International Competition and Imperfect Markets
Firm Level Evidence from French Manufacturing Firms

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Preliminary and incomplete

Abstract

The paper exploits recent advances in the estimation of mark-ups to derive a firm-level measure of market power in both the product and the labor markets. The contribution of the paper is twofold. First, exploiting a large panel of French manufacturing firms for the period 1993–2007, this paper is the first to classify firms –not industries– into six different market regimes based on the presence/absence of imperfections in the two markets and on whether labor and materials are remunerated above/below their marginal product. We find that roughly two thirds of firms enjoy some degree of market power on product markets. Efficient bargaining is by far the most common labor-market regime, covering 60% of firms in our sample, while the remaining fraction of firms is almost evenly split between perfect competition and monopsony. The second contribution of the paper is to relate the probability to belong to a specific market regime to firm-level characteristics such as productivity, size, and the degree of competition from low-wage countries. Results support the view that foreign competition, especially from China, has pushed French firms to improve their products, while reducing labor's bargaining power.

Keywords: firm heterogeneity; mark-up; imperfections; bargaining; import competition

JEL Classification: F14; F16; J50

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1 Introduction

The recent debate on the latest wave of (actual or possible) trade agreements —such as the Trans-Pacific Partnership (TPP) signed in February 2016 among 12 North-American and East Asian countries, or the Transatlantic Trade and Investment Partnership (TTIP) under negotiation among the US and the EU— has brought back on stage concerns about the effects of international trade liberalization on the labor markets of industrial countries. These concerns are highest when liberalization involves economies with different levels of income per capita, social protection, and labor costs.

In this paper we combine two streams of the recent empirical literature on market imperfections to determine the product and labor market regimes in which firms operate. More specifically, we build on the methodology developed by De Loecker & Warzynski (2012) to estimate productivity and markups at firm level and combine the results with the approach used by Dobbelaere & Mairesse (2013) and Dobbelaere et al. (2015) to classify sectors according to their degree of product and labor market imperfections. In this way, we are able to classify firms – not industries – into six different regimes depending on whether they enjoy market power on the product and /or the labor market. To the best of our knowledge this is the first time that such an exercise is performed at the firm level, and this represents the first contribution of the paper.

Moreover, we investigate the relationship among our measures of market imperfections with a number of firm-level characteristics, among which feature the degree of import competition from low-wage countries, to see whether trade liberalization is associated with a change in the degree of market power that the firm enjoys on the product and the labor market. Results support the view that foreign competition, especially from China, has pushed French firms to improve their products, while reducing labor's bargaining power.

2 Data and methodology

We use data on a large sample of French manufacturing firms based on the *Enquête Annuelle d'Entreprises* (EAE), an annual survey that gathers balance sheets information for all manufacturing firms with at least 20 employees conducted until 2007 by the French Ministry of Industry. The surveyed unit is the legal (not the productive) unit, which means that we are dealing with firm-level data. We have data for the period 1993–2007, and after some basic cleaning from outliers we have information for about 12,500 firms.[1]

Beside proving us with the main information from each firm's income statement, the EAE also reports some details on the different activities performed by firms: more specifically, it gives us a list of the detailed (4-digit) code of activities together with the corresponding number of employees, sales and export. We use this information to derive the relative importance of each activity within the firm and, by linking these weights to data on imports retrieved from the BACI dataset maintained by CEPII (Guillaume Gaulier 2010) we obtain a firm-specific measure of competition from low wage

[1] We keep companies which are present at least 8 consecutive years and for which the annual growth rates never exceed ±100%.

countries and from China.[2] Low-wage countries are defined following Bernard et al. (2006) and our competition measure is simply the ratio of French imports from those countries (or from China) over total imports.[3] The same source of data is used to compute the share of employees pertaining to high-tech sectors/activities within each firm.

2.1 Estimating markups

Similar to Hall (1986, 1988) and Roeger (1995), both Dobbelaere & Mairesse (2013) and De Loecker & Warzynski (2012) rely on the production function framework. Unlike previous contributions, however, this framework neither imposes constant returns to scale nor requires the computation of the user cost of capital, a task that is difficult to perform accurately. Finally, this framework provides time-varying and firm-specific estimates of markups and productivity that allow us to unravel the heterogeneity in firms' markup.

