

Imports as product and labor market discipline

Levinsohn (1993) revisited

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Abstract

This paper tests the pro-competitive effect of trade in the product and labor markets of UK manufacturing sectors between 1990 and 2003, using a two-stage estimation procedure. In the first stage, we use data on 9820 firms within 20 manufacturing sectors to estimate simultaneously mark-ups and workers' bargaining power parameters along three dimensions (sector, firm size and period). We find a significant drop in both the mark-up and the workers' bargaining power after 1994. In the second stage, we relate our parameters of interest to trade variables. Our results show that imports from developed countries have significantly contributed to the decrease of both mark-ups and the workers' bargaining power.

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1 Introduction

Following Levinsohn's 1993 (JIE) article, many studies have drawn on Hall's (1988) approach to estimate price-marginal cost mark-ups and have tested the imports-as-market-discipline hypothesis (see Harrison, 1994; Krishna and Mitra, 1998; Konings et al., 2001; Kee and Hoekman, 2003 among others). Inspired by Rodrik's (1997) argument that increased international trade has weakened the position of the workers, -only- two studies (Brock and Dobbelaere, 2006 and Dumont et al., 2006) have investigated whether stronger import competition has

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squeezed the workers' bargaining power. The main purpose of the present contribution is to provide evidence of international competition curtailing domestic market power in the product as well as in the labor market of UK manufacturing sectors.

Graph 1 displays the evolution in price-cost margins at the UK sector level since 1970.¹ At first sight, despite a steady increase in openness, there is little evidence of a general decline in price-cost margins. In fact, at the aggregated manufacturing level, the price-cost margin was 9.4% in 1970, 8.2% in 1980, 11.5% in 1990 and 9.2% in 2003. How could we reconcile these trends with the evidence of the pro-competitive effect of international trade highlighted above? In short, the answer might be that the effect of trade on the price-cost margin is not limited to its impact on the mark-up. This is because the price-cost margin only captures the part of the rents kept by the firms.

<Insert Graph 1 about here>

Taking into account labor market imperfections, Borjas and Ramey (1995) provide evidence of foreign competition exerting a negative impact on wages by reducing rents in concentrated sectors. However, the finding of lower rents per se does not mean that the rent-sharing scheme between capital and labor has changed. More recently, using a matched employer-employee database for France, Kramarz (2003) shows that outsourcing weakens the bargaining position of high-school graduate workers by limiting the availability of alternative jobs.

The seminal paper by Blanchard and Giavazzi (2003) has drawn attention to the importance of product and labor market interactions. Moreover, OECD studies (e.g. Brandt et al., 2005) point out that product and labor market deregulations are correlated across countries and Spector (2004) suggests that these deregulations tend to reinforce each other. Going one step further, endogenizing the bargaining regime, Ebell and Haefke (2004) argue that the strong decline in coverage and unionization in the US and the UK might have been a direct consequence of product market reforms of the early eighties. Our study suggests that the trend in price-cost margins might be the result of the joint decline in the mark-up and the workers' bargaining power following increased opening of the economy, along the lines of Blanchard (1997) for the United States.

We contribute to the literature in different ways. We take advantage of a rich firm-level dataset consisting of 9820 firms in the UK manufacturing industry covering the period 1990-2003. This enables us to estimate the mark-ups and workers' bargaining power parameters simultaneously for 20 sectors split according to 3 firm size categories and 3 time periods. To our knowledge, investigating the cross-sectional heterogeneity in the two parameters at this level of

¹Price-cost margin is defined, as in Schmalensee (1989, p.960), as the difference between revenue and variable cost over revenue. The variable cost is the sum of the costs of variable inputs, i.e. labor and materials.

disaggregation has never been carried out for the UK. Whereas previous empirical studies have tested the imports-as-market-discipline hypothesis either on the product market or on the labor market, our study bridges the gap by verifying the impact of increased import competition on both mark-ups and workers' bargaining power parameters.

We follow a two-stage approach in which we first estimate mark-ups and workers' bargaining power parameters along three dimensions (sector, firm size and time period). Our results point to a significant drop in both parameters after 1994. In the second stage, we identify factors explaining mark-ups and the workers' bargaining power with a special focus on the pro-competitive effect of international trade. We find clear evidence of imports from developed countries having contributed significantly to the decline in both mark-ups and the workers' bargaining power.

In the remainder, we first describe the theoretical framework and the empirical strategy (section 2). Section 3 concentrates on the first-stage results. Section 4 discusses the second-stage results where we evaluate the pro-competitive effect on both mark-ups and the workers' bargaining power. Section 5 concludes.

2 Methodology

2.1 Theoretical Framework

Theoretically, we rely on the model of Crépon et al. (1999, 2002), detailed further by Dobbelaere (2004). We start from a production function $Q_{it} = \Theta_{it}F(N_{it}, M_{it}, K_{it})$, where i is a firm index, t a time index, N is labor, M is material input, K is capital and $F(\cdot)$ is assumed to be homogeneous of degree one in its arguments. Θ_{it} is an index of technical change or "true" total factor productivity. The logarithmic differentiation of the production function gives:

$$\Delta q_{it} = \varepsilon_{N_{it}}^Q \Delta n_{it} + \varepsilon_{M_{it}}^Q \Delta m_{it} + \varepsilon_{K_{it}}^Q \Delta k_{it} + \Delta \theta_{it} \quad (1)$$

Each firm operates under imperfect competition in the product market. On the labor side, we assume that the union and the firm are involved in an Efficient Bargaining procedure with both wages (w) and labor (N) being the subject of an agreement (McDonald and Solow, 1981). The union is risk neutral and its objective is to maximize $U(w_{it}, N_{it}) = N_{it}w_{it} + (\bar{N}_{it} - N_{it})\bar{w}_{it}$, where \bar{N}_{it} is union membership ($0 < N_{it} \leq \bar{N}_{it}$) and \bar{w}_{it} is the alternative wage ($\bar{w}_{it} \leq w_{it}$). Consistent with capital quasi-fixity, the firm objective is to maximize its short-run profit function: $\pi(w_{it}, N_{it}, M_{it}) = R(N_{it}, M_{it}) - w_{it}N_{it} - j_{it}M_{it}$, where $R_{it} = P_{it}Q_{it}$ stands for total revenue. The outcome of the bargaining is the asymmetric generalized Nash solution to:

$$\begin{aligned} & \max_{w_{it}, N_{it}, M_{it}} \{N_{it}w_{it} + (\bar{N}_{it} - N_{it})\bar{w}_{it} - \bar{N}_{it}\bar{w}_{it}\}^{\phi_{it}} \{R_{it} - w_{it}N_{it} - j_{it}M_{it}\}^{1-\phi_{it}} \\ & = \max_{w_{it}, N_{it}, M_{it}} \{N_{it}(w_{it} - \bar{w}_{it})\}^{\phi_{it}} \{R_{it} - w_{it}N_{it} - j_{it}M_{it}\}^{1-\phi_{it}} \end{aligned} \quad (2)$$

where $\phi_{it} \in [0, 1]$ represents the workers' bargaining power.

