Panel data estimates of the production function and product and labor market imperfections*

Sabien DOBBELAERE† Jacques MAIRESSE‡

January 2007

Abstract

Embedding the efficient bargaining model into the R. Hall (1988) approach for estimating price-cost margins shows that both imperfections in the product and labor markets generate a wedge between factor elasticities in the production function and their corresponding shares in revenue. This article investigates these two sources of discrepancies both at the industry level and the firm level using an unbalanced panel of 10646 French firms in 38 manufacturing industries over the period 1978-2001. By estimating standard production functions and comparing the estimated factor elasticities for labor and materials and their shares in revenue, we are able to derive estimates of average price-cost mark-up and extent of rent sharing parameters. For manufacturing as a whole, our estimates of these parameters are of an order of magnitude of 1.17 and 0.44 respectively. Our industry-level results indicate that industry differences in these parameters and in the underlying estimated factor elasticities and shares are quite sizeable. Since firm production function, behavior and market environment are very likely to vary even within industries, we also investigate firm-level heterogeneity in estimated mark-up and rent-sharing parameters. To determine the degree of true heterogeneity in these parameters, we adopt the P.A. Swamy (1970) methodology allowing to correct the observed variance in the firm-level estimates from their sampling variance. The median of the firm estimates of the price-cost mark-up ignoring labor market imperfections is of 1.10, while as expected it is higher of 1.20 when taking them into account and the median of the corresponding firm

*We are grateful to Susantu Basu, Michael Burda, Ferre De Graeve, Bronwyn Hall, Benoit Mulkay, Mark Rogers, Chad Syversson, Philip Vermeulen, and other participants at the ZEW Conference on the Economics of Innovation and Patenting (Mannheim, 2005), the International Industrial Organization Conference (Boston, MA, 2006), the NBER Productivity Seminar (Cambridge, MA, 2006) and the ECB/CEPR 2006 Labour Market Workshop on Wage and Labour Cost Dynamics (Frankfurt, 2006) for helpful comments and suggestions. All remaining errors are ours.

†Ghent University, K.U.Leuven, IZA Bonn, visiting CREST. Postdoctoral Fellow of the Research Foundation - Flanders (FWO).

‡CREST, Institut National de la Statistique et des Etudes Economiques (INSEE), MERIT-Maastricht University, NBER.

estimates of the extent of rent sharing is of 0.62. The Swamy corresponding robust estimates of true dispersion are of about 0.18, 0.37 and 0.35, showing indeed very sizeable within-industry firm heterogeneity. We find that firm size, capital intensity, distance to the industry technology frontier and investing in R&D seem to account for a significant part of this heterogeneity.

JEL classification : C23, D21, J51, L13.
Keywords : Rent sharing, price-cost mark-ups, production function, panel data.

1 Introduction

In a world of perfect competition, the output contribution of individual production factors equals their respective revenue shares. In numerous markets, however, market imperfections and distortions are prevalent. The most common sources for market power in product as well as labor markets are product differentiation, barriers to entry and imperfect information. Focusing on the labor side, market power generally originates from coalitions between employers and employees. The labor economics literature is dominated by the standard rent sharing models where, for example, costs of hiring, firing and training can be exploited by employees to gain market power. Those models generate wage differentials that are unrelated to productivity differentials and hinder the competitive market mechanism.[1]

Since the 1970s, models of imperfect competition have *separately* permeated many fields of economics ranging from industrial organization (see Bresnahan, 1989; Schmalensee, 1989 for surveys) to international trade (Brander and Spencer, 1985; Krugman, 1979) to labor economics (see Booth, 1995; Manning, 2003 for surveys). Recently, there has been a number of attempts to examine *simultaneously* imperfections in both the product and the labor market (Bughin, 1996; Crépon-Desplatz-Mairesse, 1999, 2002; Neven-Röller-Zhang, 2002; Dobbelaere, 2004).[2] These articles aim at bridging the gap between the econometric literature on estimating product market imperfections and the one on estimating labor market imperfections. Two methods dominate the most recent approaches to simultaneously estimate product market and labor market imperfections. One is the production function approach which entails estimating a structural model including the full set of explicitly specified factor share equations and the production function (see Bughin, 1996 and Neven et al., 2002). The other approach is an extension of a microeconomic version of R. Hall's (1988) framework and boils down to estimating a reduced form equation (see Crépon et al., 1999, 2002 and Dobbelaere, 2004). Following Marschak and

[1] Recently, the monopsony model (Manning, 2003) has received attention in the labor economics literature. Contrary to the classical rent sharing models, search frictions generate upward sloping labor supply curves to individual firms, giving *employers* some market power.

[2] For *theoretical* contributions on this issue, we refer to Blanchard and Giavazzi (2003) and Nickell (1999).

Andrews' 1944 *Econometrica* article, many studies have applied the simultaneous equations methodology to production function estimation (see Griliches and Mairesse, 1998 and Ackerberg-Benkard-Berry-Pakes, 2006 for surveys). The core of this paper is to provide an in-depth analysis of imperfections in the product and the labor markets as two sources of discrepancies between the marginal products of input factors and the apparent factor prices. By doing so, we contribute to the econometric productivity literature on estimating microeconomic production functions and to the recent econometric literature on simultaneously estimating imperfections in product and factor markets.

This article differs from the existing literature in the following ways. Consistent with the standard models of imperfect competition in the labor market pointed out above, we reflect on an extension of a microeconomic version of R. Hall's (1988) framework. Following Crépon et al. (1999, 2002), we presume that employees possess a degree of market power when negotiating with the firm over wages and employment (efficient bargaining model, McDonald and Solow, 1981). Under this presumption, it can be shown that product and labor market imperfections generate a wedge between factor elasticities in the production function and their corresponding shares in revenue. By estimating standard production functions and comparing the estimated factor elasticities for labor and materials and their shares in revenue, we are able to derive estimates of average price-cost mark-up and extent of rent sharing parameters. Taking advantage of a rich panel of French manufacturing firms covering the period 1978-2001 (INSEE, SESSI, DEP), we analyze across- as well as within-industry heterogeneity in the estimated output elasticities and the retrieved parameters of interest. Our industry-level results indicate that industry differences in the estimated price-cost mark-up and extent of rent sharing parameters and in the underlying estimated factor elasticities and shares are quite sizeable, as could be expected. The estimated price-cost mark-up is lower than 1.04 for the first quartile of industries and exceeds 1.19 for the top quartile. There is no evidence of rent sharing for the first quartile of industries but we estimate it to be higher than 0.33 for the top quartile. The estimated across-industry heterogeneity in these parameters is partly explained by differences in profitability, technology intensity, unionization and import penetration. Since firm production function, behavior and market environment are very likely to vary even within industries, we also investigate within-industry firm heterogeneity in estimated mark-up and rent-sharing parameters (and the estimated factor elasticities and their shares). To determine the degree of true heterogeneity in the production function coefficients and parameters of interest, we adopt the P.A. Swamy (1970) methodology as a variance decomposition approach (see Mairesse-Griliches, 1990 for a related analysis). The median of the firm estimates of the price-cost mark-up ignoring labor market imperfections is of 1.10, while as expected it is higher of 1.20 when taking them into account and the median of the corresponding firm estimates of the extent of rent sharing is of 0.62. The Swamy corresponding robust estimates of true dispersion are of about 0.18, 0.37 and 0.35, showing evidence of indeed very sizeable within-industry firm heterogeneity. Firm size, capital in-

tensity, distance to the industry technology frontier and investing in R&D seem to account for a significant part of this heterogeneity.

We proceed as follows. Section 2 briefly presents our theoretical framework. In Section 3, we discuss the data and provide estimates of output elasticities, price-cost mark-ups and the extent of rent sharing at the manufacturing level. Section 4 focuses on across-industry heterogeneity and investigates different dimensions across industries. In Section 5 , we provide different estimators and indicators of heterogeneity in the firm price-cost mark-up and the extent of rent sharing and look at within-industry heterogeneity. In addition, we concentrate on the role of specific firm-level variables in explaining part of the estimated heterogeneity. Section 6 concludes.

2 Theoretical framework

Consistent with two models of imperfect competition in the labor market that are currently commonplace in the literature, the efficient bargaining model and the monopsony model, we originally reflect on two extensions of Hall's (1988) framework. First, following Crépon et al. (1999, 2002), we presume that, for example, costs of firing, hiring and training can be exploited by employees to gain market power when negotiating with the firm over wages and employment (efficient bargaining). In this framework, the firm price-cost mark-up and the extent of rent sharing generate a wedge between output elasticities and factor shares. Second, we abstain from the assumption that the labor supply curve facing an individual employer is perfectly elastic (monopsony model). In this setting, the firm price-cost mark-up and the firm wage elasticity of the labor supply curve elicit deviations between marginal products of input factors and input prices.

Both extensions entail estimating a reduced-form equation which allows us to identify the structural parameters -measures of product and labor market imperfections- derived from theory. Having a priori a prediction about the magnitude of economically meaningful parameter estimates, we can reject the extension anchoring the monopsony model on the basis of the data. The underlying theoretical model and a summary of the results at the manufacturing, the industry and the firm level are briefly presented in Appendix B. Based on the estimates, we did not follow that route in the remaining of the paper.

This section explains the theoretical framework encompassing the efficient bargaining model and derives the reduced-forms.

2.1 Efficient bargaining model

Following Crépon et al. (1999, 2002),[3] 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 $\Theta_{it} = Ae^{\eta_i + u_t + v_{it}}$ is an index of technical change or "true" total factor productivity. The logarithmic specification of the production function gives:

$$q_{it} = \varepsilon^Q_{N_{it}} n_{it} + \varepsilon^Q_{M_{it}} m_{it} + \varepsilon^Q_{K_{it}} k_{it} + \theta_{it} \tag{1}$$

We first assume that firms operate under imperfect competition in the product market and act as price takers in the input markets. Assuming that labor and material input are variable factors, short run profit maximization implies the following two first-order conditions:

$$\varepsilon^Q_{N_{it}} = \mu_{it} \alpha_{N_{it}} \tag{2}$$

$$\varepsilon^Q_{M_{it}} = \mu_{it} \alpha_{M_{it}} \tag{3}$$

where $\alpha_{J_{it}} = \frac{P_{J_{it}} J_{it}}{P_{it} Q_{it}}$ $(J = N,\, M)$ is the share of inputs in total revenue. $\mu_{it} = \frac{P_{it}}{C_{Q,it}}$ refers to the mark-up of price over marginal cost. Assuming that the elasticity of scale, $\lambda_{it} = \varepsilon^Q_{N_{it}} + \varepsilon^Q_{M_{it}} + \varepsilon^Q_{K_{it}}$, is known, the capital elasticity can be expressed as:

$$\varepsilon^Q_{K_{it}} = \lambda_{it} - \mu_{it} \alpha_{N_{it}} - \mu_{it} \alpha_{M_{it}} \tag{4}$$

Inserting (2), (3) and (4) in (1) and rearranging terms gives the following expression:

$$q_{it} - k_{it} = \mu_{it} \left[\alpha_{N_{it}} (n_{it} - k_{it}) + \alpha_{M_{it}} (m_{it} - k_{it}) \right] + (\lambda_{it} - 1)\, k_{it} + \theta_{it} \tag{5}$$

Let us now abstain from the assumption that labor is priced competitively. 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 agreement. The union objective is to maximize $U(w_{it},\, N_{it}) = N_{it} w_{it} + (\overline{N}_{it} - N_{it}) \overline{w}_{it}$, where $\overline{N}_{it}$ is union membership $(0 < N_{it} \leq \overline{N}_{it})$ and $\overline{w}_{it} \leq w_{it}$ is the alternative or the reservation wage. The firm objective is to maximize its short-run profit function: $\pi(w_{it},\, N_{it},\, M_{it}) = R_{it} - w_{it} N_{it} - j_{it} M_{it}$. The outcome of the bargaining is the asymmetric generalized Nash solution to:

$$\max_{w_{it},\, N_{it},\, M_{it}} \left\{ N_{it} w_{it} + \left(\overline{N}_{it} - N_{it} \right) \overline{w}_{it} - \overline{N}_{it} \overline{w}_{it} \right\}^{\phi_{it}} \left\{ R_{it} - w_{it} N_{it} - j_{it} M_{it} \right\}^{1 - \phi_{it}} \tag{6}$$

[3] For technical details, see Crépon et al. (1999, 2002).

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

The first-order condition with respect to material input is $R_{M,it} = j_{it}$, which directly leads to the corresponding equation (3). Maximization with respect to the wage rate and labor respectively gives the following first-order conditions:

$$w_{it} = \overline{w}_{it} + \frac{\phi_{it}}{1-\phi_{it}} \left[\frac{R_{it} - w_{it}N_{it} - j_{it}M_{it}}{N_{it}} \right] \tag{7}$$

$$w_{it} = R_{N,it} + \phi_{it} \left[\frac{R_{it} - R_{N,it}N_{it} - j_{it}M_{it}}{N_{it}} \right] \tag{8}$$

Solving simultaneously (7) and (8), leads to the following expression for the contract curve:

$$R_{N,it} = \overline{w}_{it} \tag{9}$$

which shows that the firm decision about employment is the same as if it was maximizing its short-run profit at the alternative wage.

Given that $\mu_{it} = \frac{P_{it}}{R_{Q,it}}$, and that $R_{N,it} = R_{Q,it}\, Q_{N,it} = R_{Q,it}\, \varepsilon^{Q}_{N_{it}} \frac{Q_{it}}{N_{it}}$, we also obtain the modified equation (2):

$$\varepsilon^{Q}_{N_{it}} = \mu_{it} \left(\frac{\overline{w}_{it} N_{it}}{P_{it} Q_{it}} \right) = \mu_{it} \overline{\alpha}_{N_{it}} \tag{10}$$

Given that we can rewrite (7) as $\alpha_{N_{it}} = \overline{\alpha}_{N_{it}} + \frac{\phi_{it}}{1-\phi_{it}} (1 - \alpha_{N_{it}} - \alpha_{M_{it}})$, equation (10) can also be rewritten as:

$$\varepsilon^{Q}_{N_{it}} = \mu_{it}\alpha_{N_{it}} + \mu_{it} \frac{\phi_{it}}{1-\phi_{it}} (\alpha_{N_{it}} + \alpha_{M_{it}} - 1) \tag{11}$$

Estimating the following equation:

$$q_{it} - k_{it} = \varepsilon^{Q}_{N_{it}}(n_{it} - k_{it}) + \varepsilon^{Q}_{M_{it}}(m_{it} - k_{it}) + (\lambda_{it} - 1)k_{it} + \theta_{it} \tag{12}$$

allows the identification of (1) the mark-up of price over marginal cost and (2) the extent of rent sharing:

$$\mu_{it} = \frac{\varepsilon^{Q}_{M_{it}}}{\alpha_{M_{it}}} \tag{13}$$

$$\gamma_{it} = \frac{\phi_{it}}{1-\phi_{it}} = \frac{\varepsilon^{Q}_{N_{it}} - \left(\varepsilon^{Q}_{M_{it}} \frac{\alpha_{N_{it}}}{\alpha_{M_{it}}}\right)}{\frac{\varepsilon^{Q}_{M_{it}}}{\alpha_{M_{it}}}\left(\alpha_{N_{it}} + \alpha_{M_{it}} - 1\right)} \tag{14}$$

$$\phi_{it} = \frac{\gamma_{it}}{1+\gamma_{it}} \tag{15}$$

By embedding the efficient bargaining model into a microeconomic version of Hall's (1988) framework, it follows that the firm price-cost mark-up and the extent of rent sharing generate a wedge between output elasticities and factor shares.[4] The advantages of this extended approach are twofold: it avoids the problematic computation of the user cost of capital to assess the magnitude of the price-cost mark-up and it avoids the measurement of the alternative wage to estimate the extent of rent sharing.

3 Data description and a first look at general results

In this section, we discuss the data and present the results of estimating the production function -both with and without imposing constant returns to scale- at the manufacturing level over the complete period under consideration. We concentrate on a range of estimators (levels OLS, first-differenced OLS, first-differenced GMM and system GMM). By comparing the estimated average production function coefficients, i.e. the estimated average factor elasticities of labor and materials, with the average shares of labor and materials in revenue,[5] we derive average price-cost mark-up and average extent of rent sharing parameters at the manufacturing level.

3.1 Data description

We use an unbalanced panel of French manufacturing firms over the period 1978-2001, based mainly on firm accounting information from EAE ("Enquête Annuelle d' Entreprise", "Service des Etudes et Statistiques Industrielles" (SESSI)). We only keep firms for which we have at least 12 years of observations, ending up with an unbalanced panel of 10646 firms with the number of observations for

[4] Note that to accommodate two imperfectly competitive markets, we need at least two variable input factors to identify the model. Going beyond Hall (1988) is hence not possible when starting from a value added specification.

[5] Variation in input shares is idiosyncratic and possibly related to variation in hours of work, machinery, capacity utilization (variation in the business cycle). When deriving our key parameters, measures of product and labor market imperfections, we want to abstract from this possible source of contamination. Consistent with the constancy of $\widehat{\mu}$ (*only*) and $\widehat{\phi}$, we assume constant input shares.

each firm varying between 12 and 24.[6] We use real current production deflated by the two-digit producer price index of the French industrial classification as a proxy for output (Q). Labor (N) refers to the average number of employees in each firm for each year and material input (M) refers to intermediate consumption deflated by the two-digit intermediate consumption price index. The capital stock (K) is measured by the gross bookvalue of fixed assets. The shares of labor (α_N) and material input (α_M) are constructed by dividing respectively the firm total labor cost and undeflated intermediate consumption by the firm undeflated 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. The average growth rate of real firm output for the overall sample is 2.1% per year over the period 1978-2001. Capital has decreased at an average annual growth rate of 0.1%, while materials and labor have increased at an average annual growth rate of 4% and 0.6% respectively. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, capital growth is smaller than -7.2% for the first quartile of firms and higher than 6% for the fourth quartile.

<Insert Table 1 about here>

3.2 Manufacturing-level results

Being interested in average output elasticities and derived average reduced-form parameters, we estimate the following specification for manufacturing as a whole over the period 1978-2001:

$$q_{it} - k_{it} = \varepsilon_N^Q (n_{it} - k_{it}) + \varepsilon_M^Q (m_{it} - k_{it}) + (\lambda - 1) k_{it} + \zeta_{it} \tag{16}$$

with and without imposing constant returns to scale.

Part 1 of Table 2 shows the results of estimating the basic production function (Eq.(16)) under the assumption of constant returns to scale ($\lambda = 1$), while Part 2 allows for non constant returns to scale. We present both set of results for a range of estimators. Columns 1 and 2 report the levels OLS and the first-differenced OLS estimates, respectively. From column 3 onwards, we take into account endogeneity problems. Columns 3 and 5 show the results of estimating the model in first differences to eliminate unobserved firm-specific effects and using appropriate lags of the variables in levels (n, m and k) as instruments for the differenced regressors to correct for simultaneity (standard panel first-differenced GMM). As argued by, for example, Blundell and Bond (2000), the first-differenced GMM estimator might be subject to large finite sample biases due to the time series persistence properties of some of the variables. In columns 4 and 6, we therefore adopt a more efficient GMM estimator which includes level

[6] Putting the number of firms between brackets and the number of observations between square brackets, the structure of the data is given by: (1398) [12], (1369) [13], (1403) [14], (1315) [15], (3414) [16], (226) [17], (215) [18], (200) [19], (164) [20], (153) [21], (180) [22], (136) [23], (473) [24]. The average number of observations per firm is 15.5 and the total number of observations is 165009.

moments (system GMM).[7] The last two columns report the results of estimating a dynamic specification of Eq.(16), allowing for an autoregressive component in the productivity shocks.[8]

The first section of each part of the table gives the estimated output elasticities. The second section presents our parameters of interest which are derived from the average production function coefficient estimates: an estimate of the average price-cost mark-up assuming perfect competition in the labor market ($\widehat{\mu}$ *only*), and estimates of the average price-cost mark-up ($\widehat{\mu}$) and the corresponding average extent of rent sharing ($\widehat{\phi}$).[9] We also report the profit ratio parameter, which can be expressed as the estimated mark-up divided by the estimated scale elasticity ($\frac{\widehat{\mu}}{\widehat{\lambda}}$). This ratio shows that the source of profit lies either in imperfect competition or decreasing returns to scale.

