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

Lionel Nesta* Stefano Schiavo†

May 16, 2017

Preliminary draft

Abstract

The paper investigates the impact of import competition from both low-wage and industrial countries on product and labor market imperfections. By applying recent advances in the estimation of price-costs margins to a large panel of French manufacturing firms for the period 1993–2007, we are able to classify each firm into six different market regimes based on the presence/absence of imperfections in the in both the labor and product markets. To the best of our knowledge this is the first paper to do so. We find a large degree of within-sector heterogeneity in firm behavior both markets, suggesting that industry-level analysis may indeed hide a lot of information. For those firms that engage in efficient bargaining we derive a measure of workers' bargaining power, which we relate to firm-level characteristics such as productivity, size, labor composition, and the degree of import competition facing the firm. Results suggest that import competition has a differentiated effect on firms, which depends both on whether competition comes from low-wage or OECD countries, and on whether firms focus on the high-or low-end of the product range. In fact, import competition from advanced countries tends to lower workers' bargaining power, whereas Chinese competition seems to push French firms upscale, thus improving the share of the rent that goes to labor.

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

JEL Classification: F14; F16; J50

*OFCE SciencesPo, GREDEG CNRS and SKEMA Business School. E-mail: lionel.nesta@sciencespo.fr

†University of Trento and OFCE SciencesPo. E-mail: stefano.schiavo@unitn.it

1 Introduction

The recent debate on the pros and cons of new (actual or potential) trade agreements and the associated raise in protectionism sentiments —culminated in the recent withdrawal by the US from the Trans-Pacific Partnership (TPP) but further witnessed by the difficult ratification of the EU-Canada FTA and the dire state of negotiations on the Transatlantic Trade and Investment Partnership (TTIP)— have brought back on stage concerns about the effects of international trade liberalization on the labor markets of industrial countries.

These concerns tend to resonate more with the general public when liberalization involves economies with different levels of income per capita, social protection, and labor costs. In fact, the last two decades have witnessed a very sharp increase in trade between OECD and emerging markets, due to the rapid integration of some countries (most notably China) into world markets, to falling trade costs and to the disintegration of production into several stages. Figure 1 shows the evolution of import penetration in France between 1995 and 2007, distinguishing between imports from OECD countries, China and low-wage countries. The period under investigation has witnessed a generalized increase in import penetration, but it is clear the imports from China and other low-wage countries have grown much faster than imports from other OECD countries, although these continue to represent a larger share of French imports.

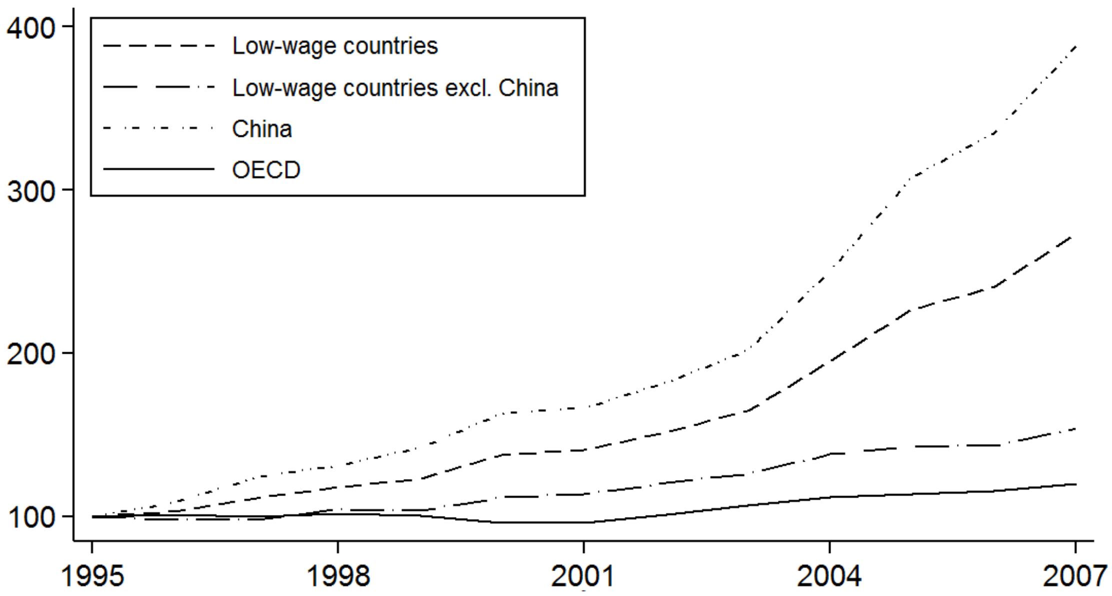


Figure 1: Evolution of import penetration from different groups of countries: France 1995–2007 (1995 = 100). Import penetration is defined as the ratio between imports and the sum of domestic production plus imports minus exports.

Intuitively, we would expect increased competition from abroad to lower domestic firm's profit margins and, as a result, to lower the scope for rent sharing between firms and workers, even in the context of highly regulated labor markets where direct effects on both employment and wage levels might take time to materialize. On the other hand, some firms might respond to price competition from emerging markets by improving product quality, moving upscale and thus increase their price-cost margins. Hence, the impact of import competition on a firm's market power both in the product and in the labor markets may be heterogeneous and remains an empirical issue.

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 the (combined) 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 between our measure of workers' bargaining power and a number of firm-level characteristics, among which features the degree of import competition from both low-wage and industrial countries. In this way, we test the hypothesis that import penetration acts as a disciplining device in wage bargaining, and we uncover significant heterogeneity across firms. Such heterogeneity is important to analyze because in many countries, and France is one of them, the system of collective bargaining often takes place at the enterprise level, so that industry-level analysis may hide significant differences among firms operating in the same sector.

The paper is organized as follows: the next section provides a quick overview of recent contributions dealing with the effect of import competition on workers' bargaining power; Section 3 describes the theoretical background and the empirical methodology adopted in the analysis, as well as the data used. Section 4 presents results from the empirical analysis, starting from summary statistics, and moving to estimation of the relationship between import penetration and bargaining power using different econometric techniques. A discussion of the results and some conclusions are then summarized in Sections 5 and 6.

2 A glance at the existing literature

The impact of trade liberalization on labor market outcomes, such as wages and employment, represents a classical research question in international economics. The literature has tackled it from different angles, alternatively looking at developed or developing countries, wage levels or wage inequality, skill premia vs unemployment. Early studies dating back to the 1990s tend to find little direct effect of trade on labor market outcomes, and convey the broad message that technical change plays a much more prominent role in explaining job losses and wage polarization in industrial countries. However, more recent studies that take into account outsourcing and offshoring in addition to the standard import competition mechanism, tend to give more relevance to trade-related explanations Dumont et al. (2012). The effect of international trade on workers's bargaining power remains however a much less studied phenomenon. Moreover, while a handful of studies exist on the subject, to the best of our knowledge, none of them has ever addressed the issue at the firm level.

Dumont et al. (2006) analyze evidence for five European countries during 1994–1998. First they estimate sector-level bargaining power from firm microdata, then they investigate its determinant looking in particular at labor composition, R&D intensity, outsourcing practices, market structure and imports from both OECD and emerging economies. For what concerns trade variables, results suggest that only imports from OECD countries have a significant effect on workers' bargaining power.

A similar result emerges from a study on the UK performed by Boulhol et al. (2011). The empirical approach is similar: the authors first estimate both markups and bargaining power (by sector, year and size class), and then regress them on a series of covariates among which one finds the share of imports from both industrial and developing countries in total demand. As before, only imports from high-income countries seem to matter.[1]

Closer to our own approach, at least in spirit, is the work by Abraham et al. (2009) who analyze the price and wage setting behavior of Belgian manufacturing firms in the period 1996–2004, and distinguish between import competition from four country groups, namely EU-15, new EU members, other OECD countries, and the rest of the world. Their model assumes that increased economic integration reduces firms' price-cost margins and thus lowers the size of the rent to share with workers. As a result, workers' bargaining power is reduced. Although Abraham et al. (2009) use firm-level data, they still assume that markups and bargaining power are the same for all firms within the same industry. Their findings suggest that import competition puts pressure on both markups and bargaining power, especially when there is increased competition from low wage countries. The authors conclude that trade integration is associated with wage moderation, which should then yield a positive effect on employment.

