.94	54.921
$\chi 2$ (2)	[0.0000]**	[0.0000] **	[0.0000] **
Heteroskedasticity	2.2695	13.02	2.2908
F[m, T-m] m = n° restrictions	[0.0000]**	[0.0000] **	[0.0000]**
Autocorrelation order 2	1.5459	1.2503	0.7777
$\chi 2$ (2)	[0.4616]	[0.5352]	[0.6778]
Testing all coefficients = 0 F[k,T-k] or	0.97594	4508.5	1.375e+005
$\chi 2$ (k) k = n° predetermined vars.	[0.0000]**	[0.0000]**	[0.0000]**
Estimation method	Least Squares	Instrumental Variables	Instrumental Variables
Instruments used	_____	Employment mix lagged; Relative wage blue/white-collars;	Employment mix lagged; Relative wage blue/white-collars; Wage lagged; Wage *Union lagged; Alternative wage; Wedge; GDP lagged; GDP*Union lagged

Note: Industries are: food, beverage & tobacco (31); textiles & leather (32); paper (34); chemicals & oil (35); non-metallic minerals (36); metal products (38). Heteroskedasticity consistent standard errors (White, 1980) are in parenthesis besides each estimated coefficient. 'Dummy1993' is equal to 0 before 1993.1 and equal to 1 afterwards. Tests statistics are reported with p-values in parenthesis below. A '*' means the hypothesis is rejected at 95% confidence while if '**' it is so at 99% confidence.

Table A7.2 Initial specification: estimated coefficients 1985 - 1992

Variable	Employment Composition	Wage Level	Employment Level
Constant	0.1245 (0.054)	1.1600 (0.809)	1.8913 (0.825)
Quarter 1	-0.0193 (0.008)	-0.0566 (0.016)	-0.0134 (0.009)
Quarter 2	0.0068 (0.008)	-0.0118 (0.012)	-0.0048 (0.007)
Quarter 3	-0.0012 (0.008)	-0.0284 (0.019)	-0.0123 (0.006)
Industry 31	-0.0578 (0.082)	0.189 (0.147)	0.1487 (0.091)
Industry 32	0.0071 (0.085)	0.4145 (0.225)	0.0676 (0.074)
Industry 34	-0.0805 (0.056)	-0.0131 (0.118)	0.0345 (0.058)
Industry 35	-0.0813 (0.046)	0.0519 (0.093)	0.0068 (0.036)
Industry 36	-0.0264 (0.055)	0.0723 (0.128)	-0.0229 (0.071)
Export share (industry)	-0.0455 (0.123)	-1.7206 (1.072)	0.2279 (0.258)
Import penetration (industry)	-0.1287 (0.121)	-0.3032 (0.593)	0.2124 (0.144)
Openness (economy)	0.0869 (0.137)	0.6256 (0.386)	-0.1069 (0.102)
Employment composition	____	-0.1387 (0.323)	____
Union density	____	0.3039 (0.833)	____
Export share * Union density	____	2.2550 (1.838)	____
Import penetration * Union density	____	0.9027 (1.289)	____
Openness * Union density	____	-1.0564 (0.863)	____
Employment composition * Union density	____	-0.5242 (0.963)	____
Relative wage	-0.7503 (0.124)	____	____
Relative wage 1 lag	0.3865 (0.148)	____	____
Relative wage 2 lags	-0.1786 (0.151)	____	____
Relative wage 3 lags	0.2547 (0.141)	____	____
Relative wage 4 lags	0.0783 (0.143)	____	____
Wedge	____	-0.8605 (0.272)	____
Wedge 1 lag	____	0.0892 (0.436)	____
Wedge 2 lags	____	0.4146 (0.409)	____
Wedge 3 lags	____	-0.3450 (0.424)	____
Wedge 4 lags	____	0.0734 (0.368)	____
Alternative wage	____	0.7327 (0.403)	____
Alternative wage 1 lag	____	-0.7360 (0.537)	____
Alternative wage 2 lags	____	0.2780 (0.597)	____
Alternative wage 3 lags	____	-0.4675 (0.480)	____
Alternative wage 4 lags	____	0.1404 (0.230)	____
Employment composition	____	1.1193 (0.569)	____
Product demand	____	____	-0.0189 (0.180)
Product demand 1 lag	____	____	0.0066 (0.096)
Product demand 2 lags	____	____	0.0957 (0.052)
Product demand 3 lags	____	____	-0.0573 (0.052)
Product demand 4 lags	____	____	0.1397 (0.097)
Wage level	____	____	-0.1737 (0.136)
Wage level 1 lag	____	____	0.0696 (0.140)
Wage level 2 lags	____	____	-0.0230 (0.098)
Wage level 3 lags	____	____	0.0864 (0.094)
Wage level 4 lags	____	____	-0.1848 (0.085)
Dependent variable 1 lag	0.5171 (0.086)	0.6256 (0.386)	0.7818 (0.152)
Dependent variable 2 lags	0.0771 (0.096)	0.0791 (0.224)	-0.1923 (0.210)
Dependent variable 3 lags	0.1209 (0.093)	0.2791 (0.206)	0.1403 (0.171)
Dependent variable 4 lags	0.0323 (0.100)	0.0350 (0.235)	-0.1275 (0.204)

