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RIETI Discussion Paper Series 12-E-020

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Research Institute of Economy, Trade & Industry, IAA

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http://www.rieti.go.jp/en/

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April 2012

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Abstract

Allowing for three labor market settings, this paper relies on an extension of Hall's econometric framework for simultaneously estimating price-cost mark-ups and scale economies. Using an unbalanced panel of 17,653 firms over the period 1986-2001 in France, 8,725 firms over the period 1994-2006 in Japan, and 7,828 firms over the period 1993-2008 in the Netherlands, we first classify 30 comparable manufacturing industries in six distinct regimes that differ in terms of the type of competition prevailing in product and labor markets. For each of the three predominant regimes in each country, we then investigate industry differences in the estimated product and labor market imperfections and scale economies. We not only find important regime differences across the three countries, but also observe cross-country differences in the levels of product and labor market imperfections and scale economies within a particular regime.

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

* The analysis using the Japanese firm-level data was conducted at the Research Institute of Economy, Trade and Industry (RIETI). Kiyota acknowledges financial support from the Japan Society for the Promotion of Science (Grant-in-aid A-22243023). We are grateful to Björn Brügemann, Masahisa Fujita, Kyoji Fukao, Bas van der Klaauw, José Luis Moraga-González, Masayuki Morikawa and Ayumu Tanaka for helpful comments and suggestions. All errors or omissions are the sole responsibility of the authors.

1 Introduction

There is an abundant literature on production function estimation studying how firms convert inputs into outputs and the efficiency with which this occurs (see Syverson, 2011 for a survey). This literature as of late has given increasing attention to possible biases that market imperfections –particularly in the product market– could induce in production function and productivity estimates. There is a long tradition in applied industrial organization of estimating product market power (see De Loecker and Warzynski, 2011 for references). While most economists believe that product and labor market imperfections almost surely exist to one degree or another, only few have explicitly accounted for their joint influence on production function estimation at the micro level (see Dobbelaere and Mairesse, 2012 for references). Contributing to the econometric literature on estimating micro-economic production functions and the one on estimating simultaneously product and labor market imperfections, this paper serves the purpose of quantifying industry differences in product and labor market imperfections and scale economies using firm-level data in France, Japan and the Netherlands. How do manufacturing industries in the three countries under consideration differ in the type of competition prevailing in product and labor markets? How different are manufacturing industries within a particular regime in the levels of imperfections in the product and labor markets in which they operate? These are the main questions that we address.

In this paper, we rely on two extensions of Hall's (1988) econometric framework for estimating simultaneously price-cost mark-ups and scale economies using firm panel data by taking into account imperfections in the labor market. Instead of imposing a particular labor market setting on the data, a common practice in empirical studies estimating labor market imperfections, we follow Dobbelaere and Mairesse (2012) and use econometric production functions as a tool for testing the competitiveness of product and labor markets. Using an unbalanced panel of 17 653 firms over the period 1986-2001 in France, 8 725 firms over the period 1994-2006 in Japan and 7 828 firms over the period 1993-2008 in the Netherlands, we classify 30 comparable manufacturing industries in distinct regimes that differ in terms of the type of competition prevailing in product and labor markets in each country. We consider two product market settings (perfect competition (PC) and imperfect competition (IC)) and three labor market settings (perfect competition or right-to-manage bargaining (PR), efficient bargaining (EB) and monopsony (MO)). We thus distinguish 6 regimes. We find pronounced regime differences across the three countries. Focusing on the product market side, 85% of the industries comprising more than 90% of the firms are characterized by imperfect competition in France and the Netherlands. In Japan, only 50% of the industries comprising 50% of the firms are typified by imperfect competition. Focusing on the labor market side, 30% of the industries comprising about 55% of the firms are characterized by efficient bargaining and 63% of the industries comprising about 43% of the firms are characterized by perfect competition on right-to-manage bargaining in France, while 83% of the industries comprising about 84% of the firms are typified by perfect competition or right-to-manage bargaining in Japan. In the Netherlands, the three labor market settings are more evenly distributed: 47% of the industries comprising about 46% of the firms are featured by perfect competition or right-to-manage bargaining, 30% of the industries comprising about 30% of the firms by efficient bargaining and 23% of the industries comprising about 23% of the firms by monopsony.

For each of the three predominant regimes in each country, we investigate industry differences in the estimated product and labor market imperfection parameters and scale economies. We do not only reveal important cross-country regime differences, we also find cross-country differences in the levels of market imperfections and scale economies within a particular regime.

We proceed as follows. Section 2 discusses the theoretical framework. Section 3 elucidates our empirical strategy. Section 4 presents the firm panel data for France, Japan and the Netherlands. In Section 5, we first classify 30 comparable manufacturing industries in regimes differing in the type of competition that is prevalent in the product and labor markets in the three countries and then investigate industry differences in the estimated parameters of interest within the three predominant regimes in each country. Section 6 concludes.

2 Theoretical framework

This section extends the framework of Hall (1988) for estimating price-cost mark-ups and scale economies. To this end, we follow Dobbelaere and Mairesse (2012) by considering three labor market settings: perfect competition or right-to-manage bargaining (Nickell and Andrews, 1983), efficient bargaining (McDonald and Solow, 1981) and monopsony (Manning, 2003). This section contains the main ingredients of the theoretical framework. For technical details, we refer to Section A.1 in Appendix A.

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 and K is capital. $\Theta_{it} = Ae^{\eta_i + u_t + v_{it}}$, with η_i an unobserved firm-specific effect, u_t a year-specific intercept and v_{it} a random component, is an index of technical change or "true" total factor productivity. Denoting the logarithm of Q_{it}, N_{it}, M_{it}, K_{it} and Θ_{it} by q_{it}, n_{it}, m_{it}, k_{it} and θ_{it} respectively, the logarithmic specification of the production function gives:

$$q_{it} = (\varepsilon_N^Q)_{it} n_{it} + (\varepsilon_M^Q)_{it} m_{it} + (\varepsilon_K^Q)_{it} k_{it} + \theta_{it} \tag{1}$$

where $(\varepsilon_J^Q)_{it}$ $(J = N, M, K)$ is the elasticity of output with respect to input factor J.

Firms operate under imperfect competition in the product market (IC). We allow for three labor market settings (LMS): perfect competition or right-to-manage bargaining (PR), efficient bargaining (EB) and monopsony (MO). We assume that material input and labor are variable factors. Short run profit maximization implies the following first-order condition with respect to material input:

$$(\varepsilon_M^Q)_{it} = \mu_{it} (\alpha_M)_{it} \tag{2}$$

where $(\alpha_M)_{it} = \frac{j_{it} M_{it}}{P_{it} Q_{it}}$ is the share of material costs in total revenue and $\mu_{it} = \frac{P_{it}}{(C_Q)_{it}}$ refers to the mark-up of output price P_{it} over marginal cost $(C_Q)_{it}$. Depending on the prevalent LMS, short-run profit maximization implies the following first-order condition with respect to labor:

$$\begin{aligned}
(\varepsilon_N^Q)_{it} &= \mu_{it} (\alpha_N)_{it} \qquad \text{if } LMS = PR && (3)\\
&= \mu_{it} (\alpha_N)_{it} - \mu_{it} \gamma_{it} \left[1 - (\alpha_N)_{it} - (\alpha_M)_{it}\right] \qquad \text{if } LMS = EB && (4)\\
&= \mu_{it} (\alpha_N)_{it} \left(1 + \frac{1}{(\varepsilon_w^N)_{it}}\right) \qquad \text{if } LMS = MO && (5)
\end{aligned}$$

where $(\alpha_N)_{it} = \frac{w_{it} N_{it}}{P_{it} Q_{it}}$ is the share of labor costs in total revenue. $\gamma_{it} = \frac{\phi_{it}}{1 - \phi_{it}}$ represents the relative extent of rent sharing, $\phi_{it} \in [0, 1]$ the absolute extent of rent sharing and $(\varepsilon_w^N)_{it} \in \Re_+$ the wage elasticity of the labor supply. From the first-order conditions with respect to material input and labor, it follows that the parameter of joint market imperfections (ψ_{it}):

$$\begin{aligned}
\psi_{it} &= \frac{(\varepsilon^Q_M)_{it}}{(\alpha_M)_{it}} - \frac{(\varepsilon^Q_N)_{it}}{(\alpha_N)_{it}} &(6)\\
&= 0 \quad \text{if } LMS = PR &(7)\\
&= \mu_{it}\gamma_{it}\left[\frac{1-(\alpha_N)_{it}-(\alpha_M)_{it}}{(\alpha_N)_{it}}\right] > 0 \quad \text{if } LMS = EB &(8)\\
&= -\mu_{it}\frac{1}{(\varepsilon^N_w)_{it}} < 0 \quad \text{if } LMS = MO &(9)
\end{aligned}$$

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:

$$(\varepsilon^Q_K)_{it} = \lambda_{it} - (\varepsilon^Q_N)_{it} - (\varepsilon^Q_M)_{it} \tag{10}$$

Inserting Eqs. (2), (6) and (10) in Eq. (1) and rearranging terms gives:

$$q_{it} = \mu_{it}\left[(\alpha_N)_{it}(n_{it}-k_{it}) + (\alpha_M)_{it}(m_{it}-k_{it})\right] + \psi_{it}(\alpha_N)_{it}(k_{it}-n_{it}) + \lambda k_{it} + \theta_{it} \tag{11}$$

3 Econometric framework

From Eq. (6), it follows that the data features that are key to empirical identification of the product and labor market imperfection parameters are the differences between the estimated output elasticities of labor and materials and their revenue shares.