Moreno & RodrÃguez (2011) address a similar question by looking at the hypothesis that import reinforces market discipline both on product and labor markets. Using a small sample of around 2,000 Spanish firms over the period 1990–2005 they look at both markups and bargaining power, looking at whether import competition affects both the size of economic rents (measured by the Lerner's index) and their distribution between firms and workers. They find a negative effect of import competition on the Lerner's index, that is larger for firms producing final goods. This is consistent with the notion that imports of final goods are more directly in competition with domestic production and therefore put particular pressure on local firms. From the point of view of rent sharing, Moreno & RodrÃguez (2011) find that bargaining power is smaller for producers of final and homogeneous goods. Interestingly, this paper presents a first attempt to estimate markups at the firm level, applying the methodology developed by Roeger (1995) (amended to allow for labor market imperfections as in Crépon et al. 2005) to each firm. This implies running firm-level regressions that have between 9 and 15 observations each for a subsample of 885 firms, and then focusing on the distribution of markups rather than on the specific firm-level values.

An interesting extension to the standard theoretical setup that assumes homogeneity among work-

[1] Boulhol et al. (2011) assume that all firms/sectors are engaged in an efficient bargaining wage setting.

ers is offered by Dumont et al. (2012), who explicitly model bargaining between firms and two types of unions, representing high- and low-skilled workers. The model's implications are then brought to the data using information on Belgian firms. The authors study the determinants of bargaining power at sectoral level, and find that while the bargaining position of high-skilled workers is not affected by either technical change or globalization, low-skilled workers are negatively affected by imports from non-OECD countries (where the wage differential is likely to be larger), offshoring activities, and the presence of foreign affiliated in Central and Easter European countries.

Two recent papers look at the effect of trade liberalization in India, thus taking the vintage point of an emerging economy where market imperfection may be more relevant and where an increase in (foreign) competition could trigger larger efficiency gains. Ahsan & Mitra (2014) focus on the labor share of income following liberalization, but also report results on bargaining power. They find that sectors featuring lower tariff rates before the liberalization display lower bargaining power. Pal & Rathore (2016) exploit state-level variations in the deregulation of both product and labor markets, and find that both types of reforms has led to significant declines in workers' bargaining power, while none of them has had any meaningful effect on firms' price-cost margins.

3 Data and methodology

3.1 Data sources

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.[2]

Beside containing 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 provides us a list of the 4-digit code of activities in which the firm is active, 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 countries, from China, and from OECD members.[3] In this way we can exploit firm-specific heterogeneity in import competition, that would otherwise be masked by the use of sector-level measures of import penetration. The same source of data on each firm's detailed activities is used to compute the share of employees pertaining to high-tech activities within the firm.

Low-wage countries are defined following Bernard et al. (2006): a country is classified as low-wage

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

[3]For more information on the BACI data, see `http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=1`

if its per capita GDP lower than 5% of the US value; our import competition measure is the ratio of French imports (from any specific country or group of countries) over apparent consumption in the same sector, i.e. total sales plus imports minus exports. Since trade data are reported according to the HS classification while the EAE is based on the French industrial classification system (NAF) we have developed a concordance between HS and NAF codes.

3.2 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 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

[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.

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

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. We also perform a baseline OLS estimation, finding results that are qualitatively similar: summary statistics on OLS results are displayed in Tables A.3 and A.4 in the Appendix.

3.3 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 labor 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 90% 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, $z = 1.64$ 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 90% CI μ_{it}^M exceeds the upper bound of the 90% 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 90% 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 90% level.

3. MO: *Monopsony.* If lower bound for the 90% CI μ^L_{it} exceeds the upper bound of the 90% CI for μ^M_{it}, then μ^M_{it} is significantly lower than μ^L_{it}: $\mu^M_{it} < \mu^L_{it} \Rightarrow \Psi_{it} < 0$, at 90% 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 90% 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 4.1 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

4 Empirical Analysis

4.1 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 trans-log production function: Tables A.1-A.3 in the Appendix report analogous results for the Cobb-Douglas specification and the OLS estimation of the trans-log production function respectively, which are qualitatively similar.[6]

We see that there is substantial heterogeneity both across and within different sectors. Looking at the whole economy, around 41% of firm-year observations fall within of the regimes classified as imperfect competition, meaning that the markup is significantly (from a statistical point of view) but this fraction varies from a lower bound of less then 1% for *Textiles* to a higher bound of almost 100% for *Electric and electronic equipment* and *Printing and publishing*.

For what concerns the labor market, efficient bargaining represent nearly 54% of firm-year observations, followed by right-to-manage (37%) and monopsony, with less than 10% of observations. The single most common joint 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; this regime

[6] In the Cobb-Douglas specification the estimated output elasticities are constant within each sector, so that all the firm-level heterogeneity in μ_L, μ_M and the associated parameters such as Ψ comes from variation in the input shares α_L and α_M. In fact, Table A.1 shows that firms are all classified as belonging to the EB labor market regime.

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 & footwear	1527	11062	57.32	19.27	2.67	1.53	17.12	2.09
C2	Printing & publishing	1629	14346	0.81	0	0.09	7.58	91.02	0.50
C3	Pharmaceuticals	555	4459	41.84	32.01	7.01	2.63	14.92	1.59
C4	House equipm. & furnishings	1457	11622	23.03	25.30	2.035	2.65	44.52	2.46
D0	Automobile	597	5085	61.56	22.44	5.30	1.10	9.15	0.45
E1	Transportation machinery	332	2782	74.70	8.83	3.31	2.80	9.93	0.43
E2	Machinery & mechanical equipm.	3694	31744	17.51	10.17	8.00	5.49	56.19	2.64
E3	Electric & electronic equipm.	1198	9240	0.45	0	0.08	2.25	97.18	0.04
F1	Mineral industries	904	7981	63.32	18.44	7.90	3.15	5.56	1.62
F2	Textile	1254	10278	75.76	4.12	19.22	0.37	0.17	0.37
F3	Wood & paper	1326	11581	57.91	15.58	16.33	1.33	5.72	3.13
F4	Chemicals	2212	19301	19.63	19.63	3.22	4.33	51.38	1.81
F5	Metallurgy, Iron & Steel	3881	34666	44.85	31.60	15.28	0.88	6.72	0.67
F6	Electric & electronic comp.	960	7754	11.39	11.63	2.07	2.60	67.81	4.50
TOT	All manufacturing	20622	181901	33.78	17.22	7.81	3.13	36.32	1.73

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

accounts for 36% of the sample, closely follows by the PC-PR group (close to 34%) representing perfect competition in both labor and product markets.

It is worth noting that the relatively large standard errors associated with the fixed-effects IV estimation of the production function results in wide confidence intervals for the the markup μ and the joint market imperfection parameter Ψ: as a result, participation into the PC and PR product- and labor-market regimes is somehow inflated since the confidence intervals often include zero. In fact, OLS results (see Table A.3), which are characterized by lower standard errors (although plagued by endogeneity issues) suggest that a much smaller faction of firms operates in perfect competition.

Table 2 suggests the presence of widespread variations also within each sector. In fact, while in most of the sectors it is possible to identify a prominent regime, in several cases, there at least a second, and often a third, relevant regime that covers a significant fraction of firm-year observations. 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, 57.32% of the observations within *Clothing and Footwear* are classified as PC-PR, while 17.12% belong to the IC-EB regime and another 19.27% to PC-EB. In *Metallurgy, Iron and Steel* the most common regime (PC-PR) covers 45% of observations, 32% are classified as PC-EB and 15% as PC-MO.

