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## Joint Estimation of Mark-up and Bargaining Power Parameters for Belgian Manufacturing

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# LICOS Centre for Transition Economics

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### Joint Estimation of Mark-up and Bargaining Power Parameters for Belgian Manufacturing

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# Joint Estimation of Mark-up and Bargaining Power Parameters for Belgian Manufacturing

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## ABSTRACT

This paper applies several extensions of Hall's (1988) methodology to analyse imperfections in both the product and the labour market for firms in the Belgian manufacturing industry over the period 1988-1995. We investigate (1) the heterogeneity in mark-up and bargaining power parameters among 17 sectors within the manufacturing industry, (2) whether higher bargaining power parameters are associated with higher mark-ups and (3) whether both parameters are influenced by cyclical and competition effects. Our GMM results indicate that ignoring imperfection in the labour market leads to an underestimation in the price-cost margin of Belgian manufacturing firms. These findings are confirmed in the sectoral analysis. As expected, higher bargaining power parameters are associated with higher price-cost margins at the sectoral level. We find that both the mark-up and the bargaining power parameter move procyclically. Finally, after controlling for cyclical effects, our results show that the introduction of a new competition policy in Belgium in 1993 has exerted a statistically significant negative effect on the price mark-ups, leaving the bargaining strength of the workers unchanged. Hence, the stringent competition law seems to have disciplined firms' pricing behaviour.

*JEL Classification* : C23, D21, J50, K21, L13.

*Key Words* : Efficient Bargaining, Price Setting, Market Power, Competition Policy, Enterprise Behaviour.

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## 1. INTRODUCTION

One of the most prolific research area in industrial organisation has led to the design of more and more refined methods to test price-setting behaviour of firms in various environments (see Bresnahan, 1989 and Schmalensee, 1989 for surveys). However, this approach has generally remained restrictive, in the sense that it has ignored the possibility that inputs, and particularly labour, are not priced competitively. The fact that unions bargain over wages and hence over a share of the firm's non-competitive rents necessitates the integration of labour market variables when investigating profit margins.

Labour economists on the other hand have devoted effort to test for imperfect competition in the labour market. Most papers deal with the determination of wages and employment in the presence of trade unions. The broad body of papers examines the effect of industry or firm performance on wages within a collective bargaining framework<sup>1</sup> and strongly supports the rent sharing hypothesis. But a similar criticism applies to these studies, i.e. they solely focus on imperfections in the labour market, assuming perfect competition in the product market.

Only a few studies (Bughin, 1996; Crépon et al., 2002; Schroeter, 1988) have considered the possibility of imperfections in both product and factor markets, thereby taking into account that wages may no longer be considered as an exogenous variable in econometric tests of product market power.

In this paper we follow the methodology of Crépon et al. (2002). Their methodology is a natural extension of Hall's (1988) approach, which in turn originates from Solow's (1957) well-known article on estimating total factor productivity as a measure of technical change. Besides deviating from competition in the product market, the model allows for the possibility that wages are bargained off the labour demand curve, according to an Efficient Bargaining model.

Relaxing the condition that labour is priced competitively has important implications for the derivation of the Solow Residual. More precisely, it can be shown that the Solow residual can be decomposed into three components: (1) a mark-up of price over marginal cost component, (2) a factor reflecting the bargaining power of the workers and (3) the rate of technical change. This extended approach has the advantage that no measurement of the user cost of capital is needed to estimate the firm's mark-up as in most analyses of price-cost margins and no measurement of the alternative wage is required to estimate the workers' bargaining power as in most studies about rent-sharing. In addition to testing simultaneously for imperfections in the product and the labour market, this approach provides an alternative test, based on the labour share, to the ones in the literature of the Right-to-Manage versus the Efficient Bargaining Union model.

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<sup>1</sup> See e.g. Abowd and Lemieux (1993), Blanchflower et al. (1996), Dobbelaere (2001), Goos and Konings (2001) and Teulings and Hartog (1998).

Applying this methodology to French manufacturing, Crépon et al. (2002) provide evidence that ignoring labour market imperfections causes a significant underestimation in price-cost margins. The economic mechanism behind this finding is the following. With a union organised to bargain successfully over employment in addition to wages, overemployment of labour exists at any wage rate, i.e. employment is negotiated at the right of the conventional labour demand curve. Since any efficient contract forces the firm to operate beyond the point at which the wage equals the marginal revenue product of labour, the firm is constrained to employ at any wage level more labour than required by cost-minimising principles. Hence, profits are forgone and wage rents appear that directly erode the firm's price-cost margins.

In this paper, we apply this methodology to check whether ignoring imperfect competition in the labour market leads to an omitted variable bias in mark-up parameters for Belgian manufacturing industries over the period 1988-1995. We take advantage of a rich firm-level dataset covering the entire Belgian manufacturing industry, allowing us to make various contributions to the literature.

First, in contrast to Crépon et al. (2002), our large sample enables us to examine the important issue of heterogeneity in both the mark-up and the bargaining power parameters. More specifically, we study:

- (1) the heterogeneity among industries,
- (2) whether higher bargaining power parameters are associated with higher mark-ups,
- (3) whether both parameters are influenced by cyclical and competition policy effects.

Second, in contrast to most of the literature following Hall (1988), we estimate market power using a firm-level dataset. In addition to increasing the reliability and the efficiency of the estimates and to taking into account firm-heterogeneity within sectors, the use of firm-level data allows us to construct good instruments. We follow the Arellano and Bond (1991) Generalised Method of Moments (GMM) technique.

Third, we are able to compare our estimates of bargaining and market power with previous studies (Bughin, 1996) and we are therefore testing the robustness of the methodology used in our paper.

Since there is some evidence in favour of Efficient Bargaining for Belgium (Bughin, 1993), our fourth contribution consists in verifying whether this methodology provides results that are consistent with stylised facts about Belgian industrial relations<sup>2</sup>. As Belgium is a small open economy, it might be objected that sectors facing external competition would be forced to follow

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<sup>2</sup> Belgian collective agreements do not only deal with wages but also with employment issues like hours of work and part-time labour policies (Bughin, 1996).

purely competitive behaviour and hence would generate no oligopoly rents. Existing empirical studies have however provided evidence of non-competitive pricing strategies for Belgian manufacturing industries (Bughin, 1996; Konings et al., 2001).

In the remainder of the paper, we will first describe our theoretical framework (section 2) and empirical model (section 3). Section 4 presents the dataset and some summary statistics. Section 5 discusses the estimation method and confronts the theoretical hypotheses with Belgian firm-level data. Section 6 concludes.

## 2. THEORETICAL FRAMEWORK

### 2.1. Imperfection in the output market, perfect competition in the labour market

We start from a standard production function  $Q_{it} = A_{it}F(N_{it}, M_{it}, K_{it})$  where  $i$  is a firm index,  $t$  a time index,  $A$  a parameter capturing technical progress,  $N$  is labour,  $M$  is material input and  $K$  is capital.

Under perfect competition, it is well known since Solow that the growth rate of output can be decomposed as follows:

$$\frac{\Delta Q_{it}}{Q_{it}} = \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} + \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} + \alpha_{Kit} \frac{\Delta K_{it}}{K_{it}} + \frac{\Delta A_{it}}{A_{it}} \quad (1.1)$$

where  $\alpha_{Jit} = \frac{P_{Jit}J_{it}}{P_{it}Q_{it}}$  ( $J = N, M, K$ ) is the share of inputs in total revenue.