Essential is that the test for the prevalent LMS takes the materials market as perfectly competitive and compares it to the labor market. In a perfectly competitive labor market or in a right-to-manage bargaining setting, the only source of discrepancy between the estimated output elasticity of labor and the share of labor costs in revenue is the firm price-cost mark-up, just like in the materials market [Eq. (3)]. Therefore, the difference in the two factors' output-elasticity-to-revenue-share ratios, i.e. the parameter of joint market imperfections, equals zero [Eq. (7)].

In an efficient bargaining setting, the marginal employee receives a wage that exceeds his/her marginal revenue since efficient bargaining allocates inframarginal gains across employees. As such, the output-elasticity-to-revenue-share ratio for labor becomes smaller, and smaller than the respective ratio for materials in particular. Hence, there is a positive difference between the materials and labor ratios, i.e. the parameter of joint market imperfections is positive [Eq. (8)].

In a monopsony setting, on the other hand, the marginal employee obtains a wage that is less than his/her marginal revenue. As such, the output-elasticity-to-revenue-share ratio for labor exceeds the respective ratio for materials, yielding the negative parameter of joint market imperfections [Eq. (9)].

Depending on the LMS, it follows from the parameter of joint market imperfections that the differences between the estimated output elasticities of labor and materials and their revenue shares can be mapped into either the firm price-cost mark-up and the extent of rent sharing [Eq. (8)] or the firm price-cost mark-up and the firm labor supply elasticity [Eq. (9)].

Since our study aims at (*i*) comparing regime differences in terms of the type of competition prevailing in product and the labor markets across France, Japan and the Netherlands and (*ii*) assessing within-regime industry differences in the estimated product and labor market imperfection parameters and the scale elasticity parameters in each of the countries, we estimate *average* parameters.[1] There are many sources of variation in input shares. Some of them are related to variation in machinery and capacity utilization (variation in the business cycle). When deriving our parameters of interest, we want to abstract from such sources of variation. Therefore, we assume *average* input shares. The empirical specification that acts as the bedrock for the regressions at the industry level is hence given by:

$$q_{it} - k_{it} = \mu \left[\alpha_N (n_{it} - k_{it}) + \alpha_M (m_{it} - k_{it})\right] + \psi \alpha_N (k_{it} - n_{it}) + (\lambda - 1) k_{it} + \zeta_{it} \tag{12}$$

The estimated industry-specific joint market imperfections parameter $\left(\widehat{\psi}_j\right)$ determines the regime characterizing the type of competition prevailing in the product and the labor market. *A priori*, 6 distinct regimes are possible: (*1*) perfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market, (*2*) imperfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market, (*3*) perfect competition in the product market and efficient bargaining in the labor market, (*4*) imperfect competition in the product market and efficient bargaining in the labor market, (*5*) perfect competition in the product market and monopsony in the labor market and (*6*) imperfect competition in the product market and monopsony in the labor market.[2] We denote the 6 possible regimes by $R \in \Re = \{PC\text{-}PR, IC\text{-}PR, PC\text{-}EB, IC\text{-}EB, PC\text{-}MO, IC\text{-}MO\}$, where the first part reflects the type of competition in the product market and the second part reflects the type of competition in the labor market. Once the regime is determined, we derive the product and labor market imperfection parameters from the estimated joint market imperfections parameter.

4 Data description

This section discusses the French, Japanese and Dutch firm-level data respectively. For each country, our estimation sample is restricted to firms having at least 4 consecutive observations.

4.1 France

We use an unbalanced panel of manufacturing firms over the period 1986-2001, based mainly on firm accounting information from EAE ("Enquête Annuelle d' Entreprise", "Service des Etudes et Statistiques Industrielles" (SESSI)). After some cleaning to eliminate outliers and anomalies, we end up with an unbalanced panel of 17 653 firms with the number of observations for each firm varying between 4 and 16.[3] We use 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

[1] Note that a constant (or average) price-cost mark-up is consistent with standard utility functions such as Cobb-Douglas and constant elasticity of substitution utility functions.

[2] Following previous empirical work, we use the term "perfect competition in the product market" to refer to a product market setting where firms do not have product market power, i.e. $\mu_{it} = 1$ (see e.g. Hall, 1988; Crépon *et al.*, 2005; Dobbelaere, 2004; Abraham *et al.*, 2009; Boulhol *et al.*, 2011).

[3] Putting the number of firms between brackets and the number of observations between square brackets, the structure of the data is given by: (642) [4], (982) [5], (2 027) [6], (1 996) [7], (1 766) [8], (1 594) [9], (1 565) [10], (1 266) [11], (1 238) [12], (1 000) [13], (778) [14], (594) [15], (2 205) [16]. The median number of observations per firm is 9 and the total number of observations is 174 600.

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.

4.2 Japan

We use an unbalanced panel of manufacturing firms over the period 1994-2006, based on the confidential micro database of the "Kigyou Katsudou Kihon Chousa Houkokusho" (Basic Survey of Japanese Business Structure and Activities (BSJBSA)) collected annually by the Research and Statistics Department (METI). The survey is compulsory for firms with more than 50 employees and with capital of more than 30 million yen. After some cleaning to eliminate outliers and anomalies, we end up with an unbalanced panel of 8 725 firms with the number of observations for each firm varying between 4 and 13.[4] Output (Q) is defined as real gross output measured by nominal sales divided by the industry-level gross output price deflator. Labor (N) is defined as the number of man-hours, computed as each firm's total number of workers multiplied by working hours. Real intermediate inputs (M) is defined as nominal intermediate inputs deflated by the industry-level input price deflator. Real capital stock (K) is computed from tangible assets and investment based on the perpetual inventory method. Details on the measurement of the user cost of capital can be found in Section B.1 in Appendix B. The working hours and price deflators are obtained from the Japan Industrial Productivity (JIP) 2009 database, which was compiled as a part of a research project by RIETI and Hitotsubashi University.[5] The shares of labor (α_N) and material input (α_M) are constructed by dividing respectively the firm total labor cost and undeflated intermediate inputs by the firm undeflated production.[6]

4.3 The Netherlands

We use an unbalanced panel of manufacturing firms over the period 1993-2008, based on the Production Survey (PS) which is carried out by the "Centraal Bureau voor de Statistiek" (CBS). After some cleaning to eliminate outliers and anomalies, we end up with an unbalanced panel of 7 828 firms with the number of observations for each firm varying between 4 and 16.[7] We use turnover deflated by the industry-level gross output price index 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 industry-level intermediate inputs price index. The capital stock (K) is proxied by depreciation of fixed assets deflated by the industry-level gross fixed capital formation price index for all assets. The price deflators are obtained from the EUKLEMS database (November 2009 release, March 2011 update). 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.

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[4] Putting the number of firms between brackets and the number of observations between square brackets, the structure of the data is given by: (556) [4], (637) [5], (597) [6], (661) [7], (670) [8], (742) [9], (812) [10], (905) [11], (1325) [12], (1 820) [13]. The median number of observations per firm is 10 and the total number of observations is 83 291.

[5] For more details on the JIP database, see Fukao *et al.* (2007).

[6] For details on the Japanese data, we refer to Kiyota *et al.* (2009).

[7] Putting the number of firms between brackets and the number of observations between square brackets, the structure of the data is given by: (1 025) [4], (613) [5], (660) [6], (662) [7], (563) [8], (590) [9], (594) [10], (572) [11], (564) [12], (533) [13], (617) [14], (351) [15], (484) [16]. The median number of observations per firm is 9 and the total number of observations is 73 149.

Table 1 reports the means, standard deviations and quartile values of our key variables for each country. The average growth rate of real firm output is 3.3% per year in France (FR), 2.0% in Japan (JP) and 2.5% in the Netherlands (NL). In FR, labor, materials and capital have increased at an average annual growth rate of 1.4%, 4.9% and 0.8% respectively. In JP, labor and capital have decreased at an average annual growth rate of 0.2% and 0.3% respectively, while materials has increased at an average annual growth rate of 1.3%. In NL, labor, materials and capital have increased at an average annual growth rate of 0.4%, 2.6% and 1.6% respectively. The Solow residual or the conventional measure of total factor productivity (TFP) is stable over the considered period in each country. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, TFP growth is lower than -5.2% (-2.2%) [-4.3%] for the first quartile of firms and higher than 5.9% (4.2%) [5.9%] for the upper quartile in FR (JP) [NL].

<Insert Table 1 about here>

5 Results

From Sections 2 and 3, it follows that the industry-specific joint market imperfections parameter captures (im)perfect competition in both the product and the labor market and as such determines the prevalent regime to which the industry belongs. In this section, we first classify 30 manufacturing industries in FR, JP and NL in distinct product and labor market regimes. Once the regime is determined, we derive the average industry-specific product and labor market imperfection parameters from the estimated average industry-specific joint market imperfection parameters. Within the three predominant regimes in each country, we then provide a detailed analysis of industry differences in the estimated average parameters of interest, i.e. the scale elasticity parameter, the joint market imperfections parameter, and –depending on the regime– the price-cost mark-up and the extent of rent-sharing or the labor supply elasticity parameters.

5.1 Classification of industries

In each country, we consider 30 comparable manufacturing industries, making up our sample. This decomposition is detailed enough for our purposes and ensures that each industry contains a sufficient number of observations (minimum: 342 observations). Table B.1 in Appendix B presents the industry repartition of the sample and the number of firms and the number of observations for each industry $j \in \{1, \dots, 30\}$.

For each industry $j \in \{1, \dots, 30\}$, we estimate the production function [Eq. (12)] using the system GMM estimator[8] and apply the classification procedure introduced in Dobbelaere and Mairesse (2012) to classify our 30 manufacturing industries in $R \in \Re = \{PC\text{-}PR, IC\text{-}PR, PC\text{-}EB, IC\text{-}EB, PC\text{-}MO, IC\text{-}MO\}$. This classification procedure is summarized in Section A.4 in Appendix A. Table 2 provides details on the specific industries belonging to each regime. The last row of Table 2 indicates that the $IC\text{-}EB$-regime applies at the manufacturing level in France and the Netherlands while $PC\text{-}PR$ is the prevalent regime at the manufacturing level in Japan.