Maximization with respect to material input gives $R_{M,it} = j_{it}$, which directly leads to:

$$\varepsilon_{M,it}^Q = \mu_{it} \alpha_{M,it} \quad (3)$$

with $\mu_{it} = \frac{P_{it}}{C_{Q,it}}$ and $\alpha_{M,it} = \frac{j_{it} M_{it}}{P_{it} Q_{it}}$. Maximization with respect to employment and the wage rate respectively gives the following first-order conditions:

$$w_{it} = R_{N,it} + \phi_{it} \left[\frac{R_{it} - R_{N,it} N_{it} - j_{it} M_{it}}{N_{it}} \right] \quad (4)$$

$$w_{it} = \bar{w}_{it} + \frac{\phi_{it}}{1 - \phi_{it}} \left[\frac{R_{it} - w_{it} N_{it} - j_{it} M_{it}}{N_{it}} \right] \quad (5)$$

Eq. (5) states that the wage premium over the alternative wage is positively related to the workers' bargaining power and to the size of the rents. Solving simultaneously (4) and (5) leads to an expression for the contract curve: $R_{N,it} = \bar{w}_{it}$. Expressing the marginal revenue of labor as $R_{N,it} = R_{Q,it} Q_{N,it} = \frac{P_{it} Q_{N,it}}{\mu_{it}}$ and using this expression together with (4) and the expression for the contract curve, the elasticity of output with respect to employment can be written as:

$$\varepsilon_{N,it}^Q = \mu_{it} \alpha_{N,it} - \mu_{it} \frac{\phi_{it}}{1 - \phi_{it}} (1 - \alpha_{N,it} - \alpha_{M,it}) \quad (6)$$

with $\alpha_{N,it} = \frac{w_{it} N_{it}}{P_{it} Q_{it}}$. Assuming constant returns to scale ($\varepsilon_{N,it}^Q + \varepsilon_{M,it}^Q + \varepsilon_{K,it}^Q = 1$),² the capital elasticity can be expressed as:

$$\varepsilon_{K,it}^Q = 1 - \mu_{it} \alpha_{M,it} - \mu_{it} \alpha_{N,it} + \mu_{it} \frac{\phi_{it}}{1 - \phi_{it}} (1 - \alpha_{N,it} - \alpha_{M,it}) \quad (7)$$

Inserting (3), (6) and (7) in (1) and rearranging terms gives following expression of the Solow Residual SR_{it} :

$$\begin{aligned} & \Delta q_{it} - \alpha_{N,it} \Delta n_{it} - \alpha_{M,it} \Delta m_{it} - (1 - \alpha_{N,it} - \alpha_{M,it}) \Delta k_{it} \\ &= \beta_{it} (\Delta q_{it} - \Delta k_{it}) - \gamma_{it} (1 - \alpha_{N,it} - \alpha_{M,it}) (\Delta n_{it} - \Delta k_{it}) \\ & \quad + (1 - \beta_{it}) \Delta \theta_{it} \end{aligned} \quad (8)$$

where $\beta_{it} = \frac{\mu_{it} - 1}{\mu_{it}}$ is the Lerner index and $\gamma_{it} = \frac{\phi_{it}}{1 - \phi_{it}}$.

²The assumption of constant returns to scale is motivated by the large problem of identification which arises when mark-up and scale elasticity parameters are estimated simultaneously.

By embedding the Efficient Bargaining model into a microeconomic version of Hall's (1988) framework, the Solow Residual can be decomposed into three components: (1) a factor representing the Lerner index (β_{it}), (2) a factor reflecting the relative bargaining power of the workers (γ_{it}) and (3) a technological term ($\Delta\theta_{it}$). Note that estimating mark-ups relying on the original Hall (1988) approach suffers from a downward bias increasing with the bargaining power of the workers. Intuitively, this underestimation corresponds to the omission of the part of product rents captured by the workers (see Dobbelaere, 2004 and Dobbelaere and Mairesse, 2005 for sector-level evidence in the Belgian and the French manufacturing industry respectively).

2.2 Empirical Framework

To test the imports-as-product-and-labor-market-discipline hypothesis, we follow a two-stage estimation strategy. In the first part, we estimate the reduced-form equation (8) which allows us to identify our structural parameters of interest, i.e. the price-marginal cost mark-up $\hat{\mu}$ and the workers' bargaining power $\hat{\phi}$. We estimate these parameters for 20 sectors in the UK manufacturing industry, split according to 3 size categories and 3 time periods. In the second part, our estimated parameters are regressed on international trade variables to test the hypothesis that international competition curtails domestic product and labor market power.

3 Part I : Identifying the parameters of interest $\hat{\mu}$ and $\hat{\phi}$

In this section, we first present the data. Second, we outline our empirical strategy and compare consistently fixed effects (FE) and Generalized Method of Moments (GMM) estimates of our parameters of interest at the sectoral level for all firms and all periods. Finally, we conduct a variance analysis along the three dimensions, sector, firm size and period.

3.1 Data

Our analysis is based on two firm-level surveys: OneSource, which covers the years 1990-1998, and Financial Analysis Made Easy (FAME), which offers a coverage for the years 1994-2003.³ We only keep firms within the manufacturing industry for which we have at least 4 observations for all variables, ending up with an unbalanced panel of 9820 firms with the number of observations for

³OneSource is a database of company accounts constructed by OneSource Information Services Ltd, whilst FAME is gathered by Bureau Van Dijk Electronic Publishing and both derive ultimately from the information which companies are required to deposit at Companies House. For FAME a maximum of 10 years of complete data history can be downloaded at once. For OneSource we used the CD-ROM entitled "UK companies, Vol. 1", October 2000. Further details on the OneSource dataset can be found in Oulton (1998).

each firm varying between 4 and 14.⁴ By allowing for both entry and exit, the unbalanced structure of the panel partially mitigates potential selection and survivor bias.