(Table A7.2 continued)			
Number of observations (T) Sample	168 1986.1-1992.4	162 1986.2- 1999.4	162 1986.2- 1999.4
Sargan test of over-identifying restrictions $\chi 2$(n° of over-identifying restrictions)	0.50531 [0.4772]	1.2143 [0.2705]	5.9342 [0.2041]
Normality test (Jarque-Bera) $\chi 2$ (2)	50.096 [0.0000] **	9.2001 [0.0101] *	12.486 [0.0019] **
Heteroskedasticity F[m, T-m] m = n° restrictions	1.062 [0.3952]	2.1445 [0.0011] **	1.4215 [0.0819]
Autocorrelation order 2 $\chi 2$ (2)	0.08197 [0.9598]	3.4199 [0.1809]	2.9979 [0.2234]
Testing all coefficients = 0 $\chi 2$ (k) k = n° predetermined vars.	5655.9 [0.0000] **	1428.8 [0.0000] **	44416 [0.0000] **
Instruments used	Relative price Uruguay-Rest of World; Equivalent tariff; Import Penetration lagged; Export share lagged	Relative price Uruguay-Rest of World; Equivalent tariff; Employment mix lagged; Relative wage blue/white-collars;	Relative price Uruguay-Rest of World; Equivalent tariff; Employment mix lagged; Relative wage blue/white-collars; Alternative wage current & lagged; Wedge current & lagged; GDP lagged;

Note: Industries are: food, beverage & tobacco (31); textiles & leather (32); paper (34); chemicals & oil (35); non-metallic minerals (36); metal products (38). Standard errors are in parenthesis besides each estimated coefficient (corrected following White (1980) for the wage equation). Tests statistics are reported with p-values in parenthesis below. A '*' means the hypothesis is rejected at 95% confidence while if '**' it is so at 99% confidence.

