Price-Cost Margins and Rent Sharing:
Evidence from a Panel of French Manufacturing Firms

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ABSTRACT

This paper presents a model for estimating both the magnitude of price-cost margins and the extent of rent sharing. The model generalizes Robert Hall’s framework, relating the conventional measure of total factor productivity (the "Solow residual") to the degree of imperfect competition in product markets, by allowing also for the possibility of imperfect competition in labor markets. It does so by assuming that the firm wages and level of employment are jointly determined according to an efficient bargaining scheme between the firm and its workers. One attractive aspect of Hall's approach is that it does not require measurement of the user cost of capital to assess the magnitude of markup, in contrast to more conventional analyses of price-cost margins. Similarly, one interesting feature of our extended framework is that it does not require measurement of the alternative external wage to estimate the degree of workers' bargaining power, contrary to most studies on rent sharing.

Our model is estimated on a panel of French manufacturing firms using the Generalized Method of Moments (GMM). We find that the lack of explicit consideration of labor market imperfection results in a large underestimation of the estimated markup, corresponding to the omission of the part of the firm rent captured by workers. Our estimate of average extent of workers’ rent sharing is about 0.6, while our estimate of average price-cost margins is of an order of magnitude of 1.4, to be compared to 1.1 only when ignoring the occurrence of rent sharing.

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1. Introduction

Imperfect competition in product markets is a concern of paramount importance since it typically leads to an inefficient allocation of resources in the economy. The issues of how to identify and estimate the degree of imperfect competition have given rise to an extensive micro and macro-econometric literature. The basic and most direct approach in the literature consists in trying to assess the existence and magnitude of price-cost margins or markups, i.e. the gap between prices and marginal costs. This approach, however, does not generally allow for an interaction between imperfect competition in labor markets and in product markets. In this paper, we first present a simple econometric framework which takes into account such an interaction and allows the estimation of markups jointly with that of the extent of rent sharing between firms and workers. We then provide evidence based on a panel of French manufacturing firms showing that both estimates of the average markup and degree of rent sharing are statistically significant and high, and that the lack of explicit consideration of labor market imperfection results in a large underestimation of the average markup, reflecting the omission of the part of the rent captured by workers.

One influential development in the literature on markups has been initiated by a series of articles of Hall (1986, 1988 and 1990), which directly refers to Solow’s (1957) famous article on estimating total factor productivity as a measure of technical change. Under perfect competition in product and factor markets (and assuming constant returns to scale), Solow shows that total factor productivity can be directly measured from observed data as being equal to the difference between the growth rate of output and the share-weighted average of the growth rates of factor inputs. This difference has come to be known as total factor productivity conventionally measured (TFP), or the “Solow residual”.¹ Hall’s approach starts from the result that the Solow residual is no longer equal to the rate of technical change when there is imperfect competition in product markets, but that the two are related by an equation which now includes a component involving the markup of price over marginal cost. It proceeds by showing that this

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¹ For a history of the residual, see Griliches (1996).
equation can thus be used to estimate the average markup \( \mu \), if properly instrumented.\(^2\)

Hall’s own estimates of markups, based on aggregated industry data for U.S. Manufacturing, have been criticized as suspiciously very high in most industries (which has been related to the difficulty of finding valid instrumental variables). Hall’s approach, with some modification and/or different data, has been followed by a large number of similar studies, which have tended to find significant markups but not as high in general.\(^3\) Compared to more conventional analyses of price-cost margins, Hall’s approach has the advantage that it does not require to measure the user cost of capital (and does not necessarily assume constant returns to scale).

The analysis of imperfect competition in labor markets has also received great attention and given rise to a large literature in labor economics, but this literature has typically remained separate from that on imperfect competition in product markets. Numerous studies have in particular documented large wage differentials across industries or firms for apparently homogeneous types of workers and occupations. Such wage differentials indicate that labor markets are far from being competitive, even though the possibility that unobserved worker or job characteristics could account for them to a large extent still remains a debated matter.\(^4\) The fact that workers in the most profitable firms tend to have, other things being equal, higher wages than those in less profitable firms also strongly suggests that wage determination exhibits important elements of rent-sharing between firms and workers. Different collective bargaining models entailing a relation between wages and firm rents or quasi-rents have been considered in the literature.\(^5\) These models imply that the negotiated wage is equal to an

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\(^2\) If one relaxes the assumption of constant returns to scale, this equation also includes another additional term and can be used to estimate jointly the average markup \( \mu \) and the elasticity of scale \( \lambda \), as in Hall (1990) and in Klette (1999).


\(^4\) For example Krueger and Summers (1988) or Gibbons and Katz (1992) do not support the view that inter-industry wage differentials are due to unmeasured worker characteristics, while Murphy and Topel (1987, Leonard and Van Audenrode (1996) or Abowd, Kramarz and Margolis (1999) tend to support it.

\(^5\) Right-to-manage models and efficient contracting models are the two basic collective bargaining models. The first involves bargaining between unionized workers and the firm over wages alone (Nickell and Andrews (1983)), while the second one implies bargaining over both wages and employment (Mac Donald and Solow (1981)).
external or reservation wage, plus a share $\theta$ of the quasi-rents per worker, where the sharing parameter $\theta$ measures the degree of workers’ bargaining power on a scale going from 0 to 1 (and where firms would fully appropriate the quasi-rents if $\theta$ equals 0 and workers be paid at the reservation wage). In practice, in most econometric studies the reservation wage is estimated on the basis of the average wage at the economy (or firm’s industry) level and the quasi-rents are measured as the excess of the firm average revenue per worker relative to that reservation wage. The estimates of the extent of rent sharing parameter $\theta$ found in these studies differ widely, with some of them finding very small values (less than 0.1) and others obtaining much higher values. Studies with the smaller estimates have been often criticized, however, on the ground that they have failed to control adequately for the endogeneity of quasi-rents.6

Our paper can be viewed as an attempt to start bridging the gap between the largely unrelated econometric literatures on imperfect competition in product markets and in labor markets. In order to sustain wages which are higher than the competitive level, firms have to possess some degree of market power on their product markets allowing them to successfully appropriate positive economic rents, while in order to capture a share of such rents, workers have to belong to these firms and be effectively or potentially able to exert some degree of bargaining power. We thus propose here an generalization of Hall’s approach to allow for the possibility that wages are contractually determined according to an efficient bargaining model.7 We show that this generalization simply amounts to adding another term to Hall's decomposition of the Solow residual, which permits the identification and estimation of the extent of workers’ rent sharing. One advantage of our extended approach is to avoid the problem

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6 See for example Blanchflower, Oswald and Sanfey (1996), Christofides and Oswald (1992), Denny and Machin (1991), or Hildred and Oswald (1997) for studies finding small estimates, and Abowd and Lemieux (1993), Abowd and Kramarz (1993), Abowd and Allain (1996), Cahuc, Gianella, Goux and Zylberberg (1998), Van Reenen (1996), or Veugelers (1989) for studies finding higher ones. See also Nickell (1999) for a concise account of the econometric literature relating wages to market power indicators, such as market shares and number of competitors, besides rents or quasi-rents per worker.

7 See also Bughin (1996) and Schroeter (1998) for a related approach, however both more ambitious and restrictive in the sense that, contrary to ours, it involves the full specification and estimation of a simultaneous equations structural model.
of measuring the external or reservation wage (which is required for the studies based on an explicit specification of a wage equation).\(^8\)

In this paper, we apply our framework to a fairly large panel data sample of French manufacturing firms. The use of firm panel data entails important benefits, and in particular it allows implementing the model at a micro-level where it is more appropriate. However, it also raises a number of specific problems.\(^9\) One of them is the lack of output price data at the firm level and hence the use of nominal instead of real output measures. Since it may seem unlikely that output price differentials between firms would be negligibly small or purely random (uncorrelated with output and factor inputs growth rates), this problem is a priori important in econometric studies on firm data such as the present one (and in productivity studies more generally), possibly leading to a misinterpretation of our estimated equation. The reason is that Hall’s original equation and our extended equation are to be both viewed as reduced or semi-reduced form equations deriving from an underlying structural model.\(^10\) This derivation in fact differs depending on whether one could use real output or has to use nominal output (even deflated by an industry level output price index) for lack of firm level output price data; it can thus imply quite different relations between the derived structural parameters of interest and the estimated reduced form coefficients).

To address this problem, we experiment with a solution considered in Klette and Griliches (1996), which only involves the use of real output at the industry level as an additional variable in our estimated equation. This solution means indeed a change in interpretation of the reduced form coefficients and a different derivation of the underlying structural parameters of interest, the average markup \(\mu\) and workers’ bargaining power \(\theta\) (and returns to scale \(\lambda\)). It is theoretically based on the assumption that the market power of firms mainly arises from a strategy of product innovation and differentiation, creating a specific demand for their products. As a side issue, it is thus possible to assess whether this is actually the case by identifying and estimating

\(^8\) Another advantage of our approach is in providing a test of the efficient bargaining model against the right to manage model.

\(^9\) For a discussion of these problems in the context of productivity studies, see for example Griliches and Mairesse (1998).

\(^10\) Note that we are using here the term reduced form equations in a broad sense, in which all the right hand side variables in these equations are not necessarily considered as exogenous.
separately a specific "demand markup" $\mu_{(n)}$ corresponding essentially to the
differentiated product markup, and a "general markup" $\mu$ corresponding also to other
forms of imperfect competition. We can test whether these two markups are in effect
significantly different.