We use turnover deflated by the producer price index at the four- and five-digit level, according to availability,⁵ as a proxy for output (Q). Labor (N) refers to the average number of employees in each firm for each year. Intermediate inputs (M) are calculated by subtracting the value added from the value of production, deflated by the two-digit materials and fuel price index. The capital stock (K) is measured by the gross bookvalue of fixed assets deflated by a price index of net capital defined at the two-digit level. All deflators are drawn from the UK Office for National Statistics (ONS). The input shares (α_N and α_M) are computed by dividing respectively the firm total labor cost and undeflated intermediate inputs by the value of production and by taking the average of these ratios over adjacent years. Table 1 reports the means, standard deviations and first and third quartiles of our main variables used in the Part I estimation.⁶

<Insert Table 1 about here>

We split the total sample into 20 two-digit sectors according to the Standard Industrial Classification 2003, which is a relatively minor revision of SIC 1992.⁷ Employment coverage of our sample is on average 60% of total UK manufacturing employment (SIC 15-37). Table A.1 in Appendix shows the sector repartition of the sample.

3.2 Empirical Strategy

The main difficulty in estimating the extended Hall-type equation (8) lies in the potential correlation between the TFP-growth term ($\Delta\theta$) and the RHS variables. The problem arises because the productivity shocks are unobserved by the econometrician but not necessarily by the firms which, at least, might anticipate them before choosing their factor inputs. In this case, OLS estimates are likely to be biased. Moreover, the burgeoning literature on firm heterogeneity stresses the differences in productivity level and growth across firms (Bernard et al., 2003 for the US and Eaton et al., 2004 for France). As in Harrison (1994), this problem could be addressed by decomposing the productivity growth term into a firm and a time fixed effect, the latter capturing possible unobservable

⁴In OneSource, the holding companies are reported in addition to their subsidiaries. To avoid the double accounting, we excluded the holdings.

⁵The PPI is available at the 5-digit level for the period 1990-2000 and at the 4-digit level for the period 2001-2003.

⁶We made two rounds of cleaning: the first in order to harmonize OneSource with Fame and to obtain a unique and coherent dataset, and the second to eliminate outliers and anomalies in the dataset. Details are available upon request.

⁷We paid attention to the fact that some firms were recorded in two sectors at different times. To create a one-to-one match between firms and sectors, each firm was attributed to the most recorded sector. Sectors 16 and 23 have been dropped due to parsimonious data.

aggregate shocks and productivity shocks common to all firms within sector j , plus a disturbance term:

$$u_{ijt} = (1 - \beta_j) \Delta \theta_{ijt} = e_{ij} + e_{jt} + v_{ijt} \quad (9)$$

However, since inputs and output are simultaneously determined, the fixed-effects (FE) estimator might still be biased. Taking advantage of the panel dimension of the data, Eq.(8) can be estimated using the the Generalized Method of Moments (GMM). We use as instruments the 3- to 5-period lagged values of the factor inputs n , m and k .

3.3 Comparison of FE and GMM estimates

Table 2 reports the FE and GMM⁸ estimates for each of the 20 sectors.⁹ As to the GMM estimates, the parameters of interest ($\hat{\mu}_j$ and $\hat{\phi}_j$, $j = 1, \dots, 20$) are computed from the two-step estimated values of the reduced-form coefficients ($\hat{\beta}_j$ and $\hat{\gamma}_j$ respectively). The estimated standard errors ($\hat{\sigma}$) of the estimated parameters are computed using the Delta Method (Wooldridge, 2002).¹⁰

The estimated Lerner index ($\hat{\beta}_j$) is always very significant. The estimated relative bargaining of the workers ($\hat{\gamma}_j$) is significant for 18 out of the 20 sectors with FE, and this number drops to 10 with GMM. However, average parameters are very similar, around 0.20 for $\hat{\beta}_j$ and 0.70 for $\hat{\gamma}_j$, which implies an average estimated mark-up ($\hat{\mu}_j$) of 1.25 and an average estimated workers' bargaining power parameter ($\hat{\phi}_j$) of 0.40 respectively. The latter is above Van Reenen's (1996) estimates, lying in (0.22-0.29) range, but is very close to the UK estimates obtained by Dumont et al. (2006) using a smaller set of firms and sectors. More specifically, the FE range across sectors is (1.12 - 1.45) for the estimated mark-up and (0.19 - 0.56) for the estimated workers' bargaining power. The GMM specification tests behave well. The overidentification test is not rejected in all but two sectors. The autocorrelation tests are accepted for sixteen sectors.¹¹

It is worth noting that the estimated mark-up ($\hat{\mu}_j$) and the estimated workers' bargaining power parameter ($\hat{\phi}_j$) are positively correlated across sectors. The correlation between the two estimated structural parameters is 0.71 for the FE estimates and 0.53 for the GMM estimates. This is consistent with Borjas and Ramey (1995) findings that the bargaining power is positively linked to the size

⁸The GMM estimation was carried out in Stata 9.1 (Roodman, 2005).

⁹Note that a considerable share of firms generates negative profits in a given year. For instance, the sum of the shares of variable factors in output exceeds 1 for 21% of the observations in our sample, which is not uncommon. In this case, wages cannot be lower than the marginal revenue of labor and certainly not be lower than this threshold the higher the bargaining power. It follows directly that $(1 - \alpha_{N_{it}} - \alpha_{M_{it}})(\Delta n_{it} - \Delta k_{it})$ in (8) equals zero when the sum of the variable input shares exceeds one. We also tried to limit the sample to those observations of which the sum of the variable input factors is lower than 1.05 and found similar results.

¹⁰ $\sigma_{\hat{\mu}} = \frac{\sigma_{\hat{\beta}}}{(1-\hat{\beta})^2}$; $\sigma_{\hat{\phi}} = \frac{\sigma_{\hat{\gamma}}}{(1+\hat{\gamma})^2}$.

¹¹Results not reported but available upon request.

of the rents, and with Dobbelaere (2004) and Dobbelaere and Mairesse (2005). Boulhol (2006) suggests that, as capital return is determined by the share of the rents kept by the firms, an arbitrage reasoning based on capital mobility across sectors can explain this positive correlation.

<Insert Table 2 about here>

Table 3 compares the FE and the GMM estimates more synthetically. The GMM estimates are more dispersed across sectors, which even lead to two (insignificant) negative bargaining power parameters. However, the correlation between the FE and the GMM estimates is strong and significant. For the estimated Lerner indexes, the Pearson correlation coefficient is close to 0.90 between FE and GMM. For the estimated relative bargaining power parameters, it reaches 0.57 unweighted and 0.67 when weighted to take into account the precision of the estimates. This comparison highlights that the FE and the GMM estimates are very close to each other and suggests that the fixed effects do a good job in accounting for the heterogeneity in productivity growth across firms. Dobbelaere and Mairesse (2005) reach a similar conclusion; Harrison (1994) shows that her FE and IV estimates are very close and, consequently, sticks to the FE results. We follow the same route for the remaining of this study.

