The wage elasticity of labour demand in the Uruguayan manufacturing sector after re-unionisation: new results

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Abstract

This paper provides new evidence on the magnitude of the elasticity of substitution between labour and capital for the Uruguayan manufacturing sector. Labour demand is derived using a right-to-manage model estimated for the period 1985-1997 using data for six industries. The evidence found suggests that the elasticity is generally less than 1. Differences by industry and in time are also found. The latter result may be linked both to the integration process underwent by Uruguay in the nineties and to the changes in the bargaining framework that took place in that same period. As a nested CES production function is used to derive the labour demand, the partial elasticity of substitution between production and non-production workers is also calculated, being its magnitude quite low. Finally, the model was estimated using data from industrial surveys (gathered from firms) and from household surveys. The comparison of results shows that when using industrial surveys data the estimated elasticities are higher than when using household surveys data. The result is probably related to the different coverage of both sources, as well as to the different accuracy reached in measuring wages.

Resumen

Este artículo brinda nueva evidencia sobre el valor de la elasticidad de sustitución entre capital y trabajo, para la industria manufacturera uruguaya. La función de demanda de trabajo se deriva a partir de un modelo de negociación salarial de tipo *right-to-manage*, estimado durante el período 1985-1997, usando datos de seis industrias manufactureras. La evidencia sugiere que la elasticidad de sustitución es generalmente menor que 1. Se encuentran diferencias por industria y en el tiempo. Este último resultado puede asociarse tanto al proceso de integración del país, iniciado en los noventa, como al cambio en el marco de negociación salarial que tuvo lugar en el mismo período. Dado que la demanda derivada de trabajo se obtiene a partir de una función producción CES anidada, el modelo también permite calcular la elasticidad parcial de sustitución entre obreros y empleados, siendo su magnitud bastante baja. Finalmente, el modelo se estimó usando datos provenientes de encuestas industriales (en las que se entrevista a los establecimientos) y encuestas de hogares. La comparación de los resultados obtenidos muestra que las elasticidades estimadas son más altas cuando se usa el primer tipo de encuestas. Esto es probablemente explicable tanto por la diferente cobertura de ambas encuestas como por la diferente precisión en la medición de los salarios.

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1. Introduction

In 1985, when democracy was reinstated in Uruguay after a 12 years military regime, the institutional setting in which labour relations took place changed drastically. Unions were reorganised and started bargaining wage increases together with employers associations. The government participated in these negotiations until 1991. Further, public workers regained the right not to be fired (except for certain causes specified by law), while the Ministry of Labour was again the main authority solving possible conflicts between employers and employees. Previous work (Cassoni, 1999a; Cassoni, Allen and Labadie, 1999; 1996) has shown that all these changes did have an impact on the manufacturing sector labour demand. Unions, among other factors, have pushed wages up. The evidence on which is the suitable bargaining model, however, is mixed. The results obtained in Cassoni *et al.* (1996) pointed at an efficiency contracts model, or at least at a model in which employment would not be on the labour demand function of firms. However, the analysis of all contracts signed since 1985 supports the idea that the employers have retained their right to adjust employment given the wage bargained in the so called Wage Councils, as they do not include any clauses relative to the level of employment or to firing practices. Under these assumptions, the effects of the new setting would have been reflected in a change in the underlying production function, lowering both the wage and the output elasticities of labour demand (Cassoni, 1999a and Cassoni *et al.*, 1999). This result was obtained estimating a right-to-manage model for the period 1985-1997, and comparing it with those of a competitive model estimated for 1975-1984. Although the direction of the changes found in the relevant parameters are robust, their magnitude is quite small. A possible explanation could be linked to the existence of simultaneity bias. A 3-equations system derived from a CES production function was postulated, reflecting the demand for capital services, production and non-production workers, but only the demand for production workers was estimated[1].

A first aim of this paper is to estimate the elasticity of substitution and hence the wage elasticity of labour demand, using data on production *and* non-production workers, so as to obtain new evidence on the magnitude of this parameter. The model to be used follows that specified in Cassoni (1999a), that is, a right-to-manage bargaining model, with a technology defined by a CES production function. However, instead of assuming there are three distinct factors of production, a nested CES will be used (Sato, 1967), in which two inputs - capital and labour – are considered, but the latter is classified in two categories, and aggregated according to a CES function itself. Further, the partial elasticity of substitution among both types of labour will be also derived.

A second objective here pursued relates to the sensitivity of results to the information set used. In Uruguay the only source of information on employment by economic sector with a

[1] Theoretically, the elasticity of substitution between both types of labour and capital is the same, if a multi-factor CES production function is assumed. However, if when estimating the demand for production workers this restriction is not imposed, biases, of unknown sign, arise.

quarterly or monthly frequency is the Household Survey. Hence, recent work in Uruguay that has attempted to estimate the parameters of a production function has used this source of information. However, it is well known that income measures obtained from household surveys are not the best approximations of wages. Further, being the individual the unit of observation, employment levels calculated from household surveys are not equal to those obtained from establishment surveys in Uruguay. The former would cover a greater number of firms than the latter, in which only establishments with 5 or more workers are interviewed. If small firms use technologies that imply a different elasticity of substitution, then the estimated value of this parameter might be different depending on the source of information used.

2. The model

Firms are assumed to use a CES technology with two inputs, capital and labour. Labour, in turn, may be classified in two categories: according to the worker being directly involved in production or not (production and non-production workers). Labour is hence not homogenous. It is assumed that both types of workers are combined according to a CES function, following Sato (1967):

$$Q^{1/:} = \{[\forall L_{np}^{\kappa} + (1-\forall)L_p^{\kappa}]^{\Lambda/\kappa} + \exists K^{\Lambda}\}^{1/\Lambda} \qquad (1)$$

where Q is value added; L_{np} refers to non-production workers; L_p refers to production workers; and K accounts for capital services. The parameter : allows for increasing or decreasing returns to scale (:>1; :<1); while Δ and Λ determine the elasticities of substitution between L_{np} and L_p (Φ_{npp}) and between labour and capital (Φ_{KL}), according to the following formulae:

$$\Phi_{KL} = 1/(1-\Lambda)$$
$$\Phi_{npp} = \Phi_{KL} + (\Phi_{\kappa} - \Phi_{KL}) / s_L$$
with $\Phi_{\kappa} = 1/(1-\kappa)$ and s_L labour share in value added

The partial elasticity of substitution between the two types of workers - Φ_{κ} - reflects substitution within the subprocess generating labour but it does not take into account technical restrictions as summarised by the elasticity of substitution between subprocesses. On the other hand, Φ_{npp} does account for the latter effect. The nested (two-levels) CES production function thus imposes the restriction that the elasticity of substitution between capital and both categories of workers is the same but it allows for a different elasticity of substitution between the two types of labour. Further, it is possible that production and non-production workers are complementary factors depending on the value of Φ_{KL} (Anderson and Moroney, 1994).

