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Interaction between product market and labour market power: evidence from France, Belgium and Chile

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This article jointly estimates price-cost mark-ups and union bargaining power of manufacturing firms in France, Belgium and Chile. Our GMM results provide strong evidence of price-cost mark-ups being underestimated when labour market imperfections are ignored, corresponding to the omission of the part of product rents captured by the workers.

I. Introduction

The identification and estimation of imperfect competition in the product market has received great attention in the empirical industrial organisation literature (see Bresnahan, 1989 and Schmalensee, 1989 for surveys). Likewise, the degree of labour market imperfections has been explored extensively in the empirical rent sharing literature (see e.g. Blanchflower et al., 1996; Hildreth and Oswald, 1997). However, there are few empirical studies (see e.g. Schroeter, 1988; Bughin, 1996; Neven et al., 2002; Dobbelaere, 2004) which consider the possible interaction between product market and labour market imperfections when investigating price-cost mark-ups. These studies do however not allow for consistent comparisons as they rely on different modelling frameworks and econometric techniques.

The contribution of this short article is (1) to compare consistently joint estimates of price-cost mark-ups and extent of rent sharing of manufacturing firms in France, Belgium and Chile and (2) to evaluate the effect of ignoring rent sharing on the estimation of price-cost mark-ups in the three countries. Methodologically, we follow Crépon-Desplatz-Mairesse (1999, 2002). By embedding the Efficient Bargaining model (McDonald and Solow, 1981) in a microeconomic version of Hall’s (1988) framework, they derive a reduced-form equation. Estimating this equation allows the identification of several structural parameters. These parameters concern the firm’s price-cost mark-up, the scale elasticity and the workers’ bargaining power.

The main point of this article is that price-cost mark-ups of French, Belgian as well as Chilean manufacturing firms are systematically underestimated when imperfect competition in the labour market is ignored. This underestimation corresponds to the omission of the part of product rents captured by the workers.

II. Theoretical Framework

We start from a production function $Q_{it} = \Theta_i F(L_{it}, M_{it}, K_{it})$, where $i$ is a firm index, $Q$ is output, $t$ a time
index, $L$ is labour, $M$ is material input, $K$ is capital and $\Theta_t = A e^{u_i+u_i+u_i}$, is an index of technical change or ‘true’ total factor productivity. The function $F$ is assumed to be homogeneous of degree $\lambda_i$.

Under imperfect competition in the product market and perfect competition in the labour market, the Solow Residual (Total factor productivity conventionally measured) can be expressed as:

$$SR_{it} = \Delta q_{it} - \alpha_{Li} \Delta l_{it} - \alpha_{Mi} \Delta m_{it} - (1 - \alpha_{Li} - \alpha_{Mi}) \Delta k_{it}$$

$$= (\mu_i - 1) [\alpha_{Li} (\Delta l_{it} - \Delta k_{it}) + \alpha_{Mi} (\Delta m_{it} - \Delta k_{it})]$$

$$+ (\lambda_i - 1) \Delta k_{it} + \Delta \theta_i$$

Equation 1 shows that the Solow Residual can be decomposed into (1) a price mark-up component $\mu_i = P_{it}/C_{Q_{it}}$ (where $P$ denotes the output price and $C_{Q}$ the marginal cost); (2) a scale factor component with $\lambda_i$ being the scale elasticity and (3) a technological change residual term $(\Delta \theta_i = \Delta \alpha_i + \Delta \eta_i)$.

Embedding the Efficient Bargaining model into the framework extends the expression for the Solow Residual as follows:

$$SR_{it} = (\mu_i - 1) [\alpha_{Li} (\Delta l_{it} - \Delta k_{it}) + \alpha_{Mi} (\Delta m_{it} - \Delta k_{it})]$$

$$+ (\lambda_i - 1) \Delta k_{it} + \mu_i \frac{\phi_i}{1 - \phi_i} (\alpha_{Li} + \alpha_{Mi} - 1)$$

$$\times (\Delta l_{it} - \Delta k_{it}) + \Delta \theta_i$$

This equation only differs from Equation 1 by an additional term reflecting the workers’ bargaining power $\phi_i \in [0, 1]$.