Under imperfect competition in the product market and perfect competition in the input markets, Eq. (1.1) becomes (Hall, 1988):

$$\frac{\Delta Q_{it}}{Q_{it}} = \mu_{it} \left( \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} + \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} + \alpha_{Kit} \frac{\Delta K_{it}}{K_{it}} \right) + \frac{\Delta A_{it}}{A_{it}} \quad (1.2)$$

where  $\mu = \frac{P}{C_Q}$  is the mark-up of price over marginal cost.

Assuming constant returns to scale, i.e.  $\mu(\alpha_N + \alpha_M + \alpha_K) = 1$ , and rearranging terms, another way to write Eq. (1.2) is:

$$\begin{aligned}
& \frac{\Delta Q_{it}}{Q_{it}} - \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} - \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} - (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{\Delta K_{it}}{K_{it}} \\
&= (\mu_{it} - 1) \left[ \alpha_{Nit} \left( \frac{\Delta N_{it}}{N_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \alpha_{Mit} \left( \frac{\Delta M_{it}}{M_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) \right] + \frac{\Delta A_{it}}{A_{it}} \\
&= \beta_{it} \left( \frac{\Delta Q_{it}}{Q_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + (1 - \beta_{it}) \frac{\Delta A_{it}}{A_{it}}
\end{aligned} \tag{1.3}$$

where  $\beta = \frac{P - C_Q}{P} = \frac{\mu - 1}{\mu}$  is the price-cost margin.

Under non constant returns to scale,

$$\frac{WN}{C_Q Q} + \frac{P_M M}{C_Q Q} + \frac{rK}{C_Q Q} = 1 + \gamma \quad \text{or} \quad \mu(\alpha_N + \alpha_M + \alpha_K) = 1 + \gamma$$

where  $\gamma$  can be higher than 0 (increasing returns to scale) or lower (decreasing returns to scale) and  $1 + \gamma$  is the local scale elasticity measure.

Eq. (1.3) can therefore easily be generalised as:

$$\begin{aligned}
& \frac{\Delta Q_{it}}{Q_{it}} - \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} - \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} - (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{\Delta K_{it}}{K_{it}} \\
&= (\mu_{it} - 1) \left[ \alpha_{Nit} \left( \frac{\Delta N_{it}}{N_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \alpha_{Mit} \left( \frac{\Delta M_{it}}{M_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) \right] + \gamma_{it} \frac{\Delta K_{it}}{K_{it}} + \frac{\Delta A_{it}}{A_{it}} \\
&= \beta_{it} \left( \frac{\Delta Q_{it}}{Q_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \frac{\gamma_{it}}{\mu_{it}} \frac{\Delta K_{it}}{K_{it}} + (1 - \beta_{it}) \frac{\Delta A_{it}}{A_{it}}
\end{aligned} \tag{1.4}$$

This equation shows that the Solow Residual can be decomposed into (1) a mark-up component, (2) a scale factor and (3) a technological term ( $\Delta A_{it}/A_{it}$  or true total factor productivity).

## 2.2. Imperfection in both the output and the labour market

Relaxing the assumption that labour is priced competitively has important implications for the derivation of the Solow residual. To see this, assume that the union and the firm are involved in

an efficient bargaining procedure, with both wages ( $w$ ) and employment ( $N$ ) as the subject of agreement (McDonald, Solow, 1981). Both parties maximise their respective utility function during the bargaining process.

The union is risk neutral and its objective function is specified in an utilitarian form:  $U(w, N) = Nw + (\bar{N} - N)w_a$ , where  $\bar{N}$  is union membership ( $0 < N \leq \bar{N}$ ) and  $w_a \leq w$  is the alternative market wage.

The firm's utility function equals its profits  $\pi$ , with  $\pi(w, N) = R(N) - wN - F$ , where  $R = PQ$  stands for total revenue ( $R_N'' < 0$ ),  $P$  for the output price,  $Q$  for the output and  $F$  for all other costs associated with production. For simplicity, we assume that labour is the only variable input for the firm, hence,  $F$  represents fixed costs<sup>3</sup>. Moreover, we normalise for the present by assuming that  $Q = N$ .

The bounds of the bargaining range are given by the minimum acceptable utility levels for both parties. The threat point for the union is the alternative wage  $w_a$ . If no revenue accrues to the firm when negotiation breaks down, the firm's fall-back utility equals  $-F$ . The outcome of the bargaining is the asymmetric generalised Nash solution to:

$$\max_{w, N} \tilde{\Phi} = \left\{ Nw + (\bar{N} - N)w_a - \bar{N}w_a \right\}^\phi \{ R - wN \}^{1-\phi} \quad (1.5)$$

where  $\phi \in [0, 1]$  represents the union's bargaining power.

Maximisation of Eq. (1.5) with respect to the wage rate ( $w$ ) gives the following equation:

$$w = (1 - \phi)w_a + \phi \frac{R}{N} \quad (1.6)$$

Maximising Eq. (1.5) with respect to employment ( $N$ ) leads to the following first-order condition:

$$\begin{aligned} w &= R_N + \frac{\phi}{1 - \phi} \left[ \frac{R - wN}{N} \right] \\ &\quad \Updownarrow \\ w &= R_N + \phi \left[ \frac{R - R_N N}{N} \right] \end{aligned} \quad (1.7)$$

From Eq. (1.7), it follows that unions extract a rent from bargaining, expressed as a premium over the marginal revenue of labour ( $R_N$ ).

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<sup>3</sup> It can be shown that this assumption on the fixed nature of inputs other than labour does not affect the bargaining outcome provided that union preferences do not depend on those inputs (Bughin, 1996).



By solving simultaneously both first-order conditions, we obtain an expression for the contract curve, which results from the tangency between iso-profit curves and union indifference curves:  $R_N = w_a$ . This equation shows that the employment level depends on the alternative market wage ( $w_a$ ) but not on the negotiated wage ( $w$ ). It also follows that the contract curve outcome is to the right of the labour demand curve. The first-order condition related to optimal employment, [Eq. (1.7)] shows the extent to which the bargaining outcome is off the labour demand curve.

In section 2.1, we defined  $\beta$  as the price-cost margin evaluated at the competitive wage level, i.e.  $\beta = \frac{P - C_Q}{P}$ . Using the contract curve outcome, we can also write  $\beta$  in this setting as:

$\beta = \frac{R - W_a N}{R} = \frac{R - R_N N}{R}$ . Hence, rewriting Eq. (1.7) gives the following equation:

$$w = R_N + \phi \frac{R}{N} \beta \quad (1.8)$$

Eq. (1.8) shows that the union premium is defined as a part of the price-cost margin which would be set by a profit-maximising firm facing an exogenously determined wage equal to  $R_N (= w_a$  in our case)<sup>4</sup>. Hence, wage rents under Efficient Bargaining depend on the imperfect market structure in both the output market (as reflected by  $\beta$ ) and the labour market (as reflected by  $\phi$ ).

Furthermore, by reshuffling terms in Eq. (1.8), one can see that the firm's price-cost margin is eroded by wage rents (as reflected by  $\phi$ ):

$$\beta^* = \frac{(P - W)}{P} = (1 - \phi) \beta \quad (1.9)$$

Dropping the normalisation assumption ( $Q = N$ ) and defining the mark-up parameter  $\mu$  as the inverse of the elasticity of revenue with respect to output, i.e.  $\mu = \left[ R_Q \frac{Q}{R} \right]^{-1}$  where  $R_Q$  is the marginal revenue, we can express the marginal revenue of labour as:  $R_N = \frac{P Q_N}{\mu}$  with  $Q_N$  the

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<sup>4</sup> Since in the Efficient Bargaining model, marginal revenue ( $R_Q$ ) equals marginal cost ( $C_Q$ ) evaluated at the competitive levels of

output and wages, the mark-up of price over marginal cost has to be interpreted as:  $\mu = \frac{P}{C_Q(Q, w_a)}$ .

physical marginal product of labour. Using this expression for  $R_N$  in Eq. (1.7), the efficient bargaining labour share is written as:

$$\frac{wN}{PQ} = \alpha_N = \phi + (1-\phi) \frac{\varepsilon_N^Q}{\mu} \quad (1.10)$$

Under the generalised Nash solution, the equilibrium labour share ( $\alpha_N$ ) is hence a linear function of the elasticity of output with respect to labour ( $\varepsilon_N^Q$ ). The efficient bargaining labour share equals unity if  $\phi = 1$ , i.e. if the union has all the power to capture the firm's product rents.