If firms maximise profits, subject to given prices of inputs, the system of derived demands for the three inputs is:

$$K = (_0(p_c/p)^{-(_1} Q^{(_2} \qquad (2)$$
$$L_{np} = (_3(w_{np}/p)^{-(_4} Q^{(_5}[\forall L_{np}^{\kappa} + (1-\forall)L_p^{\kappa}]^{(_6} \qquad (3)$$
$$L_p = (_7(w_p/p)^{-(_4} Q^{(_5}[\forall L_{np}^{\kappa} + (1-\forall)L_p^{\kappa}]^{(_6} \qquad (4)$$

Where p_c/p, w_{np}/p y w_p/p are the prices of capital services, non-production and production workers, respectively, relative to the product price, p. The coefficients labelled $(_0$, $(_3$ and $(_7$ are constants; and the other parameters are defined as:

$$(_1 = 1/(1-\Lambda) \qquad (_2 = (1-\Lambda/:)*1/(1-\Lambda) \qquad (_4 = 1/(1-\Delta)$$

$$(_5 = (1-\Lambda/:)*1/(1-\Delta) \qquad (_6 = (\Lambda-\Delta)/[\Delta*(1-\Delta)]$$

An alternative way to specify the above model is to assume maximisation takes place over the average wage (w) so as to determine the aggregate labour input (L) and capital services, subject to the distinction among production and non-production workers in a second stage. This would yield the following model:

$$K = \exists_0(p_c/p)^{-\exists_1} Q^{\exists_2} \qquad (5)$$
$$L = \exists_3(w/p)^{-\exists_1} Q^{\exists_2} \qquad (6)$$

where $\exists_0$ and $\exists_3$ are constants; $\exists_1 = 1/(1-\Lambda)$; and $\exists_2 = (1-\Lambda/:)*1/(1-\Lambda)$

The parameter Δ, needed to calculate the elasticity of substitution among both types of workers, can be obtained by estimating the equation resulting from dividing equation (3) by equation (4):

$$L_{np} / L_p = N_0(w_{np}/w_p)^{-(_4} \qquad (7)$$

Following Cassoni (1999a), wages are not exogenous but determined after a bargaining between employers and unions takes place, taking into account that the employers retain their right to manage. Assuming the utility function of unions is derived form a median voter framework and that they maximise a surplus over an alternative income w^a, the generalised Nash bargain can be stated as:

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

where Γ and Π are the utility functions of unions and employers, respectively:

$$\Pi(p, Q, K, L, p_c, w) = pQ - wL - p_cK$$

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

Γ_0 and Π_0 are the fall-back positions of each player, which are assumed to be zero (Binmore, Rubinstein and Wolinsky, 1986) [2]; L* is employment as determined in a second stage when firms maximise profits subject to the negotiated wage level; ∃ is the bargaining power of unions; and ϕ is a parameter reflecting the weight given to employment in the union utility function.

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 wage level as follows:

$$w/p = 0(S,O)*w^a/p \quad (8)$$

where 0 is the mark-up over w^a/p and depends on union density (*S*) and the degree of competitiveness the firm is subject to (*O*), as proxies of the bargaining power of unions.
The model to be estimated would be the 4-equations system (5)-(8). However, as no data on capital services is available, equation (5) will be omitted. The exclusion of one or more equations would thus generate simultaneity biases in the estimates of the parameters. The appropriate method of estimation is the Seemingly Unrelated Regressions method, proposed by Zellner (1962).

3. Data

The units of observation are the 2-digit manufacturing industries. Only six out of eight are used, due to data availability in the period 1985-1997: food, beverage and tobacco; textiles and apparel; paper; chemicals and oil products; non-metallic minerals; and metallic products.

The first model estimated uses data on output, number of 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 were used to build quarterly time series of values for the above variables. In the second model, employment and wages are calculated using data from the Household Survey (INE) on a quarterly basis, taking into account only formal workers. Formality is defined in terms of the individual having the legally stipulated health care coverage (public or private depending on the sector).

Information relative to non-production workers, as well as to wages of both types of workers, is not published on a quarterly basis since 1992. In order to get quarterly data for number of workers it is assumed that the 1991 seasonal pattern remains for the period

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

1992-1997. Regarding wages, the within year evolution is assumed to be identical to that reported by the Wage Survey, that is also carried out by the INE.

Apart from having a different unit of observation (the establishment and the worker), the Industrial Survey gathers information relative only to firms with 5 or more workers. Further, declared earnings are known to be less accurate when obtained from individuals than from firms. Those differences have to be taken into account when comparing the estimated elasticities of substitution using both sources.

The cost of labour is built adding to the wage variable all costs related to social security; taxes; annual premia and other bargained costs, as described in Cassoni (1999a).

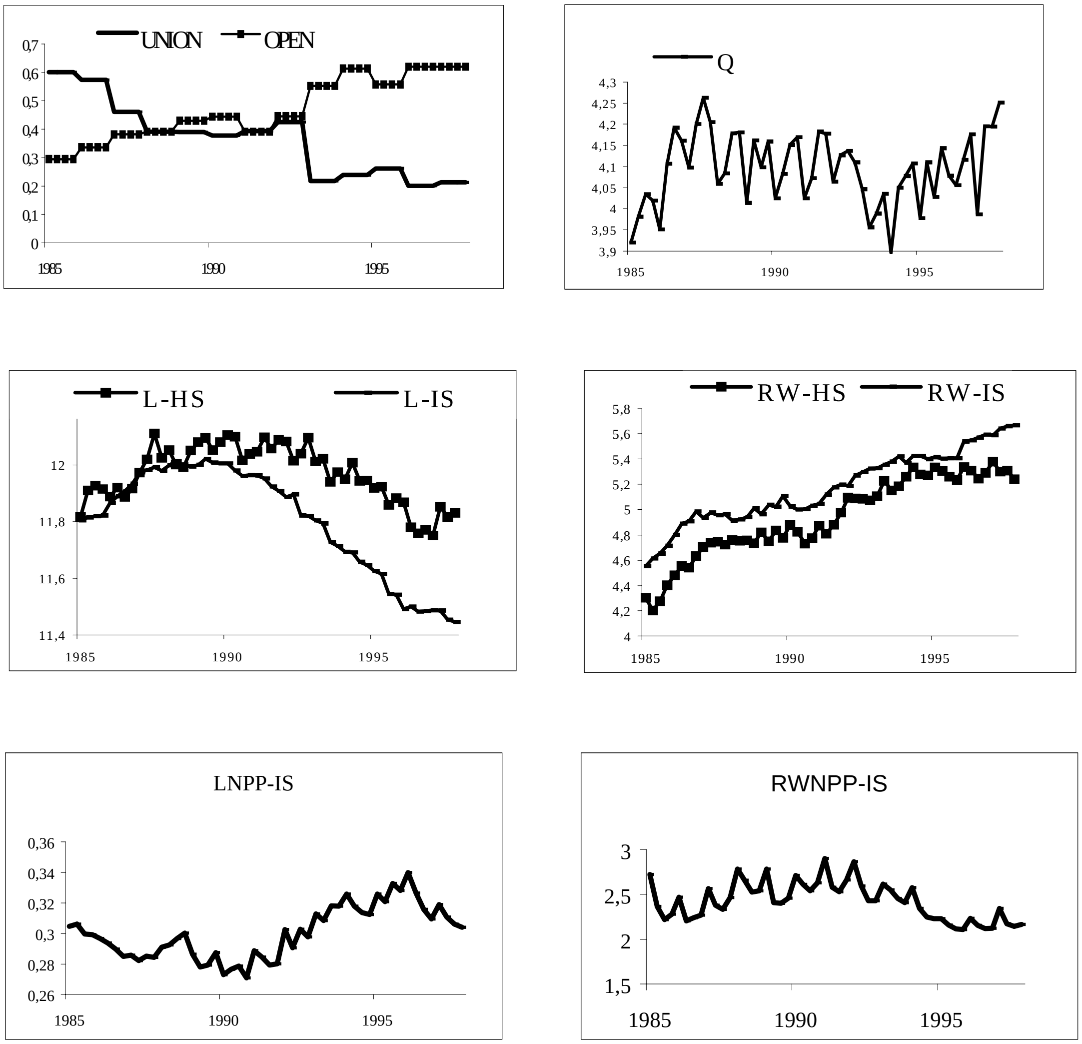
The degree of openness is used as a proxy to the competitiveness of the industry. It is calculated as the ratio of exports plus imports (as reported by the Republic Bank of Uruguay and the Customs Office) to value added.

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. These congresses took place in 1985, 1987, 1990, 1993 and 1997.

Figure 1 depicts the evolution of the main variables for the whole manufacturing sector. Table 1 reports descriptive statistics for each industry and for the whole manufacturing sector.