<Insert Table 2 about here>

[8] 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 the lagged first-differences of n, m and k dated $(t-1)$ in the levels equations. We retrieved the first-step robust standard errors. Details on the industry-specific estimates are not reported but available upon request.

Table 3 summarizes the industry classification. From Table 3, it follows that the three predominant regimes in FR are IC-EB, IC-PR and PC-PR. The IC-EB-regime contains 30% of the industries comprising 55% of the firms, the IC-PR-regime contains 50% of the industries comprising 38% of the firms and the PC-PR-regime contains 13% of the industries comprising 5% of the firms. On the product market side, 83% of the industries, comprising 94% of the firms, are typified by imperfect competition. On the labor market side, 30% of the industries, comprising 55% of the firms, are characterized by efficient bargaining, 63% of the industries, comprising 43% of the firms, by perfect competition or right-to-manage bargaining and monopsony features only 7% of the industries, comprising 2% of the firms.

In JP, the prevalent regimes are PC-PR, IC-PR and IC-EB. The PC-PR-regime –which is by far the dominant regime– contains 50% of the industries comprising 50% of the firms, the IC-PR-regime contains 33% of the industries comprising 33% of the firms and the IC-EB-regime contains 17% of the industries comprising 16% of the firms. On the product market side, 50% of the industries, comprising 50% of the firms, are typified by imperfect competition. On the labor market side, 83% of the industries, comprising 84% of the firms, are characterized by perfect competition or right-to-manage bargaining and 17% of the industries, comprising 16% of the firms, by efficient bargaining.

In NL, the three predominant regimes are IC-PR, IC-EB and IC-MO. The IC-PR-regime contains 40% of the industries comprising 44% of the firms, the IC-EB-regime contains 30% of the industries comprising 30% of the firms and the IC-MO-regime contains 17% of the industries comprising 17% of the firms. On the product market side, 87% of the industries, comprising 91% of the firms, are typified by imperfect competition. The three labor market settings are more evenly distributed compared to FR and JP: 47% of the industries, comprising 46% of the firms, are characterized by by perfect competition or right-to-manage bargaining, 30% of the industries, comprising 30% of the firms by efficient bargaining and monopsony features 23% of the industries, comprising 23% of the firms.

<Insert Table 3 about here>

Summing up, we observe important regime differences across the three countries. Does that imply that manufacturing industries in the three countries under consideration differ considerably in the type of competition prevailing in product and labor markets? To answer that question, we compare the relevant regime of each industry $j \in \{1, \ldots, 30\}$ across the three countries. If a particular industry is characterized by the same product market or labor market setting in each of the three countries, we define that industry to be "strongly" typified by that particular setting. These industries are indicated by $\left(^{\star}\right)$ in column 6 of Table 2. Focusing on the product market side, we observe 10 strongly imperfectly competitive industries. Among them are industries manufacturing chemical products, pharmaceutical products, special industrial machinery, electronic parts and components and precision instruments. Focusing on the labor market side, we observe 6 strong PR-industries. Among them are industries manufacturing pharmaceutical products, plastic products, household electrical appliances and motor vehicles.

5.2 Within-regime industry differences in parameters of interest

Within each of the three predominant regimes in FR, JP and NL, we investigate industry differences in the estimated industry-specific scale elasticity parameter $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$, and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent-sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j$ parameters.

Table 4 presents the industry mean and the industry quartile values of the system GMM results within the predominant regimes.[9] In addition to the parameters mentioned above, we also report the industry-specific profit ratio parameter, which can be expressed as the estimated industry-specific price-cost mark-up divided by the estimated industry-specific scale elasticity $\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$. This ratio shows that the source of profit lies either in imperfect competition or decreasing returns to scale. The standard errors (σ) of $\widehat{\mu}_j$, $\widehat{\gamma}_j$, $\widehat{\phi}_j$, $\widehat{\beta}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are computed using the Delta method (Wooldridge, 2002).[10]

Let us focus the discussion on the primary parameters within the predominant regimes in FR, JP and NL respectively. The predominant regimes in FR are IC-PR (15 industries), IC-EB (9 industries) and PC-PR (4 industries).

- Within regime $R = IC$-PR in FR, $\widehat{\lambda}_j$ is lower than 0.989 for industries in the first quartile and higher than 1.019 for industries in the third quartile. $\widehat{\mu}$ is lower than 1.205 for industries in the first quartile and higher than 1.270 for industries in the upper quartile. The median values of λ_j and μ_j are estimated at 1.005 and 1.237 respectively.
- Within regime $R = IC$-EB in FR, $\widehat{\lambda}_j$ is lower than 0.937 for industries in the first quartile and higher than 0.979 for industries in the third quartile. $\widehat{\psi}_j$ is lower than 0.436 for industries in the first quartile and higher than 0.702 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.310 for the first quartile of industries and higher than 1.431 for the top quartile. The corresponding $\widehat{\phi}_j$ is lower than 0.376 for the first quartile of industries and higher than 0.460 for the top quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$ $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.962, 0.518, 1.346 and 0.414 respectively.
- Within regime $R = PC$-PR in FR, $\widehat{\lambda}_j$ is lower than 0.949 for industries in the first quartile and higher than 0.988 for industries in the third quartile. $\widehat{\mu}$ is lower than 0.984 for industries in the first quartile and higher than 1.067 for industries in the upper quartile. The median values of λ_j and μ_j are estimated at 0.966 and 1.015 respectively.

The predominant regimes in JP are PC-PR (15 industries), IC-PR (10 industries) and IC-EB (5 industries).

- Within regime $R = PC$-PR in JP, $\widehat{\lambda}_j$ is lower than 1.032 for industries in the first quartile and higher than 1.088 for industries in the third quartile. $\widehat{\mu}$ is lower than 1.011 for industries in the first quartile and higher than 1.099 for industries in the upper quartile. The median values of λ_j and μ_j are estimated at 1.054 and 1.049 respectively.
- Within regime $R = IC$-PR in JP, $\widehat{\lambda}_j$ is lower than 1.032 for industries in the first quartile and higher than 1.055 for industries in the third quartile. $\widehat{\mu}$ is lower than 1.106 for industries in the first quartile

[9] Details on the industry-specific estimates are not reported but available upon request.

[10] More specifically, dropping subscript j, $\widehat{\mu}$, $\widehat{\gamma}$, $\widehat{\phi}$, $\widehat{\beta}$ and $\widehat{\varepsilon}_w^N$ are derived as follows:
$\widehat{\mu} = \frac{\widehat{\varepsilon}_M^Q}{\alpha_M}$, $\widehat{\gamma} = \frac{\widehat{\varepsilon}_N^Q - \left(\widehat{\varepsilon}_M^Q \frac{\alpha_N}{\alpha_M}\right)}{\frac{\widehat{\varepsilon}_M^Q}{\alpha_M}(\alpha_N + \alpha_M - 1)}$, $\widehat{\phi} = \frac{\widehat{\gamma}}{1+\widehat{\gamma}}$, $\widehat{\beta}_j = \frac{\alpha_N}{\alpha_M}\frac{\widehat{\varepsilon}_M^Q}{\widehat{\varepsilon}_N^Q}$ and $\widehat{\varepsilon}_w^N = \frac{\widehat{\beta}}{1-\widehat{\beta}}$. Their respective standard errors are computed as:

$$\left(\sigma_{\widehat{\mu}}\right)^2 = \frac{1}{(\alpha_M)^2}\left(\sigma_{\widehat{\varepsilon}_M^Q}\right)^2, \; \left(\sigma_{\widehat{\gamma}}\right)^2 = \left(\frac{\alpha_M}{\alpha_N + \alpha_M - 1}\right)^2 \frac{\left(\widehat{\varepsilon}_M^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2 - 2\widehat{\varepsilon}_N^Q\widehat{\varepsilon}_M^Q\left(\sigma_{\widehat{\varepsilon}_N^Q,\widehat{\varepsilon}_M^Q}\right) + \left(\widehat{\varepsilon}_N^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2}{\left(\widehat{\varepsilon}_M^Q\right)^4}, \; \left(\sigma_{\widehat{\phi}}\right)^2 = \frac{(\sigma_{\widehat{\gamma}})^2}{(1+\widehat{\gamma})^4},$$

$$\left(\sigma_{\widehat{\beta}}\right)^2 = \left(\frac{\alpha_N}{\alpha_M}\right)^2 \frac{\left(\widehat{\varepsilon}_M^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2 - 2\widehat{\varepsilon}_N^Q\widehat{\varepsilon}_M^Q\left(\sigma_{\widehat{\varepsilon}_N^Q,\widehat{\varepsilon}_M^Q}\right) + \left(\widehat{\varepsilon}_N^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_M^Q}\right)^2}{\left(\widehat{\varepsilon}_N^Q\right)^4} \text{ and } \left(\sigma_{\widehat{\varepsilon}_w^N}\right)^2 = \frac{\left(\sigma_{\widehat{\beta}}\right)^2}{(1-\widehat{\beta})^4}.$$

and higher than 1.174 for industries in the upper quartile. The median values of λ_j and μ_j are estimated at 1.035 and 1.133 respectively.

- Within $R = IC\text{-}EB$ in JP, $\widehat{\lambda}_j$ is lower than 0.993 for industries in the first quartile and higher than 1.007 for industries in the third quartile. $\widehat{\psi}_j$ is lower than 0.367 for industries in the first quartile and higher than 0.483 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.072 for the first quartile of industries and higher than 1.123 for the top quartile. The corresponding $\widehat{\phi}_j$ is estimated to be lower than 0.418 for industries in the first quartile and higher than 0.515 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$ $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.997, 0.450, 1.086 and 0.463 respectively.