Focusing on our preferred estimator, the first-differenced OLS estimator,[10] ε_N^Q, ε_M^Q and ε_K^Q are estimated at 0.298, 0.587 and 0.115 respectively, under the assumption of constant returns to scale. The derived price-cost mark-up is found to be 1.17 and the corresponding extent of rent sharing 0.44. Consistent with previous findings (e.g. Dobbelaere, 2004 for Belgian manufacturing as a whole), estimating price-cost mark-ups relying on the Hall (1988) approach, assuming allocative wages, generates a downward bias. For France, ignoring imperfect competition in the labor market brings the price-cost mark-up estimate down to 1.11. Intuitively, this underestimation corresponds to the omission of the part of product rents captured by the workers. Note that for all the GMM results, none of the specification tests is passed.[11] Since, contrary to this finding, the specification tests are passed nearly everywhere in the estimates at the industry level (see infra), we conclude that the rejection of the tests at the manufacturing level is due to imposing common slopes for the industries. Apart from being interested in across-industry heterogeneity *per se*, this finding motivates our analysis at the industry level. Note that in the dynamic specification results,

[7] The GMM estimation is carried out in Stata 9.2 (Roodman, 2005). We report results for the *one*-step estimator, for which inference based on the asymptotic variance matrix is shown to be more reliable than for the asymptotically more efficient two-step estimator (Arellano and Bond, 1991).

[8] The productivity term is modelled as: $\zeta_{it} = \eta_i + u_t + \upsilon_{it}$, with $\upsilon_{it} = \rho\upsilon_{it-1} + e_{it}$ where $|\rho| < 1$, and $e_{it} \sim MA(0)$. η_i is an unobserved firm-specific effect, u_t a year-specific intercept and υ_{it} is an $AR(1)$ error term.

[9] The standard errors (σ) of $\widehat{\mu}$ and $\widehat{\phi}$ are computed using the Delta Method (Wooldridge, 2002): $\sigma^2_{\widehat{\mu}} = \frac{1}{\alpha_M^2}\sigma^2_{\widehat{\varepsilon}_M^Q}$, $\sigma^2_{\widehat{\gamma}} = \left(\frac{\alpha_M}{\alpha_N+\alpha_{M-1}}\right)^2 \frac{\left(\widehat{\varepsilon}_M^Q\right)^2\sigma^2_{\widehat{\varepsilon}_N^Q} - 2\,\widehat{\varepsilon}_N^Q\,\widehat{\varepsilon}_M^Q\,\sigma_{\widehat{\varepsilon}_N^Q,\widehat{\varepsilon}_M^Q} + \left(\widehat{\varepsilon}_N^Q\right)^2\sigma^2_{\widehat{\varepsilon}_M^Q}}{\left(\widehat{\varepsilon}_M^Q\right)^4}$ and $\sigma^2_{\widehat{\phi}} = \frac{\sigma^2_{\widehat{\gamma}}}{(1+\widehat{\gamma})^4}$.

[10] We prefer the first-differenced OLS estimator as this estimator allows us to compare consistently our results at the manufacturing, the industry and the firm level.

[11] Results not reported but available upon request. The validity of the instruments in the first-differenced equations is rejected by the Sargan test of overidentifying restrictions but the Difference Sargan test does not reject the validity of the additional instruments in differences in the levels equations.

the test of common factor restrictions is never passed.[12]
Comparing the results allowing for non constant returns to scale (Part 2 of Table 2) with those imposing constant returns to scale (Part 1 of Table 2), leads to the following insights. The returns to scale assumption evidently affects the estimated output elasticities of factor inputs. In general, the production function coefficients are estimated to be lower when allowing for non constant returns to scale. However, since the first-order conditions with respect to the variable input factors -Eq.(2) or (11) for labor and Eq.(3) for materials- do not depend on the returns to scale assumption, our key parameters ($\widehat{\mu}$ *only*, $\widehat{\mu}$ and $\widehat{\phi}$) are robust to this assumption.[13] This crucial result along with our objective to compare consistently estimates of product and labor market imperfections at the manufacturing, the industry and the firm level, motivates our decision to maintain the constant returns to scale assumption in the remaining of the paper. Due to the finding of decreasing returns to scale, the average profit ratio parameter is estimated to be lower when allowing for non constant returns to scale.

<Insert Table 2 about here>

By way of sensitivity test, we restrict the total sample to those firms for which we have 24 years of observations and estimate Eq.(16) imposing constant returns to scale. The results are reported in Table A.1. in Appendix A. On average, the price-cost mark-up parameters are estimated to be higher and the corresponding extent of rent sharing parameters are estimated to be lower than those of the total sample across the different estimators.[14]

4 Across-industry heterogeneity in $\hat{\mu}$ and $\widehat{\phi}$

This section concentrates on across-industry heterogeneity. We first present the detailed results of estimating the production function (Eq.(16)) under the assumption of constant returns to scale for each of our 38 industries. Having observed considerable heterogeneity in the difference between the factors'

[12] Using $\zeta_{it} = \eta_i + u_t + \upsilon_{it}$, with $\upsilon_{it} = \rho \upsilon_{it-1} + e_{it}$ and $e_{it} \sim MA(0)$, and assuming constant returns to scale ($\lambda = 1$), we can transform (16) through substitution to obtain $q_{it} - k_{it} = \pi_1(q_{it-1} - k_{it-1}) + \pi_2(n_{it} - k_{it}) + \pi_3(n_{it-1} - k_{it-1}) + \pi_4(m_{it} - k_{it}) + \pi_5(m_{it-1} - k_{it-1}) + \eta_i^* + u_t^* + e_{it}$, where $\pi_1 = \rho$, $\pi_2 = \varepsilon_N^Q$, $\pi_3 = -\rho\,\varepsilon_N^Q$, $\pi_4 = \varepsilon_M^Q$, $\pi_5 = -\rho\,\varepsilon_M^Q$, $\eta_i^* = (1-\rho)\,\eta_i$ and $u_t^* = u_t - \rho\, u_{t-1}$. Given consistent estimates of the unrestricted parameter vector $\boldsymbol{\pi} = (\pi_1, \pi_2, \pi_3, \pi_4, \pi_5)$, the two non-linear common factor restrictions $\pi_3 = -\pi_1\,\pi_2$ and $\pi_5 = -\pi_1\,\pi_4$ can be tested using minimum distance to get the restricted parameter vector $\left(\varepsilon_N^Q, \varepsilon_M^Q, \rho\right)$.

[13] Except for the estimated price-cost mark-up ($\widehat{\mu}$) using the first-differenced GMM estimator, which is estimated to be much lower when allowing for non constant returns to scale (see Part 2 of Table 2). This result is due to the considerable decrease in the estimated output elasticity of materials ($\widehat{\varepsilon}_M^Q$) when abstaining from the constant returns to scale assumption.

[14] In contrast to the total sample results, the Sargan test does not reject the joint validity of the lagged levels of n, m and k dated $(t-2)$ (and earlier) as instruments in the first-differenced equations. However, the validity of the additional first-differenced variables as instruments in the levels equations is rejected by the Difference Sargan test.

estimated marginal products and their measured payments, we then tie this estimated heterogeneity to observables (profitability, technology intensity, unionization and import penetration).

4.1 Across-industry estimates

Being interested in average parameters, the average industry-level price-cost mark-up ($\hat{\mu}_j$), relative extent of rent sharing ($\widehat{\gamma}_j$) and extent of rent sharing ($\widehat{\phi}_j$) are derived from comparing the estimated average output elasticities with the average input shares: $\hat{\mu}_j = \frac{\widehat{\varepsilon}^{Q}_{M_j}}{\alpha_{M_j}}$, $\widehat{\gamma}_j = \frac{\widehat{\varepsilon}^{Q}_{N_j} - \left(\widehat{\varepsilon}^{Q}_{M_j} \frac{\alpha_{N_j}}{\alpha_{M_j}}\right)}{\frac{\widehat{\varepsilon}^{Q}_{M_j}}{\alpha_{M_j}}\left(\alpha_{N_j} + \alpha_{M_j} - 1\right)}$ and $\widehat{\phi}_j = \frac{\widehat{\gamma}_j}{1+\widehat{\gamma}_j}$.

We decompose the total sample into 38 manufacturing industries according to the French industrial classification ("Nomenclature économique de synthèse - Niveau 3" [NES 114]). Table A.2 in Appendix A shows the industry repartition of the sample. Table 3 summarizes the first-differenced OLS and the system GMM results of the industry analysis. For each estimator, we consider two subsamples. The first subsample contains the estimates for which the price-cost mark-up equals or exceeds 1 and the corresponding extent of rent sharing lies in the $[0, 1]$-interval.[15] The second subsample includes the estimates showing no evidence of rent sharing and a price-cost mark-up ignoring labor market imperfections that equals or exceeds 1.[16] Both estimators have 21 industries in common in the first subsample and 8 in the second subsample. Detailed information on the first-differenced OLS and the system GMM estimates is presented in Table A.3.a in Appendix A. In the left part of Table A.3.a [Part 1-2], we compute the average shares of labor, material input and capital for each industry. The middle part reports the first-differenced OLS and the system GMM estimates of the output elasticities. The right part presents the derived parameters of interest: the price-cost mark-up assuming that labor is priced competitively ($\widehat{\mu}_j$ *only*), the price-cost mark-up taking into account labor market imperfections ($\widehat{\mu}_j$), the relative extent of rent sharing ($\widehat{\gamma}_j$) and the extent of rent sharing ($\widehat{\phi}_j$). For each estimator, we first report the estimates of the first subsample [24 industries for OLS DIF and 26 for system GMM], followed by those of the second subsample [14 for OLS DIF and 11 for system GMM[17]]. Within each

[15] This subsample contains 24 industries using the first-differenced OLS estimator. The estimates of $\widehat{\mu}_j$ (≥ 1) and $\widehat{\mu}_j$ *only* (≥ 1) are significant for all industries, whereas $\widehat{\phi}_j$ ($\in [0, 1]$) is significant for 19 out of 24 industries. As to the system GMM results, 26 industries belong to this subsample. $\widehat{\mu}_j$ (≥ 1) and $\widehat{\mu}_j$ *only* (≥ 1) are significant for all industries, whereas $\widehat{\phi}_j$ ($\in [0, 1]$) is significant for 16 out of 26 industries.

[16] This subsample contains 14 industries using the first-differenced OLS estimator. The estimates of $\widehat{\mu}_j$ *only* (≥ 1) are significant for all industries, whereas $\widehat{\mu}_j$ (≥ 1) is significant for 9 out of 14 industries. 4 out of 14 estimated rent sharing parameters ($\widehat{\phi}_j = 0$) are significant. As to the system GMM results, 11 industries belong to this subsample. $\widehat{\mu}_j$ *only* (≥ 1) and $\widehat{\mu}_j$ (≥ 1) are significant for all industries, whereas there is only one significantly estimated rent sharing parameter ($\widehat{\phi}_j = 0$).

[17] In Table A.3.a [Part 4], we also report the estimates of industry 1, for which $\widehat{\phi}_j =$

subsample, the table is drawn up in increasing order of $\widehat{\mu}_j$ *only*. Economically meaningful estimates are blackened.[18]

From Table 3, it follows that industry differences in the parameters and in the underlying estimated factor elasticities and shares are quite sizable, as could be expected. Concentrating on the economically meaningful first-differenced OLS estimates of the price-cost mark-up and the corresponding extent of rent sharing [24 industries], the price-cost mark-up ($\widehat{\mu}_j$) is estimated to be lower than 1.15 for the first quartile of industries and higher than 1.22 for the top quartile. The corresponding estimate of the extent of rent sharing is found to be lower than 0.13 for the first quartile of industries and higher than 0.39 for the top quartile. The median values are estimated at 1.18 and 0.27 respectively. As to the first-differenced OLS results of the full sample, the estimated price-cost mark-up ($\widehat{\mu}_j$) is lower than 1.04 for the first quartile of industries and exceeds 1.19 for the top quartile. There is no evidence of rent sharing for the first quartile of industries but we estimate it to be higher than 0.33 for the top quartile. Focusing on the median, the price-cost mark-up and the extent of rent sharing are estimated at 1.15 and 0.12 respectively. Ignoring the occurrence of rent sharing reduces the estimated median price-cost mark-up to 1.09.

Table C.1 in Appendix C presents summary information on the accounting price-cost mark-ups and the corresponding extent of rent sharing at the industry level and shows the correlation between these accounting measures and the first-differenced OLS estimates of $\widehat{\mu}_j$ *only*, $\widehat{\mu}_j$ and $\widehat{\phi}_j$.[19] For the subsample of 24 industries, the correlation amounts to 0.69 for the price-cost mark-up assuming allocative wages, 0.25 for the price-cost mark-up taking into account labor market imperfections and 0.23 for the extent of rent sharing. For the subsample of 14 industries, the correlation is 0.35 for the price-cost mark-up ignoring labor market imperfections.

When taking into account endogeneity problems, the estimates of the price-cost mark-up appear to be higher than the first-differenced OLS results (see system GMM results in Table 3). For the full sample, the median price-cost mark-up and the median extent of rent sharing are estimated at 1.25 and 0.11 respectively. For 26 out of 38 industries, we find evidence of price-cost mark-ups being underestimated when imperfection in the labor market is ignored, hence validating the findings of Bughin (1996) and Dobbelaere (2004). Consistent with the first-differenced OLS results, the median of the industry estimates of the price-cost mark-up (value of 1.28) and -in particular- the median of the corresponding industry estimates of the extent of rent sharing (value of 0.29) are considerably higher when considering only the economically meaningful parameter estimates [26 industries].

<Insert Table 3 about here>

1 and $\widehat{\mu}_j$ *only* > 1. The estimate of the extent of rent sharing is however not significant.

[18] If $\widehat{\mu}_j \geq 1$ and $\widehat{\phi}_j \in [0,1]$, $\widehat{\boldsymbol{\mu}}_{\mathbf{j}}$, $\widehat{\boldsymbol{\gamma}}_{\mathbf{j}}$ and $\widehat{\boldsymbol{\phi}}_{\mathbf{j}}$ are blackened (see f.e. industry 6, OLS DIF). If $\widehat{\phi}_j = 0$ and $\widehat{\mu}_j$ *only* ≥ 1, $\widehat{\boldsymbol{\mu}}_{\mathbf{j}}$ **only** is blackened (see f.e. industry 3, OLS DIF).

[19] For details on the computation of the accounting measures, we refer to Appendix C.

Table A.3.b in Appendix A summarizes all the industry estimates. The upper part displays the correlation between our parameters of interest for a range of estimators (first-differenced OLS, first-differenced GMM and system GMM). The lower part of the table shows the correlation of the parameters across the different estimators. The left part of the table considers the full sample while the right part restricts the sample to those industries for which the estimated extent of rent sharing lies in the $[0, 1]$-interval. The correlation between the estimated price-cost mark-up ignoring the occurrence of rent sharing ($\widehat{\mu}_j$ *only*) and the estimate taking into account labor market imperfections ($\widehat{\mu}_j$) amounts to 0.6 for each estimator (see upper part of Table A.3.b). The correlation between the price-cost mark-up estimate ($\widehat{\mu}_j$) and the estimated relative extent of rent sharing ($\widehat{\gamma}_j$) is found to be 0.8 for the whole sample and 0.5 for the restricted sample. From the lower part of Table A.3.b, it follows that particularly the first-differenced OLS and the system GMM estimates are highly correlated.

4.2 Different dimensions across industries

To investigate different dimensions across industries, we classify the industries according to profitability, technology intensity, unionization and import penetration. For each dimension, we consider four types (low, medium low, medium high and high). As to the profitability dimension, we calculate the average industry-level price-cost margin (PCM)[20] and determine the different types based on the quartile values. The identification of the technology types relies on the OECD classification. This methodology uses two indicators of technology intensity, R&D expenditures divided by value added and R&D expenditures divided by production (OECD, 2005). To construct our measure of the degree of unionization, we merge our original dataset consisting of firms from EAE (SESSI) with the REPONSE 1998 ("Relations Professionnelles et Négociations d' Entreprises") database collected by the French Ministry of Labor. Having 911 firms left, we compute the average industry-level union density.[21] Similar to the profitability dimension, the quartile values define the four types. As to the openness dimension, we compute the average industry-level import penetration ratio as the ratio of industry product imports to the sum of these imports plus the value of domestic production in the industry using the input-output tables defined at the three-digit level (National Institute for Statistics and Economic Studies (INSEE)). The different types are identified through the quartile values. For each dimension, columns 4-7 in Table A.2 in Appendix A indicate the type to which each industry belongs.

Graphs 1-4 aim at discerning a pattern in the economically meaningful industry estimates of $\widehat{\mu}_j$ and $\widehat{\phi}_j$.[22] Each graph corresponds to one of the four dimensions (profitability, technology intensity, unionization and import penetration).

[20] The price-cost margin is defined as the difference between revenue and variable cost over revenue (see Schmalensee, 1989 p. 960).

[21] Since we use a small non-representative subsample (only 911 firms) to define the degree of industry-level unionization, the resulting classification has to be interpreted with caution.

[22] The corresponding industries are blackened in Table A.2 in Appendix A.

Within each dimension, different symbols refer to each of the four types (low, medium low, medium high and high). The dashed lines denote the median values ($\widehat{\mu}_{j,med} = 1.18$, $\widehat{\phi}_{j,med} = 0.27$). Given the positive correlation between $\widehat{\mu}_j$ and $\widehat{\phi}_j$ of 0.48, most industries are situated either in the upper right part or the lower left part of the graphs. Focusing on Graph 1, the price-cost mark-up of two thirds of the highly profitable industries is higher than the median price-cost mark-up. As to $\widehat{\phi}_j$, no clear pattern can be detected. From Graph 2, it follows that nearly two thirds of the low-technology industries are characterized by a relatively high $\widehat{\mu}_j$ and $\widehat{\phi}_j$ (see upper right part of the graph).[23] Concentrating on Graph 3, nearly two thirds of the industries with a high degree of unionization have a price-cost mark-up exceeding the median value. All weakly unionized industries are situated in the lower part of the graph, being characterized by an estimated price-cost mark-up below the median value. The estimated extent of rent sharing of half of those industries is lower than the median value.[24] Graph 4 shows that industries with high import penetration rates have estimated price-cost mark-ups below the median value, while industries shielded from import competition display an estimated extent of rent sharing exceeding the median value. These findings confirm those of Abraham et al. (2006) and Boulhol et al. (2006). They also provide support for the imports-as-product-and-labor-market discipline hypothesis using Belgian and UK firm-level data, respectively.

<Insert Graphs 1-4 about here>

5 Within-industry heterogeneity in $\hat{\mu}$ and $\widehat{\phi}$

Production behavior is very likely to vary even within industries, because input combinations differ, labor markets are not homogeneous and demand might be more elastic or inelastic in one firm than another. In this section, we allow for heterogeneous production behavior across firms. Since production is primarily affected by input factors and only secondarily by -for example- demand conditions, we assume that the relationships among variables are proper but the production function coefficients differ across firms. Therefore, we estimate the production function for each firm i and retrieve the firm price-cost mark-up $\widehat{\mu}_i$ and the extent of rent sharing $\widehat{\phi}_i$ from the estimated firm output elasticities ($\widehat{\varepsilon}^{Q}_{J_i}$, $J = N, M, K$).[25]

This section starts with a brief discussion of the Swamy (1970) methodology. We then apply this methodology to analyze whether there is real firm-level heterogeneity in the estimated average factor elasticities and average shares,

[23] Note that in contrast to Graphs 1, 3 and 4, **12** industries belong to the low-technology category.

[24] Graphs 1-4 display the first-differenced OLS estimates of $\widehat{\mu}_j$ and $\widehat{\phi}_j$ (see blackened industry estimates in Table A.3.a, Part 1). Plotting the system GMM estimates of $\widehat{\mu}_j$ against $\widehat{\phi}_j$ (see blackened industry estimates in Table A.3.a, Part 3) leads largely to the same conclusions.

[25] Besides allowing for the possible heterogeneity across firms, we could also focus on the stability of the structural parameters over time. However, relaxing the constancy of μ_i and ϕ_i in the time dimension would strain our already overextended computational framework.

and the derived average mark-up and rent sharing parameters. We end the section by tying the sizeable estimated firm heterogeneity in product and labor market imperfection parameters to observables.