Table A7.3 Initial specification: estimated coefficients 1992 - 1999

Variable	Employment Composition	Wage Level	Employment Level
Constant	0.0353 (0.191)	0.2864 (0.652)	-0.1006 (1.586)
Quarter 1	-0.1526 (0.240)	0.2838 (0.218)	0.0079 (0.018)
Quarter 2	-0.0366 (0.320)	0.3287 (0.312)	-0.0031 (0.007)
Quarter 3	-0.1100 (0.118)	0.1610 (0.102)	-0.0022 (0.009)
Industry 31	-0.1416 (0.096)	0.0336 (0.105)	0.0865 (0.217)
Industry 32	-0.0394 (0.110)	0.1865 (0.182)	0.0973 (0.288)
Industry 34	-0.0093 (0.007)	-0.0230 (0.007)	0.1759 (0.212)
Industry 35	0.0009 (0.007)	-0.0063 (0.005)	0.0591 (0.136)
Industry 36	0.0036 (0.007)	-0.0078 (0.005)	0.1559 (0.226)
Export share (industry)	0.2796 (0.644)	-0.5429 (0.468)	-0.1276 (0.456)
Import penetration (industry)	-0.2651 (0.283)	0.5803 (0.518)	0.1725 (0.422)
Openness (economy)	0.4707 (0.330)	0.0590 (0.651)	0.3117 (0.877)
Employment composition	_____	0.3478 (0.317)	_____
Union density	0.6713 (0.866)	0.5101 (1.862)	0.3682 (1.345)
Export share * Union density	-0.4392 (0.527)	0.4691 (0.455)	-0.0010 (0.277)
Import penetration * Union density	0.3618 (0.268)	-0.8031 (0.854)	0.1629 (0.283)
Openness * Union density	-1.0890 (1.209)	1.0095 (0.954)	-0.4814 (1.893)
Employment composition * Union density	_____	-1.2925 (1.362)	_____
%Workers covered by firm-level agreement	-0.2884 (0.148)	0.2074 (0.096)	-0.0972 (0.248)
Relative wage	-0.3928 (0.167)	_____	_____
Relative wage 1 lag	0.0971 (0.173)	_____	_____
Relative wage 2 lags	0.1936 (0.164)	_____	_____
Relative wage 3 lags	0.0326 (0.160)	_____	_____
Relative wage 4 lags	0.0160 (0.134)	_____	_____
Wedge	_____	-0.9412 (0.320)	_____
Wedge 1 lag	_____	0.6837 (0.431)	_____
Wedge 2 lags	_____	-0.4412 (0.648)	_____
Wedge 3 lags	_____	-0.0366 (0.431)	_____
Wedge 4 lags	_____	1.2644 (0.803)	_____
Alternative wage	_____	-0.1437 (0.236)	0.3789 (0.322)
Alternative wage 1 lag	_____	0.7177 (0.373)	0.0101 (0.441)
Alternative wage 2 lags	_____	-0.0808 (0.291)	0.0072 (0.230)
Alternative wage 3 lags	_____	-1.0084 (0.562)	-0.2351 (0.369)
Alternative wage 4 lags	_____	0.1334 (0.176)	_____
Product demand	_____	_____	0.3609 (0.189)
Product demand 1 lag	_____	_____	-0.1746 (0.109)
Product demand 2 lags	_____	_____	0.0120 (0.067)
Product demand 3 lags	_____	_____	-0.0558 (0.052)
Product demand 4 lags	_____	_____	_____
Wage level	_____	_____	-0.4159 (0.920)
Wage level 1 lag	_____	_____	0.1076 (0.682)
Wage level 2 lags	_____	_____	0.1298 (0.173)
Wage level 3 lags	_____	_____	-0.1146 (0.148)
Wage level 4 lags	_____	_____	_____
Dependent variable 1 lag	0.5308 (0.123)	0.6295 (0.132)	0.6964 (0.246)
Dependent variable 2 lags	-0.1619 (0.093)	-0.2966 (0.247)	-0.0698 (0.225)
Dependent variable 3 lags	0.0480 (0.105)	0.0714 (0.136)	-0.0065 (0.166)
Dependent variable 4 lags	0.0977 (0.082)	0.5263 (0.264)	0.3498 (0.149)

(Table A7.3 continued)			
Number of observations (T)	168	168	180
Sample	1986.1-1992.4	1993.1- 1999.4	1992.3- 1999.4
Sargan test of over-identifying restrictions	3.1855	6.6252	3.1062
$\chi 2$(n° of over-identifying restrictions)	[0.0743]	[0.3569]	[0.3755]
Normality test (Jarque-Bera)	25.433	1.1551	4.7558
$\chi 2$ (2)	[0.0000]**	[0.5613]	[0.0927]
Heteroskedasticity	0.82479	0.72476	1.2175
F[m, T-m] m = n° restrictions	[0.7555]	[0.8975]	[0.2009]
Autocorrelation order 2	0.25783	8.5321	0.10073
$\chi 2$ (2)	[0.7731]	[0.0140] *	[0.9509]
Testing all coefficients = 0	6654.6	6032.1	26260
$\chi 2$ (k) k = n° predetermined vars.	[0.0000] **	[0.0000] **	[0.0000] **
Instruments used	Relative price Uruguay-Rest of World; Equivalent tariff; Import Penetration lagged; Export share lagged	Relative price Uruguay-Rest of World; Equivalent tariff; Employment mix lagged; Relative wage blue/white-collars lagged;	Relative price Uruguay-Rest of World; Equivalent tariff; Employment mix lagged; Wedge lagged; GDP lagged; Wage lagged

Note: Industries are: food, beverage & tobacco (31); textiles & leather (32); paper (34); chemicals & oil (35); non-metallic minerals (36); metal products (38). Standard errors are in parenthesis besides each estimated coefficient. Tests statistics are reported with p-values in parenthesis below. A '*' means the hypothesis is rejected at 95% confidence while if '**' it is so at 99% confidence.

Bibliography

Abowd, J.M. and L. Allain (1996), 'Compensation structure and product market competition', NBER, Working Paper 5493.

Aghion, P. and G. Saint-Paul (1993), 'Uncovering some causal relationships between productivity growth and the structure of economic fluctuations: a tentative survey', NBER, Working Paper 4603.

Allen, S. (1986), 'Union work rules and efficiency in the building trades,' *Journal of Labor Economics*, 4/2: 212-42.