Let Q be firm output as follows: $Q_{it} = Q_{it}(\mathbf{X}_{it}, K_{it})$, where subscripts i and t stand for firm i at time t, respectively, K is capital, and $\mathbf{X}$ is a vector of production factors. In this framework, capital is assumed to be fixed, whereas all remaining production factors are variable. We suppose that $Q(\cdot)$ is twice differentiable and continuous and that the objective of the producer is to minimize costs. The associated Lagrangian function then reads

$$\mathcal{L}_{it} = \mathbf{P}_{it}^{X}\mathbf{X}_{it} + r_{it}K_{it} + \lambda_{it}(\bar{Q_{it}} - Q_{it}(\mathbf{X}_{it}, K_{it})), \tag{1}$$

where P_{it}^{X} and r_{it} are firm input prices for input vector $\mathbf{X}$ and capital, respectively.

The first-order conditions satisfy

$$\frac{\partial \mathcal{L}_{it}}{\partial \mathbf{X}_{it}} = P_{it}^{X} - \lambda_{it}\frac{\partial Q_{it}(\mathbf{X}_{it}, K_{it})}{\partial \mathbf{X}_{it}} = 0 \tag{2}$$

and

$$\frac{\partial \mathcal{L}_{it}}{\partial Q_{it}} = \lambda_{it}, \tag{3}$$

which implies that λ_{it} represents the marginal cost of production.

Rearranging (2) and multiplying both sides by $\frac{X_{it}}{Q_{it}}$ yields

$$\frac{\partial Q_{it}(\mathbf{X}_{it}, K_{it})}{\partial \mathbf{X}_{it}}\frac{\mathbf{X}_{it}}{Q_{it}} = \frac{P_{it}^{X}\mathbf{X}_{it}}{\lambda_{it}Q_{it}}. \tag{4}$$

The term on the left-hand side of Equation 4 is the output elasticity of the variable inputs $\mathbf{X}_{it}$, whereas the right-hand-side term is its share in total cost.[4] Now, defining firm markups μ as the

[2]For more information, see `http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=1`

[3]Since trade data are reported according to the HS classification while the EAE is based on the French industrial classification system (NAF) we need to assign product-level imports to industries using concordance tables.

[4]This is true when at the optimal point of production, the marginal cost equalizes the average cost due to the free entry of firms into the market.

price to marginal cost $\mu_{it} \equiv \frac{P_{it}}{\lambda it}$, it follows that $\lambda_{it} \equiv \frac{P_{it}}{\mu_{it}}$. Inserting the former into Equation 4 and simplifying yields

$$\mu_{it}^{X} = \frac{\theta_{it}^{X}}{\alpha_{it}^{X}}, \tag{5}$$

where the numerator $\theta_{it}^{X} = \frac{\partial Q_{it}(X_{it},K_{it})}{\partial X_{it}} \frac{X_{it}}{Q_{it}}$ represents the output elasticity of input $\mathbf{X}_{it}$ and the denominator $\alpha_{it}^{X} = \frac{P_{it}^{X}\mathbf{X}_{it}}{P_{it}Q_{it}}$ is the share of input $\mathbf{X}_{it}$ in total sales. Hence, to compute the markup μ_{it}, we need to compute both θ_{it}^{X} and α_{it}^{X} per firm and per time period. Although it is straightforward to compute α_{it}^{X}, the estimation of θ_{it}^{X} is more demanding.

At the outset, two important choices need to be made explicit. First, we limit the set of variable inputs to labor L and M. Theoretically, if all factor markets were perfect, the markup derived from material must yield the same value as the markup derived from labor: $\mu_{it}^{M} = \mu_{it}^{L}$. However, differences in factor markets' imperfections will yield different values of firm markups ($\mu_{it}^{M} \neq \mu_{it}^{L}$). Hence the wedge between μ_{it}^{M} and μ_{it}^{L} will be used to infer factor market imperfections. This also implies that we define output Q as gross output.

The second important choice involves the functional form of $Q(\cdot)$. The most common candidate is the Cobb-Douglas framework. This functional form would yield an estimate of the output elasticity of labor that would be common to the set of firms to which the estimation pertains: $\hat{\theta}_{it}^{L} = \hat{\theta}^{L}$, hence, $\hat{\theta}_{it}^{L} = \hat{\theta}_{jt}^{L}$ for all firms i and j, $i \neq j$, included in the estimation sample. It follows that the heterogeneity of firm markups and the ratio of the output elasticity of labor on its revenue share would simply reflect heterogeneity in the revenue share of labor: $\mu_{it}^{L} = \frac{\theta^{X}}{\alpha_{it}^{L}}$. Therefore, we prefer to use the translog production function because it generates markups whose distribution is not solely determined by heterogeneity in the revenue share of labor, as will be clear below.