5.1 Swamy (1970) methodology

To determine the degree of true heterogeneity in the coefficients and parameters of interest, we adopt the Swamy (1970) methodology as a variance decomposition approach. This method allows us to estimate the variance components of heterogeneity in the estimated firm output elasticities ($\widehat{\varepsilon}_{J_i}^{Q}$, $J = N, M, K$) and the derived structural parameters ($\hat{\mu}_i$ *only*, $\hat{\mu}_i$, $\widehat{\gamma}_i$ and $\hat{\phi}_i$), i.e., the pure sampling variance and the true heterogeneity.
Considering random production function coefficients that vary across firms, letting $x_{1it} \equiv 1$ and assuming constant returns to scale, we can rewrite the production function as follows:[26]

$$q_{it} = \sum_{k=1}^{K} \varepsilon_{kit} x_{kit} + \xi_{it} \tag{17}$$

$\boldsymbol{\varepsilon}_i$ is assumed to be randomly distributed with $\boldsymbol{\varepsilon}_i = \widetilde{\boldsymbol{\varepsilon}} + \boldsymbol{\eta}_i$. $\widetilde{\boldsymbol{\varepsilon}} = (\widetilde{\varepsilon}_1, ..., \widetilde{\varepsilon}_K)'$ represents the common-mean coefficient vector and $\boldsymbol{\eta}_i = (\eta_{1i}, ..., \eta_{Ki})'$ the individual deviation from the common mean $\widetilde{\boldsymbol{\varepsilon}}$. Following Swamy (1970), we assume that the errors for firm i are uncorrelated across firms and allow for heteroskedasticity across firms, $\boldsymbol{\xi}_i \sim N\left(\mathbf{0}, \sigma_i^2 I\right)$. $E\left(\boldsymbol{\eta}_i\right) = \mathbf{0}$, $E\left(\boldsymbol{\eta}_i \boldsymbol{\eta}_j'\right) = \Delta$, if $i = j$, $E\left(\boldsymbol{\eta}_i \boldsymbol{\eta}_j'\right) = \mathbf{0}$, otherwise. Swamy suggests first estimating Eq. (17) for each firm i by OLS giving:

$$\widehat{\boldsymbol{\varepsilon}}_i = \left(X_i' X_i\right)^{-1} X_i' \mathbf{q}_i \quad \text{with} \tag{18}$$

$$\widehat{\boldsymbol{\xi}}_i = \mathbf{q}_i - X_i \widehat{\boldsymbol{\varepsilon}}_i \tag{19}$$

Using (18) and (19), we obtain unbiased estimators of σ_i^2 and Δ, given by Eq. (20) and (21) respectively.

$$\widehat{\sigma}_i^2 = \frac{\widehat{\boldsymbol{\xi}}_i' \widehat{\boldsymbol{\xi}}_i}{T - K} \tag{20}$$

with the estimated variance-covariance matrix $Var\left(\widehat{\boldsymbol{\varepsilon}}_i\right) = \widehat{\sigma}_i^2 \left(X_i' X_i\right)^{-1}$. Defining the mean of $\widehat{\boldsymbol{\varepsilon}}_i$ as $\overline{\boldsymbol{\varepsilon}} = \frac{1}{N} \sum_{i=1}^{N} \widehat{\boldsymbol{\varepsilon}}_i$, their variance can be estimated as:

[26] For the sake of parsimony, we denote the explanatory variables by x_{kit} ($k = 1,..,K$) and the firm output elasticities by ε_{kit} (dropping the superscript (Q) and the subscript ($J = N, M$)).

$$\begin{aligned}\widehat{\Delta} &= \frac{1}{N-1}\sum_{i=1}^{N}\left(\widehat{\varepsilon}_i-\overline{\varepsilon}\right)\left(\widehat{\varepsilon}_i-\overline{\varepsilon}\right)' - \frac{1}{N}\sum_{i=1}^{N}Var\left(\widehat{\varepsilon}_i\right) \\ &= \underbrace{\frac{1}{N-1}\sum_{i=1}^{N}\left(\widehat{\varepsilon}_i-\overline{\varepsilon}\right)\left(\widehat{\varepsilon}_i-\overline{\varepsilon}\right)'}_{(1)} - \underbrace{\frac{1}{N}\sum_{i=1}^{N}\sigma_i^2\left(X_i'X_i\right)^{-1}}_{(2)} \qquad (21)\end{aligned}$$

The logic behind the definition of $\widehat{\Delta}$, the Swamy estimate of true variance of the coefficients, is that due to noisy estimates $(\widehat{\varepsilon}_i)$, much of the variation in $\widehat{\varepsilon}_i$ is not caused by "real" parameter variability but purely by sampling error. Swamy (1970) thus suggests to correct for this sampling variability by subtracting it off.

Two major advantages of the Swamy methodology are that these estimates are the most straightforward to obtain among the different estimators of coefficient heterogeneity and that they are robust to the possibility of correlated effects between the firm intercept and slope parameters and the other variables in the equation since they are based on individual regression estimates (see Mairesse-Griliches, 1990).[27]

5.2 General overview

Table 4 summarizes the first-differenced OLS results of estimating Eq.(17) for each firm i in a comprehendible fashion. Consistent with the across-industry estimates, we consider two subsamples of estimates. The first part of Table 4 shows the results of the first subsample keeping only the firm estimates of which $\hat{\mu}_i \geq 1$ and $\hat{\phi}_i \in [0,1]$ [5906 firms].[28] The second part of Table 4 presents the results of the second subsample restricting the firm estimates to those of which $\hat{\phi}_i = 0$ and $\hat{\mu}_i$ *only* ≥ 1 [1239 firms].[29] The last part of Table 4 summarizes the results of all the firm estimates [10646 firms]. Each part is split into three sections, focusing on the simple mean, the weighted mean and the median respectively. Table A.4 in Appendix A, which is structured in the same way

[27] Besides the Swamy method, the random coefficient model literature suggests another approach to estimate the variance components of heterogeneity, using the maximum likelihood (ML) estimator and the more flexible approach of regressing the squares and the cross-products of residuals on comparable squares and cross-products of the independent variables (Hildreth and Houck, 1968; Amemiya, 1977; MaCurdy, 1985). Contrary to the Swamy estimates, the ML estimates and those based on the regression of the squares and cross-products of the residuals assume either the independence of the firm slope parameteres or the independence between both the firm intercept and slope parameters and the other variables in the equation, i.e., the absence of correlated effects (see Mairesse-Griliches, 1990 for a comparison of the three different approaches).

[28] Looking at the significance of the parameter estimates, we find that 5817 out of 5906 estimates of $\widehat{\mu}_i$ (≥ 1), 4414 out of 5906 estimates of $\widehat{\phi}_i\,(\in [0,1])$ and 4426 out of 5906 estimates of $\widehat{\mu}_i$ *only* (≥ 1) are significant.

[29] Within this subsample, 1238 out of 1239 estimates of $\widehat{\mu}_i$ *only* (≥ 1) are significant. As to $\widehat{\mu}_i$ (≥ 1), 983 out of 1239 estimates are significant. None of the estimated rent sharing parameters $(\widehat{\phi}_i = 0)$. is found to be significant.

as Table 4, reports detailed information on the results of applying the Swamy (1970) methodology. For comparison purposes, we list also similar statistics for the firm input shares (α_{J_i}, $J = N, M, K$). Within each part, the last row of each section reports the F-statistic for the hypothesis of equality of the estimates (or the computed variables) across firms.

The first section of each part of Table A.4 gives the original Swamy estimates of true variance [$\widehat{\sigma}^2_{true}$, corresponding to $\widehat{\Delta}$ in Eq. (21)], which are computed as the difference between the observed variance of the individually estimated firm coefficients [$\widehat{\sigma}^2_o$, corresponding to term (1) in Eq. (21)] and the mean of the corresponding sampling variance [$\widehat{\sigma}^2_s$, corresponding to term (2) in Eq. (21)].[30] The observed variance $\left(\widehat{\sigma}^2_o\right)$ illustrates the sizeable dispersion in the estimated firm output elasticities and the derived parameters and shows that the heterogeneity at the firm level is largely magnified by large sampling errors arising from the rather short time series available. Due to the large sampling variance $\left(\widehat{\sigma}^2_s\right)$, we even find zero estimates of true variance in the individually estimated extent of rent sharing $\hat{\phi}_i$ in the first subsample [5906 firms] and the total sample [10646 firms]. All the observed variability is either common to all firms, transitory or attributable to sampling variability. Given the large number of degrees of freedom, all the F-statistics are significant at conventional significance levels (the critical value barely exceeds 1 for our sample size), except for $\hat{\phi}_i$.[31] Except for $\hat{\mu}_i$ *only*, the large sampling variance drives the true variance in all the derived parameters towards zero in the second subsample [1239 firms].

To investigate whether the true heterogeneity is not just an artefact of outliers and large sampling errors, we look at the Swamy estimates of the weighted true variance and the Swamy estimates of the robust true variance. The Swamy estimate of the *weighted* true variance, which is calculated as the weighted observed variance minus the weighted sampling variances, is reported in the second section of each part of Table A.4.[32] The weight is defined as the inverse of the sampling variance. As to the estimated firm output elasticities ($\widehat{\varepsilon}^Q_{J_i}$, $J = N, M, K$), the weighted observed and -even more so- the weighted sampling variance are considerably smaller than the corresponding simple observed and

[30] Taking into account the unbalanced nature of the sample, the equivalent for the input shares α_J can be expressed as: $\widetilde{\sigma}^2_{true} = \frac{1}{N-1}\sum_{i=1}^{N}\left(\overline{\alpha}_{J_i} - \overline{\alpha}_J\right)^2 - \frac{1}{\overline{T}}\widetilde{\sigma}^2_s$, where n_t denotes the number of years within firm i and N_{n_t} the number of firms having n_t years of observations. $\overline{T} = \sum_{n_t=12}^{24}\left(\frac{N_{n_t}}{N}n_t\right)$, $\overline{\alpha}_{J_i} = \frac{1}{T}\sum_{t=1}^{n_t}\alpha_{J_{it}}$, $\overline{\alpha}_J = \frac{1}{N}\sum_{i=1}^{N}\overline{\alpha}_{J_i}$ and $\widetilde{\sigma}^2_s = \frac{1}{N(\overline{T}-1)}\sum_{i=1}^{N}\sum_{t=1}^{n_t}\left(\alpha_{J_{it}} - \overline{\alpha}_{J_i}\right)^2$.

[31] One can question, however, the validity of these F-statistics in such large samples. A more symmetric treatment of the inference problem, advocated by Leamer (1978), would necessitate using a critical value which increases with the number of degrees of freedom. This would lead to less certainty in rejecting the hypothesis of homogeneity (Mairesse-Griliches, 1990).

[32] In practice, the weighted sampling variance is calculated as $N\sum_{i=1}^{N}\widehat{\sigma}^2_i$.

simple sampling variance. As such, the Swamy estimate of the weighted true variance exceeds the corresponding Swamy estimate of the simple true variance in both subsamples. As to the total sample, the Swamy estimate of the weighted true variance is very similar to the corresponding Swamy estimate of the simple true variance. Focusing on the derived structural parameters ($\hat{\mu}_i$ *only*, $\hat{\mu}_i$, $\widehat{\gamma}_i$ and $\hat{\phi}_i$), the difference between the weighted observed (sampling) variance and the simple observed (sampling) variance is even more pronounced. As a result, the Swamy estimates of the weighted true variance are significantly different from zero in the first subsample and the total sample. Hence, contrary to the results in the first section, the hypothesis of homogeneity is clearly rejected everywhere, even for $\hat{\phi}_i$. Given our focus on $\hat{\mu}_i$ *only* in the second subsample, we only find true variance in that parameter in this subsample.

In section 3 of each part of Table A.4, we report the Swamy estimates of the *robust* true variance,[33] which are computed by subtracting the median of the individually estimated sampling variances from the interquartile observed variance.[34] Consistent with the Swamy estimates of the weighted true variance, we find persistent individual firm differences in both the firm input shares, the firm estimated elasticities and the derived parameters in the first subsample and the total sample . Compared to the weighted results, both the interquartile observed variance, the robust sampling variance and the Swamy estimate of robust true variance of the derived parameters are larger than their weighted counterparts.

Having explained the computations of Table 4, we discuss now briefly that table. The first row of each section lists respectively the simple averages, the weighted averages and the median values of the firm input shares, the individually estimated firm output elasticities and the derived structural parameters. The corresponding observed dispersion ($\widehat{\sigma}_o$) is put between brackets while the corresponding Swamy estimates of true dispersion ($\widehat{\sigma}_{true}$) are given between square brackets. As to the estimated firm output elasticities and the price-cost mark-ups, the simple mean, the weighted mean and the median do not differ considerably. For the sample of 5906 firms, the elasticities of labor, material input and capital are estimated at about 0.13, 0.73 and 0.11, respectively. The estimates of the price-cost mark-up ignoring the occurrence of rent sharing and the one taking into account labor market imperfections amount to 1.14 and 1.46 respectively.[35] The simple average of the estimated extent of rent sharing $\left(\hat{\phi}_i\right)$ is close to the median value (0.58). The weighted mean points to a higher extent of rent sharing (0.81). Concentrating on the median, the Swamy robust estimates of true dispersion of 0.14 for $\hat{\mu}_i$ *only*, 0.28 for $\hat{\mu}_i$ and 0.20 for $\hat{\phi}_i$ are

[33] When focusing on *robust* indicators and estimates, we assume that the individually estimated parameters are normally distributed and the sampling variance is distributed as χ^2.

[34] The term *interquartile observed variance* indicates that the observed variance is computed from the interquartile range of the firm input shares and firm estimates.

[35] At the individual level, the correlation between the derived price-cost mark-up ignoring the occurrence of rent sharing and the estimate taking into account labor market imperfections amounts to 0.31 for the subsample consisting of 5906 firm estimates. Except for 13 firms, the lack of explicit consideration of labor market imperfections results in an underestimation of the firm-level price-cost mark-up.

good indicators of a credible amount of heterogeneity. For the sample of 1239 firms, the median of the firm estimates of the elasticities of labor, material input and capital is of 0.40, 0.59 and 0.01, respectively. The median of the estimated price-cost mark-ups ignoring labor market imperfections is of 1.22 with a Swamy corresponding robust estimate of true dispersion of 0.17. As to the total sample [10646 firms], the median of the estimated elasticities of labor, material input and capital is of 0.26, 0.61 and 0.09. The median of the firm estimates of the price-cost mark-up assuming that labor is priced competitively is of 1.1, while it is higher of 1.2 when taking labor market imperfections into account and the median of the corresponding firm estimates of the extent of rent sharing is of 0.62.[36] The Swamy corresponding robust estimates of true dispersion of 0.18, 0.37 and 0.35 give evidence of a very sizeable within-industry firm heterogeneity.

<Insert Table 4 about here>

Table C.2 in Appendix C presents summary information on the accounting price-cost mark-ups and the corresponding extent of rent sharing at the firm level and gives the correlation between these accounting measures and the first-differenced OLS estimates of $\widehat{\mu}_i$ *only*, $\widehat{\mu}_i$ and $\widehat{\phi}_i$. For the subsample of 5906 firms, the correlation amounts to 0.38 for the price-cost mark-up assuming that labor is priced competitively, 0.32 for the price-cost mark-up taking into account labor market imperfections and 0.01 for the extent of rent sharing. For the subsample of 1239 firms, the correlation is found to be 0.58 for the price-cost mark-up ignoring labor market imperfections.

5.3 Within-industry heterogeneity

Starting from the 10646 firm estimates, we group the individually estimated firm elasticities and the derived structural parameters into 38 industries, according to the industry classification in Section 4. Being interested in within-industry heterogeneity, we report the weighted mean and the corresponding Swamy estimate of weighted *true* standard deviation of the firm estimates in Table A.5 in Appendix A. The ranking of industries equals the one of Table A.3.a [Part1-2]. Table 5 summarizes the within-industry estimates. Focusing on the subsample of 24 industries, one-fourth of the industries exhibit a price-cost mark-up ($\widehat{\mu}_{ij}$) which is lower than 1.16. Looking at the top quartile of industries, the estimated price-cost mark-up exceeds 1.23. The estimated extent of rent sharing ($\widehat{\phi}_{ij}$) appears to be lower than 0.76 for the first quartile of industries and higher than 0.85 for the top quartile. As to the subsample of 14 industries, the estimates of the price-cost mark-up ignoring labor market imperfections ($\widehat{\mu}_{ij}$ *only*) are less dispersed. This estimated price-cost mark-up is found to be lower than 1.09 for the first quartile of industries and higher than 1.11 for the top quartile. As to the total sample, one-fourth of the industries display a price-cost mark-up ($\widehat{\mu}_{ij}$)

[36] For the total sample, the correlation between $\hat{\mu}_i$ *only* and $\hat{\mu}_i$ amounts to 0.44. For 61% of the firms, the firm price-cost mark-up is underestimated when labor market imperfections are ignored.

which is higher than 1.09. At the top quartile, the estimated price-cost mark-up exceeds 1.22. The estimated extent of rent sharing appears to be lower than 0.76 for the first quartile of industries and higher than 0.84 for the top quartile. The correlation between the estimated price-cost mark-up assuming that labor is priced competitively ($\widehat{\mu}_{ij}$ *only*) and the estimate taking into account labor market imperfections ($\widehat{\mu}_{ij}$) is found to be 0.34. The correlation between the price-cost mark-up estimate ($\widehat{\mu}_{ij}$) and the estimated relative extent of rent sharing ($\widehat{\gamma}_{ij}$) amounts to 0.45. Comparing the upper part of Table 3 with Table 5, it follows that the match between the industry and the firm estimates is quite good for $\widehat{\mu}$ *only* and $\widehat{\mu}$, but far less so for $\widehat{\gamma}$ and $\hat{\phi}$.

<Insert Table 5 about here>

5.4 Determinants of estimated heterogeneity

In this subsection, we investigate whether firm-level variables, like size, capital intensity, being a mixed or pure R&D firm and distance to the industry technology frontier, explain part of the estimated heterogeneity in the price-cost mark-up and relative extent of rent sharing parameters. First, we discuss the data. Then, we analyze whether the firm-level variables influence $\hat{\mu}$ and $\widehat{\gamma}$ at the firm level.

Data description

We only consider the economically meaningful firm estimates as dependent variables. More specifically, the dependent variable is either the vector of $\ln(\widehat{\mu}_i$ $only - 1)$ $(i = 1, ..., 1239)$, the vector of $\ln(\widehat{\mu}_i - 1)$ $(i = 1, ..., 5906)$ or the vector of $\ln(\widehat{\gamma}_i)$ $(i = 1, ..., 5906)$.[37] For each of these dependent variables, we have four different matrices of regressors. Each set consists of a firm-level variable (size, capital intensity, the R&D identifier, distance to the industry technology frontier) and industry dummies. All variables are centered around the industry mean. Size (n_i) is measured by the logarithm of the average number of employees in each firm and capital intensity ($capint_i$) by the logarithm of the gross book-value of fixed assets divided by sales. To construct the R&D variable, we merge accounting information of the considered firms from EAE (SESSI) with data of Research & Development collected by DEP ("Ministère de l'Education et de la Recherche"). The R&D surveys (DEP) provide two R&D variables: a dichotomous R&D indicator and total R&D expenditure. We assume that the sample is exhaustive, i.e., a firm which does not report any R&D expenditure is considered to be a non-R&D firm. Based on this criterion, we define three subsamples: the pure non-R&D firms, the mixed R&D firms for which we have data on R&D expenditure for less than 12 years ($mixentr_i$) and the pure R&D firms for which we have data on R&D expenditure for at least 12 years ($rdentr_i$).[38] Our measure of the distance of a firm to its industry technology frontier takes

[37] Consistent with Section 5.2, we consider two subsamples. The first subsample consists of $\widehat{\mu}_i \geq 1$ and $\widehat{\phi}_i \in [0, 1]$ (5906 estimates) and the second subsample consists of $\widehat{\phi}_i = 0$ and $\widehat{\mu}_i$ $only \geq 1$ (1239 estimates).