Table 3 summarizes the mean values of the key parameters by industry and for the overall sample of manufacturing firms. The average markup charged by French firms is around 11%, ranging between a 10% *markdown* (a markup lower than 1, see for instance Caselli et al. 2017 for an investigation of this phenomenon) in the textile sector, to a hefty 64% in electric and electronic equipment. 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 16% (machinery and mechanical equipment) and 68% (electric and electronic equipment).

Turning to labor market regimes, we see that the share of economic rent that goes to labor (ϕ) in the efficient bargaining setting is around 55% (with some variability across sectors, the min/max values are 48% and 68%). On the other hand, the wage elasticity of labor supply displays substantial variation across industries and is associated with varying degrees of monopsony power.

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

	(1) overall	(2) PC	(3) IC	(4) efficient bargaining	(5)	(6)	(7) monopsony	(8)	(9)
sector	μ	μ	μ	Ψ	γ	ϕ	Ψ	β	$\epsilon_w^{L^s}$
C1	1.192	1.141	1.419	0.522	2.808	0.619	-0.395	0.709	2.672
C2	1.454	0.995	1.469	0.667	2.514	0.602	-0.472	0.730	3.168
C3	1.160	1.076	1.563	0.714	2.104	0.559	-0.664	0.579	1.412
C4	1.127	1.022	1.284	0.470	2.386	0.591	-0.400	0.702	2.708
D0	1.017	0.980	1.347	0.446	2.395	0.591	-0.397	0.685	2.305
E1	1.118	1.067	1.469	0.648	2.079	0.587	-0.682	0.578	1.466
E2	1.078	0.961	1.164	0.348	1.818	0.527	-0.235	0.807	5.349
E3	1.642	1.007	1.675	0.973	3.409	0.684	-0.540	0.682	2.322
F1	0.994	0.963	1.286	0.360	1.706	0.506	-0.327	0.722	2.851
F2	0.899	0.894	1.434	0.366	2.093	0.523	-0.376	0.673	2.230
F3	0.976	0.950	1.218	0.401	1.533	0.493	-0.383	0.690	2.457
F4	1.096	0.979	1.223	0.417	1.694	0.505	-0.319	0.756	3.583
F5	0.933	0.910	1.190	0.255	1.471	0.484	-0.246	0.772	4.084
F6	1.205	1.030	1.302	0.584	2.475	0.600	-0.481	0.682	2.592
Total	1.110	0.974	1.323	0.477	2.085	0.553	-0.288	0.750	3.761

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.

4.2 Econometric Specification

The spirit of the empirical specification we develop in this paper is to allow for the effect of import penetration on rent sharing ϕ to be different according to the degree of market power enjoyed by firms on the product (as captured by μ). In fact, we hypothesize that the degree of rent sharing will depend on the size of the economic rent that the firm is able to generate. The baseline model can be seen as an adaptation of the standard empirical specification which reads as:

$$\phi_{it+1} = \beta_0 + \beta_1 IMP_{it} + \beta_2 \mu_{it} + \mathbf{BX} + \nu_i + \lambda_t + e_{it}, \quad (6)$$

where IMP is import penetration, μ is product market power, while $\mathbf{X}$ is a vector of control variables which are productivity ω and firm size s. An important addition to this vector is to include average cost $\bar{c}$, allowing us to interpret product market power μ as a measure of product quality and/or differentiation. Parameters ν_i and λ_t are firm i and time t effects and e_{it} is the error term. Observe that rent sharing ϕ, import penetration IMP, product market power μ and average cost $\bar{c}$ all vary across firms and over time.[7] The parameters of interest is β_1, that is, the effect of foreign competition on rent sharing.

To detect a heterogeneous effect of import penetration IMP on ϕ, a natural point of departure is simply to argue that the latter depends on product quality – that is, $\mu_i t$ – and therefore to interact IMP with μ, yielding the following model :

$$\phi_{it+1} = \beta_0 + \beta_1 IMP_{it} + \beta_2 \mu_{it} + \beta_3 IMP_{it} \times \mu_{it} + \mathbf{BX} + \nu_i + \lambda_t + e_{it}, \tag{7}$$

In this setting, the marginal effect of IMP on ϕ depends on the level of product market power, that is, $\partial\phi/\partial IMP = \beta_1 + \beta_3 \cdot \mu_{it}$. Yet the implicit assumption is that the change in IMP's marginal effect is itself linear. To detect non linearities in the effect of markups on bargaining power, we rely on the estimation and inference methodology developed by Hansen (1999). The advantage is to assume away the linear change and adopt the alternative assumption that the effect of foreign competition on workers' bargaining power can be classified into regimes to be determined and dependent upon the firm's product market power. This methods introduces econometric techniques appropriate for the detection of thresholds with panel data, and an asymptotic distribution theory is derived which is used to construct build confidence intervals for the threshold parameter. A bootstrap method is then developed to assess the statistical significance of the threshold. Last, Hansen's method also determines empirically the number of thresholds underlying the relationship between the dependent variable and the variable of interest.

Before dwelling into the presentation of the method, it is important to amend the method as follows. Whereas in his example on firm financial constraints Hansen (1999) interacts the threshold variable with only one variable of interest – namely cash flow – we interact the threshold variable – market power μ – with two variables of interest describing import penetration from OECD countries IMP^O and from China IMP^C, respectively. This allows us to test the presence of non-linear effects in how competition from other OECD countries or from China affect Union bargaining power ϕ. For the one-threshold case, the model reads

$$\begin{aligned}\phi_{it} = \; & \beta_1(\gamma) IMP^O_{it}\mathbf{I}(\mu_{it} \leq \gamma) + \beta_2(\gamma) IMP^O_{it}\mathbf{I}(\mu_{it} > \gamma) + \\ & \beta_3(\gamma) IMP^C_{it}\mathbf{I}(\mu_{it} \leq \gamma) + \beta_4(\gamma) IMP^C_{it}\mathbf{I}(\mu_{it} > \gamma) + \\ & \beta_5 \mu_{it} + \mathbf{BX} + \beta_0 + \nu_i + \lambda_t + e_{it},\end{aligned} \tag{8}$$

where $\mathbf{I}$ is an indicator variable set to unity, whether the threshold variable μ_{it} exceeds (is below) a

[7] Import penetration is firm-year specific because we make use of information of firm sales by industry at the four digit level:

$$IMP_{it} = \sum_s \frac{S^d_{s,it} \times IMP_{st}}{\sum_s S^d_{s,it}}$$

where IMP_{st} is import penetration for sector s at year t, that is, total imports over domestic demand, variable S denotes sales by firm i at year t in sector s. Superscript d denote domestic sales.

given threshold value γ. Notice first that this model allows to detect empirically discontinuities in relationship between the threshold variable μ and our variables of interest IMP. It is thus important to compare the result of this model with those of simpler model that allows for interactions between μ and the variables of interest IMP.

To retrieve an estimate of γ, we should first define ϕ – the vector stacking all observations of the dependent variable, and $\hat{\phi}(\gamma)$ – the corresponding vector of predicted values by estimating equation 11 and the vector of residuals $\hat{\mathbf{e}}(\gamma) = \phi - \hat{\phi}(\gamma)$. The algorithm proposed by Hansen (1999) chooses γ so as to minimizes the sum of squared errors $S_1(\gamma)$, where $S_1(\gamma) = \hat{\mathbf{e}}(\gamma)'\hat{\mathbf{e}}(\gamma)$. More precisely, the estimator of $\hat{\gamma}$ reads:

$$\hat{\gamma} = \underset{\gamma}{\operatorname{argmin}}\ S_1(\gamma). \tag{9}$$

The computation of the least square estimate of the threshold γ involved the minimization exercise 9. To do so, we first sort the threshold variable μ_{it} in ascending order, and exclude the bottom and top 2% of the variable. This is to rule out a partition which would include too few observations below or above the threshold. The remaining μ_{p02}^{p98} observations represent the set of values over which the optimal $\hat{\gamma}$ is determined. Hence, 98 regressions are estimated using specification 8, yielding the sum of squared errors $\hat{\mathbf{e}}(\gamma)$ and its associated $S_1(\gamma)$. The smallest value for $S_1(\gamma)$ determines $\hat{\gamma}$.