Union density declined all along the period, with the strongest decline registered after 1993. Simultaneously, the degree of openness of the economy has steadily increased, being the consolidation of the integration process a further accelerator of the process. The path of the manufacturing product reveals there is a period of stagnation between 1989 and 1994. The level of employment has declined continuously since 1989, although the speed with which this is recorded by the Industrial Survey is faster than that stemming from the Household Survey data. This might reflect the fact that bigger firms adjusted the level of employment more than smaller ones. Wages have increased in the period, although at a lower pace after 1993, specially according to the Household Survey data. This date could be related to the new setting for bargaining operating since 1991 and with all contracts that had been signed before, having expired. Finally, the ratio of non-production to production workers has increased in the sub-period 1992-1996, being this pattern matched by a decrease in relative wages. On average, relative employment is equal to 0.3, but it differs greatly among industries. While only 65% of workers are directly involved in the production process in chemicals and oil products, 85% of employees in textiles are production workers. Regarding the relative wage, there are also differences among industries, but not as sharp as in the composition of employment. On average, non-production workers are paid twice the wage of production workers.

Figure 1: Evolution of main variables – Manufacturing sector 1985-1997



Note: L is employment in logs; RW is real labour cost in logs; Q is value added in logs; LNPP is the ratio of non-production to production workers; RWNPP is the ratio of non-production to production workers real wage; UNION is the affiliation rate; OPEN is the degree of openness. IS and HS mean the data stem from the Industrial Survey and the Household Survey, respectively.
Sources: Quarterly and Annual Industrial Surveys (INE); Household Survey (INE); Republic Bank of Uruguay (BROU); Central Bank of Uruguay (BCU); Customs Office; National Accounts (BCU); different newspapers for union membership, as reported by the Central Union (PIT-CNT).

Table 1: Descriptive Statistics - Manufacturing Industries 1985-1997

Employment

Mean

	I31	I32	I34	I35	I36	I38	Total
IS	45615	35702	9066	15483	6614	16662	135970
HS	53437	43467	9487	17981	6535	18470	158200

Standard Deviation

	I31	I32	I34	I35	I36	I38	Total
IS	5529	9360	1261	2875	867	3321	24197
HS	4134	9483	1321	2663	1321	2433	15683

Real labour cost

Mean

	I31	I32	I34	I35	I36	I38	Total
IS	158	163	201	345	141	166	184
HS	140	138	141	275	118	152	146

Standard Deviation

	I31	I32	I34	I35	I36	I38	Total
IS	37.64	48.56	67.01	168.56	36.55	44.87	52.39
HS	31.34	48.37	41.13	144.01	41.35	49.33	43.53

Other variables

Mean

	I31	I32	I34	I35	I36	I38	Total
LNPP	0.32	0.18	0.47	0.51	0.26	0.32	0.30
RWNPP	2.04	2.33	1.73	2.32	2.17	1.89	2.08
Q	20.34	10.59	3.26	15.71	2.35	6.57	60.17
UNION	47.34	43.35	48.17	98.95	18.34	48.12	36.50
OPEN	24.76	60.87	22.69	51.18	22.80	162.51	46.77
RAW	77.08	85.76	95.88	115.56	77.50	89.41	52.43

Standard Deviation

	I31	I32	I34	I35	I36	I38	Total
LNPP	0.03	0.02	0.04	0.05	0.03	0.03	0.02
RWNPP	0.16	0.24	0.24	0.26	0.29	0.35	0.34
Q	2.29	1.66	0.33	2.98	0.36	1.75	5.10
UNION	10.95	17.38	9.47	9.93	12.46	26.04	12.92
OPEN	3.55	11.59	10.35	25.40	8.90	102.61	10.93
RAW	12.98	23.20	25.23	43.58	16.87	23.11	14.75

Note: Employment refers to total number of workers; Real labour costs per worker are monthly pesos of 1988; LNPP is the ratio of non-production to production workers; RWNPP is the relative wage of non-production and production workers; Q is monthly value added in 1988 million pesos; UNION is the affiliation rate; OPEN is the degree of openness; and RAW is the monthly alternative real wage in pesos of 1988. IS means data come from the Industrial Survey while HS refers to information stemming from the Household Survey.

Sources: Quarterly and Annual Industrial Surveys (INE); Household Survey (INE); Republic Bank of Uruguay (BROU) ; Central Bank of Uruguay (BCU); Customs Office; National Accounts (BCU); different newspapers for union membership, as reported by the Central Union (PIT-CNT).

Finally, the comparison of the data relative to employment and wages using the Industrial and the Household Surveys shows that employment is generally higher and wages are lower when stemming from the latter source. This could be linked to the omission of the smallest establishments in the Industrial Survey, as already mentioned, and to the fact that in those firms workers are paid less than in bigger establishments.

4. Results

The model to be estimated is the system (6)-(8) that is reproduced in logs here below:

$$\ln L = \exists_0 + \exists_1 \ln(w/p) + \exists_2 \ln Q$$

$$\ln(L_{np}/L_p) = N_0 + N_1 \ln(w_{np}/w_p)$$

$$\ln(w/p) = 0_0 + 0_1 S + 0_2 O + 0_3 \ln(w^a/p)$$

The analysis of the order of integration of the series involved results in all being either integrated of order one or stationary[3]. The non-stationarity of the ratio of production to non-production workers would imply that exogenous shocks that have led to a re-structuring of the manufacturing sector have had a permanent effect on the mix of employment in most industries. A possible explanation could be related to the need of firms to reduce their labour force, partly due to the increase in non-wage costs. This has resulted in many firms promoting that some of their production workers –those linked to a specific part of the production process- create an independent firm that sells its services to the original one. Another fact worth considering is that increased competitiveness has also forced firms to emphasise processes related to quality control, commercialisation practices and strategies aiming to get new customers. Further, a possible effect of unionisation is a reduction in wage differentials and this might also have had a permanent effect in the wage structure. Co-integration tests, following Engle and Granger (1987) procedure, do not reject the existence of an equilibrium relationship between labour, wages and output, if labour costs are instrumented using the alternative wage, openness and union density as instruments. Relative employment and relative wages are also found to be co-integrated.

Given these results, the associated dynamic form is specified as a distributed lag model, starting with four lags of every variable. Output is instrumented using its own lags to avoid endogeneity biases. Fixed effects are allowed for to account for specific characteristics of the different industries.

In Cassoni (1999a) evidence was found suggesting both the labour demand function and the wage equation shifted at some point at the beginning of the nineties. This was linked to the change in the structure of bargaining that took place in 1991. The data pointed at 1993 as the time period in which the shift would have occurred. Hence, dummy variables for the post-1993 period are included here also, in all equations, and their significance tested for.

Finally, using a pooled cross section – time series dataset could result in some or all parameters being different by industry. Hence, the stability in the cross section of every coefficient was also analysed.

[3] To study the order of integration of the individual series, Augmented Dickey-Fuller tests (Dickey and Fuller, 1979) were done by industry, using PCGive and PCFiml 9.0. Results are available upon request.

Thus, the econometric strategy followed was one of specifying very general models that were sequentially reduced. The starting and final forms of these models are reported in the appendix. The final dynamic form of the equations never includes more than two lags. There is evidence supporting that some parameters are unstable in the nineties, while differences by industry cannot always be rejected. Moreover, in some cases a combination of both effects is also supported by the data. Regarding the wage and employment equations, the existence of so many sources of variation makes it difficult to arrive at a unique model, as some of these effects cannot be properly differentiated. Misspecification tests were performed to all equation individually and to the system. Normality is generally rejected, but given the sample size, the results of hypothesis tests should be still robust (Spanos, 1986). As heteroskedasticity is also found, reported standard errors are corrected following White (1980). Autocorrelation is always rejected.