[38] Among the 5906 firms in the first subsample, 182 firms are identified as pure R&D firms,

the following form $dist_i = p^{95} \ln\left(\frac{VA}{N}\right)_j - \ln\left(\frac{VA}{N}\right)_{ij}$, where i is a firm index, j a industry index and $\frac{VA}{N}$ value added per employee. We use the 95th percentile, instead of the maximum, to drop outliers.

Results

The OLS, WLS, where the weight is defined as the inverse of the sampling variance, and the median regression coefficients of the set of regressors explaining the vector of $\ln(\widehat{\mu}_i \; only - 1)$, the vector of $\ln(\widehat{\mu}_i - 1)$ or the vector of $\ln(\widehat{\gamma}_i)$ are reported in Table 6. The 0.50 quantile regression can be interpreted as a robust equivalent of OLS. Although the regression coefficients are listed in rows for each of the three sets of regressors, they are for single firm-level variable regressions (including industry dummies), except for the regression including the R&D identifier which includes two firm-level variables ($mixentr_i$) and ($rdentr_i$) and industry dummies. Large firms experience a negative effect on the estimated price-cost mark-up taking into account labor market imperfections, and on the corresponding relative extent of rent sharing while capital-intensive firms experience a positive impact on the estimated price-cost mark-up but a negative impact on the corresponding relative extent of rent sharing. Being a R&D firm exerts a negative effect on the relative extent of rent sharing. This effect is strongest for the pure R&D firms. Firms which are nearer to the industry technology frontier experience a positive effect on the estimated price-cost mark-up. This impact becomes negative when labor market imperfections are taken into consideration. Hence, consistent with the across-industry results, low-technology firms experience a positive effect on the price-cost mark-up and the corresponding relative extent of rent sharing.[39]

As a robustness check, we ran multivariate specifications for each set of regressors where we include all firm-level variables and industry dummies.[40] The results discussed above are not sensitive to using these multivariate specifications, except for the negative effect of being a capital-intensive firm or a R&D firm on the estimated extent of rent sharing. More specifically, the former effect looses significance, while the latter effect becomes significantly positive with the effect being strongest for the pure R&D firms.

<Insert Table 6 about here>

584 as mixed R&D firms and -the complement- 5140 as pure non-R&D firms. The second subsample of 1239 firms includes 75 pure R&D firms, 177 mixed R&D firms and 987 pure non-R&D firms.

[39] Technological change (either captured by our R&D variable or our measure of the distance of a firm to its industry technology frontier) might exert an effect on the relative extent of rent sharing by impacting the nature of the production process. However, this effect is, a priori, 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. Horn and Wolinsky (1988) develop a similar argument.

[40] Results not reported but available upon request.

6 Conclusion

This article thoroughly investigates product and labor market imperfections as two sources of discrepancies between the output contribution of individual production factors and their respective revenue shares. By doing so, we contribute to the econometric productivity literature on estimating microeconomic production functions and to the recent econometric literature on simultaneously estimating imperfections in product and factor markets. Embedding the efficient bargaining model into the R. Hall (1988) approach shows that the firm price-cost mark-up and the extent of rent sharing generate a wedge between marginal products of input factors and the apparent factor prices. To econometrically explore these particular sources of discrepancies, we start by estimating a standard production function using a panel of 10646 French manufacturing firms covering the period 1978-2001. From the production function coefficients, i.e., the output elasticities, we derive our parameters of interest. At the manufacturing level, the first-differenced OLS estimates point to an average price-cost mark-up of 1.17 and an average extent of rent sharing of 0.44. The next step into our empirical strategy is to examine across-industry heterogeneity in the production function coefficients and the retrieved parameters. Splitting the sample into 38 industries, we find a considerable degree of across-industry heterogeneity. The median price-cost mark-up and the median extent of rent sharing are estimated at 1.15 and 0.12 respectively. The median values of the economically meaningful industry estimates are of an order of magnitude of 1.18 and 0.27 respectively. Highly profitable industries display a price-cost mark-up that is higher than the median value. Low-technology industries, likely to be typified as less competitive industries, display a price-cost mark-up and extent of rent sharing above the respective median values. Weakly unionized industries are characterized by a price-cost mark-up below the respective median value. The estimated extent of rent sharing of half of those industries is lower than the respective median value. Industries faced by high import competition show an estimated price-cost mark-up below the median value. The estimated extent of rent sharing in industries that are shielded from import competition exceeds the median value. Since production behavior is likely to vary across firms, we finally take into account firm-level heterogeneity and look at within-industry heterogeneity. To determine the degree of heterogeneity in the production function coefficients and parameters of interest, we adopt the Swamy (1970) methodology as a variance decomposition approach. This method allows us to estimate the variance components of heterogeneity, i.e., the pure sampling variance and the true heterogeneity or dispersion. The median of the firm estimates of the price-cost mark-up ignoring the occurrence of rent sharing is of 1.10, while it is higher of 1.20 when taking them into account and the median of the corresponding firm estimates of the extent of rent sharing is of 0.62. The Swamy corresponding robust estimates of true dispersion of 0.18, 0.37 and 0.35 are good indicators of a credible amount of heterogeneity. Firm size, capital intensity, distance to the industry technology frontier and investing in R&D seem to explain part of the estimated heterogeneity in price-cost mark-ups and the extent of rent sharing.

References

[1] Abraham, F., J. Konings and S. Vanormelingen, 2006, Price and Wage Setting in an Integrating Europe: Firm Level Evidence, NBB Research Paper 200610-5, National Bank of Belgium.

[2] Amemiya, T., 1977, A Note on a Heteroskedastic Model, Journal of Econometrics, 5, 295-299.

[3] Ackerberg, J., L. Benkard, S. Berry and A. Pakes, 2006, Econometric Tools for Analyzing Market Outcomes, in: Heckman, J.J. (Ed.), Handbook of Econometrics, forthcoming.

[4] Arellano, M. and S. Bond, 1991, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, Review of Economic Studies, 58(2), 277-297.

[5] Betcherman, G., 1991, Does Technological Change Affect Union Bargaining Power? British Journal of Industrial Relations, 29(3), 447-462.

[6] Blanchard, O. and F. Giavazzi, 2003, Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets, The Quarterly Journal of Economics, 18(3), 879-907.

[7] Blundell, R. and S. Bond, 2000, GMM Estimation with Persistent Panel Data: An Application to Production Functions, Econometric Review, 19, 321-340.

[8] Booth, A., 1995, The Economics of the Trade Union, Cambridge: Cambridge University Press.

[9] Boulhol, H., S. Dobbelaere and S. Maioli, 2006, Imports as Product and Labor Market Discipline, IZA Discussion Paper 2178, Institute for the Study of Labor, Bonn.

[10] Brander, J. A. and B. J. Spencer, 1985, Export Subsidies and International Market Share Rivalry, Journal of International Economics, 18(1-2), 83-100.

[11] Bresnahan, T., 1989, Empirical Studies of Industries with Market Power, in: Schmalensee, R., Willig R. (Eds.), Handbook of Industrial Organization, vol. 2, Amsterdam: North Holland.

[12] Bughin, J., 1996, Trade Unions and Firms' Product Market Power, The Journal of Industrial Economics, XLIV(3), 289-307.

[13] Crépon, B., R. Desplatz and J. Mairesse, 1999, Estimating Price-Cost Margins, Scale Economies and Workers' Bargaining Power at the Firm Level, CREST Working Paper G9917, Centre de Recherche en Economie et Statistique.

[14] Crépon, B., R. Desplatz and J. Mairesse, 2002, Price-Cost Margins and Rent Sharing: Evidence from a Panel of French Manufacturing Firms, Centre de Recherche en Economie et Statistique, revised version.

[15] Dobbelaere, S., 2004, Estimation of Price-Cost Margins and Union Bargaining Power for Belgian Manufacturing, International Journal of Industrial Organization, 22(10), 1381-1398.

[16] Doornik, J.A., M. Arellano and S. Bond, 2002, Panel Data Estimation using DPD for Ox, Nuffield College, Oxford.

[17] Griliches, Z. and J. Mairesse, 1998, Production Functions: The Search for Identification, in: Strom, S. (Ed.), Essays in Honour of Ragnar Frisch, Econometric Society Monograph Series, Cambridge: Cambridge University Press.

[18] Hall, R.E., 1988, The Relationship between Price and Marginal Cost in US Industry, Journal of Political Economy, 96, 921-947.

[19] Hildreth, C. and H. Houck, 1968, Some Estimates for a Linear Model with Random Coefficients, Journal of the American Association, 63, 584-595.

[20] Horn, H. and A. Wolinsky, 1988, Worker Substitutability and Patterns of Unionisation, The Economic Journal, 98(391), 484-497.

[21] Koenker, R. and G. Bassett, 1978, Regression Quantiles, Econometrica, 46, 33-50.

[22] Krugman, P., 1979, Increasing Returns, Monopolistic Competition and International Trade, Journal of International Economics, 9(4), 469-479.

[23] Leamer, E.E., 1978, Specification Searches: Ad hoc Inference with Nonexperimental Data, New York: John Wiley and Sons.

[24] MaCurdy, T., 1985, A Guide to Applying Time Series Models to Panel Data, Stanford, CA: Stanford University.

[25] Mairesse, J. and Z. Griliches, 1990, Heterogeneity in Panel Data: Are there Stable Production Functions?, in: Champsaur, P., Deleau, M., Grandmont, J.M., Laroque, G., Guesnerie, R., Henry, C., Laffont, J.J., Mairesse, J., Monfort, A., Younes, Y. (Eds.), Essays in Honor of Edmond Malinvaud, vol. 3, Cambridge, MA: MIT Press.

[26] Manning, A., 2003, Monopsony in Motion: Imperfect Competition in Labor Markets, Princeton: Princeton University Press.

[27] Marschak, J. and W.H. Andrews, 1944, Random Simultaneous Equations and the Theory of Production, Econometrica, 12(3-4), 143-205.

[28] McDonald, I.M. and R.M. Solow, 1981, Wage bargaining and employment, American Economic Review, 71(5), 896-908.

[29] Neven, D.J., L. Röller and Z. Zhang, 2002, Endogenous Costs and Price-Costs Margins, DIW Berlin Discussion Paper 294, German Institute for Economic Research, Berlin.

[30] Nickell, S., 1999, Product Markets and Labour Markets, Labour Economics, 6(1), 1-20.

[31] OECD, 2005, OECD Science, Technology and Industry Scoreboard 2005, Organisation for Economic Co-operation and Development, www.oecd.org/sti/scoreboard.

[32] Roodman, D., 2005, xtabond2: Stata Module to Extend xtabond Dynamic Panel Data Estimator. Center for Global Development, Washington.

[33] Schmalensee, R., 1989, Inter-industry Studies of Structure and Performance, in: Schmalensee, R., Willig R.(Eds.), Handbook of Industrial Organization, vol.2, Amsterdam: North Holland.

[34] Swamy, P.A.V.B., 1970, Efficient Inference in a Random Coefficient Model, Econometrica, 38, 311-323.

[35] Veugelers, R., 1989, Wage Premia, Price Cost Margins and Bargaining Power in Belgian Manufacturing, European Economic Review, 33(1), 169-180.

[36] Woolridge, J., 2002, Econometric Analysis of Cross sections and Panel Data, Cambridge, MA: MIT Press.

Table 1
Summary statistics

Variables	1978-2001				
	Mean	Sd.	Q_1	Q_3	N
Real firm output growth rate Δq	0.021	0.152	-0.061	0.103	154363
Labor growth rate Δn	0.006	0.123	-0.043	0.054	154363
Capital growth rate Δk	-0.001	0.151	-0.072	0.060	154363
Materials growth rate Δm	0.040	0.192	-0.060	0.139	154363
Labor share in nominal output α_N	0.307	0.136	0.208	0.387	165009
Materials share in nominal output α_M	0.503	0.159	0.399	0.614	165009
$\Delta q - \Delta k$	0.022	0.188	-0.081	0.126	154363
$\Delta n - \Delta k$	0.007	0.166	-0.073	0.088	154363
$\Delta m - \Delta k$	0.041	0.220	-0.079	0.160	154363

Table 2
Estimates of output elasticities $\widehat{\varepsilon}_J^Q$ $(J = N, M, K)$, mark-up $\hat{\mu}$ $(only)$ and extent of rent sharing $\hat{\phi}$:
Full sample: 10646 firms, each firm between 12 and 24 years of observations - Period 1978-2001
Part 1: Imposing constant returns to scale: $\widehat{\varepsilon}_K^Q = 1 - \widehat{\varepsilon}_N^Q - \widehat{\varepsilon}_M^Q$

	STATIC SPECIFICATION				DYNAMIC SPECIFICATION	
	OLS LEVELS	**OLS DIF**	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$
$\widehat{\varepsilon}_N^Q$	0.331	0.298	0.138	0.298	0.134	0.201
	(0.003)	(0.003)	(0.020)	(0.008)	(0.032)	(0.015)
$\widehat{\varepsilon}_M^Q$	0.592	0.587	0.726	0.675	0.595	0.541
	(0.003)	(0.003)	(0.017)	(0.007)	(0.022)	(0.019)
$\widehat{\varepsilon}_K^Q$	0.077	0.115	0.137	0.027	0.271	0.258
λ	1	1	1	1	1	1
$\widehat{\mu}\, only = \frac{\widehat{\mu}\, only}{\lambda}$	1.144	1.112	1.129	1.211	1.041	0.934
	(0.003)	(0.002)	(0.013)	(0.007)	(0.032)	(0.020)
$\widehat{\mu} = \frac{\widehat{\mu}}{\lambda}$	1.177	1.167	1.443	1.342	1.184	1.076
	(0.007)	(0.005)	(0.033)	(0.015)	(0.043)	(0.039)
$\widehat{\phi}$	0.393	0.440	0.619	0.490	0.605	0.534
	(0.006)	(0.004)	(0.009)	(0.008)	(0.018)	(0.015)
$\widehat{\rho}$					0.713	0.619
					(0.023)	(0.018)

Part 2: Not imposing constant returns to scale: $\widehat{\varepsilon}_K^Q = \widehat{\lambda} - \widehat{\varepsilon}_N^Q - \widehat{\varepsilon}_M^Q$

	STATIC SPECIFICATION				DYNAMIC SPECIFICATION	
	OLS LEVELS	**OLS DIF**	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$
$\widehat{\varepsilon}_N^Q$	0.331	0.189	0.149	0.240	0.111	0.057
	(0.001)	(0.002)	(0.022)	(0.011)	(0.031)	(0.025)
$\widehat{\varepsilon}_M^Q$	0.592	0.554	0.566	0.696	0.554	0.562
	(0.001)	(0.002)	(0.020)	(0.008)	(0.023)	(0.020)
$\widehat{\varepsilon}_K^Q$	0.077	0.049	-0.027	0.033	0.033	0.241
	(0.002)	(0.003)	(0.038)	(0.017)	(0.057)	(0.027)
$\widehat{\lambda}$	1	0.792	0.688	0.969	0.803	0.860
	(0.0006)	(0.003)	(0.020)	(0.004)	(0.052)	(0.025)
$\widehat{\mu}\, only$	1.153	1.011	0.890	1.219	1.011	0.916
	(0.004)	(0.004)	(0.022)	(0.008)	(0.035)	(0.033)
$\frac{\widehat{\mu}\, only}{\widehat{\lambda}}$	1.145	1.189	1.398	1.212	1.074	0.897
	(0.003)	(0.003)	(0.035)	(0.007)	(0.054)	(0.022)
$\widehat{\mu}$	1.177	1.102	1.126	1.383	1.100	1.117
	(0.002)	(0.004)	(0.039)	(0.016)	(0.046)	(0.041)
$\widehat{\phi}$	0.395	0.552	0.589	0.549	0.615	0.651
	(0.002)	(0.002)	(0.015)	(0.007)	(0.017)	(0.011)
$\frac{\widehat{\mu}}{\widehat{\lambda}}$	1.178	1.392	1.637	1.427	1.371	1.299
	(0.002)	(0.006)	(0.055)	(0.020)	(0.088)	(0.057)
$\widehat{\rho}$					0.723	0.609
					(0.023)	(0.020)

Robust standard errors and first-step robust standard errors in columns 1-2 and columns 3-6 respectively.
Time dummies are included but not reported.
(1) Input shares: $\alpha_N = 0.307$, $\alpha_M = 0.503$, $\alpha_K = 0.190$.
(2) $GMM\,DIF$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and $(t-3)$.
(3) $GMM\,SYS$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and $(t-3)$ in the first-differenced equations and correspondingly the lagged first-differences of n, m and k dated $(t-1)$ in the levels equations.

Table 3

Summary industry analysis: Estimated industry-level output elasticities $\widehat{\varepsilon}^{Q}_{J_j}$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ $(only)$ and extent of rent sharing $\hat{\phi}_j$ [a]

				OLS DIF						
	α_{N_j}	α_{M_j}	α_{K_j}	$\widehat{\varepsilon}^{Q}_{Nj}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$
$\widehat{\mu}_j \geq 1 \quad \vee \quad \widehat{\phi}_j \in [0,1]$ **[24 industries]**[b]										
Industry mean	0.323	0.495	0.182	0.300 (0.014)	0.586 (0.012)	0.113 (0.011)	1.111 (0.013)	**1.188 (0.023)**	**0.399 (0.088)**	**0.257 (0.052)**
Industry Q_1	0.285	0.470	0.165	0.274 (0.011)	0.557 (0.009)	0.091 (0.009)	1.075 (0.011)	**1.152 (0.020)**	**0.154 (0.059)**	**0.134 (0.029)**
Industry median	0.322	0.487	0.180	0.292 (0.014)	0.581 (0.011)	0.107 (0.011)	1.113 (0.013)	**1.175 (0.022)**	**0.365 (0.077)**	**0.267 (0.036)**
Industry Q_3	0.343	0.529	0.202	0.330 (0.016)	0.637 (0.014)	0.130 (0.014)	1.143 (0.016)	**1.219 (0.028)**	**0.633 (0.114)**	**0.388 (0.077)**
$\widehat{\phi}_j = 0 \quad \vee \quad \widehat{\mu}_j$ *only* ≥ 1 **[14 industries]**[c]										
Industry mean	0.239	0.560	0.201	0.321 (0.019)	0.570 (0.018)	0.108 (0.015)	**1.083 (0.020)**	1.022 (0.032)	-0.367 (0.137)	-0.783 (0.538)
Industry Q_1	0.201	0.530	0.188	0.279 (0.016)	0.532 (0.015)	0.091 (0.013)	**1.058 (0.016)**	0.974 (0.028)	-0.594 (0.115)	-1.464 (0.168)
Industry median	0.240	0.548	0.203	0.338 (0.021)	0.553 (0.019)	0.104 (0.016)	**1.085 (0.020)**	1.017 (0.033)	-0.370 (0.141)	-0.593 (0.385)
Industry Q_3	0.300	0.579	0.219	0.365 (0.022)	0.638 (0.021)	0.123 (0.017)	**1.102 (0.025)**	1.053 (0.037)	-0.212 (0.157)	-0.270 (0.942)
Full sample [38 industries]										
Industry mean	0.292	0.519	0.189	0.308 (0.016)	0.580 (0.014)	0.111 (0.013)	1.101 (0.016)	1.125 (0.027)	0.117 (0.106)	-0.126 (0.231)
Industry Q_1	0.257	0.480	0.170	0.275 (0.012)	0.541 (0.010)	0.091 (0.010)	1.066 (0.011)	1.041 (0.021)	-0.230 (0.073)	-0.299 (0.034)
Industry median	0.305	0.516	0.187	0.302 (0.016)	0.573 (0.013)	0.106 (0.013)	1.092 (0.015)	1.150 (0.025)	0.136 (0.106)	0.120 (0.077)
Industry Q_3	0.333	0.552	0.213	0.340 (0.020)	0.638 (0.017)	0.123 (0.016)	1.135 (0.019)	1.188 (0.033)	0.489 (0.138)	0.328 (0.242)

				GMM SYS $(t-2)(t-3)$						
	α_{N_j}	α_{M_j}	α_{K_j}	$\widehat{\varepsilon}^{Q}_{Nj}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$
$\widehat{\mu}_j \geq 1 \quad \vee \quad \widehat{\phi}_j \in [0,1]$ **[26 industries]**[b]										
Industry mean	0.311	0.502	0.187	0.312 (0.034)	0.645 (0.030)	0.043 (0.026)	1.193 (0.031)	**1.291 (0.060)**	**0.389 (0.196)**	**0.243 (0.119)**
Industry Q_1	0.265	0.470	0.170	0.267 (0.030)	0.606 (0.025)	0.018 (0.022)	1.147 (0.025)	**1.249 (0.048)**	**0.065 (0.132)**	**0.061 (0.056)**
Industry median	0.322	0.493	0.182	0.304 (0.035)	0.657 (0.030)	0.040 (0.026)	1.191 (0.031)	**1.278 (0.059)**	**0.415 (0.196)**	**0.292 (0.108)**
Industry Q_3	0.341	0.529	0.208	0.359 (0.039)	0.682 (0.034)	0.075 (0.030)	1.244 (0.036)	**1.328 (0.072)**	**0.536 (0.239)**	**0.349 (0.164)**
$\widehat{\phi}_j = 0 \quad \vee \quad \widehat{\mu}_j$ *only* ≥ 1 **[11 industries]**[c]										
Industry mean	0.255	0.552	0.193	0.347 (0.043)	0.624 (0.038)	0.029 (0.035)	**1.193 (0.042)**	1.133 (0.069)	-0.273 (0.290)	-0.468 (0.672)
Industry Q_1	0.230	0.530	0.152	0.328 (0.039)	0.581 (0.035)	-0.003 (0.027)	**1.157 (0.033)**	1.081 (0.060)	-0.488 (0.198)	-0.955 (0.267)
Industry median	0.258	0.553	0.202	0.341 (0.042)	0.626 (0.038)	0.028 (0.030)	**1.186 (0.037)**	1.115 (0.067)	-0.262 (0.226)	-0.356 (0.419)
Industry Q_3	0.312	0.579	0.229	0.364 (0.047)	0.652 (0.042)	0.055 (0.048)	**1.228 (0.058)**	1.170 (0.076)	-0.109 (0.386)	-0.122 (0.894)
Full sample [38 industries][d]										
Industry mean	0.292	0.519	0.189	0.325 (0.037)	0.637 (0.033)	0.038 (0.029)	1.189 (0.035)	1.236 (0.063)	0.154 (0.227)	0.173 (0.463)
Industry Q_1	0.257	0.480	0.170	0.295 (0.032)	0.600 (0.027)	0.009 (0.024)	1.147 (0.026)	1.149 (0.052)	-0.109 (0.153)	-0.039 (0.084)
Industry median	0.305	0.516	0.187	0.331 (0.039)	0.638 (0.032)	0.028 (0.028)	1.187 (0.033)	1.254 (0.063)	0.071 (0.210)	0.112 (0.164)
Industry Q_3	0.333	0.552	0.213	0.359 (0.042)	0.676 (0.039)	0.075 (0.035)	1.243 (0.039)	1.312 (0.074)	0.503 (0.290)	0.337 (0.289)

Robust standard errors (OLS DIF) and first-step robust standard errors (GMM SYS) in parentheses.