Rewriting Eq. (1.10) as:  $\varepsilon_N^Q = \mu\alpha_N + \mu \frac{\phi}{1-\phi} (\alpha_N - 1)$ , an extra term can be added to Eq. (1.4):

$$\begin{aligned} & \frac{\Delta Q_{it}}{Q_{it}} - \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} - \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} - (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{\Delta K_{it}}{K_{it}} \\ &= (\mu_{it} - 1) \left[ \alpha_{Nit} \left( \frac{\Delta N_{it}}{N_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \alpha_{Mit} \left( \frac{\Delta M_{it}}{M_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) \right] + \\ & \gamma_{it} \frac{\Delta K_{it}}{K_{it}} + \mu_{it} \frac{\phi_{it}}{1-\phi_{it}} (\alpha_{Nit} - 1) \left( \frac{\Delta N_{it}}{N_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \frac{\Delta A_{it}}{A_{it}} \\ &= \beta_{it} \left( \frac{\Delta Q_{it}}{Q_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + \frac{\gamma_{it}}{\mu_{it}} \frac{\Delta K_{it}}{K_{it}} + \frac{\phi_{it}}{1-\phi_{it}} (\alpha_{Nit} - 1) \left( \frac{\Delta N_{it}}{N_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + (1 - \beta_{it}) \frac{\Delta A_{it}}{A_{it}} \end{aligned} \quad (1.11)$$

From Eq. (1.11), it follows that the Solow residual can be decomposed into four components: (1) a mark-up of price over marginal cost component, (2) a scale factor, (3) a factor reflecting the bargaining power of the worker and (4) the rate of technical change. Remember that the mark-up has to be interpreted as a mark-up of prices over marginal costs evaluated at the competitive wage level.

### 3. EMPIRICAL MODEL

Let  $q_{it}, n_{it}, m_{it}, k_{it}$  and  $a_{it}$  be the logarithms of  $Q_{it}, N_{it}, M_{it}, K_{it}$  and  $A_{it}$ .

Rewriting:

$$\Delta q_{it} - \alpha_{Nit} \Delta n_{it} - \alpha_{Mit} \Delta m_{it} - (1 - \alpha_{Nit} - \alpha_{Mit}) \Delta k_{it}$$

as  $SR_{it}$ , we are able to test four different specifications.

Model 1 : constant returns to scale and no bargaining

$$SR_{it} = \beta(\Delta q_{it} - \Delta k_{it}) + (1 - \beta)\Delta u_{it} \quad (1.12)$$

Model 2 : non constant returns to scale and no bargaining

$$SR_{it} = \beta(\Delta q_{it} - \Delta k_{it}) + \left(\frac{\gamma}{\mu}\right)\Delta k_{it} + (1 - \beta)\Delta u_{it} \quad (1.13)$$

Model 3 : constant returns to scale and bargaining

$$SR_{it} = \beta(\Delta q_{it} - \Delta k_{it}) + \frac{\phi}{1 - \phi}(\alpha_{Nit} - 1)(\Delta n_{it} - \Delta k_{it}) + (1 - \beta)\Delta u_{it} \quad (1.14)$$

Model 4 : non constant returns to scale and bargaining

$$SR_{it} = \beta(\Delta q_{it} - \Delta k_{it}) + \left(\frac{\gamma}{\mu}\right)\Delta k_{it} + \frac{\phi}{1 - \phi}(\alpha_{Nit} - 1)(\Delta n_{it} - \Delta k_{it}) + (1 - \beta)\Delta u_{it} \quad (1.15)$$

where  $\Delta u_{it} = \Delta a_{it} + \xi_{it}$ , i.e. the disturbance term comprises the true total factor productivity component ( $\Delta a_{it}$ ) and other changes, shocks and types of errors.

### ***Hypotheses***

We expect the estimate of the mark-up parameter from Model 1 to be a lower bound estimate of the firm's mark-up since the influence of returns to scale and the direct effect of wages on the firm's price-cost margin is not taken into account.

As the mark-up in Model 3 and Model 4 is evaluated at the competitive wage level, the corresponding estimates of the price to marginal cost ratio are expected to be higher than those from Model 1 and Model 2. This is because the price-cost margin in these models embodies the part of product rents captured by unions. Consequently, the larger the estimate of the union's bargaining power ( $\phi$ ), the larger the expected increase in the estimate of the firm's price-cost margin<sup>5</sup>.

## **4. DATA**

We use an unbalanced panel of the entire population of Belgian firms from the manufacturing sector over the period 1988-1995. All variables are taken from annual company accounts which were collected by the National Bank of Belgium (NBB). Nominal variables are

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<sup>5</sup> Note that under the normalisation assumption  $Q = N$ , the estimate of the price-cost margin in Model 1 would correspond to the observed price-cost margin (denoted by  $\beta^*$  in the theoretical part) while the estimate from Model 3 would correspond to the true price-cost margin (denoted by  $\beta$  in the theoretical part).

deflated by the three-digit producer price index which was drawn from the National Statistical Office.

In the initial dataset, the number of firms observed each year is approximately 19 000. For the estimates, we only keep firms for which we have at least three consecutive observations for all variables, ending up with 7 044 firms. Table 1 reports the means, standard deviations and first and third quartiles for our main variables. The average of the firm growth rate of deflated output for the overall sample is 1.9% per year over the period 1988-1995 whereas the corresponding average manufacturing industry growth rate of real output amounts to 4.8%. Capital has decreased at an average annual growth rate of nearly 4%, materials have increased at an average annual growth rate of nearly 2% and labour is stable over the period. The Solow residual or the conventional measure of total factor productivity has also remained stable. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, TFP is smaller than -3.5% for the first quartile of firms and higher than 4.9% for the fourth quartile.

**Table 1 Summary Statistics**

Variables	1988-1995			
	Mean	Sd	Q1	Q3
<b>Real firm output growth rate <math>\Delta q</math></b>	0.019	0.174	-0.073	0.111
<b>Real industry output growth rate <math>\Delta q_{ind}</math></b>	0.048	0.317	-0.040	0.106
<b>Labour growth rate <math>\Delta n</math></b>	-0.002	0.150	-0.038	0.027
<b>Capital growth rate <math>\Delta k</math></b>	-0.039	0.203	-0.164	0.066
<b>Materials growth rate <math>\Delta m</math></b>	0.019	0.197	-0.089	0.125
<b>Labour share <math>\alpha_N</math> in output value</b>	0.277	0.159	0.159	0.369
<b>Materials share <math>\alpha_M</math> in output value</b>	0.628	0.180	0.512	0.756
<b>Solow residual SR (TFP)</b>	0.007	0.095	-0.035	0.049
$\Delta(q - k)$	0.058	0.222	-0.079	0.207
$(\alpha_N - 1) \Delta(n - k)$	-0.024	0.163	-0.122	0.062

Note: (1) For all variables, the number of observations is 29 703.

$$(2) SR = \Delta q_t - \alpha_{nk} \Delta n_t - \alpha_{mk} \Delta m_t - (1 - \alpha_{nk} - \alpha_{mk}) \Delta k_t.$$

## 5. ESTIMATION METHOD AND RESULTS

### *Estimation Technique*

Since transitory productivity shocks might affect the level of factor inputs to the extent that the shock becomes part of the firm's information set before input choices are determined, Ordinary Least Squares (OLS) estimates would produce inconsistent and biased estimates. Moreover, the production price is endogenous to our models since the product market is imperfectly competitive

and the production price depends on strategic quantity choices made by firms. Hence, we treat all current dated firm-specific variables as potentially endogenous.