Allen, S., A. Cassoni and G.J. Labadie (1994), 'Labor market flexibility and unemployment in Chile and Uruguay', *Estudios de Economía*, Vol. 21, especial number: 129-46.

Altenburg, L. and M. Straub (2001), 'Taxes on labour and unemployment in a shrinking model with union bargaining', *Labour Economics,* Vol. 8/6: 721-44.

Azariadis, C. (1975), 'Implicit contracts and underemployment equilibria', *Journal of Political Economy*, 83/6: 1183-1202.

Baily M.N. (1974), 'Wages and employment under uncertain demand', *Review of Economic Studies*, 41/1: 37-50.

Banerjee, A., J. Dolado, J.W. Galbraith and D. Hendry (1993), *Co-integration, error correction, and the econometric analysis of non-stationary data*, Oxford University Press.

Bean, C.R., R. Layard and S. Nickell (1985), 'The rise in unemployment: a multi-country study', *Economica*, supplement 53(S): S89-S120.

Benassy, J.P. (1995), 'Nominal rigidities in wage setting by rational trade unions', *Economic Journal*, 105: 635-43.

Berlinski (2000), ' International trade and commercial policies of Argentina (An overview of selected evidence and issues of the 20th century)', Instituto di Tella, mimeo.

Binmore, K., A. Rubinstein and A. Wolinsky (1986), 'The Nash bargaining solution in economic modelling', *Rand Journal of Economics,* 17/2: 176-88.

Black S. and L. Lynch (1997), 'How to compete: the impact of workplace practices and information technology on productivity', NBER, Working Paper 6120.

Blanchard, O. and S. Fischer (1993), *Lectures on macroeconomics*, Cambridge Mass.: MIT Press.

Blanchard, O. and D. Quah (1989), 'The dynamic effects of aggregate demand and supply disturbances', *The American Economic Review*, 79/4: 655-73.

Blanchard, O. and L.H. Summers (1986), 'Hysteresis and the European unemployment problem', in S. Fischer (ed.), *NBER Macroeconomic Annual* Vol.1, Cambridge Mass.: MIT Press.

Blanchflower, D.G. (1984), 'Union relative wage effects: a cross-section analysis using establishment data', *British Journal of Industrial Relations*, 22: 311-32.

Blanchflower, D.G., N. Millward and A.J. Oswald (1991), 'Unionism and employment behaviour', *Economic Journal*, 101: 815-34.

Blau, F. (1998), 'Trends in the well being of American women, 1970-1995', *Journal of Economic Literature*, 36/1: 112-65.

Boal, W.M. (1985), 'Unionism and productivity in West Virginia coal mining', Stanford University, Department of Economics, unpublished PhD dissertation.

Boal, W.M. and J.H. Pencavel (1994), 'The effects of labor unions on employment, wages and days of operation: coal mining in West Virginia', *Quarterly Journal of Economics*, 109: 267-98.

Booth, A.L. (1985), 'The free-rider problem and a social custom theory of trade union membership', *Quarterly Journal of Economics*, 100: 253-61.

(1995), *The economics of the trade unions*, Cambridge University Press.

Booth, A.L. and M. Chatterji (1993), 'Reputation, membership and wages in an open shop trade union', *Oxford Economic Papers*, 45/1: 23-41.

(1995), 'Union membership and wage bargaining when membership is not compulsory', *Economic Journal*, 105: 345-60.

Booth, A.L. and D.T. Ulph (1990), 'Union wages and employment with endogenous membership', University College London, Department of Economics, mimeo.

Brown, J.N. and O. Ashenfelter (1986), 'Testing the efficiency of employment contracts', *Journal of Political Economy*, 94 (supplement): S40-S87.

Budd, J.W. and I. Na (2000), 'The union membership wage premium for employees covered by collective bargaining agreements', *Journal of Labor Economics*, Vol.18/4: 783-807.

Burgess, S.M. (1988), 'Employment adjustment in the UK manufacturing', *Economic Journal*, 98: 81-93.

(1989), 'Employment and turnover in UK manufacturing industries, 1963-82', *Oxford Bulletin of Economics and Statistics*, 51/2: 163-92.

Burgess, S.M. and J. Dolado (1989), 'Intertemporal rules with variable speed of adjustment: an application to UK manufacturing employment', *Economic Journal*, 99: 347-65.

Calmfors, L. (1985), 'Trade unions, wage formation and macroeconomic stability -An introduction', *Scandinavian Journal of Economics*, 87/2: 143-59.

(1993), 'Centralisation of wage bargaining and macroeconomic performance - a survey', Stockholm University, Institute for International Economic Studies, Seminar Paper 536.