Several different methods exists to estimate the production function. Here we follow Wooldridge (2009), i.e. a modification of the approach proposed by Levinsohn & Petrin (2003) and Ackerberg et al. (2015) to control for unobserved productivity shocks using intermediate inputs. Wooldridge (2009) proposes a joint estimation method that sidesteps some of the drawbacks associated with the various two-step procedures and leads to more efficient estimators.

2.2 Measuring market imperfections

Dobbelaere & Mairesse (2013) show that in the context of a gross output production function where factor inputs comprise labor, capital and materials, one can exploit the difference between the markup computed on materials and labor to infer the existence of imperfect competition on both the product and the labor market. The first important working assumption in this context is that both labor (L) and materials (M) are variable inputs.[5] The second key assumption of the paper is to consider that materials prices P^{M} equalize their marginal product. This assumption allows us to consider the wedge between μ_{it}^{M} and μ_{it}^{L} as stemming from imperfections in the labor market. In particular, Dobbelaere

[5] One could object that labour market is a quasi-variable input, especially in the case of France. However, incorporating it into the model is beyond the scope of the paper.

& Mairesse (2013) define a joint market imperfection parameter:

$$\Psi_{it} = \frac{\theta_{it}^{M}}{\alpha_{it}^{M}} - \frac{\theta_{it}^{L}}{\alpha_{it}^{L}} = \mu_{it}^{M} - \mu_{it}^{L}$$

whose sign and significance provides us with information on the presence of labor market imperfections. If all markets are perfects, the two terms on the right-hand side should amount to unity. If the product market is imperfect but the two factor markets are perfect, then the terms μ_{it}^{M} and μ_{it}^{L} must be strictly equal. Hence the left hand side term Ψ_{it} should be zero. Based on our second working assumption, an inequality in μ_{it}^{X} ($\Psi_{it} \neq O$) implies the presence of imperfections in the labor market. Based on Hall (1988), Dobbelaere & Mairesse (2013) formally show that Ψ_{it} informs us on three labor market regimes:

1. *Efficient Bargaining* (EB, $\Psi > 0$). Firms and risk-neutral workers bargain over wages and employment level. In this case, it is possible to derive an expression for the absolute extent of rent sharing ($\phi_{it} \in [0, 1]$), i.e. the part of the rent that is appropriated by workers (with $1 - \phi$ being the share going to the firm).

2. *Perfect competition - Right-to-manage* (PR, $\Psi = 0$). In this case the labour market is coined as operating under perfect competition, for neither the firms nor the workers can influence wages.

3. *Monopsony* (MO, $\Psi < 0$). If firms enjoy *monopsony* power, we can derive measure of the elasticity of labour supply with respect to wages β_{LS}.

Exploiting the methodology presented above, we are able to obtain firm-level estimates of the key parameters and therefore we can classify each firm in a different regime with the following procedure. First, we compute the confidence intervals (CI) at 95% level for each firm-level measure of μ_{it}^{M} and μ_{it}^{L} in a classical fashion ($\mu_{it}^{X} < \hat{\mu}_{it}^{X} \pm z \times \sigma_{\mu_X,it}$) where X stands for either M ort L, $z = 1.96$ and $\sigma_{\mu_X,it}$ is given by:

$$(\sigma_{\mu_X,it})^2 = (\alpha_{it}^{X})^{-2} \cdot \left[\sum_{w} w_{it}^2 \cdot (\sigma_x)^2 + 2 \cdot \sum_{x,z,x \neq z} x_{it} \cdot z_{it} \cdot cov_{xz} \right]$$

where $w = \{1, l, k, lk\}$ and $x, z = \{m, lm, mk, lmk\}$ when $X = M$ and $w = \{1, m, k, mk\}$ and $x, z = \{l, lm, lk, lmk\}$ when $X = L$, where lower cases denote the log transformed variables of capital K, labor L and materials M.

Second, and consistently with the above classification, the comparison of the two confidence intervals allows us to classify the labor market in which each firm operates:

1. EB: *Efficient Bargaining*. If lower bound for the 95% CI μ_{it}^{M} exceeds the upper bound of the 95% CI for $\mu_{it}LM$, then μ_{it}^{M} is significantly greater than μ_{it}^{L}: $\mu_{it}^{M} > \mu_{it}^{L} \Rightarrow \Psi_{it} < 0$, at 95% level.

2. PR: *Perfect competition - Right-to-manage*. If the two confidence intervals overlap, then μ_{it}^{M} is not significantly different from μ_{it}^{L}: $\mu_{it}^{M} = \mu_{it}^{L} \Rightarrow \Psi_{it} = 0$, at 95% level.