[a] Detailed information on the industry-level estimates is presented in Table A.3.a in Appendix.

[b] These subsamples have 21 industries in common.

[c] The intersection between the two subsamples contains 8 industries.

[d] For industry 1, $\widehat{\phi}_j > 1$, but insignificantly so.

Table 4
Heterogeneity of firm output elasticities $\widehat{\varepsilon}^{Q}_{J_i}$ $(J = N, M, K)$, mark-up $\hat{\mu}_i$ $(only)$ and extent of rent sharing $\hat{\phi}_i$:
Different indicators and first-differenced OLS estimates[a]

	α_{N_i}	α_{M_i}	α_{K_i}	$\widehat{\varepsilon}^{Q}_{N_i}$	$\widehat{\varepsilon}^{Q}_{M_i}$	$\widehat{\varepsilon}^{Q}_{K_i}$	$\hat{\mu}_i$ *only*	$\hat{\mu}_i$	$\widehat{\gamma}_i$	$\hat{\phi}_i$
$\widehat{\mu}_i \geq 1 \ \vee \ \widehat{\phi}_i \in [0,1]$ **[5906 firms]**										
Simple mean	0.335	0.489	0.175	0.132	0.736	0.131	1.148	**1.580**	**1.859**	**0.544**
Observed dispersion $\widehat{\sigma}_o$	(0.130)	(0.138)	(0.089)	(0.224)	(0.197)	(0.205)	(0.276)	**(0.533)**	**(1.759)**	**(0.214)**
True dispersion $\widehat{\sigma}_{true}$	[0.130]	[0.134]	[0.084]	[0.063]	[0.114]	[0.084]	[0.173]	**[0.315]**	**[1.126]**	**[0]**
Weighted mean	0.368	0.559	0.251	0.132	0.730	0.080	1.137	**1.367**	**1.328**	**0.813**
Weighted observed dispersion $\widehat{\sigma}_o$	(0.138)	(0.141)	(0.138)	(0.167)	(0.184)	(0.141)	(0.170)	**(0.295)**	**(1.175)**	**(0.114)**
Weighted true dispersion $\widehat{\sigma}_{true}$	[0.138]	[0.141]	[0.138]	[0.122]	[0.158]	[0.109]	[0.134]	**[0.237]**	**[1.104]**	**[0.109]**
Median	0.322	0.495	0.150	0.137	0.737	0.111	1.134	**1.442**	**1.384**	**0.580**
Interquartile observed dispersion $\widehat{\sigma}_o$	(0.138)	(0.158)	(0.105)	(0.192)	(0.195)	(0.173)	(0.212)	**(0.387)**	**(1.391)**	**(0.237)**
Robust true dispersion $\widehat{\sigma}_{true}$	[0.138]	[0.155]	[0.100]	[0.109]	[0.148]	[0.109]	[0.141]	**[0.279]**	**[1.158]**	**[0.202]**
$\widehat{\phi}_i = 0 \ \vee \ \widehat{\mu}_i$ *only* ≥ 1 **[1239 firms]**										
Simple mean	0.252	0.508	0.239	0.417	0.594	-0.012	**1.298**	1.186	-0.437	-4.687
Observed dispersion $\widehat{\sigma}_o$	(0.100)	(0.134)	(0.118)	(0.158)	(0.164)	(0.167)	**(0.277)**	(0.239)	(0.286)	(26.192)
True dispersion $\widehat{\sigma}_{true}$	[0.100]	[0.130]	[0.114]	[0]	[0]	[0]	**[0.167]**	[0]	[0]	[0]
Weighted mean	0.275	0.590	0.352	0.366	0.621	0.007	**1.187**	1.137	-0.282	-0.139
Weighted observed dispersion $\widehat{\sigma}_o$	(0.109)	(0.141)	(0.158)	(0.148)	(0.161)	(0.114)	**(0.170)**	(0.155)	(0.257)	(0.192)
Weighted true dispersion $\widehat{\sigma}_{true}$	[0.109]	[0.141]	[0.158]	[0.071]	[0.130]	[0.063]	**[0.141]**	[0]	[0]	[0]
Median	0.241	0.520	0.201	0.402	0.593	0.008	**1.222**	1.134	-0.416	-0.712
Interquartile observed dispersion $\widehat{\sigma}_o$	(0.109)	(0.170)	(0.152)	(0.152)	(0.167)	(0.134)	**(0.224)**	(0.192)	(0.366)	(1.340)
Robust true dispersion $\widehat{\sigma}_{true}$	[0.109]	[0.167]	[0.148]	[0]	[0.105]	[0]	**[0.167]**	[0]	[0]	[0]
Full sample [10646 firms]										
Simple mean	0.307	0.503	0.190	0.288	0.599	0.112	1.097	1.238	-0.880	0.583
Observed dispersion $\widehat{\sigma}_o$	(0.126)	(0.138)	(0.100)	(0.305)	(0.257)	(0.241)	(0.310)	(0.610)	(56)	(18)
True dispersion $\widehat{\sigma}_{true}$	[0.126]	[0.134]	[0.095]	[0.195]	[0.195]	[0.130]	[0.212]	[0.443]	[0]	[0]
Weighted mean	0.339	0.570	0.278	0.222	0.627	0.071	1.107	1.172	1.129	0.822
Weighted observed dispersion $\widehat{\sigma}_o$	(0.138)	(0.141)	(0.148)	(0.232)	(0.234)	(0.161)	(0.195)	(0.373)	(1.272)	(0.122)
Weighted true dispersion $\widehat{\sigma}_{true}$	[0.138]	[0.141]	[0.148]	[0.197]	[0.212]	[0.126]	[0.161]	[0.327]	[1.167]	[0.114]
Median	0.291	0.510	0.160	0.262	0.613	0.094	1.096	1.200	0.528	0.617
Interquartile observed dispersion $\widehat{\sigma}_o$	(0.134)	(0.161)	(0.114)	(0.277)	(0.261)	(0.197)	(0.245)	(0.457)	(1.950)	(0.435)
Robust true dispersion $\widehat{\sigma}_{true}$	[0.134]	[0.158]	[0.109]	[0.217]	[0.226]	[0.138]	[0.184]	[0.367]	[1.578]	[0.348]

[a] Detailed information on the firm-level estimates is presented in Table A.4 in Appendix.

Table 5

Within-industry dispersion: Weighted mean and Swamy estimate of weighted true standard deviation ($\widehat{\boldsymbol{\sigma}}_{true}$) of $\widehat{\varepsilon}^{Q}_{J_{ij}}$, mark-up $\hat{\mu}_{ij}(only)$ and extent of rent sharing $\hat{\phi}_{ij}$ [a]

	OLS DIF						
	$\widehat{\varepsilon}^{Q}_{N_{ij}}$	$\widehat{\varepsilon}^{Q}_{M_{ij}}$	$\widehat{\varepsilon}^{Q}_{K_{ij}}$	$\hat{\mu}_{ij}$ *only*	$\hat{\mu}_{ij}$	$\widehat{\gamma}_{ij}$	$\hat{\phi}_{ij}$
24 industries							
Industry mean	0.236 [0.012]	0.625 [0.012]	0.076 [0.010]	1.106 [0.010]	**1.194 [0.020]**	**1.146 [0.072]**	**0.792 [0.007]**
Industry Q_1	0.207 [0.009]	0.580 [0.010]	0.057 [0.008]	1.082 [0.008]	**1.161 [0.015]**	**0.979 [0.045]**	**0.757 [0.004]**
Industry median	0.224 [0.011]	0.628 [0.011]	0.073 [0.010]	1.108 [0.009]	**1.194 [0.017]**	**1.130 [0.067]**	**0.779 [0.007]**
Industry Q_3	0.266 [0.014]	0.664 [0.014]	0.087 [0.012]	1.117 [0.012]	**1.231 [0.021]**	**1.293 [0.090]**	**0.853 [0.008]**
Correlation with industry estimates[b]	0.750 [0.845]	0.791 [0.785]	0.626 [0.884]	0.565 [0.897]	0.455 [0.798]	0.670 [0.823]	0.316 [0.653]
14 industries							
Industry mean	0.227 [0.015]	0.635 [0.018]	0.062 [0.013]	**1.106 [0.013]**	1.085 [0.024]	0.682 [0.066]	0.776 [0.013]
Industry Q_1	0.165 [0.012]	0.574 [0.014]	0.047 [0.010]	**1.088 [0.011]**	1.055 [0.020]	0.534 [0.047]	0.718 [0.009]
Industry median	0.234 [0.015]	0.630 [0.017]	0.059 [0.012]	**1.102 [0.012]**	1.085 [0.023]	0.678 [0.066]	0.788 [0.010]
Industry Q_3	0.289 [0.019]	0.680 [0.020]	0.074 [0.015]	**1.109 [0.014]**	1.097 [0.028]	0.813 [0.078]	0.820 [0.016]
Correlation with industry estimates[b]	0.889 [0.753]	0.841 [0.694]	-0.046 [0.657]	0.266 [0617]	0.273 [0.438]	0.689 [0.293]	0.484 [0.621]
38 industries							
Industry mean	0.232 [0.013]	0.629 [0.014]	0.071 [0.011]	1.106 [0.011]	1.154 [0.021]	0.975 [0.070]	0.786 [0.009]
Industry Q_1	0.199 [0.010]	0.577 [0.011]	0.051 [0.009]	1.086 [0.008]	1.085 [0.016]	0.686 [0.046]	0.757 [0.005]
Industry median	0.224 [0.013]	0.630 [0.013]	0.069 [0.010]	1.106 [0.011]	1.161 [0.019]	1.005 [0.066]	0.780 [0.008]
Industry Q_3	0.273 [0.016]	0.669 [0.017]	0.083 [0.013]	1.117 [0.014]	1.221 [0.026]	1.242 [0.081]	0.837 [0.010]
Correlation with sector estimates[b]	0.789 [0.828]	0.793 [0.830]	0.470 [0.812]	0.460 [0.761]	0.712 [0.680]	0.795 [0.471]	0.318 [0.732]

[a] Detailed information on the within-industry estimates is presented in Table A.5 in Appendix.

[b] Estimates reported in Table A.3.a, Part 1-2.

Table 6
Determinants of firm-level $\ln(\hat{\mu}_i\, only - 1)$, $\ln(\hat{\mu}_i - 1)$ and $\ln(\widehat{\gamma}_i)$:
OLS, WLS and median regression coefficients

Variables	n_i	$capint_i$	$mixentr_i$	$rdentr_i$	$dist_i$
$\hat{\boldsymbol{\beta}}_{OLS}$					
$\ln(\hat{\mu}_i\ only - 1)$	0.040	-0.023	0.083	-0.087	-0.512***
	(0.031)	(0.054)	(0.085)	(0.157)	(0.111)
$\ln(\hat{\mu}_i - 1)$	-0.048***	0.066***	-0.143***	-0.101	0.158***
	(0.014)	(0.021)	(0.047)	(0.080)	(0.047)
$\ln(\widehat{\gamma}_i)$	-0.210***	-0.088***	-0.226***	-0.419***	0.949***
	(0.015)	(0.023)	(0.049)	(0.084)	(0.051)
$\hat{\boldsymbol{\beta}}_{WLS}$					
$\ln(\hat{\mu}_i\ only - 1)$	-0.058	-0.031	-0.020	-0.159*	-0.065
	(0.049)	(0.054)	(0.075)	(0.084)	(0.128)
$\ln(\hat{\mu}_i - 1)$	-0.048***	0.140***	-0.097*	-0.179***	0.251***
	(0.016)	(0.025)	(0.055)	(0.070)	(0.058)
$\ln(\widehat{\gamma}_i)$	-0.191***	-0.127***	-0.299***	-0.508***	0.750***
	(0.029)	(0.047)	(0.095)	(0.087)	(0.115)
$\hat{\boldsymbol{\beta}}(\mathbf{0.50})$					
$\ln(\hat{\mu}_i\ only - 1)$	0.081	0.025	0.110	0.247*	-0.513***
	(0.026)	(0.070)	(0.100)	(0.146)	(0.115)
$\ln(\hat{\mu}_i - 1)$	-0.032**	0.105***	-0.069	-0.047	0.182***
	(0.015)	(0.018)	(0.052)	(0.090)	(0.054)
$\ln(\widehat{\gamma}_i)$	-0.222***	-0.096***	-0.234***	-0.418***	0.942***
	(0.014)	(0.023)	(0.055)	(0.094)	(0.050)

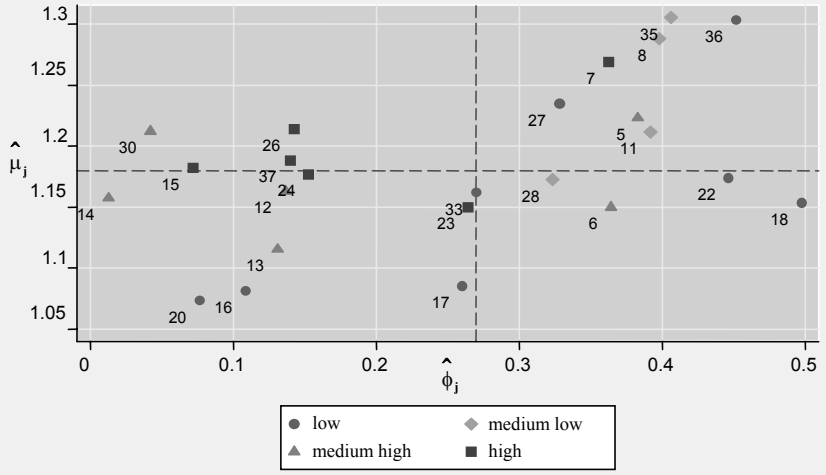
*** Significant at 1%; ** Significant at 5%; * Significant at 10%. Robust standard errors in parentheses.

(1) The vector of $\ln(\widehat{\mu}_i\ only - 1)$ includes 1239 estimates, the vector of $\ln(\widehat{\mu}_i - 1)$ or $\ln(\widehat{\gamma}_i)$ consists of 5906 estimates.

(2) The dependent and the explanatory variables are centered around the industry mean.

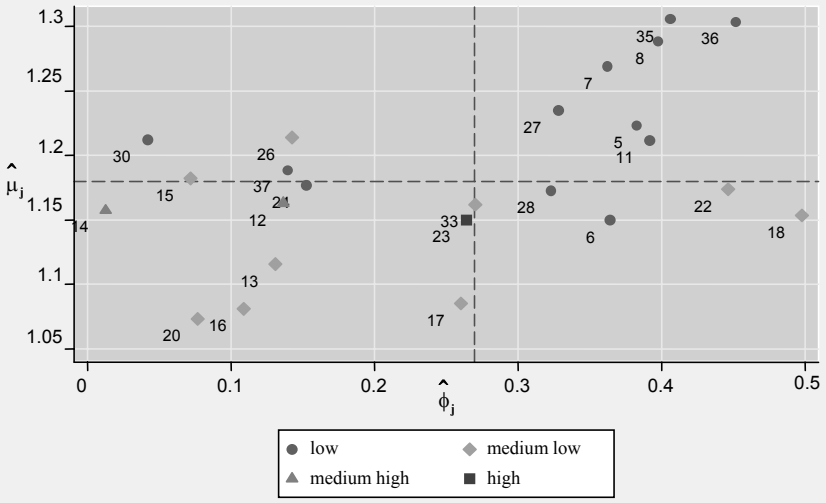
(3) The coefficients are for single firm-level variable regressions (including industry dummies), except for the regression including the R&D identifier which includes two firm-level variables ($mixentr_i$ and $rdentr_i$) and industry dummies.