Calmfors, L. and E.J. Driffill (1988), 'Bargaining structure, corporatism and macroeconomic performance', *Economic Policy*, 6: 13-62.

Calvo, G. and E.S. Phelps (1977), 'Employment contingent wage contracts', *Journal of Monetary Economics*, Supplement: 160-68.

Card, D. (1986), 'Efficient contracts with costly adjustment: short-run employment determination for airlines mechanics', *The American Economic Review*, 76: 1045-71.

(1990), 'Strikes and wages: a test of an asymmetric information model', *Quarterly Journal of Economics*, 105: 625-60.

Card, D. and C.A. Olson (1995), 'Bargaining power, strike durations and wage outcomes: an analysis of strikes in the 1880s', *Journal of Labor Economics*, 13/1: 32-61.

Carruth A.A. and A.J. Oswald (1985), 'Miners' wages in post-war Britain: an application of a model of trade union behaviour', *Economic Journal*, 95: 1003-20.

(1987), 'On union preferences and labour market models: insiders and outsiders', *Economic Journal*, 97: 431-45.

Cassoni, A. (1999), 'Unemployment and precariousness of employment: who are the losers', The World Bank, mimeo.

Cassoni, A., S. Allen and G. Labadie (1996), 'Wages and employment after re-unionization in Uruguay', *Cuadernos de Economía* 99: 277-94.

Cassoni, A. and G. Fachola (1997), 'El sector servicios no financieros: perspectivas ante la apertura y la integración', Ministry of Labor Uruguay, mimeo.

Cassoni, A. and Z. Ferre (1997), 'Costos no salariales en el mercado de trabajo de Uruguay', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 8/97.

Cassoni, A., G.J. Labadie and S. Allen (1995), 'Labour market reforms in the economic liberalisation. The case of Uruguay', in G. Marquez (ed.), *Reforming the labor market in a liberalized economy*, Center for Research in Applied Economics - IDB: chapter 4.

Cassoni, A., G.Fachola and G.J.Labadie (2001), 'The impact of unions on the economic performance of firms', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 15/01.

Cedrola, G., J. Raso and F. Perez Tabó (1998), *La negociación colectiva en el Uruguay, 1996-1997*, ILO Santiago.

Chatterjee, K. and L. Samuelson (1987), 'Bargaining with two-sided incomplete information: an infinite horizon model with alternating offers', *Review of Economic Studies*, 54/2: 175-92.

Clark, A. (1990), 'Efficient bargains and the MacDonald-Solow conjecture', *Journal of Labor Economics*, 8/4: 502-28.

(2001), 'What really matters in a job? Hedonic measurement using quit data', *Labour Economics*, Vol.8/2: 223-42.

Conlin, M. and T. Furusawa (2000), 'Strategic delegation and delay in negotiations over the bargaining agenda', Vol.18/1: 55-73.

Corneo, G. and C. Lucifora (1997), 'Wage formation under union threat effects: theory and empirical evidence', *Labour Economics*, Vol.4/3: 265-92.

Cramton, P.C. and J.S. Tracy (1994), 'Wage bargaining with time-varying threats', *Journal of Labor Economics*, 12/4: 594-617.

Croce, H., L. Macedo and P. Triunfo (2000), 'Función de costos: un estudio para los bancos comerciales uruguayos', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 1/00.

de Brun, J. and G. Labadie (1997), 'Mercado laboral, apertura y recesión: la experiencia uruguaya de los noventa', in *Mercados laborales en los noventa: cinco ejemplos de América Latina*, CIEDLA, Konrad Adenauer, Stiftung, Argentina.

de Menil, G. (1971), *Bargaining: monopoly power versus union power*, Cambridge Mass.: MIT Press.

Dertouzos, J. N. and J. Pencavel (1981), 'Wage and employment determination under trade unionism: the International Typographical Union', *Journal of Political Economy*, 89/6: 1162-81.

Diez de Medina, R. (2001), 'Jóvenes y empleo en los noventa en América Latina', ILO Montevideo.

Dow, G.K. (1993), 'Why capital hires labor: a bargaining perspective', *American Economic Review,* 83:118-34.

Driffill, E.J. (1985), 'Macroeconomic stabilization policy and trade union behaviour as a repeated game', *Scandinavian Journal of Economics*, 87/2: 300-26.

Driffill, E.J. and F. van der Ploeg (1993), 'Monopoly unions and the liberalisation of international trade', *Economic Journal*, 103: 379-85.

Dunlop, J.T. (1944), *Wage determination under trade unions*, London: MacMillan.