<Insert Table 3 about here>

3.4 Variance Analysis

The above estimates should be considered as sectoral average parameters. There are, however, many reasons to believe that mark-ups and bargaining power parameters vary across time and firm size. What follows confirms this presumption. In addition to the sectoral dimension, the sample is split according to size and period criteria. For the former, the sample is divided between small firms (fewer than 75 employees on average), medium-sized firms (between 75 and 200) and large firms (more than 200), which provides three sub-samples of comparable size. For the latter, three sub-periods are defined: 1990-1994, 1995-1998, 1999-2003. This leaves us with 179 estimates for the mark-up and the bargaining power parameter: 20 sectors x 3 periods x 3 size classes, minus sector 19, first period, small firms due to lack of data.

These 179 "observations" are used in our Part II estimates. Before formally assessing the determinants of the two parameters of interest, we conduct a variance analysis along the three dimensions presiding over the splitting of the sample. Each of these Part I estimates is weighted by the inverse of the square root of the sampling variance. 19 out of the 179 Part I estimates display a negative estimated bargaining power. Therefore, as a robustness check, the various results are compared with and without the 19 "outliers".

As for the estimated mark-ups (see the left part of Table 4), the three dimensions (sector, size and period) are very significant at the 99% confidence level, the sectoral dimension accounting expectedly for the larger part of the explained

variance. Two findings show up clearly. First, mark-ups drop significantly and importantly by around eight percentage points between the first and the second period. They are even lower in the last period, but the difference between the last two periods is small and not significant. Second, the estimated mark-up is increasing in firm size. This is consistent with both theory (Dixit-Stiglitz) and empirical evidence in the heterogeneous firm literature. The difference according to firm size is especially true between the small firms and the others.

The right part of Table 4 reports the variance analysis for the estimated workers' bargaining power parameters. The sector share of the explained variance is also predominant. Similar to the estimated mark-up, the workers' bargaining power dropped significantly by around 0.14 after the first period. This decrease in the workers' bargaining power echoes Blanchflower and Bryson (2004) who find a significant decline in the union wage premium after 1994 for the UK. It is also consistent with the diluted role of UK labor market institutions, documented by Machin (1997). In addition to other legislative measures, he draws attention to the abolition of the Wages Council system of minimum wages in August 1993, covering 2.5 million workers at that time. Moreover, the workers' bargaining power is estimated to be lower by around 0.05-0.07 for the smaller firms. However, the latter difference is only significant with the medium-sized firms, which surprisingly seem to record the highest workers' bargaining power.

<Insert Table 4 about here>

4 Part II : Testing the imports-as-product-and-labor-market-discipline hypothesis

This section concentrates on the identification of the effect of increased import competition on the estimated mark-ups and workers' bargaining power parameters. Each Part I estimate is weighted by the inverse of the square root of the sampling variance. A description of all variables used in this section and data sources are reported in table A.2 in Appendix.

4.1 Mark-up

4.1.1 Specification

Our main focus is the impact of international trade on our two parameters of interest. The following variables are defined. *IMPORT* is the share of imports in sectoral demand. Trade theory, however, highlights that the impact of imports is differentiated depending on the origin of the imports. For the United Kingdom, trade with developing countries is supposedly based on comparative advantage and the impact of trade is mainly channelled through relative prices. In contrast, trade with developed countries is mostly intra-branch and is therefore a better candidate for the pro-competitive effect on markups. We

distinguish *IMP NORTH*, which is the share of imports from Western Europe, North America, Japan, Australia and New Zealand in total demand, from *IMP SOUTH*, its complement. Since firms are likely to select foreign markets based on the margins they offer for their products, exports could be positively related to markups. The export ratio is *EXP FIRM*.

Data is lacking to take into account the change in domestic competition at the sectoral level. At the country level, we test three variables that might have an impact on markups. *PMR* is the product market regulation index computed by the OECD on a scale from 0 to 6, in ascending order of regulation. The series is available for 1988, 1993, 1998 (Nicoletti et al., 1999) and 2003 (Conway et al., 2005), and is linearly interpolated between these years. For the UK, it has decreased from 3.5 in 1988 to 1.0 in 2003. The second variable is the (log of) stock market capitalization as a share of *GDP*, *CAPIT*. Hoekman et al. (2001) provide evidence of stock market capitalization exerting a significantly positive impact on average industry mark-ups. They argue that financial deepening reduces the cost of capital, thus increasing the overall profitability of the economy. Finally, the Herfindahl index, *HERF*, is calculated from our sample. Caution is required using this variable as it is very sensitive to the entrance or exit of big firms in the *database* at different times.

From another perspective, Sutton (1991, 1997) insists on the endogeneity of market structure. An increase in the competitive environment may trigger an endogenous reaction of firms, through an increase in R&D or advertisement spending for instance. This might force out firms that are unable to keep the pace. R&D could hence be positively related to mark-ups. *R&D RATIO* is defined as the share of R&D spending in total output at the sectoral level.

Because of its importance in the drawing up of macroeconomic policies, an abundant literature deals with the cyclicity of mark-ups. Rotemberg and Woodford (1999) provide some detailed -empirical and theoretical- explanations, such as overhead labor, adjustment costs and labor hoarding, in support of the counter-cyclicity of mark-ups. We use the annual change in value-added, and *VALUCYC* is the de-trended series using a Hodrik-Prescott filter. Our empirical specification can be expressed as:

$$\hat{\mu}_{jst} = \alpha_1 \text{IMPORT}_{jt-2} + \alpha_2 \text{EXP FIRM}_{jst-2} + \alpha_x X_{jst-2} + e_j + e_s + e_t + \xi_{jst} \quad (10)$$

with j , s and t indexing sector, size and period, respectively.

To overcome the endogeneity problem of trade and other variables, all explanatory variables are 2-year lags, except for firm size, the cyclical variable and the Herfindahl index.

4.1.2 Results

Our results are presented in Table 5. The main result is that imports exert a negative impact on mark-ups, although this effect is not significant when the origin of imports is not differentiated. As specification (2) indicates, this is because only imports from developed countries appear to have a significant effect, which is consistent with the discussion above. The estimated impact is actually strong: an increase of one point in the share of imports from the North triggers a decrease of between 0.008 - 0.010 in the mark-up, depending on the specification. It implies a very low level of domestic competition and a high elasticity of substitution between varieties (see Boulhol, 2006 for theoretical details). The effect of total imports of -0.56 (see specification (1)) is more in line with the findings of Kee and Hoekman (2003), Chen et al. (2004) and Boulhol (2005).