To summarize, we have estimated Hall's original equation and our extended
version of it, with and without trying to control for firm output price differentials (and
with and without assuming constant returns to scale). We have done so on a sample of
about 1000 French manufacturing firms over the seven years period 1986-1992. Taking
advantage of the panel data structure of the sample, we control for the endogeneity of
the right hand side variables relying to estimate the model on the Generalized Method
of Moments (GMM), with the past values of these variables as instruments. The results
appear to be reasonably good.\textsuperscript{11} They confirm the importance of trying to consider
explicitly the interrelations between product and labor markets imperfections. They
show that the lack of such consideration leads to a significant underestimation of the
actual markup, corresponding to the omission of the part of the firm rent captured by
workers. Our estimate of the average markup $\mu$ is on the order of magnitude of 1.4 with
an estimated average workers’ bargaining power $\theta$ of about 0.6, to be compared with an
estimated $\mu$ of the order of 1.1 only, when ignoring the incidence of rent sharing.

In the following section 2 of the paper, we explain the econometric framework:
we start from Hall’s original equation (in 2.1), show how it can be extended to allow for
labor market imperfection and rent sharing (in 2.2), and how it can be further modified
to control for unobserved output price differentials between firms (in 2.3). In section 3,
we present our application: we first give information on the sample construction and
measurement of variables (in 3.1) and discuss the reduced form coefficients estimates
(in 3.2); we then provide a brief overview of our results in terms of the markup and rent
sharing parameters of interest (in 3.3), and compare them in detail with previous
estimates in the literature (in 3.4). We conclude briefly in section 4.

\textsuperscript{11} We have also been able to largely corroborate these results on a longer and much larger sample: see
Appendix and Dobbelaere-Mairesse (2007).
2. Theoretical framework

2.1. Price-cost margins and scale economies

We start from the production function of firm $i$ in period $t$, expressing that output $Q_{it}$ is produced from capital $K_{it}$, labor $L_{it}$ and materials $M_{it}$ according to:

\[ Q_{it} = A_{it}^F(K_{it}, L_{it}, M_{it}) \]

where $A_{it}$ is an index of technical change or "true" total factor productivity, and $F$ is assumed to be homogeneous of degree $\lambda_{it}$ in all factor inputs. Denoting the logarithm of $Z_{it}$ by $z_{it}$, the logarithmic differentiation of (1) gives:

\[ \Delta q_{it} = \Delta a_{it} + \epsilon_{it}^K \Delta k_{it} + \epsilon_{it}^L \Delta l_{it} + \epsilon_{it}^M \Delta m_{it} \]

In practice, applying the Tornquist approximation, the time log-derivatives $\Delta z_{it} = \partial q_{it} / \partial t$ can be replaced by the year to year log-changes ($\Delta z_{it} = z_{it} - z_{i,t-1}$) and the production function log-derivatives (the elasticities) $\epsilon_{it}^Z = \partial q_{it} / \partial z_{it}$ by their averages over adjacent years $\epsilon_{it}^Z = (1/2)(\partial q_{it} / \partial z_{it-1} + \partial q_{it} / \partial z_{it})$. In what follows, we will also denote the total cost and revenue of firm $i$ in period $t$ by $C_{it}$ and $R_{it}$, and their derivatives relative for example to output or labor by $C_{it}^Q$ or $R_{it}^L$.

We first assume that firms operate under imperfect competition in the output markets and act as price takers in the input markets. We further consider that labor and materials are variable factors while capital is a quasi-fixed factor, and that firms are maximizing their short run profits so that labor and materials are fully adjusted to their (short run) equilibrium value in every period.\(^\text{12}\) In this setting, the marginal cost $C_{it}^Q$ and marginal revenue $R_{it}^Q$ are equal, and it is equivalent to define the firm markup $\mu_{it}$ as the ratio of output price $P_{it}$ to marginal revenue or as the ratio of output price $P_{it}$ to marginal cost: $\mu_{it} = P_{it} / R_{it}^Q = P_{it} / C_{it}^Q$. Short run profit maximization then implies the two following first order conditions:

\[ \epsilon_{it}^L = \mu_{it} \epsilon_{it}^L \]

\(^\text{12}\) It can also be assumed implicitly that firms are maximizing their long run profits, but this is not necessary for what follows.
and

\[ \varepsilon_i^M = \mu_i s_i^M \]

where \( \mu_i \) is the markup, and \( s_i^L \) and \( s_i^M \) are the shares of labor and materials costs in total revenue (which can be computed as the averages over adjacent years to be consistent with the Tornquist approximation). These equations simply mean that the ratio of a (variable) input payment to output valued at its marginal cost equals the elasticity of output with respect to this input. The input share (in total revenue) underestimates the input elasticity if the firm markup \( \mu_i \) is higher than 1 (that is when price exceeds marginal cost).

Assuming that the elasticity of scale is \( \lambda_i = \varepsilon_i^L + \varepsilon_i^M + \varepsilon_i^K \), the capital elasticity can thus be expressed as:

\[ \varepsilon_i^K = \lambda_i - \mu_i s_i^L - \mu_i s_i^M \]

This equation shows that the problematic computation of the user cost of capital and input share of capital services \( r_i^K \) and \( s_i^K \) can be avoided by estimating an (average) elasticity of scale \( \lambda \) or by assuming (approximate) constant returns to scale \( (\lambda=1) \).

One other interesting parameter to consider is the ratio of price over average cost, or profit ratio, which can be expressed as the markup divided by the elasticity of scale, that is \( P_i / (C_i / Q_i) = \mu_i / \lambda_i \). This expression clearly shows that the source of profit lies either in imperfect competition or in decreasing returns to scale. It explains why we encounter practical difficulties when trying to identify and estimate both \( \lambda \) and \( \mu \) within our framework.

Inserting (3), (4) and (5) into equation (2) and rearranging gives:

\[ \Delta q_i = \mu_i \left[ p_i^L (\Delta l_i^L - \Delta k_i) + s_i^M (\Delta m_i^M - \Delta k_i) \right] + \lambda_i \Delta k_i + \Delta a_i \]

13 Knowing the user cost of capital \( r_K \) and assuming long run profit maximization, we could write \( \varepsilon^K = \mu s^K \), where the share of capital \( s^K \) could be directly measured by \( (r_K K / R) \), and hence we will have \( \lambda = \mu (s^L + s^M + s^K) \). Assuming also constant (long run) returns to scale, the markup could thus be directly measured from the input shares as \( \mu = (s^L + s^M + s^K)^{-1} \), or \( \mu = R/C \), the ratio of total revenue to total (long run) cost. See, for example, Basu and Fernald (1997).

14 It can be shown that \( (C_i^M / (C_i / Q_i)) = 1/\lambda_i \) and hence that the ratio of price over average cost \( P_i / (C_i / Q_i) = (P_i / C_i^M) (C_i^M / (C_i / Q_i)) = \mu_i / \lambda_i \).
Equation (6) can also be rewritten in terms of the Solow residual $SR_{it}$ (TFP as conventionally measured) as:

\[(7)\quad SR_{it} = (\mu_{it} - 1)\left[ L_{it}^L (\Delta L_{it} - \Delta k_{it}) + s_{it}^M (\Delta m_{it} - \Delta k_{it}) \right] + (\lambda_{it} - 1)\Delta k_{it} + \Delta a_{it}\]

where $SR_{it} = \Delta q_{it} - s_{it}^L \Delta L_{it} - s_{it}^M \Delta m_{it} - (1 - s_{it}^L - s_{it}^M) \Delta k_{it}$ (the difference between the output growth rate and the input share weighted average of the input growth rates). Equation (7) shows that the Solow residual can be decomposed into a technological term ($\Delta a_{it}$ or the true TFP), a markup component and a scale factor.

Finally, assuming that the markup and scale coefficients $\mu$ and $\lambda$ are approximately constant or considering that they are average parameters, and introducing the notation $\Delta x_{it}^\mu = s_{it}^L (\Delta L_{it} - \Delta k_{it}) + s_{it}^M (\Delta m_{it} - \Delta k_{it})$, we can estimate them by the following regression model:

\[(I)\quad SR_{it} = (\mu_{it} - 1)\Delta x_{it}^\mu + (\lambda_{it} - 1)\Delta k_{it} + \Delta u_{it}\]

where $\Delta u_{it}$ is the disturbance in the regression (standing for the true TFP component $\Delta a_{it}$, and other changes and shocks, as well as functional approximation errors and other types of errors).

### 2.2. Price-cost margins and rent sharing

One key assumption underlying model (I) is that labor is priced competitively (firms are "staying on their labor demand curves") so that wage equals marginal revenue of labor: $w = R^L$, where $w$ denotes the wage. There are, however, multiple reasons for this relation to fail. Following the efficient bargaining model of Mc Donald and Solow (1981) and Brown and Ashenfelter (1986), in which both wage and employment are bargained between firms and their employees, it can be shown that wage is determined at a level which is higher than the firm marginal revenue of labor $R^L$ but less than its average revenue once materials are paid: $(R - jM)/L$, where $j$ denotes the price of materials.