Graph 1 Profitability differences across industries



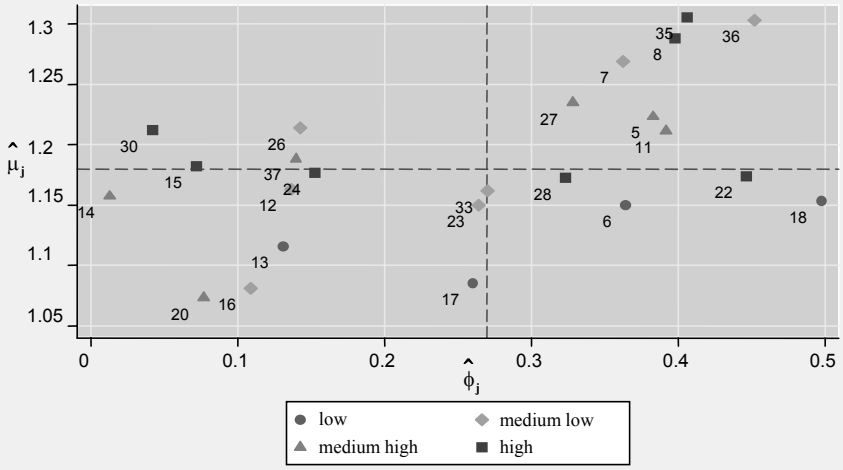
Source: Table A.3.a [Part 1] estimates

Graph 2 Technology differences across industries



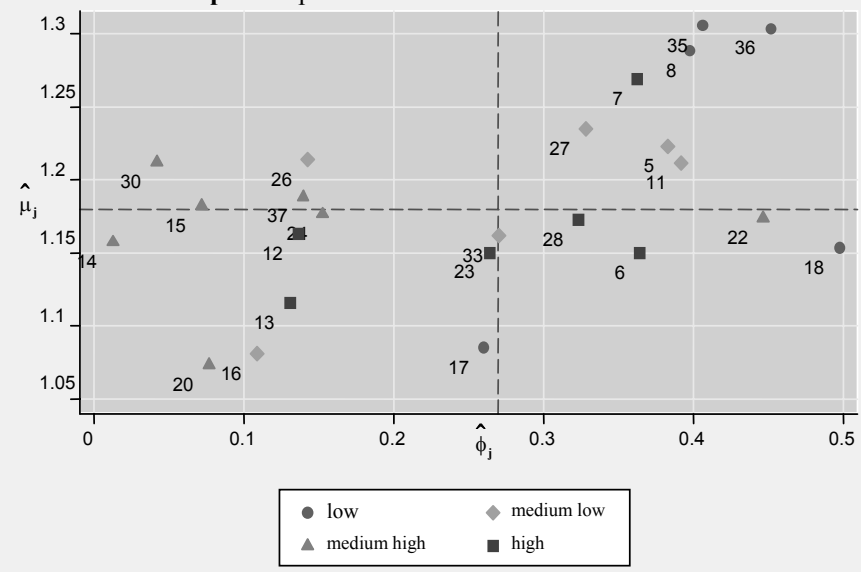
Source: Table A.3.a [Part 1] estimates

Graph 3 Unionization differences across industries



Source: Table A.3.a [Part 1] estimates

Graph 4 Openness differences across industries



Source: Table A.3.a [Part 1] estimates

Appendix A: Detailed results

Table A.1
Estimates of output elasticities $\widehat{\varepsilon}_J^Q$ $(J = N, M, K)$, mark-up $\hat{\mu}$ $(only)$ and extent of rent sharing $\hat{\phi}$:
Balanced sample: 473 firms, each firm 24 years of observations - Period 1978-2001

	STATIC SPECIFICATION				DYNAMIC SPECIFICATION	
	OLS LEVELS	**OLS DIF**	**GMM DIF** $(t-2)$	**GMM SYS** $(t-2)$	**GMM DIF** $(t-2)$	**GMM SYS** $(t-2)$
$\widehat{\varepsilon}_N^Q$	0.257	0.320	0.134	0.241	0.302	0.262
	(0.016)	(0.011)	(0.067)	(0.022)	(0.032)	(0.028)
$\widehat{\varepsilon}_M^Q$	0.646	0.586	0.664	0.666	0.602	0.628
	(0.015)	(0.011)	(0.051)	(0.022)	(0.023)	(0.023)
$\widehat{\varepsilon}_K^Q$	0.097	0.094	0.202	0.093	0.096	0.110
λ	1	1	1	1	1	1
$\widehat{\mu}\, only = \frac{\widehat{\mu}\, only}{\lambda}$	1.208	1.190	1.121	1.213	1.204	1.159
	(0.014)	(0.011)	(0.042)	(0.023)	(0.026)	(0.028)
$\widehat{\mu} = \frac{\widehat{\mu}}{\lambda}$	1.319	1.197	1.357	1.359	1.230	1.282
	(0.031)	(0.023)	(0.105)	(0.045)	(0.048)	(0.048)
$\widehat{\phi}$	0.345	0.182	0.481	0.374	0.230	0.328
	(0.024)	(0.033)	(0.053)	(0.029)	(0.068)	(0.044)
$\widehat{\rho}$					0.712	0.390
					(0.022)	(0.035)

Robust standard errors and first-step robust standard errors in columns 1-2 and columns 3-6 respectively.
Time dummies are included but not reported.
(1) $\widehat{\varepsilon}_K^Q = 1 - \widehat{\varepsilon}_N^Q - \widehat{\varepsilon}_M^Q$.
(2) Input shares: $\alpha_N = 0.270,\ \alpha_M = 0.490,\ \alpha_K = 0.240$.
(3) $GMM\ DIF$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and earlier.
(4) $GMM\ SYS$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and earlier in the first-differenced equations and the lagged first-differences of n, m and k dated $(t-1)$ in the levels equations.

Table A.2
Industry repartition

Industry	Code	Name	Profit.[a] type	Tech.[b] type	Union.[c] type	Imp.[d] type	# Obs. (# Firms)
Ind 1	B01	Meat preparations	L	L	ML	L	4881 (324)
Ind 2	B02	Milk products	L	L	MH	L	1981 (122)
Ind 3	B03	Beverages	H	L	H	L	1705 (106)
Ind 4	B04	Food production for animals	MH	L	L	L	1942 (126)
Ind 5	B05-B06	Other food products	MH	L	MH	ML	7835 (518)
Ind 6	C11	Clothing and skin goods	MH	L	L	H	6938 (453)
Ind 7	C12	Leather goods and footwear	H	L	ML	H	3400 (213)
Ind 8	C20	Publishing, (re)printing	ML	L	H	L	10919 (724)
Ind 9	C31	Pharmaceutical products	H	H	L	ML	2153 (130)
Ind 10	C32	Soap, perfume and maintenance products	ML	MH	L	L	1877 (114)
Ind 11	C41	Furniture	ML	L	MH	ML	5043 (322)
Ind 12	C42, C44-C46	Accommodation equipment	MH	MH	ML	H	2871 (179)
Ind 13	C43	Sport articles, games and other products	MH	ML	L	H	2390 (156)
Ind 14	D01	Motor vehicles	MH	MH	MH	MH	2064 (133)
Ind 15	D02	Transport equipment	H	ML	H	MH	2177 (129)
Ind 16	E11-E14	Ship building, aircraft and railway construction	L	ML	ML	ML	1834 (110)
Ind 17	E21	Metal products for construction	L	ML	L	L	2590 (171)
Ind 18	E22	Ferruginous and steam boilers	L	ML	L	L	4461 (294)
Ind 19	E23	Mechanical equipment	MH	MH	ML	H	3020 (182)
Ind 20	E24	Machinery for general usage	L	ML	MH	MH	4151 (268)
Ind 21	E25-E26	Agriculture machinery	ML	ML	ML	H	2391 (154)
Ind 22	E27-E28	Other machinery for specific usage	L	ML	H	MH	4355 (286)
Ind 23	E31-E35	Electric and electronic machinery	H	H	ML	H	2934 (203)
Ind 24	F11-F12	Mineral products	H	L	H	MH	3099 (205)
Ind 25	F13	Glass products	H	ML	H	ML	1681 (104)
Ind 26	F14	Earthenware products and construction material	H	ML	ML	ML	6109 (391)
Ind 27	F21	Textile art	L	L	MH	ML	4338 (270)
Ind 28	F22-F23	Textile products and clothing	ML	L	H	H	4858 (310)
Ind 29	F31	Wooden products	ML	L	L	ML	7170 (475)
Ind 30	F32-F33	Paper and printing products	MH	L	H	MH	5312 (330)
Ind 31	F41-F42	Mineral and organic chemical products	ML	MH	MH	H	3026 (192)
Ind 32	F43-F45	Parachemical and rubber products	MH	MH	H	MH	2759 (171)
Ind 33	F46	Transformation of plastic products	L	ML	ML	ML	9037 (600)
Ind 34	F51-F52	Steel products, non-ferrous metals	ML	ML	MH	H	2024 (125)
Ind 35	F53	Ironware	ML	L	H	L	2247 (138)
Ind 36	F54	Industrial service to metal products	L	L	ML	L	14930 (1000)
Ind 37	F55-F56	Metal products, recuperation	H	L	MH	MH	9314 (599)
Ind 38	F61-F62	Electrical goods and components	MH	H	L	MH	5193 (319)

L: low-type, **ML**: medium low-type, **MH**: medium high-type, **H**: high-type.

[a] **L**: PCM $< 19\%$ (10 industries), **ML**: $19\% \leq$ PCM $< 22\%$ (9 industries), **MH**: $22\% \leq$ PCM $< 24\%$ (10 industries), **H**: PCM $\geq 24\%$ (9 industries).

[b] **L** (17 industries), **ML** (6 industries), **MH** (12 industries), **H** (3 industries).

[c] **L**: union density $< 6.7\%$ (9 industries), **ML**: $6.7\% \leq$ union density $< 10.2\%$ (10 industries), **MH**: $10.2\% \leq$ union density $< 12.9\%$ (9 industries), **H**: union density $\geq 12.9\%$ (10 industries).

[d] **L**: import penetration < 0.15 (10 industries), **ML**: $0.15 \leq$ import penetration < 0.27 (9 industries), **MH**: $0.27 \leq$ import penetration < 0.36 (10 industries), **H**: import penetration ≥ 0.36 (9 industries).

Table A.3.a

Industry analysis: Estimated industry-level output elasticities $\widehat{\varepsilon}^{Q}_{J_j}$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ $(only)$ and extent of rent sharing $\hat{\phi}_j$

Part 1: OLS DIF: $\widehat{\mu}_j \geq 1 \quad \vee \quad \widehat{\phi}_j \in [0,1]$ [24 industries]

					OLS DIF						
Industry	# Firms	α_{N_j}	α_{M_j}	α_{K_j}	$\widehat{\varepsilon}^{Q}_{N_j}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$
Ind 6	453	0.424	0.398	0.178	0.370 (0.011)	0.457 (0.008)	0.173 (0.009)	1.037 (0.011)	**1.150 (0.020)**	**0.573 (0.073)**	**0.364 (0.029)**
Ind 18	294	0.406	0.482	0.112	0.341 (0.011)	0.556 (0.008)	0.103 (0.010)	1.053 (0.011)	**1.153 (0.017)**	**0.992 (0.114)**	**0.498 (0.029)**
Ind 17	171	0.286	0.594	0.120	0.265 (0.016)	0.645 (0.013)	0.090 (0.014)	1.054 (0.015)	**1.085 (0.022)**	**0.352 (0.153)**	**0.261 (0.084)**
Ind 20	268	0.313	0.535	0.152	0.322 (0.015)	0.574 (0.012)	0.103 (0.012)	1.063 (0.013)	**1.073 (0.021)**	**0.083 (0.124)**	**0.077 (0.106)**
Ind 16	110	0.345	0.496	0.159	0.352 (0.021)	0.536 (0.015)	0.112 (0.018)	1.066 (0.019)	**1.081 (0.030)**	**0.122 (0.163)**	**0.109 (0.129)**
Ind 22	286	0.379	0.482	0.139	0.313 (0.015)	0.566 (0.011)	0.121 (0.013)	1.073 (0.014)	**1.174 (0.022)**	**0.808 (0.115)**	**0.477 (0.035)**
Ind 28	310	0.334	0.483	0.183	0.289 (0.012)	0.566 (0.011)	0.145 (0.010)	1.078 (0.012)	**1.173 (0.023)**	**0.478 (0.075)**	**0.324 (0.035)**
Ind 5	518	0.285	0.528	0.187	0.207 (0.009)	0.646 (0.011)	0.148 (0.008)	1.079 (0.011)	**1.223 (0.020)**	**0.621 (0.049)**	**0.383 (0.018)**
Ind 13	156	0.322	0.465	0.213	0.323 (0.018)	0.519 (0.017)	0.158 (0.017)	1.081 (0.021)	**1.115 (0.037)**	**0.151 (0.106)**	**0.131 (0.080)**
Ind 23	203	0.385	0.450	0.165	0.375 (0.018)	0.518 (0.014)	0.107 (0.016)	1.090 (0.018)	**1.150 (0.032)**	**0.360 (0.132)**	**0.264 (0.072)**
Ind 11	322	0.317	0.518	0.165	0.254 (0.011)	0.628 (0.011)	0.118 (0.010)	1.095 (0.012)	**1.211 (0.022)**	**0.645 (0.073)**	**0.392 (0.027)**
Ind 33	600	0.282	0.552	0.166	0.256 (0.008)	0.641 (0.008)	0.103 (0.007)	1.099 (0.008)	**1.162 (0.014)**	**0.370 (0.054)**	**0.270 (0.029)**
Ind 8	724	0.341	0.478	0.181	0.286 (0.008)	0.615 (0.008)	0.099 (0.005)	1.126 (0.007)	**1.288 (0.016)**	**0.661 (0.017)**	**0.398 (0.017)**
Ind 36	1000	0.385	0.443	0.172	0.317 (0.007)	0.577 (0.005	0.106 (0.005)	1.129 (0.006)	**1.303 (0.012)**	**0.825 (0.017)**	**0.452 (0.012)**
Ind 12	179	0.331	0.480	0.188	0.351 (0.016)	0.559 (0.014)	0.091 (0.012)	1.131 (0.015)	**1.163 (0.029)**	**0.158 (0.017)**	**0.136 (0.080)**
Ind 24	205	0.265	0.497	0.238	0.261 (0.016)	0.585 (0.012)	0.154 (0.014)	1.135 (0.016	**1.177 (0.024)**	**0.180 (0.068)**	**0.153 (0.049)**
Ind 7	213	0.334	0.470	0.197	0.281 (0.015)	0.596 (0.013)	0.123 (0.012)	1.138 (0.015)	**1.269 (0.027)**	**0.569 (0.076)**	**0.363 (0.031)**
Ind 27	270	0.309	0.514	0.178	0.274 (0.013)	0.634 (0.011)	0.091 (0.011)	1.143 (0.011)	**1.235 (0.022)**	**0.489 (0.078**	**0.328 (0.035)**
Ind 37	599	0.322	0.442	0.236	0.337 (0.010)	0.526 (0.009)	0.137 (0.008)	1.144 (0.012)	**1.188 (0.019)**	**0.162 (0.049)**	**0.140 (0.037)**
Ind 14	133	0.258	0.558	0.185	0.296 (0.020)	0.646 (0.017)	0.059 (0.014)	1.155 (0.017)	**1.157 (0.031)**	**0.013 (0.122)**	**0.013 (0.119)**
Ind 35	138	0.333	0.491	0.177	0.276 (0.017)	0.640 (0.016)	0.083 (0.015)	1.161 (0.018)	**1.306 (0.033)**	**0.685 (0.093)**	**0.406 (0.017)**
Ind 15	129	0.259	0.533	0.208	0.287 (0.017)	0.630 (0.014)	0.083 (0.014)	1.167 (0.016)	**1.182 (0.026)**	**0.078 (0.088)**	**0.072 (0.075)**
Ind 26	391	0.294	0.471	0.236	0.309 (0.012)	0.571 (0.011)	0.120 (0.010)	1.168 (0.013)	**1.214 (0.024)**	**0.166 (0.060)**	**0.143 (0.044)**
Ind 30	330	0.237	0.529	0.234	0.275 (0.012)	0.642 (0.012)	0.084 (0.008)	1.200 (0.011)	**1.212 (0.022)**	**0.044 (0.058)**	**0.042 (0.053)**
Total	8002	0.327	0.486	0.187	0.296 (0.002)	0.586 (0.002)	0.118	1.118 (0.003)	**1.206 (0.004)**	**0.998 (0.011)**	**0.499 (0.003)**

Table A.3.a (ctd)

Industry analysis: Estimated industry-level output elasticities $\widehat{\varepsilon}^{Q}_{J_j}$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ $(only)$ and extent of rent sharing $\hat{\phi}_j$

Part 2: OLS DIF: $\widehat{\phi}_j = 0 \quad \vee \quad \widehat{\mu}_j \; only \geq 1$ [14 industries]

					OLS DIF						
Industry	# Firms	α_{N_j}	α_{M_j}	α_{K_j}	$\widehat{\varepsilon}^{Q}_{N_j}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$
Ind 3	106	0.183	0.579	0.238	0.288 (0.022)	0.549 (0.021)	0.163 (0.021)	**1.027 (0.027)**	0.949 (0.036)	-0.503 (0.127)	-1.013 (0.514)
Ind 21	154	0.300	0.553	0.147	0.344 (0.021)	0.556 (0.016)	0.099 (0.016)	**1.037 (0.018)**	1.006 (0.030)	-0.284 (0.195)	-0.396 (0.380)
Ind 2	122	0.137	0.693	0.170	0.234 (0.022)	0.675 (0.026)	0.092 (0.016)	**1.049 (0.024)**	0.974 (0.037)	-0.605 (0.178)	-1.534 (1.145)
Ind 32	171	0.230	0.565	0.205	0.337 (0.021)	0.541 (0.019)	0.123 (0.015)	**1.058 (0.020)**	0.957 (0.034)	-0.594 (0.155)	-1.464 (0.942)
Ind 4	126	0.116	0.681	0.202	0.240 (0.022)	0.656 (0.027)	0.104 (0.017)	**1.061 (0.027)**	0.963 (0.039)	-0.656 (0.157)	-1.908 (1.331)
Ind 19	182	0.326	0.486	0.188	0.381 (0.019)	0.502 (0.015)	0.117 (0.014)	**1.070 (0.017)**	1.032 (0.031)	-0.230 (0.144)	-0.299 (0.242)
Ind 10	114	0.250	0.531	0.219	0.339 (0.021)	0.532 (0.019)	0.129 (0.015)	**1.080 (0.021)**	1.002 (0.036)	-0.405 (0.138)	-0.679 (0.389)
Ind 1	324	0.201	0.607	0.192	0.255 (0.012)	0.639 (0.014)	0.107 (0.009)	**1.090 (0.011)**	1.053 (0.022)	-0.212 (0.084)	-0.270 (0.135)
Ind 29	475	0.257	0.538	0.205	0.292 (0.010)	0.579 (0.010)	0.128 (0.008)	**1.090 (0.011)**	1.076 (0.019)	-0.073 (0.063)	-0.079 (0.073)
Ind 31	192	0.260	0.544	0.196	0.339 (0.016)	0.566 (0.015)	0.094 (0.013)	**1.100 (0.016)**	1.041 (0.028)	-0.336 (0.115)	-0.506 (0.262)
Ind 38	319	0.330	0.500	0.170	0.365 (0.013)	0.550 (0.010)	0.085 (0.010)	**1.102 (0.011)**	1.100 (0.021)	-0.012 (0.098)	-0.012 (0.100)
Ind 9	130	0.232	0.530	0.238	0.385 (0.024)	0.527 (0.022)	0.088 (0.018)	**1.122 (0.025)**	0.994 (0.041)	-0.653 (0.155)	-1.882 (1.291)
Ind 25	104	0.312	0.459	0.229	0.423 (0.026)	0.472 (0.022)	0.105 (0.019	**1.126 (0.025)**	1.028 (0.048)	-0.434 (0.179)	-0.767 (0.560)
Ind 34	125	0.218	0.569	0.213	0.279 (0.024)	0.643 (0.019)	0.078 (0.017)	**1.153 (0.020)**	1.131 (0.033)	-0.135 (0.125)	-0.156 (0.168)
Total	2644	0.247	0.554	0.199	0.314 (0.005)	0.579 (0.004)	0.107	**1.090 (0.006)**	1.045 (0.008)	0.039 (0.025)	0.037 (0.024)

Robust standard errors in parentheses. Time dummies are included but not reported.