3. MO: *Monopsony*. If lower bound for the 95% CI μ_{it}^L exceeds the upper bound of the 95% CI for μ_{it}^M, then μ_{it}^M is significantly lower than μ_{it}^L: $\mu_{it}^M < \mu_{it}^L \Rightarrow \Psi_{it} < 0$, at 95% level.

Observe that to classify firms as operating under perfect or imperfect product market is now straightforward. Using the confidence interval for μ^M, firms are coined as operating in perfect markets if the lower bound of the 95% CI is below unity.

Based on the joint market imperfection parameter, Dobbelaere & Mairesse (2013) identify six different regimes – each being a combination of the types of competition on both the product and the labor market – in which they classify each industry (see Table 1). Results reported in Section 3 suggest that there is substantial heterogeneity across firms operating in the same industry: therefore, the ability to account for the different behavior of firms represent an important contribution of our work.

Table 1: Product and labor market regimes

	product market	
labor market	perfect competition	imperfect competition
perfect competition	PC-PR	IC-PR
efficient bargaining	PC-EB	IC-EB
monopsony	PC-MO	IC-MO

3 Results

3.1 Descriptive statistics

Tables 2 present information on the fraction of firm belonging to the six different market regimes defined above by looking at the presence of product- and labor-market imperfections. Results are based on a translog production function: Table A.1 in the Appendix reports analogous results for the Cobb-Douglas specification, which are qualitatively very similar.

We see that there is substantial heterogeneity both across and within different sectors. Looking at the whole economy, around 64% of firm-year observations fall within of the regimes classified as imperfect competition, but this fraction varies from a lower bound of 46% for *Clothing and Footwear* to a higher bound of 78% for *Printing and Publishing*. The single most common regime is the IC-EB combination, whereby firms enjoy some degree of market power on both the product and labor market, and the rent is shared with workers, which accounts for 53% of the sample.

Table 2 also suggests the presence of widespread variations within each sector. In fact, while in most of the sectors it is possible to identify a prominent regime, in several cases, this covers less than 50% of firm-year observations, while the second and third most popular regimes cover a large fraction of the sample. Hence, characterizing all firms within a sector as belonging to the same regime would imply a significant loss of information and would hide substantial heterogeneity. For instance, 37.83% of the observations within *Clothing and Footwear* are classified as IC-EB, while 31.61% belong to the

Table 2: Percentage of firms in each market regime by sector: Trans-log production function

	Sector name	♯Firm	♯Obs.	PC-PR	PC-EB	PC-MO	IC-PR	IC-EB	IC-MO
C1	Clothing and footwear	733	8468	31.61	17.82	4.032	8.398	37.83	0.313
C2	Printing and publishing	955	11973	8.284	0.194	12.99	14.09	59.6	4.836
C3	Pharmaceuticals	317	3648	20.98	1.211	10.52	18.74	45.81	2.741
C4	House equipment and furnishings	891	10019	23.8	1.403	10.94	12.81	50.01	1.042
D0	Automobile	375	4366	33.84	3.403	10.65	7.217	44.65	0.247
E1	Transportation machinery	196	2298	39.95	1.786	5.153	17.81	34.74	0.561
E2	Machinery and mechanical equipment	2376	27727	13.05	1.827	21.55	7.813	53.58	2.176
E3	Electric and Electronic equipment	680	7293	26.3	3.421	9.818	8.607	51.35	0.499
F1	Mineral industries	586	7262	20.93	3.229	15.17	11.11	48.16	1.401
F2	Textile	774	9193	24.49	4.19	17.25	9.008	43.89	1.183
F3	Wood and paper	873	10539	26.58	1.598	13.78	15.04	41.98	1.021
F4	Chemicals	1387	16471	13.32	4.716	14.23	6.406	59.66	1.668
F5	Metallurgy, Iron and Steel	2602	30890	11.99	6.668	11.37	2.585	66.88	0.511
F6	Electric and Electronic components	596	6604	30.61	2.323	13.57	10.59	42.45	0.446
TOT	All Manufacturing	12532	156751	18.37	3.853	13.91	8.76	53.62	1.476

Product market regimes: PC = perfect competition; IC = imperfect competition.
Labor market regimes: PR = perfect comp.; EB = efficient bargaining; MO = monopsony.

PC-PR regime and another 17.82% to PC-EB. In *Transportation Equipment* the most common regime (PC-PR) covers 39.95% of observations, 34.74% are classified as IC-EB and 17.81% as IC-PR.