More precisely, we can write:

\[(8)\quad w_{it} = R^L - R^L_j M_{it} + \theta_{it} \frac{R^L_{it} - j_{it} M_{it}}{L} = \theta_{it} \frac{R^L_{it} - j_{it} M_{it}}{L} + (1 - \theta_{it}) R^L_{it}\]
where $\theta_{it}$ is a parameter which can vary between 0 and 1 and which characterizes workers’ bargaining power within the firm. We can also rewrite this equation as the following relation between the markup $\mu_{it}$, where markup is defined as before ($= P_{it}/R_{it}^O$), labor elasticity and labor share $\varepsilon_{it}^L$ and $s_{it}^L$, and also materials share $s_{it}^M$:

(9) $s_{it}^L = \theta_{it} \left(1 - s_{it}^M\right) + (1 - \theta_{it}) \frac{1}{\mu_{it}} \varepsilon_{it}^L$

To explain the meaning of this relation and make clear the interpretation of the markup $\mu$ in terms of price-cost margins in this new setting, it is useful to briefly recall the basis of the efficient bargaining model. In this model, the workers in the firm, possibly by forming an union, bargain with the firm over both the level of employment $L_{it}$ and of the wage $w_{it}$. Their collective objective is to maximize the extent of rent sharing $L_{it} \left(w_{it} - \bar{w}_{it}\right)$, $\bar{w}_{it}$ being the alternative wage on the external labor market, or reservation wage, and $w_{it}$ the negotiated wage, while the firm objective is to maximize its short run profit $R_{it} - w_{it}L_{it} - j_{it}M_{it}$. In the absence of agreement, the workers have the option of getting the reservation wage, while the “fall-back position” or threat point for the firm is a zero short run profit, in which the firm has to bear only the fixed costs of capital (and not the variable costs of labor and materials). The Nash solution to the bargaining problem results in the maximization of a weighted average of the firm short-run profit and the workers’ rent sharing collective objective which has the following multiplicative expression:

(10) $\max_{w_{it}, L_{it}, M_{it}} \left[ L_{it} \left(w_{it} - \bar{w}_{it}\right) \right]^\theta_{it} \left[ R_{it} - w_{it}L_{it} - j_{it}M_{it} \right]^{1-\theta_{it}}$

The first order condition with respect to employment directly gives equation (8), leading to equation (9), that is equation (3) as before if $\theta = 0$. The first order condition for materials remains unchanged: $R_{it}^M = j_{it}$, or equation (4) as before.

It can be easily shown that in this setting the markup now includes the part of the rent that goes to the workforce and must be interpreted as the ratio of price to marginal cost, where marginal cost is now evaluated at the reservation wage $\bar{w}_{it}$, not the observed wage $w_{it}$, that is: $\mu_{it} = \frac{P_{it}}{C^Q(Q_{it}, \bar{w}_{it}, j_{it})}$.

Indeed, writing the first order condition for (10) also with respect to wage gives:
and combining (11) and (8) directly leads to the relation: \( R_{it}^{L} = \bar{w}_{it} \), which can be rewritten as:

\[
(12) \quad \varepsilon_{it}^{L} = \mu \left( \frac{\bar{w}_{it}}{P_{it}Q_{it}} \right)
\]

This is nothing but equation (3) with \( \bar{w}_{it} \) instead of \( w_{it} \), which shows that the firm decisions about employment, materials and output are exactly the same as if the firm was maximizing its short term profit computed at the reservation wage.\(^{15}\)

By replacing equation (3) by the new equation (9) and proceeding as before with the new notation \( \Delta x_{it} = \left( s_{it}^{L} + s_{it}^{M} - 1 \right) \left( \Delta x_{it} - \Delta k_{it} \right) \), we obtain the following extended regression model for the Solow residual:

\[
(II) \quad SR_{it} = (\mu - 1)\Delta x_{it} + (\lambda - 1)\Delta k_{it} + \mu \frac{\theta}{1 - \theta} \Delta x_{it} + \Delta u_{it}
\]

which differs only from the previous regression (I) by an additional term allowing us to estimate the workers' bargaining power average parameter \( \theta \) (in addition to the markup and returns to scale average parameters).\(^{16}\)

One important advantage of considering regression model (II) in order to estimate the degree of workers' bargaining power \( \theta \), is that this approach does not require measuring the reservation wage \( \bar{w}_{it} \). Most econometric studies interested in estimating \( \theta \) rely on the first order condition with respect to wages of the efficient

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\(^{15}\) Maximization with respect to output of firm short profit computed at the reservation wage \( R_{u} - \bar{w}_{u}L_{u} - j_{u}M_{u} = R_{u} - C \left( Q_{u}, \bar{w}_{u}, j_{u} \right) \) leads to the condition \( R_{u}^{0} = C^{0} \left( Q_{u}, \bar{w}_{u}, j_{u} \right) \), that is to (12) with the appropriately modified definition of the markup \( \mu_{u} = P_{u} / C^{0} \left( Q_{u}, \bar{w}_{u}, j_{u} \right) \).

\(^{16}\) Regression (II) shows that estimation of markups using Hall's original approach will suffer from a downward bias increasing with the workers' bargaining power. This appears more clearly if we rewrite it as: \( SR_{it} = (\nu - 1)s_{it}^{L} (\Delta x_{it} - \Delta k_{it}) + (\mu - 1)s_{it}^{M} (\Delta m_{it} - \Delta k_{it}) + (\lambda - 1)\Delta k_{it} + \Delta u_{it} \) where \( \nu = \mu \left[ 1 - \left( \theta / (1 - \theta) \right) \left( (1 - s_{it}^{L} - s_{it}^{M}) / s_{it}^{L} \right) \right] \). Using (11), we can also write that \( \nu = \mu \left[ 1 - (\bar{w}_{it} / \bar{w}_{it}) \right] \) which shows that \( \nu \) is positive and lower than the markup \( \mu \). In this form, we see that the estimated markup should be in between this lower value \( \nu \) and the true \( \mu \) (depending on the relative variability of labor and materials components). This can be seen even more simply if we assume constant returns to scale and abstract from materials as in Hall's original study.
bargaining model, that is, equation (11), which says that the difference between the actual wage and the reservation wage is a proportion $\theta$ of the firm quasi-rents per worker. The measurement of the reservation wage is thus a crucial element in these studies, although it is often considered as being simply a constant (possibly varying over time and across industries).17

As a final remark, it is important to note that regression (II) receives a different interpretation if the underlying model is not the efficient bargaining model, but the so-called right-to-manage model, which is an alternative description of the process of bargaining between firms and workers. In the right-to-manage formalization, firms and workers bargain only over wages in a first step, and firms alone determine employment in a second step, without bargaining with workers. In this case, although wages are negotiated and not determined competitively, firms remain on their labor demand curves, choosing an employment level equalizing the marginal revenue of labor and the actual wage ($R^L_{it} = w_{it}$). As a consequence, the null hypothesis of $\theta = 0$ in regression (II) does not only correspond to the assumption that the labor market is competitive, but also to the less restrictive assumption that workers bargain with firms over wage, but are not willing or not in a position to bargain also over employment. Estimating regression (II) thus also entails a test of the right to manage model (or the competitive model) against the alternative of the efficient bargaining model; this can be viewed as another advantage relative to estimating a wage equation as (11), whose specification is the same in these two types of models.

17 See for example Abowd and Kramarz (1993) and Abowd and Allain (1996) for a detailed discussion of the problem. To some extent the advantage of not having to assume that the reservation wage is a constant in our setting comes at the cost of having to assume that the markup parameter is constant (or to put it differently at the cost of only estimating an average markup). To see that clearly, we can abstract from materials and capital and consider that the firm production function is the simple Cobb-Douglas function $Q_a = A L^\varepsilon_a$ with constant labor elasticity $\varepsilon^L$. From the expression of the quasi-rents $QR = (R - \bar{w} L)/L$, and equation (12), we easily derive the relation $QR_a = \bar{w}_a \left( \frac{\mu}{\varepsilon^L} - 1 \right)$, showing that there is trade off between letting the markup or the reservation wage be constant.
2.3. Implications of unobserved output prices at the firm level

Regression models (I) and (II), like all such productivity models, cannot be rigorously estimated as they stand at the micro-level, however, since the changes in output prices \( \Delta p_{it} \) and hence in real output \( \Delta q_{it} \) are not generally observed or available at the firm level. In empirical practice, changes in real output \( \Delta q_{it} \) are usually replaced by changes in nominal output (or sales) that are deflated by a common industry price index \( \Delta p_{It} \). (i.e., using \( \Delta y_{it} = \Delta q_{it} + (\Delta p_{it} - \Delta p_{I}) \) instead of \( \Delta q_{it} \)). Relying on an industry deflator \( \Delta p_{It} \) instead of a firm deflator \( \Delta p_{it} \) will introduce specific errors in variable biases in the regression estimates if differentials in the firm output price changes \( \Delta p_{it} - \Delta p_{I} \) across firms (within industry) are large and correlated with the explanatory variables (or with the variables used to instrument them). This is what might be expected when firms compete in an imperfectly competitive environment, such as in a differentiated product market, and their prices are endogenous. This point was made a long time ago by Marschak and Andrews (1944) in their pioneering article on the estimation of the production function, and was recently reconsidered in detail by Klette and Griliches (1996).