Table A.3.a (ctd)

Industry analysis: Estimated sector-level output elasticities $\widehat{\varepsilon}^{Q}_{J_j}$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ $(only)$ and extent of rent sharing $\hat{\phi}_j$

Part 3: GMM SYS: $\widehat{\mu}_j \geq 1 \;\; \vee \;\; \widehat{\phi}_j \in [0,1]$ [26 industries]

		GMM SYS $(t-2)(t-3)$									
Industry	# Firms	$\widehat{\varepsilon}^{Q}_{N_j}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$	*Sargan*	$m1$	$m2$
Ind 6	453	0.399 (0.030)	0.526 (0.017)	0.075 (0.029)	1.213 (0.033)	**1.323 (0.043)**	**0.685 (0.157)**	**0.407 (0.055)**	0.004	-9.91	-2.40
Ind 2	122	0.152 (0.035)	0.797 (0.024)	0.051 (0.027)	1.147 (0.025)	**1.151 (0.035)**	**0.027 (0.192)**	**0.026 (0.182)**	1.000	-4.03	-0.68
Ind 18	294	0.373 (0.030)	0.606 (0.030)	0.021 (0.016)	1.104 (0.018)	**1.258 (0.061)**	**0.982 (0.33)**	**0.495 (0.084)**	0.998	-8.24	0.59
Ind 16	110	0.342 (0.042)	0.632 (0.030)	0.026 (0.034)	1.174 (0.037)	**1.276 (0.061)**	**0.486 (0.262)**	**0.327 (0.119)**	1.000	-5.89	-1.79
Ind 22	286	0.261 (0.035)	0.636 (0.025)	0.103 (0.026)	1.100 (0.027)	**1.320 (0.052)**	**1.306 (0.230)**	**0.566 (0.043)**	0.995	-9.91	2.41
Ind 28	310	0.359 (0.042)	0.626 (0.034)	0.015 (0.027)	1.227 (0.031)	**1.296 (0.070)**	**0.311 (0.244)**	**0.237 (0.142)**	0.435	-8.87	-2.96
Ind 5	518	0.239 (0.016)	0.677 (0.023)	0.084 (0.022)	1.117 (0.028)	**1.281 (0.043)**	**0.527 (0.086)**	**0.345 (0.037)**	0.006	-9.15	-2.24
Ind 13	156	0.406 (0.041)	0.600 (0.040)	-0.006 (0.035)	1.281 (0.046)	**1.290 (0.086)**	**0.034 (0.222)**	**0.033 (0.208)**	1.000	-7.38	0.90
Ind 23	203	0.409 (0.040)	0.563 (0.041)	0.028 (0.041)	1.162 (0.050)	**1.249 (0.092)**	**0.348 (0.292)**	**0.258 (0.161)**	1.000	-8.18	-2.72
Ind 29	475	0.301 (0.023)	0.665 (0.027)	0.034 (0.020)	1.220 (0.027)	**1.236 (0.050)**	**0.064 (0.130)**	**0.060 (0.114)**	0.619	-11.45	-2.05
Ind 11	322	0.314 (0.042)	0.698 (0.034)	-0.012 (0.030)	1.247 (0.033)	**1.348 (0.065)**	**0.503 (0.239)**	**0.335 (0.106)**	0.676	-9.46	-2.81
Ind 33	600	0.298 (0.034)	0.654 (0.027)	0.047 (0.019)	1.147 (0.021)	**1.185 (0.048)**	**0.180 (0.229)**	**0.152 (0.164)**	0.000	-12.15	-2.98
Ind 31	192	0.298 (0.043)	0.625 (0.053)	0.077 (0.028)	1.149 (0.036)	**1.149 (0.097)**	**0.002 (0.291)**	**0.002 (0.289)**	1.000	-5.53	-0.83
Ind 38	319	0.356 (0.035)	0.558 (0.058)	0.086 (0.025)	1.102 (0.031)	**1.116 (0.075)**	**0.065 (0.294)**	**0.061 (0.259)**	0.172	-8.07	-1.86
Ind 8	724	0.295 (0.024)	0.682 (0.021)	0.023 (0.014)	1.219 (0.018)	**1.429 (0.045)**	**0.746 (0.121)**	**0.427 (0.040)**	1.000	-10.59	-0.33
Ind 36	1000	0.372 (0.020)	0.563 (0.017)	0.065 (0.013)	1.142 (0.016)	**1.272 (0.038)**	**0.537 (0.132)**	**0.349 (0.056)**	0.000	-16.96	-3.45
Ind 12	179	0.337 (0.033)	0.688 (0.025)	-0.025 (0.027)	1.285 (0.032)	**1.431 (0.052)**	**0.508 (0.153)**	**0.337 (0.067)**	1.000	-7.58	-2.44
Ind 24	205	0.264 (0.038)	0.623 (0.030)	0.113 (0.020)	1.174 (0.024)	**1.253 (0.061)**	**0.227 (0.167)**	**0.185 (0.111)**	1.000	-6.16	0.52
Ind 7	213	0.359 (0.039)	0.566 (0.035)	0.075 (0.037)	1.164 (0.045)	**1.206 (0.075)**	**0.183 (0.228)**	**0.155 (0.163)**	0.999	-6.25	0.30
Ind 27	270	0.280 (0.039)	0.674 (0.030)	0.046 (0.023)	1.193 (0.024)	**1.312 (0.058)**	**0.536 (0.214)**	**0.349 (0.091)**	0.692	-7.98	-1.73
Ind 37	599	0.238 (0.040)	0.692 (0.032)	0.070 (0.024)	1.243 (0.029)	**1.564 (0.072)**	**0.719 (0.132)**	**0.418 (0.045)**	0.000	-11.94	-2.24
Ind 34	125	0.267 (0.034)	0.714 (0.045)	0.019 (0.037)	1.249 (0.049)	**1255 (0.080)**	**0.022 (0.174)**	**0.021 (0.167)**	1.000	-6.16	0.52
Ind 35	138	0.335 (0.028)	0.668 (0.021)	-0.003 (0.022)	1.244 (0.025)	**1.362 (0.044)**	**0.490 (0.147)**	**0.329 (0.066)**	1.000	-7.18	-0.58
Ind 15	129	0.307 (0.043)	0.674 (0.029)	0.019 (0.033)	1.245 (0.034)	**1.265 (0.054)**	**0.078 (0.201)**	**0.072 (0.173)**	1.000	-5.42	-1.98
Ind 26	391	0.252 (0.032)	0.659 (0.030)	0.088 (0.028)	1.189 (0.038)	**1.401 (0.064)**	**0.482 (0.120)**	**0.325 (0.055)**	0.015	-9.16	-2.00
Ind 30	330	0.295 (0.024)	0.703 (0.028)	0.002 (0.025)	1.295 (0.035)	**1.328 (0.053)**	**0.063 (0.103)**	**0.060 (0.091)**	0.100	-8.52	-3.32
Total	8663	0.291 (0.008)	0.687 (0.008)	0.022	1.208 (0.008)	**1.401 (0.017)**	**1.125 (0.001)**	**0.529 (0.007)**	0.000	-36.83	-4.97

Table A.3.a (ctd)

Industry analysis: Estimated industry-level output elasticities $\widehat{\varepsilon}^{Q}_{J_j}$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ $(only)$ and extent of rent sharing $\hat{\phi}_j$

Part 4: GMM SYS: $\widehat{\phi}_j = 0 \;\vee\; \widehat{\mu}_j \; only \geq 1$ [11 industries] - $\widehat{\phi}_j = 1 \;\vee\; \widehat{\mu}_j \; only \geq 1$ [1 industry]

		GMM SYS $(t-2)(t-3)$									
Industry	# Firms	$\widehat{\varepsilon}^{Q}_{N_j}$	$\widehat{\varepsilon}^{Q}_{M_j}$	$\widehat{\varepsilon}^{Q}_{K_j}$	$\hat{\mu}_j$ *only*	$\hat{\mu}_j$	$\widehat{\gamma}_j$	$\hat{\phi}_j$	*Sargan*	$m1$	$m2$
Ind 3	106	0.331 (0.044)	0.640 (0.038)	0.028 (0.052)	**1.228 (0.058)**	1.107 (0.066)	-0.489 (0.198)	-0.955 (0.756)	1.000	-4.39	-1.42
Ind 21	154	0.357 (0.047)	0.647 (0.042)	-0.003 (0.030)	**1.175 (0.035)**	1.170 (0.076)	-0.029 (0.386)	-0.030 (0.409)	1.000	-6.88	-0.28
Ind 17	171	0.331 (0.049)	0.626 (0.036)	0.043 (0.029)	**1.081 (0.026)**	1.053 (0.060)	-0.238 (0.520)	-0.312 (0.894)	1.000	-6.24	0.27
Ind 32	171	0.311 (0.033)	0.611 (0.033)	0.078 (0.028)	**1.162 (0.037)**	1.084 (0.069)	-0.281 (0.207)	-0.390 (0.399)	1.000	-5.28	-1.67
Ind 4	126	0.217 (0.029)	0.754 (0.046)	0.028 (0.049)	**1.186 (0.064)**	1.107 (0.067)	-0.396 (0.153)	-0.655 (0.419)	1.000	-2.07	-2.45
Ind 20	268	0.447 (0.039)	0.606 (0.040)	-0.053 (0.027)	**1.222 (0.033)**	1.133 (0.074)	-0.536 (0.375)	-1.155 (1.741)	0.983	-8.95	-1.79
Ind 19	182	0.431 (0.062)	0.559 (0.042)	0.010 (0.037)	**1.211 (0.039)**	1.149 (0.087)	-0.263 (0.419)	-0.356 (0.770)	1.000	-7.77	-0.34
Ind 10	114	0.341 (0.039)	0.652 (0.037)	0.006 (0.030)	**1.266 (0.036)**	1.228 (0.069)	-0.130 (0.203)	-0.149 (0.267)	1.000	-5.30	0.43
Ind 1	324	0.415 (0.046)	0.576 (0.041)	0.009 (0.040)	**1.014 (0.054)**	0.949 (0.067)	-1.228 (0.368)	5.393 (7.108)	0.252	-6.86	-1.21
Ind 9	130	0.329 (0.046)	0.677 (0.027)	-0.005 (0.037)	**1.309 (0.040)**	1.276 (0.051)	-0.109 (0.180)	-0.122 (0.227)	1.000	-4.37	-1.24
Ind 25	104	0.357 (0.043	0.512 (0.039)	0.131 (0.048)	**1.128 (0.062)**	1.115 (0.086)	-0.037 (0.226)	-0.039 (0.244)	1.000	-3.74	-1.36
Ind 14	133	0.364 (0.042)	0.581 (0.037)	0.055 (0.026)	**1.157 (0.030)**	1.042 (0.066)	-0.496 (0.321)	-0.983 (1.264)	1.000	-6.57	-0.34
Total	1983	0.161 (0.022)	0.805 (0.019)	0.034	**1.214 (0.016)**	1.438 (0.035)	1.082 (0.073)	0.520 (0.017)	0.000	-17.52	-2.32

Time dummies are included but not reported. First-step robust standard errors in parentheses.

(1) Input shares: see Part 1-2 of this table.

(2) Instruments used: the lagged levels of n, m and k dated $(t-2)$ and $(t-3)$ in the first-differenced equations and the lagged first-differences of n, m and k dated $(t-1)$ in the levels equations.

(3) $Sargan$: test of overidentifying restrictions, asymptotically distributed as χ^2_{df}. p-values are reported.

(4) $m1$ and $m2$: tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$.

Table A.3.b
Industry analysis: Correlation of $\hat{\mu}_j$ $(only)$, $\widehat{\gamma}_j$ and $\hat{\phi}_j$ within and across different estimators

	Full sample			$\widehat{\phi}_j \in [0,1]$		
Correlation	**OLS DIF**	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$	**OLS DIF**	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$
$\hat{\mu}_j$ $only - \hat{\mu}_j$	0.608	0.588	0.557	0.581	0.689	0.539
$\hat{\mu}_j - \widehat{\gamma}_j$	0.857	0.789	0.787	0.482	0.438	0.538
$\hat{\mu}_j - \hat{\phi}_j$	0.820	0.223	-0.065	0.484	0.331	0.604
$\#\ \widehat{\phi}_j = 0$ $(\#\ sign.)^a$	14 (3)	18 (0)	11 (0)			
$\#\ \widehat{\phi}_j = 1$ $(\#\ sign.)$	0	2 (1)	1 (0)			

[a] Significant at -at least- 10%.

	Full sample (38 industries)		$\widehat{\phi}_j \in [0,1]$	
Correlation	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$
OLS DIF	$\hat{\mu}_j$ $only$: 0.266 $\hat{\mu}_j$: 0.453 $\widehat{\gamma}_j$: 0.157 $\hat{\phi}_j$: 0.034	$\hat{\mu}_j$ $only$: 0.313 $\hat{\mu}_j$: 0.615 $\widehat{\gamma}_j$: 0.714 $\hat{\phi}_j$: 0.187	$\hat{\mu}_j$ $only$: 0.149 $\hat{\mu}_j$: 0.182 $\widehat{\gamma}_j$: 0.370 $\hat{\phi}_j$: 0.324 14 industries	$\hat{\mu}_j$ $only$: 0.453 $\hat{\mu}_j$: 0.165 $\widehat{\gamma}_j$: 0.639 $\hat{\phi}_j$: 0.619 21 industries
GMM DIF $(t-2)(t-3)$		$\hat{\mu}_j$ $only$: -0.083 $\hat{\mu}_j$: 0.285 $\widehat{\gamma}_j$: 0.153 $\hat{\phi}_j$: 0.003		$\hat{\mu}_j$ $only$: -0.113 $\hat{\mu}_j$: -0.253 $\widehat{\gamma}_j$: 0.477 $\hat{\phi}_j$: 0.375 15 industries

(1) $GMM\ DIF$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and $(t-3)$.
(2) $GMM\ SYS$: the set of instruments includes the lagged levels of n, m and k dated $(t-2)$ and $(t-3)$ in the first-differenced equations and correspondingly the lagged first-differences of n, m and k dated $(t-1)$ in the levels equations.

Table A.4
Heterogeneity of firm output elasticities $\widehat{\varepsilon}^{Q}_{J_i}$ $(J = N, M, K)$, mark-up $\hat{\mu}_i$ $(only)$ and extent of rent sharing $\hat{\phi}_i$:
Different indicators and first-differenced OLS estimates
Part 1: $\widehat{\mu}_i \geq 1 \;\vee\; \widehat{\phi}_i \in [0,1]$ [5906 firms] - $\widehat{\phi}_i = 0 \;\vee\; \widehat{\mu}_i\ only \geq 1$ [1239 firms]

	α_{N_i}	α_{M_i}	α_{K_i}	$\widehat{\varepsilon}^{Q}_{N_i}$	$\widehat{\varepsilon}^{Q}_{M_i}$	$\widehat{\varepsilon}^{Q}_{K_i}$	$\hat{\mu}_i\ only$	$\hat{\mu}_i$	$\widehat{\gamma}_i$	$\hat{\phi}_i$
$\widehat{\mu}_i \geq 1 \;\vee\; \widehat{\phi}_i \in [0,1]$ **[5906 firms]**										
SIMPLE										
Observed variance $\widehat{\sigma}^2_o$	0.017	0.019	0.008	0.050	0.039	0.042	0.076	**0.284**	**3.093**	**0.046**
Sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0006	0.001	0.046	0.026	0.035	0.046	**0.185**	**1.825**	**0.172**
True variance $\widehat{\sigma}^2_{true}{}^a$	0.017	0.018	0.007	0.004	0.013	0.007	0.030	**0.099**	**1.268**	**0**
F-test^b	85	31.667	8	1.087	1.500	1.200	1.652	**1.535**	**1.695**	**0.267**
WEIGHTED										
Observed variance $\widehat{\sigma}^2_o$	0.019	0.020	0.019	0.028	0.034	0.020	0.029	**0.087**	**1.380**	**0.013**
Sampling variance $\widehat{\sigma}^2_s$	0.00004	0.00003	0.0004	0.013	0.009	0.008	0.011	**0.031**	**0.161**	**0.001**
True variance $\widehat{\sigma}^2_{true}{}^a$	0.019	0.020	0.019	0.015	0.025	0.012	0.018	**0.056**	**1.219**	**0.012**
F-test^b	475	667	47.5	2.154	3.778	2.500	2.636	**2.806**	**8.571**	**13**
MEDIAN										
Interquartile observed variance $\widehat{\sigma}^2_o$	0.019	0.025	0.011	0.037	0.038	0.030	0.045	**0.150**	**1.935**	**0.056**
Robust sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0008	0.0012	0.025	0.016	0.018	0.025	**0.072**	**0.594**	**0.015**
Robust true variance $\widehat{\sigma}^2_{true}{}^a$	0.019	0.024	0.010	0.012	0.022	0.012	0.020	**0.078**	**1.341**	**0.041**
F-test^b	95	31.25	9.167	1.480	2.375	1.667	1.800	**2.083**	**3.257**	**3.733**
$\widehat{\phi}_i = 0 \;\vee\; \widehat{\mu}_i\ only \geq 1$ **[1239 firms]**										
SIMPLE										
Observed variance $\widehat{\sigma}^2_o$	0.010	0.018	0.014	0.025	0.027	0.028	**0.077**	0.057	0.082	686
Sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0007	0.001	0.050	0.027	0.036	**0.049**	0.153	2.660	$2.40\ 10^8$
True variance $\widehat{\sigma}^2_{true}{}^a$	0.010	0.017	0.013	0	0	0	**0.028**	0	0	0
F-test^b	50	25.714	14	0.500	1	0.778	**1.571**	0.372	0.031	$2.858\ 10^{-6}$
WEIGHTED										
Observed variance $\widehat{\sigma}^2_o$	0.012	0.020	0.025	0.022	0.026	0.013	**0.029**	0.024	0.066	0.037
Sampling variance $\widehat{\sigma}^2_s$	0.00004	0.00003	0.0002	0.017	0.009	0.009	**0.009**	0.031	0.362	0.830
True variance $\widehat{\sigma}^2_{true}{}^a$	0.012	0.020	0.025	0.005	0.017	0.004	**0.020**	0	0	0
F-test^b	300	667	125	1.294	2.889	1.444	**3.222**	0.774	0.182	0.044
MEDIAN										
Interquartile observed variance $\widehat{\sigma}^2_o$	0.012	0.029	0.023	0.023	0.028	0.018	**0.050**	0.037	0.134	1.795
Robust sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0008	0.001	0.030	0.017	0.019	**0.022**	0.070	1.028	10.305
Robust true variance $\widehat{\sigma}^2_{true}{}^a$	0.012	0.028	0.022	0	0.011	0	**0.028**	0	0	0
F-test^b	60	36.25	23	0.767	1.647	0.947	**2.273**	0.528	0.130	0.174

Table A.4 (ctd)

Heterogeneity of firm output elasticities $\widehat{\varepsilon}^{Q}_{J_i}$ $(J = N, M, K)$, mark-up $\hat{\mu}_i$ $(only)$ and extent of rent sharing $\hat{\phi}_i$:
Different indicators and first-differenced OLS estimates
Part 2: Full sample [10646 firms]

	α_{N_i}	α_{M_i}	α_{K_i}	$\widehat{\varepsilon}^{Q}_{N_i}$	$\widehat{\varepsilon}^{Q}_{M_i}$	$\widehat{\varepsilon}^{Q}_{K_i}$	$\hat{\mu}_i$ *only*	$\hat{\mu}_i$	$\widehat{\gamma}_i$	$\hat{\phi}_i$
Full sample [10646 firms]										
SIMPLE										
Observed variance $\widehat{\sigma}^2_o$	0.016	0.019	0.010	0.093	0.066	0.058	0.096	0.372	3146	327
Sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0006	0.0009	0.055	0.028	0.041	0.051	0.176	$8.45\ 10^8$	$1.55\ 10^9$
True variance $\widehat{\sigma}^2_{true}{}^a$	0.016	0.018	0.009	0.038	0.038	0.017	0.045	0.196	0	0
F-test^b	80	31.667	11.111	1.690	2.357	1.415	1.822	2.114	$3.72\ 10^{-6}$	$2.11\ 10^{-7}$
WEIGHTED										
Observed variance $\widehat{\sigma}^2_o$	0.019	0.020	0.022	0.054	0.055	0.026	0.038	0.139	1.619	0.015
Sampling variance $\widehat{\sigma}^2_s$	0.00004	0.00003	0.0003	0.015	0.010	0.010	0.012	0.032	0.257	0.002
True variance $\widehat{\sigma}^2_{true}{}^a$	0.019	0.020	0.022	0.039	0.045	0.016	0.026	0.107	1.362	0.013
F-test^b	475	667	73.33	3.600	5.500	2.600	3.167	4.343	6.300	7.500
MEDIAN										
Interquartile observed variance $\widehat{\sigma}^2_o$	0.018	0.026	0.013	0.077	0.068	0.039	0.060	0.209	3.803	0.189
Robust sampling variance $\widehat{\sigma}^2_s$	0.0002	0.0006	0.0011	0.030	0.017	0.020	0.026	0.074	1.312	0.068
Robust true variance $\widehat{\sigma}^2_{true}{}^a$	0.018	0.025	0.012	0.047	0.051	0.019	0.034	0.135	2.491	0.121
F-test^b	90	43.333	11.818	2.567	4	1.950	2.308	2.824	2.899	2.779

^{a} The estimated true variance is computed by adjusting the observed variance for the sampling variability: $\widehat{\sigma}^2_{true} = \widehat{\sigma}^2_o - \widehat{\sigma}^2_s$.

^{b} F-test $= \frac{\widehat{\sigma}^2_o}{\widehat{\sigma}^2_s}$.