The predominant regimes in NL are $IC\text{-}PR$ (12 industries), $IC\text{-}EB$ (9 industries) and $IC\text{-}MO$ (5 industries).

- Within regime $R = IC\text{-}PR$ in NL, $\widehat{\lambda}_j$ is lower than 1.008 for industries in the first quartile and higher than 1.045 for industries in the third quartile. $\widehat{\mu}$ is lower than 1.299 for industries in the first quartile and higher than 1.392 for industries in the upper quartile. The median values of λ_j and μ_j are estimated at 1.024 and 1.361 respectively.
- Within $R = IC\text{-}EB$ in NL, $\widehat{\lambda}_j$ is lower than 0.983 for industries in the first quartile and higher than 1.016 for industries in the third quartile. $\widehat{\psi}_j$ is lower than 0.397 for industries in the first quartile and higher than 0.693 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.331 for the first quartile of industries and higher than 1.447 for the top quartile. The corresponding $\widehat{\phi}_j$ is estimated to be lower than 0.267 for industries in the first quartile and higher than 0.294 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$ $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.995, 0.451, 1.369 and 0.273 respectively.
- Within $R = IC\text{-}MO$ in NL, $\widehat{\lambda}_j$ is lower than 1.046 for industries in the first quartile and higher than 1.064 for industries in the third quartile. $\widehat{\psi}_j$ is lower than -0.668 for industries in the first quartile and higher than -0.496 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.223 for the first quartile of industries and higher than 1.271 for the top quartile. The corresponding $\left(\widehat{\varepsilon}_w^N\right)_j$ is estimated to be lower than 1.831 for industries in the first quartile and higher than 2.431 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$ $\widehat{\mu}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are estimated at 1.059, -0.604, 1.231 and 2.106 respectively.

<Insert Table 4 about here>

Summing up, we do not only observe important regime differences across the three countries, we also find cross-country differences in the levels of product and labor market imperfections and scale economies within a particular regime. Within the $IC\text{-}PR$-regime, the median scale elasticity estimates are comparable across the three countries while the median price-cost mark-up is estimated to be the highest in the Netherlands and the lowest in Japan. Within the $IC\text{-}EB$-regime, the median scale elasticity estimates are comparable across the three countries. The median price-cost mark-up is estimated to be the highest in the Netherlands and the lowest in Japan while the opposite is true for the median absolute extent of rent sharing.

How do our estimates of product and labor market imperfections match up with other studies focusing on the same countries? Our industry classification and the order of magnitudes of our joint market imperfections parameter and corresponding product and labor market imperfection parameters within each regime are consistent with the corresponding classification and parameter estimates of Dobbelaere and Mairesse (2012). The latter study uses an unbalanced panel of 10 646 French firms in 30 manufacturing industries over the period 1978-2001 extracted from EAE and assumes constant returns to scale. Using an unbalanced panel of more than 8 000 Japanese firms in 26 manufacturing industries over the period 1994-2006 extracted from the BSJBSA and imposing $LMS = PR$ on the data, Kiyota (2010) estimates the scale elasticity parameter to be lower than 0.868 for the bottom quartile of industries and higher than 0.930 for the top quartile. The price-cost mark-up is estimated to be lower than 0.940 for the first quartile of industries and higher than 0.993 for the upper quartile. Using an unbalanced panel of 2 471 Dutch firms in 11 manufacturing industries over the period 1992-1997 extracted from the Amadeus database, assuming constant returns to scale and imposing $LMS = PR$ on the data, Konings *et al.* (2001) find that the price-cost mark-up is lower than 1.460 for the first quartile of industries and higher than 1.790 for the upper quartile.

Other studies focusing on the same kind of analysis include Dobbelaere (2004) and Boulhol *et al.* (2011). Using an unbalanced panel of 7 086 Belgian firms in 18 manufacturing industries over the period 1988-1995 extracted from the annual company accounts collected by the National Bank of Belgium and imposing $LMS = EB$ on the data, the former estimates the scale elasticity parameter to be lower than 1 for the first quartile of industries and higher than 1.171 for the upper quartile. The price-cost mark-up is estimated to be lower than 1.347 for the bottom quartile of industries and higher than 1.629 for the top quartile. The corresponding absolute extent of rent-sharing estimate is lower than 0.134 for the first quartile of industries and higher than 0.221 for the third quartile. Using a panel of 11 799 British firms in 20 manufacturing industries over the period 1988-2003 extracted from OneSource and Financial Analysis Made Easy, assuming constant returns to scale and imposing $LMS = EB$ on the data , Boulhol *et al.* (2011) estimate the price-cost mark-up to be lower than 1.212 for the bottom quartile of industries and higher than 1.292 for the top quartile. The corresponding absolute extent of rent sharing is estimated to be lower than 0.189 for the first quartile of industries and higher than 0.544 for the upper quartile. Whereas there is an abundant literature on estimating the extent of product market power (see Bresnahan, 1989 for a survey), there is little direct evidence of employer market power over its workers. For studies estimating the wage elasticity of the labor supply curve facing an individual employer, we refer to Reynolds (1946), Nelson (1973), Sullivan (1989), Boal (1995), Staiger *et al.* (1999), Falch (2001), Manning (2003) and Booth and Katic (2011). These studies point to an elasticity in the [0.7-5]-range.

6 Conclusion

How different are manufacturing industries in their factor shares, in their marginal products, in their scale economies and in their imperfections in the product and labor markets in which they operate? How does their behavior deviate across countries? In order to analyze these questions, we rely on an extension of Hall's (1988) econometric framework for estimating price-cost mark-ups and scale economies by nesting three distinct labor market settings (perfect competition or right-to-manage bargaining, efficient bargaining and monopsony).

Using an unbalanced panel of 17 653 firms over the period 1986-2001 in France, 8 725 firms over the period 1994-2006 in Japan and 7 828 firms over the period 1993-2008 in the Netherlands, we follow Dobbelaere and Mairesse (2012) and first classify 30 comparable manufacturing industries into 6 regimes depending on the type of competition in the product and labor markets. Our analysis provides evidence of pronounced regime differences across the three countries. The dominant regime in France is one of imperfect competition in the product market and efficient bargaining in the labor market (IC-EB), followed by a regime of imperfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market (IC-PR), and by a regime of perfect competition in the product market and and perfect competition or right-to-manage bargaining in the labor market (PC-PR). The median price-cost mark-up and absolute extent of rent-sharing parameters in the IC-EB-industries are of about 1.41 and 0.41 respectively, while the median price-cost mark-up in the IC-PR-industries is of about 1.24 and the median price-cost mark-up in the PC-PR-industries is of about 1.01. In Japan, the predominant regimes are PC-PR (with a median price-cost mark-up of about 1.05), IC-PR (with a median price-cost mark-up of about 1.13) and IC-EB (with a median price-cost mark-up and absolute extent of rent sharing of about 1.09 and 0.46 respectively). In the Netherlands, the predominant regimes are IC-PR (with a median price-cost mark-up of about 1.36), IC-EB (with a median price-cost mark-up and absolute extent of rent sharing of 1.37 and 0.27 respectively) and imperfect competition in the product market and monopsony in the labor market (IC-MO, with a median price-cost mark-up and labor supply elasticity of 1.23 and 2.11 respectively).

Our study does not only highlight cross-country regime differences, it also reveals cross-country differences in the levels of product and labor market imperfections and scale economies within a particular regime.

Our analysis can be extended in several promising ways. First, we might investigate the potential consequences of labor adjustment costs on our estimates of labor and product market imperfections. Labor adjustment costs resulting from employment protection legislation and other institutional factors may account for part of the estimated wedge between labor output elasticity and share which might bias our parameters of joint market imperfections and labor market imperfections. Second, we might examine how our parameters of interest might be biased by estimating a revenue production function rather than an output production function for lack of firm-level output price indices. The unavailability of firm-level price data is a major drawback in microeconometric studies of firm behavior and is clearly an important avenue for future research.[11] Third, we might investigate how our industry estimates of market imperfection parameters in the three countries correlate with industry characteristics. This worthwhile exercise might allow us to assess the plausibility of our estimated imperfection parameters and reveal cross-country differences in the sources of market imperfections.

References

[1] Abraham F, Konings J, Vanormelingen S. 2009. The effect of globalization on union bargaining and price-cost margins of firms. *Review of World Economics* **145(1)**: 13-36.

[2] Bhaskar V, Manning A, To T. 2002. Oligopsony and monopsonistic competition in labor markets. *Journal of Economic Perspectives* **16(2)**: 155-174.

[3] Bhaskar V, To T. 1999. Minimum wages for Ronald McDonald monopsonies: A theory of monopsonistic competition. *Economic Journal* **109(455)**: 190-203.

[4] Boal WM. 1995. Testing for employer monopsony in turn-of-the-century coal mining. *RAND Journal of Economics* **26(3)**: 519-536.

[11] For recent discussions and studies related to this issue, we refer to Griliches and Mairesse (1998), Melitz (2000), Mairesse and Jaumandreu (2005), Levinsohn and Melitz (2006), Foster *et al.* (2008), Katayama *et al.* (2009) and Syverson (2011).

[5] Boal WM, Ransom MR. 1997. Monopsony in the labor market. *Journal of Economic Literature* **35(1)**: 86-112.

[6] Booth AL, Katic P. 2011. Estimating the wage elasticity of labour supply to a firm: What evidence is there for monopsony? *Economic Record* **87(278)**: 359-369.