More precisely, when the Solow residuals are not measured on the basis of the log-changes of real output \( \Delta q_{it} \), but on the log-changes of industry deflated sales \( \Delta y_{it} = \Delta q_{it} + \Delta p_{it} - \Delta p_{I} \), regressions (I) and (II) become in fact:

(I) \[ SR'_{it} = (\mu - 1)\Delta x^u_{it} + (\lambda - 1)\Delta k_{it} + \Delta u'_{it} \]

and

(II) \[ SR''_{it} = (\mu - 1)\Delta x^u_{it} + (\lambda - 1)\Delta k_{it} + \mu \frac{0}{1-\theta} \Delta x^0_{it} + \Delta u'_{it} \]

with \( SR'_{it} = \Delta y_{it} - s^I_{it} \Delta I_{it} - s^M_{it} \Delta m_{it} - (1-s^I_{it} - s^M_{it}) \Delta k_{it} \) and \( \Delta u'_{it} = (\Delta u_{it} + \Delta p_{it} - \Delta p_{I}) \). The unobserved differential between the changes in the firm own output price and the industry output price index \( \Delta p_{it} - \Delta p_{I} \) is thus an idiosyncratic component of the error \( \Delta u'_{it} \) in the equation, and it will be a source of downward bias for ordinary least squares (OLS) estimates whenever this component is negatively correlated with the right hand side variables in the equation, that is with the changes in factor inputs (and with input shares). This seems likely if the firm market power arises mainly from a specific
demand for its products. In this case, moreover, trying to solve the problem by an instrumental variable method is bound to be particularly difficult. As we shall see just below, potentially useful instruments, which have to be correlated with the changes in factor inputs, will also tend to be correlated with the output price change component \((\Delta p_n - \Delta p_n)\) buried in the error in the equation, and if so will be in fact illegitimate instruments.

We will follow here the solution suggested by Klette and Griliches. Assuming that the firm has a specific product demand allows us to express its relative output price change \((\Delta p_n - \Delta p_n)\) in terms of the corresponding relative change in the firm real output \((\Delta q_n - \Delta q_n)\), where \(\Delta q_n\) is the change in the industry real output. Substituting this expression in regressions (I) and (II) results in modified regressions (I-C)) and (II-C) with \(\Delta q_n\) as an additional regressor and a different interpretation of the coefficients in terms of the markup, rent sharing and scale parameters.

More precisely, we can write the firm’s own demand in terms of the following market share equation:

\[
(14) \quad s_{hi} = \frac{(P_{hi}Q_{hi})}{(P_{hi}Q_{hi})} = \left(\frac{P_{hi}}{P_{hi}}\right)^{1-\eta} e^{v_{hi}}
\]

where \(s_{hi}\) is the market share of firm (equal to the ratio of firm sales to total industry sales), \(\eta\) is the elasticity of demand which summarizes within industry substitution effects, and \(v_{hi}\) is a disturbance term which corresponds to specific firm demand shifters and idiosyncratic demand shocks. Such an equation arises in the “Spence-Dixit-Stiglitz” model of demand for differentiated products.\(^{18}\) Note that in this model the elasticity of the demand perceived by the firm \(\zeta_{hi}\) is different from the within industry demand elasticity \(\eta\) and the overall industry demand elasticity \(\xi\), but is equal to their market share weighted average: \(\zeta_{hi} = (1-s_{hi})\eta + s_{hi}\xi\).\(^{19}\) Note also that the model assumes that imperfect competition arises only from product differentiation (and innovation), not from other sources such as collusion between firms. In the case of such collusive

---


\(^{19}\) When substitution effects are stronger within industries than between industries, which is to be expected, \(\eta\) is smaller than \(\xi\), and hence \(\zeta_{hi}\) is in general larger than \(\eta\) and smaller than \(\xi\). \(\zeta_{hi}\) will thus be practically equal to \(\eta\) whenever the firm market share \(s_{hi}\) is very small, and close to \(\xi\) if \(s_{hi}\) is very large.
behavior, the firm demand elasticity $\zeta$ will increase, and at the limit if there is perfect coordination of firm price decisions within the industry, it will tend to be equal to the industry demand elasticity $\xi$ (and firm output price differentials are no longer related to the firm market share and input changes).

Introducing a specific demand markup $\mu_{\eta}$ associated with the within industry demand elasticity $\eta$, where $\mu_{\eta} = \eta/(\eta-1)$, to be distinguished from the overall markup $\mu$ corresponding also to other forms of imperfect product competition, we can rewrite equation (14) as:

$$\Delta y_{it} = \frac{1}{\mu_{\eta}} \Delta q_{it} + \frac{\mu_{\eta} - 1}{\mu_{\eta}} \Delta q_{it} + \frac{\mu_{\eta} - 1}{\mu_{\eta}} \Delta v_{it}$$

Then, by substituting $\Delta y_{it}$ to $\Delta q_{it}$ in regressions (I) and (II), we obtain the "corrected" regressions (I-C) and (II-C):

(I-C)  \[ SR'_{it} = (-\frac{\mu_{\eta}}{\mu_{\eta}} - 1) \Delta x_{it}^{\mu} + (\frac{\lambda}{\mu_{\eta}} - 1) \Delta k_{it} + \frac{\mu_{\eta} - 1}{\mu_{\eta}} \Delta q_{it} + \Delta v_{it} \]

and

(II-C)  \[ SR'_{it} = (-\frac{\mu_{\eta}}{\mu_{\eta}} - 1) \Delta x_{it}^{\mu} + (\frac{\lambda}{\mu_{\eta}} - 1) \Delta k_{it} + \frac{\theta}{\mu_{\eta}} (1 - \theta) \Delta x_{it}^{\theta} + \frac{\mu_{\eta} - 1}{\mu_{\eta}} \Delta q_{it} + \Delta v_{it} \]

where $\Delta v_{it} = \Delta u_{ita}/\mu_{\eta} + \Delta v_{ita} (\mu_{\eta} - 1)/\mu_{\eta}$ is an error term which captures both demand and productivity shocks.

While trying to control for unobserved firm output price differentials, regressions (I-C) and (II-C) allow to estimate both the demand markup $\mu_{\eta}$ and overall markup $\mu$. The relations they imply between the parameters of interest and the reduced form coefficients are also markedly different from those entailed by the previous regressions (I) and (II) allow to estimate both the demand markup $\mu_{\eta}$ and overall markup $\mu$. Comparing these sets of relations shows that not controlling for firm output price differentials will tend to seriously bias downward the estimated markup and rent sharing parameters, if the demand markup $\mu_{\eta}$ is greater than 1 (i.e., if $\eta > 1$) and a large part of the overall markup $\mu$.\(^{20}\) That will not be the case, however, if the demand

\(^{20}\) That is assuming that the
markup amounts only to a small part of overall markup (i.e., \( \mu(\eta) \) not different from 1 or \( \mu \) much larger than \( \mu(\eta) \)).
3. Empirical application

3.1. Data

In the application we estimate the four regression models (I), (II), (I-C) and (II-C) on a balanced panel sample of 1026 French manufacturing firms over the seven years period 1986-1992. This sample has been constructed from the data base SUSE ("Système Unifié des Statistiques d’Entreprises") of INSEE, the French National Institute for Statistics and Economic Studies, which is based on the combination of the information gathered in the firms annual surveys ("Enquêtes Annuelles d’Entreprises") and that obtained from the firms fiscal declarations ("Déclarations sur les Bénéfices Industriels et Commerciaux"). More precisely our sample is based on the files known as "Echantillon", which concern a sub-set of medium sized and large firms for which more detailed information on their current accounts and balance sheets is available, and we have restricted ourselves to the balanced sample of these firms which belonged to the manufacturing industries and were present in all seven years 1986-1992.\(^{21}\) We also had to delete from our sample the few firms for which one of our main variables happened to be missing or clearly had a very erroneous value in one year.\(^{22}\)

Based on the firm current account and balance sheet information collected in SUSE and in the "Echantillon", we have measured our main variables as well as possible. The firm output measure is gross production deflated by the national accounts industry output price index at the two-digit level of the French industrial classification (NAP 90 in the "Nomenclature des activités et produits"), corresponding to 38 different manufacturing industries in our sample. The industry real output measure is

\(^{21}\) We have thus taken out firms which were missing in one year or more for whatever reason (because they went into business or ceased their activities during the period, being for example taken over, or because they passed over or under the minimum turnover threshold necessary to be recorded in the "Echantillon" files, or because they were just missing in a year for some fortuitous reason).

\(^{22}\) More precisely we “cleaned” our sample from the observations which were extreme outliers in the distributions of the annual growth rates of the output, labor, materials and capital variables and in the distributions of the labor and materials shares. We thus deleted the observations which were less than the 1\(^{st}\) centiles of these distributions or more than the 99\(^{th}\) centiles, but were able to verify that the precise choice of these cut-off points had no significant impact on our results.
the national accounts evaluation at the two digit level, consistent with the industry output price index (that is for the 38 manufacturing industries). Firm intermediate inputs or materials are obtained by subtracting the firm value added to gross production, and are deflated by the overall materials price index for manufacturing in the national accounts. Firm physical capital stock is computed as the gross book value of fixed assets, approximately adjusted for inflation on the basis of an estimated average age of fixed assets derived from the net to gross book value ratio. Labor is simply measured as the average of the total number of employees in the firm over the year. The rates of growth of these variables are defined as the log first differences (as in equation 2). The shares of labor and materials are obtained by dividing respectively the firm total labor compensation and (undeflated) intermediate inputs by the firm (undeflated) gross production, and by taking the average (the half-sum) of these ratios over adjacent years (as in equations 3 and 4).