Table A.5
Within-industry dispersion: Weighted mean and Swamy estimate of weighted true standard deviation ($\widehat{\boldsymbol{\sigma}}_{true}$) of $\widehat{\varepsilon}^{Q}_{J_{ij}}$, mark-up $\hat{\mu}_{ij}(only)$ and extent of rent sharing $\hat{\phi}_{ij}$

	OLS DIF						
Industry	$\widehat{\varepsilon}^{Q}_{N_{ij}}$	$\widehat{\varepsilon}^{Q}_{M_{ij}}$	$\widehat{\varepsilon}^{Q}_{K_{ij}}$	$\hat{\mu}_{ij}$ *only*	$\hat{\mu}_{ij}$	$\widehat{\gamma}_{ij}$	$\hat{\phi}_{ij}$
Ind 6	0.276 [0.010]	0.490 [0.012]	0.082 [0.009]	1.109 [0.009]	**1.207 [0.015]**	**1.782 [0.082]**	**0.857 [0.004]**
Ind 18	0.318 [0.010]	0.607 [0.007]	0.078 [0.009]	1.107 [0.007]	**1.184 [0.011]**	**1.275 [0.098]**	**0.881 [0.004]**
Ind 17	0.212 [0.011]	0.719 [0.011]	0.050 [0.009]	1.077 [0.009]	**1.170 [0.015]**	**1.311 [0.102]**	**0.855 [0.008]**
Ind 20	0.274 [0.013]	0.632 [0.011]	0.062 [0.010]	1.099 [0.007]	**1.134 [0.015]**	**1.051 [0.065]**	**0.867 [0.008]**
Ind 16	0.260 [0.024]	0.577 [0.018]	0.067 [0.016]	1.080 [0.016]	**1.163 [0.030]**	**1.008 [0.120]**	**0.774 [0.009]**
Ind 22	0.263 [0.013]	0.569 [0.011]	0.083 [0.012]	1.062 [0.010]	**1.159 [0.021]**	**2.006 [0.105]**	**0.859 [0.005]**
Ind 28	0.199 [0.011]	0.609 [0.011]	0.131 [0.010]	1.078 [0.010]	**1.196 [0.017]**	**1.242 [0.064]**	**0.834 [0.007]**
Ind 5	0.118 [0.007]	0.721 [0.010]	0.070 [0.006]	1.083 [0.008]	**1.271 [0.020]**	**1.567 [0.056]**	**0.794 [0.004]**
Ind 13	0.218 [0.014]	0.566 [0.018]	0.125 [0.017]	1.026 [0.020]	**1.167 [0.037]**	**1.013 [0.116]**	**0.852 [0.007]**
Ind 23	0.351 [0.019]	0.501 [0.019]	0.068 [0.013]	1.055 [0.015]	**1.080 [0.036]**	**1.338 [0.155]**	**0.922 [0.004]**
Ind 11	0.192 [0.008]	0.685 [0.010]	0.070 [0.008]	1.107 [0.009]	**1.249 [0.016]**	**1.235 [0.055]**	**0.757 [0.006]**
Ind 33	0.207 [0.007]	0.660 [0.007]	0.077 [0.007]	1.097 [0.006]	**1.144 [0.012]**	**1.025 [0.043]**	**0.781 [0.005]**
Ind 38	0.227 [0.007]	0.650 [0.007]	0.052 [0.008]	1.114 [0.005]	**1.248 [0.011]**	**1.250 [0.038]**	**0.733 [0.004]**
Ind 36	0.249 [0.006]	0.583 [0.006]	0.105 [0.006]	1.111 [0.005]	**1.268 [0.011]**	**1.452 [0.033]**	**0.771 [0.003]**
Ind 12	0.269 [0.016]	0.621 [0.014]	0.051 [0.010]	1.158 [0.010]	**1.228 [0.019]**	**1.185 [0.079]**	**0.778 [0.009]**
Ind 24	0.225 [0.010]	0.634 [0.011]	0.123 [0.010]	1.143 [0.011]	**1.210 [0.018]**	**0.521 [0.043]**	**0.640 [0.010]**
Ind 7	0.208 [0.012]	0.668 [0.014]	0.038 [0.012]	1.148 [0.015]	**1.335 [0.021]**	**0.812 [0.074]**	**0.814 [0.018]**
Ind 27	0.223 [0.012]	0.627 [0.012]	0.051 [0.010]	1.111 [0.008]	**1.152 [0.018]**	**1.045 [0.063]**	**0.820 [0.007]**
Ind 37	0.195 [0.008]	0.593 [0.009]	0.106 [0.008]	1.117 [0.008]	**1.233 [0.015]**	**1.076 [0.032]**	**0.694 [0.004]**
Ind 14	0.253 [0.014]	0.763 [0.012]	0.027 [0.011]	1.173 [0.012]	**1.222 [0.017]**	**0.508 [0.070]**	**0.761 [0.012]**
Ind 35	0.204 [0.014]	0.636 [0.012]	0.081 [0.016]	1.109 [0.016]	**1.193 [0.029]**	**1.272 [0.083]**	**0.751 [0.009]**
Ind 15	0.215 [0.015]	0.694 [0.017]	0.069 [0.011]	1.160 [0.012]	**1.184 [0.019]**	**0.724 [0.075]**	**0.708 [0.010]**
Ind 26	0.253 [0.010]	0.630 [0.011]	0.080 [0.008]	1.117 [0.009]	**1.222 [0.016]**	**0.752 [0.041]**	**0.764 [0.008]**
Ind 30	0.289 [0.016]	0.562 [0.015]	0.091 [0.011]	1.101 [0.012]	**1.033 [0.030]**	**0.950 [0.046]**	**0.757 [0.008]**
Ind 3	0.165 [0.019]	0.633 [0.027]	0.051 [0.022]	**1.101 [0.027]**	1.016 [0.038]	0.334 [0.051]	0.877 [0.023]
Ind 21	0.249 [0.013]	0.630 [0.015]	0.058 [0.013]	**1.073 [0.011]**	1.100 [0.028]	0.769 [0.048]	0.837 [0.015]
Ind 2	0.084 [0.012]	0.796 [0.018]	0.045 [0.011]	**1.102 [0.011]**	1.096 [0.021]	0.686 [0.049]	0.655 [0.016]
Ind 32	0.197 [0.018]	0.631 [0.017]	0.085 [0.016]	**1.109 [0.018]**	1.085 [0.026]	0.736 [0.080]	0.761 [0.009]
Ind 4	0.132 [0.013]	0.800 [0.020]	0.047 [0.009]	**1.106 [0.012]**	1.097 [0.020]	0.216 [0.044]	0.662 [0.023]
Ind 19	0.328 [0.016]	0.522 [0.015]	0.090 [0.011]	**1.107 [0.012]**	1.066 [0.023]	0.638 [0.079]	0.851 [0.009]
Ind 10	0.273 [0.019]	0.535 [0.023]	0.074 [0.015]	**1.102 [0.017]**	1.034 [0.032]	0.534 [0.077]	0.703 [0.015]
Ind 1	0.156 [0.009]	0.680 [0.014]	0.060 [0.007]	**1.080 [0.006]**	1.055 [0.015]	0.650 [0.044]	0.817 [0.009]
Ind 29	0.180 [0.009]	0.680 [0.011]	0.054 [0.009]	**1.153 [0.008]**	1.243 [0.016]	1.002 [0.033]	0.718 [0.005]
Ind 31	0.295 [0.015]	0.574 [0.017]	0.062 [0.013]	**1.088 [0.014]**	1.018 [0.026]	0.866 [0.075]	0.813 [0.011]
Ind 38	0.289 [0.012]	0.559 [0.012]	0.074 [0.010]	**1.091 [0.008]**	1.085 [0.020]	1.142 [0.066]	0.820 [0.006]
Ind 9	0.330 [0.022]	0.593 [0.020]	0.039 [0.015]	**1.162 [0.014]**	1.087 [0.029]	0.496 [0.066]	0.774 [0.016]
Ind 25	0.277 [0.009]	0.592 [0.024]	0.039 [0.012]	**1.130 [0.011]**	1.120 [0.023]	0.814 [0.112]	0.797 [0.010]
Ind 34	0.219 [0.019]	0.669 [0.018]	0.094 [0.021]	**1.086 [0.013]**	1.084 [0.021]	0.669 [0.100]	0.779 [0.009]

Appendix B: Extension embedding the monopsony model

B.1 Model

The R. Hall (1988) model is based on the assumption that there is a potentially infinite supply of employees wanting a job in the firm. Limited mobility on the part of the employees and entry costs on the part of competing firms might however create rents to jobs. This gives employers some power over their workers as a small wage cut will no longer induce them to leave the firm.
Consider a firm facing a labor supply $N_{it}(w_{it})$, which is an increasing function of the wage w_{it}. The monopsonist firm objective is to maximize its short-run profit function, taking the labor supply curve as a given:

$$\max_{w_{it},\, M_{it}} \pi(w_{it},\, N_{it},\, M_{it}) = R_{it}(N_{it}(w_{it}),\, M_{it}) - w_{it}N_{it}(w_{it}) - j_{it}M_{it} \tag{B.1}$$

Maximization with respect to material input gives $R_{M,it} = j_{it}$, which directly leads to the corresponding equation (3). Maximization with respect to the wage rate gives the following first-order condition:

$$w_{it} = \left(\frac{\varepsilon^N_{w_{it}}}{1+\varepsilon^N_{w_{it}}}\right) R_{N,it} \tag{B.2}$$

where $\varepsilon^N_{w_{it}} \in \Re_+$ represents the elasticity of the labor supply. From (B.2), it follows that the degree of monopsony power, measured by $\left(\frac{R_{N,it}}{w_{it}}\right)$, depends negatively on $\varepsilon^N_{w_{it}}$. Rewriting (B.2) results in a modified equation (2):

$$\varepsilon^Q_{N_{it}} = \mu_{it}\alpha_{N_{it}}\left(1+\frac{1}{\varepsilon^N_{w_{it}}}\right) \tag{B.3}$$

Assuming constant returns to scale, estimation of the reduced-form equation $q_{it} - k_{it} = \varepsilon^Q_{N_{it}}(n_{it} - k_{it}) + \varepsilon^Q_{M_{it}}(m_{it} - k_{it}) + \theta_{it}$, allows the identification of (1) the mark-up of price over marginal cost and (2) the elasticity of the supply of labor of the firm with respect to the wage rate:

$$\mu_{it} = \frac{\varepsilon^Q_{M_{it}}}{\alpha_{M_{it}}} \tag{B.4}$$

$$\beta_{it} = \frac{\varepsilon^N_{w_{it}}}{1+\varepsilon^N_{w_{it}}} = \frac{\alpha_{N_{it}}}{\alpha_{M_{it}}}\frac{\varepsilon^Q_{M_{it}}}{\varepsilon^Q_{N_{it}}} \tag{B.5}$$

$$\varepsilon^N_{w_{it}} = \frac{\beta_{it}}{1-\beta_{it}} \tag{B.6}$$

B.2 Results

We first present the estimates of the labor supply elasticity at the manufacturing, the industry and the firm level and then comment on the results at the different levels.

Manufacturing-level results

Table B.1
Estimates of output elasticities $\widehat{\varepsilon}_J^Q$ $(J = N, M, K)$, mark-up $\hat{\mu}$ and labor supply elasticity $\widehat{\varepsilon}_w^N$:
Full sample: 10646 firms - Period 1978-2001

	OLS LEVELS	**OLS DIF**	**GMM DIF** $(t-2)(t-3)$	**GMM SYS** $(t-2)(t-3)$
$\widehat{\varepsilon}_N^Q$	0.331	0.298	0.138	0.298
	(0.003)	(0.003)	(0.020)	(0.008)
$\widehat{\varepsilon}_M^Q$	0.592	0.587	0.726	0.675
	(0.003)	(0.003)	(0.017)	(0.007)
$\widehat{\varepsilon}_K^Q$	0.077	0.115	0.137	0.027
$\widehat{\mu}$	1.177	1.167	1.443	1.342
	(0.007)	(0.005)	(0.033)	(0.015)
$\widehat{\varepsilon}_w^N$	-12.343	-6.246	-1.453	-3.623
	(2.106)	(0.425)	(0.109)	(0.327)

Robust standard errors and first-step robust standard errors in columns 3-4.
Time dummies are included but not reported.
(1) $\widehat{\varepsilon}_K^Q = 1 - \widehat{\varepsilon}_N^Q - \widehat{\varepsilon}_M^Q$.
(2) Input shares: $\alpha_N = 0.307$, $\alpha_M = 0.503$, $\alpha_K = 0.190$.

Across-industry estimates

Table B.2
Estimated industry-level output elasticities $\widehat{\varepsilon}_{J_j}^Q$ $(J = N, M, K)$, mark-up $\hat{\mu}_j$ and labor supply elasticity $\widehat{\varepsilon}_{w_j}^N$ [a]

	OLS DIF				
38 industries	$\widehat{\varepsilon}_{Nj}^Q$	$\widehat{\varepsilon}_{M_j}^Q$	$\widehat{\varepsilon}_{K_j}^Q$	$\widehat{\mu}_j$	$\widehat{\varepsilon}_{w_j}^N$
Industry mean	0.308 (0.016)	0.580 (0.014)	0.111 (0.013)	1.125 (0.027)	-1.665 (66.79)
Industry Q_1	0.275 (0.012)	0.541 (0.010)	0.091 (0.010)	1.041 (0.021)	-6.782 (0.399)
Industry median	0.302 (0.016)	0.573 (0.013)	0.106 (0.013)	1.150 (0.025)	-2.972 (1.324)
Industry Q_3	0.340 (0.020)	0.638 (0.017)	0.123 (0.016)	1.188 (0.033)	1.894 (7.007)

Robust standard errors in parentheses.
[a] Detailed information on the industry-level estimates is available upon request.

Within-industry firm estimates

Table B.3
Estimated firm-level output elasticities $\widehat{\varepsilon}^{Q}_{Ji}$ $(J = N, M, K)$, mark-up $\hat{\mu}_i$ and labor supply elasticity $\widehat{\varepsilon}^{N}_{w_i}$ [a]

	OLS DIF				
10646 firms	$\widehat{\varepsilon}^{Q}_{N_i}$	$\widehat{\varepsilon}^{Q}_{M_i}$	$\widehat{\varepsilon}^{Q}_{K_i}$	$\widehat{\mu}_i$	$\widehat{\varepsilon}^{N}_{w_i}$
Firm mean	0.288 (0.201)	0.599 (0.149)	0.112 (0.171)	1.239 (0.334)	-6.132 (30 10^4)
Firm Q_1	0.094 (0.119)	0.434 (0.094)	-0.025 (0.097)	0.908 (0.179)	-1.685 (0.309)
Firm median	0.263 (0.174)	0.614 (0.132)	0.094 (0.145)	1.200 (0.273)	-0.928 (0.913)
Firm Q_3	0.459 (0.249)	0.778 (0.185)	0.236 (0.211)	1.508 (0.410)	0.520 (4.096)

Robust standard errors in parentheses.
[a] Detailed information on the firm-level estimates is available upon request.

Discussion results

Contrary to the theoretical prediction, the labor supply elasticity is estimated to be significantly negative across the different estimators at the manufacturing level (see Table B.1). Focusing on the first-differenced OLS estimator, the labor supply elasticity estimate amounts to -6.25.
From Table B.2, it follows that the elasticity of the labor supply with respect to the wage rate is estimated to be lower than -6.78 for the first quartile of industries and higher than 1.89 for the top quartile. More specifically, the labor supply elasticity estimate is positive for 14 out of 38 industries, with 10 out of 14 estimates being *significantly* positive.[1] For those industries, $\widehat{\varepsilon}^{N}_{w_j}$ lies in the $[0.88, 7.53]$-interval.
Table B.3 shows that $\varepsilon^{N}_{w_i}$ is estimated to be lower than -1.68 for the first quartile of firms and higher than 0.52 for the top quartile. For 4024 out of 10646 firms, the labor supply elasticity estimate is positive. However, only 355 of these estimates are *significantly* positive.[2] For these firms, $\widehat{\varepsilon}^{N}_{w_i}$ lies in the $[0.04, 2.78]$-interval.
Based on these findings, we conclude that the extension embedding the monopsony model is rejected by the data.

[1]Note that $\widehat{\mu}_j \geq 1 \ \vee \ \widehat{\varepsilon}^{N}_{w_j} > 0$ for 9 industries. 5 of these industries have a *significantly* positive labor supply elasticity estimate.

[2]Note that $\widehat{\mu}_i \geq 1 \ \vee \ \widehat{\varepsilon}^{N}_{w_i} > 0$ for only 1340 firms. 91 of these firms have a *significantly* positive labor supply elasticity estimate.

Appendix C: Accounting measures of product and labor market imperfections at the industry and the firm level

To compare our estimated price-cost mark-up and extent of rent sharing parameters, $\hat{\mu}\ only$, $\hat{\mu}$, and $\hat{\phi}$, with accounting measures, we follow Veugelers (1989) and compute the following three variables, $\mu\ only_a$, μ_a and ϕ_a, as follows:

$$\mu\ only_a = \frac{PQ\ -\ jM\ -\ wN}{PQ} \tag{C.1}$$

$$\mu_a = \frac{PQ\ -\ jM\ -\ \overline{w}N}{PQ} = \mu\ only_a + \frac{(w - \overline{w})N}{PQ} \tag{C.2}$$

$$\phi_a = \frac{(w - \overline{w})N}{PQ\ -\ jM\ -\ \overline{w}N} = 1 - \frac{\mu\ only_a}{\mu_a} \tag{C.3}$$

where the alternative wage $\overline{w}$ is measured by the 5th percentile value of the nominal wage per worker in the industry in which the firm operates.

Tables C.1 and C.2 present summary information on the accounting price-cost mark-ups ($\mu\ only_a$ and μ_a) and the extent of rent sharing (ϕ_a) at the industry and the firm level and show the correlation between the accounting measures of product and labor market imperfections and the estimated (first-differenced OLS) parameters at both levels. Consistent with section 4.1 and section 5.2 , we consider two subsamples. The first subsample consists of industry (firm) estimates for which the price-cost mark-up equals or exceeds 1 and the corresponding extent of rent sharing lies in the $[0, 1]$-interval. The second subsample includes the industry (firm) estimates showing no evidence of rent sharing and a price-cost mark-up ignoring labor market imperfections that equals or exceeds 1.

Table C.1
Accounting versus estimated price-cost mark-ups and extent of rent sharing at the industry level

					Correlation with[c]		
	Ind. mean	Ind. Q_1	Ind. median	Ind.Q_3	$\hat{\mu}\ only_j - 1$	$\hat{\mu}_j - 1$	$\hat{\phi}_j$
24 industries[a]							
$\mu\ only_{a_j}$	0.178	0.163	0.175	0.197	0.689		
μ_{a_j}	0.260	0.239	0.264	0.277		0.251	
ϕ_{aj}	0.315	0.221	0.342	0.443			0.231
14 industries[b]							
$\mu\ only_{a_j}$	0.197	0.185	0.199	0.213	0.354		

[a] $\widehat{\mu}_j \geq 1 \quad \vee \quad \widehat{\phi}_j \in [0, 1]$.
[b] $\widehat{\phi}_j = 0 \quad \vee \quad \widehat{\mu}_j\ only \geq 1$.
[c] For detailed information on the industry-level estimates, see Table A.3.a [Part 1-2] in Appendix A.

Table C.2
Accounting versus estimated price-cost mark-ups and extent of rent sharing at the firm level

					Correlation with[c]		
	Firm mean	Firm Q_1	Firm median	Firm Q_3	$\hat{\mu}\ only_i - 1$	$\hat{\mu}_i - 1$	$\hat{\phi}_i$
5906 firms[a]							
$\mu\ only_{a_i}$	0.177	0.104	0.148	0.210	0.381		
μ_{a_i}	0.252	0.182	0.239	0.310		0.324	
ϕ_{a_i}	0.321	0.219	0.359	0.521			0.011
1239 firms[b]							
$\mu\ only_{a_i}$	0.234	0.144	0.208	0.293	0.580		

[a] $\widehat{\mu}_i \geq 1 \quad \vee \quad \widehat{\phi}_i \in [0, 1]$.
[b] $\widehat{\phi}_i = 0 \quad \vee \quad \widehat{\mu}_i\ only \geq 1$.
[c] For detailed information on the firm-level estimates, see Table A.4 [Part 1] in Appendix A.