Earle, J.S. and J. Pencavel (1990), 'Hours of work and trade unionism', *Journal of Labor Economics*, 8/1, s.2: 150-74.

Edwards, S. (1995), *Crisis and reform in Latin America*, Oxford University Press.

Engle, R.F. and C.W.J. Granger (1987), 'Cointegration and error correction: representation, estimation and testing', *Econometrica*, 55: 251-76.

Engle, R.F and B.S. Yoo (1987), 'Forecasting and testing in cointegrated systems', *Journal of Econometrics*, 35: 143-59.

Ermida, O., G. Cedrola, J. Raso and F. Perez Tabó (1998), 'Estructura y contenido de la negociación colectiva en Uruguay', ILO Lima, Document Series.

Espinoza, M.P. and C. Rhee (1989), 'Efficient wage bargaining as a repeated game', *Games and Economic Behavior*, 1: 327-60.

Farber, H.S. (1978), 'Individual preferences and union wage determination: the case of the United Mine Workers', *Journal of Political Economy*, 86/5: 932-42.

Favaro, E. and C. Sapelli (1986), *Shocks externos, grado de apertura y política doméstica*, Montevideo: Banco Central del Uruguay.

Forteza, A. (1992), 'Los convenios salariales de 1990 y la inflación', *SUMA* 7/12: 7-36.

Freeman, R. and J.L. Medoff (1982), 'Substitution between production labor and other inputs in unionized and nonunionized manufacturing,' *Review of Economics and Statistics*, 64/2: 220-33.

(1984), *What do unions do?*, New York: Basic Books.

Fuller, W.A. (1976), *Introduction to statistical time series*, New York: John Wiley.

Gillespie, C.G. (1991), *Negotiating democracy*, Cambridge: Cambridge University Press.

Goerke, L. (1994), 'Asymmetric information, centralized bargaining and strike outcomes', Universitat Hamburg, mimeo.

Grossman, G. (1983), 'Union wages, seniority and unemployment', *The American Economic Review*, 73: 277-90.

Haltiwanger, J. and J. Harrington (1991), 'The impact of cyclical demand movements on collusive behaviour', *Rand Journal of Economics*, 22: 89-106.

Hamermesh, D.S. (1993), *Labor demand*, New Jersey: Princeton University Press.

(1995), 'Labour demand and the source of adjustment costs', *Economic Journal*, 105: 620-34.

Hamermesh, D.S. and G.A. Pfann (1996), 'Adjustment costs in factor demand', *Journal of Economic Literature*, 34/3: 1264-92.

Handelman, H. (1981), 'Labor-industrial conflict and the collapse of Uruguayan democracy', *Journal of Interamerican Studies and World Affairs*, 28/4: 371-94.

Harris, R.J. (1975), *A primer of multivariate statistics*, New York : Academic Press.

Hart, O.D. (1989), 'Bargaining and strikes', *Quarterly Journal of Economics*, 104/1: 25-43.

Hausman, J.A. (1978), 'Specification tests in econometrics', *Econometrica*, 46: 1251-71.

Heylen, F. (1993), 'Labour market structures, labour market policy and wage formation in the OECD', *Labour*, 7.

Hirsch, B.T. and J.T. Addison (1986), *The economic analysis of unions: new approaches and evidence*, Boston: Allen & Unwin.

Hirsch B. and K. Prasad (1995), 'Wage-employment determination and a union tax on capital: can theory and evidence be reconciled?', *Economics Letters* 48: 61-71.

Horn, H. and A. Wolinsky (1988), 'Worker substitutability and patterns of unionisation', *Economic Journal*, 98: 484-97.

Jimenez-Martin, S. (1999), 'Controlling for endogeneity of strike variables in the estimation of wage settlement equations', *Journal of Labor Economics*, Vol.17/3: 583-606.

Johansen, S. (1988), 'Statistical analysis of cointegration vectors', *Journal of Economic Dynamics and Control*, 12: 231-54.

Johnson, G.E. (1975), 'Economic analysis of trade unionism', *The American Economic Review*, P&P 65: 23-29.

(1990), 'Work rules, featherbedding, and Pareto - optimal union-management bargaining', *Journal of Labor Economics*, 8/1(2): 237-59.

Jones, S.R.G. and C.J. McKenna (1994), 'A dynamic model of union membership and employment', *Economica*, 61: 179-89.

Kandori, M. (1991), 'Correlated demand shocks and price wars during booms', *Review of Economics Studies*, 58: 171-80.