[7] Boulhol H, Dobbelaere S, Maioli S. 2011. Imports as product and labour market discipline. *British Journal of Industrial Relations* **49(2)**: 331-361.

[8] Bresnahan T. 1989. Empirical studies of industries with market power. In *Handbook of Industrial Organization, vol. 2*, Schmalensee R, Willig R (eds). North-Holland: Amsterdam.

[9] Burdett K, Mortensen D. 1998. Wage differentials, employer size and unemployment. *International Economic Review* **39(2)**: 257-273.

[10] Crépon B, Desplatz R, Mairesse J. 2005. Price-cost margins and rent sharing: Evidence from a panel of French manufacturing firms. *Annales d'Economie et de Statistique, Special issue in memory of Zvi Griliches* **79/80**: 585-611.

[11] De Loecker K, Warzynski F. 2011. Markups and firm-level export status. *American Economic Review*, forthcoming.

[12] Dobbelaere S. 2004. Estimation of price-cost margins and union bargaining power for Belgian manufacturing. *International Journal of Industrial Organization* **22(10)**: 1381-1398.

[13] Dobbelaere S, Mairesse J. 2012. Panel data estimates of the production function and product and labor market imperfections. *Journal of Applied Econometrics*, forthcoming.

[14] Falch T. 2001. Decentralized public sector wage determination: Wage curve and wage comparison for Norwegian teachers in the pre-WW2 period. *Labour* **15(3)**: 343-369.

[15] Foster L, Haltiwanger J, Syverson C. 2008. Reallocation, firm turnover, and efficiency: Selection on productivity or profitability? *American Economic Review* **98(1)**: 394-425.

[16] Fukao Kyoji, Hamagata S, Inui T, Ito K, Kwon HU, Makino T, Miyagawa T, Nakanishi Y, Tokui J. 2007. Estimation procedures and TFP analysis of the JIP database 2006. *RIETI Discussion Paper 07-E-003*. Research Institute of Economy, Trade and Industry.

[17] Fukao K, Kwon HU. 2006. Why did Japan's TFP growth slow down in the lost decade? An empirical analysis based on firm-level data of manufacturing. *Japanese Economic Review* **57(2)**: 195-228.

[18] Griliches Z, Mairesse J. 1998. Production functions: The search for identification. In *Essays in honour of Ragnar Frisch, Econometric Society Monograph Series*. Strom S (ed). Cambridge University Press: Cambridge.

[19] Hall RE. 1988. The relationship between price and marginal cost in US industry. *Journal of Political Economy* **96(5)**: 921-947.

[20] Katayama H, Lu S, Tybout JR. 2009. Firm-level productivity studies: Illusions and a solution. *International Journal of Industrial Organization* **27(3)**: 403-413.

[21] Kiyota K. 2010. Productivity, markup, scale economies, and the business cycle: Estimates from firm-level panel data in Japan. *RIETI Discussion Paper 10-E-040*. Research Institute of Economy, Trade and Industry.

[22] Kioyta K, Nakajima T, Nishimura KG. 2009. Measurement of the market power of firms: the Japanese case in the 1990s, *Industrial and Corporate Change* **18(3)**: 381-414.

[23] Konings J, Van Cayseele P, Warzynski F. 2001. The dynamics of industrial mark-ups in two small open economies: Does national competition policy matter? *International Journal of Industrial Organization* **19(5)**: 841-859.

[24] Levinsohn J, Melitz MJ. 2006. Productivity in a differentiated products market equilibrium. Unpublished manuscript. Princeton University.

[25] Manning A. 2003. Monopsony in motion: Imperfect competition in labor markets. Princeton University Press: Princeton.

[26] Mairesse J, Jaumandreu J. 2005. Panel-data estimates of the production function and the revenue function: What difference does it make? *Scandinavian Journal of Economics* **107(4)**: 651-672.

[27] McDonald IM, Solow RM. 1981. Wage bargaining and employment. *American Economic Review* **71(5)**: 896-908.

[28] Melitz MJ. 2000. Estimating firm-level productivity in differentiated product industries. Unpublished manuscript. Harvard University.

[29] Nelson P. 1973. The elasticity of labor supply to the individual firm. *Econometrica* **41(5)**: 853-866.

[30] Nickell SJ, Andrews M. 1983. Unions, real wages and employment in Britain 1951-79. *Oxford Economic Papers* **35(supplement)**: 183-205.

[31] Research and Statistics Department, Ministry of Economy, Trade and Industry (METI). 1994-2006. *Kigyou Katsudou Kihon Chousa Houkokusho* (*Basic Survey of Japanese Business Structure and Activities*). Tokyo: METI.

[32] Reynolds L. 1946. The supply of labor to the firm. *Quarterly Journal of Economics* **60(2)**: 390-411.

[33] Staiger D, Spetz J, Phibbs C. 1999. Is there monopsony in the labor market? Evidence from a natural experiment. *NBER Working Paper 7258*. National Bureau of Economic Research.

[34] Sullivan D. 1989. Monopsony power in the market for nurses. *Journal of Law and Economics* **32(2)**: S135-S178.

[35] Syverson C. 2011. What determines productivity? *Journal of Economic Literature* **49(2)**: 326-365.

[36] Tokui J, Inui T, Kim YG. 2008. Embodied technological progress and productivity slowdown in Japan. *RIETI Discussion Paper 08-E-017*. Research Institute of Economy, Trade and Industry.

[37] Wooldridge J. 2002. *Econometric analysis of cross sections and panel data*. MIT Press: Cambridge, MA.

Table 1
Summary statistics

	FRANCE (1986-2001)					
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.033	0.152	-0.050	0.030	0.115	156 947
Labor growth rate Δn_{it}	0.014	0.128	-0.040	0.000	0.066	156 947
Materials growth rate Δm_{it}	0.049	0.192	-0.054	0.044	0.148	156 947
Capital growth rate Δk_{it}	0.008	0.156	-0.070	-0.013	0.074	156 947
$(\alpha_N)_j(\Delta n_{it}-\Delta k_{it})+(\alpha_M)_j(\Delta m_{it}-\Delta k_{it})$	0.022	0.148	-0.058	0.024	0.102	156 947
$(\alpha_N)_j(\Delta k_{it}-\Delta n_{it})$	-0.002	0.055	-0.028	-0.004	0.024	156 947
SR_{it}	0.003	0.098	-0.052	0.004	0.059	156 947
Labor share in nominal output $(\alpha_N)_i$	0.309	0.130	0.217	0.296	0.386	174 600
Materials share in nominal output $(\alpha_M)_i$	0.502	0.143	0.413	0.511	0.602	174 600
$1-(\alpha_N)_i-(\alpha_M)_i$	0.188	0.087	0.130	0.165	0.219	174 600
Number of workers N_{it}	144	722	30	46	99	174 600

	JAPAN (1994-2006)					
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.020	0.140	-0.050	0.015	0.085	75 038
Labor growth rate Δn_{it}	-0.002	0.099	-0.045	-0.005	0.038	75 038
Materials growth rate Δm_{it}	0.013	0.161	-0.065	0.009	0.088	75 038
Capital growth rate Δk_{it}	-0.003	0.108	-0.071	-0.032	0.028	75 038
$(\alpha_N)_j(\Delta n_{it}-\Delta k_{it})+(\alpha_M)_j(\Delta m_{it}-\Delta k_{it})$	0.011	0.144	-0.058	0.021	0.090	75 038
$(\alpha_N)_j(\Delta k_{it}-\Delta n_{it})$	0.000	0.027	-0.015	-0.003	0.011	75 038
SR_{it}	0.011	0.067	-0.022	0.009	0.042	75 038
Labor share in nominal output $(\alpha_N)_i$	0.199	0.088	0.139	0.187	0.245	83 291
Materials share in nominal output $(\alpha_M)_i$	0.714	0.105	0.657	0.728	0.786	83 291
$1-(\alpha_N)_i-(\alpha_M)_i$	0.087	0.048	0.054	0.074	0.105	83 291
Number of workers N_{it}	530	2253	94	160	340	83 291

	THE NETHERLANDS (1993-2008)					
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.025	0.186	-0.063	0.022	0.115	65 321
Labor growth rate Δn_{it}	0.004	0.127	-0.026	0.000	0.034	65 321
Materials growth rate Δm_{it}	0.026	0.251	-0.088	0.020	0.142	65 321
Capital growth rate Δk_{it}	0.016	0.227	-0.076	0.000	0.114	65 321
$(\alpha_N)_j(\Delta n_{it}-\Delta k_{it})+(\alpha_M)_j(\Delta m_{it}-\Delta k_{it})$	0.001	0.175	-0.077	-0.003	0.078	65 321
$(\alpha_N)_j(\Delta k_{it}-\Delta n_{it})$	0.003	0.061	-0.023	0.000	0.032	65 321
SR_{it}	0.008	0.107	-0.043	0.004	0.059	65 321
Labor share in nominal output $(\alpha_N)_i$	0.275	0.109	0.200	0.273	0.344	73 149
Materials share in nominal output $(\alpha_M)_i$	0.447	0.147	0.349	0.439	0.539	73 149
$1-(\alpha_N)_i-(\alpha_M)_i$	0.278	0.092	0.215	0.272	0.332	73 149
Number of workers N_{it}	105	472	27	45	93	73 149

[a] $SR_{it}= \Delta q_{it}-(\alpha_N)_j\,\Delta n_{it}-(\alpha_M)_j\,\Delta m_{it}-(1-\alpha_N-\alpha_M)\Delta k_{it}$.