Exports never show up as being significant. Comparing the period fixed effect of -0.048 with the one obtained in the variance analysis (Table 4), -0.080, we infer that imports could account for 40% of the decline in the mark-ups between the first two sub-periods.¹²

R&D appears to have a positive effect on mark-ups. The impact is large as one standard deviation in *R&DRATIO* makes a difference of 0.10 in mark-ups. When we substitute the (log of) average employment by the size dummies or when the sample is restricted to the positive bargaining power observations, the results are not altered. When timedummies are withdrawn, the only other significant variable is *VALUCYC* which is found to be negative, hence supporting the counter-cyclicity of mark-ups.

<Insert Table 5 about here>

4.2 Workers' Bargaining Power

4.2.1 Specification

In addition to the variables described in Section (4.1.1), we evaluate the effect of three labor market variables on the workers' bargaining power: *UNIONDENS*, *REPLRATE* and *UNEMPRATE*, referring to union density, the replacement rate and the unemployment rate at the country level respectively. Union density is supposed to be directly linked to union power in bargaining, with a positive expected relationship. For the unemployment rate, the link might not be clear-cut. An increase in the unemployment rate has a negative effect on the outside option, hence a negative relationship with the workers' bargaining power is expected. However, because the union wage premium softens the impact of shocks on wages, Blanchflower and Bryson (2004) find that the union wage premium is counter-cyclical, pointing to a positive relationship. Therefore, the resulting effect is a priori ambiguous. The replacement rate is expected to be positively related to the workers' bargaining power.

¹²The explanatory power measured by the adjusted R^2 increases from 0.38 to 0.46.

Product market deregulation (*PMR*) has been found to be positively correlated to labor market deregulation across countries and seems to precede labor market reforms (see Fig. 34 in Brandt et al., 2005). If capital deepening (*CAPIT*) is linked to increased capital mobility, it might have a negative impact on the workers' bargaining power. Finally, it is often argued that technological change, instead of international trade, triggers changes in the labor market (see e.g. Berman et al., 1994; Krugman and Lawrence, 1996). Technological change (*R&DRATIO*) might exert an effect on the workers' bargaining power through affecting the nature of the production process. This effect is however ex-ante unclear. As discussed in Betcherman (1991), it depends on the importance of labor costs in the firm's total costs and on the workers' essentiality in the production process.

To test the imports-as-labor-market discipline hypothesis, we estimate the following specification:

$$\hat{\phi}_{jst} = \alpha_1 IMPORT_{jt-2} + \alpha_2 EXPFIRM_{jst-2} + \alpha_x X_{jst-2} + e_j + e_s + e_t + \xi_{jst} \quad (11)$$

with j , s and t indexing sector, size and period, respectively.

To take into account endogeneity problems, we use the 2-year lags for all the explanatory variables, except for firm size, the replacement rate and the Herfindahl index.

4.2.2 Results

Our results, which are reported in Table 6, provide strong and robust evidence of imports having squeezed the workers' bargaining power. When the origin is taken into account, this impact is only significant for imports from developed countries. An increase of one point in the share of imports from the North has reduced the bargaining power by 0.011 on average.¹³ The fact that only increased import competition from the North exerts a significantly negative impact might seem surprising at first sight. However, one would need to rely on a more detailed skill structure within sectors to have a clearer analysis. Our result might point out that, because of similar characteristics in terms of education, productivity and skills, foreign workers in developed countries are more substitutable to UK workers than those in developing countries through imports. Interestingly, Neven and Wyplosz (1999) find similar effects.

Because most of the explanatory variables lack the sectoral dimension, we run into severe multicollinearity issues. This makes it almost impossible to disentangle the effect of these country variables. Therefore, we test each of them separately, keeping in mind that the contribution of each variable should not be cumulated. The impact of *UNIONDENS*, *PMR*, *REPLRATE*, *CAPIT*

¹³Considering 5 EU countries (Belgium, France, Germany, Italy and the UK), Dumont et al. (2006) find a comparable effect.

and *UNEMPRATE* show up significantly. The first two variables have the highest explanatory power. De-unionization seems to be associated with a decline in the workers' bargaining power between 1990 and 2003. Product market and labor market deregulation are found to go hand in hand. The unemployment rate, the cut in the replacement rate and the financial deepening seem negatively related to the workers' bargaining power. Finally, the workers' bargaining power is found to be significantly higher in concentrated sectors whereas no significant relationship is detected with R&D.¹⁴

<Insert Table 6 about here>

5 Conclusion

Many empirical studies have provided evidence that trade has a pro-competitive effect by reducing mark-ups to marginal cost in import competing industries. Most of them have focused on developing countries assuming a perfectly competitive labor market. In contrast, this study concentrates on a developed country and labor market imperfections, using firm-level data for UK manufacturing sectors. We estimate that mark-ups and the workers' bargaining power have decreased after 1994. Moreover, imports from developed countries are shown to contribute significantly to these changes, whereas firm exports have a positive but insignificant impact on both mark-ups and the workers' bargaining power. These joint effects imply that trade has had a conflicting impact on price-cost margins, i.e. on the share of the rents kept by the firms. We also find, consistently with the recent literature on firm heterogeneity, that small firms have lower mark-ups. Additionally, their workers enjoy a lower bargaining power.

¹⁴As a robustness check, we used a logit specification. The results, which are available upon request, confirm our previous findings.

Appendix

Table A.1

Sector repartition of the sample

	Code	Name
Sec 1	15	Food products and beverages
Sec 2	17	Textiles
Sec 3	18	Beverages
Sec 4	19	Wearing apparel, dressing, dying of fur
Sec 5	20	Wood and products of wood and cork
Sec 6	21	Pulp, paper and paper products
Sec 7	22	Printing and publishing
Sec 8	24	Chemicals and chemical products
Sec 9	25	Rubber and plastic products
Sec 10	26	Other non-metallic mineral products
Sec 11	27	Basic metals
Sec 12	28	Fabricated metal products, except machinery and equipment
Sec 13	29	Machinery and equipment, n.e.c.
Sec 14	30	Office, accounting and computing machinery
Sec 15	31	Electrical machinery and apparatus, n.e.c.
Sec 16	32	Radio, television and communication equipment
Sec 17	33	Medical, precision and optical instruments
Sec 18	34	Motor vehicles, trailers and semi-trailers
Sec 19	35	Other transport equipment
Sec 20	36	Manufacturing, n.e.c.