Table 3 reports the mean values of the key parameters by industry and for the overall sample of manufacturing firms. Results are in line with expectations and suggests estimates are correct. The average markup charged by French firms is around 20%, ranging between 11% in the automobile sector to 34% in printing and publishing. Within each sector there is however a substantial difference between firms that have significant market power (i.e. they operate in imperfect competition) and those for which the price is not significantly different from the marginal cost. Columns (2) and (3) highlight this difference and show that firms classified as price takers have markups not significantly different from 1, while the remaining group manages to charge markups that range between 27% (*Wood and Paper*; *Chemicals*; *Automobiles*) and 62% (*Clothing and Footwear*, which in the case of France includes famous luxury brands).

Turning to labor market regimes, we see that the share of rent that goes to labor (ϕ) in the efficient bargaining setting is around 60% (with low variability across sectors, the min/max values are 57 and 70%). On the other hand, the wage elasticity of labor supply displays substantial variation across industries and is associated with varying degrees of monopsony power.

3.2 Econometric analysis

Table 4 displays results for a multivariate probit specification on labor market regimes, where the baseline category is perfect competition. The baseline specification (cols 1–2) controls for firm productivity, size (number of employees), the share of worker employed in high-tech activities, the product market regime (using a dummy for imperfect competition), the share of imports from low-wage countries in the sectors where the firm is active weighted by the revenue share of each sector for the individual firm. The other two specifications add a control for employment growth at the firm- (cols 3–4) or the

Table 3: Mean values of key parameters by industry: trans-log production function

	(1) overall	(2) PC	(3) IC	(4) efficient	(5) bargaining	(6)	(7) monopsony	(8)	(9)
sector	μ	μ	μ	Ψ	γ	ϕ	Ψ	β	$\epsilon_w^{L^s}$
C1	1.260	0.928	1.617	1.322	4.148	0.703	-0.826	0.566	1.568
C2	1.344	0.961	1.448	0.918	3.019	0.647	-1.153	0.538	1.522
C3	1.231	0.962	1.371	0.940	2.403	0.590	-1.423	0.454	0.962
C4	1.177	0.953	1.315	0.661	2.852	0.629	-0.740	0.594	1.855
D0	1.117	0.956	1.272	0.705	2.749	0.635	-0.926	0.517	1.212
E1	1.209	0.984	1.400	0.852	3.097	0.671	-0.836	0.538	1.319
E2	1.169	0.935	1.308	0.661	2.857	0.633	-0.625	0.635	2.392
E3	1.220	0.948	1.411	0.812	3.163	0.656	-0.723	0.588	1.738
F1	1.181	0.936	1.357	0.761	2.820	0.618	-0.744	0.580	1.691
F2	1.218	0.933	1.451	0.909	3.023	0.638	-0.861	0.555	1.594
F3	1.135	0.954	1.270	0.630	2.472	0.595	-0.731	0.591	1.800
F4	1.147	0.939	1.270	0.648	2.258	0.568	-0.686	0.617	2.146
F5	1.213	0.932	1.345	0.719	2.710	0.627	-0.713	0.602	2.199
F6	1.159	0.951	1.344	0.789	2.873	0.631	-0.849	0.545	1.447
Total	1.197	0.942	1.350	0.763	2.821	0.627	-0.762	0.593	1.979

μ: markup, Ψ: joint market imperfection; ϕ: absolute rent sharing; $\gamma = \phi/(1-\phi)$: relative rent sharing; $\epsilon_w^{L^s}$: wage elasticity of the labor supply; $\beta = \epsilon_w^{L^s}/(1-\epsilon_w^{L^s})$: degree of monopsony power.

provincial level (cols 5–6).[6]

Results are consistent across the different specifications and suggest that more efficient firms are respectively less likely to share their rents with their workers and more likely to have some degree of monopsony power relative to the baseline case of perfect competition. Larger firms are less likely to have monopsony power, probably due to the higher likelihood that labor is organized in this case and can therefore extract some of the rent. The share of foreign competition does not exerts a significant impact on the probability of firms being classified in efficient bargaining, whereas it is negatively correlated with the probability of having monopsony power. The composition of the labor force, that we proxy with the share of employment associated with high-tech activities as reported by firms in the EAE survey, is negatively correlated with efficient bargaining and positively correlated with monopsony. Linking these last two results together, a tentative explanation might be that firms enjoy significant monopsony power when they focus on niche markets characterized by a large degree of non-routine tasks, high qualification of the labor force, and are therefore shielded from competition from low-wage countries. Employment growth at the firm level is positively associated with the presence of monopsony power and negatively with rent-sharing between firms and workers, while it is not significant once we measure it at the provincial level.

In the next empirical exercise we focus on firms characterized by efficient bargaining in the labor market, which is the most common labor market regime on average (covering almost 60% of our sample) and in all sectors but transportation machinery where perfect competition is more widespread. Results are reported in Table 5.