Table 1 shows the means, standard deviations and first and third quartiles of all the variables entering in the four regression models (I), (II), (I-C) and (II-C). The average of the firm growth rate of deflated output for our overall sample is of 2.8% per year over the seven years period 1986-92, not too different from the corresponding manufacturing average of 2.4% of the industry growth rate of real output based on national accounts. While capital and materials have increased at a sizeable average annual growth rate of nearly 4%, labor has remained stable. The Solow residual, or TFP as conventionally measured, is also stable over the period. As typically the case with firm level data, the dispersion of all these variables is extremely large. For example, TFP is higher than 3.7% per year for the fourth quartile of firms and smaller than –3.1% for the first quartile.
Table 1: Simple statistics on the main variables, for the balanced panel data sample of 1026 firms over the period 1987-92.

<table>
<thead>
<tr>
<th>Variables: annual log-growth rates and factor shares in output value</th>
<th>Mean</th>
<th>Standard-deviations</th>
<th>Q1</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output growth rate (deflated by an industry output price index)</td>
<td>Δy_{it}</td>
<td>0.028</td>
<td>0.203</td>
<td>-0.042</td>
</tr>
<tr>
<td>Industry real output growth rate</td>
<td>Δq_{it}</td>
<td>0.024</td>
<td>0.041</td>
<td>-0.007</td>
</tr>
<tr>
<td>Labor growth rate</td>
<td>Δl_{it}</td>
<td>-0.002</td>
<td>0.151</td>
<td>-0.043</td>
</tr>
<tr>
<td>Capital growth rate</td>
<td>Δk_{it}</td>
<td>0.039</td>
<td>0.208</td>
<td>-0.025</td>
</tr>
<tr>
<td>Materials growth rate</td>
<td>Δm_{it}</td>
<td>0.037</td>
<td>0.248</td>
<td>-0.048</td>
</tr>
<tr>
<td>Labor share</td>
<td>s^L_{it}</td>
<td>0.267</td>
<td>0.130</td>
<td>0.172</td>
</tr>
<tr>
<td>Materials share</td>
<td>s^M_{it}</td>
<td>0.612</td>
<td>0.145</td>
<td>0.519</td>
</tr>
<tr>
<td>Solow residual a</td>
<td>SR_{it}</td>
<td>0.002</td>
<td>0.082</td>
<td>-0.031</td>
</tr>
<tr>
<td>Share weighted growth rates of labor and materials to capital ratios b</td>
<td>Δx''_{it}</td>
<td>-0.013</td>
<td>0.220</td>
<td>-0.095</td>
</tr>
<tr>
<td>Share weighted growth rate of labor to capital ratio c</td>
<td>Δx^θ_{it}</td>
<td>0.004</td>
<td>0.032</td>
<td>-0.004</td>
</tr>
</tbody>
</table>

Note:  
a) \( SR_{it} = \Delta y_{it} - s^L_{it} \Delta l_{it} - s^M_{it} \Delta m_{it} - (1 - s^L_{it} - s^M_{it}) \Delta k_{it} \)  
b) \( \Delta x''_{it} = s^L_{it}(\Delta l_{it} - \Delta k_{it}) + s^M_{it}(\Delta m_{it} - \Delta k_{it}) \)  
c) \( \Delta x^θ_{it} = (s^L_{it} + s^M_{it} - 1)(\Delta l_{it} - \Delta k_{it}) \)
3.2. Estimation methods and reduced-form estimates

We estimate the four regression models (I), (II), (I-C) and (II-C) in two stages as four nested specifications of the same encompassing regression. In the first stage, we estimate these regressions as linear regressions in the reduced or semi-reduced form coefficients of the two, three or four left hand side variables $\Delta k_{it}$, $\Delta x_{it}^{\mu}$, $\Delta x_{it}^{\theta}$ and $\Delta q_{it}$. In the second stage, we recover the corresponding estimates of the underlying structural parameters of interest: the average general markup $\mu$, the average demand markup $\mu(\eta)$, the average workers' bargaining power or rent sharing parameter $\theta$, the average elasticity of scale $\lambda$, and also the average markup to scale elasticity ratio or average profit ratio ($\mu/\lambda$). We also estimate these parameters when imposing constant returns to scale ($\lambda=1$), since there is a problem in estimating jointly and precisely the markup and the elasticity of scale.\footnote{Since there is in this case one structural parameter less than the reduced form coefficients, we use the minimum distance or asymptotic least squares method (Chamberlain 1982, Gourieroux, Monfort and Trognon 1985). Note that we could impose constant returns to scale directly on regressions (I) and (II) by simply not including $\Delta k_{it}$ as right hand side variable, but not in the case of regressions (I-C) or (II-C). Note that we could also retrieve the estimated structural parameters from the encompassing regression (II-C) alone. All these procedures are asymptotically equivalent, and indeed make little difference on our results.} It is important to underline that we are estimating average parameters, but that there are good reasons for these parameters to vary across firms and over time.\footnote{For example, Abowd and Lemieux (1993) and Abowd and Allain (1996) explore the heterogeneity of the bargaining power parameter and find it to be significantly related to the level of rents. Similarly, in the "Spence-Dixit-Stiglitz" model, firm markups are different from one firm to the other, depending on the size of their market shares.} Our focus here is in estimating average orders of magnitude in an attempt to assess the differences which result from modeling imperfect competition on both product and labor markets, while remaining broadly comparable to previous studies and not asking too much to the data.

In all four regressions the pure productivity shocks (affecting the production function) directly enter the overall error terms ($\Delta \bar{u}_{it}$ or $\Delta \bar{v}_{it}$), but the pure demand shocks (affecting the demand equation) also indirectly enter them through the
unmeasured firm output price differentials. These error terms are thus potentially correlated with the changes in factor inputs ($\Delta l$, $\Delta m$ and $\Delta k$) and hence the right hand side variables of the regressions ($\Delta x^\mu_i$, $\Delta x^\theta_i$ and $\Delta k$). The ordinary Least Squares (OLS) estimates of the reduced form coefficients and the corresponding structural estimates are thus likely to be biased. However, we can avoid such biases and control for the endogeneity of the variables in the regressions, by taking advantage of the panel data structure of our sample and estimating them by the Generalized Method of Moments (GMM), with the past values of the factor inputs as instruments.

To be more precise, we have thoroughly experimented with GMM using for instruments the lagged levels $l$, $m$ and $k$ (lagged by 1, 2 or 3 years and more) or using only the corresponding lagged changes $\Delta l$, $\Delta m$ and $\Delta k$. The Sargan tests of suridentification are more or less strongly rejected when we take the lagged levels as instruments, but accepted when we keep only the lagged changes. In the case, for example, of the encompassing specification (II-C), the P-value is about 65% with lagged changes from 2 to 5 years as instruments, and about 30% with lags from 1 to 5 years. With these two sets of instruments, we obtain two corresponding sets of estimates.

Note that demand shocks are also likely to be correlated with the overall error terms in our regressions because our labor and capital variables $\Delta l$ and $\Delta k$ as we are able to measure them do not adequately reflect the variations in hours and intensity of work and in capacity utilization.

Note that the existence and extent of these biases in the OLS estimates depends on the effective transmission of the productivity (and demand) shocks to the firm’s choices of factor inputs and hence on whether they are anticipated before these choices. See for example Griliches and Mairesse (1998) for a more detailed discussion of the “transmission bias” problem and other issues in estimating the production function on firm panel data.

See for example Arellano and Bond (1991) for the use of GMM with panel data. Note that since our model is already specified in terms of rates of change in the variables (first differences in the logs), we control for individual firm effects in the production function (and the demand equation). We have reported here the second step (optimal) GMM estimates; they are not significantly different, although more precise, than the first step estimates. In a previous version of the paper (Crepon, Desplat and Mairesse, 1999), we have used Chamberlain's matrix $\Pi$ approach to panel data (Chamberlain, 1984). We have checked that the two methods provide a similar picture and lead to the same qualitative conclusions. This is what could be expected since both methods are asymptotically equivalent, when exactly based on the same set of instrumental variables (see Crepon and Mairesse, 1995). We have preferred to rely here on GMM, since it is of common use whereas Chamberlain approach is not employed in practice. In our previous version of the paper, our finding of estimates which were respectively higher and lower for the average markup and average bargaining power is not related to our use of the Chamberlain method, but is mainly due to a different and less realistic assumption on the objective and fall-back position for the firm in the firm and workers’ union bargaining model (see footnote 33).
which are not statistically different and lead to the same basic findings. The latter ones, however, look a little better and we choose to show them in the tables.28

Table 2 presents our preferred GMM estimates for the reduced form parameters entering into our four regression models of the Solow residual, with and without rent sharing, and with and without controlling for output price differentials. Although these reduced form estimates are not directly interpretable, we can draw two clear-cut conclusions by comparing them across the four regressions. The first one is that the coefficient of the variable $\Delta x^\theta_\mu$, included in the regression to account for rent sharing, is indeed statistically very significant, and that its inclusion also induces significant changes in the other estimated coefficients. The second is that the coefficient of the industry output variable $\Delta q_t$, included to try to control for output price differentials, is also statistically significant but not strongly so, and that its inclusion does not affect the estimated values of the other coefficients. However, as we have stressed, the interpretation in this case of the reduced form coefficients in terms of the underlying structural parameters is profoundly modified.