4.1 Results using industrial surveys data

The final form of the equation describing the relative demand of blue and white-collar workers allows for one lag in the dependent variable and none in the relative wage. There are differences by industry in the speed of adjustment to equilibrium, as indicated by the coefficient of lagged relative labour demand (see Table 2). Thus, it could be argued that the long run partial elasticity of substitution between production and non-production workers ($1/(1-\rho)=\Phi_\kappa$) is greater in paper; chemicals and oil products; and non-metallic minerals than in food, beverage and tobacco; textiles; and metallic products, the estimated values being 0.5 and 0.2, respectively. Although these figures seem a bit low, estimates for developed countries are between 0 and 3.7, with a mean value of 1 (Wood, 1994, pp132).

Finally, there is also evidence suggesting the curve shifted out in the nineties, so that the same relative wage would yield a higher ratio of non-production to production workers after 1993 (between 7% and 14%, depending on the industry, in the long run). The result could be linked to the processes already described by which firms have increased the number of white-collar workers and reduced that of blue-collars.

The final form of the wage equation includes two lags of the wage and one of the alternative income (Table 3). The long run estimator of the coefficient multiplying the alternative wage is statistically equal to one. On the other hand, the effect of openness on the mark-up is statistically zero when including these lags. In spite of this, the value of the coefficient in the long run is of the same order than when estimating the model with no lags of the alternative wage and one lag of the real wage, in which case the estimator is significant[4]. Although the fact that increased openness would set a bound to the wage inflation is very appealing, the order of the effect is very small, as doubling the degree of openness would only generate a 2.5% reduction in the real wage, in the long run.

[4] This specification was also tried in order to compare results with Cassoni (1999a). The long run values of the estimators multiplying the three variables are very similar (-0.039 and -0.037 for OPEN; 1.22 and 1.08 for RAW, both statistically equal to 1; 0.22 and 0.17 for UNION, although the latter would have fallen after 1993 for three of the six industries).

Table 2

Dependent variable: LNPP Nº Obs: 300		
Variable	Coefficient	Std.Error
Constant	-0,45917	0,11550
I31	0,21550	0,11827
I32	-0,14898	0,16341
I34	0,35074	0,14536
I35	0,37876	0,12643
I36	0,24257	0,12132
DUMMY93	0,031821	0,00936
RWNPP	-0,10057	0,03349
LNPP_1	0,55270	0,10401
LNPP31_1	0,18415	0,11621
LNPP32_1	0,04578	0,15591
LNPP34_1	0,25140	0,13297
LNPP35_1	0,22812	0,10231
LNPP36_1	0,24469	0,11827

Note: LNPP is the relative employment of non-production to production workers. qr1, qr2 and qr3 denote dummy variables for quarters 1 to 3, respectively. I31 to I36 are dummy variables related to the industry (31 is food, beverage and tobacco; 32 is textiles; 34 is paper; 35 is chemicals and oil products; 36 is non-metallic minerals). Dummy93 is equal to 1 after 1992. RWNPP is the relative cost of non-production to production labour. LNPP_1 is LNPP lagged one quarter. LNPP31_1 to LNPP36_1 are LNPP_1 multiplied by I31 to I36.

Regarding the effect of union density on the mark-up, it is not possible to arrive at a unique specification. Some of the tests performed to analyse temporal stability point at a change in the nineties, lowering the effect of unions on the mark-up over the alternative wage. However, the result is quite sensitive to the inclusion or exclusion of other variables, as well as to the combination of changes in the parameters in time and among industries (see the appendix). Thus, the final specification chosen was a simple one, in which the parameter multiplying union density is imposed to be the same for all industries and stable in time (column (1) of Table 3). Its estimated effect is such that a 10% increase in the affiliation rate - calculated at its mean value – would imply a 1% increase in the real wage. All these three effects are consistent with the ones obtained in previous work using data only on production workers. The result can be read as supporting the hypothesis that trade unions bargain disregarding the specific occupation of their members at the firm. However, in 1993 the wage equation would have shifted, so that for equal values of the alternative income, union density and openness, real wages would be 11% higher than before (in the long run). This last finding might be linked to the change in the composition of labour, increasing the relative share of non-production workers, whose wage is twice that of production workers. This, in turn is consistent with some recent evidence on increased wage dispersion and increased returns to schooling since 1992 (Gradín and Rossi, 1999; Miles and Rossi, 1999).

Table 3

Dependent variable: RW **Nº obs: 300**	**(1)**		**(2)**	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	-0,02190	0,06924	0,12953	0,10000
qr1	0,01337	0,00714	-0,02360	0,00846
qr2	-0,02726	0,00567	0,00553	0,00699
qr3	-0,00615	0,00485	-0,00299	0,00682
I31	0,01614	0,01254	0,01750	0,01534
I32	0,00285	0,01015	0,00111	0,01363
I34	0,01017	0,01318	0,00892	0,01707
I35	0,05638	0,01776	0,14400	0,02289
I36	0,00253	0,01439	-0,01131	0,02209
DUMMY93	0,01908	0,00916	0,10680	0,02709
UNION	0,03918	0,01886	0,09912	0,02842
OPEN	-0,00725	0,00580	-0,02107	0,00946
RAW	1,03670	0,04738	0,61091	0,04566
RAW_1	-0,81793	0,05864	------	------
RW_1	0,70344	0,04291	0,46418	0,03683
RW_2	0,11746	0,02899	------	------
UNION9331	------	------	-0,11120	0,06446
UNION9332	------	------	-0,29380	0,06891
UNION9334	------	------	-0,09316	0,06052
UNION9335	------	------	-0,00110	0,02729
UNION9336	------	------	-0,57148	0,27853
UNION9338	------	------	-0,24002	0,05490

Note: RW is the real cost of labour. qr1, qr2 and qr3 denote dummy variables for quarters 1 to 3, respectively. I31 to I36 are dummy variables related to the industry (31 is food, beverage and tobacco; 32 is textiles; 34 is paper; 35 is chemicals and oil products; 36 is non-metallic minerals; 38 is metallic products). DUMMY93 is equal to 1 after 1992, 0 elsewhere. UNION is union density; OPEN is degree of openness; RAW is the alternative wage. Variables ending in "_1" indicate that the original variable is lagged one period. UNION9331 to UNION9338 refer to UNION multiplied by DUMMY93 and by I31 to I38, respectively.

Finally, three specifications are reported for the labour demand equation. As in the wage equation, temporal and cross-section instability was supported by the data, but the results are too sensitive to the inclusion and exclusion of variables.

The final models reported reflect quite different situations. In column (1) of Table 4 the elasticity of substitution between labour and capital is allowed to vary per industry as well as in time. Before 1993, the value of the parameter would have ranged from 0 (reflecting a

Leontieff technology) to 0.74, which is not a surprising result, given the heterogeneous nature of the activities involved. After that date, all industries would have changed technology, towards one with a greater elasticity of substitution (that is equal to 1 in four of them). However, the temporal change would have been accompanied by an outward shift of the labour demand function, so that the final result would depend on the wage level (see Figure 2).