Identification of $\hat{\gamma}$ involves two additional steps. The first one regards significance of the threshold, and tests whether the identified two regimes are significantly different from one another, the null hypothesis being $H_0 : \beta_1 = \beta_2$, where 1 and 2 refer to the first and second regime, respectively. The second step concerns efficiency in order to determine the 95% confidence interval of the threshold likely values, with the null hypothesis being $H_0 : \gamma = \gamma_0$.

Concerning the first step, inference on $\hat{\gamma}$ is achieved by generating bootstrapped samples and comparing model 6 with model 8. First, observe that specification 6 is nested in 8, which is a more general representation of the effect of policies on green innovation. Hence we can rely on the use of a likelihood ratio test to determine whether specification 8 conveys more information than specification 6. Second, given the unbalanced nature of the panel data, we randomly draw firms - not observations - in order to produce a bootstrapped sample of a size which may range between 40% and 95% of the original number of firms in the sample. Selecting the whole time series for each randomly drawn company, and using the bootstrapped sample, we then estimate specifications 6 and 8 and perform the likelihood ratio test. We repeat this procedure a sufficiently large number of times and count the number of times for which the likelihood ratio test fails to reject the null hypothesis that the specification 6 brings as much information as specification 8. By way of example, for the case of impoprt penetration from China M^C the null hypothesis is $H_0 : \beta_3(\mu_{it} \leq \gamma) = \beta_4(\mu_{it} > \gamma)$, which implies the absence of two distinct regimes. The share of samples failing to reject the null hypothesis of no threshold is used as the critical probability value.

The second step is concerned with efficiency, with the null hypothesis being $H_0 : \gamma = \gamma_0$. We follow Hansen (1999) and use the likelihood ratio statistics $LR_1(\gamma_0)$ as follows:

$$LR_1(\gamma) = \frac{S_1(\gamma) - S_1(\hat{\gamma})}{\hat{\sigma}^2}, \tag{10}$$

where $\sigma = \frac{1}{n(T-1)} S_1(\hat{\gamma})$. Hansen (1999) shows that this statistics follows the distribution function $\Pr(LR_1(\gamma) \leq x) = (1 - exp(-x/2))^2$, with inverse function $c(\alpha) = -2\ln(1 - \sqrt{(1-\alpha)})$, where α is the chosen critical probability value at which one fails to reject the null H_0. For example, the null hypothesis is rejected at 5% level when the LR statistics exceeds $c(\alpha = .05) = 7.35$. To form a confidence interval for γ, the no-rejection region of the $(1-\alpha)$ confidence level is the set of values for which $LR_1(\gamma) \leq c(\alpha = 0.05)$. This is done by plotting the $LR_1(\gamma)$ and drawing a flat line at $c(\alpha = 0.05)$ (see Hansen 1999, pages 351-352).

Model 8 implicitly assumes that there be only two regimes of policy effectiveness on the direction of technical change. Yet there may very well be several thresholds. In such cases, one possibility is to search simultaneously for (γ_1, γ_2) by minimizing $S_2(\gamma_1, \gamma_2)$. While this seems a reasonable path to search, the scope of search over the entire grid may be computationally cumbersome.[8] Rather, Hansen (1999) suggests to proceed sequentially by taking threshold $\hat{\gamma}_1$ as given, and to search for γ_2 over the threshold variable μ_{it}, by minimizing $S_2(\hat{\gamma}_1, \gamma_2)$. Because it is important to have a minimum number of observations in each regime, we restrict the search over μ_{it} so that the distance between $\hat{\gamma}_1$ and $\hat{\gamma}_2$ amounts to at least a decile. To give a concrete example, if $\hat{\gamma}_1 < \gamma_2$, the two threshold estimation equation becomes:

$$\begin{aligned} \phi_{i,t} = \; & \beta_1(\gamma) IMP^O_{it} \mathbf{I}(\mu_{it} \leq \gamma_1) + \beta_2(\gamma) IMP^O_{it} \mathbf{I}(\gamma_1 < \mu_{it} \leq \gamma_2) + \beta_3(\gamma) IMP^O_{it} \mathbf{I}(\mu_{it} > \gamma_2) + \\ & \beta_4(\gamma) IMP^C_{it} \mathbf{I}(\mu_{it} \leq \gamma_1) + \beta_5(\gamma) IMP^C_{it} \mathbf{I}(\gamma_1 < \mu_{it} \leq \gamma_2) + \beta_6(\gamma) M^C_{it} \mathbf{I}(\mu_{it} > \gamma_2) + \\ & \beta_7 \mu_{it} + \mathbf{BX} + \nu_i + \lambda_t + e_{it}. \end{aligned} \tag{11}$$

Fixing γ_1 to $\hat{\gamma}_1$, the minimization program to identify the second threshold can be written as:

$$\hat{\gamma}_2 = \underset{\gamma_2}{\text{argmin}} \; S_2\left(\gamma_2\big|_{\gamma_1 = \hat{\gamma}_1}\right). \tag{12}$$

Inference on γ_2 and the determination of its 95% confidence interval are determined as previously described, based on bootstrapped samples to test $H_0 : \beta_1(\gamma) = \beta_2(\gamma)$ and $H_0 : \gamma = \gamma_0$, respectively, using the likelihood ratio statistics below

$$LR_2(\gamma) = \frac{S_2(\gamma_2) - S_2(\hat{\gamma}_2)}{\hat{\sigma}^2}. \tag{13}$$

If $\hat{\gamma}_2$ proves significant, Bai (1997) shows that estimation of $\hat{\gamma}_1$ must be refined by a third stage

[8] A search grid over (γ_1, γ_2) requires 98^2 regressions. The search grid for a higher order number of thresholds rapidly becomes prohibitive.

estimation, taking $\hat{\gamma_2}$ as given and the refinement minimization program becomes:

$$\hat{\gamma_1} = \underset{\gamma_1}{\text{argmin}}\ S_1\left(\gamma_1\big|_{\gamma_2=\hat{\gamma_2}}\right). \tag{14}$$

The algorithm described above can be generalized to any higher order of thresholds. In this paper, we fix the maximum number of possible thresholds to possibly three, implying potentially four types of regimes. The advantage of this algorithm is to avoid to arbitrarily set the number of regimes. Instead, this number is determined endogenously, giving rise to significant structural breaks which are not time-dependent but dependent upon the threshold variable μ representing the firm's product market power.

4.3 Baseline Results

In this section we test the hypothesis that import competition from abroad acts as a discipline device in wage bargaining. To do so, we focus on firms classified as operating in efficient bargaining, for which we can compute the (absolute) degree of rent sharing between firms and workers. This parameter (ϕ_{it}) ranges between 0 and 1 and represents the fraction of the rent that is appropriated by labor, with the remainder ($1-\phi_{it}$) going to the firm. We therefore interpret ϕ_{it} as a measure of workers' bargaining power, and use it as our main dependent variable.

The final specification in the regression analysis takes the following form:

$$\begin{aligned}\phi_{i,t+1} = \beta_0 \quad &+ \quad \beta_1 IMP^C_{it} + \beta_2 IMP^O_{it} + \beta_3 \ln TFP_{it} + \beta_4 \mu_{it} \\ &+ \quad \beta_5 \ln size_{it} + \beta_6 \ln AVC_{it} + \beta_7 EMPG_{NUTS3,t} + \beta_8 IMR_{it} \\ &+ \quad \gamma D_t + \delta D_i + \varepsilon_{it}\end{aligned} \tag{15}$$

where IMP is our measure of import penetration at the firm level, and additional controls include firm productivity ($\ln TFP$), size (measured as the log-transformed value of the number of employees), the mark-up charged by the firm, the log-transformed values of average cost ($\ln AVC$)[9], and a measure of employment growth at the NUTS3 level ($EMPG_{NUTS3}$) capturing the local labor market conditions of firms. Estimation is based on OLS with individual fixed effects and includes time dummies. To reduce endogeneity concerns, the dependent variable is forwarded one period.