Kidd, D.P. and A.J. Oswald (1987), 'A dynamic model of trade union behaviour', *Economica*, 54: 355-65.

Kuhn, P. and W. Gu (1999), 'Learning in sequential wage negotiations: theory and evidence', *Journal of Labor Economics*, Vol.17/1: 109-40.

Layard, R., S. Nickell (1990), 'Is unemployment lower if unions bargain over employment?', *Quarterly Journal of Economics*, 105/3: 773-87.

Layard, R., S. Nickell and R. Jackman (1991), *Unemployment: macroeconomic performance and the labour market*, Oxford University Press.

Lewis, H.G. (1986), *Union relative wage effects: a survey*, Chicago: University of Chicago Press.

(1990), 'Union/nonunion wage gaps in the public sector', *Journal of Labour Economics*, 8/1, (part 2): S260-S328.

Lockwood, B. and A. Manning (1987), 'Dynamic wage-employment bargains with endogenous membership', Birkbeck College, mimeo.

(1989), 'Dynamic wage-employment bargaining with employment adjustment costs', *Economic Journal*, 99: 1143-58.

Low, Olarreaga, and Suarez (1999), 'Does globalization cause a higher concentration of international trade and investment flows?', World Trade Organisation, Working Paper.

MacDonald, I. and R. Solow (1981), 'Wage bargaining and employment', *The American Economic Review*, 71: 896-908.

MacKinnon, J.G. (1991), 'Critical values for co-integration tests', in R. Engle and C.W.J. Granger, (eds.), *Long-run economic relationships*, Oxford University Press: 267-76.

Machin S. and S. Wadhwani (1991), 'The effects of unions on organisational change and employment', *Economic Journal*, 101: 835-54.

Machin, S., M. Stewart and J. van Reenen (1993), 'The economic effects of multiple unionism', *Scandinavian Journal of Economics*, 95/3: 275-92.

Malcomson, J.M. (1983), 'Trade unions and economic efficiency', *Economic Journal*, Conference Papers Supplement, 93: 51-65.

Manning, A. (1987), 'An integration of trade union models in a sequential bargaining framework', *Economic Journal*, 97: 121-39.

(1994), 'How robust is the microeconomic theory of the trade union?', *Journal of Labor Economics*, 12/3: 430-59.

McCallum, J. (1983), 'Inflation and social consensus in the seventies', *Economic Journal*, 93: 55-63.

Menezes-Filho, N., D.Ulph and J. van Reenen (1998), 'The determination of R&D: empirical evidence on the role of unions', *European Economic Review*, 42/3-5: 919-30.

Metcalf D. and M. Stewart (1992), 'Close shops and relative pay: institutional arrangements or high density?', *Oxford Bulletin of Economics and Statistics,* 54,4: 503-16.

Moreton, D. (1993), 'Trade unions effects on labour productivity in UK manufacturing, 1950-1987', University of Greenwich, mimeo.

Myles, G.D. and R. Naylor (1995), 'Do unions reduce discrimination? A model of Nash bargaining between a union and an employer with discriminatory tastes', *Labour Economics*, Vol.2/3: 249-74.

Naish, H.F. (1988), 'Optimal wage setting behaviour and the non-neutrality of anticipated monetary changes', *Oxford Economic Papers*, 40: 346-64.

Naylor, R.A. (1989), 'Strikes, free riders and social customs', *Quarterly Journal of Economics*, 104/4: 771-86.

(1995), 'On the economic effects of multiple unionism', *Scandinavian Journal of Economics*, 97/1: 161-67.

(1998), 'International trade and economic integration when labour markets are generally unionised', *European Economic Review*, Vol.42: 1251-67.

(1999), 'Union wage strategies and international', *Economic Journal*, Vol.109/452: 102-25.

(2000), 'Trade and wages when the trade regime is determined endogenously', *Review of International Economics*, Vol.8/3: 556-66.

Nickell, S.J. (1982), 'A bargaining model of the Phillips curve', London School of Economics, Centre for Labour Economics, Discussion Paper.

Oswald, A.J. (1982), 'Uncertainty and the trade union', *Economic Letters* 9: 105-11.

(1985), 'The economic theory of trade unions: an introductory survey', *Scandinavian Journal of Economics*, 87/2: 160-93.

(1986a), 'A theory of non-contingent wage contracts', London School of Economics, Centre for Labour Economics, Discussion Paper 266.

(1986b), 'Unemployment insurance and labor contracts under asymmetric information: theory and facts', *The American Economic Review*, 76: 365-77.

(1993), 'Efficient contracts are on the labour demand curve: theory and facts', *Labour Economics*, 1/1: 85-113.