Table 4

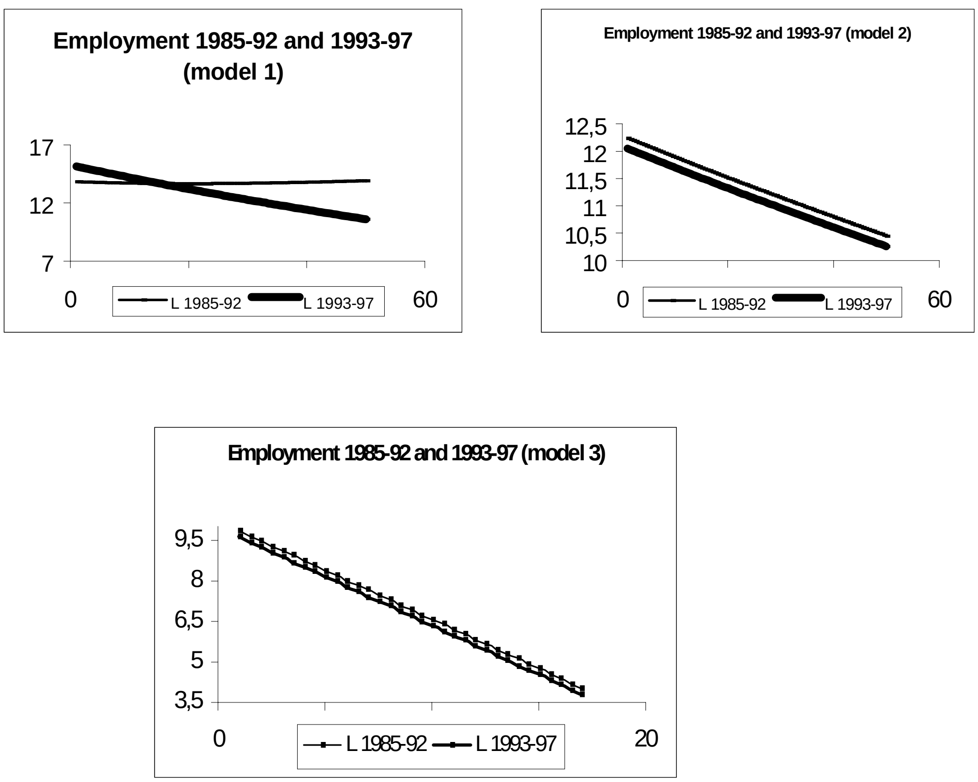
Dependent variable: L **Nº obs: 300**	**(1)**		**(2)**		**(3)**	
Variable	Coefficient	Std.Error	Coefficient	Std.Error	Coefficient	Std.Error
Constant	2,13600	0,35229	1,78210	0,26808	1,31480	0,23009
qr1	0,01938	0,00959	0,01014	0,00940	0,01118	0,00917
qr2	0,00163	0,00493	0,00200	0,00490	0,00204	0,00479
qr3	-0,01734	0,00489	-0,01775	0,00518	-0,01758	0,00509
I31	-0,00397	0,34562	-0,03881	0,13267	0,03953	0,03465
I32	-0,53530	0,31817	0,31006	0,14319	0,04843	0,01981
I34	-0,49697	0,30885	-0,21929	0,14670	-0,01999	0,02409
I35	-0,16632	0,29856	0,05784	0,13280	0,24065	0,05747
I36	-1,03910	0,28626	-0,27761	0,16921	-0,04694	0,03451
DUMMY93	0,60606	0,24197	-0,02968	0,01184	-0,03022	0,00974
PROD	0,22385	0,06778	0,11825	0,04510	0,12424	0,03637
PROD_1	-0,09565	0,04541	-0,05417	0,02461	-0,05180	0,02380
PROD35	-0,16456	0,02231	-0,09296	0,04067	-0,10470	0,02240
RW	-0,15281	0,05916	-0,07928	0,03259	-0,04680	0,01461
RW31	0,01288	0,07141	0,02306	0,02843		
RW32	0,13046	0,06543	-0,04656	0,02709		
RW34	0,09589	0,06300	0,03447	0,02678		
RW35	0,10643	0,05959	0,03080	0,02451		
RW36	0,20240	0,05734	0,03855	0,02968		
RW93	-0,11005	0,04714				
RW3193	-0,00561	0,00745				
RW3293	-0,02206	0,00726				
RW3493	-0,00430	0,00779				
RW3593	0,00554	0,01000				
RW3693	-0,02352	0,00668				
L_1	0,79557	0,03054	0,84670	0,02603	0,87618	0,02208

Note: : L is total employment. qr1, qr2 and qr3 denote dummy variables for quarters 1 to 3, respectively. I31 to I36 are dummy variables related to the industry (31 is food, beverage and tobacco; 32 is textiles; 34 is paper; 35 is chemicals and oil products; 36 is non-metallic minerals; 38 is metallic products). Dummy93 is equal to 1 after 1992., 0 elsewhere; PROD is production; PROD35 is PROD by I35. RW is the real cost of labour. RW31 to RW36 are RW by I31 to I36. RW93 is RW by DUMMY93. RW3193 to RW36 are RW93 multiplied by I31 to I36.

The second model, summarised in column (2) of the same table, thus allows for a different elasticity of substitution by industry but that is stable in time. However, only that of textiles is statistically different from the rest (the elasticity of substitution would be equal to 0.42 for all industries, while that of textiles would be 0.77 and statistically equal to 1).

The last model imposes a common elasticity of substitution for all industries and that does not vary in time[5]. Its estimated long run value is 0.36, quite similar to that obtained using the previous model, although in the short run it is smaller than that resulting from model 2 (0.048 versus 0,067 for all industries except textiles). In Figure 2 a simulation is done in order to show the modelled change in the labour demand function in 1993. It is there assumed that all industries have the same initial wage level and that production is constant. The values used for the wage (in logs) are not the actual ones but just a simulated series. The picture that emerges from the graphs is that, if the models were correctly predicting labour demand, then at least at high wage levels employment would be lower today than before 1993, in all industries.

Figure 2



The above results suggest that, although it is not possible to obtain a robust specification, differences by industry and in time do exist and their omission might be biasing the results obtained when imposing common coefficients. An alternative strategy would have been to estimate a multivariate model in which the labour demand of each industry was estimated separately. However, and probably due to the level of aggregation of the data, this

[5] When a common parameter for all industries is imposed, temporal instability is rejected.

methodology proved to be ineffective. Thus, future work should be directed to obtain data at the level of the firm.

Considering all the evidence found, it could be argued that the elasticity of substitution between capital and labour in the manufacturing industries should range between 0.3 and 1. There is also some evidence suggesting an increase of the parameter in the nineties, but this result is not robust enough at this stage. In Cassoni (1999a) an elasticity equal to 1 was found before 1985. So a first question would be: is it sensible that firms could have changed technology twice in 23 years, towards one with less/more possibilities of substitution between the two main production factors when relative prices change? An affirmative answer can be proposed if one looks at the economic and institutional environment in which manufacturing firms operated along the period. First, in 1985-1992 unions were not only active but very influential. Membership was at its top and bargaining was very synchronised and co-ordinated. On the other hand, in the pre-1985 period unions were illegal while after 1992 they started losing members and bargaining power, negotiations at the firm level started to generalise and contracts were no more enforceable. One could think then that during 1985-1992 the institutional framework could have promoted technologies in which substitution between labour and capital was more difficult than in others, due to the explicit and/or implicit pressure of strong unions. Together with this institutional setting, the economic policies instrumented in the sub-periods have promoted or discouraged investment. In the mid-seventies the first steps towards liberalisation were taken. This, together with the exchange rate policy (pre-announced exchange rate and overvalued local currency) did impulse firms to invest in new technology. However, with the 100% devaluation of the peso at the end of 1982 and the increase in interest rates, a lot of highly indebted firms were forced to close. On the other hand, in the nineties, the consolidation of the integration process in the MERCOSUR, plus a new exchange rate policy leading to an overvaluation of the local currency promoted investment in new technology once again. Thus, the economic environment, with more competitive pressure for firms and a relatively low exchange rate, could also have resulted in firms using technologies with higher elasticities of substitution in the pre-1985 period and in the nineties than those used in the 1985-1992 period.