### III. Empirical Analysis

**Reduced-form equations**

Considering $\mu$, $\lambda$ and $\phi$ as average parameters, we can estimate the following reduced-form equations:

$$SR_{it} = (\mu_i - 1) [\alpha_{Li} (\Delta l_{it} - \Delta k_{it}) + \alpha_{Mi} (\Delta m_{it} - \Delta k_{it})]$$

$$+ (\lambda_i - 1) \Delta k_{it} + \Delta \theta_i$$

$$= (\mu_i - 1) [\alpha_{Li} (\Delta l_{it} - \Delta k_{it}) + \alpha_{Mi} (\Delta m_{it} - \Delta k_{it})]$$

$$+ (\lambda_i - 1) \Delta k_{it} + \mu_i \frac{\phi_i}{1 - \phi_i} (\alpha_{Li} + \alpha_{Mi} - 1)$$

$$\times (\Delta l_{it} - \Delta k_{it}) + \Delta \theta_i$$

Equations (I) and (II) follow directly from the theoretical framework.

Changes in output prices $(\Delta p_{it})$ and hence in real output $(\Delta q_{it})$ are generally not observed at the firm level. In empirical practice, changes in real output are replaced by changes in nominal output (or sales) that are deflated by a common industry price index $\Delta p_{it}$. Ignoring output price differentials might lead to downwardly biased and inconsistent estimates of the parameters of interest if there are large differentials in the firm output prices (across firms within industry) and if these differentials are correlated with the explanatory variables (changes in factor inputs and factor shares). Equations (I–C) and (II–C) control for output price differentials, following the solution suggested by Klette and Griliches (1996). This solution results in modified regressions with the growth in industry output $(\Delta q_{it})$ as an additional regressor and a different interpretation of the coefficients in terms of the average scale elasticity and parameter $\lambda$ and $\phi$, and two mark-up

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1 For technical details, see Crépon et al. (1999, 2002).

2 Crépon et al. (1999) and Dobelaere (2004) adopt a different formulation of the bargaining model. They assume that the firm has to bear both the costs of capital and the costs of materials in its fall-back position. The firm’s objective is to maximize its short run profit defined as total revenue minus labour costs: $R_{it} - w_i L_{it}$. In this article, we follow Crépon et al. (2002) and assume that the short run profit of the firm is value added minus labour costs: $R_{it} - w_i L_{it}$. The firm has only to cover capital costs in its fall-back position.

3 The Klette-Griliches solution relies on the assumption that the market power of firms mainly arises from product differentiation. In a differentiated product market, the firm market share depends on its relative price within the industry, and hence the change in the firm relative price $(\Delta P_{it} - \Delta P_{jt})$ can be expressed in terms of its output growth relative to the industry $(\Delta q_{it} - \Delta q_{jt})$. See also Mairesse and Jaumandreu (2005).
parameters: $\mu_q$ capturing a specific demand mark-up associated with the within-industry demand elasticity $\eta$, where $\mu_q = \eta/(\eta-1)$, and the average general mark-up $\mu$, corresponding also to other forms of product market imperfections.

Data

To estimate the four reduced-form Equations (I), (II), (I–C) and (II–C) for France, we use a balanced panel of 1026 manufacturing firms over the period 1986 to 1992. This sample has been constructed from the database SUSE (‘Système Unifié des Statistiques d’Entreprises’) of INSEE, the French National Institute for Statistics and Economic Studies. For Belgium, we rely on an unbalanced panel of 5565 firms in the manufacturing industry over the period 1988 to 1995. The data are taken from company accounts which are collected by the NBB (National Bank of Belgium). For Chile, we have a balanced panel of 1954 manufacturing firms over the period 1993 to 1999; it is largely drawn from the ENIA (‘la Encuesta Nacional Industrial Annual’) which is gathered by the INE (‘el Instituto de Estadísticas de Chile’). Table 1 reports the means and the SDs of the included data for our main variables. The definitions of these variables are practically the same in the three countries.