To take into account the endogeneity problems, we estimate the models using the Generalised Method of Moments (GMM) technique for panel data as advocated by Arellano and Bond (1991). This estimation method is a more robust and efficient extension of the first difference instrumental variable method suggested for dynamic fixed effects models by Anderson and Hsiao (1982). This is because it utilises the moment restrictions around the error term to provide additional instruments. The validity of this method depends critically on the errors in the level equation being serially uncorrelated. A necessary condition for this to happen is absence of second-order serial correlation in the first difference error term. We therefore present tests of this null hypothesis using a statistic developed in Arellano and Bond (1991) which has a standard normal distribution.

Under the assumption that current random shocks are uncorrelated with past values of firm-level regressors, we use lagged values of  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1)\Delta(n-k)$  and  $Q/K$  from  $(t-2)$  and before as instruments<sup>6</sup> for the manufacturing industry as a whole and for the sectoral analysis<sup>7,8</sup>. The exogeneity of these instruments with respect to the error term is further tested by the Sargan test statistic which is distributed as chi-squared. The GMM estimator is also robust to heteroskedasticity. In addition to using IV estimation techniques, we also include time dummies to capture possible unobservable aggregate shocks. By estimating a model that is already specified in terms of growth rates, we control for individual firm effects in the production function.

Estimation is carried out using the Dynamic Panel Data program developed by Arellano and Bond (1988), which works with the GAUSS programming language.

Finally, we assume that the coefficients  $\mu$ ,  $\gamma$  and  $\phi$  are independently distributed and we restrict their values to be constant across firms within a given year, thus focusing on the pattern of their mean values over time.

### ***General Results***

To get a first insight, we ignore heterogeneity in the mark-up and the bargaining power parameters among industries and estimate equations (1.12)-(1.15) for the manufacturing sector as a whole over the period 1988-1995. The two-step estimates are reported in table 2.

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<sup>6</sup> To test the robustness of our industry as well as sectoral results, we used different sets of instruments: f.e. (1)  $\Delta(n-k)$ ,  $\Delta(m-k)$  and  $\Delta k$  and (2)  $\Delta n$ ,  $\Delta m$  and  $\Delta k$ . These results, which are very well in line with the earlier findings, are available upon request.

<sup>7</sup> Since all variables are expressed in terms of growth rates, permanent shocks are not considered.

<sup>8</sup> Assuming that the idiosyncratic component of the productivity shock is white noise, our specifications which are logarithmic differentiations introduce errors which have a moving average structure of order one. For this reason, legitimate instruments are dated  $(t-2)$  or earlier and second-order serial correlation must be excluded.

We start by estimating equation (1.12), which assumes (1) constant returns to scale, (2) perfect competition in factor markets, (3) imperfect competition in the product market and (4) capital as the only fixed factor (Model 1). The first deviation from the original model is labelled as Model 2 in which we reject the hypothesis of constant returns to scale. Operationally, this implies adding the capital stock variable and the associated parameter  $\gamma/\mu$  to equation (1.12). Model 3 and Model 4 permit the identification of workers' bargaining power and hence test for imperfection in both the product and the labour market. Model 3 imposes constant returns to scale while model 4 estimates returns to scale.

The first part of table 2 gives the estimated values of the coefficients for the regressors entering the models. Part 2 presents the structural parameters computed from the reduced form parameters and the third part provides specification tests.

In all estimated specifications, the test statistics reject the presence of second-order serial correlation in the differenced error term. Moreover, the Sargan test indicates that the instruments are not correlated with the error terms, thus legitimating the choice of instruments.

The main findings can be summarised as follows. Focusing on the degree of market power, all estimated models show that the price to marginal cost ratio is significantly greater than one, hence supporting the hypothesis of imperfect competition in the output market. Our estimates of mark-ups range from 13 to 45 percent. The results of Model 1 are in line with those of Martins et al. (1996) who find that the average mark-up for Belgian manufacturing over the period 1980-1992 is about 18 percent<sup>9</sup>. They also accord with the estimates of Konings et al. (2001) who point to a mark-up ratio of 1.27 for large firms in the Belgian manufacturing industry over the period 1994-1996.

As far as the nature of returns to scale is concerned, Model 2 and Model 4 support the hypothesis of variable returns to scale. Since the coefficient on  $\Delta k$  is significantly larger than zero (point estimates of 0.139 and 0.089 in Model 2 and Model 4 respectively), estimates support the hypothesis of increasing returns to scale. The estimated scale elasticity is 1.192 (Model 2) and 1.129 (Model 4)<sup>10</sup>. As expected, the mark-ups derived from Model 1 and Model 3 represent a lower bound for industries operating under increasing returns to scale. This is because models imposing constant returns to scale (Model 1 and Model 3) only consider the mark-up net of the influence of returns to scale, i.e. they only take into account the part of the mark-up corresponding to the difference between price and average costs.

We now turn to discuss the impact of labour market imperfections on the firm's market power, as implied by the estimates of Model 3 and Model 4. First of all, we notice that the new variable, accounting for workers' bargaining power, is strongly significant when entering the

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<sup>9</sup> These authors apply Roeger's (1995) method, however, which uses the 'nominal' Solow residual to estimate mark-ups.

<sup>10</sup> Note that the finding of increasing returns to scale is not driven by the inclusion of many small firms in our sample. Restricting the analysis to firms with more than 50 employees or firms with more than 100 employees still supports the hypothesis of increasing returns to scale.

models. The estimates of Model 3 point to a significant union bargaining power of 0.218 on a scale going from 0 to 1. In Model 4 the estimated bargaining power parameter is 0.169. These results reject the hypothesis that workers have no influence over employment, which is consistent with the idea that wages are bargained off the conventional labour demand curve. Our estimates are somewhat higher than the value of union power (0.1) obtained by Goos and Konings (2001) for Belgium during the period 1987-1994. However, their empirical analysis boils down to estimating a Right-To-Manage model in which the elasticity of wages with respect to profits per employee measures the bargaining strength of the workers. In contrast, our analysis rejects the fact that union power does not affect the labour share.

In line with our expectations, the mark-up parameter is significantly higher than the estimates obtained from Model 1 and Model 2. As explained above, this results from the fact that the part of product rents extracted by the union is taken into account. Model 3 implies a significant price to marginal cost ratio of 1.305 compared to an estimate of 1.133 when labour market imperfections are ignored. In Model 4, the price-cost ratio increases up to 1.447 compared to 1.383 when ignoring workers' bargaining power. These results provide evidence that confusion between the contract curve and the labour demand curve leads to the neglect of any direct effect of wages on the firm's price-cost margin.

Our findings are hence qualitatively consistent with those of Crépon et al. (2002). Using a panel of 1026 French manufacturing firms over the period 1986-1992, mark-ups are found to be about 40 percent and the bargaining power is estimated at about 0.60. Neglecting the part of product rents captured by workers, i.e. ignoring imperfect competition in the labour market brings the mark-up estimate down to 10 percent.