In spite of the heterogeneity of the reported results, their comparison with those stemming from other recent research for Uruguay shows they are quite sensible. Cassoni (1999a), using quarterly data only on production workers for 2-digit manufacturing industries along the same period, obtained an estimated value of 0.4, rejecting differences by industry and in time. Cassoni (1999b), using the same dataset than in this paper and a model similar to that in column (2), estimated an elasticity of substitution that is equal to 1 for textiles; non-metallic minerals; and metallic products and around 0.5 for the other three industries. On the other hand, Tansini and Triunfo (1998), used establishment data for a sub-sample of manufacturing firms (those that have survived all along the period 1988-1994) and a translog cost function. The reported elasticity of substitution is 1.78, but its standard deviation is 1.2. Finally, regarding international studies on this topic, Wood (1994, pp 132-133) argues that developed economies show an elasticity of substitution between 0.5 and 1.5 for the industrial sector while that for developing economies is between 0.5 and 1.2.

Further, Hamermesh (1993, pp 92) argues that given the empirical work surveyed in the book, a simple mean of the elasticity of substitution would be 0.75.

The calculated elasticities of substitution between capital and labour imply that the wage elasticity of labour demand would be, on average, –0.3, varying between –0.1 and –1 depending on the industry and the time period, increasing in all industries in since 1993 (see Table 5).

A last comment relates to the values of the elasticity of substitution between non-production and production workers (Φ_{npp}), given the estimated values for Φ_{KL} and Φ_{κ}, and the share of labour costs in value added (s_L). The latter varies from 18% to 55% depending on the industry, being on average 30%. If the whole period is split in two, 1985-1992 and 1993-1997, these shares slightly increase in the latter, for all industries except chemicals and oil products. Blue and white-collar workers are substitutes in paper; chemicals and oil products; and non-metallic minerals when using models in columns (2) and (3) of Table 4. If results in column (1) are used, they are substitutes also in textiles in the first subperiod. However, after 1992, the elasticity of substitution significantly decreases in paper and in non-metallic minerals, while production and non-production workers become complements in textiles and in chemicals and oil products. This is the consequence of the increase in the possibilities of substituting labour by capital (Table 5).

Table 5

	σ_{KL}				η_{LL}			
	M1	M1	M2	M3	M1	M1	M2	M3
Industry	1985-92	1993-97			1985-92	1993-97		
Food, bev. & tobacco	0,68	1,25	0,37	0,38	-0,56	-1,02	-0,30	-0,26
Textiles	0,11	0,76	0,82	0,38	-0,09	-0,57	-0,64	-0,26
Paper	0,28	0,84	0,29	0,38	-0,17	-0,49	-0,17	-0,26
Chemicals	0,23	0,74	0,32	0,38	-0,18	-0,57	-0,25	-0,26
Non-metallic min.	0,00	0,65	0,27	0,38	0,00	-0,32	-0,12	-0,26
Metallic prods.	0,75	1,29	0,52	0,38	-0,56	-0,89	-0,38	-0,26
	σ_{ρ}	σ_{npp}						
		M1	M1	M2	M3			
		1985-92	1993-97					
Food, bev. & tobacco	0,22	-1,90	-4,39	-0,42	-0,12			
Textiles	0,22	0,65	-1,42	-1,83	-0,12			
Paper	0,51	0,86	0,05	0,83	0,82			
Chemicals	0,46	1,47	-0,49	1,02	0,64			
Non-metallic min.	0,50	0,88	0,34	0,69	0,77			
Metallic prods.	0,22	-1,32	-2,18	-0,55	-0,12			

Note: M1 to M3 refer to models in columns (1) to (3) in Table 4. σ_{KL} is the elasticity of substitution between labour and capital. σ_{ρ} is the partial elasticity of substitution between non-production and production workers. σ_{npp} is the elasticity of substitution between production and non- production workers (σ_{KL} + (σ_{ρ} -σ_{KL})/s_L , with s_L thelabour share in value added). η_{LL} is the wage elasticity of labour demand (-(1- s_L)*σ_{KL})

4.2 Results using household surveys data

The Household Survey does not differentiate between white and blue-collar workers. Hence, the equation for relative employment cannot be estimated. Results for the wage and labour demand equations are summarised in Table 6. The final specification reported is slightly different from those reported in the previous sub-section. Regarding the dynamic structure, more lags are needed in the labour demand equation. Regarding the stability of parameters, no temporal instability is detected while no differences among industries are supported by the data.

A second comment relates to the significance of the parameters in the wage equation. The union variable, having the opposite sign to that expected, is not significant. Openness, on the other hand, has the expected negative effect on wages, but its magnitude is twice that of the previous model. How could one reconcile these findings with previous results? A first hypothesis must be related to the coverage of the Household Survey. If these data refer to all firms, the result poses a question on union coverage of individuals working at small firms. If workers of small firms are not union members and/or they have little or no access to the channels leading to effective wage claims, then this sample would include a lot of outsiders. Their wage might have gone down given the increase in unemployment resulting from unions rising wages in the more organised strata.

Table 6

Dependent variable: L			**Dependent variable: RW**		
Nº obs: 300			Nº obs: 300		
Variable	Coefficient	Std.Error	**Variable**	Coefficient	Std.Error
Constant	4,22730	0,63829	**Constant**	-0,30895	0,15131
qr1	0,01335	0,02411	**qr1**	0,11764	0,01975
qr2	0,02342	0,02433	**qr2**	0,03351	0,02073
qr3	-0,00753	0,02257	**qr3**	-0,00294	0,01836
I31	0,30246	0,09588	**I31**	0,04063	0,02754
I32	0,27958	0,06758	**I32**	-0,04323	0,02385
I34	-0,20270	0,06402	**I34**	-0,11853	0,03419
I35	-0,10052	0,07465	**I35**	0,17619	0,04816
I36	-0,33776	0,09337	**I36**	-0,09531	0,04098
PROD	0,12574	0,06675	**OPEN**	-0,02823	0,01608
RW	-0,06382	0,02823	**UNION**	-0,05466	0,06268
L_1	0,34172	0,07827	**RAW**	0,77151	0,07364
L_2	0,23593	0,07427	**RW_1**	0,21560	0,05758
			RW_2	0,19965	0,05047

Note: L is total employment; RW is the real cost of labour; qr1, qr2 and qr3 denote dummy variables for quarters 1 to 3, respectively. I31 to I36 are dummy variables related to the industry (31 is food, beverage and tobacco; 32 is textiles; 34 is paper; 35 is chemicals and oil products; 36 is non-metallic minerals; 38 is metallic products). PROD is production. "-1" and "-2" besides a variable means the variable is lagged one and two periods, respectively. Dummy93 is equal to 1 after 1992, 0 elsewhere. OPEN is the degree of openness. UNION is the affiliation rate. RAW is the real alternative income.

Elasticities resulting from the labour demand function are smaller than those calculated using establishment data. The output-employment elasticity is 0.20 (*vis → vis* a value of around 0.6, according to Table 4) while the capital-labour elasticity of substitution is 0.15 (*vis → vis* a value ranging from 0.4 to 1). In this case, it is sensible to think that establishments using less than 5 workers have technologies in which substitution between capital and labour is more difficult, given their relatively restricted access to capital markets. Thus, their inclusion in the sample would bias downwards the average elasticity. Accordingly, the wage elasticity of labour demand is only –0.1 on average, and varying very little among industries (between –0.07 and –0.12). Finally, the elasticity of substitution between non-production and production workers indicates they are substitutable factors (σ_{npp} is between 0.4 and 1.7 depending on the industry), which is no surprise given the low possibilities of substitution between labour and capital.

5. Conclusions

New evidence regarding the magnitude of the elasticity of substitution between capital and labour in the Uruguayan manufacturing industry is here reported. Results point to this parameter being less than or equal to 1. This result, in turn, is quite consistent with other research performed for Uruguay. It also implies a quite low wage elasticity of labour demand, although still within international ranges. Regarding the magnitude of the elasticity of substitution among production and non-production workers, when keeping the level of the labour input fixed, the evidence found points at a low value. Further, once substitution with capital is allowed for, both categories of labour result in being complements.