An important issue in selection bias. Because the sample is limited to firm-year observations belonging to the efficient bargaining regime, we need to control for the possible selection bias by including the inverse Mill's ratio (IMR) into equation (15). This variable is obtained from a first-stage pooled-probit regression of the probability to operate under efficient bargaining conditional on TFP, size, the market share of the firm in both the product and the labor market (defined at the industry level), the share of employees devoted to high-tech activities, sector, year and department

[9] Average cost is the summation of the wage bill, the cost of materials and the user cost of capital using the formula given by Jorgenson & Griliches (1967), over nominal production.

dummies.

Results are reported in Table 4: we report results from different specifications, starting from a very parsimonious one that only includes productivity and markups as explanatory variables (column 1), and augmenting it with additional controls. We find a negative relationship between the markup and bargaining power, while productivity does not appear to exert any additional effect on top of its possible influence on the markup of firms. Workers in larger firms enjoy a stronger bargaining power: most probably, this is due to the larger role played by unions in larger manufacturing firms. Indeed, data about unionization in France show that the share of workers belonging to a union is as low as 5% within small private firms with less than 50 employees, while reaching 14.4% among large enterprises (with more than 200 employees, see Pignoni 2016).

Results including import penetration are first reported in column (3), where we initially distinguish between OECD and low-wage countries in general, including China into the collection of low wage countries. Estimates show that import penetration has a differential effect based on where competition comes from: while firms facing higher imports from OECD countries display lower workers' bargaining power, the opposite occurs for competition from low-wage countries. One possible explanation is that French firms selling products that are more easily sourced from developing, low-wage countries choose to escape competition by improving quality, innovating, and moving upscale. In this attempt, they hire more skilled labor, which typically enjoys a stronger bargaining power. This is consistent with empirical evidence put forward by Monfort et al. (2008) on restructuring in the Belgian textile sector, by Bugamelli et al. (2010) on Italian firms following the introduction of the euro, and by Bloom et al. (2016) on twelve European countries after China's accession to the WTO.

On the contrary, firms whose competitors are mainly located in other OECD countries are likely to confront with imported goods featuring a more advanced technology and analogous levels of quality, and being produced with more similar cost structures. As a result, upgrading quality is more difficult while containing (labor) costs is relatively easier. The negative effect of imports from OECD countries on bargaining power is in line with the existing sector-level evidence presented for instance by Dumont et al. (2006) or Boulhol et al. (2011).

To further investigate the relationship between import penetration and workers' bargaining power we proceed in two steps. First, in column (4) we add (the log of) average costs to the regression equation: by controlling simultaneously for costs and productivity, we can interpret the markup μ as a measure of quality or, more precisely, as the price/cost margin that is not due to cost factors, but rather to the market power enjoyed by firms on product markets. The coefficient for μ now changes sign and turns positive, in line with the notion that worker's bargaining position is stronger for firms that sell high quality products.

The second step we take is to distinguish imports from China from those originating in other low-wage countries. The purpose of this exercise is to look for a specific "China effect" stemming from the sheer size of the Chinese economy and its quick integration into global markets, as summarized in Figure 1. In fact, column (5) of the table shows that it is only Chinese competition that has a significant effect on bargaining power, while imports from other low-wage countries appear not to

Table 4: Import as a labor-market discipline device: effect of import penetration on bargaining power.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
productivity	0.007	0.012	0.013*	0.012*	0.012	0.012	0.012*
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
mark-up	-0.306***	-0.324***	-0.335***	0.207***	0.225***	0.223***	0.219***
	(0.016)	(0.017)	(0.017)	(0.051)	(0.054)	(0.054)	(0.050)
log N. employees		0.037***	0.039***	0.027***	0.026***	0.026***	0.026***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
log avg costs				0.556***	0.573***	0.571***	0.567***
				(0.052)	(0.054)	(0.054)	(0.051)
IMP OECD			-0.048***	-0.024**	-0.021*	-0.021*	-0.022*
			(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
IMP low-wage			0.452***	0.198**			
			(0.075)	(0.078)			
IMP low-wage excl. China					-0.047	-0.044	
					(0.176)	(0.176)	
IMP China					0.283***	0.283***	0.279***
					(0.095)	(0.095)	(0.094)
Empl. growth (NUTS3)						0.006*	0.006*
						(0.003)	(0.003)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inverse Mill's ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51,793	51,793	51,793	51,793	51,793	51,793	51,793
Firms	11,513	11,513	11,513	11,513	11,513	11,513	11,513
R^2	0.059	0.061	0.063	0.067	0.067	0.067	0.067

Clustered standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
constant, time dummies and inverse Mill's ratio not reported
size measured as the log number of employees

affect the way rents are shared among firms and workers.

In the last two columns we add an additional control to capture the extent of local labor market conditions (at the NUTS3 level), making use of information on firm location. We find that firms located in areas with higher employment growth, i.e. tighter conditions, give a larger share of the rent to workers, in line with economic intuition. The coefficient of the variables is significant at 10% level, and its weak significance may simply reflect the nature of our data, collected at the firm rather than plant level.[10]

The use of estimated (rather than measured) variables on both sides of the regression equation —such as bargaining power, markups and productivity— may lead to biased standard errors. We follow Ashraf & Galor (2013) and Caselli (2016) and use two-step block bootstrapping to retrieve unbiased and consistent estimates of the standard errors.[11] The main results do not change. [**we need to integrate these results into the Tables throughout the paper**]

4.4 Linear interaction model and Threshold models

To further investigate the heterogeneous effect of import competition on bargaining power, we augment the baseline specification represented by (15) with an interaction term between the import penetration measures and the markup. In this way we explicitly allow import competition to exert a different impact on workers' bargaining power depending on the quality of products sold by each firm (which we proxy with the markup). Given the results reported in Table 4, we focus only on imports from China and from OECD countries, leaving aside competition from other low-wage countries, that seems not to have a sizable effect on bargaining power.

Column (1) of Table 5 displays the results from the following regression:

$$\begin{aligned}\phi_{i,t+1} &= \beta_0 + \beta_1\mu_{it} + \beta_2 IMP^O_{it} + \beta_3 IMP^C_{it} + \beta_4(\mu_{it}\times IMP^O_{it}) + \beta_5(\mu_{it}\times IMP^C_{it}) \\ &+ \beta_6 \ln TFP_{it} + \beta_7 \ln size_{it} + \beta_8 \ln AVC_{it} + \beta_9 EMPG_{NUTS3,t} + \beta_{10} IMR_{it} \\ &+ \gamma D_t + \delta D_i + \varepsilon_{it}. \qquad (16)\end{aligned}$$

Results confirm the presence of important heterogeneity across firms: the role of import competition as a discipline device depends both on the origin of imports and on the structure of firm activities. More specifically, import from OECD is no longer significantly different from zero, both an the mean value of the markup or for any meaningful value of the interaction variable. On the contrary, import from China is positively correlated to bargaining power, but this effect declines for larger values of the markup.

[10]This means that we use the location of the headquarter, which may not capture precisely the labor market condition faced my firms owning multiple production facilities.

[11]We run 500 boostrap replications of the entire procedure, estimating the production function, deriving the relevant parameters to compute markups, productivity and bargaining power, and then estimating each regression. Bootstrapped samples are stratified by sector and rely on block sampling, meaning that firms are sampled for all the periods in which they appear in the data. Not all the pooled-probit models used to compute the inverse Mill's ratios converge: when this happens we discard the results. In the end we base our bootstrapped standard errors from 344 observations for each coefficient.