*<Insert Table 2 about here>*

In the specifications mentioned above, firm-level data are deflated by a common industry price index at the three-digit level of sectoral disaggregation. Output price differentials between firms are hence not taken into account. Relying on an industry instead of a firm deflator will however give rise to an omitted variable bias if output price differentials between firms and within an industry are endogenous and correlated with the explanatory variables in the model (changes in factor inputs and factor shares). This problem might arise when firms compete in an environment with differentiated products and imperfect competition. To address this issue, we adopted the solution suggested by Klette and Griliches (1996) which amounts to adding the growth in industry output as an additional regressor<sup>11</sup>. Theoretically, this solution relies on the assumption that the market power of firms originates from product differentiation, i.e. from being able to create a specific demand for their products.

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<sup>11</sup> For technical details, see Klette and Griliches (1996).

In contrast to Klette and Griliches (1996) and Crépon et al. (2002), we find that the growth of industry output is not statistically significant in the empirical specifications<sup>12</sup>. Moreover, its inclusion has no effect on the estimated values of the other coefficients. Our results hence suggest that the market power of Belgian firms has not its main source in product differentiation but rather corresponds to other forms of imperfect competition. On the contrary, the results of Crépon et al. (2002) indicate that the mark-up of French manufacturing firms is mainly a differentiated product mark-up (or demand mark-up).

### ***Sectoral Analysis***

To take into account heterogeneity among sectors, we disaggregate the Belgian manufacturing industry into 20 two-digit sectors and estimate the four models for each sector. Due to data limitations and econometric problems, we had to restrict the analysis to 17 sectors for Model 1 and Model 2 and 16 sectors for Model 3 and Model 4. For all reported results, the test statistics show that second-order serial correlation is not present in the estimated equations. Moreover, the Sargan test allows us to reject the null hypothesis of correlation among instruments and error terms.

Table 3 and Table 4 report the results for Model 1 and Model 2 respectively. The ratio of price over marginal cost is significantly greater than one at the 1% level for all industries. As expected, Model 1 provides a lower bound mark-up estimate, i.e. a mark-up net of the influence of returns to scale and net of the direct effect of wages<sup>13</sup>. The estimated mark-ups range from 4 to 31 percent. This range seems plausible and is also in line with the findings of Martins et al. (1996) and Konings et al. (2001).

We can group sectors according to the value of the estimated mark-ups. Relatively high mark-ups (21-31 percent) appear in sectors such as non-metallic mineral products, agricultural and industrial machinery, office and data processing machines, precision and optical instruments, motor vehicles and beverages. On the other hand, estimated mark-ups are relatively low (4-12%) in the sectors producing milk and dairy products, textiles and clothing, metal products except machinery and transport equipment and rubber and plastic products.

When taking into account the influence of returns to scale, the mark-up ratio ranges from 1.100 to 1.623. The scale elasticity varies from 1.028 to 1.364, pointing to increasing returns to scale. The higher the scale elasticity, the larger the increase in and the level of the price over marginal cost ratio compared to Model 1. The ranking of sectors according to the estimated price

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<sup>12</sup> These results are not reported but available upon request.

<sup>13</sup> Large sunk costs or strong adjustment rigidities over the business cycle affect the mark-up estimate in the same way as increasing returns to scale, i.e. neglecting them is also likely to generate a downward bias to the estimated value of the mark-up (Martins et al., 1996).



over marginal cost ratio remains the same except for the metal products and the textiles and clothing sectors which belong now to the sectors with the highest mark-ups. This finding can be explained by the fact that these sectors are characterised by relatively strong increasing returns to scale.

Although high mark-ups may be indicative of a lack of competition in the sector, they cannot be considered as persistent rents resulting from market power. In innovative sectors, for example, high mark-ups may be the result of temporary innovation rents. Sunk costs may also necessitate mark-up pricing in order to sustain the competitive process in some sectors.

*<Insert Table 3 and Table 4 about here>*

Focusing on the direct effect of wages on the mark-up leads to following insights (see Table 5 and Table 6). In Model 3, the estimated mark-up ratio ranges from 1.078 to 1.698 and the bargaining power parameter varies from 0.047 to 0.297. The estimates of the workers' bargaining power accord with those of Vandebussche et al. (2001), who estimate bargaining power coefficients for NACE-three digit sectors over the period 1987-1994. Model 4 points to a range of 1.115-1.715 for the estimated mark-up ratio and 0.025-0.310 for the workers' bargaining power.

For each sector, we find evidence of mark-ups being underestimated when ignoring imperfection in the labour market, hence, validating the findings of Bughin (1996). In line with our expectations, the higher the bargaining power of the workers in a sector, the higher the level of and the increase in the estimated price over marginal cost ratio. This is because unions with high bargaining power are able to obtain a large part of the product rents. The difference between the estimated price-cost margin ( $\beta$ ) in Model 3 and Model 1 gives us a proxy for the portion of product rents captured by unions. The higher the bargaining power parameter, the higher this proxy for wage rents.

This allows us again to split up sectors according to the value of both the mark-up ratio and the workers' bargaining power. Concentrating on Model 3, sectors such as office and data processing machines, precision and optical instruments, motor vehicles, textiles and clothing and paper and printing products are characterised by relatively high mark-ups (range of 40-70%) and relatively high bargaining power (range of 0.220-0.297). The sector office and data processing machines, precision and optical instruments can be labelled as the sector with both the highest mark-up and the highest bargaining power. We expected to find the highest mark-up in this sector since this sector is characterised by considerable R&D expenditures. Hence, high mark-ups are needed to recoup the sunk R&D investment. The sectors producing textiles and clothing and paper and printing products move from respectively the 'low' and 'moderate' categories (Model 1) to the 'high' category (Model 3) because of the high union bargaining power in these sectors. Unions in

these sectors succeed in extracting a significant part of product rents, depressing observed rents significantly.

Sectors such as ferrous and non-ferrous ores and metals, metal products except machinery and transport equipment and rubber and plastic products can be classified as sectors with moderate mark-ups (range of 1.264-1.326) and moderate bargaining power (range of 0.139-0.216).

Sectors producing chemical products and milk and dairy products display a relatively low price over marginal cost ratio (range of 1.078-1.255) and relatively low bargaining power (range of 0.047-0.108). The lowest mark-up ratio as well as the lowest bargaining power parameter is found in the milk and dairy products sector. The change in ranking from the 'moderate' category (Model 1) to the 'low' category (Model 3) for the chemical products sector is due to the relatively low bargaining strength of the unions, narrowing the difference between the estimated price-cost margin for both models. Model 4 produces similar results.

*<Insert Table 5 and Table 6 about here>*

### ***Cyclical and Competition Effects***

A lot of studies have provided evidence that price-cost margins vary over the business cycle (see e.g. Bils, 1987; Domowitz et al., 1988; Haskel et al., 1995 and Rotemberg and Woodford, 1992). The theoretical literature is ambiguous as to whether mark-ups should be pro- or counter-cyclical. Different kinds of models produce contradictory conclusions.

Firms operating in monopolistic markets may find it optimal to set counter-cyclical price-cost margins. Under profit maximisation, the mark-up is an inverse function of the price elasticity of product demand. If the elasticity of demand is pro-cyclical<sup>14</sup>, firms may find it optimal to lower their mark-ups in order to develop their customer base during a boom, as suggested by Bils (1989). The collusion model of Rotemberg and Saloner (1986) also suggests counter-cyclical price-cost margins. The idea is that during economic upturns, firms have an incentive to behave more competitively in order to expand their market shares. If they can do so, the gains from deviating from a cartel agreement may outpace the long-term losses from punishment.