[6]We use the French *départements* to compute local employment growth.

Table 4: Multivariate probit estimation on labor market regimes (the baseline category is perfect competition)

	(1) EB	(2) MO	(3) EB	(4) MO	(5) EB	(6) MO
productivity	-0.00440*	0.0193***	-0.00512*	0.0207***	-0.00513*	0.0207***
	(0.00265)	(0.00336)	(0.00282)	(0.00361)	(0.00282)	(0.00361)
log employment	0.00495	-0.271***	0.00114	-0.270***	0.00112	-0.270***
	(0.00606)	(0.00818)	(0.00646)	(0.00881)	(0.00646)	(0.00881)
% imports from LWC	0.00516	-0.0390***	0.00688	-0.0378***	0.00688	-0.0378***
	(0.00492)	(0.00588)	(0.00512)	(0.00614)	(0.00512)	(0.00614)
% empl in hi-tech activities	-0.107***	0.170***	-0.0993***	0.168***	-0.0992***	0.168***
	(0.0230)	(0.0266)	(0.0245)	(0.0286)	(0.0245)	(0.0286)
imperfect comp	1.814***	-0.991***	1.826***	-0.983***	1.826***	-0.983***
	(0.0125)	(0.0173)	(0.0133)	(0.0186)	(0.0133)	(0.0186)
empl. growth			-0.383***	0.279***	-0.383***	0.279***
			(0.0480)	(0.0562)	(0.0480)	(0.0562)
empl.growth (province)					-0.00851	-0.0172
					(0.0351)	(0.0427)
Observations	125,171	125,171	111,764	111,764	111,764	111,764

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Year and industry dummies not reported

In this case the dependent variable becomes the (absolute) degree of rent sharing between firms and workers. This parameter (ϕ_{it}) ranges between 0 and 1 and represents the fraction of rent that is appropriated by labor, with the remainder $(1 - \phi_{it})$ going to the firm. We can therefore interpret ϕ_{it} as a measure of labor's bargaining power.

Table 5 shows that the productivity of the firm is negatively associated with the degree of bargaining power by labor, whereas firm size has a positive sign. Once again, we interpret this as to suggest that large firms are more likely to face an organized (unionized) labor force and therefore may need to share a larger fraction of the rent. Neither total imports nor the share of imports from low-wage countries appear to have a significant effect of labor's bargaining power, but this changes when we control for the share of Chinese imports faced by the firm. In fact, firms facing stronger Chinese competition cede a smaller fraction of the rent to their workers. Contrary to our expectations, the composition of the labor force does not exert any significant effect on ϕ_{it}.

To further investigate the notion that foreign competition might push French manufacturing firms to improve their products in order to gain non-price competitiveness and therefore escape price competition, we run a probit model on the product market regime where the dependent variable is a dummy for imperfect competition.

Table 6 reports the results for both pooled probit (cols 1–4) and a random-effect panel specification (col. 5). More productive firms are more likely to have a positive markup, whereas size has a negative effect on the probability to operate in imperfect competition (apart from the panel specification where the coefficient becomes positive). Higher imports in the sectors where the firs is active is associated with a higher probability to have positive markups, and the same applies to the share of imports from low-wage countries. Here we not find much difference between the coefficient estimates using low-

Table 5: Efficient bargaining: absolute risk sharing & import penetration

	(1)	(2)	(3)
	low-wage countries		China
productivity	-0.000378	-0.000548**	-0.000536**
	(0.000246)	(0.000261)	(0.000264)
log employees	0.0394***	0.0429***	0.0555***
	(0.00319)	(0.00372)	(0.00414)
log imports	0.000146	-2.46e-05	-6.47e-05
	(0.000341)	(0.000570)	(0.000576)
% imports from low-wage countries	-0.000238		
	(0.000830)		
% imports from China		-0.00221**	-0.00187*
		(0.00110)	(0.00112)
% employments in hi-tech activities	-9.60e-05	0.00814	0.00343
	(0.00745)	(0.00858)	(0.00873)
employment growth			-0.0333***
			(0.00490)
Observations	60,340	51,927	50,449
R-squared	0.049	0.055	0.056
Number of firms	9,299	9,111	9,055

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Year and industry dummies not reported

wage countries or China alone, suggesting that the China-effect found above might be stronger on the labor than on the product market. Overall, the notion that firms facing stronger foreign competition are more likely to operate in imperfectly competitive markets is in line with the theory that underlies most trade models featuring heterogeneous firms, which postulate monopolistic competition and intra-industry trade.