Table 5: Interaction effects: linear interaction model and threshold regressions

	(1)	(2)	(3)
productivity	0.014*	0.013*	0.014**
	(0.007)	(0.007)	(0.007)
log avg costs	0.572***	0.562***	0.563***
	(0.051)	(0.051)	(0.050)
log N. employees	0.026***	0.028***	0.027***
	(0.006)	(0.006)	(0.006)
empl. growth (department)	0.006*	0.006*	0.006*
	(0.003)	(0.003)	(0.003)
markup	0.227***	0.196***	0.197***
	(0.050)	(0.049)	(0.049)
IMP OECD	-0.058		
	(0.040)		
IMP China	1.533***		
	(0.250)		
IMP OECD $\times \mu_{it}$	0.030		
	(0.032)		
IMP China $\times \mu_{it}$	-0.937***		
	(0.173)		
IMP OECD $\times \mathbf{I}(\mu_{it} \leq \gamma_1)$		-0.046***	-0.047***
		(0.013)	(0.013)
IMP OECD $\times \mathbf{I}(\mu_{it} > \gamma_1)$		-0.011	
		(0.012)	
IMP China $\times \mathbf{I}(\mu_{it} \leq \gamma_1)$		0.386***	0.455***
		(0.114)	(0.114)
IMP China $\times \mathbf{I}(\mu_{it} > \gamma_1)$		0.264***	
		(0.094)	
IMP OECD $\times \mathbf{I}(\gamma_1 < \mu_{it} \leq \gamma_2)$			-0.0129
			(0.012)
IMP OECD $\times \mathbf{I}(\mu_{it} > \gamma_2)$			0.009
			(0.017)
IMP China $\times \mathbf{I}(\gamma_1 < \mu_{it} \leq \gamma_2)$			0.345***
			(0.093)
IMP China $\times \mathbf{I}(\mu_{it} > \gamma_2)$			-0.135
			(0.131)
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Inverse Mill's ratio	Yes	Yes	Yes
Observations	51,793	51,793	51,793
N. firms	11,513	11,513	11,513
R^2	0.068	0.068	0.069
LL	42177	42194	42207
rss	594.4	594.6	594.3
LR-test		33.67	26.47
P value		4.89e-08	1.79e-06

Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include a full vector of unreported year fixed effects.

The way in which the markup mediates the effect of import competition is portrayed more clearly in Figure 2, which provides a graphical representation of the marginal effect of import competition on bargaining power for different levels of the markup. The figure shows that import from OECD countries is never significant, albeit having relatively small confidence intervals, irrespective of the price-cost margin of the firm. On the other hand, Chinese competition is positively associated with bargaining power, and the relationship is significant for a large range of values between 0.9 and 1.3. The marginal effect becomes negative only for very high values of markups, namely when $\mu > 1.8$: this represents less then 5% of the firm-year observations in our sample.

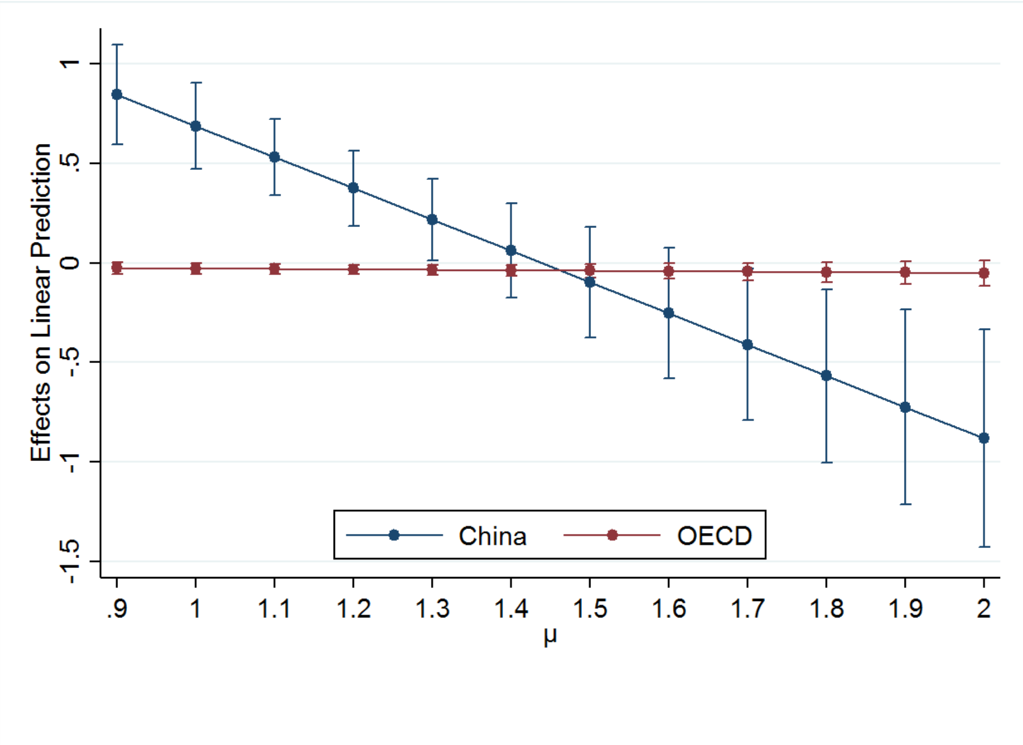


Figure 2: Marginal effects of import penetration from China and OECD countries on workers' bargaining power (ϕ), conditional on the level of the markup (μ).

Equation (16) assumes that the impact of import penetration on bargaining power depends linearly on the price-cost margin. To investigate the possible presence of nonlinearities, we adopt the procedure developed by Hansen (1999) and presented in Section 4. This entails the (endogenous) identification of threshold values for the mediating variable, in this case the markup μ_{it} and the estimation of a regression equation in which firms belonging to different groups (based on the level of the markup) are allowed to react differently to competition from abroad. An important feature of Hansen's methodology is that both the number and the magnitude of the thresholds is determined within the procedure, and we do not have to make any arbitrary assumption in this respect. In this way, the method lets the data "speak", and imposes as little structure as possible upon the empirical analysis.

Figure 3 reports the results for the likelihood ration test on which the search process for threshold values is conducted. Intuitively, a significant threshold exists when the test falls below the critical value represented by the dashed horizontal line, and then returns above it. The range of values for which the LR-test remains below the critical value represents the confidence interval for the threshold. The three panels represent the value of the LR-test for different percentiles of the markup distribution. We identify two significant threshold vales, whose significance is confirmed by running 1,000 bootstrapping replication of procedure. On the contrary, a possible third threshold is not statistically significant at the 10% level and it is therefore discarded. Detailed information on the results are presented in Table 6. A first group of firms contains the companies whose markup is below 1.093, which corresponds to the 36th percentile of the distribution for μ_{it}. The second threshold is located at the high end of the distribution, around the 89th percentile, i.e. at a price-cost margin of 1.538. Firm featuring markup larger than this second threshold belongs to the third group.[12]

Having identified three groups of firm-year observations on the basis of their market power on product market, we then build the corresponding interaction terms by multiplying the markup with indicator variables that classify observations into a low-, medium- or high-markup group. These terms are then used in the regression analysis in place of the linear interaction terms $(\mu_{it} \times IMP_{it}^{O})$ and $(\mu_{it} \times IMP_{it}^{C})$.