If firms operate under a regime of oligopolistic competition, it can be shown that the profit-maximising mark-up of a firm depends on (1) the degree of concentration in the market and (2) the firm's conjecture of the output responses of all other competitors to a change in its output. The cyclicity of price-cost margins is then likely to depend on specific market characteristics, such as capacity constraints. Given pro-cyclical capacity constraints, competitors operating under full capacity may not be able to raise their output in response to a firm's price increase in periods of high demand. As a result, firms can charge an additional profit premium (see Gordon, 1987).

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<sup>14</sup> This is likely the case if, for example, product variety is also pro-cyclical (Martins et al., 1996).

Vickers (1985) explains the pro-cyclical nature of mark-ups by a counter-cyclical price elasticity of demand. The reasoning behind this is that buyers might be less price conscious during periods of prosperity.

In the end, the cyclicity of mark-ups becomes an empirical question. As far as the bargaining power parameter is concerned, it is expected that workers' bargaining strength will be weakened during a recession.

In 1993, Belgium adopted a new competition law. In essence, the prevailing price regulation system was replaced by a new antitrust legislation very similar to the European Union legislation, i.e. Articles 85 and 86 of the Treaty of Rome<sup>15</sup> and the Merger regulation. An interesting question is hence whether the change in competition policy has had an effect on the price mark-ups within our framework.

To address both issues, we check whether and how the mark-up and the bargaining power parameters are affected by both cyclical and competition effects. We control for cyclicity by interacting the regressors  $[\Delta(q-k), \Delta k \text{ and } (\alpha_N - 1) \Delta(n-k)]$  with the growth rate of GDP. After correcting for cyclicity, we test whether we find a statistically significant change in the estimated parameters in the years 1994-1995. The results are reported in table 7.

The results are reported in table 7. Lagged values of  $\Delta(q-k), \Delta k, (\alpha_N - 1) \Delta(n-k), Q/K$  and the growth rate of GDP from (t-2) and earlier are used as instruments. Appropriate tests show that second-order serial correlation is not present in any estimated equation. Moreover, the Sargan test legitimates the choice of instruments. Model 3 and Model 4 clearly perform better in terms of the specification tests than Model 1 and Model 2 respectively. Considering workers' bargaining power as an additional regressor seems again to be important.

The results show that the mark-up as well as the bargaining power parameter move pro-cyclically. The finding of pro-cyclical mark-ups is consistent with those of Domowitz et al. (1988) for US manufacturing and Haskel et al. (1995) for UK manufacturing.

After controlling for cyclical effects, we find that the introduction of a new competition policy has exerted a statistically significant negative effect on the price mark-ups, leaving the bargaining strength of the workers unchanged. Hence, stringent competition law seems to have disciplined firm behaviour.

*<Insert Table 7 about here>*

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<sup>15</sup> Article 85 refers to antitrust rules against agreements between firms and Article 86 refers to antitrust rules against the abuse of a dominant position.

## 6. CONCLUSION

This paper analyses price-setting behaviour in both the product and the labour market of Belgian manufacturing firms over the period 1988-1995. By embedding an Efficient Bargaining model into Hall's (1988) framework, we are able to estimate mark-up and bargaining power parameters simultaneously. This allows us to focus on the implications of ignoring imperfect competition in the labour market on the estimation of price-cost margins at the firm level.

Applying the Generalised Method of Moments (GMM) technique for panel data, our results strongly reject perfect competition in both the output and the labour market. Assuming constant returns to scale, mark-ups are estimated at about 31 percent and the bargaining power parameter is found to be about 0.22. Neglecting the part of product rents captured by workers brings the mark-up down to 13 percent.

To examine the important issue of heterogeneity in both the mark-up and the bargaining power parameters, we split up the sample into 20 sectors. For each sector separately, our results confirm the finding that neglecting imperfection in the labour market causes a significant underestimation in the mark-up. As expected, we find that higher bargaining power parameters are associated with higher price-cost margins at the sectoral level. The sector office and data processing machines, precision and optical instruments can be labelled as the sector with both the highest bargaining power (estimate of 0.30) and the highest mark-up (estimate of 70 percent). The high price-cost margin can be explained by the fact that this sector is characterised by considerable R&D expenditures. High mark-ups are hence needed to recoup the sunk R&D investment. The lowest bargaining power parameter (estimate of 0.05) and the lowest mark-up (estimate of 8 percent) is found in the milk and dairy products sector.

Finally, we check whether and how the mark-up and the bargaining power parameters are affected by cyclical and competition policy effects. As far as the nature of cyclicity is concerned, we find that both parameters move pro-cyclically. After controlling for cyclical effects, the introduction of a stringent competition policy in 1993 seems to have exerted a negative effect on the price-cost margin without having affected the bargaining strength of the workers.

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**Table 2 General Results**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>
REDUCED FORM PARAMETERS				
<b>Constant</b>	-0.002 (0.002)	-0.014*** (0.003)	-0.007*** (0.003)	-0.014*** (0.003)
<b>Output per Capital</b> $\Delta(q - k)$	0.117*** (0.025)	0.277*** (0.042)	0.234*** (0.036)	0.309*** (0.042)
<b>Capital</b> $\Delta k$		0.139*** (0.028)		0.089*** (0.031)
<b>Share-weighted Labour per Capital</b> $(\alpha_N - 1) \Delta(n - k)$			0.278*** (0.055)	0.203*** (0.062)
STRUCTURAL PARAMETERS				
<b>Mark-up</b> $\mu$	1.133*** (0.032)	1.383*** (0.080)	1.305*** (0.061)	1.447*** (0.088)
<b>Scale Elasticity</b> $1 + \gamma$	1	1.192*** (0.039)	1	1.129*** (0.037)
<b>Workers' Barg. Power</b> $\phi$			0.218*** (0.034)	0.169*** (0.043)
SPECIFICATION TESTS				
<b>Sargan IV Test</b> $\sim \chi_{df}^2$	63.769	47.950	50.453	43.645
<b>df</b>	59	58	58	57
<b>p-value</b>	0.312	0.824	0.749	0.612
<b>SOC</b> $\sim N(0,1)$	-0.481	-0.603	-0.537	-0.835
<b>N</b>	27496	27496	27496	27496

\*\*\*Significant at 1%; \*\*Significant at 5%; \*Significant at 10%. Standard errors in parentheses.

- (1) Sample period: 1988-1995.
- (2) Dependent variable: Solow Residual,  $SR = \Delta q_{it} - \alpha_{N_{it}} \Delta n_{it} - \alpha_{M_{it}} \Delta m_{it} - (1 - \alpha_{N_{it}} - \alpha_{M_{it}}) \Delta k_{it}$ .
- (3) The equations are estimated in levels as the specifications are in differenced logs, i.e. growth rates.
- (4) Sargan IV Test: two-step estimates Sargan test of correlation among instruments and residuals, asymptotically distributed as  $\chi_{df}^2$ .
- (5) SOC: test for 2<sup>nd</sup>-order serial correlation (SOC), referring to the differenced specifications and checking that there is no correlation between the differenced errors and their second lag. This is, of course, a necessary condition for the undifferenced errors to be white noise. This test statistic is asymptotically distributed as  $N(0,1)$ .
- (6) Instruments used are:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$  and  $Q/K$ , all dated  $(t-2)$  and earlier.
- (7) Time dummies are included as regressors and instruments in all equations.