Table 2
Classification of industry $j \in \{1, \ldots, 30\}$ in
regime $R \in \Re = \{PC\text{-}PR, IC\text{-}PR, PC\text{-}EB, IC\text{-}EB, PC\text{-}MO, IC\text{-}MO\}$

		Regime R			
Industry j	Name	**FR**	**JP**	**NL**	
1	Livestock, seafood and flour products	*IC-PR*	*IC-EB*	*PC-MO*	
2	Miscellaneous food and related products	*IC-EB*	*IC-EB*	*IC-PR*	IC^*
3	Beverages and tobacco	*IC-MO*	*PC-PR*	*IC-MO*	
4	Textiles	*IC-EB*	*IC-PR*	*IC-PR*	IC^*
5	Clothing and skin goods	*IC-EB*	*PC-PR*	*PC-PR*	
6	Wooden products	*IC-PR*	*IC-EB*	*IC-EB*	IC^*
7	Furniture	*IC-PR*	*IC-PR*	*IC-EB*	IC^*
8	Pulp, paper and paper products	*IC-PR*	*PC-PR*	*PC-MO*	
9	Publishing, (re)printing	*IC-EB*	*PC-PR*	*IC-MO*	
10	Chemicals	*IC-PR*	*IC-EB*	*IC-EB*	IC^*
11	Organic chemical products	*PC-MO*	*IC-PR*	*IC-PR*	
12	Pharmaceuticals	*IC-PR*	*IC-PR*	*IC-PR*	IC^*-PR^*
13	Miscellaneous chemical products	*IC-PR*	*PC-PR*	*PC-PR*	PR^*
14	Plastics	*IC-PR*	*PC-PR*	*IC-PR*	PR^*
15	Ceramic, stone and clay products	*IC-EB*	*PC-PR*	*IC-MO*	
16	Steel	*IC-EB*	*PC-PR*	*IC-PR*	
17	Metals	*IC-EB*	*PC-PR*	*IC-PR*	
18	Architectural metal products	*PC-PR*	*PC-PR*	*IC-EB*	
19	Other metal products	*IC-EB*	*PC-PR*	*IC-PR*	
20	Special industrial machinery	*IC-EB*	*IC-EB*	*IC-PR*	IC^*
21	General industrial machinery	*IC-PR*	*PC-PR*	*IC-EB*	
22	Miscellaneous machinery	*PC-PR*	*IC-PR*	*IC-MO*	
23	Industrial apparatus	*PC-PR*	*IC-PR*	*IC-EB*	
24	Household electrical appliances	*IC-PR*	*PC-PR*	*IC-PR*	PR^*
25	Other electrical machinery	*IC-PR*	*PC-PR*	*IC-PR*	PR^*
26	Electronic parts and components	*IC-PR*	*IC-PR*	*IC-EB*	IC^*
27	Motor vehicles	*PC-PR*	*IC-PR*	*IC-PR*	PR^*
28	Other transport equipment	*IC-PR*	*IC-PR*	*IC-EB*	IC^*
29	Precision instruments	*IC-PR*	*IC-PR*	*IC-EB*	IC^*
30	Miscellaneous manufacturing products	*IC-PR*	*PC-PR*	*IC-MO*	
Total		*IC-EB*	*PC-PR*	*IC-EB*	

Table 3
Summary industry classification

CLASSIFICATION PROCEDURE (GMM SYS) - FRANCE				
	LABOR MARKET			
PRODUCT MARKET	Perfect competition or right-to-manage bargaining (PR)	Efficient bargaining (EB)	Monopsony (MO)	
Perfect competition (PC)				
# ind.	4	0	1	5
prop. of ind. (%)	13.3%	0%	3.3%	16.7%
prop. of firms (%)	5.1%	0%	0.6%	5.7%
Imperfect competition (IC)				
# ind.	15	9	1	25
prop. of ind. (%)	50.0%	30.0%	3.3%	83.3%
prop. of firms (%)	38.0%	55.3%	1.0%	94.3%
# ind.	19	9	2	30
prop. of ind. (%)	63.3%	30.0%	6.7%	100%
prop. of firms (%)	43.1%	55.3%	1.6%	100%

CLASSIFICATION PROCEDURE (GMM SYS) - JAPAN				
	LABOR MARKET			
PRODUCT MARKET	Perfect competition or right-to-manage bargaining (PR)	Efficient bargaining (EB)	Monopsony (MO)	
Perfect competition (PC)				
# ind.	15	0	0	15
prop. of ind. (%)	50.0%	0%	0%	50.0%
prop. of firms (%)	50.4%	0%	0%	50.0%
Imperfect competition (IC)				
# ind.	10	5	0	15
prop. of ind. (%)	33.3%	16.7%	0%	50.0%
prop. of firms (%)	33.5%	16.1%	0%	50.0%
# ind.	25	5	0	30
prop. of ind. (%)	83.3%	16.7%	0%	100%
prop. of firms (%)	83.9%	16.1%	0%	100%

CLASSIFICATION PROCEDURE (GMM SYS) - THE NETHERLANDS				
	LABOR MARKET			
PRODUCT MARKET	Perfect competition or right-to-manage bargaining (PR)	Efficient bargaining (EB)	Monopsony (MO)	
Perfect competition (PC)				
# ind.	2	0	2	4
prop. of ind. (%)	6.7%	0%	6.7%	13.3%
prop. of firms (%)	2.2%	0%	6.5%	8.7%
Imperfect competition (IC)				
# ind.	12	9	5	26
prop. of ind. (%)	40.0%	30.0%	16.7%	86.7%
prop. of firms (%)	44.0%	30.4%	16.8%	91.3%
# ind.	14	9	7	30
prop. of ind. (%)	46.7%	30.0%	23.3%	100%
prop. of firms (%)	46.2%	30.4%	23.4%	100%

Table 4
Industry-specific scale elasticity parameter $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$,
and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j^a$

	FRANCE - GMM SYS					
Regime $R = IC\text{-}PR$ **[15 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	0.992 (0.028)	0.028 (0.262)	1.237 (0.075)	1.247 (0.089)		
Industry Q_1	0.989 (0.022)	-0.148 (0.208)	1.205 (0.058)	1.199 (0.070)		
Industry Q_2	1.005 (0.027)	0.078 (0.263)	1.237 (0.074)	1.229 (0.080)		
Industry Q_3	1.019 (0.033)	0.193 (0.307)	1.270 (0.098)	1.276 (0.118)		
Regime $R = IC\text{-}EB$ **[9 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$
Industry mean	0.962 (0.024)	0.540 (0.147)	1.360 (0.049)	1.416 (0.064)	0.724 (0.183)	0.408 (0.064)
Industry Q_1	0.937 (0.020)	0.436 (0.138)	1.310 (0.043)	1.353 (0.054)	0.603 (0.140)	0.376 (0.045)
Industry Q_2	0.962 (0.021)	0.518 (0.144)	1.346 (0.046)	1.413 (0.062)	0.707 (0.151)	0.414 (0.054)
Industry Q_3	0.979 (0.027)	0.702 (0.151)	1.431 (0.051)	1.482 (0.074)	0.853 (0.209)	0.460 (0.064)
Regime $R = PC\text{-}PR$ **[4 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	0.969 (0.037)	-0.260 (0.294)	1.025 (0.085)	1.058 (0.098)		
Industry Q_1	0.949 (0.028)	-0.326 (0.271)	0.984 (0.073)	1.018 (0.084)		
Industry Q_2	0.966 (0.037)	-0.258 (0.297)	1.015 (0.084)	1.064 (0.096)		
Industry Q_3	0.988 (0.046)	-0.195 (0.317)	1.067 (0.098)	1.098 (0.112)		
	JAPAN- GMM SYS					
Regime $R = PC\text{-}PR$ **[15 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	1.056 (0.023)	-0.153 (0.263)	1.063 (0.048)	1.009 (0.054)		
Industry Q_1	1.032 (0.019)	-0.402 (0.236)	1.011 (0.038)	0.949 (0.045)		
Industry Q_2	1.054 (0.021)	-0.285 (0.275)	1.049 (0.043)	0.996 (0.047)		
Industry Q_3	1.088 (0.029)	0.005 (0.299)	1.099 (0.063)	1.056 (0.061)		
Regime $R = IC\text{-}PR$ **[10 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	1.040 (0.017)	0.063 (0.208)	1.136 (0.038)	1.093 (0.046)		
Industry Q_1	1.032 (0.014)	-0.199 (0.199)	1.106 (0.032)	1.081 (0.040)		
Industry Q_2	1.035 (0.017)	0.145 (0.211)	1.133 (0.039)	1.096 (0.043)		
Industry Q_3	1.055 (0.019)	0.242 (0.235)	1.174 (0.042)	1.118 (0.052)		
Regime $R = IC\text{-}EB$ **[5 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$
Industry mean	1.002 (0.018)	0.415 (0.193)	1.098 (0.030)	1.096 (0.041)	0.883 (0.407)	0.464 (0.113)
Industry Q_1	0.993 (0.014)	0.367 (0.159)	1.072 (0.022)	1.075 (0.039)	0.719 (0.363)	0.418 (0.105)
Industry Q_2	0.997 (0.015)	0.450 (0.164)	1.086 (0.035)	1.094 (0.041)	0.862 (0.365)	0.463 (0.111)
Industry Q_3	1.007 (0.017)	0.483 (0.239)	1.123 (0.036)	1.131 (0.047)	1.061 (0.503)	0.515 (0.135)

Table 4 (ctd)
Industry-specific scale elasticity parameter $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$,
and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j^a$