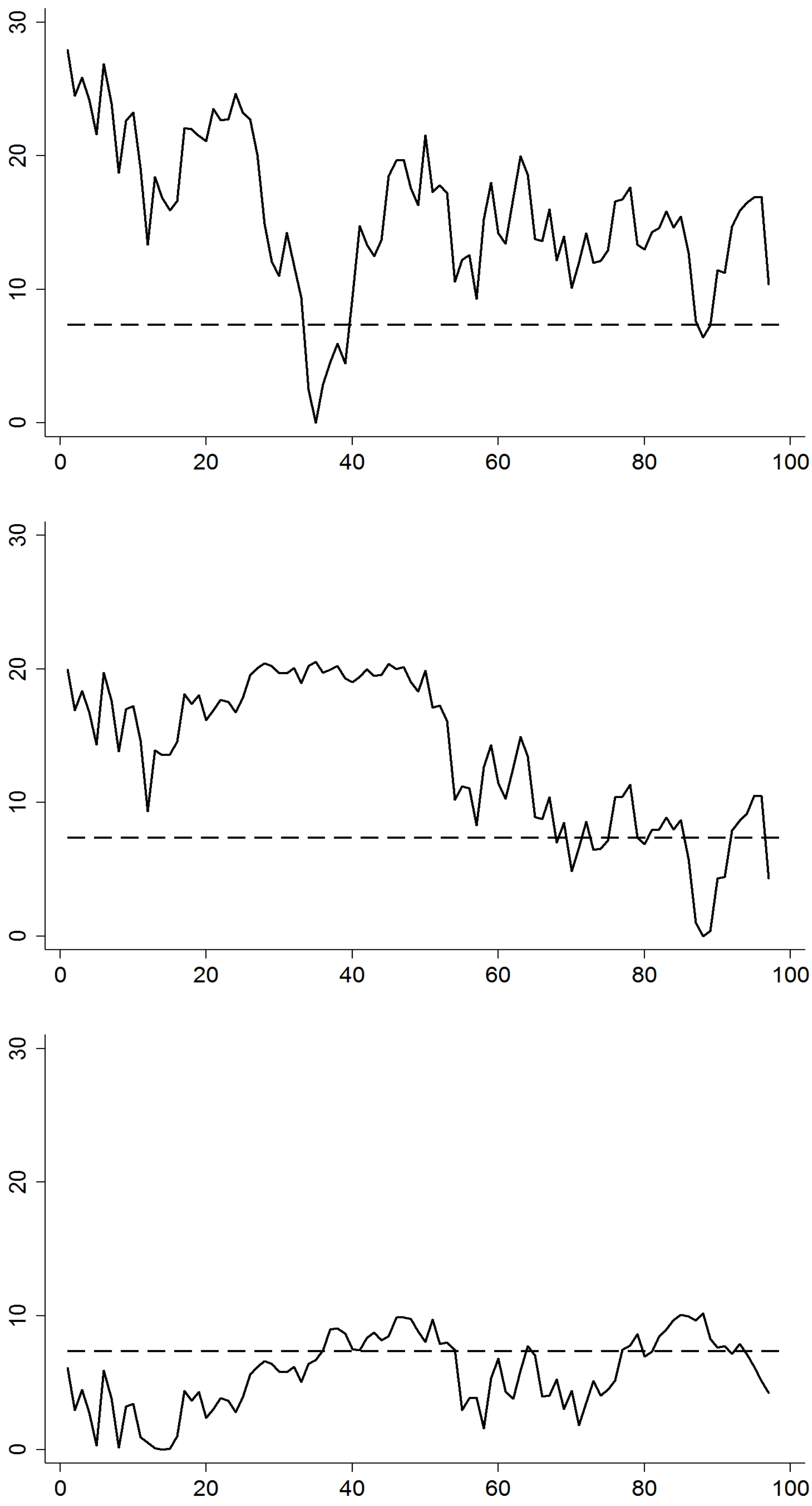
Table 6: Threshold Statistics.

	γ_1	γ_2	γ_3
Threshold percentile	36	89	13
Threshold value for μ	1.088	1.516	.978
95 % CI for μ	[1.084, 1.104]	[1.474, 1.592]	[NA, 1.084]
F-statistics	3.956	2.827	1.534
P-value	.016	.029	.119

Results are summarized in the last 2 columns of Table 5: column (2) refers to a regression that only considers the first (lower) threshold, whereas column (3) represents our preferred specification where both significant thresholds are considered ($\gamma_1 = 1.088; \gamma_2 = 1.516$) and observations are divided into three different groups. Results are consistent earlier evidence, and confirm our interpretation: import competition from other OECD countries correlates negatively with bargaining power only for firms with low markups/quality, while no relationship exists for firms belonging to the mid- or high-markup groups. When we turn to import penetration from China, a different picture emerges: stiffer Chinese competition is associated with higher future bargaining power for most firms, and only companies that already enjoy a large market power (the top 10% of the markup distribution) do not experience any effect.

[12]The third, non-significant, threshold would be located around the 15th percentile, where markups are not statistically different from 1 and firms are classified as price-takers.

Figure 3: Likelihood Ratio test and confidence interval construction for the three thresholds tested. Vertical axis: LR-test; horizontal axis: percentiles of the markup distribution. The dashed horizontal line represents the 5% critical value of the test.



5 Discussion

Our interpretation of the results is that the heterogeneous effect of import penetration on bargaining power is due to the fact that high product quality somehow protects firms from price-based competition from low-wage countries. As a result, Chinese import penetration spurs French companies to move upscale, improve quality and in this way increase the size of the economic rent they capture. To do so, however, firms need to invest in technology and skill upgrading, and therefore need to share a larger part of the "pie" with their workers.

The impact is different for imports from OECD countries, because quality, technology and labor costs are more similar, so that the response strategy adopted by firms is different and there is more scope for wage compression that reduces workers' bargaining power.

Discussion of possible channel linking Chinese import competition to quality upgrading: Evidence based on descriptive statistics, plus results from previous literature

[To be completed]

Table 7: Summary statistics of firm characteristics by markup. The thresholds are determined according to the procedure described in Section 4.2

group	firms	obs	N. empl.	N. plants	TFP	VA/ empl	profit*	avg L cost	Φ	export	LMHT†	% empl high-tech
$\mu < 1.088$	7705	22260	108	1.62	1.85	42.56	0.14	32.73	0.55	0.75	2.13	0.23
$1.088 < \mu < 1.516$	7883	33411	151	1.95	1.52	51.82	0.22	35.41	0.53	0.77	2.22	0.41
$\mu > 1.516$	1887	7603	112	2.34	1.16	59.50	0.23	39.32	0.61	0.64	2.45	0.50
Total	12403	63274	131	1.88	1.59	49.48	0.19	34.93	0.54	0.75	2.22	0.36

$*$ gross operating margin over value added: † index of technological development ranging from 1 (low-tech) to 4 (high-tech)

6 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.

The methodology adopted in the paper allows us to estimate a measure of workers' bargaining power, that we relate to measures of import competition to investigate how globalization affects rent sharing, while controlling for a number of firm-level characteristics such as average costs, productivity and size. We find that import competition has an heterogeneous effect on workers' bargaining power depending both on the source of imports and the characteristics of the firm. We find three main results: i) import from OECD countries is negatively correlated with the share of economic rent going to workers; ii) competition from China, on the contrary, is positively associated with bargaining power. We interpret this result as suggesting that French manufacturing firms has attempted to escape this type of competition by moving upscale and improving the quality of their products. Indeed, we find that iii) the impact of Chinese competition depends on the quality of the products sold by firms, and its effects are stronger for firms in the lower end of the quality ladder.

The methodology presented in the paper lends itself to several different applications: in particular, 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.

Acknowledgments

The authors blame each other for any remaining mistake. They thank Mauro Caselli, Sabien Dobbelaere and participants to the 2016 ISGEP meeting in Pescara and the XXXI AIEL National Conference in Trento for useful discussion.

References

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

Ackerberg, D. A., Caves, K. & Frazer, G. (2015), 'Identification properties of recent production function estimators', *Econometrica* **83**(6), 2411–2451.

Ahsan, R. N. & Mitra, D. (2014), 'Trade liberalization and labor's slice of the pie: Evidence from Indian firms', *Journal of Development Economics* **108**(C), 1–16.

Ashraf, Q. & Galor, O. (2013), 'The 'Out of Africa' Hypothesis, Human Genetic Diversity, and Comparative Economic Development', *American Economic Review* **103**(1), 1–46.

Bai, J. (1997), 'Estimating Multiple Breaks One at a Time', *Econometric Theory* **13**(03), 315–352.

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*

Bloom, N., Draca, M. & Reenen, J. V. (2016), 'Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity', *Review of Economic Studies* **83**(1), 87–117.

Boulhol, H., Dobbelaere, S. & Maioli, S. (2011), 'Imports as Product and Labour Market Discipline', *British Journal of Industrial Relations* **49**(2), 331–361.