The analyses performed, however, also suggest that the elasticity of substitution between capital and labour has changed in the nineties, increasing its value. Is this linked to the integration process the economy is undergoing? Which is the role of the new bargaining framework in this process? Is the death of small firms, possibly as a consequence of increased competitiveness, in the root of the econometric result? The answers to these questions need further research.

On the one side, decentralised relative to sectoral bargaining would imply lower wage inflation, as it was demonstrated in Calmfors and Driffill (1988), despite there are other issues to be taken into account when an open economy such as the Uruguayan is analysed (Rama, 1994; Forteza, 1998). Hence, one interesting line of future work should be one developing a model that incorporates the new bargaining setting. Related to this, a gap to be filled is that of a possible change in the objective function of trade unions, once synchronisation and co-ordination are broken.

A completely different but nonetheless necessary research goal should be to develop a model that explicitly considers the death and birth of firms, as a result of the re-structuring of the manufacturing sector. This should be accounted for by specifying an equation in which the probability of surviving or dying is modelled.

On the other hand, the analysis done has shown that using data aggregated by industry might be inconclusive, at least in the Uruguayan case. Shocks to the industrial sector, as well as changes in the institutional setting in which labour relations take place, are so many and so diverse, that the individual analysis of each industry seems inevitable. Hence, data at the level of the firm must be used to better conclude on these issues.

Finally, a warning has emerged from the paper as a side exercise regarding the use of household or establishment data. Both sources are not exchangeable and work should be done previous to any analysis in order to be sure that we are measuring the appropriate theoretical concepts.

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Dynamics

Employment

Variable	IF Coefficient	IF Std.Error	FF Coefficient	FF Std.Error
Constant	0,64116	0,26209	0,98576	0,21538
I31	-0,01372	0,02691	0,01478	0,02300
I32	0,00489	0,01734	0,02558	0,01483
I34	0,01353	0,01667	-0,00371	0,01424
I35	-0,02275	0,02003	-0,02074	0,01821
I36	0,00296	0,02575	-0,02668	0,02153
qr1	0,01939	0,00903	0,01247	0,00788
qr2	0,00530	0,00805	-0,00131	0,00635
qr3	-0,01468	0,00782	-0,02155	0,00600
PROD	0,20868	0,03646	0,15653	0,04022
PROD_1	-0,13275	0,03007	-0,10004	0,03047
PROD_2	0,03002	0,02377		
PROD_3	-0,06791	0,02399		
PROD_4	0,01771	0,02061		
RW	-0,02836	0,04731	-0,05856	0,01037
RW_1	0,02340	0,05771		
RW_2	-0,02715	0,04993		
RW_3	0,01849	0,04834		
RW_4	-0,03623	0,03502		
L_1	0,88251	0,05782	0,91816	0,01890
L_2	-0,01738	0,07571		
L_3	0,10870	0,07565		
L_4	-0,02567	0,05874		
	\sigma =0,0396966		\sigma =0,0380211	

Non-production/ production ratio

Variable	IF Coefficient	IF Std.Error	FF Coefficient	FF Std.Error
Constant	-0,23019	0,04649	-0,23560	0,03956
I31	0,00593	0,01269	0,00082	0,01218
I32	-0,09497	0,02477	-0,11804	0,02204
I34	0,07515	0,01888	0,08111	0,01688
I35	0,07431	0,02394	0,10946	0,02102
I36	-0,04257	0,01591	-0,05136	0,01448
qr1	0,02508	0,01349	0,00769	0,00996
qr2	-0,00522	0,01362	-0,01124	0,00973
qr3	0,01517	0,01304	0,00475	0,00954
RWSU	-0,21051	0,05576	-0,03793	0,02687
RWSU_1	0,08819	0,06619		
RWSU_2	-0,03203	0,06579		
RWSU_3	0,12732	0,06437		
RWSU_4	0,05801	0,05502		
LSU_1	0,71381	0,05517	0,77213	0,03309
LSU_2	-0,04782	0,06753		
LSU_3	0,12053	0,06759		
LSU_4	0,04015	0,05398		
	\sigma =0,0598478		\sigma =0,0595281	

Temporal Stability

Employment

Variable	IF Coefficient	IF Std.Error	FF Coefficient	FF Std.Error
Constant	1,19610	0,22779	1,18490	0,21593
I31	0,04566	0,02300	0,06318	0,02258
I32	0,04561	0,01550	0,04970	0,01492
I34	-0,02499	0,01458	-0,03489	0,01448
I35	-0,03411	0,01840	-0,01433	0,01909
I36	-0,05033	0,02110	-0,06451	0,02075
qr1	0,00846	0,00749	-0,00058	0,00650
qr2	0,00272	0,00622	0,00577	0,00608
qr3	-0,02015	0,00587	-0,01832	0,00589
PROD	0,12906	0,03994	0,03101	0,01846
PROD_1	-0,07651	0,03244		
PROD93	-0,02715	0,01820		
PROD93_1	0,03166	0,02109		
RW	-0,05287	0,01758	-0,05295	0,01730
RW93	0,02727	0,01478	0,02925	0,01365
L_1	0,89524	0,02042	0,90071	0,01943
L93_1	-0,00876	0,00460		
D93	-0,09611	0,08615	-0,18094	0,07012
	\sigma = 0,0361166		\sigma = 0,036478	

Non-roduction/ production ratio

Variable	IF Coefficient	IF Std.Error	FF Coefficient	FF Std.Error
Constant	-0,25709	0,04626	-0,25227	0,04022
I31	0,00345	0,01244	0,00349	0,01201
I32	-0,12685	0,02252	-0,12355	0,02211
I34	0,08935	0,01865	0,08732	0,01697
I35	0,12904	0,02292	0,12700	0,02204
I36	-0,05310	0,01495	-0,05161	0,01430
qr1	0,00969	0,00995	0,00932	0,00981
qr2	-0,01167	0,00960	-0,01165	0,00956
qr3	0,00413	0,00941	0,00415	0,00937
RWSU	-0,06740	0,03791	-0,06923	0,02882
RWSU93	-0,00095	0,04731		
LSU_1	0,74634	0,03501	0,74948	0,03451
LSU93_1	-0,00558	0,01537		
D93	0,01938	0,03453	0,02450	0,00761
	\sigma = 0,0587871		\sigma = 0,058522	

Real wage				
	IF		FF	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	-0,17254	0,05445	-0,12125	0,04679
I31	0,01189	0,01128	0,01773	0,01082
I32	0,00034	0,01006	0,00326	0,00965
I34	-0,00056	0,01204	0,00721	0,01143
I35	0,04046	0,01834	0,04876	0,01592
I36	-0,00328	0,01403	0,00359	0,01298
qr1	0,01644	0,01063	0,01622	0,00706
qr2	-0,02419	0,01034	-0,02817	0,00678
qr3	-0,01529	0,01052	-0,00510	0,00589
UN	0,02915	0,04863	0,02944	0,01732
UN_1	0,00282	0,06527		
UN_2	-0,05631	0,06343		
UN_3	0,05034	0,06337		
UN_4	0,00019	0,04537		
OPEN	-0,00913	0,02531	-0,00711	0,00615
OPEN_1	0,03885	0,03434		
OPEN_2	-0,01859	0,03421		
OPEN_3	-0,05581	0,03415		
OPEN_4	0,03124	0,02581		
RAW	1,05180	0,04699	10496,00000	0,04401
RAW_1	-0,68170	0,09103	-0,82777	0,05418
RAW_2	-0,18733	0,09826		
RAW_3	0,08098	0,09838		
RAW_4	-0,03448	0,07498		
RW_1	0,61784	0,05789	0,71602	0,04101
RW_2	0,23195	0,06796	0,12412	0,03157
RW_3	-0,06112	0,06888		
RW_4	0,05738	0,05804		