	THE NETHERLANDS - GMM SYS					
Regime $R = IC\text{-}PR$ **[12 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	1.027 (0.027)	0.116 (0.285)	1.379 (0.090)	1.341 (0.098)		
Industry Q_1	1.008 (0.019)	0.005 (0.171)	1.299 (0.054)	1.262 (0.059)		
Industry Q_2	1.024 (0.023)	0.124 (0.225)	1.361 (0.068)	1.319 (0.083)		
Industry Q_3	1.045 (0.035)	0.277 (0.395)	1.392 (0.095)	1.212 (0.106)		
Regime $R = IC\text{-}EB$ **[9 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$
Industry mean	1.005 (0.027)	0.507 (0.231)	1.381 (0.077)	1.375 (0.090)	0.398 (0.166)	0.279 (0.084)
Industry Q_1	0.983 (0.019)	0.397 (0.149)	1.331 (0.051)	1.340 (0.064)	0.364 (0.127)	0.267 (0.068)
Industry Q_2	0.995 (0.022)	0.451 (0.207)	1.369 (0.067)	1.352 (0.085)	0.375 (0.169)	0.273 (0.090)
Industry Q_3	1.016 (0.040)	0.693 (0.326)	1.447 (0.104)	1.410 (0.121)	0.417 (0.190)	0.294 (0.100)
Regime $R = IC\text{-}MO$ **[5 industries]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\beta}_j$	$\left(\widehat{\varepsilon}_w^N\right)_j$
Industry mean	1.053 (0.029)	-0.800 (0.328)	1.249 (0.098)	1.186 (0.100)	0.647 (0.097)	2.266 (1.104)
Industry Q_1	1.046 (0.022)	-0.668 (0.196)	1.223 (0.068)	1.177 (0.070)	0.647 (0.079)	1.831 (0.955)
Industry Q_2	1.059 (0.030)	-0.604 (0.299)	1.231 (0.095)	1.177 (0.098)	0.678 (0.081)	2.106 (1.037)
Industry Q_3	1.064 (0.034)	-0.496 (0.399)	1.271 (0.117)	1.195 (0.113)	0.708 (0.107)	2.431 (1.141)

First-step robust standard errors in parentheses.

[a] $\widehat{\psi}_j = \frac{\left(\widehat{\varepsilon}_M^Q\right)_j}{(\alpha_M)_j} - \frac{\left(\widehat{\varepsilon}_N^Q\right)_j}{(\alpha_N)_j}$ $\quad \widehat{\gamma}_j = \frac{\left(\widehat{\varepsilon}_N^Q\right)_j - \left[\left(\widehat{\varepsilon}_M^Q\right)_j \frac{(\alpha_N)_j}{(\alpha_M)_j}\right]}{\frac{\left(\widehat{\varepsilon}_M^Q\right)_j}{(\alpha_M)_j}\left[(\alpha_N)_j + (\alpha_M)_j - 1\right]}$ $\quad \widehat{\beta}_j = \frac{(\alpha_N)_j}{(\alpha_M)_j}\frac{\left(\widehat{\varepsilon}_M^Q\right)_j}{\left(\widehat{\varepsilon}_N^Q\right)_j}$

$\widehat{\mu}_j = \frac{\left(\widehat{\varepsilon}_M^Q\right)_j}{(\alpha_M)_j}$ $\quad \widehat{\phi}_j = \frac{\widehat{\gamma}_j}{1+\widehat{\gamma}_j}$ $\quad \left(\widehat{\varepsilon}_w^N\right)_j = \frac{\widehat{\beta}_j}{1-\widehat{\beta}_j}$

Appendix A : Technical details of the theoretical and econometric framework

A.1 *IC* and perfectly comp. labor market/right-to-manage bargaining (*IC-PR*)

IC and perfectly competitive labor market

Let us start from the following specification of the production function: $q_{it} = (\varepsilon_N^Q)_{it} n_{it} + (\varepsilon_M^Q)_{it} m_{it} + (\varepsilon_K^Q)_{it} k_{it} + \theta_{it}$ (Eq. (1) in the main text). Firms operate under imperfect competition in the product market (IC) and act as price takers in the input markets. Assuming that material input and labor are variable input factors, short-run profit maximization implies the following two first-order conditions:

$$(\varepsilon_M^Q)_{it} = \mu_{it} \, (\alpha_M)_{it} \tag{A.1}$$

$$(\varepsilon_N^Q)_{it} = \mu_{it} \, (\alpha_N)_{it} \tag{A.2}$$

Eqs. (A.1) and (A.2) equal Eqs. (2) and (3) in the main text.

Assuming that the elasticity of scale, $\lambda_{it} = (\varepsilon_N^Q)_{it} + (\varepsilon_M^Q)_{it} + (\varepsilon_K^Q)_{it}$, is known, the capital elasticity can be expressed as:

$$(\varepsilon_K^Q)_{it} = \lambda_{it} - (\varepsilon_N^Q)_{it} - (\varepsilon_M^Q)_{it} \tag{A.3}$$

Inserting Eqs. (A.1), (A.2) and (A.3) in the production function and rearranging terms yields:

$$q_{it} = \mu_{it} \left[(\alpha_N)_{it} \, (n_{it} - k_{it}) + (\alpha_M)_{it} \, (m_{it} - k_{it}) \right] + \lambda_{it} k_{it} + \nu_{it} \tag{A.4}$$

IC and right-to-manage (RTM) bargaining

Let us abstain from the assumption that labor is priced competitively. We assume that the workers and the firm bargain over wages (w) but that the firm retains the right to set employment (N) unilaterally afterwards (right-to-manage bargaining; Nickell and Andrews, 1983). Since, as in the perfectly competitive labor market case, material input and labor are unilaterally determined by the firm from profit maximization [see Eqs. (A.1) and (A.2) respectively], the mark-up of price over marginal cost (μ) that follows from Eq. (A.4) is not only consistent with the assumption that the labor market is perfectly competitive but also with the less restrictive right-to-manage bargaining assumption.

A.2 *IC* and efficient bargaining $\left(IC\text{-}EB\right)$

Firms operate under imperfect competition in the product market (IC). On the labor side, we assume that the workers and the firm bargain over wages (w) and employment (N) (efficient bargaining; McDonald and Solow, 1981). It is the objective of the workers to maximize $U(w_{it}, N_{it}) = N_{it}w_{it} + (\overline{N}_{it} - N_{it})\overline{w}_{it}$, where $\overline{N}_{it}$ is the competitive employment level ($0 < N_{it} \leq \overline{N}_{it}$) and $\overline{w}_{it} \leq w_{it}$ the reservation wage. Consistent with capital quasi-fixity, it is the firm's objective to maximize its short-run profit function: $\pi_{it} = R_{it} - w_{it}N_{it} - j_{it}M_{it}$, where $R_{it} = P_{it}Q_{it}$ stands for total revenue. The outcome of the bargaining is the generalized Nash solution to:

$$\max_{w_{it},\, N_{it},\, M_{it}} \left\{N_{it}w_{it} + \left(\overline{N}_{it} - N_{it}\right)\overline{w}_{it} - \overline{N}_{it}\overline{w}_{it}\right\}^{\phi_{it}} \left\{R_{it} - w_{it}N_{it} - j_{it}M_{it}\right\}^{1-\phi_{it}} \tag{A.5}$$

where $\phi_{it} \in [0, 1]$ represents the absolute extent of rent sharing.

Material input is unilaterally determined by the firm from profit maximization, which directly leads to Eq. (A.1).

Maximization with respect to the wage rate and labor respectively gives the following first-order conditions:

$$w_{it} = \overline{w}_{it} + \gamma_{it}\left[\frac{R_{it} - w_{it}N_{it} - j_{it}M_{it}}{N_{it}}\right] \tag{A.6}$$

$$w_{it} = (R_N)_{it} + \phi_{it}\left[\frac{R_{it} - (R_N)_{it}N_{it} - j_{it}M_{it}}{N_{it}}\right] \tag{A.7}$$

with $\gamma_{it} = \frac{\phi_{it}}{1-\phi_{it}}$ the relative extent of rent sharing and $(R_N)_{it}$ the marginal revenue of labor.

Solving simultaneously Eqs. (A.6) and (A.7) leads to the following expression for the contract curve:

$$(R_N)_{it} = \overline{w}_{it} \tag{A.8}$$

Eq. (A.8) shows that under risk neutrality, the firm's decision about employment equals the one of a (non-bargaining) neoclassical firm that maximizes its short-run profit at the reservation wage.

Denote the marginal revenue by $(R_Q)_{it}$ and the marginal product of labor by $(Q_N)_{it}$. Given that $\mu_{it} = \frac{P_{it}}{(R_Q)_{it}}$ in equilibrium, we can express the marginal revenue of labor as $(R_N)_{it} = (R_Q)_{it}\,(Q_N)_{it} = (R_Q)_{it}\,(\varepsilon_N^Q)_{it}\frac{Q_{it}}{N_{it}} = \frac{P_{it}(Q_N)_{it}}{\mu_{it}}$. Using this expression together with Eq. (A.8), the elasticity of output with respect to labor can be written as:

$$(\varepsilon_N^Q)_{it} = \mu_{it}\left(\frac{\overline{w}_{it}N_{it}}{P_{it}Q_{it}}\right) = \mu_{it}\,(\overline{\alpha}_N)_{it} \tag{A.9}$$

Given that we can rewrite Eq. (A.6) as $(\alpha_N)_{it} = (\overline{\alpha}_N)_{it} + \gamma_{it}\,[1 - (\alpha_N)_{it} - (\alpha_M)_{it}]$, Eq. (A.9) is equivalent to Eq. (4) in the main text:

$$(\varepsilon_N^Q)_{it} = \mu_{it}\,(\alpha_N)_{it} - \mu_{it}\gamma_{it}\,[1 - (\alpha_N)_{it} - (\alpha_M)_{it}] \tag{A.10}$$

A.3 *IC* and monopsony (*IC-MO*)

So far, we have assumed that there is a potentially infinite supply of employees wanting a job in the firm. A small wage cut by the employer will result in the immediate resignation of all existing workers. However, there are a number of reasons why labor supply might be less than perfectly elastic, creating rents to jobs. Paramount among these are the absence of perfect information on alternative possible jobs (Burdett and Mortensen, 1998), moving costs (Boal and Ransom, 1997) and heterogeneous worker preferences for job characteristics (Bhaskar and To, 1999; Bhaskar *et al.*, 2002) on the supply side, and efficiency wages with diseconomies of scale in monitoring (Boal and Ransom, 1997) and entry costs on the part of competing firms on the demand side. All these factors give employers nonnegligible market power over their workers.