**Table 3 Sector Analysis: Model 1**

	Code	Name	Output per Capital $\Delta(q - k)$	Mark-up $\mu$
<b>Sec 1</b>	13	Ferrous and non-ferrous ores and metals, other than radioactive	0.157*** (0.004)	1.186*** (0.006)
<b>Sec 2</b>	15	Non-metallic mineral products	0.177*** (0.029)	1.215*** (0.043)
<b>Sec 3</b>	17	Chemical products	0.136*** (0.024)	1.157*** (0.032)
<b>Sec 4</b>	19	Metal products except machinery and transport equipment	0.107** (0.048)	1.120*** (0.060)
<b>Sec 5</b>	21	Agricultural and industrial machinery	0.176*** (0.020)	1.214*** (0.029)
<b>Sec 6</b>	23	Office and data processing machines, precision and optical instruments	0.219*** (0.019)	1.280*** (0.031)
<b>Sec 7</b>	25	Electrical goods	0.130*** (0.024)	1.149*** (0.032)
<b>Sec 8</b>	27	Motor vehicles	0.236*** (0.013)	1.309*** (0.022)
<b>Sec 9</b>	29	Other transport equipment	na	na
<b>Sec 10</b>	31	Meats meat preparations and preserves, other products from slaughtered animals	0.068*** (0.013)	1.073*** (0.015)
<b>Sec 11</b>	33	Milk and dairy products	0.039*** (0.0004)	1.041*** (0.0004)
<b>Sec 12</b>	35	Other food products	0.227*** (0.026)	1.294*** (0.044)
<b>Sec 13</b>	37	Beverages	0.213*** (0.018)	1.271*** (0.029)
<b>Sec 14</b>	39	Tobacco products	na	na
<b>Sec 15</b>	41	Textiles and clothing	0.107** (0.033)	1.120*** (0.041)
<b>Sec 16</b>	43	Leathers, leather and skin goods, footwear	na	na
<b>Sec 17</b>	45	Timber, wooden products and furniture	0.164*** (0.036)	1.196*** (0.052)
<b>Sec 18</b>	47	Paper and printing products	0.135*** (0.038)	1.156*** (0.051)
<b>Sec 19</b>	49	Rubber and plastic products	0.108*** (0.023)	1.121*** (0.029)
<b>Sec 20</b>	51	Other manufacturing products	0.083*** (0.023 )	1.091*** (0.027)

Time dummies included but not reported. Standard errors in parentheses.

\*\*\*Significant at 1%; \*\*Significant at 5%; \*Significant at 10%.

Instruments:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$  and  $Q/K$ , all dated (t-2) and earlier.



**Table 4 Sector Analysis: Model 2**

	<b>Output per Capital</b> $\Delta(q - k)$	<b>Capital</b> $\Delta k$	<b>Mark-up</b> $\mu$	<b>Scale Elasticity</b> $1 + \gamma$
<b>Sec 1</b>	0.204*** (0.006)	0.152*** (0.008)	1.250*** (0.009)	1.190*** (0.010)
<b>Sec 2</b>	0.311*** (0.036)	0.251*** (0.047)	1.451*** (0.076)	1.364*** (0.068)
<b>Sec 3</b>	0.197*** (0.036)	0.076* (0.041)	1.245*** (0.056)	1.095*** (0.051)
<b>Sec 4</b>	0.285*** (0.055)	0.214*** (0.045)	1.399*** (0.108)	1.299*** (0.063)
<b>Sec 5</b>	0.285*** (0.037)	0.172*** (0.043)	1.399*** (0.072)	1.241*** (0.060)
<b>Sec 6</b>	0.269*** (0.024)	0.096*** (0.027)	1.368*** (0.045)	1.131*** (0.037)
<b>Sec 7</b>	0.183*** (0.030)	0.080** (0.034)	1.224*** (0.045)	1.098*** (0.042)
<b>Sec 8</b>	0.276*** (0.017)	0.067*** (0.023)	1.381*** (0.032)	1.093*** (0.032)
<b>Sec 9</b>	na	na	na	na
<b>Sec 10</b>	0.097*** (0.021)	0.039** (0.018)	1.107*** (0.026)	1.043*** (0.020)
<b>Sec 11</b>	0.091*** (0.001)	0.075*** (0.001)	1.100*** (0.001)	1.083*** (0.001)
<b>Sec 12</b>	0.343*** (0.042)	0.159*** (0.048)	1.522*** (0.097)	1.242*** (0.073)
<b>Sec 13</b>	0.300*** (0.023)	0.121*** (0.018)	1.429*** (0.047)	1.173*** (0.026)
<b>Sec 14</b>	na	na	na	na
<b>Sec 15</b>	0.329*** (0.054)	0.230*** (0.046)	1.490*** (0.120)	1.343*** (0.069)
<b>Sec 16</b>	na	na	na	na
<b>Sec 17</b>	0.384*** (0.047)	0.195*** (0.038)	1.623*** (0.124)	1.316*** (0.062)
<b>Sec 18</b>	0.288*** (0.058)	0.148*** (0.048)	1.404*** (0.114)	1.208*** (0.067)
<b>Sec 19</b>	0.210*** (0.038)	0.160*** (0.031)	1.266*** (0.061)	1.203*** (0.039)
<b>Sec 20</b>	0.104*** (0.029)	0.025* (0.014)	1.116*** (0.036)	1.028*** (0.016)

Time dummies included but not reported. Standard errors in parentheses. \*\*\*Significant at 1%; \*\*Significant at 5%; \*Significant at 10%.

Instruments:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$  and  $Q/K$ , all dated (t-2) and earlier.

**Table 5 Sector Analysis: Model 3**

	<b>Output per Capital</b> $\Delta(q - k)$	<b>Share-weighted Labour per Capital</b> $(\alpha_N - 1) \Delta(n - k)$	<b>Mark-up</b> $\mu$	<b>Workers' Barg. Power</b> $\phi$
<b>Sec 1</b>	0.218*** (0.008)	0.162*** (0.011)	1.279*** (0.013)	0.139*** (0.008)
<b>Sec 2</b>	0.295*** (0.033)	0.282*** (0.057)	1.418*** (0.066)	0.220*** (0.035)
<b>Sec 3</b>	0.203*** (0.030)	0.121*** (0.038)	1.255*** (0.047)	0.108*** (0.030)
<b>Sec 4</b>	0.246*** (0.053)	0.275*** (0.060)	1.326*** (0.093)	0.216*** (0.037)
<b>Sec 5</b>	0.286*** (0.024)	0.294*** (0.034)	1.401*** (0.047)	0.227*** (0.020)
<b>Sec 6</b>	0.411*** (0.023)	0.423*** (0.038)	1.698*** (0.066)	0.297*** (0.019)
<b>Sec 7</b>	0.196*** (0.031)	0.150*** (0.049)	1.244*** (0.048)	0.130*** (0.037)
<b>Sec 8</b>	0.400*** (0.015)	0.380*** (0.031)	1.667*** (0.042)	0.275*** (0.016)
<b>Sec 9</b>	na	na	na	na
<b>Sec 10</b>	na	na	na	na
<b>Sec 11</b>	0.072*** (0.0004)	0.049*** (0.001)	1.078*** (0.001)	0.047*** (0.001)
<b>Sec 12</b>	0.325*** (0.050)	0.233*** (0.070)	1.481*** (0.110)	0.189*** (0.046)
<b>Sec 13</b>	0.264*** (0.019)	0.122*** (0.013)	1.359*** (0.035)	0.107*** (0.010)
<b>Sec 14</b>	na	na	na	na
<b>Sec 15</b>	0.314*** (0.038)	0.354*** (0.056)	1.458*** (0.081)	0.261*** (0.031)
<b>Sec 16</b>	na	na	na	na
<b>Sec 17</b>	0.350*** (0.042)	0.325*** (0.053)	1.538*** (0.099)	0.245*** (0.030)
<b>Sec 18</b>	0.354*** (0.048)	0.351*** (0.061)	1.548*** (0.115)	0.260*** (0.033)
<b>Sec 19</b>	0.209*** (0.034)	0.184*** (0.031)	1.264*** (0.054)	0.155*** (0.022)
<b>Sec 20</b>	0.123*** (0.028)	0.065*** (0.017)	1.140*** (0.036)	0.061*** (0.015)

Time dummies included but not reported. Standard errors in parentheses. \*\*\* Significant at 1%; \*\* Significant at 5%; \* Significant at 10%.