\sigma =0,0363048 \sigma = 0,0366894

Real wage				
	IF		FF	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	0,06152	0,08628	0,00685	0,07705
I31	0,03766	0,01653	0,01715	0,01084
I32	0,01686	0,01227	0,00360	0,00961
I34	0,03782	0,01826	0,01176	0,01147
I35	0,09450	0,02223	0,06045	0,01685
I36	0,02175	0,01840	0,00267	0,01297
qr1	0,01958	0,00740	0,01468	0,00707
qr2	-0,03125	0,00699	-0,02832	0,00674
qr3	-0,00638	0,00578	-0,00604	0,00587
UN	0,04734	0,01940	0,03458	0,01885
UN93	-0,01427	0,03011	0,01618	0,01763
OPEN	0,02840	0,02190	-0,00657	0,00614
OPEN93	-0,02680	0,01765		
D93	0,02179	0,14094	0,01471	0,00993
RAW	1,06790	0,04758	1,03750	0,04448
RAW_1	-0,78308	0,06164	-0,81426	0,05432
RAW93	-0,00150	0,03446		
RAW93_1	-0,09312	0,05281		
RW_1	0,62627	0,04743	0,69987	0,04142
RW_2	0,11595	0,03349	0,11177	0,03229
RW93_1	0,08506	0,04324		
RW93_2	-0,00345	0,00302		

\sigma = 0,0358731 \sigma = 0,0364661

loglik =3636,6 loglik =3535,6 loglik =3562,5 loglik =3554,9

Cross section stability

Employment

	IF		FF	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	3,21970	0,51229	2,88860	0,47294
I31	-0,39871	1,21590	-0,48461	1,13790
I32	-1,38720	0,80023	-1,22790	0,78583
I34	-2,64740	0,86570	-2,52540	0,82209
I35	-1,25190	0,94540	-2,26380	0,96826
I36	-1,31910	0,95763	-1,43210	0,70573
qr1	0,00404	0,00617	0,00278	0,00639
qr2	0,00810	0,00590	0,00821	0,00587
qr3	-0,01601	0,00567	-0,01665	0,00565
D93	0,64400	0,26953	0,39242	0,25170
PROD	0,10999	0,03096	0,07042	0,02289
PROD31	-0,05902	0,08006		
PROD32	0,02873	0,05360		
PROD34	0,01534	0,07278		
PROD35	-0,13341	0,04062		
PROD36	0,00794	0,06652		
RW	-0,16485	0,04345	-0,15851	0,04759
RW31	0,05940	0,07427	0,04077	0,06961
RW32	0,15304	0,06298	0,13663	0,06505
RW34	0,15516	0,06720	0,17171	0,06348
RW35	0,11793	0,05012	0,12218	0,05376
RW36	0,21597	0,08488	0,21804	0,07022
RW93	-0,11989	0,05108	-0,07353	0,04801
RW3193	-0,00548	0,00678	-0,00211	0,00663
RW3293	-0,01865	0,00694	-0,01655	0,00689
RW3493	-0,00142	0,00684	-0,00422	0,00662
RW3593	0,01195	0,00970	0,01236	0,00982
RW3693	-0,02286	0,00741	-0,01921	0,00688
L_1	0,73353	0,04623	0,77204	0,04082
L31_1	0,03922	0,10137	0,03952	0,09517
L32_1	0,06848	0,06420	0,06637	0,06002
L34_1	0,19405	0,07532	0,17278	0,07113
L35_1	0,09763	0,08397	0,16384	0,08618
L36_1	0,01453	0,07942	0,02614	0,05915
	\sigma = 0,0345611		\sigma =0,0350039	

Real Wage	IF		FF	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	0,75487	0,34911	0,17083	0,08960
I31	-0,43765	0,43418	0,14029	0,05404
I32	0,03593	0,52438	0,05495	0,03310
I34	-0,38932	0,41686	0,05120	0,03859
I35	-0,66457	0,37421	-0,04114	0,05518
I36	-0,65770	0,50223	-0,02630	0,02483
qr1	0,01228	0,00697	0,01365	0,00691
qr2	-0,02599	0,00665	-0,02701	0,00656
qr3	-0,01037	0,00568	-0,00719	0,00567
D93	-0,03694	0,03502	-0,01087	0,02770
UN	0,00642	0,03148	0,02855	0,02721
UN31	-0,15430	0,12183	-0,21320	0,09119
UN32	-0,17415	0,11182	-0,08789	0,05707
UN34	-0,00694	0,07122	-0,05609	0,06783
UN35	0,13684	0,06545	0,14849	0,05866
UN36	0,07325	0,09751	0,10094	0,06157
UN93	0,09652	0,08493	-0,01235	0,05686
UN9331	0,03596	0,08534	0,05732	0,05973
UN9332	0,02036	0,08723	0,02660	0,05717
UN9334	0,10238	0,08605	0,14187	0,05133
UN9335	0,00522	0,07456	0,10452	0,04279
UN9336	0,69498	0,36871	0,61777	0,25670
OPEN	0,03024	0,01947	0,00929	0,01125
OPEN31	0,14810	0,16232		
OPEN32	0,14566	0,08264		
OPEN34	0,21354	0,09620		
OPEN35	-0,01814	0,04205		
OPEN36	-0,05434	0,20430		
RAW	1,21350	0,07702	1,04090	0,04425
RAW31	-0,43162	0,12874	-0,72215	0,05853
RAW32	-0,14017	0,10913		
RAW34	-0,20782	0,10563		
RAW35	-0,24844	0,09602		
RAW36	-0,09635	0,10848		
RAW_1	-0,89493	0,14948		
RAW31_1	0,32747	0,19450		
RAW32_1	0,27884	0,24147		
RAW34_1	0,41701	0,20219		
RAW35_1	0,22051	0,18457		
RAW36_1	0,02807	0,19235		
RW_1	0,57780	0,11357	0,60661	0,04480
RW31_1	0,14706	0,16893		
RW32_1	-0,24337	0,22232		
RW34_1	-0,20873	0,17085		
RW35_1	0,18341	0,16928		
RW36_1	0,14295	0,14743		
RW_2	-0,00093	0,06957	0,09136	0,03255
RW31_2	0,04592	0,11906		
RW32_2	0,12702	0,09951		
RW34_2	0,11907	0,10237		
RW35_2	-0,02732	0,09662		
RW36_2	0,04840	0,10164		
	\sigma = 0.0336345		\sigma = 0.0351569	

Non-production/ production ratio

	IF		FF	
Variable	Coefficient	Std.Error	Coefficient	Std.Error
Constant	-0,53897	0,12130	-0,52960	0,11642
I31	0,30880	0,17388	0,28601	0,14850
I32	-0,09619	0,19970	-0,09709	0,19093
I34	0,42536	0,14722	0,40795	0,13483
I35	0,47563	0,15950	0,46537	0,13995
I36	0,29660	0,16135	0,29732	0,15052
qr1	0,01364	0,01019	0,01319	0,00988
qr2	-0,01123	0,00982	-0,01085	0,00957
qr3	0,00189	0,00965	0,00248	0,00940
D93	0,03674	0,01113	0,03463	0,00849
RWSU	-0,10347	0,05472	-0,11538	0,03202
RWSU31	-0,05369	0,12519		
RWSU32	-0,07746	0,11858		
RWSU34	-0,02002	0,09402		
RWSU35	-0,02830	0,10518		
RWSU36	0,00250	0,09524		
LSU_1	0,48356	0,11205	0,48482	0,10650
LSU31_1	0,23305	0,14012	0,24506	0,12889
LSU32_1	0,06119	0,15296	0,09681	0,13424
LSU34_1	0,30166	0,13857	0,29471	0,13205
LSU35_1	0,28852	0,14889	0,30513	0,14194
LSU36_1	0,29700	0,13042	0,29451	0,12350
	\sigma = 0,0599442		\sigma =0,0584916	
	loglik = 3635.5		loglik = 3590.1	