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28 The first set of estimates is the following: $\lambda = 0.87 (0.17)$; $\mu = 1.20 (0.20)$; $\mu(\eta) = 1.24 (0.19)$; $\theta = 0.61 (0.09)$; $\mu/\lambda = 1.37 (0.10)$; with a Sargan test $\chi^2$ of 22.6 for 26 degrees of liberty (and a P-value of 65%) to be compared to the second set of estimates (given in Table 3): $\lambda = 1.01 (0.12)$; $\mu = 1.42 (0.17)$; $\mu(\eta) = 1.32 (0.15)$; $\theta = 0.66 (0.01)$; $\mu/\lambda = 1.41 (0.04)$ ; with a Sargan test $\chi^2$ of 45.5 for 41 degrees of liberty (and a P-value of 30%). The difference Sargan test $\chi^2$ is equal to 22.9 for 15 degrees of liberty, and corresponds to a P-value of 10% showing that the two sets of estimates are not statistically different and confirming the simple “eye test” based on a direct comparison of the individual estimates and their standard errors. Irrespective of the statistical test, the estimated average rent sharing and profit ratios $\theta$ and $\mu/\lambda$ are extremely close in the two sets of estimates, but the estimated average elasticity of scale and mark up $\lambda$ and $\mu$ show differences, which are sizeable though not statistically significant. This reflects a basic difficulty in jointly estimating with precision these two parameters, while their ratio $\mu/\lambda$ can be much more precisely estimated. Since the finding of nearly constant returns to scale for manufacturing firms is more plausible than that of large decreasing returns scale (and since our estimates in the second set are also less imprecise), we prefer to report on them here. This choice, however, do not affect otherwise our main findings. Note that the OLS estimates are significantly different with $\lambda = 1.20 (0.002)$; $\mu = 1.43 (0.002)$; $\mu(\eta)= 1.32 (0.002)$; $\theta = 0.24 (0.006)$; $\mu/\lambda = 1.19 (0.002)$. 

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Table 2: Reduced form parameters estimates

<table>
<thead>
<tr>
<th>Model</th>
<th>Not controlling for firm output price differentials</th>
<th>Controlling for firm output price differentials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(I)</td>
<td>(II)</td>
</tr>
<tr>
<td>(\Delta x_{it}^\mu)</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>(\Delta k)</td>
<td>-0.08</td>
<td>-0.24</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>(\Delta x_{it}^\theta)</td>
<td>-</td>
<td>2.08</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td></td>
</tr>
<tr>
<td>(\Delta q_{it})</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specification test

| \(\chi^2\) values       | 56.5                                              | 52.0                                            | 56.1                                           | 45.5                                           |
| Degrees of freedom       | 43                                                | 42                                              | 42                                             | 41                                             |
| P-value                  | 0.08                                              | 0.14                                            | 0.07                                           | 0.29                                           |

Where:

(I) \(\overline{SR}_{it} = (\mu - 1)\Delta x_{it}^\mu + (\lambda - 1)\Delta k_{it} + \Delta \mu_{it}\)

(II) \(\overline{SR}_{it} = (\mu - 1)\Delta x_{it}^\mu + (\lambda - 1)\Delta k_{it} + \mu \frac{\theta}{1 - \theta} \Delta x_{it}^\theta + \Delta \mu_{it}\)

(I-C) \(\overline{SR}_{it} = \left(\frac{\mu}{\mu_{(n)}}\right) - 1\Delta x_{it}^\mu + \left(\frac{\lambda}{\mu_{(n)}}\right) - 1\Delta k_{it} + \frac{\mu_{(n)} - 1}{\mu_{(n)}} \Delta q_{it} + \Delta v_{it}\)

(II-C) \(\overline{SR}_{it} = \left(\frac{\mu}{\mu_{(n)}}\right) - 1\Delta x_{it}^\mu + \left(\frac{\lambda}{\mu_{(n)}}\right) - 1\Delta k_{it} + \frac{\mu}{\mu_{(n)}} \frac{\theta}{1 - \theta} \Delta x_{it}^\theta + \frac{\mu_{(n)} - 1}{\mu_{(n)}} \Delta q_{it} + \Delta v_{it}\)

with \(\overline{SR}_{it} = \Delta y_{it} - s_{it} L \Delta l_{it} - s_{it} M \Delta m_{it} - (1 - s_{it}^L - s_{it}^M) \Delta k_{it}\)

\(\Delta x_{it}^\mu = s_{it}^L (\Delta l_{it} - \Delta k_{it}) + s_{it}^M (\Delta m_{it} - \Delta k_{it})\) and \(\Delta x_{it}^\theta = (s_{it}^L + s_{it}^M - 1)(\Delta l_{it} - \Delta k_{it})\)

Note: The reported results are the GMM estimates using as instruments the past values of \(\Delta l_{it}\), \(\Delta m_{it}\) and \(\Delta k_{it}\) (from one to five years lagged). \(\Delta q_{it}\) is not instrumented. All the regressions include year dummies. Numbers in parentheses are heteroscedastic consistent standard errors.
3.3. Overview of the main results

From each of the four groups of reduced form coefficients given in Table 2, we can recover two groups of estimates of the underlying parameters of interest, the first one allowing for non constant returns to scale and the second one imposing constant returns to scale. In total, we thus obtain eight different sets of estimates for the elasticity of scale, the general and demand markups, the bargaining power parameter and the profit ratio, which are presented in Table 3. Four basic findings can be seen at first glance.

<table>
<thead>
<tr>
<th>Model</th>
<th>Without imposing constant returns to scale</th>
<th>Imposing constant returns to scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(I) (II) (I-C) (II-C)</td>
<td>(I) (II) (I-C) (II-C)</td>
</tr>
<tr>
<td>Scale elasticity $\lambda$</td>
<td>0.92 (0.01) 0.76 (0.02) 1.10 (0.10) 1.01 (0.12)</td>
<td>=1 =1 =1 =1</td>
</tr>
<tr>
<td>General markup $\mu$</td>
<td>1.02 (0.02) 1.05 (0.03) 1.23 (0.12) 1.42 (0.18)</td>
<td>1.13 (0.02) 1.20 (0.03) 1.11 (0.02) 1.41 (0.04)</td>
</tr>
<tr>
<td>Demand markup $\mu_{(\eta)}$</td>
<td>=1 =1 1.19 (0.11) 1.32 (0.15)</td>
<td>=1 =1 1.08 (0.01) 1.31 (0.03)</td>
</tr>
<tr>
<td>Bargaining power $\theta$</td>
<td>=0 0.66 (0.01) =0 0.66 (0.01)</td>
<td>=0 0.56 (0.01) =0 0.66 (0.01)</td>
</tr>
<tr>
<td>Profit ratio $\mu/\lambda$</td>
<td>1.11 (0.02) 1.38 (0.04) 1.12 (0.02) 1.41 (0.04)</td>
<td>1.13 (0.02) 1.20 (0.03) 1.11 (0.02) 1.41 (0.04)</td>
</tr>
</tbody>
</table>

Note: See Table 2 for the specification of (I), (II), (I-C) and (II-C).

First, the parameter of average bargaining power $\theta$ is very precisely estimated and quite robustly so across specifications; it is very high, about 0.6, indicating the great
importance of rent sharing at least for our sample of medium and large firms. This is also a strong indication that the right-to-manage model, as well as the competitive model, is rejected in favor of the efficient bargaining model, in which workers are not only bargaining over wages, but are also concerned by the level of employment. Second, taking into account the existence of rent sharing tends to result in a rise in the estimated average markup $\mu$ and a decline in the estimated elasticity of scale $\lambda$, and hence in a sizeable and significant increase in the average profit ratio $\mu/\lambda$ from about 1.1 to 1.4. Third, trying to control for price heterogeneity results in a large increase in both the average markup and scale elasticity but does not modify our assessment of the magnitude of the average profit ratio. Thus whether we take into consideration the problem of price heterogeneity or simply disregard it, allowing for rent sharing leads us to the view that the average profit ratio $\mu/\lambda$ is quite large, in the order of 1.4, but that in the first case it would arise from a very high average markup $\mu$ (1.4) and roughly constant returns to scale, while in the second case it would correspond to a rather modest average markup $\mu$ (of about 1.05) and large decreasing returns to scale. Since constant returns to scale are more likely than large decreasing returns to scale in the manufacturing sector, this also tends to confirm the need to correct for output price differentials. Finally, we have an indication that the high markup which we find is mainly a demand markup (with $\mu_{(\eta)}$ not significantly smaller than $\mu$), thus has its main source in product differentiation.

3.4. Comparison with other estimates

Besides these four basic findings, we can make a number of further remarks, by confronting our results with more or less comparable estimates in directly related studies. In particular, our estimates of model (I), which is Hall's original specification, can be compared to his own estimates for the U.S. on industry level data, to similar

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29 The standard error of 0.01 for $\theta$ may seem suspiciously small; it is still equal to 0.03 for an estimated $\theta$ of 0.63 using the GMM first step estimates (not the second step estimates reported here). It is also equal to 0.09 for an estimated of 0.61 for the GMM estimates using as instruments the lagged values of $\Delta l_{it}$, $\Delta m_{it}$ and $\Delta k_{it}$ from only two to five years (not from one to five years): see previous footnote 25.
estimates of Roeger (1995) on the same data, and to those of Martins, Scarpetta and Pilat (1996) for OECD countries, including France. They can also be compared to the estimates of Nishimura, Ohkusa and Ariga (1999) for Japan and those of Klette (1999) for Norway, both based on firm or establishment panel data.