Estimation method and main results

Since changes in factor inputs ($\Delta l$, $\Delta m$ and $\Delta k$) are endogenous to our model and since these changes can be affected by past and current productivity shocks (and demand shocks through the specification error due to unobserved firm level output prices), Ordinary Least Squares (OLS) estimates of the reduced-form coefficients and the corresponding structural estimates are likely to be biased and inconsistent. To avoid such biases and to take into account endogeneity problems, we estimate Equations (I)–(II–C) by the Generalized Method of Moments (GMM) technique. More specifically, we use interior variables (lagged values of the growth of the input factors $\Delta l$, $\Delta m$ and $\Delta k$) as instruments. To capture possible unobservable aggregate shocks and productivity shocks common to all firms in a given year, we include time dummies.

Since our focus is on the magnitude of the underlying structural parameters ($\mu$, $\mu_q$, $\lambda$ and $\phi$) and on assessing the differences which result from modelling imperfect competition in both the product and the labour market in the three different countries, we present in Table 2 the structural parameters. These are computed from the estimated values of the reduced-form coefficients. For all reported results, we can never reject the null hypothesis that the instruments are valid on the basis of the Sargan test.

Our main findings can be summarized as follows. First, the parameter of average degree of rent sharing $\phi$ is estimated precisely and robustly across the specifications. The estimates point to a statistically significant workers’ bargaining power of 0.66 (France), 0.36 (Belgium) and 0.31 (Chile) on a scale going from 0 to 1, indicating a high degree of rent sharing. Second, in the three countries, the lack of explicit consideration of labour market imperfections results in an underestimation of the average price-cost mark-up, corresponding to the omission of the part of rents captured by the workers. When taking into account the existence of rent sharing and controlling

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Table 1. Summary Statistics

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Real firm output growth rate $\Delta q$</td>
<td>0.028 (0.203)</td>
<td>0.047 (0.177)</td>
<td>−0.011 (0.282)</td>
</tr>
<tr>
<td>Real industry output growth rate $\Delta q_{ind}$</td>
<td>0.024 (0.041)</td>
<td>0.046 (0.168)</td>
<td>−0.013 (0.118)</td>
</tr>
<tr>
<td>Labour growth rate $\Delta l$</td>
<td>−0.002 (0.151)</td>
<td>0.020 (0.142)</td>
<td>−0.008 (0.221)</td>
</tr>
<tr>
<td>Capital growth rate $\Delta k$</td>
<td>0.039 (0.208)</td>
<td>−0.009 (0.253)</td>
<td>−0.016 (0.179)</td>
</tr>
<tr>
<td>Materials growth rate $\Delta m$</td>
<td>0.037 (0.248)</td>
<td>0.048 (0.221)</td>
<td>−0.022 (0.396)</td>
</tr>
<tr>
<td>Labour share $\alpha_L$ in nominal output</td>
<td>0.267 (0.130)</td>
<td>0.272 (0.138)</td>
<td>0.150 (0.087)</td>
</tr>
<tr>
<td>Materials share $\alpha_M$ in nominal output</td>
<td>0.612 (0.145)</td>
<td>0.587 (0.160)</td>
<td>0.533 (0.163)</td>
</tr>
<tr>
<td>Solow residual SR (TFP)</td>
<td>0.002 (0.082)</td>
<td>0.014 (0.084)</td>
<td>0.005 (0.197)</td>
</tr>
</tbody>
</table>

Note: $SR = \Delta q_l - \alpha_{Llt} \Delta l - \alpha_{Mlt} \Delta m - (1 - \alpha_{Llt} - \alpha_{Mlt}) \Delta k_l$. 