Table A.2

Description and source of variables in Part II regressions

Variable	Description	Source
CAPIT	Log of stock market capitalization as a percentage of GDP	Datastream
EXPFIRM	Firm exports/turnover ratio	OneSource, FAME
HERF	Sample-based Herfindahl index	OneSource, FAME
IMPORT	Sectoral import penetration ratio: imports/(imports+production-exports)	STAN
IMP NORTH	IMPORT from Western Europe, North America, Japan, Australia and New Zealand	Bilateral Trade Database (OECD)
IMPSOUTH	Complement of IMP NORTH	Bilateral Trade Database (OECD)
PMR	Product market regulation index	Conway et al. (2005)
R&DRATIO	Sectoral share of R&D expenses in total output	OECD
UNEMPLRATE	Country-level unemployment rate	Nickell and Nunziata (2001)
UNIONDENS	Manufacturing-level union density	Nickell and Nunziata (2001)
REPLRATE	Manufacturing-level replacement rate	Nickell and Nunziata (2001)
VALUCYC	De-trended sectoral annual change in value added	STAN

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Graph 1

Price-cost margins for large UK manufacturing sectors
1970-2003, STAN database

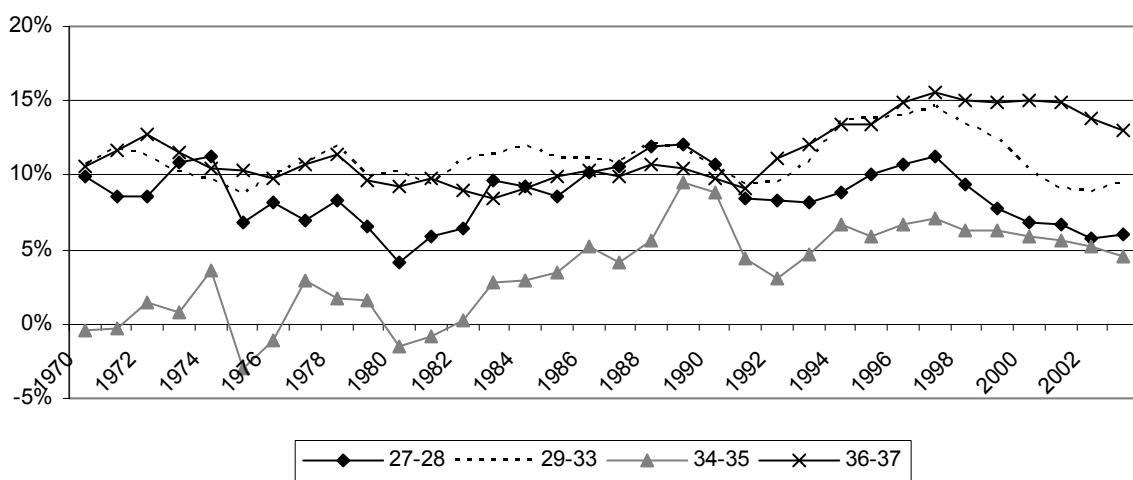
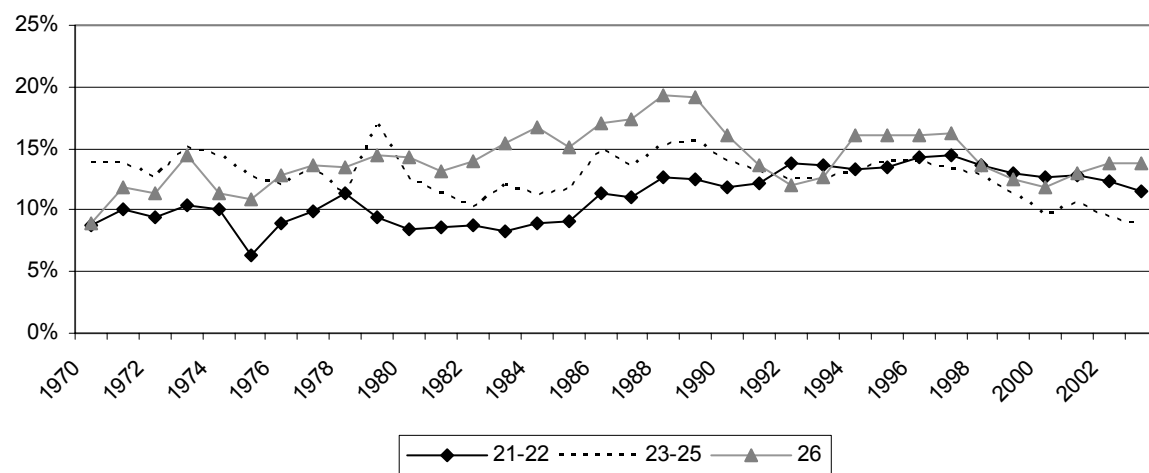
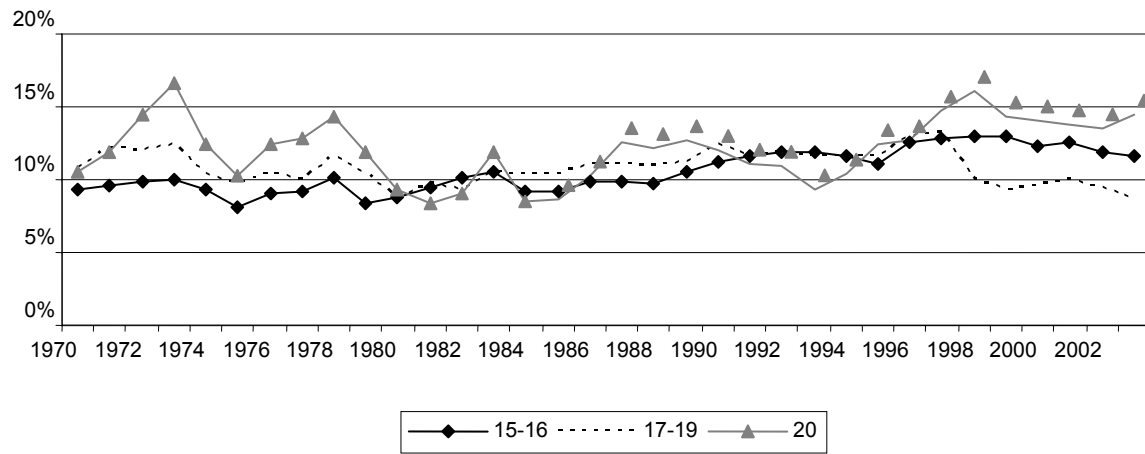


Table 1
Summary statistics

Variables	1990-2003				
	Mean	Sd.	Q ₁	Q ₃	N
Real firm output growth rate Δq	0.014	0.166	-0.081	0.107	60579
Labor growth rate Δn	0.003	0.129	-0.061	0.062	60579
Capital growth rate Δk	0.006	0.178	-0.090	0.088	60579
Intermediate inputs growth rate Δm	0.029	0.189	-0.084	0.138	60579
Share of labor in nominal output α_N	0.287	0.130	0.192	0.369	60579
Share of intermediate inputs in nominal output α_M	0.656	0.137	0.567	0.752	60579
Solow residual SR^a	0.0008	0.079	-0.037	0.037	60579
$\Delta q - \Delta k$	0.007	0.219	-0.116	0.137	60579
$(\alpha_N + \alpha_M - 1)(\Delta n - \Delta k)$	0.0002	0.019	-0.005	0.005	60579

^a $SR = \Delta q - \alpha_N \Delta n - \alpha_M \Delta m - (1 - \alpha_N - \alpha_M) \Delta k$.