Hall (1986, 1988 and 1990) finds statistically significant average markups in most (one or two-digit) industries, but many of these estimates appear suspiciously high, with values greater than 2, even in industries exposed to severe foreign competition. However, the choice of instrumental variables he used has been criticized on the ground that, even if uncorrelated with productivity shocks, they are likely to be correlated with demand shocks. This would explain that his average markups seem largely overestimated. The estimates of average markups found by Roeger, who follows a modified version of Hall's approach, are substantially lower than those of Hall's in nearly all industries and look more reasonable, although still on the high side, with most of them being in the 1.3 to 1.6 range. The estimates of Martins, Scarpetta and Pilat (1996), who also follow Roeger's approach, tend to be significantly smaller than his estimates (and much smaller than Hall's), in the range of 1.1 to 1.3 for the U.S and for the French manufacturing industries, and thus about roughly consistent with our estimates (derived from model (I) or (I-C) assuming constant returns to scale).

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31 Roeger uses a framework to estimate average markups that is directly inspired by Hall's framework but is in fact significantly different. He considers the wedge between the 'primal' TFP or Solow residual, as usually computed from the production function side, and its dual counterpart as computed from the cost function side (by the difference between the share-weighted average of the growth rates of factor input prices and the growth rate of output price). This wedge should be null under both assumptions of perfect competition in the product market (and the factor markets) and of constant returns to scale. He shows that it will not be null, however, if there is imperfect competition on the product market, but it will be instead a linear function of the difference between the growth rates of the two ratios of output to capital and output price to user cost of capital, with a coefficient which is simply equal to \((\mu - 1)/\mu\), the relative deviation of the average markup from one. Roeger then argues that this relation can be directly and simply used to estimate the average markup without having to rely on a problematic choice of instruments. Actually, in Roeger's approach one has to measure directly the user cost of capital in order to estimate the dual TFP; hence, as shown in footnote 12 above, under the assumption of constant returns to scale (and of perfect competition on the factor markets), one can also compute the average markup directly as a simple accounting ratio.

32 One reason why Roeger's estimates may appear higher than Martins, Scarpetta and Pilat estimates, is that his estimates (like Hall's) are based on value added data while those of Martins, Scarpetta and Pilat estimates (like ours) are based on output data. It can be shown (see for example Hall, 1986) that the "value added markup" \(\mu^*\) and the "output markup" \(\mu\) would
Using an approach largely different from that of Hall, but implementing it on firm panel data, Nishimura, Ohkusa and Ariga (1999) obtain average markups for the Japanese manufacturing industries, which are also in a comparable range of 1.0 to 1.3. Relying exactly on regression model (I) and also estimating it on panel data (for a sample of establishments), Klette (1999) finds small but significant average markups in the range of 1.0 to 1.1 for most Norwegian manufacturing industries (and constant or moderately decreasing returns to scale in the range of 0.9 to 1.0). This is indeed quite close to what we find for French manufacturing as a whole.

In contrast to Hall’s regression model (I), no other study has estimated regression model (II), with the only exception of the recent investigation by Dobbelaere (2002), directly inspired by our own work (see below). Aside from Dobbelaere’s estimates, our joint estimates of the average markup and bargaining power parameters cannot be assessed against previous estimates, which would be strictly comparable. Our estimate of the average bargaining power $\theta$ can be compared, however, to those based on the many studies estimating a wage equation, such as (11), relating firm wage differentials and quasi-rents. Even if we consider only the studies based of firm panel data which have found high estimates of $\theta$, in particular by being able to control adequately for the endogeneity of quasi-rents, our estimated $\theta$ of about 0.6 is much higher than these estimates. Abowd and Kramarz (1993), and Abowd and Allain (1996) obtain an estimated $\theta$ of about 0.4 for France, while Cahuc, Gianella, Goux and Zylberberg

only be equal if the changes in materials and in output were uncorrelated, but that $\mu^*$ overstates $\mu$ in the more realistic case where they are positively correlated. In the extreme case where materials and output grow at the same rate and the share of materials costs $s^M$ is constant, we have the following formula between the two: $\mu^* = \mu (1-s^M)/(1-\mu s^M)$ or $\mu = \mu^*/(1+s^M(\mu^* - 1))$, showing that a value added markup $\mu^*$ of 2 would correspond to a production markup $\mu$ of 1.25 for a share of materials of 0.60.

33 Nishimura, Ohkusa and Ariga approach differs from Hall’s approach and ours in a number of important ways. They also start from the first order conditions implied by short run profit maximization but combine them with an explicitly specified short run production function. More precisely, instead of simply assuming that capital is a quasi-fixed factor, they rely on a short-run production function involving the ratio of the firm’s “normal output” to its current output and the growth rate of the firm’s “scale” (where current output is sales deflated by an overall price index, normal output is the fitted value of deflated sales on a time trend, and capital is a proxy for scale). Like in the case of Roeger’s approach, their approach requires to measure the user cost of capital, implying that the long-run average markup could be directly computed from the data.
(1998) obtain a smaller value of about 0.2. Veugelers (1989) for Belgium, Abowd and Lemieux (1993) for Canada, and Van Reenen (1996) for the United Kingdom also find an estimated $\theta$ of about 0.2. Since in these wage equation studies the estimated magnitude of the bargaining power or quasi-rent sharing parameter $\theta$ depends closely on the exact definition of the quasi-rents, it is important to note that most of the studies, with few exceptions, use a measure of quasi-rents based on the value added of the firm, which is consistent with our definition of the profit and fall back position of the firm (in the overall objective function (10) of the bargaining model). Hence, the difficulties in measuring the firm quasi-rents do not seem to be the reason why in our approach we find a substantially higher average bargaining power parameter $\theta$.\footnote{More precisely, Abowd and Kramarz find an overall $\theta$ for the manufacturing industries of 0.4 for the subset of firms having a collective wage agreement ("accords d'entreprises"), but of 0.2 for the complementary subset of firms without such an agreement. Abowd and Allain also find an overall $\theta$ of 0.4 for all industries when estimated on the basis of external instrumental variables (IV) as in Abowd and Kramarz, and of 0.2 when simply estimated by OLS. Cahuc, Gianella, Goux and Zylberberg obtain an overall $\theta$ for manufacturing industries of 0.2 whether estimated by OLS or IV.}

\footnote{More precisely, Veugelers’ estimates, which are also performed by industries and separately for blue-collar and white-collar workers (but only by OLS and on a firm cross-section), vary very widely across the different manufacturing industries and to some extent between the two groups of workers. Abowd and Lemieux estimates (for all industries) are insignificant when estimated by OLS, but vary between 0.2 and 0.4 when estimated on the basis of external instrumental variables. Van Reenen’s estimates (for all industries) are of 0.1 when estimated by OLS and of 0.2 when estimated by IV.}

\footnote{In a previous version of this paper (Crepon, Desplat and Mairesse, 1999), we had adopted a different and less realistic formulation of the bargaining model, in which the firm has to bear both the costs of capital and the costs of materials in its fall-back position, thus assuming that its objective is to maximize its short run profit defined as total output revenue or sales minus labor compensation: $(R_{it} - w_{it}L_{it})$. In the present revised version, the short run profit of the firm is value added minus labor compensation: $(R_{it} - j_{it}M_{it} - w_{it}L_{it})$, and the firm has only to cover the capital costs in its fall back position. As could be expected, with our previous formulation, our estimates of average markup and bargaining power tended to be respectively higher and lower than with the present one: $\mu$=1.6 instead of 1.4, and $\theta$=0.3 instead of 0.6 (the estimates of average returns to scale being about constant in both cases). The fact that in our previous formulation the estimated $\theta$ was in the range of values found in the wage equations studies was thus in fact misleading. Note also that in the wage equation literature a number of authors have tried to measure the firm quasi-rents net of the user costs of capital. This can also make a significant difference in the estimated $\theta$ and contributes to the difficulties of a precise comparison between the results of the various studies (see for example Abowd and Allain, 1996, who compare using a gross and a net of capital costs measure of quasi-rents, or Abowd and Lemieux, 1993, who make the point that the capital cost component in the quasi-rents should be taken care by the firm fixed effects and the year effects in the wage equation).}
In her study, Dobelaere (2002) replicates very much what we do in the case of Belgium for a very large panel of manufacturing firms. She estimates the regression models (I) and (II), with and without constant returns to scale, with only minor differences except for one important feature. The implicit definition of the profit of the firm in the objective function of the underlying bargaining problem is output revenue, or sales, minus labor costs, implying that the firm would have to bear not only the costs of capital but also the costs of materials in the case an agreement with the workers’ union cannot be reached. Although her precise estimates are different from ours, they are qualitatively consistent: she finds both a significant average profit ratio \( \mu/\lambda \) of about 1.3 and a significant bargaining power parameter (of about 0.2) for model (II), and a smaller average profit ratio of 1.1 for model (I) when not accounting for rent sharing.