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4 For detailed information on the sample construction and the variable measurement, we refer to Crépon et al. (2002), Dobelaere (2004) and Contreras and Benavente (2006), respectively.
Table 2. Structural parameter estimates

<table>
<thead>
<tr>
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<th>Not controlling for firm output price differentials</th>
<th>Controlling for output price differentials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>France (I) Belgium (II) Chile (I-C) (II-C)</td>
<td>France (I-C) Belgium (II-C) Chile (I-C) (II-C)</td>
</tr>
<tr>
<td>General mark-up: $\mu$</td>
<td>1.02 (0.02) 1.05 (0.03) 1.16 (0.09) 1.21 (0.10) 0.95 (0.10) 1.00 (0.11) 1.23 (0.12) 1.42 (0.18) 1.21 (0.14) 1.24 (0.14) 1.18 (0.63) 1.28 (0.49)</td>
<td></td>
</tr>
<tr>
<td>Demand mark-up: $\mu_q$</td>
<td>1 1 1 1 1 1 1.19 (0.11) 1.32 (0.15) 1.04 (0.08) 1.02 (0.08) 1.15 (0.38) 1.17 (0.34)</td>
<td></td>
</tr>
<tr>
<td>Scale elasticity: $\lambda$</td>
<td>0.92 (0.01) 0.76 (0.02) 1.01 (0.08) 0.94 (0.10) 0.75 (0.06) 0.60 (0.10) 1.10 (0.10) 1.01 (0.12) 1.06 (0.12) 0.96 (0.13) 0.88 (0.45) 0.78 (0.36)</td>
<td></td>
</tr>
<tr>
<td>Workers’ bargaining</td>
<td>0 0.66 (0.01) 0 0.36 (0.22) 0 0.39 (0.12) 0 0.66 (0.01) 0 0.36 (0.16) 0 0.31 (0.11)</td>
<td></td>
</tr>
<tr>
<td>Profit ratio: $\mu/\lambda$</td>
<td>1.11 (0.02) 1.38 (0.04) 1.14 (0.07) 1.29 (0.12) 1.28 (0.16) 1.66 (0.39) 1.11 (0.02) 1.41 (0.04) 1.14 (0.07) 1.29 (0.13) 1.35 (0.38) 1.65 (0.59)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Robust SEs in parentheses.
for output price differentials, the average profit ratio \((\mu/\lambda)\) increases from 1.11 to 1.41 (France), 1.14 to 1.29 (Belgium) and 1.35 to 1.65 (Chile). For the three countries, this increase is due to a rise in the estimated average mark-up \(\mu\) and a decline in the estimated scale elasticity \(\lambda\).\(^5\) Third, controlling for price heterogeneity leads to a sizeable increase in the average mark-up and the scale elasticity of French and Chilean manufacturing firms and a small increase in both parameters of Belgian manufacturing firms. Taking into consideration the problem of price heterogeneity does however not modify our assessment of the magnitude of the average profit ratio \((\mu/\lambda)\). Finally, the results suggest that the mark-up of French and Chilean manufacturing firms is mainly a differentiated product or demand mark-up. In contrast, it seems that the main source of market power of Belgian manufacturing firms is not in product differentiation but rather corresponds to other forms of imperfect competition.

**IV. Conclusion**

This article compares in a consistent way joint estimates of imperfections in both the product and the labour market in three different countries, i.e. France, Belgium and Chile, and evaluates the effect of ignoring labour market imperfections on the estimation of the price-cost mark-up. For the three countries, the empirical analysis shows clearly that the lack of explicit consideration of labour market imperfections results in a considerable underestimation of the average price-cost mark-up, corresponding to the omission of the part of firm rents captured by the workers. The average workers' bargaining power is estimated at 0.66 (France), 0.36 (Belgium) and 0.31 (Chile), while our estimate of the average price-cost mark-up is about 1.42 (France), 1.24 (Belgium) and 1.28 (Chile). Ignoring the occurrence of rent sharing reduces the price-cost mark-up to 1.23 (France), 1.21 (Belgium) and 1.18 (Chile). A key implication of our results is that wages should not be considered exogenous in econometric tests of product market power.

**Acknowledgements**

This work is based on Crépon-Desplatz-Mairesse (1999, 2002), Dobbelaeere (2004) and Contreras-Benavente (2006). We are particularly thankful to B. Crépon, R. Desplat and J.S. Contreras, our co-authors in these articles.

**References**


\(^5\) In Dobbelaeere (2004), the Belgian manufacturing industry is split up into 18 sectors. For each sector separately, it is found that price-cost mark-ups are underestimated when labour market imperfections are ignored.