Table 2Sector analysis: Estimated sector-level mark-up $\hat{\mu}_j$ and workers' bargaining power $\hat{\phi}_j$, FE and GMM results

		FIXED EFFECTS				GMM			
	# Obs. (# Firms)	$\hat{\beta}_j$	$\hat{\mu}_j = \frac{1}{1-\hat{\beta}_j}$	$\hat{\gamma}_j$	$\hat{\phi}_j = \frac{\hat{\gamma}_j}{1+\hat{\gamma}_j}$	$\hat{\beta}_j$	$\hat{\mu}_j = \frac{1}{1-\hat{\beta}_j}$	$\hat{\gamma}_j$	$\hat{\phi}_j = \frac{\hat{\gamma}_j}{1+\hat{\gamma}_j}$
Sec 1	3893 (787)	0.195*** (0.008)	1.242*** (0.012)	0.670*** (0.120)	0.401*** (0.043)	0.198*** (0.032)	1.247*** (0.050)	0.350 (0.441)	0.259 (0.242)
Sec 2	1957 (377)	0.178*** (0.010)	1.216*** (0.014)	1.137*** (0.165)	0.532*** (0.036)	0.211*** (0.037)	1.267*** (0.059)	1.679*** (0.543)	0.627*** (0.076)
Sec 3	834 (192)	0.111*** (0.012)	1.124*** (0.015)	0.420* (0.254)	0.296*** (0.126)	0.134*** (0.027)	1.155*** (0.036)	0.022 (0.711)	0.022 (0.681)
Sec 4	432 (74)	0.103*** (0.019)	1.115*** (0.023)	0.238 (0.371)	0.192 (0.242)	0.101*** (0.036)	1.112*** (0.045)	1.272* (0.680)	0.560*** (0.132)
Sec 5	948 (213)	0.145*** (0.016)	1.170*** (0.022)	0.597** (0.268)	0.374*** (0.105)	0.076*** (0.021)	1.082*** (0.246)	-0.302 (1.840)	-0.433 (3.777)
Sec 6	1565 (306)	0.197*** (0.013)	1.246*** (0.019)	0.841*** (0.145)	0.457*** (0.043)	0.213*** (0.037)	1.271*** (0.060)	1.155*** (0.274)	0.536*** (0.059)
Sec 7	4824 (1120)	0.187*** (0.007)	1.230*** (0.011)	0.244*** (0.075)	0.196*** (0.048)	0.191*** (0.035)	1.236*** (0.053)	0.316 (0.287)	0.240 (0.166)
Sec 8	4061 (781)	0.235*** (0.009)	1.308*** (0.015)	0.821*** (0.104)	0.451*** (0.031)	0.209*** (0.038)	1.264*** (0.051)	1.171** (0.460)	0.539*** (0.098)
Sec 9	3194 (612)	0.200*** (0.009)	1.250*** (0.014)	0.455*** (0.107)	0.313*** (0.050)	0.212*** (0.034)	1.269*** (0.055)	0.066 (0.358)	0.062 (0.315)
Sec 10	1607 (305)	0.236*** (0.016)	1.309*** (0.027)	0.978*** (0.174)	0.494*** (0.044)	0.253*** (0.056)	1.339*** (0.100)	0.552 (0.476)	0.356* (0.198)
Sec 11	1779 (337)	0.186*** (0.0110)	1.329*** (0.017)	0.733*** (0.192)	0.423*** (0.064)	0.210*** (0.033)	1.266*** (0.053)	1.385** (0.566)	0.581*** (0.100)
Sec 12	5061 (1115)	0.190*** (0.007)	1.235*** (0.011)	0.442*** (0.109)	0.306*** (0.053)	0.175*** (0.034)	1.212*** (0.050)	-0.231 (0.264)	-0.300 (0.446)
Sec 13	5417 (1101)	0.198*** (0.006)	1.247*** (0.010)	0.829*** (0.100)	0.453*** (0.030)	0.225*** (0.031)	1.290*** (0.052)	0.869* (0.507)	0.465*** (0.145)
Sec 14	563 (142)	0.179*** (0.018)	1.219*** (0.026)	0.523*** (0.202)	0.344*** (0.087)	0.159*** (0.037)	1.189*** (0.052)	0.179 (0.251)	0.152 (0.181)
Sec 15	2181 (475)	0.273*** (0.012)	1.375*** (0.023)	1.228*** (0.147)	0.551*** (0.030)	0.318*** (0.043)	1.466*** (0.092)	1.046** (0.451)	0.511*** (0.108)
Sec 16	1393 (325)	0.309*** (0.015)	1.448*** (0.032)	1.289*** (0.211)	0.563*** (0.040)	0.390*** (0.041)	1.639*** (0.110)	1.316*** (0.467)	0.568*** (0.087)
Sec 17	2155 (478)	0.222*** (0.012)	1.285*** (0.019)	0.637*** (0.148)	0.389*** (0.055)	0.210*** (0.033)	1.266*** (0.053)	0.252 (0.488)	0.201 (0.311)
Sec 18	1682 (320)	0.193*** (0.012)	1.239*** (0.019)	0.807*** (0.223)	0.447*** (0.068)	0.269*** (0.026)	1.368*** (0.049)	1.526*** (0.486)	0.604*** (0.076)
Sec 19	847 (205)	0.234*** (0.015)	1.306*** (0.026)	0.951*** (0.188)	0.488*** (0.049)	0.230*** (0.026)	1.299*** (0.044)	0.807** (0.368)	0.447*** (0.113)
Sec 20	2468 (555)	0.173*** (0.009)	1.210*** (0.013)	0.627*** (0.136)	0.385*** (0.051)	0.174*** (0.031)	1.211*** (0.045)	0.265 (0.414)	0.209 (0.259)
Sector average		0.197 (0.012)	1.250 (0.018)	0.723 (0.172)	0.403 (0.065)	0.208 (0.044)	1.272 (0.068)	0.685 (0.517)	0.310 (0.378)

$$SR_{it} = \Delta q_{it} - \alpha_{N_{it}} \Delta n_{it} - \alpha_{M_{it}} \Delta m_{it} - (1 - \alpha_{N_{it}} - \alpha_{M_{it}}) \Delta k_{it}$$

$$= \beta (\Delta q_{it} - \Delta k_{it}) - \gamma (1 - \alpha_{N_{it}} - \alpha_{M_{it}}) (\Delta n_{it} - \Delta k_{it}) + (1 - \beta) \Delta \theta_{it}$$

Time dummies are included but not reported. FE: robust standard errors in parentheses.