Oswald, A.J. and I. Walker (1994), 'Rethinking labour supply: contract theory and unions', London School of Economics, Centre for Economic Performance, mimeo.

Palokangas T. (2000), *Labour unions, public policy and economic growth*, Cambridge University Press.

Pencavel, J. (1991), *Labor markets under trade unionism: employment, wages and hours*, New York: Basil Blackwell Ltd.

Petrakis, E. and M. Vlassis (2000), 'Endogenous scope of bargaining in a union-oligopoly model: when will firms and unions bargain over employment?', *Labour Economics*, Vol.7/3: 261-81.

Picardo, S., C. Daude and Z. Ferre (1997), 'Indice del costo de la mano de obra: 1982-1995', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 1/97.

Rama, M. (1993a), 'Organized labor and the political economy of product market distortions', The World Bank and CINVE, mimeo.

(1993b), 'Institucionalidad laboral y crecimiento económico en el Uruguay', Academia Nacional de Economía, mimeo.

(1994) 'Bargaining structure and economic performance in the open economy', *European Economic Review*, 38: 403-15.

Reggio, I. and V. Amarante (2000), 'El desempleo en el Uruguay, 1995-1997', Economic Sciences and Administration Faculty of Uruguay, Institute of Economics, Working Paper 1/00.

Rodriguez, J. M., B. Cozzano, G. Mazzuchi and M. L. Pozzolo (1998), *¿Hacia un nuevo modelo de relaciones laborales?*, Montevideo: Trilce-Universidad Católica.

Rodrik, D. (1997), *Has globalisation gone too far?*, Washington: Institute for International Economics.

Rodrik, D. and F. Rodriguez (1999), 'Trade policy and economic growth: a skeptics guide to cross-national evidence', NBER, Working Paper 7081.

Rosen, A. (1989), 'Bargaining over effort', London School of Economics, Centre for Economic Performance, Discussion Paper 351.

Ross, A.M. (1948), *Trade union wage policy*, University of California Press.

Rotemberg, J. and M. Woodford (1992), 'Oligopolistic pricing and the effects of aggregate demand on economic activity', *Journal of Political Economy*, 100/6: 1153-1207.

Sampson, A. (1988), 'Unionized contracts with fixed wage rates and state-contingent employment levels', *Economica*, 55: 95-105.

Schultz, C. (1994), 'Wages and employment in a repeated game with revenue fluctuations', University of Copenhagen, Institute of Economics, mimeo.

Spanos, A. (1986), *Statistical foundations of econometric modelling*, Cambridge University Press.

Strand, J. (2000), 'Wage bargaining and turnover costs with heterogeneous labor and asymmetric information', *Labour Economics*, Vol. 7/1: 95-116.

Tansini, R. and P. Triunfo (1998a), 'Eficiencia técnica y apertura externa en el sector manufacturero uruguayo', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 4/98.

(1998b), 'Cambio tecnológico y productividad de las empresas industriales uruguayas', Social Sciences Faculty of Uruguay, Department of Economics, Working Paper 12/98.

Ulph, A.M. and D.T. Ulph (1988), 'Bargaining structures and delay in innovation', *Scandinavian Journal of Economics*, 90: 475-91.

(1994), 'Labour markets and innovation', *European Economic Review*, 38: 195-210.

(1998), 'Labour markets, bargaining and innovation', *European Economic Review* , 42/3-5: 931-39.

Vaillant, M. (2000), 'Medidas alternativas de la apertura comercial. Un análisis país, Uruguay 1976-1999', Social Sciences Faculty of Uruguay, Department of Economics, mimeo.

van Reenen, J. (1995), 'The creation and capture of rents: wages and innovation in a panel of UK companies', University College London, Discussion Paper 1017.

Vetter, H. (1995), 'The dynamics of monopoly union wages with asymmetric information', *Scandinavian Journal of Economics*, 97/1: 89-103.

Wadhawani, S. (1990), 'The effect of unions on productivity growth, investment and employment: a report on some recent work', *British Journal of Industrial Relations*, 28/3: 371-85.

White, H. (1980), 'A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity', *Econometrica*, 48: 817-38.

Zellner, A. (1962), 'An efficient method of estimating seemingly unrelated regressions and tests of aggregation bias', *Journal of the American Statistical Association*, 57: 500-9.

Zubillaga, C. and J. Balbi (1992), *Historia del movimiento sindical uruguayo. Vol. 4: cuestión social y debate ideológico*, Montevideo: Banda Oriental.

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