Bugamelli, M., Schivardi, F. & Zizza, R. (2010), The Euro and Firm Restructuring, *in* A. Alesina & F. Giavazzi, eds, 'Europe and the Euro', NBER Chapters, National Bureau of Economic Research, Inc, pp. 99–138.

Caselli, M. (2016), Do all imports matter for productivity? Intermediate inputs vs capital goods. mimeo, University of Trento.

Caselli, M., Schiavo, S. & Nesta, L. (2017), Markups and markdowns, Working Paper 2017-11, Sciences Po OFCE.

Crépon, B., Desplatz, R. & Mairesse, J. (2005), 'Price-Cost Margins and Rent Sharing: Evidence from a Panel of French Manufacturing Firms', *Annals of Economics and Statistics* (79-80), 583–610.

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*

Dumont, M., Rayp, G. & Willemé, P. (2006), 'Does internationalization affect union bargaining power? An empirical study for five EU countries', *Oxford Economic Papers* **58**(1), 77–102.

Dumont, M., Rayp, G. & Willemé, P. (2012), 'The bargaining position of low-skilled and high-skilled workers in a globalising world', *Labour Economics* **19**(3), 312–319.

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.

Hansen, B. E. (1999), 'Threshold effects in non-dynamic panels: Estimation, testing, and inference', *Journal of econometrics* **93**(2), 345–368.

Jorgenson, D. W. & Griliches, Z. (1967), 'The explanation of productivity change', *Review of Economic Studies* **34**(3), 249–283.

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*

Monfort, P., Vandenbussche, H. & Forlani, E. (2008), Chinese Competition and Skill-Upgrading in European Textiles: Firm-level Evidence, Discussion Papers 19808, LICOS - Centre for Institutions and Economic Performance, KU Leuven.

Moreno, L. & RodrÃguez, D. (2011), 'Markups, bargaining power and offshoring: An empirical assessment1', *The World Economy* **34**(9), 1593–1627.

Pal, R. & Rathore, U. (2016), 'Estimating workers' bargaining power and firms' markup in India: Implications of reforms and labour regulations', *Journal of Policy Modeling* **38**(6), 1118–1135.

Pignoni, M. T. (2016), La syndicalisation en france, Dares Analyses 26, DARES.

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

Cobb-Douglas specification

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

	Sector name	♯Firm	♯Obs.	PC-EB	IC-EB
C1	Clothing and footwear	1527	11062	35.87	64.13
C2	Printing and publishing	1629	14346	4.614	95.39
C3	Pharmaceuticals	555	4459	51.80	48.20
C4	House equipment and furnishings	1457	11622	68.29	31.71
D0	Automobile	597	5085	90.26	9.739
E1	Transportation machinery	332	2782	84.53	15.47
E2	Machinery and mechanical equipment	3694	31744	33.83	66.17
E3	Electric and Electronic equipment	1198	9240	3.286	96.71
F1	Mineral industries	904	7981	60.05	39.95
F2	Textile	1254	10278	79.85	20.15
F3	Wood and paper	1326	11581	75.42	24.58
F4	Chemicals	2212	19301	52.34	47.66
F5	Metallurgy, Iron and Steel	3881	34666	54.97	45.03
F6	Electric and Electronic components	960	7754	50.89	49.11
	All Manufacturing	20622	181901	45.52	54.48

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

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

	overall	PC	IC	efficient bargaining		
sector	μ	μ	μ	Ψ	γ	Φ
C1	1.350	1.113	1.269	1.588	4.899	0.702
C2	1.407	1.228	1.509	0.537	2.694	0.593
C3	1.355	1.026	1.369	0.788	2.103	0.537
C4	1.084	1.076	1.355	0.210	2.587	0.563
D0	1.035	0.992	1.409	0.199	2.432	0.558
E1	1.100	1.084	1.510	0.0289	2.495	0.557
E2	1.094	1.039	1.148	0.140	2.559	0.567
E3	1.530	1.180	1.656	0.899	3.136	0.629
F1	1.106	0.960	1.115	0.0239	2.559	0.555
F2	1.154	0.893	1.027	-0.163	3.022	0.591
F3	1.020	0.963	1.077	-0.0309	2.184	0.513
F4	1.089	1.022	1.256	0.305	2.100	0.524
F5	1.095	0.900	1.001	0.124	2.517	0.572
F6	1.136	1.118	1.383	0.350	2.544	0.559
Total	1.171	1.011	1.304	0.308	2.656	0.572

μ: markup, Ψ: joint market imperfection; ϕ: absolute rent sharing; $\gamma = \phi/(1-\phi)$: relative rent sharing.

OLS estimation of trans-log specification

Table A.3: Percentage of firms in each market regime by sector: OLS estimation of trans-log production function

	Sector name	♯Firm	♯Obs.	PC-PR	PC-EB	PC-MO	IC-PR	IC-EB	IC-MO
C1	Clothing and footwear	1527	11062	4.216	1.702	1.349	1.597	90.72	0.419
C2	Printing and publishing	1629	14346	3.303	1.179	1.196	9.140	84.05	1.137
C3	Pharmaceuticals	555	4459	10.40	2.047	1.010	14.36	71.81	0.382
C4	House equipment and furnishings	1457	11622	4.010	2.776	0.679	2.369	90.05	0.111
D0	Automobile	597	5085	20.18	6.296	2.149	8.268	62.91	0.202
E1	Transportation machinery	332	2782	27.67	1.155	7.271	14.88	47.65	1.369
E2	Machinery and mechanical equipment	3694	31744	4.170	2.147	2.811	4.151	85.93	0.791
E3	Electric and Electronic equipment	1198	9240	1.154	0.225	0.360	1.918	96.19	0.150
F1	Mineral industries	904	7981	11.27	7.175	1.348	5.743	74.25	0.216
F2	Textile	1254	10278	8.453	2.059	7.056	10.87	67.54	4.022
F3	Wood and paper	1326	11581	18.43	4.006	8.796	11.87	55.90	1.001
F4	Chemicals	2212	19301	11.93	7.567	2.643	7.224	69.79	0.848
F5	Metallurgy, Iron and Steel	3881	34666	9.073	8.637	7.663	4.198	69.16	1.269
F6	Electric and Electronic components	960	7754	3.574	2.984	0.759	2.006	90.49	0.185
	All Manufacturing	20622	181901	8.221	4.343	3.856	5.987	76.62	0.971

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

Table A.4: Mean values of key parameters by industry: OLS estimation of trans-log production function

	overall	PC	IC	efficient bargaining			monopsony		
sector	μ	μ	μ	Ψ	γ	Φ	Ψ	β	$\epsilon_w^{L^s}$
C1	1.235	0.953	1.290	0.678	2.903	0.625	-0.664	0.706	5.094
C2	1.253	0.962	1.285	0.525	2.101	0.545	-0.321	0.795	5.064
C3	1.212	0.955	1.281	0.757	1.753	0.503	-0.457	0.693	2.479
C4	1.160	0.947	1.218	0.550	2.360	0.587	-0.295	0.771	4.323
D0	1.101	0.958	1.188	0.470	2.053	0.547	-0.266	0.783	4.078
E1	1.122	0.955	1.235	0.534	1.927	0.539	-0.374	0.731	3.330
E2	1.150	0.947	1.193	0.444	2.062	0.556	-0.259	0.828	6.834
E3	1.338	0.945	1.379	0.753	2.848	0.633	-0.332	0.759	3.909
F1	1.124	0.950	1.213	0.471	1.780	0.501	-0.240	0.805	5.152
F2	1.155	0.947	1.223	0.517	1.898	0.510	-0.287	0.812	5.704
F3	1.087	0.955	1.168	0.485	1.580	0.487	-0.266	0.790	4.670
F4	1.106	0.947	1.190	0.447	1.682	0.497	-0.289	0.787	4.670
F5	1.114	0.944	1.191	0.421	1.709	0.504	-0.222	0.825	6.615
F6	1.202	0.966	1.252	0.661	2.507	0.604	-0.359	0.749	4.134
Total	1.159	0.949	1.227	0.514	2.041	0.542	-0.275	0.806	5.786

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.