Consider a firm that operates under imperfect competition in the product market (IC) and faces a labor supply $N_{it}\,(w_{it})$, which is an increasing function of the wage w_{it}. Both $N_{it}\,(w_{it})$ and the inverse of this relationship $w_{it}\,(N_{it})$ are referred to as the labor supply curve of the individual firm. The monopsonist firm's objective is to maximize its short-run profit function, taking the labor supply curve as given:

$$\max_{N_{it},\,M_{it}} \pi(w_{it},\,N_{it},\,M_{it}) = R_{it}(N_{it},\,M_{it}) - w_{it}\,(N_{it})\,N_{it} - j_{it}M_{it} \tag{A.11}$$

Maximization with respect to material input directly leads to Eq. (A.1).

Maximization with respect to labor gives the following first-order condition:

$$w_{it} = \beta_{it}(R_N)_{it} \tag{A.12}$$

where $\beta_{it} = \frac{(\varepsilon_w^N)_{it}}{1+(\varepsilon_w^N)_{it}}$ and $(\varepsilon_w^N)_{it} \in \Re_+$ represents the wage elasticity of the labor supply. Rewriting Eq. (A.12) gives the following expression for the elasticity of output with respect to labor (Eq. (5) in the main text) :

$$(\varepsilon_N^Q)_{it} = \mu_{it}(\alpha_N)_{it}\left(1 + \frac{1}{(\varepsilon_w^N)_{it}}\right) \tag{A.13}$$

A.4 Classification procedure

Classification procedure: Hypothesis test	Statistical significance level	Null hypothesis not rejected
PART 1: F-test of the joint hypothesis (explicit joint test): H_0: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) = \left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) = 0$	10%	$R = PC\text{-}PR$
PART 2: Two separate t-tests (implicit joint test): H_{10}: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) > 0$ and H_{20}: $\left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) = 0$	10% 10%	$R = IC\text{-}PR$
H_{10}: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) = 0$ and H_{20}: $\left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) > 0$	10% 10%	$R = PC\text{-}EB$
H_{10}: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) > 0$ and H_{20}: $\left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) > 0$	10% 10%	$R = IC\text{-}EB$
H_{10}: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) = 0$ and H_{20}: $\left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) < 0$	10% 10%	$R = PC\text{-}MO$
H_{10}: $\left(\mu_j - 1 = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - 1\right) > 0$ and H_{20}: $\left(\psi_j = \frac{(\varepsilon_M^Q)_j}{(\alpha_M)_j} - \frac{(\varepsilon_N^Q)_j}{(\alpha_N)_j}\right) < 0$	10% 10%	$R = IC\text{-}MO$

Appendix B : Statistical annex

B.1 Measurement of the cost of capital in the Japanese data

The capital stock is constructed from tangible fixed assets. In the BSJBSA, tangible fixed assets include land that is reported at nominal book values except for 1995 and 1996. In other words, the information on land is available only in 1995 and 1996. To construct the capital stock, we first exclude land from tangible fixed assets, multiplying by (1 − the land ratio):

$$(\widetilde{B}_K)_{it} = (1 - \varkappa)(B_K)_{it} \tag{B.1}$$

where $(\widetilde{B}_K)_{it}$ and $(B_K)_{it}$ are the book value of tangible fixed assets that excludes land and includes land respectively and $\varkappa$ is the land ratio. Following Fukao and Kwon (2006), the land ratio is proxied by the industry-average ratio of land to tangible fixed assets in 1995 and 1996.[1]

The book value of tangible assets (excluding land) is then converted to the current value of tangible assets (or nominal tangible assets). The conversion rate is constructed from the Financial Statements Statistics of Corporations by Industry published by the Ministry of Finance. The value of nominal tangible assets is then deflated by the investment goods deflator:

$$\widetilde{K}_{it} = \frac{\rho_t(\widetilde{B}_K)_{it}}{(P_I)_t} \tag{B.2}$$

where $\widetilde{K}_{it}$ denotes real tangible assets for firm i in year t (2000 constant prices), ρ_t is the conversion rate[2] and $(P_I)_t$ is the investment goods deflator, which is defined as industry-specific nominal investment flows divided by industry-specific real investment flows. The latter is obtained from the JIP 2009 database. The real value of tangible assets in the initial year τ is defined as the initial capital stock $\left(\widetilde{K}_{i\tau}\right)$, where τ equals 1994 or the first year that a firm appears in the BSJBSA. The perpetual inventory method is then used to construct the real capital stock:

$$K_{it} = (1 - \delta_t)K_{it-1} + \frac{I_{it}}{(P_I)_t} \tag{B.3}$$

where K_{it} is the capital stock for firm i in year t, δ_t the depreciation rate defined as the weighted average of various assets in an industry and I_{it} investment.[3] δ_t is obtained from the JIP 2009 database.

The cost of capital is the user cost of capital multiplied by the real capital stock. The user cost of capital is obtained from the JIP 2009 database and defined as the industry-specific nominal capital cost divided by the industry-specific real capital stock.

[1] Therefore, the land ratio is constant throughout the period.
[2] For more details on the conversion rate, see Tokui *et al.* (2008).
[3] We consider firms that did not report investment as firms with zero investment.

Table B.1
Industry repartition

		FRANCE		JAPAN		THE NETHERLANDS	
Industry j	Name	Code - NES 114[a]	# Firms (# Obs.)	Code - BSJBSA[a]	# Firms (# Obs.)	Code - SBI[a]	# Firms (# Obs.)
1	Livestock, seafood and flour products	B01	520 (4794)	91-93	276 (2550)	151-152, 156	283 (2688)
2	Miscellaneous food and related products	B02, B04-B06	1381 (13636)	99, 102	566 (5489)	153-155, 157- 158	867 (7649)
3	Beverages and tobacco	B03	182 (1854)	101	130 (1277)	159, 160	37 (430)
4	Textiles	F21-F23	881 (8398)	111-113, 119	207 (1902)	171-177	208 (2051)
5	Clothing and skin goods	C11-C12	1267 (11105)	121-122	144 (1134)	181-183	76 (610)
6	Wooden products	F31	840 (9197)	131, 139	82 (721)	201-205	270 (2606)
7	Furniture	C41	586 (5723)	140	88 (759)	361	413 (3680)
8	Pulp, paper and paper products	F32-F33	546 (6005)	151-152	294 (2889)	211-212	229 (2572)
9	Publishing, (re)printing	C31	1391 (12973)	160, 413-414	561 (5401)	221-222	865 (7222)
10	Chemicals	F41, F43	372 (4003)	171, 181, 189, 201, 209	229 (2409)	231-233, 251	49 (495)
11	Organic chemical products	F42	100 (1046)	172-173	154 (1569)	241-243, 247	205 (2040)
12	Pharmaceuticals	C31	205 (2041)	175	181 (1936)	244	39 (373)
13	Miscellaneous chemical products	C32	189 (1968)	174, 179	293 (3104)	245-246	96 (949)
14	Plastics	F45-F46	1206 (12572)	190	470 (4542)	252	388 (3928)
15	Ceramic, stone and clay products	F13-F14	830 (8474)	221-222, 229	408 (3804)	261-267	309 (2963)
16	Steel	F51, F53	326 (3581)	231-232	281 (2735)	271-273, 2751-2752	48 (520)
17	Metals	E22, F52, F55	1376 (14268)	241-242	218 (2203)	274, 2753-2754, 282-283	134 (1415)
18	Architectural metal products	E21	256 (2336)	251	198 (1761)	281	619 (5783)
19	Other metal products	F54	1747 (18426)	259	485 (4729)	284-287	689 (6452)
20	Special industrial machinery	E25, E27-E28	556 (5278)	262	252 (2371)	291, 293, 295	555 (5423)
21	General industrial machinery	E24	410 (3647)	261, 263	263 (2441)	292	475 (4557)
22	Miscellaneous machinery	E23, E26	344 (3498)	269	506 (4809)	294	34 (342)
23	Industrial apparatus	E32	85 (675)	271	245 (2203)	311	42 (394)
24	Household electrical appliances	C44-C46	204 (2011)	272	73 (630)	223, 297, 334-335	64 (627)
25	Other electrical machinery	E31, E33	120 (882)	273, 281-282	404 (3580)	300, 322-323	44 (347)
26	Electronic parts and components	F61-F62	533 (4825)	290	504 (4649)	314-316, 321	138 (1109)
27	Motor vehicles	D01	219 (2104)	301	672 (6794)	341-343	204 (1984)
28	Other transport equipment	D02, E11-E14	345 (3443)	309	131 (1213)	351-355	148 (1329)
29	Precision instruments	E34-E35	310 (2541)	311-313, 319	237 (2132)	331-333	227 (1920)
30	Miscellaneous manufacturing products	C42-C43	326 (3296)	310, 320	173 (1555)	362-366	73 (691)
Total			17653 (174600)		8725 (83291)		7828 (73149)

[a] NES 114: French industrial classification, "**N**omenclature **E**conomique de **N**ynthèse - Niveau 3",
BSJBSA: **B**asic **S**urvey of **J**apanse **B**usiness **S**tructure and **A**ctivities, SBI: Dutch industrial classification, "**S**tandaard **B**edrijfs**i**ndeling".