The share of employment devoted to high-tech activities has a negative impact on the probability to charge a positive markup. This is difficult to reconcile with our prior, since we would expect that a larger share of workers in high-tech activities is a sign of non-price competitiveness that should be reflected in the ability of the firm to operate in niche markets and charge apply higher price-cost margins. Indeed, when this share is substituted with a dummy variable that takes value 1 when the entire workforce is devoted to high-tech activities (col. 5), the estimated coefficient becomes positive and significant, possibly suggesting the presence of nonlinear effects.[7]

4 Conclusion

This paper combines recent advances in the estimation of firm-level markups to classify firms into six different regimes based on the presence of imperfections in both the product and labor market. Using a large sample of French manufacturing firms we show that there is substantial heterogeneity in firm behavior both across and within industries, so that being able to properly account for firm-level differences provides us with relevant information.

[7]The coefficient on the High-tech dummy is positive and significant both in a pooled probit (not shown) and in the random effect panel model displayed in column (5).

Table 6: Product market regime: probability of having a positive markup

	(1)	(2)	(3)	(4)	(5)
productivity	0.009***	0.00936***	0.00896***	0.00893***	0.0125***
	(0.002)	(0.00165)	(0.00177)	(0.00165)	(0.00241)
log employees	-0.033***	-0.0317***	-0.0342***	-0.00532	0.0948***
	(0.004)	(0.00372)	(0.00403)	(0.00382)	(0.0172)
log imports	0.019***				
	(0.001)				
log imports from LWC				0.0163***	0.0143***
				(0.00147)	(0.00355)
% imports from LWC	0.048***	0.0214***			
	(0.003)	(0.00281)			
% imports from China			0.0252***		
			(0.00228)		
% empl. in hi-tech activities	-0.087***	-0.105***	-0.108***	-0.0574***	
	(0.014)	(0.0135)	(0.0145)	(0.0136)	
export dummy				-0.291***	
				(0.00912)	
High-tech					0.287***
					(0.0429)
High-tech × imports LWC					-0.00494
					(0.00363)
Observations	125,171	125,171	107,316	125,171	125,171
Number of firms					12,532

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Year and industry dummies not reported

When we relate the probability to belong to a specific market regimes to a firm-level measure of competition from low-wage countries (and other standard covariates) we find support for the view that foreign competition has pushed French firms to improve their products, while reducing labor's bargaining power.

The methodology presented in the paper lends itself to several different applications. The possibility to link firm-level results with detailed information on employees (e.g. their composition in terms of occupations, skills, educational attainments) represents an ideal extension of the work that we would like to pursue in the future.

References

Ackerberg, D. A., Caves, K. & Frazer, G. (2015), 'Identification properties of recent production function estimators', *Econometrica* **83**(6), 2411–2451.
URL: *http://dx.doi.org/10.3982/ECTA13408*

Bernard, A. B., Jensen, J. B. & Schott, P. K. (2006), 'Survival of the best fit: Exposure to low-wage countries and the (uneven) growth of U.S. manufacturing plants', *Journal of International Economics* **68**(1), 219–237.
URL: *https://ideas.repec.org/a/eee/inecon/v68y2006i1p219-237.html*

De Loecker, J. & Warzynski, F. (2012), 'Markups and Firm-Level Export Status', *American Economic Review* **102**(6), 2437–71.
URL: *https://ideas.repec.org/a/aea/aecrev/v102y2012i6p2437-71.html*

Dobbelaere, S., Kiyota, K. & Mairesse, J. (2015), 'Product and labor market imperfections and scale economies: Micro-evidence on France, Japan and the Netherlands', *Journal of Comparative Economics* **43**(2), 290–322.
URL: *https://ideas.repec.org/a/eee/jcecon/v43y2015i2p290-322.html*

Dobbelaere, S. & Mairesse, J. (2013), 'Panel data estimates of the production function and product and labor market imperfections', *Journal of Applied Econometrics* **28**(1), 1–46.
URL: *https://ideas.repec.org/a/wly/japmet/v28y2013i1p1-46.html*

Guillaume Gaulier, S. Z. (2010), BACI: International trade database at the product-level. the 1994-2007 version, Working Paper 2010-23, CEPII.

Hall, R. (1988), 'The relationship between price and marginal cost in US industry', *Journal of Political Economy* **95**(5), 921–947.

Hall, R. E. (1986), 'Market structures and macroeconomic fluctuations', *Brookings Papers on Economic Activity* pp. 285–322.