GMM: robust standard errors with finite-sample correction for the two-step covariance matrix (Windmeijer, 2005).

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

Table 3

Correlation between FE and GMM estimates

						Correlation FE-GMM		
						Unweighted	Weight 1	Weight 2
$\hat{\beta}_j$	FE	Mean	Sd.	Min	Max	0.89***	0.87***	0.88***
	GMM	0.197	0.048	0.103	0.309			
$\hat{\gamma}_j$	FE	0.208	0.069	0.076	0.390	0.57***	0.67***	0.66***
	GMM	0.723	0.298	0.238	1.289			
		0.685	0.611	-0.302	1.679			

Weight 1: $\frac{1}{\sqrt{\hat{\sigma}_{FE}^2}}$, weight 2: $\frac{1}{\sqrt{\hat{\sigma}_{FE}\hat{\sigma}_{GMM}}}$

Table 4

Variance analysis

	Mark-up $\hat{\mu}_{jst}$	Mark-up $\hat{\mu}_{jst}$	Barg. power $\hat{\phi}_{jst}$	Barg. power $\hat{\phi}_{jst}$
PERIOD (ref: 1990-1994)				
1995-1998	-0.080*** (0.021)	-0.102*** (0.022)	-0.143*** (0.026)	-0.137*** (0.024)
1999-2003	-0.077*** (0.022)	-0.091*** (0.023)	-0.137*** (0.024)	-0.138*** (0.023)
SIZE (ref: small firms)				
Medium-sized	0.051*** (0.015)	0.046*** (0.016)	0.073** (0.028)	0.050** (0.025)
Large	0.058*** (0.018)	0.054*** (0.018)	0.045 (0.028)	0.017 (0.026)
R ²	0.380	0.402	0.374	0.478
# Obs.	179	160	179	160
SHARE OF EXPL. VARIANCE				
Sector	69%***	63%***	65%***	65%***
Period	19%***	28%***	28%***	31%***
Size	12%***	9%***	7%**	4%

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

Table 5Determinants of estimated price-cost mark-up $\hat{\mu}_{jst}$

Variables	(1)	(2)	(3)	(4)	(5)	(6)
1995-1998	-0.034 (0.027)	-0.048* (0.027)	-0.048* (0.026)			
1999-2003	-0.024 (0.026)	-0.028 (0.026)	-0.026 (0.026)			
Medium-sized	0.044*** (0.015)	0.045*** (0.015)				
Large	0.048*** (0.019)	0.050*** (0.019)				
Log(N)			0.015*** (0.006)	0.015*** (0.006)	0.016*** (0.006)	0.015*** (0.006)
VALUCYC	-0.260 (0.251)	-0.169 (0.247)	-0.174 (0.240)	-0.397** (0.170)	-0.449*** (0.168)	-0.392** (0.169)
EXPFIRM_{t-2}	0.183 (0.181)	0.142 (0.178)	0.131 (0.179)	0.141 (0.181)	0.134 (0.180)	0.141 (0.182)
IMPORT_{t-2}	-0.555 (0.360)					
IMP NORTH_{t-2}		-0.974*** (0.335)	-0.986*** (0.328)	-0.818*** (0.306)	-0.860*** (0.322)	-0.806** (0.319)
IMP SOUTH_{t-2}		-0.087 (0.384)	-0.088 (0.378)	-0.015 (0.353)	-0.084 (0.357)	-0.011 (0.353)
R&DRATIO_{t-2}	4.073 (2.788)	4.335* (2.545)	4.410* (2.573)	4.713* (2.515)	4.665* (2.551)	4.790* (2.761)
PMR_{t-2}				0.020 (0.016)		0.020 (0.016)
CAPIT_{t-2}					-0.023 (0.029)	
HERF						0.023 (0.225)
Sector dummies	YES	YES	YES	YES	YES	YES
R²	0.434	0.457	0.450	0.444	0.441	0.444
#Obs.	179	179	179	179	179	179

Robust standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Table 6

Determinants of the estimated workers' bargaining power $\hat{\phi}_{jst}$

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1995-1998	-0.131*** (0.028)	-0.135*** (0.028)	-0.136*** (0.029)					
1999-2003	-0.103*** (0.030)	-0.107*** (0.029)	-0.109*** (0.030)					
Medium-sized	0.061** (0.028)	0.064** (0.028)						
Large	0.022 (0.032)	0.026 (0.032)						
Log(<i>N</i>)			0.001 (0.009)	-0.0001 (0.009)	-0.0002 (0.009)	0.005 (0.009)	0.001 (0.009)	0.001 (0.009)
EXPFIRM_{<i>t-2</i>}	0.402 (0.279)	0.380 (0.267)	0.477* (0.281)	0.493* (0.293)	0.493* (0.294)	0.321 (0.301)	0.450 (0.303)	0.454 (0.303)
IMPORT_{<i>t-2</i>}	-0.599** (0.269)							
IMP NORTH_{<i>t-2</i>}		-1.332*** (0.296)	-1.135*** (0.332)	-0.880** (0.345)	-0.884** (0.374)	-1.799** (0.359)	-1.075*** (0.368)	-1.042*** (0.366)
IMP SOUTH_{<i>t-2</i>}		0.230 (0.310)	0.376 (0.327)	0.579* (0.317)	0.574* (0.320)	-0.426 (0.396)	0.329 (0.369)	0.365 (0.357)
R&DRATIO_{<i>t-2</i>}	-3.180 (3.058)	-2.722 (2.843)	-1.412 (2.940)	0.172 (2.966)	0.238 (2.973)	-1.926 (3.059)	0.465 (3.072)	0.483 (3.062)
PMR_{<i>t-2</i>}				0.084*** (0.019)				
UNIONDENS_{<i>t-2</i>}					1.626*** (0.382)			
UNEMPLRATE_{<i>t-2</i>}						-1.806* (0.992)		
REPLRATE							3.458*** (1.292)	
CAPIT_{<i>t-2</i>}								-0.113*** (0.039)
HERF			0.378* (0.223)	0.483** (0.232)	0.488** (0.233)	0.398 (0.257)	0.516* (0.248)	0.516** (0.246)
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES
R²	0.391	0.412	0.402	0.383	0.382	0.362	0.360	0.362
#Obs.	179	179	179	179	179	179	179	179

Robust standard errors in parentheses. ***Significant at 1%; **Significant at 5%; *Significant at 10%.