Dobelaere thus estimates the regression models (I) and (II) where \( \Delta x_i^\theta = s_i^l (\Delta q_i^a - \Delta k_i^a) + s_i^m (\Delta m_i^a - \Delta k_i^a) \) is unchanged, but \( \Delta x_i^\mu = (s_i^l - 1) (\Delta q_i^a - \Delta k_i^a) \) instead of \( \Delta x_i^\theta = (s_i^l + s_i^m - 1) (\Delta q_i^a - \Delta k_i^a) \) as in our case. She also prefers to express these regressions in a slightly modified way, by substituting \( (\Delta q_i^a - \Delta k_i^a) \) to \( \Delta x_i^\mu \) in the right hand side (taking \( \Delta x_i^\theta = (\Delta q_i^a - \Delta k_i^a) \) by definition of the Solow residual). Regression (I) thus becomes

\[
\begin{align*}
\Delta x_i^\mu = & \mu - \lambda (\Delta q_i^a - \Delta k_i^a) + \frac{\lambda - 1}{\mu} \Delta k_i^a + \frac{1}{\mu} \Delta u_i \\
\mu \Delta q_i^a = & \mu - \lambda (\Delta q_i^a - \Delta k_i^a) + \frac{\lambda - 1}{\mu} \Delta k_i^a + \frac{1}{\mu} \Delta u_i \\
\end{align*}
\]

When estimated by GMM with the same set of relevant instruments, these two different expressions (ours and Dobelaere’s) of regression models (I) and (II) should both lead to consistent (asymptotically equivalent) estimates of the average markup, bargaining power and elasticity of scale parameters of interest. We have checked that was the case on our data. However, it is possible that this will not be so with other data sets, because of finite sample biases if the sample is not large enough or if the instrument set is not fully appropriate (see Mairesse and Mulkay, 1994, for an illustration of this problem in the context of estimating an Euler equation model for investment, in which the choice of normalization greatly matters). We have an a priori preference for our expression of regression models (I) and (II), in which \( \Delta q_i^a \) is confined to the left hand side and which seems more straightforward.

The main differences between the precise estimates of Dobelaere and ours is that she finds a much smaller estimated bargaining power parameter \( \theta \) than we do, and that she finds increasing returns to scale (\( \lambda \) about 1.1) while we tend to find constant or decreasing returns to scale. Her estimates of the average profit ratio \( \mu/\lambda \) and ours are however quite close, but because of the different estimated returns to scale, her estimates of the average markup \( \mu \) are larger than ours (about 1.3 to 1.4 as against 1.1 to 1.2). The difference in the estimated \( \theta \) is mostly related to the fact that she assumes a different specification for the firm profit function in the bargaining model, her estimate being about 0.2, while we obtained an estimate of about 0.3 using this same specification in a previous version of our paper. The fact that she finds increasing returns to scale may be partly related to the fact that her sample covers practically the entire population of
To our knowledge, only two other studies have already estimated jointly both the average markup and bargaining power parameters. These studies, however, are not based on a semi-reduced form equation like regression (II), but on a fully specified structural model. Schroeter (1988) considers an aggregate demand and supply model of the U.S. beef packing industry and finds that the output price and wage distortions arising from imperfect competition are quite small in this industry (of only a few percent). Bughin (1996) considers a firm level factor demand model for four Belgium industries and finds significant estimates of the markup and bargaining power parameters (in the range of 1.1 to 1.2 and 0.2 to 0.3 respectively).39

The problem of unobserved output price differentials has been generally disregarded in firm econometric analyses, and our results for regression models (I-C) and (II-C) in which we deal with it following Klette and Griliches (1996) suggestion, are not in this sense comparable to those of any previous study. It is thus useful to consider carefully what difference it makes on our own findings when we do not neglect the issue. …

4. Conclusion (To be written)

In this paper we have presented a simple model for estimating both the magnitude of price-cost margins and the extent of rent sharing. Our model generalizes Robert Hall’s framework, relating the conventional measure of total factor productivity (the "Solow residual") to the degree of imperfect competition in product markets, by allowing also for the possibility of imperfect competition in labor markets. One key aspect of our model is that the labor share is a function of the employment-elasticity of production, the degree of imperfect competition in the product market, as in Hall framework, but

Belgium manufacturing firms, including the small ones, while ours is limited to medium and large firms. Because of her very large sample, Dobbelaere is also able to estimate regressions (I) and (II) by industries, finding markups ranging from 1.1 to 1.7, elasticities of scale ranging from 0.9 to 1.3, and bargaining power parameters from 0.1 to 0.3.

39 Bughin’s model is a three equations model consisting of a firm translog production function, a labor share equation and a materials (or capital) share equation; it is estimated on four small panels of firms (in the chemical, textile, footwear and printing industries). Schroeter’s model is similar, but at the industry level; it consists of four equations: a demand equation and a supply equation for the industry, and labor and capital demand equations derived from a generalized Leontief production function; it is estimated on a long time series (33 years).
also of the degree of imperfect competition in the labor market. We have shown that it is possible to extend Hall’s equation explaining the Solow residual as a function of the factor mix and the degree of imperfect competition in the product market to add a new term identifying the degree of imperfect competition in the labor market.

One attractive aspect of Hall's approach is that it does not require measurement of the user cost of capital to assess the magnitude of markup, in contrast to more conventional analyses of price-cost margins. Similarly, one interesting feature of our extended framework is that it does not require measurement of the alternative external wage to estimate the degree of workers' bargaining power, contrary to most studies on rent sharing.

We have also shown, following Klette and Griliches (1996), how the relationship between the Solow residual and the dependent variable implied by our model has to be corrected to account for unobserved price at the firm level.

Our model has been estimated on a panel of French manufacturing firms using the Generalized Method of Moments (GMM). Our results show that the lack of explicit consideration of labor market imperfection results in a large underestimation of the estimated markup, corresponding to the omission of the part of the firm rent captured by workers. Our estimate of average extent of workers’ rent sharing is about 0.6, while our estimate of average price-cost margins is of an order of magnitude of 1.4, to be compared to 1.1 only when ignoring the occurrence of rent sharing. The results also show that taking into account the lack of price information at the firm level is a key issue. Half the difference between the degree of imperfect competition measured when applying Hall’s framework to firm level data and our preferred specification is due to the lack of explicit consideration of missing price information.
Appendix:


Table 1: Simple statistics on the main variables,

<table>
<thead>
<tr>
<th>Variables: annual log-growth rates and factor shares in output value</th>
<th>Mean</th>
<th>Standard-deviation</th>
<th>Q1</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output growth rate (deflated by an industry output price index)</td>
<td>$\Delta y_{it}$</td>
<td>0.021</td>
<td>0.152</td>
<td>-0.062</td>
</tr>
<tr>
<td>Industry real output growth rate</td>
<td>$\Delta q_{it}$</td>
<td>0.021</td>
<td>0.037</td>
<td>0.003</td>
</tr>
<tr>
<td>Labor growth rate</td>
<td>$\Delta l_{it}$</td>
<td>0.006</td>
<td>0.124</td>
<td>-0.043</td>
</tr>
<tr>
<td>Capital growth rate</td>
<td>$\Delta k_{it}$</td>
<td>-0.001</td>
<td>0.151</td>
<td>-0.073</td>
</tr>
<tr>
<td>Materials growth rate</td>
<td>$\Delta m_{it}$</td>
<td>0.040</td>
<td>0.192</td>
<td>-0.060</td>
</tr>
<tr>
<td>Labor share</td>
<td>$s_{it}^L$</td>
<td>0.307</td>
<td>0.136</td>
<td>0.208</td>
</tr>
<tr>
<td>Materials share</td>
<td>$s_{it}^M$</td>
<td>0.503</td>
<td>0.160</td>
<td>0.399</td>
</tr>
<tr>
<td>Solow residual $^a$</td>
<td>$\bar{SR}_{it}$</td>
<td>-0.001</td>
<td>0.100</td>
<td>-0.056</td>
</tr>
<tr>
<td>Share weighted growth rates of labor and materials to capital ratios $^b$</td>
<td>$\Delta x_{it}^\mu$</td>
<td>0.023</td>
<td>0.151</td>
<td>-0.054</td>
</tr>
<tr>
<td>Share weighted growth rate of labor to capital ratio $^c$</td>
<td>$\Delta x_{it}^\theta$</td>
<td>-0.001</td>
<td>0.036</td>
<td>-0.013</td>
</tr>
</tbody>
</table>

Note: See Table 1 in text for definitions of $\bar{SR}_{it}$, $\Delta x_{it}^\mu$ and $\Delta x_{it}^\theta$.  

33
Table 2: Reduced form parameters estimates

<table>
<thead>
<tr>
<th>Model</th>
<th>Not controlling for firm output price differentials</th>
<th>Controlling for firm output price differentials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(I)</td>
<td>(II)</td>
</tr>
<tr>
<td>Δx_{it}^{μ}</td>
<td>0.003</td>
<td>0.441</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>Δk</td>
<td>-0.119</td>
<td>-0.055</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Δx_{it}^{θ}</td>
<td>-</td>
<td>1.648</td>
</tr>
<tr>
<td></td>
<td>(0.230)</td>
<td>(0.218)</td>
</tr>
<tr>
<td>Δq_{it}</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.02)</td>
</tr>
</tbody>
</table>

Note: See Table 2 in text for specifications (I), (II), (I-C) and (II-C).

Table 3: Structural parameters estimates

<table>
<thead>
<tr>
<th>Model</th>
<th>Without imposing constant returns to scale</th>
<th>Imposing constant returns to scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(I)</td>
<td>(II)</td>
</tr>
<tr>
<td>Scale elasticity λ</td>
<td>0.881</td>
<td>0.945</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>General markup μ</td>
<td>1.003</td>
<td>1.411</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>Demand markup μ(η)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Bargaining power θ</td>
<td>0.539</td>
<td>0.539</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Profit ratio μ/λ</td>
<td>1.138</td>
<td>1.494</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.055)</td>
</tr>
</tbody>
</table>

Note: See Table 2 in text for specifications (I), (II), (I-C) and (II-C).
References