Levinsohn, J. & Petrin, A. (2003), 'Estimating Production Functions Using Inputs to Control for Unobservables', *Review of Economic Studies* **70**(2), 317–341.
URL: *https://ideas.repec.org/a/oup/restud/v70y2003i2p317-341.html*

Roeger, W. (1995), 'Can imperfect competition explain the difference between primal and dual productivity measures ? estimates for U.S. manufacturing', *Journal of Political Economy* **103**, 316–330.

Wooldridge, J. M. (2009), 'On estimating firm-level production functions using proxy variables to control for unobservables', *Economics Letters* **104**(3), 112–114.
URL: *https://ideas.repec.org/a/eee/ecolet/v104y2009i3p112-114.html*

Appendix

Table A.1: Percentage of firms in each market regime by sector: Cobb-Douglas production function

	sector	#firm	#obs.	PC-PR	PC-EB	PC-MO	IC-PR	IC-EB	IC-MO
C1	Clothing and footwear	733	8468	20.19	13.79	14.54	1.091	49.97	0.419
C2	Printing and publishing	955	11973	5.394	0.0584	12.97	13.02	63.46	5.102
C3	Pharmaceuticals	317	3648	19.57	0.0967	6.061	19.63	53.22	1.418
C4	House equipment and furnishings	891	10019	16.66	1.287	17.59	9.953	52.91	1.589
D0	Automobile	375	4366	27.39	3.009	12.12	6.938	50.01	0.529
E1	Transportation machinery	196	2298	31.21	0.791	12.76	12.49	41.86	0.896
E2	Machinery and mechanical equipment	2376	27727	9.898	1.782	24.48	5.847	54.9	3.09
E3	Electric and Electronic equipment	680	7293	20.84	2.589	15.59	6.239	53.42	1.33
F1	Mineral industries	586	7262	19.89	3.079	16.05	7.943	51.23	1.804
F2	Textile	774	9193	13.95	2.288	27.48	5.025	49.85	1.406
F3	Wood and paper	873	10539	19.63	1.621	19.46	10.74	46.2	2.353
F4	Chemicals	1387	16471	12.25	3.851	15.25	5.928	60.72	2.001
F5	Metallurgy, Iron and Steel	2602	30890	8.549	7.764	11.56	1.724	69.77	0.631
F6	Electric and Electronic components	596	6604	29.64	1.845	17.51	9.186	40.86	0.95
TOT	All Manufacturing	12532	156751	14.04	3.475	16.91	6.791	56.83	1.948

product market regimes: PC = perfect competion; IC = imperfect competition.
labor market regimes: PR = perfect comp.; EB = efficient bargaining; MO = monopsony.

Table A.2: Mean values of key parameters by industry: Cobb-Douglas production function

	overall	PC	IC	efficient bargaining			monopsony		
sector	μ	μ	μ	Ψ	γ	Φ	Ψ	β	$\epsilon_w^{L^s}$
C1	1.294	0.967	1.626	1.988	5.222	0.743	-1.056	0.485	1.317
C2	1.347	0.952	1.431	0.819	2.769	0.622	-0.828	0.605	2.052
C3	1.252	0.946	1.337	0.861	2.202	0.566	-1.134	0.482	1.022
C4	1.172	0.959	1.308	0.674	2.945	0.631	-0.745	0.607	2.051
D0	1.122	0.948	1.250	0.655	2.804	0.633	-0.910	0.530	1.295
E1	1.185	0.998	1.378	0.794	3.062	0.660	-0.797	0.556	1.421
E2	1.165	0.944	1.303	0.615	2.781	0.619	-0.547	0.667	2.921
E3	1.214	0.979	1.388	0.775	3.155	0.650	-0.684	0.613	2.012
F1	1.176	0.943	1.354	0.769	3.109	0.644	-0.837	0.557	1.569
F2	1.210	0.937	1.445	0.967	3.123	0.642	-0.999	0.533	1.595
F3	1.128	0.955	1.264	0.611	2.523	0.595	-0.678	0.615	2.026
F4	1.149	0.939	1.264	0.630	2.252	0.563	-0.653	0.630	2.279
F5	1.232	0.942	1.334	0.727	2.773	0.626	-0.687	0.614	2.447
F6	1.145	0.970	1.346	0.763	2.955	0.633	-0.821	0.558	1.541
Total	1.199	0.951	1.340	0.769	2.860	0.623	-0.744	0.600	2.158

μ: markup, Ψ: joint market imperfection; ϕ: absolute rent sharing; $\gamma = \phi/(1-\phi)$: relative rent sharing; $\epsilon_w^{L^s}$: wage elasticity of the labor supply; $\beta = \epsilon_w^{L^s}/(1-\epsilon_w^{L^s})$: degree of monopsony power.