Instruments:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$  and  $Q/K$ , all dated (t-2) and earlier.

**Table 6 Sector Analysis: Model 4**

	<b>Output per Capital</b> $\Delta(q - k)$	<b>Capital</b> $\Delta k$	<b>Share-weighted Labour per Capital</b> $(\alpha_N - 1) \Delta(n - k)$	<b>Mark-up</b> $\mu$	<b>Scale Elasticity</b> $1 + \gamma$	<b>Workers' Barg. Power</b> $\phi$
<b>Sec 1</b>	0.222*** (0.009)	0.087*** (0.009)	0.098*** (0.012)	1.285*** (0.015)	1.112*** (0.012)	0.089*** (0.010)
<b>Sec 2</b>	0.351*** (0.035)	0.178*** (0.052)	0.182*** (0.068)	1.541*** (0.083)	1.274*** (0.080)	0.154*** (0.049)
<b>Sec 3</b>	0.218*** (0.036)	0.038 (0.042)	0.095** (0.039)	1.279*** (0.059)	1*** (0.054)	0.087*** (0.033)
<b>Sec 4</b>	0.307*** (0.056)	0.153*** (0.052)	0.133** (0.065)	1.443*** (0.117)	1.221*** (0.075)	0.117*** (0.051)
<b>Sec 5</b>	0.308*** (0.035)	0.046 (0.052)	0.269*** (0.045)	1.445*** (0.073)	1*** (0.075)	0.212*** (0.028)
<b>Sec 6</b>	0.417*** (0.033)	-0.003 (0.029)	0.430** (0.042)	1.715*** (0.097)	1*** (0.050)	0.301*** (0.021)
<b>Sec 7</b>	0.239*** (0.032)	0.051 (0.034)	0.151*** (0.053)	1.314*** (0.055)	1*** (0.045)	0.131*** (0.040)
<b>Sec 8</b>	0.374*** (0.014)	-0.079*** (0.017)	0.450*** (0.032)	1.597*** (0.036)	0.874*** (0.027)	0.310*** (0.015)
<b>Sec 9</b>	na	na	na	na	na	na
<b>Sec 10</b>	na	na	na	na	na	na
<b>Sec 11</b>	0.103*** (0.001)	0.066*** (0.002)	0.026*** (0.002)	1.115*** (0.001)	1.074*** (0.002)	0.025*** (0.002)
<b>Sec 12</b>	0.387*** (0.042)	0.069 (0.055)	0.202*** (0.068)	1.631*** (0.112)	1*** (0.090)	0.168*** (0.047)
<b>Sec 13</b>	0.313*** (0.025)	0.078*** (0.026)	0.096*** (0.014)	1.456*** (0.053)	1.114*** (0.038)	0.088*** (0.012)
<b>Sec 14</b>	na	na	na	na	na	na
<b>Sec 15</b>	0.397*** (0.051)	0.132*** (0.046)	0.305*** (0.059)	1.658*** (0.140)	1.219*** (0.076)	0.234*** (0.035)
<b>Sec 16</b>	na	na	na	na	na	na
<b>Sec 17</b>	0.413*** (0.048)	0.103** (0.050)	0.235*** (0.070)	1.704*** (0.139)	1.176*** (0.085)	0.190*** (0.046)
<b>Sec 18</b>	0.351*** (0.057)	0.001 (0.053)	0.344*** (0.069)	1.541*** (0.135)	1*** (0.082)	0.256*** (0.038)
<b>Sec 19</b>	0.240*** (0.039)	0.108*** (0.042)	0.108*** (0.043)	1.316*** (0.068)	1.142*** (0.055)	0.097*** (0.035)
<b>Sec 20</b>	0.118*** (0.030)	-0.007 (0.023)	0.068*** (0.025)	1.134*** (0.039)	1*** (0.026)	0.064*** (0.022)

Time dummies included but not reported. Standard errors in parentheses. \*\*\*Significant at 1%; \*\*Significant at 5%; \*Significant at 10%.

Instruments:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$  and  $Q/K$ , all dated (t-2) and earlier.

**Table 7 General Results, controlling for Cyclical and Competition Effects**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>
REDUCED FORM PARAMETERS				
<b>Constant</b>	0.002 (0.002)	0.004 (0.002)	0.002 (0.002)	0.005** (0.003)
<b>Output per Capital</b> $\Delta(q - k)$	0.051 (0.050)	0.262*** (0.076)	0.167** (0.073)	0.281*** (0.079)
<b>Capital</b> $\Delta k$		0.210*** (0.056)		0.192*** (0.057)
<b>Share-weighted Labour per capital</b> $(\alpha_N - 1) \Delta(n - k)$			0.234** (0.106)	0.082 (0.118)
<b>GDP growth g</b>	-0.002** (0.001)	-0.005*** (0.001)	-0.001 (0.001)	-0.004*** (0.001)
<b>g <math>\Delta(q - k)</math></b>	0.074*** (0.022)	0.052* (0.028)	0.066** (0.028)	0.048* (0.028)
<b>g <math>\Delta k</math></b>		0.010 (0.026)		-0.046 (0.034)
<b>g <math>(\alpha_N - 1) \Delta(n - k)</math></b>			0.085* (0.048)	0.119* (0.067)
<b>(1994 - 1995) <math>\Delta(q - k)</math></b>	-0.156*** (0.041)	-0.178*** (0.063)	-0.168*** (0.055)	-0.207*** (0.058)
<b>(1994 - 1995) <math>\Delta k</math></b>		-0.172** (0.072)		-0.095 (0.085)
<b>(1994 - 1995) <math>(\alpha_N - 1) \Delta(n - k)</math></b>			-0.196 (0.129)	-0.156 (0.173)
STRUCTURAL PARAMETERS				
<b>Mark-up</b> $\mu$	1*** (0.056)	1.355*** (0.140)	1.200*** (0.105)	1.391*** (0.153)
<b>Scale Elasticity</b> $1 + \gamma$	1	1.285*** (0.076)	1	1.267*** (0.079)
<b>Workers' Barg. Power</b> $\phi$			0.190*** (0.070)	0 (0.101)
SPECIFICATION TESTS				
<b>Sargan IV Test</b> $\sim \chi_{df}^2$	61.606	41.559	63.166	54.122
<b>df</b>	57	54	78	75
<b>p-value</b>	0.315	0.892	0.888	0.967
<b>SOC</b> $\sim N(0,1)$	-0.158	-0.451	-0.054	-0.365
<b>N</b>	27496	27496	27496	27496

\*\*\*Significant at 1%; \*\*Significant at 5%; \*Significant at 10%. Standard errors in parentheses.

Instruments:  $\Delta(q-k)$ ,  $\Delta k$ ,  $(\alpha_N - 1) \Delta(n-k)$ , Q/K and GDP growth, all dated (t-2) and earlier.